THE ADOPTION OF STEEL IN ORDNANCE, PROJECTILES, AND ARMOUR.

AT the close of 1882 the authorities arrived at the important decision that all guns manufactured in future are to consist wholly of steel. This decision is to be highly commended. It was in the long run inevitable. When once steel had clearly shown that it was superior to wrought iron, even in the very qualities to which wrought iron owed its popularity, the results of the competition between steel and wrought iron was a foregone conclusion. This we pointed out in the last of a series of articles on the application of steel to the construction of ordnance—*vide* ENGINEER, July 30th, 1880—two years and a-half ago. The Royal Carriage Department authorities, who had long before adopted steel to a large extent in the construction of carriages, gave as the results of tests—Ultimate tenacity, best wrought iron, 22 tons; Landore steel, in the soft state, 30 tons. Elongation—Best wrought iron, 30 per cent.; soft steel, 33·3 per cent. Kirkaldy gave for soft steel rings from Vavasseur's guns, ultimate tenacity, 35·15 tons; elongation, 24·25 per cent. On this we remarked that we believe that "the introduction of steel built-up guns was a mere question of time," and that "those who have preferred wrought iron, not from prejudice, but for the sake of its qualities, may with complete consistency adopt steel as soon as it is proved to possess in a still higher degree those very qualities which they valued in wrought iron." The articles to which we refer were written, after taking great pains to communicate with and collect facts from all the best known manufacturers of ordnance, viz., Armstrong, Vavasseur, Whitworth, Palliser and Krupp. On the abstract question of ordnance we have really nothing to add to what we then wrote. The introduction of steel, however, has been perhaps more rapid than we looked for. Colonel Maitland, who became superintendent of the gun factories in the Royal Arsenal in the spring of 1880, has from the beginning recognised the value of steel, and has pushed its adoption forward. Probably the new committee on ordnance have been in its favour, and so the great change has come about; a change, be it observed, which, while it brings in the system advocated by Whitworth and Vavasseur, may be adopted without at all doing violence to our preference for the original built-up guns of Armstrong to the cast steel guns of that day. The material steel has proved its powers to be so great that it has displaced wrought iron; but the principle of building up guns has held its own throughout, and has superseded the massive castings formerly used abroad. We can hardly say that the coil principle has gone out, for steel bars have been heated and made into coils, and in this form steel has been introduced in some of the more recent guns. This we do not expect to be a permanent feature in construction, such treatment not being suited to steel as pointed out by Sir W. Armstrong's paper, published in THE ENGINEER, Sept. 8th, 1882. Doubtless we may shortly see patterns of our various service guns consisting entirely of steel tubes, jackets, and exterior hoops. Steel riband, which being applied cold differs entirely from cylinders made of coiled steel bars, must be an after consideration.

The application of steel, however, will not be confined to guns and carriages. Colonel Inglis's Committee on Plates and Projectiles reported early in this year that chilled iron shot were almost useless against steel-faced armour, and we may add to their statement the fact that abroad chilled shot have, in a measure, failed against chilled iron armour. Steel is necessary to destroy hard armour of any kind whose surface opposes much resistance, because a chilled shot shivers under a shock received before its head enters and finds support. There is great difficulty in making trustworthy cast steel armour-piercing projectiles, and those of forged steel are very costly. Nevertheless, the difficulties which beset the question can hardly fail to be overcome, and even at the present moment a proportion of steel projectiles is approved for service which proportion will be greatly increased, we think, as time goes on. Then, again, common shell are being made of steel by Krupp, and to a certain extent in this country. A steel common shell may be made to contain a much larger bursting charge than one of iron; and owing to its tenacity it has the power of resisting the force of explosion longer and enabling the bursting charge to be more thoroughly ignited, and its force more completely developed, before it yields. The superiority of steel also suits it to the thin cases employed in shrapnel shells.

Finally, to come to armour; in November last Schneider's steel shield showed of what great things steel was capable under certain conditions. We have subsequently heard that Cammell's compound armour of wrought iron with a steel face had done better than a plate of Schneider's at St. Petersburg. This was on a smaller scale, the plates being 12in. thick, while those at Spezia were 19in. in thickness. We hope that Cammell's and Brown's compound plates will soon be as completely and thoroughly worked on the larger scale as on the smaller one. We must not be understood to say for a moment that the compound system will not hold its own. It seems a sound principle to have harder metal in front and that which is tougher behind, but just as our principle of building up guns has carried the day, but is no longer embodied in wrought iron but in steel, so we think it may be with the principle of steel-faced armour. Do not the same arguments apply to this case that we brought to bear on the question of the guns in 1880? If steel has greater tenacity and greater elongation than wrought iron, will it not in the long run make a better foundation plate for armour? Will it not as certainly replace wrought iron on this scale as in boiler plate, where it had the disadvantage of difficulty in welding? In this case, then, we might expect to see a hard rolled steel face united by cast steel to a soft steel foundation plate. This, indeed, is included in the Sheffield patents. Hitherto, it has not yielded such good results, but in the end we think it ought to succeed. We could hardly term this a compound or steel-faced plate, perhaps, but it would possess all the recommendations of the original design, and embody the same principles in it. Armour is entirely made by private manufacturers, but most of our guns and projectiles are made in the Royal Arsenal. In the course of the next two or three years, then, we may expect to see great changes in Woolwich, steel works springing up in the Laboratory and Gun Factories where at present none exist.

NEW SYSTEMS OF BURNING GAS.

NOTWITHSTANDING the alarm created some time back by the announcement that electricity was about to compete with gas, the older style of illumination continues to form the basis of successful commercial enterprise. At the present time the consumption of gas in London may be reckoned at about 5000 cubic feet per head per annum, representing approximately half a ton of coal. If all this gas were used for lighting purposes, and consumed in Sugg's standard burners, the light afforded per head of the population would be equal to 16,000 candles, or the light of ten candles for fully four hours per day throughout the year. The consumption of gas in London advanced 58 per cent. per head between 1869 and 1881. One of the most hopeful features of the gas supply is the extent to which the electric light has stimulated the exercise of inventive skill in the production of improved modes of combustion. A recent instance of this kind is afforded by the incandescent gas lamp of M. Clamond, founded on the principle that there is a possibility of obtaining more light from gas by employing it as a heating agent than by burning it directly. This lamp may be compared to the device employed in the Drummond light, hot air being substituted for oxygen and mixing intimately with the ordinary illuminating gas. This mixture is ignited in the meshes of a finely spun asbestos wick, and the combustion which takes place raises the material to a state of incandescence. The wick lasts about forty hours, and thus requires to be changed about once in eight days. The lamp burns with the wick downwards, so as to prevent shadow. The result has been the production of rather more than six candles up nearly to ten candles per cubic foot of gas, on a consumption ranging from 6·35 to 17·6 cubic feet per hour. It is a drawback to the system that a special distributing plant is necessary to bring the air to the lamps, and the air has to be supplied under pressure. The project is warmly espoused by M. Servier, who contends that the cheapness of air as compared with oxygen gives the Clamond burner the prospect of complete commercial success. The system seems to be particularly applicable to factories and large establishments where a supply of compressed air can be readily produced on the spot.

A supply of compressed air is also required in the incandescent gas lamp devised by Mr. James Lewis. Air and gas are mixed in an apparatus resembling a Bunsen burner, and the flame is used to produce luminosity in a cap of platinum wire gauze. Pipes have been laid and lamps put up on this principle in Clerkenwell. Here, again, there is an advance in the illuminating duty of the gas compared with direct consumption. If our readers will turn to THE ENGINEER for January 17th, 1879, they will find that what is now being done in this direction was there suggested in a leading article on "The Possibilities of Gas Lighting." Taking as a basis the Woodbury lamp, in which gas and air heated are used under pressure, we explained how the Leeds Town Hall, for example, might be lighted, the engines used to supply wind to the organ being utilised to supply compressed air to the burner, and we have yet to learn that the systems of Clamond and Lewis are superior, even in details, to the methods of obtaining light which we then sketched out.

The Siemens regenerative gas burner has acquired a high reputation, both in respect to the intensity of its light and the economy of its consumption. The invention is being applied not only to the production of large and powerful flames, but also to the smaller class of burners, such as the ordinary bat's-wing or fish-tail. Its application to street lighting is illustrated in the metropolis by the brilliant lamps which now illuminate Holborn from the Viaduct to Gray's-inn-road. The principle employed is well known as that of heating to a high degree both the gas and the air which feed the burner, and utilising for this purpose the heat still remaining in the waste products of combustion. Some of the best authorities have tested the Siemens burner, and obtained remarkable results, based on the standard of 16·4-candle gas. Early in the year the late Mr. Keates recorded in this way 5·8 candles per cubic foot, with a consumption of 6·6 cubic feet of gas per hour. About three months later Mr. Heisch observed as much as 7·13 candles per cubic foot, on a consumption slightly less than the foregoing. Mr. F. W. Hartley obtained the light of 357 candles by the consumption of 60 cubic feet per hour. The unsightly form in which the lamp was originally presented to the public is now in a great measure remedied, and its use is being extended in various directions both at home and abroad. It is employed in some of the large railway stations, in factories, and elsewhere. The light is remarkably steady, and its purity is such that delicate shades of colour are accurately distinguished by it. The apparatus itself has been cheapened, so as to encourage its more general adoption. There are, however, serious objections to its use. It is easily set smoking, as may be seen any evening in Holborn, and to be worked to advantage it requires to be moderately turned up at first, and when well heated, turned up full, which means two visits from the lamplighter.

The Grimston gas burner has been the subject of high encomium from Mr. George Livesey—an excellent authority on such a subject. Mr. Grimston has been actuated by a desire to improve on the Siemens regenerative gas burner, so as to produce something equally effective and less cumbrous. He has so far succeeded as to obtain a very brilliant light by somewhat simple means. The arrangement is like that of an inverted torch, and consequently there is no shadow. The whole of the flame is exposed to view, and hence there is no invisible waste. In the first working model made by Mr. Grimston, ten cubic feet of Chartered—common—gas per hour produced the light of sixty candles. This is practically converting 16-candle gas into 30-candle gas, and happily the system answers nearly as well with small burners as with large. The principle is that of the Siemens burner, so far as concerns the use of hot air and hot gas, but the mode of effecting this is such as to admit of great compactness in the mechanical arrangements.

The name of Mr. William Sugg has long been identified with improved gas lighting. One of the latest achievements by this inventor is the production of a light equal to 700 candles, at a cost for gas of only sevenpence per hour. Mr. George Bray, of Leeds, has developed his flat-flame system with great success. These two inventors have rendered signal service by improving the character of the more moderate class of gas-lights. We might mention other inventors in the same department, all tending to give the public the benefit of a brighter and cheaper light from gas than was known a few years ago. There is gain in this respect both to the producer and the consumer, and the improvement effected in the use of gas as an illuminating agent enables this commodity to hold its ground more surely in the presence of the electric light. In the Exhibition of Electric and Gas Apparatus now going forward at the Crystal Palace gas appears in a very satisfactory guise, and the leading inventors are well represented.

WIRE ROPE HAULAGE ON TRAMWAYS.

THE formation of the Steep Grade Tramway Company, for the construction of the Highgate Hill tramway, proved so successful, and the system has been received with so much favour in several towns in England and the Continent, that the formation of a large company is announced, styled the Hallidie Patent Cable Tramways Corporation, with a capital of £1,000,000, of which one half is now offered for subscription, the company being formed to grant licences on royalties, and to construct, work, and lease tramways on this system. We have in previous impressions referred to the system as carried out in San Francisco and Chicago, and shall give some details of the Highgate tramway in another impression. Meanwhile, we give on page 30 a perspective view of the system of working with closed cars, hauled by a vehicle, which, instead of being a dummy, is constructed so as to form an open car, in the centre of which are the two screw hand wheels, by means of which the attendant operates the coulter, which passes through the centre of the floor of the car, and through a slot in the tube in the centre of the roadway, where it grips the cable which is constantly running therein. Beside the ordinary brake applied to the car wheels, a slipper brake, as shown between the wheels, is attached for application on very steep grades. This is necessary, as grades can be worked on this system which would be out of the question with horses or ordinary locomotives.

The slowness with which horses are being superseded by mechanical power to do the heavy work of tram-car haulage is not the result of objection to mechanical power of itself, but to the want of efficiency in the steam or other engines which have been at different times employed for the purpose. In many cases this want of efficiency can hardly be said to have resided in the engine itself, but rather in the tramway, which has often been utterly unfit for haulage by locomotives, and while being ruined itself has ruined the engine. In the north and centre of England and in Scotland steam locomotives are being used on good roads with promising results; but there are towns and streets in towns in which it would be inadmissible under any circumstances to allow the passage of steam engines. The cost of haulage should be lower by tramway locomotives on good tramways than by horses, and this, as well as the power of locomotives to ascend the steeper gradients and to put up with the frequent stopping and starting, all of which ruin horses, has been the incentive to the adoption of mechanical power. In respect of freedom from objections, such as escaping steam, smoke, cost of repairs, and also on the score of cheap haulage, the wire rope system of Hallidie has the advantage. Although new for tramway purposes in this country, thousands of tons of coal are hauled per day in our mines by means of wire ropes used in a manner very similar, but under inferior conditions, to those under which they will be used on the street tramways. From years of experience the cost of haulage by the rough apparatus below ground has been ascertained, while by the actual experience in the United States the system has been found to work tramway traffic so cheaply that in San Francisco it earns from 14 to 30 per cent. on the capital expended. In England, or at any rate in London, the cost of installation will, no doubt, be higher than in San Francisco or Chicago, but it is estimated that the working expenses and profits on the tramways in London would be reduced as follows:—

	Horse Haulage.		Cable Haulage.	
	Working Expenses.	Dividend.	Working Expenses.	Dividend.
North Metropolitan Co.	73·75	9·5	37·75	19·0 per cent.
London Tramways Co.	82·5	7·75	39·0	31·75 ,,
London Street Tramways Co...	74·0	8·75	41·75	16·5 ,,

These are actual working figures, from the books of the London companies, compared with estimates only. The estimates have, however, good foundation, and there is little doubt that the system will rapidly grow in favour, for the cost of haulage is the chief item in the enormous proportion which the working expenses of tramways bear to the whole receipts. In spite, however, of this heavy proportion, the extension of tramways promises to be as rapid in the near future as it has been during the past six years. According to a return procured last session by Lord Sudeley, the length of tramways open for traffic in England in 1876 was only 94 miles; in June, 1882, it was 444, or nearly five times as much. The total number of passengers carried, which was 89,442,108 in 1878, was 187,875,779 in 1882—that is, it had more than doubled; and the capital expended had risen between 1876 and 1882 from a million and a-quarter to six millions and a-half. The figures for the United Kingdom are striking. In the year ending June 30th, 1882, no fewer than 257,760,060 passengers were conveyed, and the receipts amounted to £1,970,350. Nor is there the slightest ground for thinking that the development of tramways has come nearly to an end. The schemes of which notice has actually been given are numerous and important. In many cities, such as Birmingham, Wakefield, Halifax, Macclesfield, and Portsmouth, new tramways are projected; several are on the Hallidie system, and a considerable number of the schemes to be dealt with next session relate to London.

SHIPBUILDING IN GREAT BRITAIN IN 1882.

THE accompanying table gives particulars of the ships built in Great Britain and Ireland in 1882. It has been compiled from "Lloyd's Register Book," which can be consulted by any one interested. In it will be found the year and month when any ship is built, together with the builder's name, net, gross, and under-deck tonnage, besides full particulars of the vessel.

It will be seen from this table that no less than 905,941 tons of shipping were turned out of the shipyards of this country in one year—a work, we believe, unprecedented in the history of shipbuilding.

The following figures, compiled from the last volume of the "Bureau Veritas," show the sailing tonnage of the seven principal maritime nations:—

	Vessels.	Tons.
Great Britain	18,035	5,319,872
United States	6,057	2,054,685
Norway	4,112	1,381,203
Germany	2,871	933,387
Italy	3,054	924,957
Russia	2,155	477,072
France	2,536	406,370

The following table shows the steam tonnage of the seven principal maritime nations:—

	Vessels.	Gross.	Net.
Great Britain	4317	5,352,549	3,462,807
United States	574	748,012	445,479
France	414	561,318	371,853
Germany	354	411,525	292,272
Italy	121	142,249	95,848
Russia	187	138,291	90,857
Norway	185	90,933	66,387

These figures show how immeasurably in advance of all other nations Great Britain now is in respect to tonnage, more especially steam tonnage. We believe that the table will be found interesting to a great many of our readers, who have neither the time nor the leisure to compile a similar set of statistics for themselves.

W. Doxford & Sons, Sunderland.

	Tons.
ss. Corean	3488
ss. Catterthun	2179
bk. County of Pembroke	1098
ss. City of Liverpool	3514
ss. Congella	1597
ss. Coban	1055
ss. Glanwern	980
ss. Hanoverian	3603
ss. Laurel	1367
ss. Olive Branch	1728
ss. Tannadice	2183
Total tonnage	22,792

Dobie and Co., of Glasgow.

	Tons.
ss. Albingia	1848
ss. Allemannia	1846
ss. Condor	1105
br. Henry James	986
ship Illawarra	1963
ss. Ludgate Hill	4162
steel ss. Notting Hill	4021
steel ss. Tower Hill	4021
Total tonnage	19,952

C. Connell and Co., of Glasgow.

	Tons.
ss. Atlantique	2434
ss. Bretton Hall	2421
ss. City of Calcutta	3836
ss. Kansas	5276
ss. Missouri	5146
Total tonnage	19,113

W. Denny & Bros., Dumbarton.

	Tons.
ss. Antonio Lopez	3460
ss. Clyde	4124
ss. Goorkha	4104
ss. India	4065
ss. Manapouri	1783
steel s. Mahinapua	423
ss. Quetta	3302
Total tonnage	21,261

J. Laing, of Sunderland.

	Tons.
ss. Congo	2178
ss. Charrington	1823
ss. City of Hamburg	1219
ss. Friary	2307
ss. Laju	1910
ss. Moscow	1603
ss. Oliveto	2175
br. Paposa	1160
ss. Rhodora	2690
ss. Rosina	2706
Total tonnage	19,771

Russell and Co., Port Glasgow.

	Tons.
ship Rotomahana	1658
br. Port Glasgow	923
br. Bandeeth	724
ship Clan Macfarlane	1588
br. Closeburn	924
br. Clynder	1145
ship Drumburton	1891
br. Duncrag	924
ship Falls of Afton	1974
ship Falls of Dee	1974
br. Henry Swayne	725
br. Java	913
ship Kilmodan	1624
ship Nerbudda	1632
Total tonnage	18,619

E. Withy and Co., Hartlepool.

	Tons.
ss. Ashton	1663
ss. Brenda	1679
ss. Billow	1659
ss. Catanian	2015
ss. City of Bristol	1293
ss. Elgirshire	2069
ss. Hesper	1655
ss. Jeanie	1816
ss. Lemuria	1680
ss. Lindus	1679
ss. Marina	1672
ss. Ross Shire	2080
Total tonnage	20,960

R. Thompson and Sons, of Sunderland.

	Tons.
ss. Ada	876
ss. Barnsley	2002
ss. Cubano	2753
ss. Embleton	1233
ss. Grafton	1802
ss. Howards	1133
ss. Queensferry	1111
ss. Sultana	2089
ss. Straits of Dover	2352
ss. Thetford	1345
ss. Westwood	1336
ss. Zakynthos	1502
Total tonnage	19,534

Harland and Wolff, of Belfast.

	Tons.
ss. Arabic	4368
ss. British Prince	3974
ship Garfield	2347
ship Lord Downshire	2322
ss. Shannon	4189
steel ss. Winnebah	1390
Total tonnage	18,590

Richardson, Duck, and Co., of Stockton.

	Tons.
ship Andora	1720
ship Combermere	1727
ss. Gloucester City	1940
ss. Jersey City	1936
ship Kelat	1894
ship Magician	1712
ss. Shevington	3172
ss. Snnrise	2113
ss. Turquoise	2077
Total tonnage	18,291

M. Pearse and Co., of Stockton.

	Tons.
ss. Amalfi	2345
ss. Athabasca	2517
ss. Abana	2927
ss. Bertie	1716
ss. Chrysolite	1619
ss. James Whishaw	1522
ss. Miranda	1689
ss. Ramleh	2308
ss. Regent	841
ss. Thor	1657
Total tonnage	19,141

A. McMillan, of Dumbarton.

	Tons.
ss. Braila	1728
ss. Bucarest	1725
ss. Clan Buchanan	2933
ss. Edam	2957
ss. Galatz	1727
ss. Lydia Monarch	3916
ss. Stamboul	2202
Total tonnage	17,188

Tyne Iron Shipbuilding Company, of Newcastle.

	Tons.
ss. Clytha	819
ss. Clan Murray	2108
ss. Clintonia	1970
ss. George Heaton	2215
ss. Ixia	1970
ss. Muriel	2108
ss. Napier	1927
ss. Nuphar	1963
ss. Nymphæa	1969
Total tonnage	17,049

Swan and Hunter, of Newcastle.

	Tons.
ss. Antvergua	2208
ss. Broomhaugh	2095
ss. Brunette	866
ss. Cilurnum	2190
ss. City of Newcastle	1985
ss. Darlington	1990
ss. Dordogne	729
ss. Schaldio	2021
ss. Scaramanga	1591
Total tonnage	15,675

Schlesinger, Davis, and Co., of Newcastle.

	Tons.
ss. Benisaf	1689
ss. Boskenna Bay	2300
ss. Llangollen	1752
ss. Lavrion	1682
ss. Mounts Bay	2293
ss. Talabot	1359
ss. Tuetonia	2287
ss. Taghaferrs	1598
Total tonnage	14,960

J. Readhead and Co., of South Shields.

	Tons.
ss. Agnes Otto	1319
ss. Grantully	1694
ss. Gwentland	1553
ss. John Readhead	1691
ss. Lady Mostyn	730
ss. Lynton	1284
ss. Langdon	1372
ss. Nant Francon	670
ss. Susan	1506
ss. Trevilley	1353
ss. Treneglos	1513
ss. Wydale	1961
Total tonnage	16,646

London and Glasgow Shipbuilding Company, of Glasgow.

	Tons.
ss. Carnarvonshire	2362
ss. Glenogle	3749
ss. Lake Huron	4040
ss. Leonora	2851
ss. Posang	1531
ss. Saint George	548
ss. Saint Andrew	558
Total tonnage	15,639

W. H. Potter and Son, Liverpool.

	Tons.
ship Copley	1794
ship Columba	1794
ship Jessomene	1950
ship Mylomene	1949
ship Muncaster Castle	2104
ship Orchomene	1586
ship Thalatta	1793
ship Walden Abbey	1799
Total tonnage	14,769

A. Leslie and Co., of Newcastle.

	Tons.
ss. Abissinia	2723
ss. Giava	2713
ss. Huntingdon	2224
ss. James Turpie	1767
ss. Largo Bay	1706
ss. Poushkin	1485
ss. Robert Dickinson	1978
ss. Thomas Melville	1781
Total tonnage	16,371

W. Richardson & Co., Newcastle.

	Tons.
ss. Amazonense	1692
ss. Bushire	1566
ss. Dryburgh Abbey	2264
ss. Ehrenfels	2328
ss. Hunting Tower	2408
ss. Oceanique	2273
ss. Peking	1476
ss. Ville du Cap	1566
Total tonnage	15,573

Short Bros., of Sunderland.

	Tons.
ss. Acacia	1753
ss. Ahdeek	1536
ss. Inflexible	2300
ss. Regina	2378
ss. Raisby	2288
ss. Silverdale	2249
ss. Westergate	1794
ss. Perseverance	1113
Total tonnage	15,411

Barclay, Curle, & Co., Glasgow.

	Tons.
ss. Cormorant	2255
ss. Concordia	3544
ss. Dromedary	922
ss. Gorilla	929
ship Loch Moidart	2081
ship Loch Torridon	2081
ss. Pelican	2586
ss. Scalay	783
ship Siren	1555
Total tonnage	15,736

Sunderland Shipbuilding Co.

	Tons.
ss. Abergeldie	2863
ss. Bussorah	1986
ss. Chateau Leoville	3354
ss. Drachenfels	2251
ss. Hermann	2879
ss. Harbinger	1860
Total tonnage	15,193

Caird and Co., of Greenock.

	Tons.
ss. Carthage	5043
ss. Orion	2809
ss. Rome	5013
ss. Saigon	1224
Total tonnage	14,089

T. Turnbull and Son, of Whitby.

	Tons.
ss. Baron Androssan	1451
ss. Everilda	1455
ss. Florence	2213
ss. Highgate	1451
ss. Matthew Bedlington	2216
ss. Sharon	1453
ss. Saxon	1673
ss. Zenobia	2069
Total tonnage	13,981

Earle's Shipbuilding Company, of Hull.

	Tons.
ss. Angola	1966
ss. Eastward	235
ss. Galileo	2990
ss. Portugal	1966
ss. Saint Ronans	4484
ss. Zodiac	114
Total tonnage	11,755

J. Reid and Co., Port Glasgow.

	Tons.
br. Bolivia	904
br. Carleton	1358
br. Cloucaird	1361
br. Kenmore	958
ss. Laja	2147
bk. Valdivia	905
Total tonnage	7633

Norddeutsch Werft, of Berlin.

	Tons.
ss. Cassino	2286
ss. Etna	2262
ss. Svea	568
ss. Victoria	550
ss. Wergeland	330
Total tonnage	5996

J. and G. Thompson, Glasgow.

	Tons.
ss. Catalonia	4841
ss. Moor	3688
ss. Spartan	3491
ss. Servia	7392
ss. Thames	4101
Total tonnage	23,513

R. Steele and Co., of Greenock.

	Tons.
ss. Cape Clear	2350
ship Inversnaid	1614
ss. Modena	1211
ship Routenburn	2097
ss. Savona	1211
ss. Wicklow	987
Total tonnage	9470

A. and J. Inglis, of Glasgow.

	Tons.
ss. Bohemia	3410
ss. Dacca	3909
Total tonnage	7319

Napier and Son, of Glasgow.

	Tons.
ss. Aberdeen	3616
ss. Screna	2394
Total tonnage	6010

Blumer and Co., of Sunderland.

	Tons.
ss. Anerley	1942
ss. City of Antwerp	731
ss. Finchley	1951
ss. Fei Lung	1180
ss. Godalming	1292
ss. Maulkins Tower	2750
ss. Vercingetorix	2019
Total tonnage	11,865

Osbourne and Graham, of Sunderland.

	Tons.
ss. Ashdene	1138
br. Araroa	1334
br. Balaklava	1347
ss. Ethel Horatia	1151
ss. Elk	1476
bk. Ganges	1529
ss. Salerno	1354
Total tonnage	9329

Hodgson and Solsby, of Blyth.

	Tons.
ss. Blagdon	2062
ss. Baines Hawkins	746
ss. Ealing	2063
ss. Florence	349
ss. Kirkheaton	495
ss. Muriel	105
ss. Montserrat	1088
ss. Pelham	350
Total tonnage	8158

Austin and Son, of Sunderland.

	Tons.
ss. Dewdrop	1144
ss. Harvest	1380
ss. Laura	1133
ss. Rocklands	953
ss. Talley Abbey	638
Total tonnage	5248

Batram and Haswell, of Sunderland.

	Tons.
ss. Aleona	895
ss. Clan Monroe	2197
ss. Clan Mackay	2171
ss. Elizabeth Allen	1614
ss. Handel	2123
ss. Palm Branch	1706
Total tonnage	10,706

Scott and Co., of Greenock.

	Tons.
ss. Cavour	632
ss. Clan Macdonald	2642
pal. s. Marco Aurelio	785
ss. Omniopolis	1217
ss. Professor	2593
ss. Vesta	3055
Total tonnage	10,924

Whitehaven Shipbuilding Co.

	Tons.
ss. Artmathwaite	1487
br. Devock Water	1056
ss. Hercules	1155
ss. Marion Lee	688
ship Wasdale	1879
Total tonnage	6265

H. Murray and Co., of Port Glasgow.

	Tons.
ss. Alora	729
ship Ben Douran	1950
ss. Ingeria	588
ss. River Clyde	962
ss. Seville	688
Total tonnage	4917

R. Duncan and Co., of Glasgow.

	Tons.
ship Amphitrite	1777
ss. Arracan	2880
ship Hermes	1464
ss. Katherina Clark	803
ss. Lamington	1958
ship Poseidon	1778
Total tonnage	10,660

D. and W. Henderson and Co., of Glasgow.

	Tons.
ss. Armenia	3896
ss. Birksgate	1458
ss. Galatia	3096
Total tonnage	8450

Murdoch and Murray, of Port Glasgow.

	Tons.
ss. Corsican	926
ss. Ivanhoe	942
ss. Iolani	1543
ss. Lido	977
ss. Patria	837
ss. Rydal Fell	601
ss. Westport	421
Total tonnage	6247

Barrow Shipbuilding Company, of Barrow.

	Tons.
ss. Bearn	4134
ss. City of Rome	8415
ss. Fenella	518
ss. Ganges	4196
ss. Navarre	4137
ss. Strabo	1965
ss. Sutlez	4194
Total tonnage	27,559

Aitken and Mansell, of Glasgow.

	Tons.
ss. Athenian	3877
ss. Ella	820
ss. Engineer	2667
ss. Governor	2623
steel s. Victoria	366
Total tonnage	10,353

H. McIntyre and Co., of Paisley.

	Tons.
ss. Amitie	695
ss. Alpin	1059
ss. Crete	492
ss. Gedeon	507
ss. Lolland	488
ss. Mindanao	1033
ss. Ossian	652
ss. Palna	879
ss. Persevero	468
ss. Risveglio	468
ss. Remus	1039
Total tonnage	7780

W. Pickersgill and Sons, of Sunderland.

	Tons.
ss. Corrwg	931
ss. Foscolino	1124
ss. Godolphin	1140
ss. Gwalia	1354
ss. Longueil	1711
Total tonnage	6260

Irvine and Co., West Hartlepool.

	Tons.
ss. Dewdrop	1144
ss. Harvest	1380
ss. Laura	1133
ss. Rocklands	953
ss. Talley Abbey	957
Total tonnage	5567

Palmers and Co., of Newcastle.

	Tons.
ss. Blaenavon	1296
ss. Bracadaile	2198
ss. Bretwalda	2907
ss. Darien	2743
ss. De Bay	1664
ss. Ebbwvale	1350
ss. Glenmavis	2114
ss. General Roberts	1450
ss. Goldcliffe	1310
ss. Guildford	2281
ss. Hindoustan	2895
ss. Hildegarde	1940
ss. Lancaster	1746
ss. Mareca	2211
ss. North Cambria	1969
ss. Palomares	1381
ss. Principia	2749
ss. Ross	1356
ss. Roxburgh	2148
ss. Sportsman	1953
ss. Suez	2125
ss. Tredegar	1343
Total tonnage	43,129

A. Stephens and Son, Glasgow.

	Tons.
ss. Archimede	2839
ss. Benlarig	2265
ss. Cantania	2198
ss. Cameo	2280
ss. Clan Cameron	2433
ss. Fidra	1139
br. Glenfarg	898
br. Glenshee	895
ss. Iniziativa	2033
ss. Mudela	1712
ss. Marsala	2367
ss. North Sea	1117
ss. Pallas	595
ss. Picter de Coninck	3310
ss. Sorrento	2371
ss. White Sea	1119
Total tonnage	29,570

J. Elder and Co., of Glasgow.

	Tons.
ss. Alaska	6932
ss. Austral	5588
ss. Insulinde	2997
ss. Prins Alexander	2978
ss. Prins Frederik	2997
ss. Stirling Castle	4423
Total tonnage	25,915

W. Gray and Co., of West Hartlepool.

	Tons.
ss. Boyne	2006
ss. Boston City	2334
ss. Beechville	1747
ss. Carisbrooke	1724
ss. Coningsby	1757
ss. Deer Hill	1733
ss. Durham City	2844
ss. Everest	1728
ss. Gulf of Carpentaria	2454
ss. Gulf of St. Vincent	2450
ss. Hasland	1755
ss. Hughenden	1802
ss. Hawarden	1816
ss. Merannio	1036
ss. Macedonia	1766
ss. Manna	1056
ss. Pamana	1765
ss. Surrey	2949
ss. Shelley	2003
ss. York City	2325
Total tonnage	38,050

R. Dixon and Co., of Middlesbrough.

	Tons.
ss. Anjer Head	2015
ss. Afrikaan	1180
ss. Bothwell Castle	2542
ss. Chancellor	2116
ss. Chitagong	1912
ss. Iron Acton	1148
ss. Juliet	2090
ss. Jacob Christensen	1773
ss. Joseph Arbit	1900
ss. Minard Castle	2460
ss. Middlesborough	1278
ss. S. J. Oteri	989
ss. Uppingham	2203
ss. Zuid Holland	2275
Total tonnage	25,881

Oswald, Mordaunt, and Co., of Southampton.

	Tons.
ship Androsa	1999
ss. Chateau Lafite	3462
ship Darjiling	2002
ship Frankistan	2002
ship The Hahnemann	1997
ship Victoria Regina	2000
Total tonnage	13,462

Royden and Son, of Liverpool.

	Tons
ss. Aristides	1536
br. Bankville	1042
ss. Britannia	2456
ss. Cerigo	1547
ss. Knight of St. Patrick	2311
ss. Knight of the Bath	2311
ship Orealla	1843
ss. Pawnee	1798
ss. Peconic	1795
ss. Picqua	1796
ship Windsor Park	1840
Total tonnage	20,475

Hall, Russell, and Co., of Aberdeen.

	Tons.
ss. Austerlitz	1653
ss. Douglas	1566
ss. Fooksang	1557
Total tonnage	4776

C. Mitchell and Co., Newcastle.

	Tons.
ss. Australia	2119
ss. America	2118
ss. Enero	1423
ss. Inchrhona	2292
ss. India	1551
ss. Inchborva	2301
ss. Khalif	2282
ss. Lady Dalhousie	1982
ss. M. Meanatchy	2111
ss. Maha Vajirunhis	1176
ss. Polynesia	2196
ss. Polaria	2724
ss. Stolzenfels	2328
ss. Swift	190
Total tonnage	26,793

J. L. Thompson and Sons, of Sunderland.

	Tons.
ss. Ashford	1964
ss. Creole	1372
ss. Crystal	2608
ss. Critic	2601
ss. Dorset	2638
ss. Dodona	1533
ss. Elsie	2374
ss. Maritana	1862
ss. Nutford	1214
ss. Rosella	1415
ss. Recta	2921
Total tonnage	22,502

RAILWAY MATTERS.

THE London and South-Western Company's curve line between Hounslow and Twickenham has been opened.

IN the United States, 9171 miles of railway were made in 1882, as compared with 6649 miles in 1881 and 534 miles in 1880.

OF several reports just received by officers of the Board of Trade, two relate to accident and damage done by timber and steel bars improperly loaded with goods wagons.

M. M. DEBARNOT ET JACQUOT proposes to construct locomotives with the axles above the boiler, thus giving a larger diameter of wheel, and consequently greater speed without increasing the usual number of piston strokes per minute. This is not new.

IN concluding a report on the collision which occurred on the 31st October at Fenchurch-street station, on the Great Eastern Railway, when a Tilbury train came into collision with a Great Eastern Company's unattached tank engine, Major-General C. S. Hutchinson says: "Had the Tilbury train been fitted throughout with a quickly acting continuous brake in the driver's hands the collision would most probably have been prevented."

A VERY ingenious electric clock for use in railway stations has been recently exhibited in Boston. It gives automatically the signals for starting trains at the proper times, and it is automatically regulated at noon each day by electric impulse from some astronomical station. Though the details of the apparatus are rather complicated, the *Times* says the principle is simple. The mechanism for giving the signals shows two discs, each pierced with 1440 holes, arranged in spirals of twenty-four turns, with 60 holes in each turn. Small metallic pegs are inserted in the holes corresponding to any given minute and hour, and the contact of these with an electric conductor allows passage of the current for the signal. When any change is made in the time of starting trains, the pegs are shifted. One, two, three, or more successive and different signals can be given for each train. It is proposed to connect all the stations of a railway with the main office, so that signals for starting trains will be given from a single apparatus.

AS an instance of Austrian railroad regulation, the *Railroad Gazette* gives the following:—"A company proposed to accommodate a number of wealthy people living along its line by changing a second-class compartment in one of its cars into a first-class, and placing it at the disposal of these people without change from the second-class rate, making it a sort of private compartment for the use of a special company. The Ministry of Trade held this to be a case of undue discrimination, and refused to approve the arrangement unless the road should permit every purchaser of a given number of second-class tickets to ride first-class. If the requirement were that every company of an equal number should have the same privilege as the one for which the arrangement was made, there could be no objection to it. But the case is an illustration of the disposition of European States to avoid any appearance even of violating the principle of equality—further evidence that the French revolution has revolutionised Austria even."

IN an article on the effect of free canals on railway traffic, the *Railway Gazette* says:—"The canal shipments cannot be said to have been reduced by the competition of the railroads except in the years of long and desperate railroad wars, namely, in 1876 and 1881; they were larger on the average in the five years ending with 1881, including that year of the worse railroad war, than in the five years ending with 1875, when there was no such season of very low rail rates—56,600,000 in the last and 52,000,000 in the first five years; and the largest grain shipments ever made by canal were in 1880, when they reached 77,271,127 bushels. The canal has remained important, but comparatively it is less important than it used to be. There is an important lumber traffic on the canal, sometimes greater than the grain traffic, and the shipments of coal, ore, salt, &c., are considerable; but for none of these shipments do the railroads compete as they do for grain. Tolls were taken off from some articles of merchandise some time ago, with scarcely any effect on shipments. Grain shipments will, if anything, be increased by abolition of tolls."

A CORRESPONDENT writing to the *Times* on a recent break-down of a goods train on the Great Eastern Railway, says "the signalman, whose promptitude and judgment averted a bad accident, has met with the recognition and reward to which he was so justly entitled; and that the engine-driver of the express train who received his warning, and behaved with equal promptitude, has also been similarly rewarded. The case was this—The down express train approached the Angel-road station of the Great Eastern Railway with the distant and home signals taken off to allow it to pass through at speed, when the signalman heard a noise as of something wrong in a goods train approaching in the opposite direction. The express train had already passed the distant signal, and was within a comparatively short distance of the home signal, when the signalman threw up the red light of the home signal in his face on finding reason to apprehend danger. The engine-driver at once applied the Westinghouse continuous brake, with which the train was provided, and brought the train to a stand in 200 yards, within ten yards of the home signal; and thus averted what would otherwise have been a very serious accident."

THE strong feeling in support of the water-ways in the United States showed itself in the recent elections. In New York it was voted by a large majority to render the Erie Canal free of all tolls, and to raise such sums as may be necessary to keep it in repair or enlarge it by means of taxation. In Illinois the amendment ceding the Illinois and Michigan Canal to the general Government was also carried. The latter transfer is upon the understanding that the canal will be enlarged for the whole or a portion of its length, and shall form a through water-way from the lakes to the Mississippi river. This will give a free water-way from the Mississippi river to tidewater. Such a route cannot be opened without material effect upon existing channels of traffic, but, according to the *Railway Review*, opinions differ widely as to the ultimate result upon the welfare of railroads running nearly parallel to such water-ways. We have seen that in the past the usefulness of canals in several of the States has steadily declined before the competition of railways. The experience of the past in the gradual lowering of cost of railroad transportation will be repeated to some extent in the future, though not in as great a degree. This fact, taken in connection with the stoppage of canal traffic during the winter months, will largely offset the effect of the reduced tolls.

THE earthslip near Fort de l'Ecluse nearly caused one of the most calamitous inundations on record. On Tuesday night, the 2nd inst., an old railway watchman who lives in a cabin between the station of Collonges and the long Credo tunnel, which runs under the pass to Bellegarde, felt his house shake and heard a noise like thunder. Feeling sure that something was wrong, and knowing that the train which leaves Geneva at midnight was due, he ran along the line, placing detonators on the rails as he went. By this device he succeeded in stopping the train, and not a minute too soon, for the noise he had heard came from an earthslip, which carried 200 metres of the permanent way bodily into the Rhone, whither, the Geneva correspondent of the *Times* says, but for the old man's presence of mind, the train must inevitably have followed it. The line from Geneva before entering the great Credo tunnel passes through a short one immediately below the fort. On Wednesday a great mass of earth fell from the mountain directly above the smaller tunnel, and completely blocked the course of the Rhone. At noon the tunnel itself fell in with a report that was heard for miles. The water accumulated behind the barrier with frightful rapidity, and if it had gone on gathering, even for a day or two, the consequences would have been frightful—the valley of the Rhone as far as Lyons would have been swept as by an avalanche. As it was, the dam burst a few hours after the second earthslip.

NOTES AND MEMORANDA.

BELGIUM produced, during the first half of 1882, 359,725 tons of pig iron, 324,622 tons of finished iron, and 108,472 tons of steel.

DURING the recent storms the wind-pressure plates erected on the Forth under the orders of the engineers of the Forth Bridge have indicated a maximum pressure of 20 lb. per square foot of the smaller plate of 2 square feet, while the large heavy plate of 300 square feet has indicated but 12·5 lb. per square foot.

HERR R. BASSEL, a Berlin engineer, who last year published an article in the *Centralblatt der Bauverwaltung* on the aqueduct of Betilienus at Altari, has recently made further excavations, and has succeeded in recovering some of the lead pipes which conveyed the water. Many fragments of terra-cotta have also been found, probably indicating a factory.

DURING the excavation of the tramway tunnel through Posilippo an antique water conduit of singular interest was discovered, and examined by competent archæologists. The walls, of thick cement, contain inscriptions indicating the villas supplied with water. The dimensions of the conduit are such that people can walk erect inside. One of the inscriptions was made apparently after a partial restoration. It bears the name of Consul Nerva.

COMMENTING on the communications of the Duke of Argyll, Emeritus Professor Blackie, and others, which have appeared in the *Times* in connection with the depopulation in the Highlands, a statement appears in the *Celtic Magazine* to the effect that since the census of 1831 the population of Argyllshire has actually declined from 100,973 to 76,468; and as to the latter number, no fewer than 30,387 are classified as urban. The conclusion arrived at is that the rural population has been reduced in the course of the last fifty years from 85,973 to 46,081, or nearly one half.

THE population of France is now 37,405,290, of whom 18,656,518 are males and 18,748,772 females, the latter being stronger in numbers by 92,254. Of the males 10,110,601 are unmarried, 7,520,186 married, and 1,025,731 widowers; while of the females 9,280,862 are unmarried, 7,503,353 married, and 1,964,557 widows. Agriculture employs no fewer than 18,204,799 persons, or very nearly one-half of the entire population. Next come the manufactures, which find employment for 9,324,107 pairs of hands, and then commerce, which employs 3,843,447. Persons of independent income number 2,148,473, and the liberal professions support 1,629,768 representatives.

THE total eclipse of the sun on the 6th of May next will last six minutes, and no eclipse of longer duration will probably occur within the next 100 years. It will be partially visible in many places, but few will see it in its entirety, as its path lies almost entirely through the ocean, touching land nowhere but at a little island in the South Pacific called Caroline Island, which is out of the track of any established commerce or travel. The *Panama Star and Herald* says the French Government have determined to send an expedition to that island, it is almost certain an American party will go thither, and it is more than probable a grand international gathering of astronomers will take place at the Caroline Island to take part in this scientific quest.

M. TREVES, Paris Academy of Sciences, in writing on the use of zinc in boilers, says a couple is formed by the iron and zinc, which occasions a continuous decomposition of water. The oxygen combines with the zinc, and the zinc oxide combines with the fatty acids present in the feed water, forming a zinc soap, which prevents the adhesion of saline matter to the sides and plates of the boiler. The hydrogen lessens the danger of explosion from the absence of gaseous matter, and consequent superheating. When a boiler has been kept for a considerable time with its fire banked up, the hot water is totally deprived of air, and on then raising the temperature an explosion is possible. In such cases he recommends that a part of the water should be run off and fresh water containing air introduced in its stead.

TAKING the whole of the Welsh ports, we find that the foreign shipments of coal during the past year were as follows:—From Cardiff, 5,799,919 tons, or an excess over 1880 of 1,000,000 tons; from Newport, 1,365,105, or an increase of 116,688 tons; from Swansea, 937,275 tons, or an increase of 165,793 tons. In coastwise shipments we find Cardiff sent 951,197 tons, as compared with 933,505 tons in 1881; Newport, 809,307, as compared with 900,557 tons in 1881; and Swansea, 758,642, as compared with 683,955. Turning to other exports we find that Cardiff sent away in 1882, 137,827 tons iron, 28,820 tons of coke, and 169 tons patent fuel. The vessels employed maintained a fair average of 450 per month, and totalled in the year 5493. Newport sent away in 1882, 174,828 tons of iron, 5527 tons of coke, and cleared an average of 150 vessels, totalling 1803 vessels in the year. Swansea despatched 6067 tons of iron, 10,733 coke, 279,376 tons patent fuel, and cleared 2204 vessels in 1882. Llanelly, the fourth Welsh port, is beginning to make a figure. In the year it sent away 66,316 tons of coal foreign, 110,497 coastwise, and cleared in the year 273 vessels.

THE manufacture of carbons free from ash can be accomplished—according to Jacquelain in the *Comptes Rendus*, xciv. 837—by passing dry chlorine gas over pulverised coal or coke heated to bright redness. All of the silica, alumina, and magnesia, as well as alkalies and metallic oxides, would be converted into volatile chlorides and expelled; even the hydrogen is driven off as hydrochloric acid. The easiest method of carrying out the process on a large scale is to allow the dry chlorine gas to act upon gas carbon—from the retorts—cut into thin prisms, for thirty hours, and then raise the temperature to a bright white heat. This makes the carbon porous, and in order to convert into a dense, heavy carbon, which is a good conductor and not easily combustible, the vapours of heavy tar oils—dead oil (?)—are passed slowly over the pieces of glowing carbon, when a deposition of carbon will take place within the pores of the coke. If the carbon rods are treated with fused sodic hydrate—caustic soda—the silica and alumina will be dissolved as sodic silicate and aluminate, and can be removed by washing with hot water. Oxide of iron and other constituents of the ash are removed with hydrochloric acid followed by pure water. The simplest process recommended by Jacquelain, the *Scientific American* says, is to leave them for two or four days in dilute hydrofluoric acid, at ordinary temperature, then wash well and expose for a few hours to a slow current of tar vapours at a high temperature.

SOME time since Professor A. Wagner, Munich, made a series of experiments on the action of different solutions on copper, zinc, lead, tin, Britannia metal, brass, and German silver, first in air free from carbonic acid, then in the presence of carbonic acid and air. These metals and alloys were in the form of foil, of equal surface—namely, two square inches—and of as nearly equal thickness as possible. The copper foil was practically pure; the zinc was common sheet, with 0·68 per cent. of lead; the lead was commercial sheet; the tin was the pure cast metal. The Britannia metal consisted of 90 per cent. tin, and 10 per cent. antimony. The brass was composed of 64½ per cent. copper, and 35½ per cent. zinc. The German silver was 70·2 per cent. copper, and 29·8 zinc and nickel. These pieces of sheet metal were placed vertically in glass vessels, each holding 6·1 cubic inches of the solution to be tested, the metal being completely covered with the solution. In the experiments they were left in the solution for a week. In freshly boiled distilled water, zinc suffered the most change; tin and Britannia metal suffered no change. With access of air and carbonic acid, the action upon lead, copper, zinc, brass and German silver was much more energetic than in the presence of air free from carbonic acid. In the latter case only traces of copper, zinc, and lead were dissolved; tin, Britannia metal, brass, and German silver were not attacked at all. In the presence of carbonic acid and air, tin and Britannia metal were the only metals not attacked; all the other metals were perceptibly dissolved.

MISCELLANEA.

A FRANCO-ITALIAN Exhibition at Nice is being organised for next winter.

ABOUT 2000 volumes relating to the history of Canada have been purchased in New York for addition to the Canadian parliamentary library.

THE *Citizen* states that the Corporation have spent upwards of £10,000 in aiding the Royal Commission on the Pollution of the Thames.

A COURSE of lectures will be delivered during this session at King's College, by Professor W. G. Adams, on "Voltaic and Dynamic Electricity."

AN international Exhibition of industrial, and principally electrical objects, is being organised by the Bohemian Architekten und Ingenieur-Verein, at Prague, to open on 17th March.

AT a meeting of the lighting committee of the Dublin Corporation held last week it was resolved to engage the services of Mr. Angelo Fahie, C.E., of Dublin, as consulting electrician to advise the committee on the electric lighting.

THE waterworks department of the Stafford Corporation are contemplating an engineering scheme, which will cost some £9000, in order to obtain a water supply from the neighbourhood of the Iston and Croten Valley. The borough surveyor is preparing plans and estimates for carrying out the work.

MR. A. FISCHER, of St. Bride-street, is now publishing a new series of the "Art Workman." The price is now 1s. 6d., and the first part of the new edition consists of seven sheets of beautifully executed engravings relating to ornamental lock work, cabinet with marquetery in relief, surface decoration, glass and silversmiths' work, chairs, jewellery, and woven fabrics.

A SCHEME has just been started to make a ship canal from the Tyne to the Solway Firth. An engineer is engaged on the necessary survey, and plans and estimates will shortly be made public. Meantime a notice of motion in favour of the project has been given at a meeting of the Newcastle Town Council. The distance from sea to sea is about eighty miles, of which about twelve are navigable.

DURING the recent fearful continental floods a kilometre of the Simplon line, near Sierre, was destroyed by an earthslip, and traffic has not yet been resumed. A steamer has been wrecked, with the loss of one life, on Lake Constance. The Thur has overflowed its banks, and all the country between Kappel and Lichtensteig is under water. The Val de Travers has been converted into a vast lake.

ELECTRICITY is being used at the Trafalgar Collieries, Forest of Dean, to work a pump in the underground workings employed for pumping the drainage water from some of the deep workings to the bottom of the shaft, whence the ordinary steam pumps raise it to the surface. The total vertical lift of the pump worked by electricity is 115ft., whilst the length of pipes through which the water is forced is some 500 yards.

THE Sheffield Town Council, by a majority of ten votes—thirty to twenty—have decided to abandon their application to the Board of Trade for a provisional order to supply electricity within the borough. They have also resolved to oppose the application of the Union Electric Light and Power Company, Limited, which has lodged a bill to undertake the electric lighting of Sheffield and seven other large towns.

THE Royal Commission appointed to inquire into the discharge of sewage into the Thames met on Tuesday in No. 9 Committee Room, House of Commons, for the purpose of taking further evidence on behalf of the Corporation of London, but an adjournment of the proceedings was applied for on the ground that the City authorities had been unable to complete their experiments and the examination of the river in time for their meeting that day. The meeting was adjourned until the 23rd inst.

MR. T. HAMPTON, whose retirement from the firm of Messrs. Steel, Tozer, and Hampton, Phœnix Bessemer Works, The Ickles, Rotherham, was noticed a fortnight ago, has accepted an appointment as manager of the Bessemer department in the Barrow Hematite Steel and Iron Ore Company. The salary is variously stated at from £1500 to £2000 a year. Mr. W. S. Davy, of Davy Brothers, Park Ironworks, was recently appointed manager of these works at a salary of £3000, rising to £3500 the second year, and £4000 the third.

THE first number of vol. i. of a monthly journal entitled "Amateur Mechanics," conducted by Mr. P. N. Hasluck, has been published by Messrs. Trübner and Co. It contains thirty-two pages with many original articles and a collection of information which must make the journal a favourite with those who find in the use of tools an agreeable leisure occupation, if the promising character of the first part is maintained by those which succeed it. The illustrations are, however, badly done and not sufficiently complete, for which in these days there is no excuse.

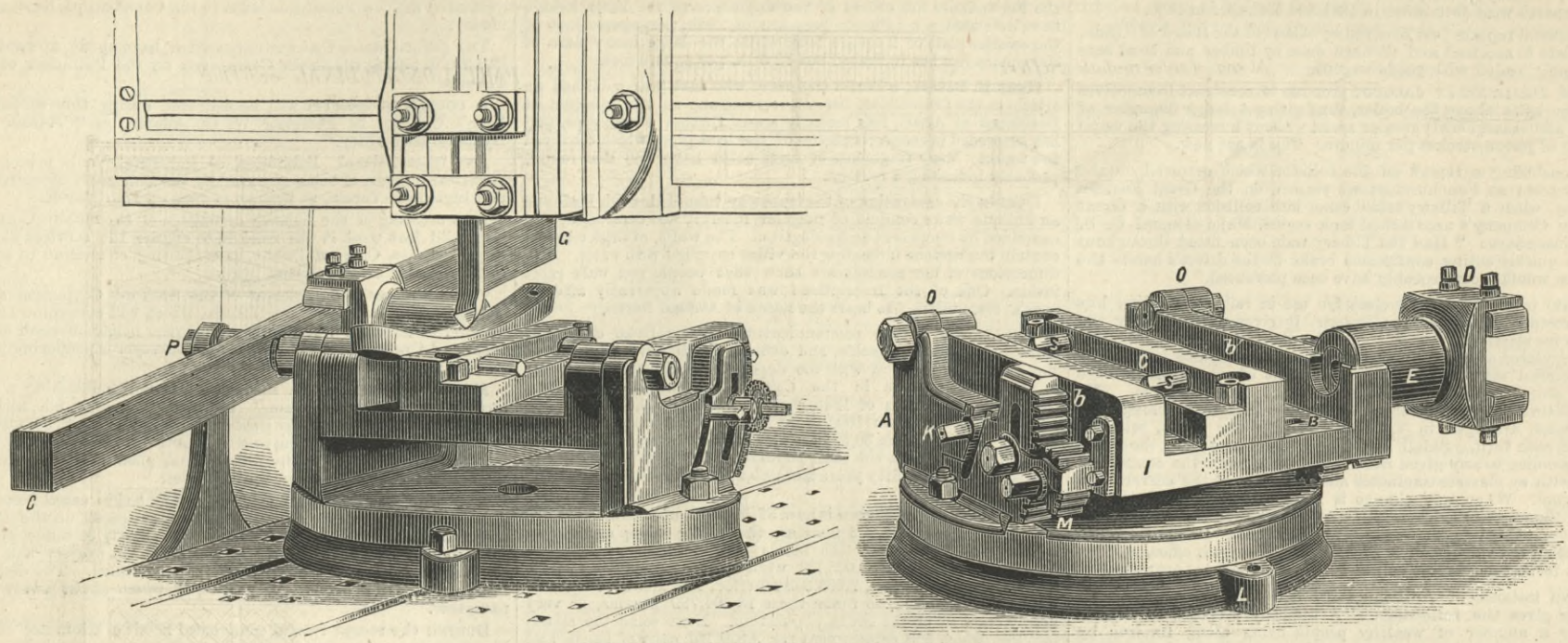
A RECENT *Gazette* announced the appointment of Mr. Henry Christopher Mance, of the Government Indo-European Telegraph Department, to be a companion of the Order of the Empire of India. Mr. Mance holds the responsible appointment of engineer and electrician in his department, and has done good service, not only to it in the maintenance for some years of the cable between Kurrachee and the head of the Persian Gulf, but to electrical science in the invention of new methods and formulæ. He is also known as the inventor of the heliograph, or sun telegraph.

ENGINEERING work of considerable magnitude has just been completed at the Wolverhampton Corporation's Waterworks. A new well, 12ft. in diameter, has been sunk through sandstone rock to the depth of about 120ft. At the bottom there are fixed into the solid rock heavy iron girders about 2 tons in weight, forming a bed for the pumping gear. Underneath the girders are iron plates 9ft. by 3ft. 6in. broad and 3in. thick, firmly bedded in cement. A new pumping engine has been built specially by the Lillieshall Iron Co., and is of the Cornish type. The steam cylinder is 56in. diameter with an 8ft. stroke, and with a steam pressure of 55 lb. per square inch; it is equal to a lift of 4,000,000 gallons per twenty-four hours. The steam is generated by two new double-flued boilers, built by Messrs. Tinker, Shenton, and Co., of Hyde, near Manchester. Each is 27ft. by 7ft., constructed with welded tubes of the best obtainable material, and with the most modern arrangements for economical consumption of fuel. The water required for the purposes of condensation of steam at the works amounts to 400,000 gallons per day. The object of the well and engine is to increase the outcome from two artesian borings, at a depth respectively of 300ft. and 1000ft., from 800,000 gallons per day to 3,500,000 gallons.

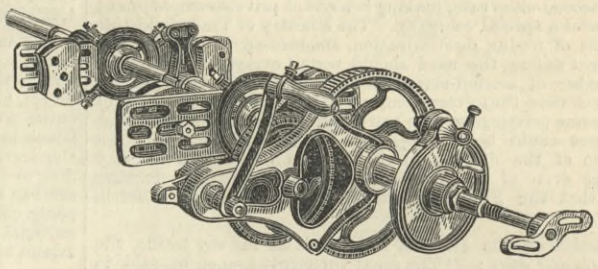
THE Select Committee of Commissioners of Sewers on Electric Lighting reported on Tuesday that a licence would in all probability be granted making it compulsory to supply electric lighting in a small area and permissive to supply outside that compulsory area, such permissive powers to be reasonably and fairly exercised at the discretion of the Commission. The committee suggested that the Court should apply for a licence for permissive power to supply or contract for the supply to the whole City, and specify certain areas in which the supply should be compulsory, and they recommended that they be empowered to prepare a draft licence framed on the principle of becoming undertakers and of contracting with reliable electric lighting companies for the supply of electric lighting, and they asked authority to negotiate with the companies in respect of the areas in which the supply was proposed to be made compulsory, leaving the other portions of the City to be dealt with more at leisure as circumstances and the experience gained in respect of the compulsory areas might dictate, by which means they hoped within a reasonable time to accomplish the lighting of the whole City by electricity at a minimum of cost to the ratepayers. The report was adopted.

SPECIAL AMERICAN MACHINE TOOLS FOR RAILWAY REPAIR SHOPS.

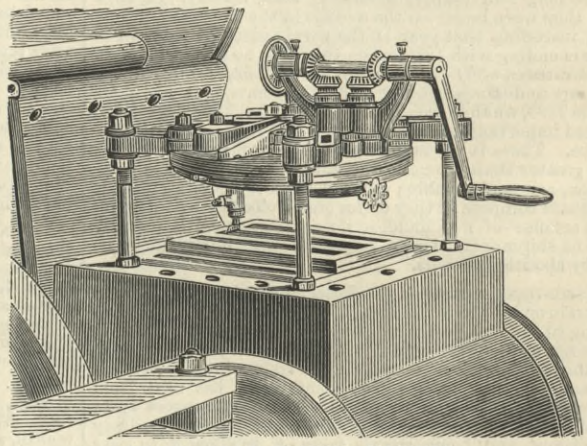
MESSRS. PEDRECK AND AYER, PHILADELPHIA, ENGINEERS.



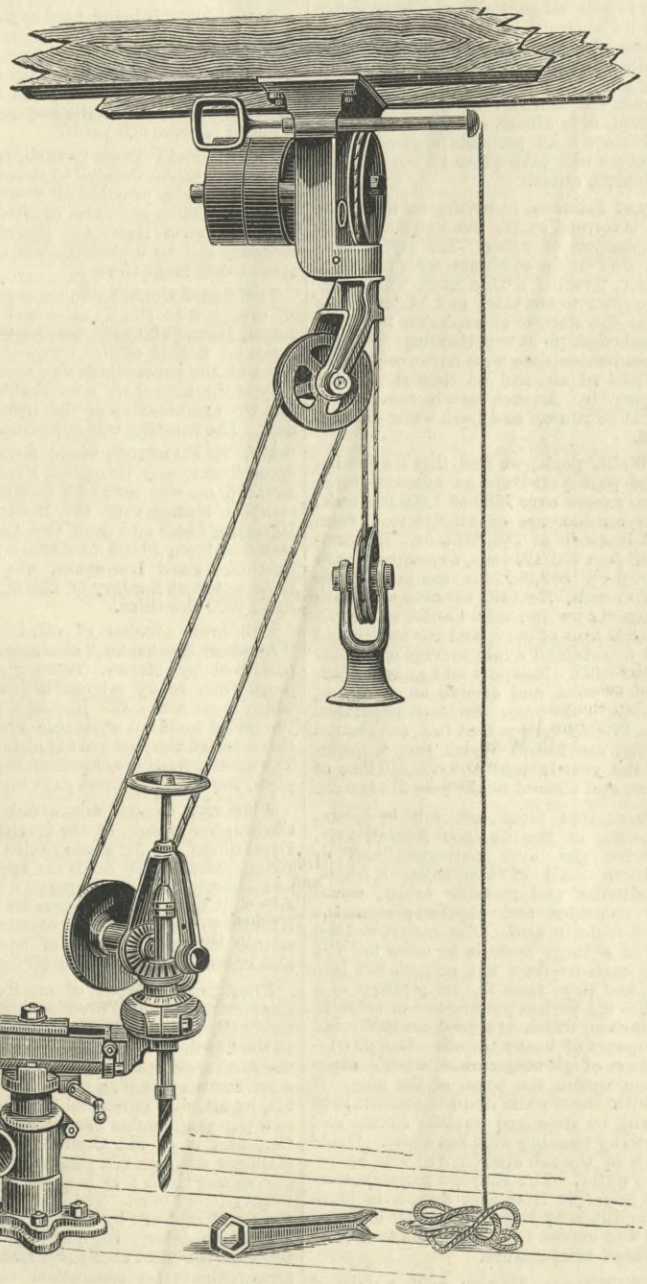
GREENWOOD'S UNIVERSAL PLANER CHUCK.



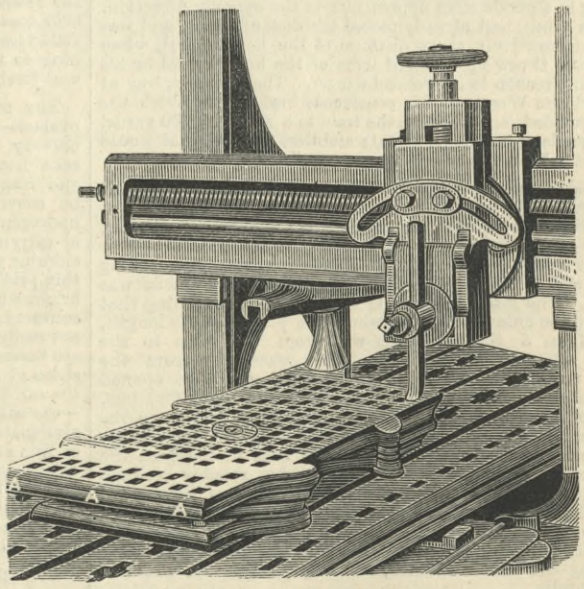
CYLINDER BORING MACHINE.



VALVE SEAT PLANING MACHINE.



FLANDER'S PORTABLE DRILL.



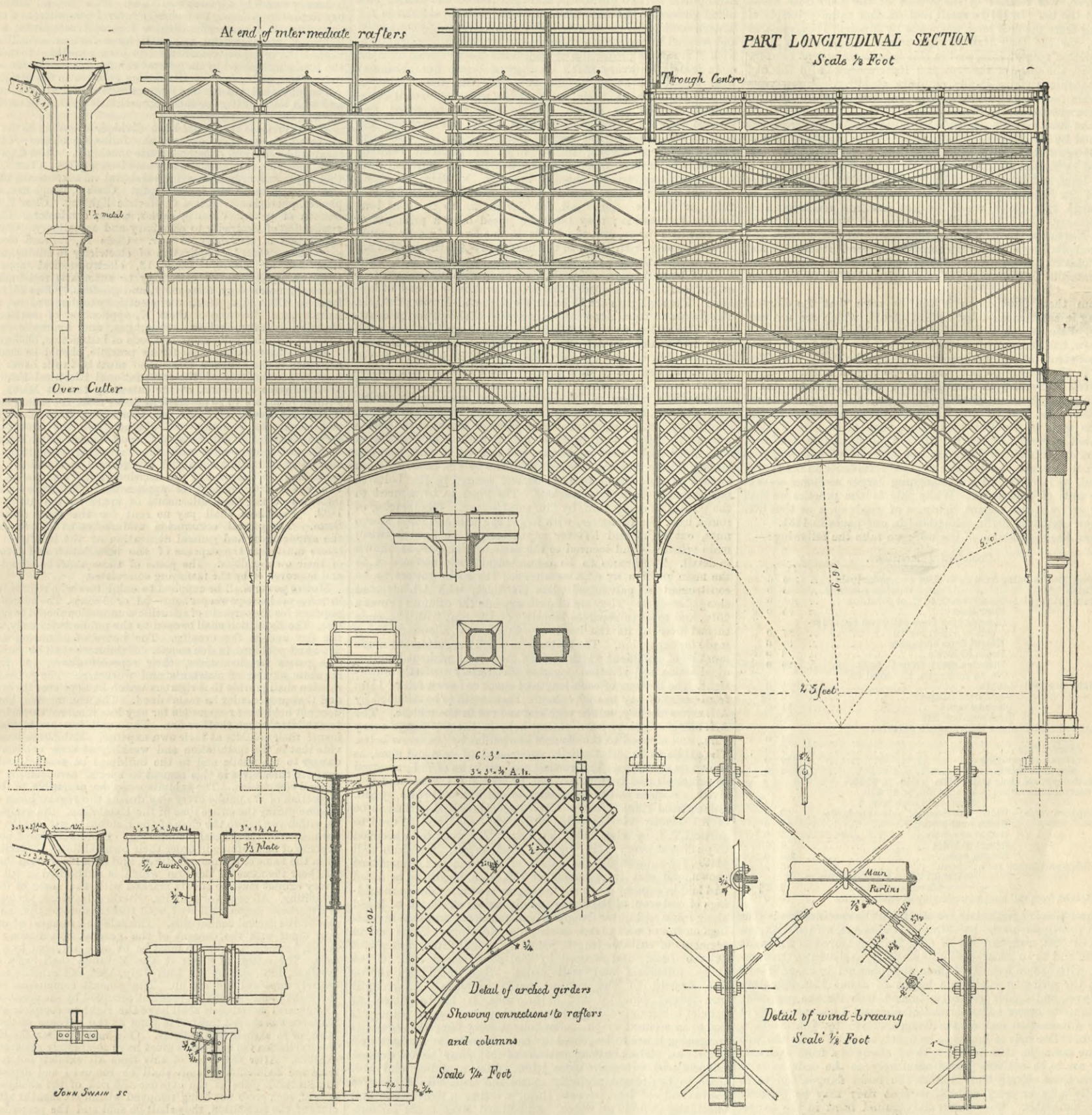
FLANDER'S RADIAL PLANER.

AMERICAN toolmakers have always been celebrated for the production of ingenious devices for accomplishing special classes of work, and we believe that the examples of this, which we illustrate above, will be found interesting. They are all the production of the L. B. Flanders Machine Works—Messrs. Pedrick and Ayer—Philadelphia.

The first tool is Greenwood's universal planer chuck. The leading feature of this chuck is its capacity for planing circular curves of large radius. The various functions of the chuck will be more clearly understood after describing its parts. The first view shows it complete with the guide bar, its bracket, and pivot, and the arc or quadrant by which the guide bar is set to plane any particular circle; without these the chuck as shown in the second view. The vice C is pivotted to two supports O O, one on each side. These supports project up from the chuck body, within which the vice is placed. Room is allowed at the bottom of the second piece to allow the vice to rise and fall at the right-hand end. It is made to rise and fall in dressing circular surfaces by the crosshead D sliding upon the guide bar G; when the latter is elevated at the end toward the right a concave surface is planed, and when depressed a convex surface is cut. To change the degree of convexity or concavity the inclination of the guide bar is to be changed, it being horizontal for planing straight. The guide bar is fixed at one point by a pivot P, about which it swings in being raised or lowered at one end. This pivot is supported by a bracket fastened firmly to the frame of the planer below the table. The movement by which the circular arc is secured in dressing work is indicated thus: Suppose a piece of work clamped in the vice, and the guide bar set at an inclination. Then as the table of the planer is moved forward and back, as in planing, the base of the chuck is borne upon it, as also the vice and crosshead. But the latter, in sliding upon the stationary inclined guide bar, must slide on an incline. This makes one end of the vice of the chuck rise and fall, the other end being held at a constant height above the table by the vice pivots. This gives a revolving or swinging motion above a horizontal axis. The cutting tool now being brought to bear upon the piece of work cuts it to the circular arc. The tool can always be so placed as to give a mathematically correct circle. The jaw of the chuck has a graduated arc by which the inclination for any wedge or key is easily given. Also the guide bar has a graduated arc for setting it to any given circular arc. A table is prepared for use in setting the bar at once and correctly. A segmental rack and pinion are applied to the jaw of the chuck in such a way that the weight of the jaw is easily lifted by applying a wrench. Thus we have in this universal planer chuck, the ordinary chuck, a chuck for planing tapers and keys, and the novelty of the circular planer for long radii, so that the possession of this chuck enables the workman to do all the various kinds of work described, with the cross feed of the common planer found in every machine shop, and without other or additional appliances. The chuck is comprised in three principal parts—the bottom plate L by which it is fastened to the planer table, the vice C by which the work is held, and a guide bar G held by a bracket on the planer bed. With these parts it is possible to produce a great range and variety of work.

The next engraving shows Flanders' radius planer, for planing

ROOF OVER RUNNING SHED, GREAT SOUTHERN AND WESTERN RAILWAY, NEW SOUTH WALES.



links, blocks and circular work on an ordinary planer. This attachment is used in planing curves of any radius, and perfectly parallel, as applied to the ordinary planing machines. A pin projecting from a plate bolted to the table of the planer holds an upper table A upon which the work is fastened. Thus the work may be moved forward and backward, and to a greater or less distance from the centre pin, the amount of circular movement determining the radius of the circle to which the work is finished. From the corner of the table A a wrist projects upwards and takes hold of a slide, which is fastened at the required angle to the beam of the planer. When this slide stands parallel to the bed of the planer, the table A will move in a straight line. In proportion to the angle of the slide with the bed of the planer, the table A will be deflected from a straight line into a true curve of greater or less radius.

The third engraving shows the Flanders' portable drill. The cut nearly explains itself. The tool can be placed as easily as a ratchet-brace, and will drill at any angle, in any position, at any distance, and in any direction from the power. It is specially adapted to drilling all pieces which are inconvenient to move or which cannot be readily adjusted under stationary drilling machines. The operation of the machine is as follows :—The counter-hanger is bolted to the ceiling or other convenient place, and receives power from the line shaft by a flat belt on the fast and loose pulleys. The frame carrying the "idlers" rotates on a hollow stud, through which the round belt passes to the grooved driving pulley. The rotation of this frame permits the belt to be led to the drilling machine in any direction, radially from the hanger, while the rise and fall of the weighted "idler" permit it to be led to any point within the scope of this rise and fall, say, 10ft. to 15ft., or more. By inserting sections of belt, by means of the hook couplings. any distance can be reached. The base of the drilling machine is intended to be bolted or clamped to the piece to be drilled. The height of the post can be adjusted to suit the different lengths of drills and chucks used in the spindle. The radial slotted arm is fastened to the post by the stud and nut; the position of the drill being adjusted by the screw which travels the arm, and the worm and tangent wheel which rotate it on the post. When it is required to drill parallel with the base, the post is held by the clamp bearing on the side of the base. There is a shoulder turned on the bottom of the ball on the gear frame, and a half collar fitted to it and bolted on the arm; this keeps the spindle square with the base. When this half collar is removed, the spindle can be set to an angle in any direction.

The fourth tool is a rotating valve seat planing machine. There are two horizontal discs, the upper secured by radial arms, adjusted to suit the position of the studs in the valve seat; the lower, carrying the cutter and its slide, revolves freely against the upper, and is held in place by a king-bolt passing through its centre. This lower plate is also secured by a circular gib upon its circumference, which admits of taking up the wear. It is an annular gear, having teeth cut on its inner periphery, from which it receives its rotary motion by means of its connections with the bevel gear and crank. The crank may be replaced by a pulley if power be convenient. The double bevel shaft acts like a back gear and admits of a change of speed. Either bevel is thrown into gear at pleasure by the movement of a pin in a slot operated by the hand wheel. If the outer bevel is in action, it gears directly into the lower plate; if the inner bevel it is slow geared to the outer, and that to the plate. The revolving lower plate is fitted with the V slide and the tool post, and is fed by a screw and star wheel, arranged to give a large variation in the feed, from roughing to finishing, &c, The cutter is conveniently fed down by the operation of a nut on the cutter spindle acting against the tool post. The radial arms which secure this machine to the studs are so finished with slots as to give a wide range of adjustment. The nuts and their bearings in the washers which jamb the radial arms are curved to admit of their being firmly secured without springing the machine, even though the studs should be a little out of line. In case the stud holes in a small valve seat should come inside the plates, four other radial arms are furnished with the machine, fitted with a T-slot, and with a hole at the other end corresponding to the hole for the old stud, thus affording facilities for extreme cases. The points claimed for this tool are the great saving in time and labour over old methods. The saving claimed by the makers over the old methods is from 75 to 80 per cent., and 100 per cent. in files, as none need be used. After the seat is planed, the machine can be lifted off and placed on a table, which is supplied with stationary adjusting columns and a chuck for holding the valve; then the valve is planed. It is estimated that an ordinary locomotive valve seat can be thoroughly trued up in two hours.

The last tool is for boring cylinders in their places. On removing the piston and leaving the front cylinder cover and stuffing-box, a small cone takes its place in the stuffing-box at once, and with proper adjustment at the front end, the tool is ready for work. This machine is fed with a constant feed of cut-gears. The clamps or crossheads are so arranged that they may be used conveniently on locomotive cylinders of all sizes, which is a great improvement over the old machine.

ROOF OVER RUNNING SHED AT EVELEIGH, SYDNEY, GREAT SOUTHERN AND WESTERN RAILWAYS, NEW SOUTH WALES.

THIS roof, as shown on the drawing, is of the type which has now been adopted for several railway stations of the dimensions given below ; but we believe it is the first time that a design which is of necessity more expensive than an ordinary trussed roof has been erected for such a purpose as a locomotive running shed. This is, however, a matter which concerns the proprietors of the railway—in this instance the taxpayers of the colony—as the railways are State lines, constructed and maintained by the Government. Besides the advantage of an open space, unimpeded by intermediate columns, this roof has the ridge-and-furrow system of lighting, which is convenient not only in construction, but for easy repair afterwards. In its general method of construction the Sydney roof seems to follow those that have preceded it ; but the skilful simplicity of details which was so characteristic of the earlier structures, and one of the best signs of a skilful designer, is in the present case wanting in some parts. There appears to be unnecessary smithing and welding, which add to the cost and involve risk to the structure. The ironwork is now being made in this country for Messrs. D. and W. Robertson, of Sydney and London. The first roof of this kind was that for St. Pancras Station, London, designed by Mr. R. M.

Ordish for Mr. W. H. Barlow, engineer-in-chief of the extension of the Midland Railway from Bedford to London, and was made by the Butterley Company. The St. Pancras roof has a span of 240ft. The thrust of the roof, minimised by the shape of the curve, was resisted by the girders of the iron floor which formed the tie. In 1870 a small roof on the same principle of starting from the floor level was made by Messrs. Handyside, of Derby, for the Drill Hall in that town. This roof is 150ft. long, with a span of 75ft., and in this case there was no need for a tie rod, the shape of the roof and its connection to the cast iron stanchions giving it the requisite stability. A few years later this roof was reproduced, with but trifling difference, for the gymnasium of the Royal Naval College, Greenwich. In 1876 the roof over St. Enoch's terminal station, Glasgow, was designed by Mr. Ordish for the late Mr. Blair, then engineer of the Glasgow and South-Western Railway, and was made and erected by Messrs. Handyside and Co., of Derby. This roof is 518ft. long, and has a span 198ft., and it differs in shape from that of St. Pancras, the form of the arch and the anchorage to the large base plates which project inwards rendering a tie unnecessary. In 1878 the joint station at Manchester of the Great Northern, the Manchester, Sheffield, and Lincolnshire and Midland Railways was constructed by Messrs. Handyside and Co. This roof has a span of 210ft., and is 550ft. long. It was illustrated in THE ENGINEER of the 13th and 27th of February, 1880.

From these illustrations it will be seen that the diagonal bracing is supplemented by vertical struts, which are not used at St. Pancras, while the roof of the Enoch-square Station, Glasgow, has similar triangulation or Warren girder bracing, with vertical struts at every alternate bay, but lighter. The differences in the bracing do not seem to be accompanied by corresponding differences in scantling, and the Manchester roof is certainly heavy, unless others are too light, which is certainly not the case. The roof we now illustrate is rather heavy in details, and, as well as double triangulation, vertical or normal struts are used at every fifth apex. It is a pity that the maximum strains on roofs of this kind are not ascertained with sufficient accuracy to enable the designer to place confidence in his figures, instead, as is often the case, assigning larger sectional areas to make sure of sufficiency. While this is the practice we shall never arrive at the elegant lightness of roofs such as that over the new station in Berlin, illustrated in our pages in 1881.

From the specification of the work we take the following:—

Principal Dimensions.

		ft.	in.
Length of building from C. to C. of end principals	..	300	0
Width " " " outside columns	..	303	0
Main principals:—Span from C. to C. of columns	.. ..	101	0
Clear span	.. ..	95	0
Clear height from rail level to underside of rib at crown	.. ..	37	0
Height from springing	.. ..	39	6
Depth at crown	.. ..	3	0
Distance apart, from C. to C.	.. ..	25	0
No. in each span, 13—total 39			
Main purlins:—Length	.. ..	25	0
Depth over flanges	.. ..	2	1¼
Distance apart	.. ..	11	0
Total number, 324			
Arched girders under intermediate gutters:—			
Span	.. ..	24	0
Versed line	.. ..	7	0
Depth at springing	.. ..	10	0
Depth at crown	.. ..	3	0
Rolled girders along walls, 10in. × 5in. × 36 lb.			
Intermediate rafters:—5⅝in. × 4in. × 13·5 lb.			
Number in each bay, 3			
Lantern roofs:—Width, out-to-out of side standards	..	22	0
Width over covering	.. ..	26	6
Height at centre	.. ..	5	0
Height at sides	.. ..	4	0
Length each	.. ..	250	0
Ridge-and-furrow roofs:—Span	.. ..	6	3
Height from main purlins to underside of ridge	.. ..	2	2⅝
Height from rail level to underside of main gutter	..	20	0

The following particulars are also from the specification:—The main principals are to be elliptic in the shape, struck with two radii of 32ft. each, and one of 58ft. 1in., measured to the inside of rib, and to be constructed substantially, as shown on the drawings, with flanges formed of plate and channel irons, solid web from the springing to within a height of about 15ft. 9in. above rail level, and double triangular braced web for the remaining portion, the braces being formed of channel bars, connected at their intersection and to the flanges of rib by ⅞in. rivets, as shown. The ends of braces to be upset, so as to make the web of the same ⅝in. thick for a length of about 9in. from each end, they are to be cut and planed accurately at the ends, so as to ensure them cutting truly against the main flanges, and to be exactly alike in every respect, so that they may be perfectly interchangeable. These plates and channel irons in the flanges are to be in lengths of about 22ft. and joined, as shown on the drawings. Principals to be bolted to the cast iron columns by 1in. screw bolts, tapped into columns and spaced 14in. C. to C. The ends of principals are to be planed so as to ensure even bearing on the bed-plates, and each end is to be secured by six anchor bolts 1⅝in. diameter, passing through bed-plates into the foundations to such depth as shall be directed. The anchor bolts to have jagged dovetail and secured by lead, run in and caulled after the bolts are fixed in position. The spandrels to be constructed as shown, with A.I. flanges and lattice web. Each side of the flanges must be in one piece all round, welded and forged where required, of the shape shown, and fit accurately to the principals and columns. The spandrels will be secured to the principals by ⅞in. bolts placed 14in. C. to C., and to the columns by 1in. screw bolts placed 14in. C. to C. The lattice bars to be rivetted between flange A.I. and at their intersections, as shown. Main purlins to be of trellis type with A.I. flanges, ⊏ I. verticals, and A.I. diagonals, constructed substantially of the forms and dimensions shown. To be connected at the ends to each other and to the principals by ⅞in. bolts, the bolt holes in the top and bottom flanges of purlins being made oblong to allow free expansion. Each purlin to be braced at centre to intermediate rafters by two braces 1in. diameter, secured by ⅝in. bolts to vertical ⊏ iron. The arched girders, carrying centre gutters and intermediate rafters, to be constructed substantially as shown, with A.I. flanges, lattice web, and ⊏ I. vertical struts. Each side of the flanges must be in one piece all round, welded and forged where required, and the two sides rivetted together with the lattice bars between. The girders to be bolted to the columns by ¾in. screw bolts spaced 12in. C. to C. Lattice bars to be rivetted at their intersections. Channel irons to be placed back to back and rivetted to the flanges and lattice bars with proper packing strips on each side of the lattice bars. Each channel iron to have a strong knee rivetted on for supporting intermediate rafter. Rolled I girders, 10in. × 5in. × 36 lb. for carrying outside gutters, and intermediate rafters are to be secured to columns by A.I. knees rivetted to each end and ⅞in. screw bolts tapped into columns. Also to have strong knees rivetted on for supporting intermediate rafters. The intermediate rafters are to be of rolled T.I. 5⅝in. × 4in. × $\frac{5}{16}$in. × 13·5 lb., in lengths of not less than 11ft., and curved exactly to the curvature of the main principals and spandrels. Where possible they are to join over the main purlins; if the joints occur between the purlins they are to be fished with two plates 4½in. × ⅝in. × 12in. and four bolts ⅝in. diameter. The rafters to be secured to each main purlin by two ⅝in. bolts, and their feet to the arched and rolled girders as shown: The centre and outside standards for lantern roofs to be constructed of T and A.I.; strongly connected and secured to the main principals, purlins and rafters, as shown, with T.I. rafters projecting at each side. To be braced over the main principals (every 25ft.) by diagonal braces ⅝in. diameter with forged eye at each end and ¾in. pins, the braces to be tied together at their intersections with two small ornamental castings as shown. Angle iron to be fitted and secured between outer standards, as shown, for securing the ends of ridge-and-furrow roofs. Louvre blades, of the form and dimensions shown, to be fitted and secured between frames of lantern roof. The bottom line of purlins, next to the gutters to be channel iron 6in. × 2½in. × $\frac{5}{16}$in., the next line Z I 2½in. × 4in. × $\frac{5}{16}$in., and the remainder Z I 2½in. × 3in. × $\frac{5}{16}$in. All the purlins are to be in as long lengths as possible; they must be joined over a principal or intermediate rafter, and the joints in one line of purlins must break properly with those in the next line. All the purlins are to be secured to each principal and rafter by one ½in. bolt. The ends of lantern roof purlins will be formed with turned-over web on purpose to secure wooden frame and mouldings at end of lantern. The skylights are to be on the ridge-and-furrow principle. The frames to be substantially constructed as shown on the drawings. The rafters to be of A.I. in one piece accurately bent, with their feet secured to A.I. on top of principals and intermediate rafters by ⅝in. bolts. The verticals to be of T.I., rivetted to top of rafters, and secured at their feet between flanges of main purlins by ⅝in. bolts, as shown. The A.I.'s on top of principals and intermediate rafters to be secured to the same by ⅝in. bolts, 12in. C. to C., and to have A.I. brackets between skylight rafters, secured by ⅝in. bolts, also cast iron distance blocks at the points where the rafters and brackets are secured. Ridge purlin of T.I., fitted with wood as shown, and secured to A.I. between lantern frames and top of skylight rafters by ⅝in. bolts. Bottom purlins of A.I., fitted with wood, and secured by ⅝in. bolts to rafters and intermediate brackets. The wood to be secured to the purlins at every 12in. by ⅝in. wood screws. Windbracing of round iron, ⅝in. diameter, with forged eye ends and brass sleeve nuts, cut right and left for adjustment, to be fixed between main principals and secured to the same by 1in. pins, as shown in detail. The braces to be connected at their intersection to the main purlins by clips as shown. The main gutters to be constructed of galvanised plate ⅛in. thick, with A.I. rivetted along the edges. They are to discharge into the columns at every 25ft., and to be in separate lengths of 24ft. 8in., with the ends turned over to fit the head of columns, one allowance being made for expansion. The plates from which the gutters are made must be of sufficient width to form the gutters without longitudinal seams, and rivetted together transversely perfectly watertight. The bottom of each length of gutter to have a fall of 1½in. from centre of bay to each column. Each length to be stiffened by A.I. across the top, one at each end and one in the middle. The A.I. along edges to have oblong holes in the top flange every 12in., and secured to the channel iron purlins by ½in. screw bolts. The gables to be substantially constructed of iron and glass, as shown on drawings. The vertical supports to be of T. I., rivetted to principals and bottom A.I. rail by strong A.I. knees and ⅞in. rivets. Bottom rail to be secured to cast iron wall plate by ⅞in. bolts, placed 12in. C. to C. Curved and horizontal purlins to be of A.I. 2in. by 2in. by $\frac{5}{16}$in., fitted with wood, and secured to vertical T. I. by cleats and ½in. bolts. The wood to be secured to purlins at every 12in. by ⅝in. wood screws. Cast iron wall plates, for supporting the gables, of the form and dimensions shown, and cast in segments of 13ft. 1½in. length, to be fitted and laid in cement on top of coping as shown. Cornice mouldings of cast iron, of the forms and dimensions shown, to be fitted along inner and outer flanges of end principals, and base mouldings on top of wall plates, as shown on drawings. To be cast in segments of suitable length, joined by wrought iron joint plates at the back, and secured by ⅝in. bolts, placed 12in. C. to C. to principals and wall plates. Base mouldings to be also secured to the vertical purlin supports. A wrought iron plate, ½in. by 2ft. 11in. wide, is to be fitted at back of cornice mouldings, to screen the lattice bars in principals and to be secured by ½in. screw bolts at every 6in.; the segments composing it are to be joined by covering plates at the back and ⅝in. rivets. The abutting surfaces of mouldings to be dressed fair and true to ensure close joints. Base moulding and wall plate to be dressed perfectly square and true, with a layer of canvas and red lead between them, to ensure a tight joint and effectually exclude all water. All bolt and rivet heads on outside of cornice must be countersunk, and all joints must be stopped and puttied after erection and before the final coat of paint is applied. The columns between main principals are each to be cast in one piece, with gutter head and rain-water outlets as shown, and to be in every respect in conformity with the drawings. The thickness of metal in shaft of columns not to be less than 1½in. The heads to be dressed fair, so as to fit the gutters accurately, and the base and socket turned to fit the bed-plates. The outlets to be made to fit sockets of 6in. drain pipes. All bolts tapped into columns are to be packed with hemp and red lead, so as to ensure the column being perfectly watertight. The outlets not connected to drain pipes are to be closed with a plug of hard wood, packed with canvas and lead, and driven in tight. The bed-plates to be substantially of the forms and dimensions shown, planed accurately on top to receive the principals and columns. They are to be let into the bed stones to within half the thickness of the plates, and the stones must be dressed accurately on top to fit. After the plates have been fixed in their true position the cavities between the same and the stones are to be run in with sulphur to ensure a perfectly fair and effective bearing. All the wrought iron used in the construction of the roof must be of the best description—tough, ductile, of uniform quality, and free from flaws and cracks along the edges, capable of sustaining 50,000 lb. per square inch of area in tension, without fracture, and 24,000 lb. per square inch of area without taking a permanent set. The reduction of area at breaking point shall average 15 per cent.—10 per cent. in plates, 15 per cent. in T, L, and ⊏-iron, and 20 per cent. in bar iron—and the elongation from 9 to 12½ per cent. When cold it must bend without signs of fracture from 60 deg. to 120 deg. The compressive breaking strain is not to be less than 37,000 lb. per square inch of area, and 24,000 lb. per square inch of area without taking a permanent set.

INTERNATIONAL ELECTRIC EXHIBITION, VIENNA, 1883.

BY a decree of the Imperial Ministry of Commerce of the 8th of June, 1882, No. 17,202, permission was given to hold an International Electric Exhibition in Vienna, and the Rotunda, together with the remaining buildings erected for the Universal Exhibition of 1873, were devoted for this purpose. This Exhibition shall be opened on the 1st of August, and shall be closed on the 31st of October, 1883. To organise and carry through the Electric Exhibition, a general commission has been formed, which has secured the necessary means by a guaranteed fund. This general commission has formed from among its members several committees—a central committee, a finance committee, a technical committee, a committee of arrangements—and shall form further committees as needed. A managing committee has been appointed to carry out the resolutions passed by the general commission and by the several committees, and to manage all matters relative to the Exhibition. All communications with the representatives of foreign countries, and with the exhibitors or their representatives, shall be carried on through the managing committee.

The exhibits to be admitted are divided, according to the principles which they embody, into the following classes:—Class 1, magneto-electric and dynamo-electric machines. Class 2, galvanic cells, batteries, accumulators, thermo-electric piles. Class 3, scientific apparatus, instruments for electrical measurements, electrostatic apparatus. Class 4, telegraphs. Class 5, telephones, microphones, photophones. Class 6, electric lighting. Class 7, transmission of power. Class 8, cables, wires, conductors. Class 9, application of electricity to chemistry and metallurgy. Class 10, application of electricity to war. Class 11, railroad electrical appliances. Class 12, application of electricity to mining, navigation, and agriculture. Class 13, electro-medical apparatus. Class 14, application of electricity to automatic registration, to horology, meteorology, astronomy, and geodesy. Class 15, miscellaneous. Class 16, application of electricity to domestic use, to art, industry, and decoration. Class 17, application of machinery to electrical industry, boilers, steam, gas, and hydraulic engines. Class 18, historical collections, methods of instruction, bibliography.

Applications for space, so far as possible, should be made out according to the annexed forms, and must be in the hands of the managing committee of the International Electrical Exhibition, Wallfischgasse 9, Vienna, at the latest by the 1st March, 1883. Printed forms are to be obtained at home from the managing committee, the Boards of Trade and Commerce, from the scientific and commercial societies, and abroad from the Austrian-Hungarian Consuls. When necessary, special local committees shall be formed to co-operate with the managing committee. The acceptance of exhibits rests with the general commission. Applicants shall be informed of the decision of the commission within two weeks after receipt of application. Exhibitors shall be informed of the final allotments of space by the 1st of May, 1883. Exhibitors shall pay no rent for the space allotted to them. The general commission undertakes at its own expense the arrangement and general decoration of the building. Exhibitors must bear the expense of the installation and decoration of their own exhibits. The plans of these must be submitted to and approved of by the managing committee.

Motive power shall be supplied to exhibitors who require it at 20 kreuzers per horse-power per hour—5d. or 10 cents. The motive power required for the purposes of scientific commission should be supplied free. The Exhibition shall be open to the public twice daily, during the day and in the evening. The hours of admission shall be fixed and published in due course. Exhibitors shall be entitled to free passes for themselves, their representatives, and for the requisite number of assistants and workmen. The general commission shall provide that rigorous watch be kept over the exhibits, and that proper order be maintained. The commission, however, does not hold itself responsible for any loss incurred through injury to exhibits through theft or fire. The exhibitors are at liberty to insure their exhibits at their own expense. Exhibitors must provide that in the installation and working of their exhibits every danger to the public and to the buildings be avoided, and must conform themselves in this respect to special arrangement of the general commission. The exhibits must be accessible to the free inspection of the public every day during the regular hours of admission during the entire time of the Exhibition. No exhibit shall be withdrawn before the close of the Exhibition without the special permission of the general commission. Exhibitors must bear the expense of maintaining in order their own exhibits. Exhibits must be in the name of the manufacturer, and with his consent they may also bear the name of the firm which is authorised to sell them. Every exhibit must be clearly marked with the name of the firm exhibiting. All copies of exhibits, whether drawings, photographs, or otherwise, are only allowed with the consent of the exhibitors and of the general commission. The sale and removal of exhibits may occur with the consent of the general commission; every object, however, withdrawn must be at once replaced by a duplicate. The receipt of goods at the Rotunda shall begin on the 1st June, 1883, and by the 15th July, 1883, all exhibits must be entirely unpacked and set up. The general commission reserves the right to dispose of the space not occupied by the specified date. The general commission shall have the right to complete such installations as are not finished in time at the expense of the exhibitor, or to exclude him entirely. One month after the close of the Exhibition the exhibitors must have completely removed their exhibits. After the lapse of this time all exhibits not removed from the Exhibition grounds shall be removed and deposited in some suitable place at the expense and risk of the exhibitor. In case of such goods not being removed within six months after the close of the Exhibition, they shall be sold and the proceeds made use of as stated in the last paragraph.

The general commission has taken the necessary steps to enable exhibitors to enjoy the advantage of the patent laws from the time of the entry of their goods to the Exhibition grounds until exit therefrom, and to enable foreign exhibitors to enjoy exemption from duty in case of the re-export of their goods before the end of the year 1883. The special conditions relative hereto shall be given in due course. No prizes will be awarded by a jury. During the Exhibition a technical and scientific commission shall be organised in co-operation with the exhibitors, in order to carry out electrical measurements and other scientific investigations with a view to testify results. The general commission shall make arrangements for scientific and technical lectures. A complete catalogue shall be drawn up by the general commission and published at the opening of the Exhibition. Further special regulations and arrangements relative to service, to the use of motive power, to the scientific experiments, to transportation of goods, to advertisements, and to similar matters, shall be duly sent to exhibitors, who shall also be kept informed of all important measures and occurrences. The ultimate decision where cases of dispute or complaint may arise shall be reserved to the general commission. The net proceeds of the Exhibition shall be devoted, with the agreement of the Imperial Ministry of Commerce, either to such scientific institutions as may carry out further the aims of the Exhibition, or to the pursuit of important inventions in the field of electrical science.

The honorary president is Graf Hans Wilczek; the president is Victor Freiherr von Erlanger; the managing committee are Carl Pfaff and Rudolf Ritter von Grimburg.

INSTITUTION OF CIVIL ENGINEERS.—Mr. James Brunlees, F.R.S.E., delivered the inaugural address of this Institution, as President, on Tuesday evening. He said that when he joined it in 1852 there were 745 members of all classes; the number was now 4210. Mr. Brunlees referred to most of the leading engineering works or projects of the present time, and gave a great deal of statistical and engineering information of interest. Among them the bridge to be erected across the Forth, the new Tay Bridge, the bridge over the Ganges at Benares, the Kinzua Viaduct, the Suspension Bridge between New York and Brooklyn, and the St. Gothard, Severn, and Hudson tunnels, the Panama Canal, and the Alexandra Dock at Hull. In conclusion, he referred to engineering matters and prospects generally.

LETTERS TO THE EDITOR.

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

HYDRAULIC BALANCE LIFTS.

SIR,—With your permission we write a few lines by way of final reply upon the above subject. Our statements, which have been questioned, are three in number:—(1) Our lift is cheaper than the dead-weight balance lift with wheels and chains. (2) The amount saved by removal of weights, chains, wheels, balance guides, and top framing, more than pays for the balance cylinders of our system. (3) The metal of the old weights will make our cylinders and rams. It is only the second statement which can make the first possible, and the second is the explanation of the first. We make these three assertions as facts, based upon our manufacturers' and our own practical experience of the two systems, and if your correspondents prefer to hold opinions in opposition to the facts, they are, of course, at full liberty to do so, but their opinions cannot influence the facts. We can only repeat that our first two statements are based upon our manufacturers' books, they being makers of both types of lifts; and that the weights given for the balance cylinders and rams were obtained by actually weighing the castings. We take this opportunity of pointing out that the discussion upon the merits or demerits of our lifts has been conducted almost entirely upon side issues. The chief purpose of the hydraulic balance is to ensure safety, and such economy as is gained is only obtained fortuitously; we take it that the safety is unquestioned.

Mr. Turner's two references to lift guides show simply that in this direction he has something to learn. The guides we use are for their purpose unsurpassed. They cost per foot of travel per set 1s. 6d. We can venture to challenge Mr. Turner to produce for this price a set of guides which will guide both cage and balance weights, and at the same time support the overhead frame and wheels. Mr. Turner somewhat perverts our statement respecting cost. We did not say that the cost of the old balance weights would pay for the cylinders. We did say that the cost of the parts of the old system which we remove, and of which the balance weight is one only, will more than pay for the cylinders; and that the metal of the weights would make the cylinders. Excuse the reiteration, but it appears to be necessary. If Mr. Turner has experimented upon lifts, he knows that the friction of the upward journey is often more, but never less, than that of the downward. Taking 20 per cent. friction for the upward journey and the same as the maximum downward friction, we have 60 per cent. efficiency after paying for both journeys; and we have not yet heard of a dead weight balance lift giving better results than this.

Mr. Barr suggests that though for some occult reason 700 lb. is generally the best pressure, in the case of the lift illustrated, it might be made less costly if worked at 400lb. This is decidedly inconsequential. But it happens that 400lb., or very nearly that, is the proper pressure for the lift illustrated. For many types of lifts and hydraulic machinery we should prefer to use pressures of from 600lb. to 700lb. per square inch; but our hydraulic balance lifts introduce new conditions, and for reasons too involved to explain here, a pressure of lower value is found more suitable for them. If necessary they can, however, be made to use the higher pressure water economically, and at very little extra cost. We have now inflicted upon your readers as much dry reading as we think desirable, and devoted as much time to the correspondence as we can afford. Should either of your correspondents desire further information, our manufacturers, Messrs. Smith and Stevens, will be happy to supply it privately. Thank you for space.

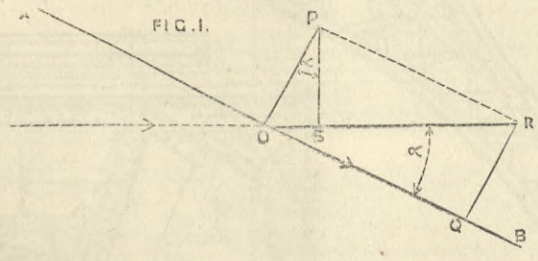
JOHN S. STEVENS.
C. G. MAJOR.

Queen's-road, Battersea,
January 6th.

FLYING MACHINES.

SIR,—The problem of artificial flight is from time to time discussed in scientific journals, and when much the same conclusions have usually been arrived at, the subject drops. These conclusions are:—(1) That man can never hope to fly by his own unaided muscular power. (2) That it is possible man may hereafter construct flying machinery by means of which he may be carried through the air, but that neither the suitable motor nor machinery have yet been contrived or even suggested.

The first of these conclusions is, for a certain reason mentioned in the first paragraph of your article last week, a tolerably safe one, and the second is safer still. With even a remote possibility of its being practicable, the subject is so important that I trust you will permit me to make a few remarks upon the statements and arguments employed in the article in question. The ground there taken is that the practicable limit to a natural flying machine has been reached by Nature, and the arguments in support of this are of two kinds:—(1) That Nature does not make many mistakes, or, in other words, the conditions under which species are developed are such that everything goes as far as it can go in size and speed, so that if larger natural flying machines had been possible there would have been larger birds than there are. (2) That for certain mechanical reasons, which are given, larger natural flying machines are not possible. With regard to the first, it seems only necessary to point out that it was well the early shipbuilders did not use this argument in connection with the nautilus, or perhaps the swan, or we might now be dependent upon our natatory powers for oceanic communication. The mode of arguing the second point appears to need more serious consideration. Is it well known that the strength of every machine rapidly decreases as it increases in dimensions? To commence with, the example quoted, viz., the crank shaft of a model engine, and one of twelve times the size. Unless all books and practice of machine construction are wrong, their torsional strength will vary as the cubes of their diameters, and this whether solid or hollow, that is, the larger one will be 1728 times as strong as the model. Their relative weights will vary as the square of their diameters and as their lengths, that is, the weight of the larger is also 1728 times that of the smaller. Thus they are of exactly the same proportional strength. If it be intended to state that in practice the model would be stronger, then this can only be due to abnormal conditions of material, &c., which cannot fairly be taken into consideration. But this is not the only part of the engine. Take, for instance, the approximate weight of cast iron pedestals (Unwin's "Machine Design"), $W = 1{\cdot}1d^3 + 18$ lb.; so that as the strength varies as the cube of the diameter, the weight for the larger one may be a great deal less in proportion than for the model. Many other instances might be quoted to show that at any rate the statement is not true for "every machine." With a beam or girder a proportional increase in every dimension does result in weakness, but no engineer would think of distributing his material in the same way in a very large girder as he is obliged to do in a small one, for the increase of size enables a more economical section to be employed. Coming now to the example taken—viz., that of the albatross. It may be admitted at once that the weight must vary as the cube of the linear dimensions—that is, the weight of a similar bird with twice the length of wing would be eight times as great, or would be 2 cwt. instead of 28 lbs. It thus seems a pity that the matter is complicated by introducing the question of strength before the required power is dealt with, as upon this depends the strength of the wing required. It is stated that the strength must be at least doubled when the length only of the wing is doubled. Remembering that the resistance of the air varies as the square of the velocity, it might easily be shown that the strength should be at least eight times, instead of twice, as great. Passing to the question of power. The soaring of birds is a most important fact, of which no one who has taken the trouble to make observations has any doubt. Though it was lately the subject of a protracted discussion in the columns of a contemporary, no satisfactory explanation appears to have been given of it. Certainly it cannot be dismissed by a mere assertion, much less by a more than questionable analogy. Thus it cannot be admitted that the action of a swimmer even carrying a weight is "strictly analogous" to the work done by a bird. The density of water is 800 times that of air, so that the proportional efforts to sustain weight, and to overcome the resistance to motion, are greatly different in the two cases. Moreover the fluid friction is very different in air and water, and to admit the analogy as a strict one would be to cut away the only grounds on which soaring can be explained. Perhaps the following explanation may partly account for the soaring power of birds, which has been stated by competent witnesses to be exhibited only when a wind is blowing. Let A B be the plane of a bird's body, making an angle, and with the



horizon; let O be the centre of pressure, and O R be the effective horizontal action of the wind on A B. By resolution, effective normal force = O P = O R sin. α. Tangential force (ineffective) = O Q = O R cos. α. Resolving O P gives force tending to drive the bird back = O S = O R $\sin.^2 \alpha$; force tending to support the bird = P S = O R cos. α sin. α. Thus the bird would only have to exert a force O R $\sin.^2 \alpha$ in order to remain stationary. As long as $\alpha < 45$ deg. this force is less than its weight, and is smaller the smaller the angle α. Until this reasoning is shown to be erroneous it cannot be asserted that, "Nothing is got from the air in the way of help save when upward currents strike the flying bird," for in the assumed case the current of air is horizontal.

The next analogy seems scarcely open to argument. Is it really meant that the weight of a bird may be regarded in exactly the same light as the weight on a brake driven by a portable engine, and that the power exerted by the bird may be measured in the same way by taking the distance passed through by the wings? If so, it would have been well to have made a few calculations with, at any rate, approximate values in the case of the albatross. Doing this, it may be readily seen that the power thus given is from ½-horse power to 1-horse power. The values given in the article for the maximum power exerted by a strong man are equivalent to a little less than ¼-horse power. Thus the assumption which immediately follows, viz., that the power of an albatross may be taken as nearly that of a man, has not the slightest connection with the previous line of argument, being in fact quite at variance with it; neither does the allusion to the small spec. gravity of the air justify the assumption, which must therefore be taken for what it is worth. As to the correct mode of estimating the power of an albatross, this is certainly a difficult matter, and I fear I have already trespassed too much on your space to venture any further suggestions.

It is to be hoped that the brief concluding remarks of the article will not be taken as giving the results of the labours and investigations of the many able scientific men who have worked at the subject, or as being even the very briefest summary of all that modern improvements in small motors or machinery can suggest for the solution of one of the oldest and most interesting of problems.

H. S. HELE SHAW.

University College, Bristol, January 2nd.

[Our correspondent will, we think, see on reflection that his strictures on what we have written are not justified by facts. In what we said concerning the strength of models, it is clear from the context that we referred really to weight for weight; and this, we think, Professor Hele Shaw sees quite plainly. We agree with him, as a matter of course, that the shaft 1in. in diameter would be as strong as the shaft 12in. in diameter, weight for weight; but he has overlooked the fact that the strains on the 12in. shaft would be immensely greater than the strains on the 1in. shaft; because the areas of the pistons would vary as the squares of their diameters—not as their diameters; and our statement is specially applicable, as our correspondent indirectly admits, to the framework of any structure—bird or machine—intended to fly through the air. Our argument must also be taken as applying to the whole model, not to individual members of it. We are a little surprised that Professor Hele Shaw should cite the nautilus—which has no bearing whatever on our argument. As well say that the tiny humming bird marked the limit of nature's progress in flying. Has Professor Hele Shaw forgotten the existence of the whale? That whales are not bigger than they are is not the result of a limitation of capacity for floatation in water, but of other and totally different conditions—such as facility for obtaining food, power of blood distribution on the part of the heart, and the possibility of obtaining muscular power enough to give the animal the necessary velocity of motion through the water. We come now to our correspondent's diagram, and the argument he has based on it, which involve a very curious error, no doubt due to a complete oversight. Professor Hele Shaw would be quite accurate if he could show that there was any current in the air relative to the inclined plane; but as a matter of fact, the inclined plane must, by the condition of things, be moving at precisely the same rate as the air, and for the plane no current exists. Thus, when a boat is floating down a stream, it has no steerage way, because there is no current as to the boat, though there may be a very sharp current as to the banks of the river. A kite will fall when the string is broken, just as though no wind existed, only it will not fall vertically down, but will describe a curved path of greater or less irregularity, in its descent. The wind acts on the inclined planes of ships' sails, and the sails of ice boats, just as Professor Hele Shaw has shown in his sketch, but only because the boat is held up to the wind either by the water or the ice. The occupants of the car of a balloon are in perfect calm, although the balloon may be flying before the wind at sixty miles an hour, nor would they be sensible of any current of air were it not that the force of the wind being variable, the inertia of the balloon will have to be overcome when a gust blows, or its momentum expended when the velocity of the breeze falls off. Therefore, what we have said is perfectly correct, and birds can only sail by virtue of momentum, or as Professor Shaw implies, by the direct forward propelling action of their wings, but in this case they gain no assistance whatever from the air, save in a sense that a locomotive may be said to be assisted by an inclined plane in climbing up a given vertical height. Whether an inclined plane is or is not used, the foot-pounds of work expended by the bird or the locomotive must remain unaltered. We have failed to catch our correspondent's meaning in the passage concerning the analogy between the weight on a friction dynamometer and the action of a hovering bird, and we can therefore only maintain that the analogy does exist. The resistance of the air to a wing is apparently a function of the weight of air displaced at each stroke, and its velocity. We shall be glad to hear an expression of opinion on this point from Professor Hele Shaw.—ED. E.]

STEEL CASTINGS.

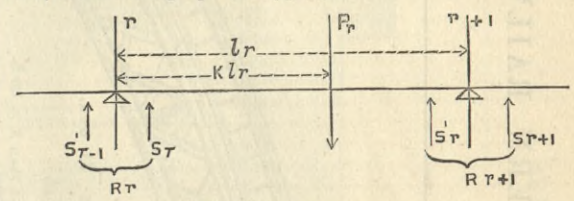
SIR,—In reference to your very able remarks on cast steel marine crank shafts and the tests recently made thereon by Messrs. Parker and Milton, of Lloyd's Register, in your general review of improvements during the year of 1882 on Saturday last, I think a few words of explanation are due from me. In the first place I am afraid that it might be understood from the wording that my firm do not anneal their large castings, whereas they anneal them very carefully indeed; but they do so in a particular way by the aid of their own initial heat. That is to say, they do not re-heat them and then reanneal them, which process they have found, after careful investigation, to be both detrimental and dangerous for most large castings, although it will do well enough for small ones. When I first openly declared some few years ago, on behalf of my firm, in favour of the larger crank shafts being made in plain castings, I was met with such an amount of prejudice and ill favour that I hardly expected to have got so far as I have done in so short a time, particularly as my most strenuous opponents were some of those very steel makers who, having since learned what they can, or think they can do, are now the most anxious to enter into competition for the very article they previously cried down—viz., large crank shafts in plain steel castings. To these and other steel manufacturers who may attempt the same, I would say, if they will not be offended with me, "Beware!" The thing can be done, as has now been amply proved, by the number manufactured by my own firm, some of which have been constantly at work for the last three or four years, and have run from 80,000 to 100,000 miles without a failure of any kind; but this has only been accomplished by using the very best material and great care. The danger is that one or more of those wonderful steel manufacturers, who are now rushing into the trade and learning in less than twelve months what has taken others over twelve years' practical study to acquire, may not only damage themselves, as that would be of little moment, but may bring the very name of steel castings into such ill repute that they will be discarded entirely. There are many other matters on this most important subject that I could dilate on, but I am afraid I have already trespassed too much on your valuable space.

J. F. HALL, Manager,
Wm. Jessop and Sons (Limited), Sheffield.

January 10th.

CONTINUOUS GIRDERS.

SIR,—I am studying the theory of continuous girders, and in a little work by Mr. Mansfield Merriman, C.E., published in New York, the following equation appears:—



$$Sr = \frac{Mr - Mr + 1}{lr} + Pr\,(1 - K)$$

in which lr represents the loaded span of a continuous girder, Mr and Rr the moment and reaction at the support r. Sr representing the shear immediately to the right of that support, and $S'r - 1$ the shear immediately to the left. Pr being a concentrated weight at distance K lr from support r.

This I thoroughly understand, but he goes on to show that $S'r$—that is, the shear immediately to left of support $r + 1$ is

$$S'r = \frac{Mr + 1 - Mr}{lr} + Pr\,K$$

and this I cannot understand. I make it

$$S'r = \frac{Mr + 1 - Mr}{lr} - Pr\,K.$$

Eccles, January 4th. W. H. B.

[The two equations $Sr = \frac{Mr - Mr + 1}{lr} + Pr\,(1 - K)$

and $S'r = \frac{Mr + 1 - Mr}{lr} + Pr\,K$

are exactly similar and complementary; one being obtained by expressing the moment at one end of span lr, and the other in the same way by expressing the moment at the other end. Thus $Mr + 1 = Mr + Pr\,(lr - Klr) - Sr\,lr$, or

$$Sr = \frac{Mr - Mr + 1}{lr} + Pr\,(1 - K).$$

This is the first equation given. Similarly, taking the moment at the other end, $Mr = Mr + 1 + Pr\,lr - S'r\,lr$, or

$$S'r = \frac{Mr + 1 - Mr}{lr} + Pr$$

which is the record of the equations given.—ED. E.]

CHILLED CALENDER ROLLS.

SIR,—Will "Paper-maker" kindly tell me what are the points in which the English calenders fail when compared with those of American manufacturers? Are the English rolls too soft, or the grinding not sufficiently accurate, or both? "Cheap and nasty," as your correspondent observes, spells ruination, not only in the paper trade, but in most others; and if a fair price is paid for English calenders, I see no reason why they cannot be made equal to the American. But if the same system is resorted to in the purchase of these as in the purchase of most other things—that of inviting tenders and selecting the lowest—I believe we arrive at the cause of failure.

A CONSTANT READER.

January 4th.

RAILWAY SPEEDS.

SIR,—The through express trains between Glasgow, St. Enoch, and London, St. Pancras, run between Glasgow and Kilmarnock *viâ* the Glasgow, Barrhead, and Kilmarnock Joint Railway. The distance from Glasgow to Kilmarnock by this route is 24 miles 28 chains, and as the trains are allowed 35 minutes to perform this part of the journey, it will be seen that the speed is under 42 miles per hour, not 58, as stated by Mr. Henry Barcroft in his letter which appeared last week. With reference to the table given by "J. F.," p. 480 of your last volume, I may mention that the Midland Company's "longest run without stopping" is between London and Leicester, a distance of 99 miles 9 chains, and the trains of this company attain the highest average speed between Liverpool (central) and Manchester (central). The distance by the Cheshire lines' route is 34 miles 4 chains, and the Midland express trains perform the journey in 40 minutes, or at an average speed of over 51 miles per hour.

CLEMENT E. STRETTON.

Saxe Coburg-street, Leicester,
January 6th.

SIR,—Your correspondent, Mr. Barcroft, in your last issue made a great mistake when he says that the Midland express, leaving Glasgow at 9.15 p.m., travels the distance to Kilmarnock at 58 miles per hour. He says the train is timed to arrive at Kilmarnock at 9.50, but if he looks again he will find that it is 9.53. I have no means of checking the distance, which he says is 33¾ miles; but assuming it to be correct, the speed is a little over 53 miles per hour, not 58.

JOHN H. WALL.

Hampden House, Milton Avenue, New Southgate, N.,
January 8th.

SIR,—I think your correspondent, Mr. Henry Barcroft, is in error respecting the speed of the 9.15 p.m. Midland express from Glasgow. This train runs—*viâ* Barrhead to Kilmarnock—a distance of about 28 miles in 35 minutes, the speed therefore being about 48 miles per hour; but your correspondent has reckoned the distance from Glasgow to Kilmarnock, *viâ* Paisley, Lochwinnock, and Crosshouse, which is, as he states, 33¾ miles.

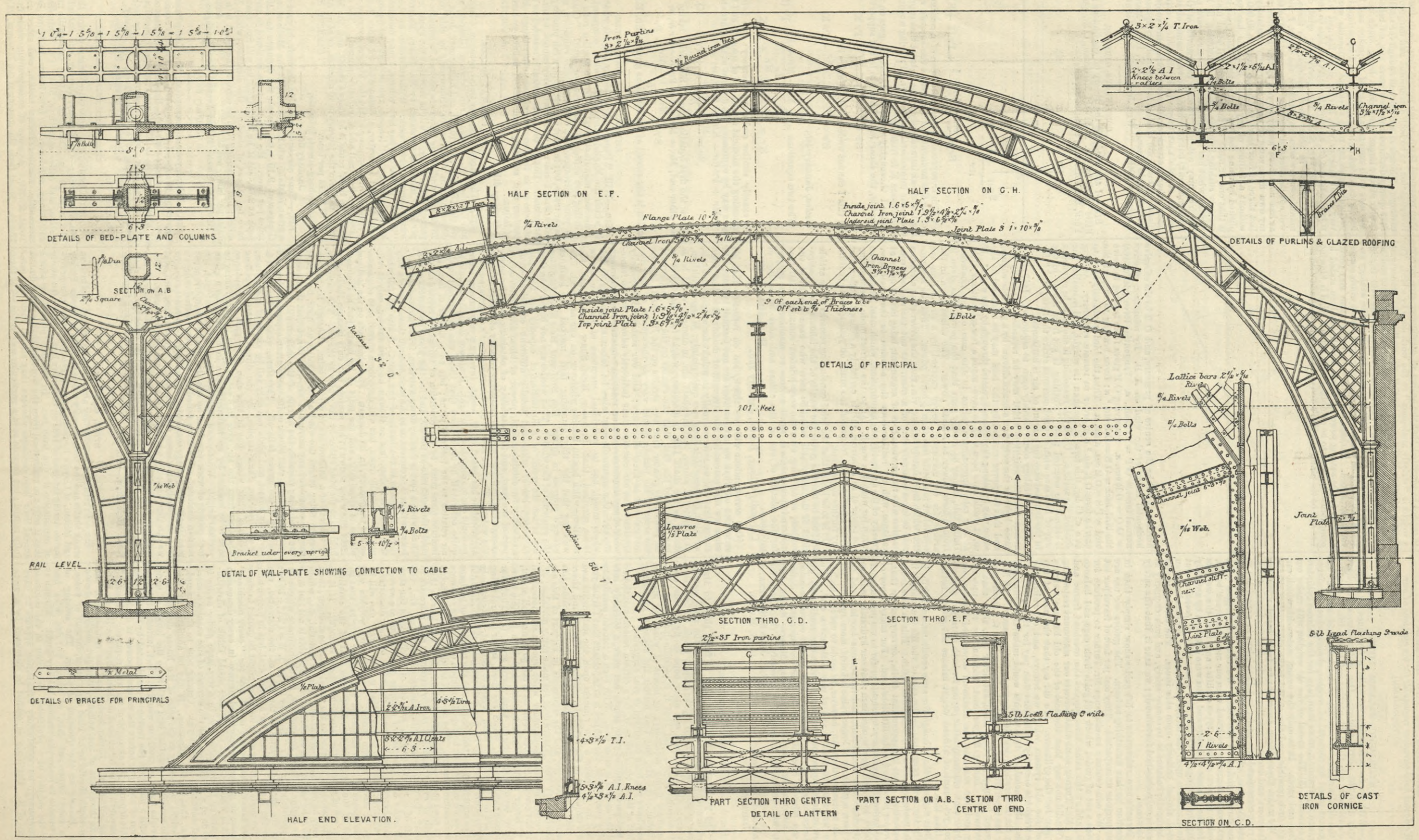
J. F.

January 8th.

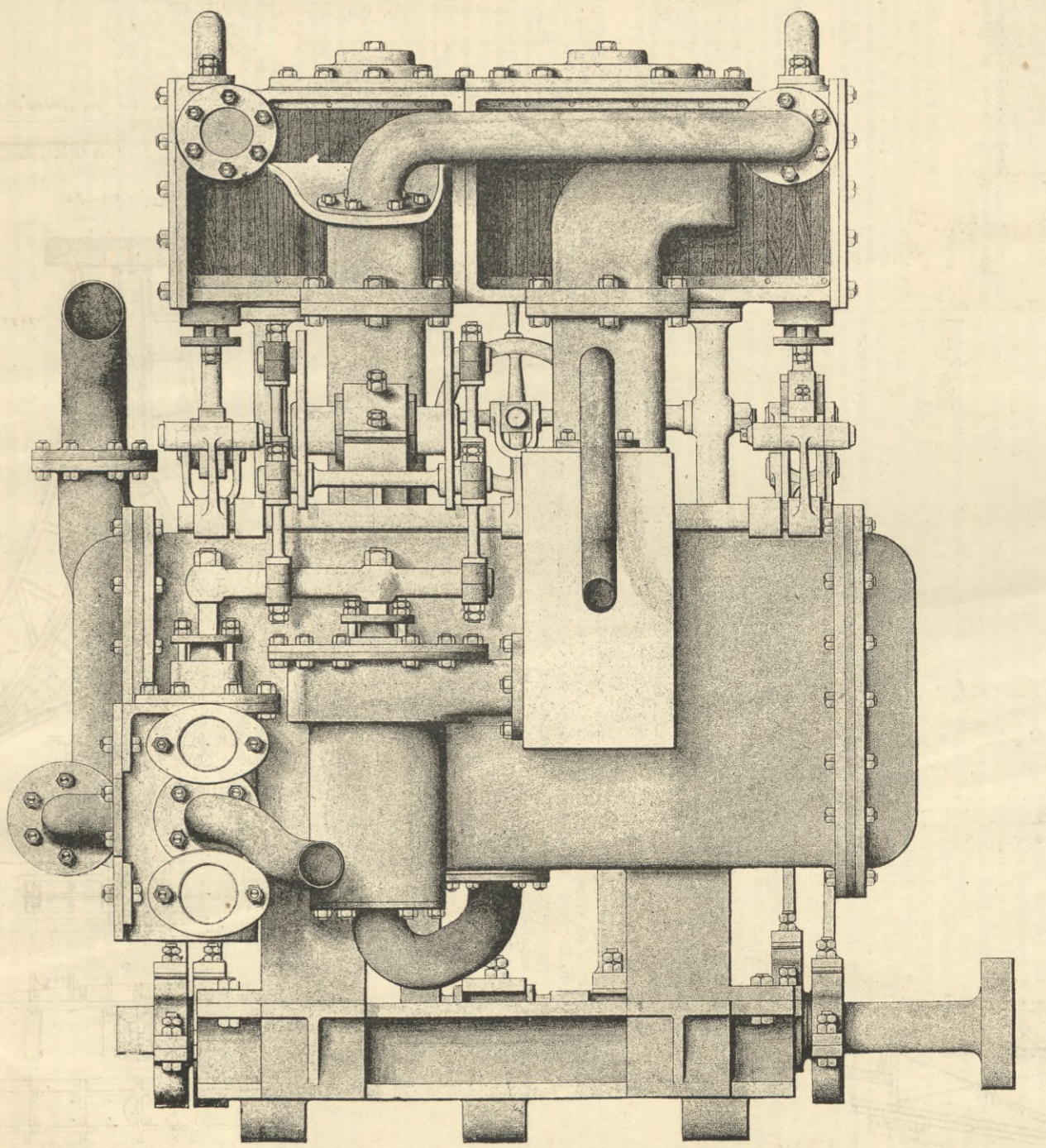
SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Jan. 6th, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 16,630; mercantile marine, Indian section, and other collections, 6161. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m., Museum, 2031; mercantile marine, Indian section, and other collections, 448. Total, 25,270. Average of corresponding week in former years, 17,464. Total from the opening of the Museum, 21,607,372.

ROOF OVER RUNNING SHED AT EVELEIGH, SYDNEY, GREAT SOUTHERN AND WESTERN RAILWAY, NEW SOUTH WALES.

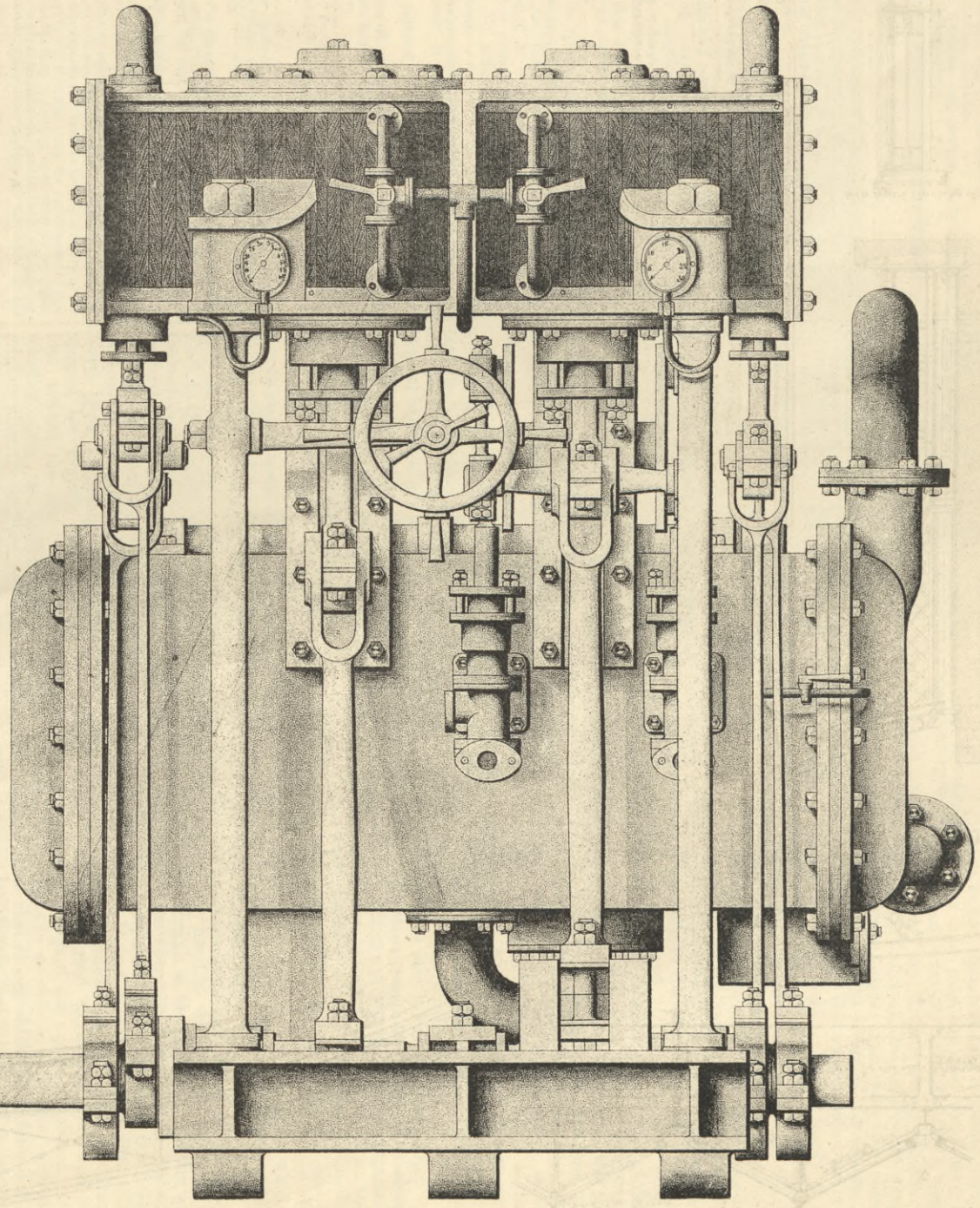
(*For description see page 23.*)



BACK VIEW.



FRONT VIEW.

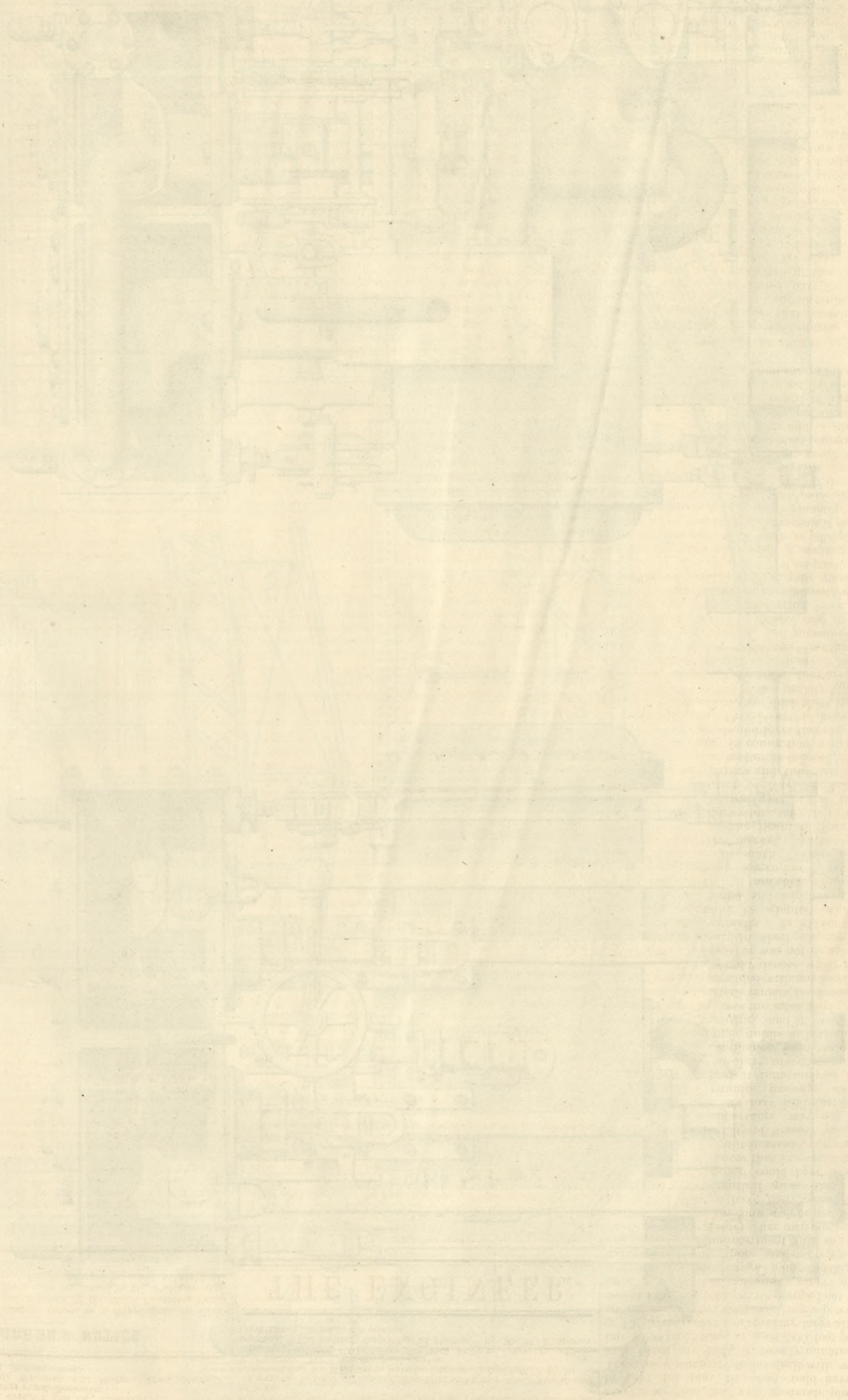


INK PHOTO Sprague & Cº 22 Martins Lane Cannon St EC

COMPOUND SURFACE CONDENSING ENGINES 20 H.P. NOMINAL.

FOR SCREW YACHTS "VENUS" & "SOUTHERN CROSS.

MESSRS J. COPLEY & Cº ENGINEERS, MIDDLESBOROUGH.



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

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

PUBLISHER'S NOTICE.

*** *With this week's number is issued as a Supplement, an illustration of the Compound Engines of the Steam Launches Venus and Southern Cross. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

TO CORRESPONDENTS.

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

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

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

J. H. (Hull).—*The names of the contractors have not been made known.*

A. X.—*Box's "Treatise on Heat" is the only work we know likely to suit you.*

J. F.—*The invention may be patented in the United States if the English patent is not too old.*

W. T. H.—*We fancy you mean the Clammond gaslight, concerning which you will find information on another page. You can see the light every evening at the Crystal Palace.*

H. G.—*There is no recent work on the turbine which will answer your purpose better than those you name. The statements made by your friend are quite correct. If you will say what it is you want to know we will try and answer your question.*

STRATFORD.—*The larger the wheels of the truck, other things being equal, the less resistance will it offer to traction. If you can obtain a copy of Wood's "Treatise on Railways," published about* 1830, *you will find particulars of experiments made to decide this and other questions which will interest you.*

STUDENT.—*The work done by a Cornish engine is reduced to foot-pounds. Thus, a duty of* 80,000,000 *means that* 80,000,000 *of pounds of water have been lifted* 1*ft. high by* 112 *lb. of coal. Let us suppose that the height through which the water is lifted is* 300*ft. Then* $\frac{80,000,000}{300} = 266,666$, *that is to say, the engine will have lifted* 266,666 *lb. of water, or* 26,666 *gallons of water* 300*ft. high by the combustion of* 1 *cwt. of coal.*

G. L. (Barnet).—*The usual effect of surface condensed feed-water on a boiler is injurious. When it is used it is absolutely necessary to take measures to get a thin scale of incrustation deposited all over the heating surface of the boiler, otherwise rapid corrosion will take place, and the permanence of this scale, which may not be thicker than a visiting card, must be carefully guarded. In steamships the scale is obtained and maintained by filling up the boilers to begin with with sea water, and making up for waste at the safety valves, &c., from the sea.*

BRAYTON'S PETROLEUM ENGINES.

(To the Editor of The Engineer.)

SIR,—Can any of your readers inform me where Brayton's petroleum engine is to be seen or heard of? ENGINEER.
London, N., January 9th.

GLASS STOPPER PRESSES.

(To the Editor of The Engineer.)

SIR,—Would any reader be kind enough to tell us the name of any good firm that can supply a press with the newest improvements for making glass stoppers? SUBSCRIBERS.
Dublin, January 4th.

TRICYCLES AND LUBRICANTS.

(To the Editor of The Engineer.)

SIR,—Would any correspondent tell me what power in pounds I shall require on both driving wheels to propel a self-moving tricycle, the weight of which is 600 lb., on good, dry macadamised roads, levels, and ordinary inclines, at six miles per hour? What is the best lubricant to stand 550 deg. Fah. in a superheated steam engine cylinder?
Birmingham, January 8th. VORTEX.

STRAINS IN ARCHES.

(To the Editor of The Engineer.)

SIR,—In looking over a work recently published, I noticed the following formula for calculating the horizontal thrust at the crown of an arch:—$t = Wr$ when r = the radius of the arch in feet; W = the load per horizontal lineal foot on the arch, and t = the thrust at the crown. I shall be glad if any of your readers conversant with the calculation of strains in arches will say whether the above formula is a reliable one or not. Is there an easier or better method of finding the thrust at the crown than to take the moment of the weight of half the arch collected at its centre of gravity, about the springing of the arch, and to divide it by the vertical distance from springing to crown? ARCHES.
January 8th.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Jan. 16th, at 8 p.m.: Paper to be read with a view to discussion, "The Antwerp Waterworks," by Mr. William Anderson, M. Inst. C.E.

SOCIETY OF TELEGRAPH ENGINEERS AND ELECTRICIANS.—Thursday, Jan. 18th, at 8 p.m.: Mr. Willoughby Smith will deliver his inaugural address, as President, for the ensuing year.

THE METEOROLOGICAL SOCIETY.—Wednesday, Jan. 17th, at 7 p.m.: The report of the Council will be read, the election of officers and Council for the ensuing year will take place, and the President will deliver his address.

CHEMICAL SOCIETY.—Thursday, Jan. 18th, at 8 p.m.: "On a New Method of Estimating the Halogens in Volatile Organic Compounds," by Mr. R. P. Plimpton, Ph.D., and Mr. E. E. Graves.

SOCIETY OF ARTS.—Wednesday, Jan. 17th, at 8 p.m.: Seventh ordinary meeting, "The Sanitary Inspection of Houses," by Mr. W. K. Burton. Lord Alfred Churchill will preside.

THE ENGINEER.

JANUARY 12, 1883.

THE LOSS OF THE CITY OF BRUSSELS.

THE sinking of an Inman steamer at the mouth of the Mersey appears, at first sight, to be an almost incredible event. Liverpool passenger steamers have come to be regarded as at least as safe means of transport as railway trains; and it is not too much to say that a railway journey of 3000 miles performed in any country would be attended by as much risk as a voyage across the Atlantic in one of the ships of this celebrated fleet. The precautions taken to ensure the safety of passengers by the Cunard and other companies leave absolutely nothing to be desired. The Cunard steamers, for example, are now, and have for some time back, ceased to be either the largest or fastest crossing the Atlantic; but as regards safety, they enjoy an unrivalled reputation. The announcement that the City of Brussels had been sunk, and that several lives had been lost, close to Liverpool, were at first received with doubt. It remains, of course, to be proved that the officers of the ship are in no way to blame for the catastrophe. With the details of the collision, which sent a fine steamer to the bottom, our readers are, no doubt, familiar; but it may be worth while to place the fact on record in our pages for future reference. On Sunday morning there was a thick fog in the Mersey, which extended some way out to sea. The Inman steamer City of Brussels had made a very satisfactory passage from New York to Queenstown, and a good run from Queenstown to the mouth of the Mersey. Then the fog settled down, and no further progress without extreme risk became possible; so Captain Land, who was in command of the ship, as soon as he heard the sound of the fog-bells of the North-West Lightship, turned the ship's head to sea, stopped her engines, and allowed her to drift up stern first toward the Bar. It is stated that he kept his whistles going at half-minute intervals. Forty-one minutes after the engines had been stopped the sound of another steamer's whistle was heard, and immediately afterwards the City of Brussels was struck on the starboard nearly amidship by the Kirby Hall, a new steamer on her trial trip from Glasgow. The Kirby Hall, a ship of about 1500 tons, cut well into the City of Brussels, making a hole, it is said, 8ft. wide, and below the water line. The Kirby Hall had her own bows twisted, but it does not appear that she suffered any serious injury. She has a large rent in her plates from the 18ft. watermark to the 24ft. She was flying light, and to this fact she probably owes her safety, as she made, we understand, little or no water, all her injuries being above the sea. Captain Land and his officers did all that men could do, and succeeded in saving the lives of nearly all on board. The discipline of the ship was perfect, the boats all ready for launching, and the result was, on the whole, satisfactory. Several lives, however, were lost, eight of the crew and two passengers, Italians, being drowned. So much for some of the facts concerning the catastrophe. Let us see what is the lesson it conveys; for there is no such thing as an accident. Nothing happens without a cause, and if we rightly understand what caused a given "accident," it is possible that we may be able to avoid its recurrence.

The first point worth notice is that the case of the ship, after she began to leak, was hopeless. Nothing could be done to keep her afloat. But, nevertheless, unaided as she was by any assistance from her crew, she did not founder for about twenty minutes. Now even the sinking of ships is effected according to rule and law by Nature. Not one pound of water less than a certain quantity would have sunk the City of Brussels, and the rate at which this water got into her was fixed by immutable rule. The City of Brussels was 390ft. long, and 40ft. 3in. beam. Her gross tonnage was 3774; her net tonnage, 2434. Her bunkers must have been nearly empty, and would represent a space capable of holding, say, 800 tons of water. She had a valuable cargo on board, but not, we fancy, a heavy one. If we say that her margin of floatation was equivalent to 1800 tons or so, we shall not, we think, be far short of the mark. To sink her she must therefore have taken 1800 tons of water on board. It is quite certain that some obstacle intervened to prevent the water from finding its way through the whole ship at once, because if a hole 8ft. wide had been knocked in her side, assuming it to be only 4ft. deep below the surface, she would have taken in enough water to sink her in less than five minutes, the head rapidly augmenting as her bows sank. The ship was, however, divided by watertight compartments, and probably a single compartment was rapidly filled, and this having been done, her head was so far pulled down that water found its way over the deck to which the bulkhead extended, and thence ran aft. The ship, however, went down by the head; and it is noteworthy that she remained afloat until the water reached the bridge. The City of Brussels had nine bulkheads and seven watertight compartments; and it is said that the reason why she foundered was that the Kirby Hall struck her just at the end of a bulkhead, and so knocked two compartments into one. This is, however, to a large extent, pure conjecture; and even if it is true, then the circumstance supplies another argument in favour of so constructing bulkheads that two compartments cannot be knocked into one. How this is to be done we explained fully in THE ENGINEER for June 14th, 1878, page 416. Be this as it may, it is clear that if the bulkhead had been more efficient, the City of Brussels might now be lying in dock in Liverpool. But assuming that the bulkhead was what it was—inefficient beyond a certain point—it is easy to see that, had very moderate pumping power been brought into play, the ship could have been kept afloat. The utmost quantity to be dealt with was, say, 2000 tons, to be lifted, say, 20ft., in twenty minutes. This represents but 40,000 foot-tons, or 4,480,000 foot-pounds per minute, or 135-horse power; or, making large allowances for waste, an engine of 250 indicated horse-power, properly used, would have kept the water pumped out of her as fast as it came in. She had an ample supply of steam available, and one large centrifugal pump would, in all probability, have sufficed to save her. Assistance was close at hand, and even with one compartment full, she might have been towed to a place of safety, her own pumps dealing with what we may term the overflow over or past the bulkhead. The ship and her cargo have been valued at £300,000. We speak close to the truth if we say that a pump and engine of the required power could have been had for £1000. We are happy to know that in most of the great passenger steamers recently built immense pumping power has been provided; but the City of Brussels was thirteen years old, and sufficient importance was not then attached to pumps; and here we may hint that the various Liverpool companies running passenger steamers across the Atlantic would find it immensely to their advantage if they could state in their advertisements that their ships were fitted with appliances which would deal with huge leaks. The passenger public at both sides of the Atlantic is very discriminating, and it would not be slow to understand which was the safest ship.

Two other questions remain for consideration. Was the City of Brussels provided with any special sound-signalling apparatus which would denote which way her head lay, and whether she was or was not in motion? We believe she was not; that, in short, she had nothing but the ordinary steam whistle. Is it not time that a universal code should be adopted which would be intelligible to all ships, and which would tell an advancing steamer that, "I am here, lying with my head to the west, drifting astern," or "I am going dead slow with my head to the south." There is no want of such sound signals in the market. Another question is, When will shipowners, or the Board of Trade, or "Lloyd's," or the Liverpool underwriters, take the bulkhead problem in hand? It is a noteworthy fact that this is a subject on which the Institution of Naval Architects never touches. Those who read papers and those who discuss them alike seem to regard the matter as tabooed. If it is referred to at all, it is so only in connection with ships-of-war. We know that among shipbuilders there is a rooted contempt for bulkheads, and this is not to be wondered at, seeing that they themselves have done their utmost to make them contemptible. As they are usually fitted, they cost some money—not much it is true; they are a nuisance to the owners, coming as they do more or less in the way of cargo, and they are absolutely worthless. We shall feel indebted to any one of our numerous readers who can give us particulars of a single case in which bulkheads prevented a ship from foundering. We do not now refer to collision bulkheads, which are almost invariably well made, well designed, and therefore quite efficient. We refer to the other bulkheads, which, if as good, would be as useful. By only too many persons it is assumed that the modern passenger steamer is as safe as she can be made. The foundering of the City of Brussels is proof that she is not safe, and there is a universal consensus of opinion among engineers, at all events, that passenger steamers can be made much safer than they are. If the time of foundering in case of collision could always be delayed by some few hours, an immense advantage would be gained; and it really appears that if those most concerned would do what can be done to secure this end, a great deal might be effected. It requires, we hold, but a moderate effort on the part of Lloyd's and the Board of Trade, and the thing could be done. Unless they act, bulkheads will probably continue to be delusions and snares to the end of time.

ENGINEERS IN THE NAVY.

IT will be remembered that during last February Mr. Trevelyan made a promise that something should be done for engineers in the navy; and an Order in Council bearing date the 30th of November has just been promulgated. The most prominent feature in this Order, or rather the changes introduced by Mr. Trevelyan, is that the number of engineer officers shall be reduced to 650—it so happens that this is about the number now on the Admiralty books—while the number of what are now known as chief engine-room artificers is to be augmented. Furthermore, the number of engineers may be still further reduced, and that of the artificers increased, provided the aggregate number shall not exceed 800, of whom chief inspectors shall be limited to five, inspectors to seven, and chief engineers to 220. The full pay for chief inspectors of machinery is now to be £1 15*s.* a day, an increase of 3*s.*; inspectors, £1 10*s.*, an increase of 2*s.*; and engineers of nine years' seniority, 12*s.*, an increase of 1*s.* per day. Hitherto the daily full pay of an engineer rose to 10*s.* after he had served three years, and to 11*s.* after six years' service, at which point it remained until he was promoted. Promotion came slowly, and many engineers had not passed for promotion. For the majority, therefore, the 11*s.* represented the maximum. It was for the purpose of bettering the position of these officers that Mr. Trevelyan agreed to give another increment of pay after a third term of three years' service. The Order also gives an extra allowance of 4*s.* a day to the chief engineer in charge of the machinery of such an exceptional ship as the Hecla or the Polyphemus, though under 3000 indicated horse-power. Another alteration abolishes the allowance which has been paid to engineer officers required to mess in the ward-room, with the exception of those who may be considered to belong to the gun-room.

It will be seen that the engine-room artificers are daily becoming a more important class of men; and that the

engineers are gradually diminishing in number. The change has our approval, because we see in it the first operation of a policy which we have long advocated. The facts are very plain and simple. Successive Governments have been impressed with the idea that men in charge of machinery in her Majesty's ships should receive a technical education of a very high type. But the truth is that this theory is completely erroneous. The men who design machinery and superintend its construction do need such an education, but the men who have charge of it do not. They require a totally different, and not less important training. A knowledge of German, and more or less profound acquaintance with higher mathematics, will not in any way help a man to cool a hot bearing, pack a gland, or mend a burst feed pipe. Those in charge of machinery at sea should be versed in the broad principles of mechanics; they should be able to read a diagram; to make a fair drawing, and competent to do, or superintend the doing, of repairs. Hitherto it has been found quite impossible to produce in a regular way a good engine-driver, and an educated scientific engineer. in one. There are such men, it is true, but they are quite exceptional. As a rule, the scientific young man has a soul above engine-driving, with its dirt and its drudgery, and we are not surprised. He is too intellectual for his work. The Admiralty found this out some time since; and so, while they give engineers the education of gentlemen, they employ engine-room artificers to do the work. In other words, engineers in the Navy are professional men, and engine-room artificers learn and practise a trade. It requires no extreme perspicacity to see that the engine-room artificers have quietly stepped into the places filled at one time by engineers, and that the new type of engineer—the product of the Training Colleges at Greenwich and Portsmouth—is an addition, not a substitution. It was complained that the old type of engineer was not a gentleman, and this was quite true, with, be it understood, certain exceptions. Then it was expected that gentlemen would do the necessary work, but it was found that they would not, and so the old type engineer still finds his place in our Navy, and the new type is, as we have said, something thrown in. The truth is, that the engine-room artificer is the right man in the right place, and the highly-trained engineer is not. Plain speaking is best in this matter for all parties; and we assert that there is not sufficient scope to be found on board a man-of-war for the display of talent, or even of ability, of a high order. The work to be done is simply engine driving when a ship is running, or engine watching when she is out of commission. There is in all this nothing which can make any demand on the higher intellectual powers; and if there were a compliance with the demand would bring no return. Engineers have no chance of distinguishing themselves in action. They have no chance of doing anything, in fact, in the way of making use of a somewhat expensive education. The artificers do the work and the engineers look on; and very wearisome and irksome work this same looking on must be to young men of brains and abilities.

That the Admiralty begin to see matters in their true light is, we think, evident. The pay of artificers is to be improved. A chief artificer will get 7s. 6d. a day, and there are besides pensions and other advantages which will really make him better off than were his predecessors, the engineers, of whom but few are now to be found in the Navy. The number of artificers employed has been steadily increasing, while that of engineers has been diminishing, and in this way we are, it would seem, gradually getting nearer the complete adoption of the system we have long advocated—namely, the employment of one superintending engineer in each ship, having under him a staff of engine-room artificers, with their foreman, or leading hand. If we take a large vessel, say a ship of 8000-horse power, with twin screws, the engine-room staff might be composed of one chief engineer, one assistant-engineer, and about twenty engine-room artificers, which would allow four men on watch at a time in each engine-room, and four men over. The artificers would have different ranks, according to pay and seniority; but they would be of an entirely different grade from the engineer and assistant-engineer. Both these gentlemen would really be professional men of high training; and the pay of a chief should not be less than £1 10s. per day, with certain extras while on foreign service, &c. In smaller ships but one engineer would be carried, save in time of war, when extra force would be required in the engine-room. In yet smaller ships an assistant-engineer only might be carried. These assistant-engineers would be young men passed into the ships after a good training both at college and in the work-shop. Not that they would be subsequently called to work with their hands, but that, knowing how to do a thing themselves, they could see that it was properly done by others. In short, the training for engineers in the Navy would be just of that kind which is now given in the works of mechanical engineers to what are known as articled pupils, with this difference, that the naval engineer would also receive what the articled pupil does not—namely, a sound technical education.

The number of engineers needed if this scheme were carried out would not be large. The pay might, accordingly, be high, and the services of really first-rate men would be secured; the work would be done in all respects as well as it could be done; promotion would be at least as rapid as it is now, and there would be far less grumbling and dissatisfaction than now exists. The engine-room artificers are, on the whole, an admirable body of men, and the engineer students now being turned out are in a very full sense of the word officers and gentlemen. They are highly educated, well-mannered young men, an ornament to the service; but they are out of place in an engine-room, whether the ship is under steam or lying in dock. In plain English, they are a great deal too good for their work in one sense, too bad for it in another. After a time it will be understood that a steam engine does not know whether it is in a Government ship or in that of a private firm; steam is above Admiralty regulations, and the class of men and the system of management which does best in the mercantile marine is just that which ought to do best in the Navy. There are, of course, differences, and as the repairs to be done are not effected in the same way in the two services, there must be a difference. But after all is said, the chief engineer of a great Transatlantic passenger ship holds very much the position which we would assign to the chief engineer of one of her Majesty's ships of war. It is to be hoped that the Admiralty, having begun to reduce the number of engineers, will continue the work. It is, we may add, to be regretted that the addition they have made to the pay of engineers in the Navy is so small. Twelve shillings a day, or £219 a year, is a poor reward for long service and an expensive education. As much can be earned by men with far less knowledge and possibly shorter service. Engineers in large steamers get as much as £30 a month, and a first-class table is kept for them, and while at sea they have literally no expenses, save what they think proper to incur. Even in comparatively small ships a chief engineer's pay and his mess together represent much more than he could hope to earn in the Navy; and it must not be forgotten that Mr. Trevelyan's changes do not apply at all to chief engineers in the Navy. Engineers may take what they have got as an instalment, and be thankful; but the whole system of providing engineers for men-of-war is manifestly in a transition state, and some time must elapse before it can be regarded as quite satisfactory.

CONTINUOUS BRAKES IN FRANCE.

THE French Minister of Public Works, M. Ch. Hérisson, has taken a very singular step. He has issued a circular to the French Railway Companies, dated the 7th of last December, in which he actually recommends the adoption of a special form of continuous brake. For a long time past the French Government has, like our own, urged on the railway companies the adoption of continuous brakes, but we need hardly say that the companies have been hitherto left entirely to themselves to choose whatever brakes they like. Now, it so happens that in France the railway companies will, as a rule, do nothing to make themselves specially agreeable to other companies. In fact, the adoption of any mechanical device by one company is enough to prevent any other from using it; and it has been pointed out, half in jest, half in earnest, that this jealousy is carried to such an extreme that the Paris, Lyons, and Mediterranean, Eastern, and other railways, each uses even nails of a particular pattern. In the search for a continuous brake, the first-mentioned line adopted the Smith-Hardy vacuum brake, the Chemin de Fer l'Ouest took the Westinghouse brake, and so did the Midi and the Ceinture lines. The Eastern Company to gain time kept on experimenting with the Achard electrical brake, without achieving anything. The Lyons Company put the Westinghouse brake on the Montargis line, and the Smith brake on the Montereau line. Meanwhile the locomotive superintendent of the line, M. Wenger, began experimenting with what was known as the Marté brake. This, now known as the Wenger brake, is worked by compressed air, and appears to be a very defective modification of the Westinghouse brake, the sole merit which it appears to possess being that coaches fitted with it can be run in trains fitted with the Westinghouse brake. Why the companies should hunt about for other brakes when they had one ready to their hands, the merits of which have been fully demonstrated by successful working, cannot be explained; unless, indeed, it arises from the dislike, to which we have already referred, manifested by every company to use anything used by another company. Under all the circumstances it is clear that the only proper course for M. Hérisson to adopt was simply to insist on the adoption of a continuous brake, which should be efficient, without recommending any particular brake, but in his circular of the 7th ult., he actually recommends the adoption of the Wenger brake. This may appear so incredible that we prefer to give M. Hérisson's own words. After referring to the delay in fitting continuous brakes, his circular goes on: "J'ai recherché la cause de ces retards. Elle ne réside pas, avant tout, dans la multiplicité des types soumis à des essais. La vérité est aussi que plusieurs compagnies ont donné la préférence au frein américain Westinghouse, mais que ce constructeur, après s'être chargé de livraisons considérables, paraît impuissant à les effectuer en temps utile. C'est sans doute une des raisons qui ont déterminé l'administration des chemins de fer de l'Etat et la compagnie d'Orléans à s'adresser, dans une certaine mesure, au système Wenger. Sur l'invitation de cette compagnie, j'ai assisté, le 22 Novembre dernier, à des expériences comparative du frein américain et du frein français basés l'un et l'autre sur l'emploi de l'air comprimé. Ce dernier, sur lequel le comité de l'exploitation technique s'est déjà prononcé favorablement, est continu et automatique. D'après M. l'ingénieur en chef du matériel et de la traction de la compagnie d'Orléans, dont la compétence est indiscutable, il aurait l'avantage d'être simple, robuste et d'un entretien facile. Il peut enfin s'accoupler avec le frein Westinghouse et fonctionner de concert, de telle sorte que les compagnies déjà pourvues d'un certain nombre de freins américains pourraient à l'ooccasion, sans renoncer á ces derniers, compléter leur outillage avec le système français." We may add that this circular has excited a good deal of feeling in France, and popular opinion has not been strengthened in M. Hérisson's favour by the circumstance that, by a decree of the 28th December, M. Wenger has, upon the recommendation of M. Hérisson, been made a chevalier of the Legion of Honour "for remarkable services rendered in connection with the rolling stock of railways."

ST. JAMES'S PARK.

THERE is nothing of which Londoners are more justly proud than of the parks which constitute the so-called "lungs" of this great city, and we are far from wishing for any alterations affecting these which should in the least militate against their use as elegant adornments and healthful resorts for the metropolis. But, while so desirous, it is undoubted that their great extent, and the necessity for excluding from them traffic of a miscellaneous character, greatly interfere with ready access between certain districts. Where such interference can be avoided it appears desirable that the department charged with the care of our parks should take every possible step to increase public convenience. The closing of the park gates after a certain hour is a measure the necessity for which no one will dispute; but there is one thoroughfare at least, the inclusion of which in this rule gives rise to great inconvenience. We allude to that largely used footway through St. James's Park crossing the suspension bridge over the ornamental water. Since the establishment of the St. James's Park station of the District Railway this foot-path has become the highway followed by thousands of residents along the line of the railway to reach the neighbourhood of St. James'-street; and it is a complaint made by the numerous class who use our London clubs, which are chiefly situated in that vicinity, that the thoroughfare above alluded to is closed to them at a comparatively early hour. Not alone to them, but to many others, dwellers in the neighbourhood of Victoria-street, Queen Anne's Mansions, &c., is this stoppage a most inconvenient obstacle. Much has been done of late years to improve the foot-paths along and about the Mall; but the road we have stated to be so largely used is still only laid with gravel of so clayey a composition that the least rain turns it into a sea of mud. A comparatively small outlay would suffice for laying down an asphalte pavement of about 12ft. in width. Approximately, the total distance to be so laid would be about 300 yards, and, at current rates, we should say the work we desire could be done for about £350, inclusive of the required curbing, an expenditure which certainly the large use made of this thoroughfare would fully justify. Then as to the question of including it in the "early closing movement," it seems to us that the safety of the park and the insurance of its proper use at all hours could be attained by the substitution of ornamental non-climbable railings for the present low ordinary iron fence. These need in no degree interfere with the proper view of the adjacent lawns and gardens by passers-by. Ingress to the off-paths could be stopped at night by gates of corresponding design, and thus season ticket-holders to the St. James's Park Station and others whom business or pleasure call to its neighbourhood would no longer, as at present, be forced to a long detour to reach either the Charing-cross or Victoria Stations of the District Railway. The granting of such a boon would be largely and widely appreciated, and, in comparison with the benefits it would secure, the outlay necessary would be but small. It is manifestly the duty of the authorities to minimise the inconveniences inseparable from the maintenance of large reserves of land for pleasure and health purposes in the midst of a population, and we trust the suggestion we have thrown out will be considered in the proper quarter.

STEAM SHIPPING PROSPECTS.

THE importance of the shipbuilding industries to the engineering trades gives interest to the question of what effect the comparatively low rate of freights that prevails will have upon shipbuilding, which for above eighteen months has been exceedingly brisk. It may be taken for granted that freights are on a lower range than they were a few years ago, and that the tendency is to decrease as the tonnage of the merchant navy increases. But those who take a pessimist view of matters forget that, concurrently with the decrease in the rate of freights, there is a decrease in the cost of the production of vessels. Ten years ago, or even before high prices ruled, the cost of ship plates—iron plates—was about £11 per ton, now, in the same producing centre they are obtainable at £6 10s.; and ship angles have fallen in a similar proportion. When the largeness of the tonnage of iron used in vessels is borne in mind, it will be seen that the cost of production is very materially reduced, and thus that, other things being equal, lower freights will pay the same dividend; and there is also to be remembered that these lower freights tend to materially increase the trade across the seas, and that whilst on the one hand lower freights do not diminish the earning power of a vessel owing to its lesser cost, yet they do increase the work of the steamship; and there is a further benefit from the low prices of the vessels—this country is better enabled to compete with foreigners in the cargo carrying trades, for the effect of the bounties that some of them impose is to increase the first cost of the vessels. On the other hand, it cannot be said that the cost of working our vessels is being reduced so rapidly as it ought to be when the large additions to the labour-saving appliances on board is borne in mind, and it may be that the low freights that now prevail will stimulate owners in this direction to revise the rate of costs. Eras of low prices and low rates are usually favourable to economical working, and there is room in the working of our steamers for more of this. But looking at the question broadly, although the tonnage built is now so large, yet with losses of iron vessels which increase in number yearly with the increase in the total of our steam merchant marine, and looking at the fact that we have yearly to do a share of the trade of the world that is increasing and that must for some time increase, because other nations are building fewer steamers—there seems ground for the belief that the era of great activity in our shipbuilding yards is not likely to pass away soon; and this conclusion is apart from the question whether the Americans may take steps to increase their merchant navy. If they do, it will, in the first instance, benefit us; if they do not, as their trade grows so will the demand that they make on our carrying vessels. Our shipyards may not, perhaps, keep at the present high pressure in regard to steamship building; but there are grounds for the belief that for some time to come there will be continued activity in them, and that activity is necessarily reflected upon the marine engine works of the country, and that in an increasing degree, because of the fact that not only do new vessels need engines, but that the old ships need renewals of engines from time to time.

STEAM HEATING IN NEW YORK.

IN our last impression we mentioned that the advantages of a public system of heating towns by steam were not altogether unalloyed. Beside the continual breaking up of the streets to make good leaky joints, the obstruction of traffic, and the heating of the water in town supply mains, the supply is not altogether unattended with dangers, and judging from a report in an edition of the New York *Evening Telegram* which has reached us this week, some of the streets of New York promise to afford recreation for those of a sporting turn of mind who like amusement spiced with a certain amount of danger. The heading of the report referred to runs thus: "Exploding Steam Pipes; the Paving Stones and Dirt thrown a Hundred Feet; Passers-by Covered with Mud," and so on. A policeman on duty thus describes what took place on the 18th ult. at the corner of John and Nassau-streets:—"I noticed that steam was oozing from the pavement, and I was about to make a closer examination of the place when the pavement was lifted 3ft. or 4ft. and thrown to all sides. I jumped away as quickly as I could, but I did not escape a good drenching with hot water and filth. A truckman had just driven past the place. He and his team and wagon had a narrow escape from serious injury. As it was he got a full dose of charcoal and lampblack. The steam and hot water soaked the black stuff into a tarry sort of paste. I think at least fifty people who were in the vicinity had their clothing completely besmeared. Many of them received bruises from flying pieces of mortar and stone, but I think no person was seriously injured." The pipes which have become thus distinguished belong to the American Steam Heating and Power Company, and had just been attended to, the paviors having only a short time left the spot. Shop fronts were damaged and covered with mud and other materials above-mentioned. The fact that these escapes and explosions have been frequent does not necessarily prove that a general steam supply is bad in principle, but they certainly show that the pipe fitting needs to be well done, and that American pipe-

fitting designers and pipe fitters might in this matter at least learn a little from the old-fashioned people on this side of the ferry.

THE SUEZ CANAL.

THE Works Committee of the Suez Canal Company has now decided upon the expenditure of about £920,000 on improving the canal and its dock accommodation. The first improvement consists in the construction of a siding or resting and passing place 500 metres in length and 25 metres in width along the sheltered slope northward from the Quai Eugénie, and the second is the construction of a new dock at Port Said, on the African bank of the canal and south of the Ismail dock. It is to be 750 metres long and 200 metres in width. The widening of the canal where it crosses the Bitter Lake, between Suez and the 152nd kilometre station, already commenced, is to be pushed on to completion, so that the width will be 40 instead of 22 metres. The siding at Kantara is to be increased from 1000 to 4000 metres in length, while that at the 153rd kilometre is to be increased from 700 to 2000 metres in length, and increased from 26 metres on both sides, measuring from the centre of the canal, to 40 metres on each side The station at Lake Tamsah is to be doubled in area, and thus made to contain as many vessels as the Kantara siding. The curve at the north of El Guise is to be widened from 42 metres to 71½ metres, and other curves are to be similarly treated to facilitate navigation. At Port Tewfik the siding accommodation is to be greatly enlarged, and the floating dock at the same place to be deepened. By these improvements, the execution of which is to extend over several years, the estimated traffic capacity will, it is expected, be doubled or increased to 10 million tons. When the traffic reaches this the committee propose to take into consideration the idea, not the proposal they say, of constructing a second canal parallel with that existing, so as to make up and down lines of traffic. If the English scheme for the Alexandria Canal is carried, there will soon be a lot of work going on in this part of Egypt.

LITERATURE.

Gold: its Occurrence and Extraction. By ALFRED G. LOCK. 8vo., pp. 1229. London: E. and F. N. Spon. 1882.

IN this portly volume the author has gathered together an enormous mass of information concerning the occurrence and distribution of gold-bearing deposits, and the methods employed in extracting the precious metal in different parts of the world. The matter is classified into seven chapters, the first four dealing with geographical distribution and mode of occurrence, the latter under the divisions of geological occurrence and mineralogical association, shallow places and live rivers, and deep leads or dead rivers; while the three remaining chapters are devoted to hydraulic mining, the working of auriferous vein stuff, and the treatment of auriferous ores. In the first chapter, that on geographical distribution, a strictly alphabetical arrangement is adopted, which has the effect of putting one of the least important areas, namely, Africa, into the foremost place; and in the section on Australasia, New Zealand is sandwiched in between New South Wales and Queensland, and Tasmania and Timor between South Australia and Victoria, thus doing away with any proper geographical treatment of the subject as a whole. In the same way, New York and New Mexico, Ohio and Oregon, Pennsylvania and Utah, alternate in the most bewildering manner. The section on Asia contains a long and well-digested account of the progress of alluvial gold working in Asiatic Russia, apparently derived from some official source, which, however, is not stated. There is also much valuable information on the alluvial deposits of New Zealand; but being mainly made up of extracts from reports, the story is not so well connected as in the Siberian section. Some of the author's geographical notions are, to say the least, decidedly peculiarly, especially in regard to mountain chains; thus "what may be called the Pacific coast range includes the Rocky Mountains, the Sierra Nevada, and the Black Hills of Dakotah," and, nearer home, the Hohen Tauern is placed in Bohemia.

The technological chapters contain descriptions and examples of the various methods of working alluvial deposits by sluicing and hydraulic jets, among which the New Zealand beach box, a portable surface amalgamator and blanket frame, used in washing auriferous sands upon the sea beach, the richer gold-bearing stuff being thrown up by the sea during heavy storms in the same way as tin ore is got upon the beaches of the north of Cornwall after a north-westerly gale. Another New Zealand speciality is the so-called fly-catching table, which is a large blanket table placed across the stream, bringing down the waste from alluvial washings higher up the valley.

The chapter on auriferous vein stuff is mainly devoted to the considerations of stamps and machinery for the treatment of tailings, such as amalgamators, blanket strakes, &c., the illustrations being mainly familiar friends taken from Hague, Eggleston, and other writers, and in almost all cases without acknowledgment. There are also notices of certain new forms, such as the elephant and recoil stamps, and Howland's and Jordan's pulverisers. As most of these are only experimental machines, it seems strange that the author has made no mention of the Broyeur Vapart, which has achieved a certain practical success. The Dingey Mill and its modifications are at least equally worthy of notice with the Howland.

Under the head of auriferous ores the various processes of calcination and chlorination are noticed, the latter being described in detail as practised at Sandhurst, Victoria, an account which is exceedingly interesting, but is very inadequately illustrated, the two sketches given being so small as to be unintelligible, and no scale is given, the latter defect being in common with nearly all the illustrations of plant and machinery in the book. In this section of the book the chlorine process is spoken of as Plättner's, while in the chapter on gold in Germany it is attributed to Güttler, of Reichenstein, the real fact being that Plättner invented the process for the use of Güttler's arsenic works some thirty or forty years since.

There is no notice of the methods of treating auriferous lead ores by fusion, unless a statement that "the ore of the Richmond mine is put into a blast furnace and the lead runs out carrying the silver and gold," may be considered as such; and the whole subject of parting is dismissed in about twenty lines, while two pages are devoted to an account of some experiments made in Hungary upon the treatment of ores containing tellurium, which are not known to have produced any practical result. There is no notice of the methods of parting auriferous copper, which is now of some importance.

Taken as a whole, the work bears witness to great industry and extensive reading on the part of the author, and the collection of such a large quantity of material, even although very little attempt has been made in the direction of editing, will render it of value to those who may be to some extent familiar with the subject; but it cannot be considered as a substitute for already existing systematic treatises, such as that of Phillips. The value for reference would have been greatly enhanced if the indications of the original sources of information had been given at the foot of the page in the usual way, an omission that is but imperfectly supplied by the bibliography at the end.

THE LAWS OF PROJECTILE MOTION IN VACUO.

By PROFESSOR OLIVER J. LODGE.

IT would be a pity if Mr. Dare's question of the 29th December concerning the elementary theory of projectiles in vacuo should remain incompletely answered, especially as the matter is so generally and loosely referred to in popular books that many persons experience a similar difficulty about it. The question relates to the possibility of firing a ball round the earth in an orbit for ever; the retardation of the air being, of course, supposed absent.

And first of all everything suggesting a straight path to begin with, and then a circular path—see Fig. on p. 480, last vol.—is wrong and misleading, as also is everything suggesting a limit to the action of gravity. There is no discontinuity in the path, and the path is a simple and accurate ellipse, passing through the point of projection, with the earth's centre as one focus. The position of the other focus depends on the magnitude and direction of the initial velocity, and on g. The ellipse may be circular, as a special case.

This is true whether the initial velocity be great or small, whether the direction of projection be vertical or horizontal or inclined, and whether the range of the projectile before it strikes the earth be measured in feet or in miles, or in thousands of miles. But it is pretty obvious that to get the projectile to clear the whole bulk of the earth, and to sail completely round it, is a ticklish matter requiring nice adjustment, no matter how high the possible projection velocity; and if the point of projection be on the earth's surface it is simply impossible to miss the earth except by *exactly horizontal* projection, and even then the shot on its return journey will come tearing and grazing along the surface to get to the point of projection again. The annual motion of the earth need not be taken into account, but its diurnal rotation must, in estimating the initial velocity.

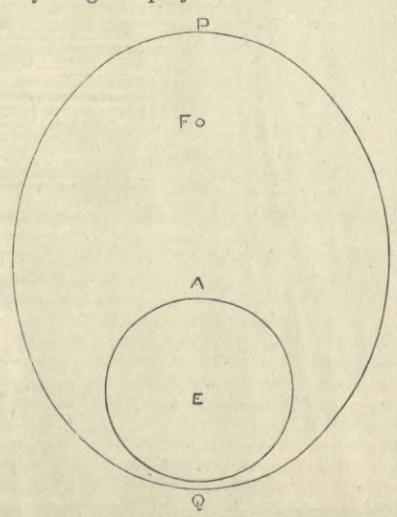
Observe that the *centre* of the earth is the centre of force round which the shot is revolving—not in a circle, but in an ellipse, as the planets revolve round the sun—and that the bulk of the earth is to be regarded as a gratuitous obstruction or target placed in the natural orbit of the projectile; a target also which differs from ordinary targets in being hard to miss.

It is easy to find the second focus of the elliptical path if the initial velocity is given, and then the path can be drawn, and the conditions determined as to whether the shot shall miss the earth or where it shall hit it. The position of the second focus is given by the following rules:—

(1) The distance of the second focus from the point of projection is equal to the greatest height the shot would have attained if it had been fired vertically upwards, which is $\frac{V^2}{2g}$ for ordinarily possible velocities of projection.

(2) The angle which a line joining the second focus to the point of projection makes with an upward vertical is double the angle which the direction of projection makes with the same vertical.

These two conditions fix the position of the second focus, and then with two pins and a bit of string in the ordinary way the ellipse can be drawn, passing through the point of projection, and having the above point and the centre of the earth E as its two foci. Having drawn this, the largest circle that can be drawn inside the ellipse with E as centre is the biggest bulk of earth that will not be struck by the given projectile.



P F = h
E P = r
E A = R

Note this, however, that if a shot is fired from the earth at any point it must graze the earth at this point in all its subsequent revolutions, no matter what its initial velocity was; and hence the origin of the planets cannot have been a projectile one. The nebular hypothesis may be valid, but the old projectile notion is a certainly false one. The moon may have slowly separated itself from the earth by reason of tidal deformation and viscosity, as Mr. G. H. Darwin and Dr. Ball suppose; but it cannot have been shot out volcanically into its present orbit.

Consider a shot fired horizontally from a point P at a distance r from the centre of the earth E with an initial velocity v. The greatest height it could attain if fired vertically upwards is—

$$h = \frac{v^2 r^2}{2 g R^2 - v^2 r}$$

where R is the radius of the earth and g the intensity of gravity *at its surface*. The second focus of the orbit in this case must—by rules 1 and 2—lie at this distance directly below P; let it be F. E and F are the foci, and the orbit can now be drawn, viz., P Q. Now, in order that the earth may not be struck by the shot, it is necessary that h shall be greater than the radius of the earth, as is obvious from the figure, where h = P F = E Q, and where E Q must exceed the radius of the earth if the shot is to clear it.

It is pretty obvious that the supposed case of horizontal projection is more likely to clear the earth than any other, since it gives a symmetrical orbit; so, therefore, the least sufficient initial velocity in the most general case is given by putting h = R in the above equation, and is—

$$v = \sqrt{\left\{\frac{2 g R}{r (R + r)}\right\}}$$

Putting r − R = 60 miles or so, we find the least speed a meteor can have at that height above the surface of the earth, in order that it may avoid striking the earth. It is about 26,000ft., or five miles a second. If it is going slower than this, it cannot escape being drawn in; if much faster, it may revolve round the earth for a long time. In order that it may go in a circle, F must coincide with E, or h must equal r, whence V must equal $\sqrt{\left(g \frac{R^2}{r}\right)}$. This is nearly the case of the moon.

At the distance of the moon r = 60 R, so the minimum sufficient velocity there is $\frac{1}{\sqrt{3}}$ of that necessary near the surface of the earth, being 620ft. a second. If the moon were to slacken to this pace it would begin just to graze the earth at one point of its orbit; but its actual velocity is about 5½ times as great as this, so it gets round the earth with a good margin—240,000 miles or so—to spare.

If P is a point close to the surface of the earth—so that r = R—it is plain that the earth will be struck unless F is below E; a case represented by turning the figure upside down, and regarding Q as the point of projection instead of P. If F coincides with E, we have the limiting case when the projectile would just graze the surface of the earth all the way round. The velocity necessary thus to carry the shot just round the earth, if fired from a point anywhere near its surface, is $\sqrt{(g R)}$, or a trifle over five miles a second; no smaller velocity than this is sufficient. It would get completely round in less than an hour and a-half.

University College,
Liverpool, Jan. 6th, 1883. OLIVER J. LODGE.

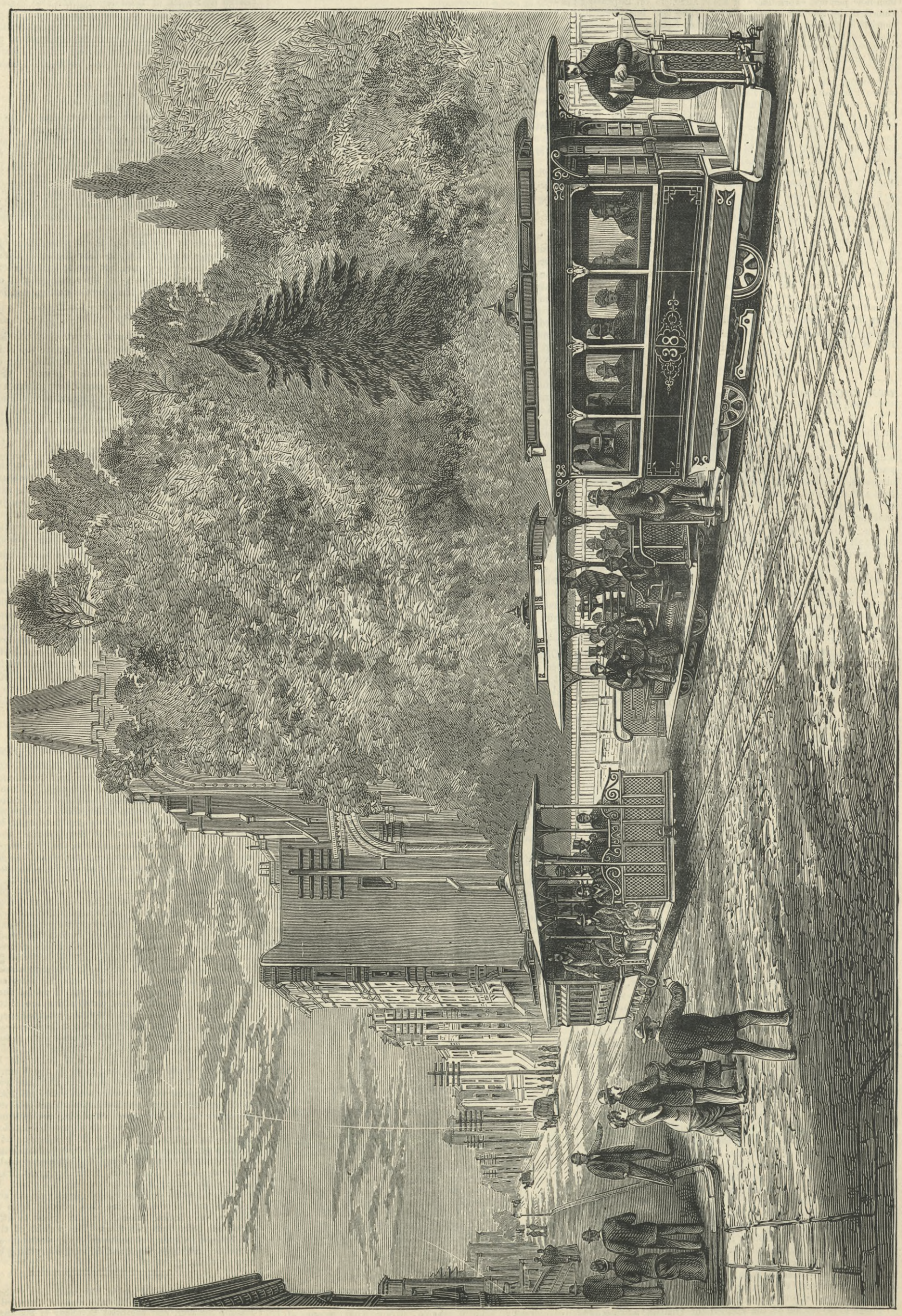
COPLEY'S COMPOUND LAUNCH ENGINES.

WE publish this week a supplement illustrating the compound engines of the Venus and the Southern Cross, constructed by Messrs. I. Copley and Co., Middlesbrough. These engines are compound surface condensing, working at a pressure of 85 lb. The high-pressure cylinder is 10in. diameter, low-pressure 18in., and the stroke 12in. The air pump is a solid brass casting, single-acting, 9in. diameter and 8½in. stroke; the circulating pump is double-acting, 5½in. diameter and 8½in. stroke, and both are worked by levers from the crosshead of the high-pressure engine. The crank shaft is forged out of a bloom of Bolckow, Vaughan, and Co.'s Cleveland steel, and the cranks, which are at right angles, are balanced. The steam chests are placed outside to make them more accessible, and the exhaust from the high-pressure engine to the low-pressure steam chest is carried through a copper pipe 5in. diameter. The low-pressure engine exhausts direct through the standard supporting it into the condenser. The tube plates are of brass, and the tubes are secured by Horn's patent wood ferules. The diameter of tubes is ⅝in., number 200, and length 5ft. The feed and bilge pumps are worked off pins in the air pump levers, and are solid brass castings, with ball valves, and are fixed against the front of the condenser. Starting valves of simple construction are fitted to both engines. The boiler is the multitubular marine type, constructed entirely of steel of the Landore make, and the ends are flanged both to the shell and furnaces. The furnaces are two in number, 25in. diameter; number of tubes 64, diameter 3in., and inclination 1¼ to the foot. The test pressure of boiler was 180 lb. The first pair of these engines were fitted to the Venus yacht, the property of Mr. John Bell, of Rushpool, and have worked for the last three seasons with extremely satisfactory results. Steam at 85 lb. pressure is maintained with the utmost ease and with the barometer at 30, a vacuum of 28½in.; revolutions, 152, with propeller 6·0 diameter, and 6·6 pitch; speed, 9 nautical miles per hour; consumption, 24½ tons for 2000 miles, or at the rate of 82 miles per ton consumed. The Venus is 90ft. long, and 16ft. beam; draught aft, 9ft.; area of immersed midship section, 78 square feet. The Venus, from her great draught, being intended for sailing as well as steaming, is a much heavier boat to drive than the ordinary class of lightly rigged steam yachts. Another pair of these engines has recently been sent out to Durban, in South Africa, for the yacht Southern Cross, which has been built out there. The weight of these engines and boilers, including connections, pipes, shafting, steam tubes, propeller, stokehole plates, and, in fact, everything but water, is 12 tons 4 cwt.

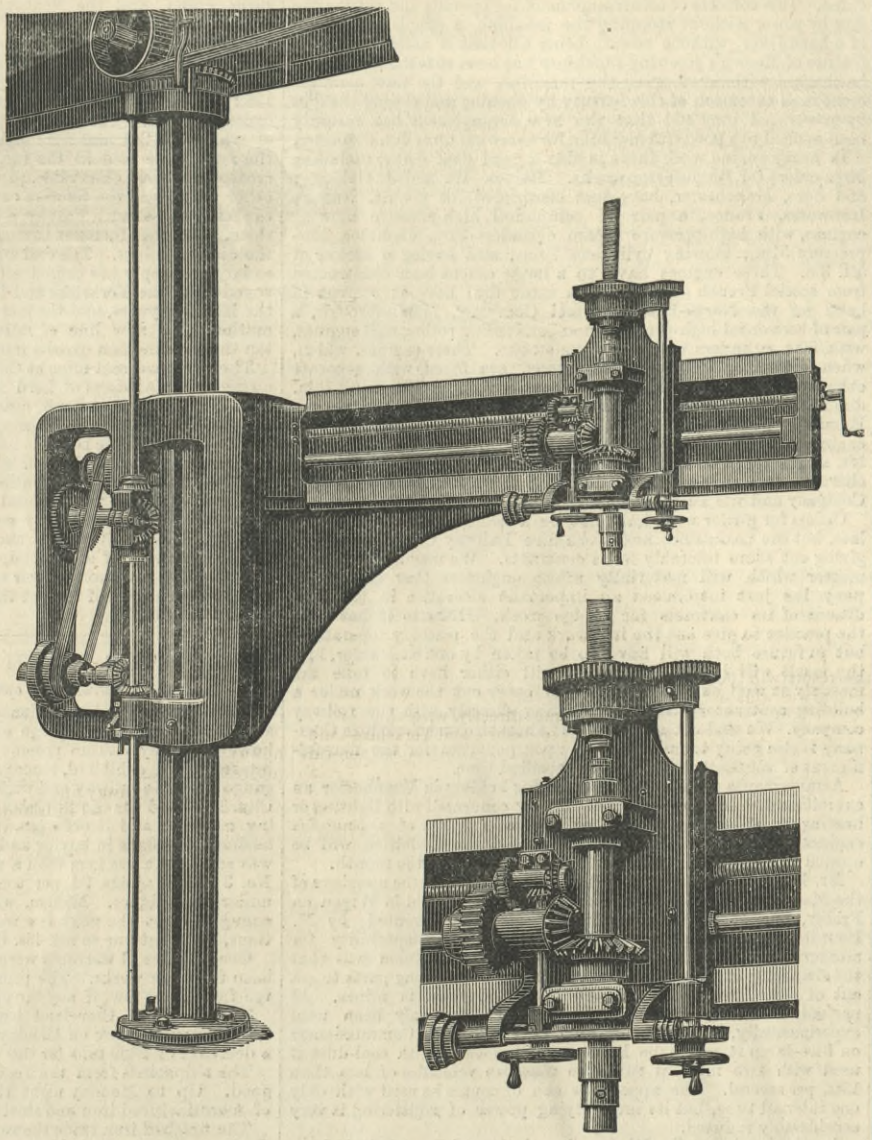
STEEL CASTING.—We stated last week that "the only firms producing steel castings in the strict sense of the word are Messrs. Jessop, Spencer, and the Steel Company of Scotland. All the others manipulate the steel in some way after it has been cast." We should have added the name of Hadfield's Steel Foundry Company, Sheffield, a firm the reputation of which stands extremely high in the production of steel castings in the strictest sense of the word.

TRAMWAY WORKING ON THE HALLIDIE CABLE SYSTEM.

(For description see page 19.)

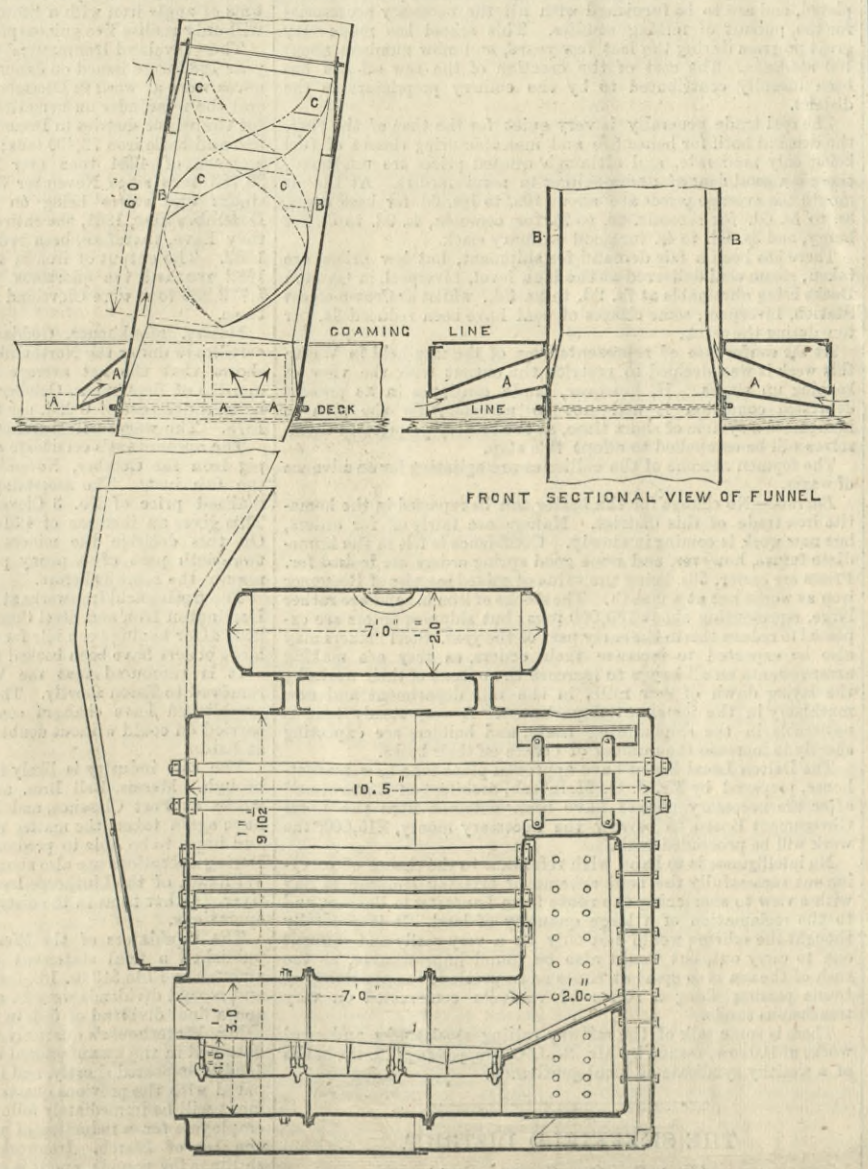


IMPROVED RADIAL DRILLING MACHINE.



IN no machine tools have greater improvements been made than in drilling machines which now perform work undreamed of by the last generation of engineers. A good example of the modern drilling machine is supplied by the accompanying illustration, which represents an improved radial drilling machine recently constructed by Messrs. Kendal and Gent, of Manchester, for Messrs. W. and J. Galloway's Knott Mill Engineering Works, Manchester. The machine, which is constructed with an elevating arm having a 10ft. radius, has been specially designed for drilling and boring in connection with work upon heavy machinery, which in course of erection would be difficult to move about for this purpose. The chief feature consists in the machine being adapted for drilling holes at any point within a circle of 20ft. diameter, and at any height from the floor, limited only by the capacity of the erecting shop. The driving is so arranged as to leave the floor space, with the exception of the footstep, quite clear for the erection of machinery, this result being obtained by driving from the top of the pillar by means of radial spur-wheel gearing. The radial arm, which is of great rigidity, has a maximum radius of spindle of 10ft., and is carried upon a strong central column, upon which it can be readily raised or lowered by power to any required position. This column, which carries also the vertical driving shafts and elevating screws for the radial arm, turns upon a footstep having a circular slot and bolts for fixing the arm in any position. The driving cones, gearing, &c., are carried within the framing of the radial arm, forming a compact self-contained driving apparatus. The saddle on the radial arm is fitted with the usual hand-feed and self-acting motions, and also with a convenient motion for traversing the saddle along the arm by means of a hand-wheel placed on the saddle within easy access of the workmen.

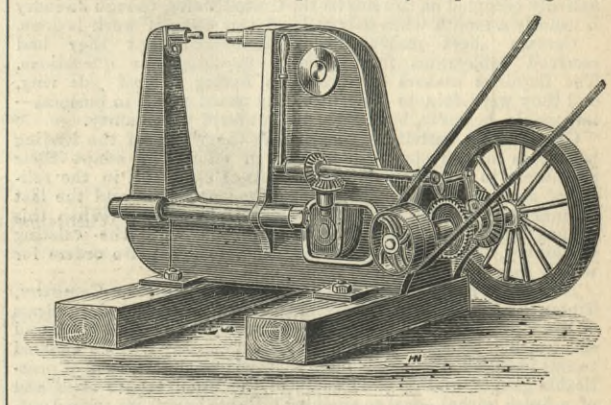
LIVET'S FURNACES AND WERY'S FUNNEL.



THE steamer Moreton, belonging to Messrs. W. Howard Smith and Sons, of London and Melbourne, built by Messrs. Walker, of Deptford, for Australian trade, with engine and boiler, by Messrs. James Watt and Co., has her boiler fitted with Mr. Livet's patent furnaces and Wery's atmospheric funnel, as illustrated by the accompanying engravings. The Moreton is 180ft. in length, 27ft. in moulded beam, and 8ft. 9in. draught. Her engines are of the ordinary compound type, with surface condensers and cylinders, high-pressure 23in., and low-pressure 40in. respectively, with a stroke of 2ft. 6in. These give an indicated horse-power of 400, working on the average at about 370. The boiler is very small, its main dimensions being 10ft. 5in. by 9ft. 10½in. The steam chest is 7ft. by 2ft.; the diameter of the two furnace tubes is 3ft. 2in.; the area of grates, 42 square feet; and total heating surface, 1330 square feet. The fire-bars have a heating surface of 600 square feet. The outer funnel is 3ft. 6in. diameter, and the spiral 6ft. high. In our engraving A A are the inlets for admitting cold air into the jacket through apertures in the coaming. B B is the air space between the jacket and the funnel. C C are the spiral grooves of Wery's patent funnel, as described in our impression of the 29th September last. Owing to the haste with which the ship was taken out of dock, the trials Messrs. Livet and Co. expected did not take place. On the trial trip to Cardiff the consumption of fuel was 5½ to 6 tons per day, the coal — which consisted almost entirely of slack and was very dirty—being weighed for periods of twelve hours. The average number of revolutions was 84, average steam pressure 75 lb., and the vacuum about 28in. We have no diagrams taken during the trial, but these figures indicate that the consumption of fuel was much lower per indicated horse power per hour than is usual. Although the coal, North-country, was of a dirty, smoky kind, no smoke came from the funnel, even at the time of stoking, except when the fires required cleaning. There was a strong wind astern all down the Channel, and the absence of smoke was a great comfort to the captain in threading his way among the numerous craft. The action of the funnel we have already described. This is the first instance of the use of the funnel in this country for marine purposes, and it is considered that the results are extremely successful considering the small size of the boiler. Messrs. Livet and Co. are fitting a boiler with their appliances for the London Steamboat Company, and are in treaty with several other large steamship owners. Since the Moreton left London, a set of common fire-bars, instead of Livet's, was tried in the furnaces, with the result in favour of Livet's arrangement of saving about 1 ton of coal out of every 7 tons used.

NABHOLZ'S IMPROVED FRICTIONAL RIVETTER.

IN THE ENGINEER dated 9th September, 1881, this rivetter was described; but as at that period no practical results had been known of its behaviour, we now bring the machine again before our readers in its recent and slightly modified form. The old machine has been at work daily under the inventor's superintendence, and it has given every satisfaction; so much so that one of these machines was supplied to Woolwich Arsenal for the closing and rivetting up of torpedo shells. The first described machine has put in, in an hour, as many as 480 ⅞in. dia. rivets into plain girders, the work being all ready drifted and prepared, so as to have no other impediments but to take bolts out and turn the work. This is equal to a daily output during nine



hours of, say, 4320 rivets, being attended to by one skilled rivetter, two strong lads of seventeen years, and two small boys of thirteen years. The old machine, although working well and giving no trouble with regard to repairs or wearing out of the friction gear, had three great disadvantages—one is that the gearing is below the ground, and that all dirt and slag from rivets will get amongst the friction gear; the second consists in the fact that the fly-wheel is greatly in the road when rivetting up boilers, &c.; the third drawback consists in the worm and worm segment not working well when the machine is new. It has been found that the three teeth of the worm do not bear truly on the teeth of the segment, one tooth having more work to do than the others; hence, it occurred that a few teeth of segment were snapped. To obviate defects 1 and 2, the makers have moved the fly-wheel and fly-wheel shaft with friction gear to the opposite end of the holder up, and replaced the worm segment by a powerful internal screw brass nut. The holder-up is made of cast iron, or if required specially small, of steel. A very simple improved flange rivetting apparatus is supplied along with machine, which can be fitted up in less than five minutes, by means of which flanges of girders or channels down to 5in. in depth may be rivetted as easily as webs, and the same number, say, 4000 in nine hours may be inserted. This improved machine is made in sizes from 3ft. 2in. to 6ft. deep gap, by Messrs. Teasdale Brothers, Banktop, Darlington. The machine takes about four effective horse-power to drive it, or about a 4in. diameter cylinder engine with 40 lb. steam per square inch.

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

(*From our own Correspondent.*)

THIS week the quarterly meetings have been held. The new business which has resulted is not yet very conspicuous, but the negotiations which have been begun will, in the next week or two, result in business of considerable extent.

In Wolverhampton yesterday—Wednesday—afternoon the all-mine pig makers led off by declaring that quotations were nominally unchanged upon the quarter. Thus cold blast sorts were again £4 10s., and hot blast sorts £3 10s. per ton. But actual selling prices were a good 2s. 6d. per ton below these figures, and in some cases even 5s. Only on this basis would consumers consent to give out orders. Native part-mine pigs were 52s. 6d., and common pigs 42s. 6d. to 40s. The brands produced at the Spring Vale Furnaces, Bilston, were quoted: Hydrates, £3 2s. 6d.; mine iron, £2 12s. 6d.; and common, £2 2s. 6d.

More business was done in foreign than in native pigs. For these latter there were some big inquiries on the market. It cannot be said, however, that hematites shared this activity. The Barrow Company's hematites were quoted nominally 70s., and the Tredegar Company's 67s. 6d.; but the full prices could not be got. More success attended those vendors of Lancashire and Welsh brands who were content to ask 65s. Derbyshire and Northampton pigs fluctuated between 47s. 6d. and 50s., delivered into this district. About 48s. 6d. delivered may be regarded as as good a price as was generally obtained. The Wellingborough brand was nominal at 52s. 6d.

Marked bars at Wednesday's meeting were re-declared £8 12s. 6d. for the Earl of Dudley's make; £8 for the bars of some of the other list houses, and £7 10s. for the bars of the New British Iron Company and Messrs. Phillip Williams and Sons. The opinion was general, however, that the £7 10s. figure was in reality the sale price of other firms than those just particularised — indeed, that not above two or three houses were strong in adhering to their £8 quotation. Common Staffordshire bars were £6 10s. to £6 as the minimum.

Plate makers did not report much activity either in tank or boiler sorts. For tank plates they asked £8 10s., and for boiler plates £9, with here and there £9 10s. Thin sheet makers are very well off for orders. They made no quotable alteration in their terms. Messrs. E. P. and W. Baldwin's prices to consumers stood at:—Severn singles, at works, £12; Baldwin-Wilden B, £13; double B, £14; and treble B, £15; charcoal, £17 10s.; best charcoal, £20 10s.; and extra best charcoal, £22 10s.

Tin-plate makers, with works in East Worcestershire, spoke of prospects as better than for some weeks past. Charcoals were quoted at 24s. per box to buyers of small quantities, but to consumers of good quantities the price was about 22s. per box. Coke plates of first quality were quoted on the open market at 22s. nominal, and second quality 21s. per box.

Sheets of the descriptions needed by the galvanisers were quiet, and prices were:—Singles, £8 5s. to £8 10s.; doubles, £9; and lattens, £10.

Strip and hoop makers reported a steady trade largely on colonial account. Gas strip was £6 12s. 6d. upwards, and hoops £6 15s. to £7.

At the quarterly meeting this afternoon—Thursday—crucial prices were declared unchanged upon those quoted in Wolverhampton yesterday. All-mine pigs were nominally 67s. 6d. to 70s., but in reality 65s. was nearer the actual price. Marked bars remained at £8 12s. 6d. for Earl Dudley's, and £8 to £7 10s. for other best makers' bars. The amount of business done in any department was disappointing. The Welsh tin-plate makers held their quarterly meeting here, and it was announced that good Welsh cokes were quoted 17s. to 17s. 6d. per box, but merchants refused to give the figure. Charcoals were quoted 21s. to 22s. The Cannock Chase colliers' delegates waited upon the masters to-day, and asked for a rise of 1½d. per stint. The request was refused.

Alike yesterday and this afternoon there was again considerable discussion on 'Change touching the proposed revision of the United States tariff duties, and traders in the midlands and from London and Liverpool were anxious to compare notes. As was to have been expected, the tin-plate makers looked for immediate good, though it was deemed scarcely possible that so greatly an augmented tariff as 85 per cent., recommended by the Tariff Commission, would be adopted by Congress. An increase of some considerable extent was, however, thought probable, and to prepare for it merchants in the United States must, it was argued, soon be buying heavily. The strip firms are selling more largely than at this time last year to the cotton tie makers, who are actively occupied on this side for the United States, though January is usually a month when only little of this class of work is done.

Certain sheet makers to-day announced that they had received cablegrams from America inquiring for quotations. The inquiries makers interpreted as having a *bonâ fide* ring, and they were fain to hope that they would result in business—impossible, however, but for the present tariff uncertainty.

Considerable activity is traceable at the works of the leading producers of sheets in particular in efforts to adapt their machinery to the manipulation of ingots of steel, and in the rolling of sizes and gauges which become the first larger and the last thinner in proportion as steel gets more into vogue. When this cannot be accomplished by the engineers with the existing machinery, there is not great hesitation to distribute orders for wholly new plant.

New plant has just been laid down by the Hope Iron Company, Tipton. This is one of the foremost of the high class sheet firms of the kingdom. The new plant comprises an additional forge and sheet mill. By its acquisition the Hope Company will be enabled to roll iron and steel sheets up to 48in. wide and 13ft. long of practicable gauges, and up to 45 gauge of the usual tagger sizes, and of a finish withal equal to anything hitherto anywhere turned out.

The Casson-Bicheroux direct gas system appears to be growing in favour with manufacturers. It involves some outlay in the first instance, but yields a larger quantity and superior quality of iron than the ordinary processes with less labour and much less fuel, slack being burnt instead of large coal. At the Earl of Dudley's Ironworks it is adopted almost entirely, both for puddling and ball furnaces, and such are the masses of iron treated that some of the furnaces are 13ft. by 11½ft. across. It is entirely adopted at Messrs. Morewood's galvanising sheet manufactory at Soho, and both at ironworks and brickworks in the neighbourhood of Wakefield. More recently still the system has been applied in the neighbourhood of Walsall, where a firm who had previously used the Siemens and other producers have decided upon the conversion of the whole of their plant to this system.

The Government are acceding to the request of the Trades' Union Congress by putting the inspection of factories into the hands of members of the artisan class. The earliest reply was the appointment of Mr. J. D. Prior as a factory inspector in Birmingham. Another has just been given by the nomination to a similar post of Mr. W. J. Davis, the secretary of the National Brassfounders' Association.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—There has been very little doing in the iron market during the past week pending the result of the quarterly meetings, and, so far, the business of the year has been characterised by a want of animation, with a downward tendency in prices. The struggle between buyers and sellers with regard to their relative ideas as to values continues, and although makers do not come down to the buyers' level in prices, there is a want of firmness which leads to a gradual giving way.

At the Manchester market on Tuesday, scarcity of orders both for pig and manufactured iron was generally reported, and the few offers by buyers were, as a rule, at lower figures than makers cared to take. In pig iron the market was easier, and Lincolnshire makers announced a further reduction of 6d. per ton on their list rates, which are now 46s. 10d. for forge, and 47s. 10d. for foundry, less 2½, delivered equal to Manchester. At the reduction a little business was done, but as a rule buyers were offering 6d., and, in some cases, 1s. per ton less. For Lancashire pig iron makers were still quoting 47s. 6d. less 2½ for forge and foundry, delivered, but, with no orders coming forward at this figure, they are open to offers. Some of the Derbyshire makers still quote 52s., less 2½, but I do not hear of any business, and this only to a limited extent being done on a higher basis than 50s., less 2½ delivered. A fairly large sale of Middlesbrough forge iron has been made during the week at 51s. 10d. net cash delivered here.

Finished iron makers' contracts are rapidly working off, but they are mostly still kept going, and are holding on to £6 10s. for bars, and £7 for hoops delivered into the Manchester district. There are fair inquiries in the market which only the question of price is keeping back from resulting in orders, and when buyers are able to judge better as to the course of the market after the quarterly meetings there is every probability of a fair amount of work being given out. In the meantime any little business doing is chiefly through merchants at under current rates.

The Lancashire manufactured iron makers have, in conformity with the Staffordshire award, which also governs wages in this district, given their men an advance of 2½ per cent. This makes a total advance of 10 per cent. since this time last year.

Messrs. Monks, Hall, and Co., of Warrington, have taken the finished ironworks at Aspul, near Wigan, formerly occupied by Mr. E. Hales, but which have been standing idle for the last twelve months. The works, which are specially laid out for rolling hoops and strips, and are capable of turning out upwards of 250 tons per week, contain twenty-two puddling furnaces, with three rolling mills, and are at present being put in repair prior to being re-started.

The new inquiries coming forward in the engineering trades are reported to be only moderate in extent, and in some cases I find local firms to be getting shorter of work than has been the case for some time back, whilst in a few odd instances I hear that customers who have given out orders, finding that their requirements are not what they expected they would be, are anxious to postpone deliveries. Generally, however, it can scarcely be said that there is any real slackness in the engineering trade. Tool makers and locomotive builders are very busy, and in most cases have work in hand which will carry them forward for some time to come.

With regard to locomotive building there does not appear to be any falling off in activity, and the principal local firms have numerous orders in hand for the Continent, the Colonies, India, South America, and also for home railways.

Messrs. Sharp, Stewart and Co. have in hand one of Mr. F. W. Webb's new compound locomotives, which has been ordered for the Austrian State Railways, and I understand that Mr. Webb has in progress a number of drawings for similar locomotives for other places.

Amongst recent patents taken out in this district is an improvement which has been applied by Messrs. Kendall and Gent, of Manchester, to the now well-known Brown's patent screwing machine. This consists of an arrangement for opening and closing the dies by power without stopping the machine, a simple movement of a hand lever, without effort, being all that is necessary. The feature of Brown's screwing machines has been that the work could be changed without stopping the machine, and the new arrangement is an extension of this feature by opening and closing the dies by power. I may add that the new arrangement has recently been applied to a powerful machine for screwing up to 4in. diameter.

In heavy engine work there is also a good deal doing, including large orders for English ironworks. Messrs. W. and J. Galloway and Sons, Manchester, have just completed for the St. Nazaire Ironworks, France, a pair of compound high-pressure blowing engines, with high-pressure steam cylinders 32in. diameter, low-pressure 51in., blowing cylinders 79in., and having a stroke of 5ft. 3in. These engines have to a large extent been constructed from special French designs. The same firm have at present in hand for the North-Eastern Steel Company, Middlesbrough, a pair of horizontal high-pressure non-condensing rolling mill engines, with 50in. cylinders and 4ft. 6in. stroke. These engines, which, when complete, will weigh 180 tons, are fitted with separate exhaust valves, link gear, &c., and have a wrought iron crank 18in. diameter. Messrs. Galloway are also constructing for the Solway Hematite Company, Maryport, a vertical condensing blowing engine with two fly-wheels, and having 50in. steam cylinders with 5ft. stroke, and two 108in. blowing cylinders. Work of a similar character is also ready for being laid down for the Dowlais Iron Company and the Bairnavon Iron Company.

Orders for girder work have not been coming out very freely of late, but the Lancashire and Yorkshire Railway Company is now giving out some tolerably large contracts. We may mention as a matter which will materially affect engineers that this company has just introduced an important alteration in the conditions of its contracts for bridge work. Hitherto it has been the practice to give out the ironwork and the masonry separately, but in future both will have to be taken by one contractor, and the result will be that engineers will either have to take the masonry as well as the ironwork, or carry out the work under a building contractor instead of dealing directly with the railway company. We understand that the Lancashire and Yorkshire Company is also going to insist rigidly upon penalties for the non-fulfilment of contracts according to specified time.

Arrangements are now being made for holding in Manchester an exhibition devoted to appliances directly connected with lighting or heating by electricity or gas, or general exhibits of a *bonâ-fide* engineering character, and it is expected the exhibition will be opened in the St. James's Hall before the close of the month.

Mr. Hy. Hall, inspector of mines, brought before the members of the Manchester Geological Society, at a meeting held in Wigan on Friday, one of the multiplying anemometers invented by M. Bourdon, with the view of illustrating their adaptability for measuring air currents in mines. The general opinion was that the simplicity of the apparatus, which has no working parts to get out of order, would recommend it for adoption in mines. At present, however, the new anemometer has only been used experimentally, and in the opinion of the French Commissioners on Fire-damp it would be liable to get choked with coal-dust if used with two internal tubes to measure velocities of less than 13ft. per second. The apparatus can of course be used with only one internal tube, but its multiplying power of registering is very considerably reduced.

I understand that the Mining Association of Great Britain have under consideration the recent case of Plant *v.* the Cheadle Valley Coal and Iron Company, in which the Court of Queen's Bench held that a certificated mine manager, irrespective of holidays when the men are not down the pit, is bound to be day by day in the mine, and not to abandon his post without providing another certificated manager to do his work. This decision has caused not a little commotion amongst mining engineers.

New buildings for the Wigan Mining School have just been completed, and are to be furnished with all the necessary accessories for the pursuit of mining studies. This school has made very great progress during the last few years, and now numbers about 100 students. The cost of the erection of the new schools has been liberally contributed to by the colliery proprietors in the district.

The coal trade generally is very quiet for the time of the year, the demand both for house fire and manufacturing classes of fuel being only moderate, and although quoted prices are unaltered, there is a good deal of under-selling to secure orders. At the pit mouth the average prices are about 10s. to 10s. 6d. for best coals, 8s. to 8s. 6d. for seconds, 6s. to 7s. for common, 4s. 9d. to 5s. for burgy, and 3s. 6d. to 4s. for good ordinary slack.

There has been a fair demand for shipment, but low prices are taken, steam coal delivered at the high level, Liverpool, in Garston Docks being obtainable at 7s. 9d. to 8s. 3d., whilst at Crown-street Station, Liverpool, some classes of coal have been reduced 1s. per ton during the week.

At the conference of representatives of the men held in Wigan this week it was decided to restrict the output with the view of keeping up wages. If, however, trade continues in its present depressed condition it will not be necessary for the men to inaugurate a system of short time, as the colliery proprietors themselves will be compelled to adopt this step.

The topmen at some of the collieries are agitating for an advance of wages.

Barrow.—No change for the better can be reported in the hematite iron trade of this district. Makers are fairly off for orders, but new work is coming in slowly. Confidence is felt in the immediate future, however, and some good spring orders are looked for. Prices are easier, 53s. being the value of mixed samples of Bessemer iron at works net at a month. The stocks of iron in hand are rather large, representing about 180,000 tons; but shipping orders are expected to reduce this in the early part of the year. Steel makers may also be expected to increase their orders, as they are making arrangements on all hands to increase the output of their works by the laying down of new mills in the rail department and new machinery in the merchant department. A very steady tone is noticeable in the shipbuilding trade, and builders are expecting shortly to increase the number of orders on their books.

The Dalton Local Board have approved plans for a new market-house, prepared by Mr. J. G. McIntosh, architect of Barrow, and after the necessary powers have been obtained from the Local Government Board to borrow the necessary money, £15,000, the work will be proceeded with.

No intelligence is to hand with reference to the chance of carrying out successfully the bold scheme of bridging Morecambe Bay with a view to shortening the route from Lancaster to Barrow, and to the reclamation of a large quantity of land. It is generally thought the scheme would not only be a very costly and difficult one to carry out, but would also be found impracticable, as the rush of the sea is so great at times as to preclude the possibility of trains passing along a series of viaducts constructed on very treacherous sands.

There is some talk of the railway rolling stock works and steel works at Barrow, owned by Mr. S. J. Claye, passing into the hands of a wealthy syndicate of local gentlemen.

THE SHEFFIELD DISTRICT.

(From Our Own Correspondent.)

THE North Lincolnshire iron and ironstone trade is of much interest to this district. During 1882 the output of pig iron has been about an average, there having been 15 out of 18 furnaces blowing the whole year, as compared with only 13 in 1881. Fully one-half of the make has been produced by the North Lincolnshire Iron Company and the Frodingham Iron Company, which have had four furnaces each in blast. The Trent Iron Company, which was the first to smelt iron in the district, has had three going, and the Redbourne Hill and Appleby Iron Companies two each at work. The Lincolnshire Iron Smelting Company have been idle during the whole twelve months. The yield of pig iron in 1881 was 187,937 tons, the average number of furnaces kept going being 14; the tonnage for 1882 has not yet been ascertained, but it is believed to be in excess of 1881. The ironstone raised in 1881 was 1,021,506 tons, of which 327,261 tons were taken out of the district by rail, and the remainder used at the furnaces. During 1882 a marked increase has been observable, particularly in the quantities sent to other parts, and the tonnage exported during last year is therefore expected to be much heavier, a large number of Yorkshire, Derbyshire, and other furnaces having drawn most of their supplies from the district mines. The coal and coke required for the smelting of so large a supply has caused an average of 430,000 tons to be conveyed from the Yorkshire and North of England coal-fields during the last few years, and the increased traffic has suggested the formation of a new line of railway from Hull to Derbyshire, to tap the Frodingham district more effectively.

The proposed coal mine at Carlton will probably be abandoned, owing to the advisers of Lord Beaumont having decided, on geological grounds, that Burn, near Selby, would be a more suitable spot. It is expected that borings will soon be made at Burn.

The hoop L trade mark is not yet settled, and another dispute is already in hand. Messrs. Thos. Firth and Sons have the right to the "Leufsta" designation, and they claim, further, the exclusive right to use a capital L enclosed in a hoop. This is the claim which is contested by several local and other firms. The new trade mark dispute is about striking the word "diamond" and the drawing of a diamond, which Messrs. Spencer and Co., of Masborough, maintain is their sole property. In this case a syndicate has been formed to fight the Peacroft firm on the score of the word "diamond."

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THERE was a good attendance at the quarterly iron market held at Middlesbrough Exchange on Tuesday last. There were not, however, many visitors present from a distance. Many objects of interest were exhibited, amongst which was a sample of the 20in. gauge portable railway and wagons now under construction by Mr. Charles Wood for the Fiji Islands. Duckham's hydrostatic weighing machine and Stott's gas valve were also shown. But little business was done in buying and selling, and the tone of the market was somewhat less firm than a week ago. Merchants were offering No. 3 g.m.b. at 42s. 9d. per ton f.o.b., and would not do business under that figure. Makers, who for the most part have orders enough to last the next few weeks, have not reduced their quotations, and continue to ask 43s. 6d. for No. 3 for prompt delivery.

Connal's No. 3 warrants were more freely offered than they have been for some weeks. The price asked for them was 42s. 6d. per ton f.o.b., but few, if any buyers, were willing to give the price.

The stock of Cleveland iron in Messrs. Connal and Co.'s Middlesbrough store on Monday night was 96,527 tons, which is a a decrease of 2080 tons for the week.

The shipments from the Tees have so far this month been very good. Up to Monday night 19,785 tons of pig iron and 5336 tons of manufactured iron and steel had been shipped.

The finished iron trade shows no signs of improvement at present. Consumers are still holding back their orders, though prices are very low. Ship plates are quoted at £6 10s. to £6 12s. 6d. per ton, but favourable specifications could no doubt be placed at £6 7s. 6d. per ton. Angles and bars for shipbuilding purposes may be had at £5 10s. per ton, all f.o.t. at makers' works, less 2½ per cent. discount. Most of the mills started again on Monday night after the holidays, and will continue to work five days a week for the rest of this month as arranged. It is rumoured that a well-known firm of manufacturers have just made a contract for several thousands of tons of angle iron with a Scotch merchant firm at a price which will only realise five guineas per ton at makers' works.

The Cleveland Ironmasters' returns for December and for the year 1882 were issued on January 4th. They show that 120 furnaces were at work in December, 84 of which were on Cleveland, and the remainder on hematite iron. The make of Cleveland iron for the whole district in December was 156,990 tons, and of hematite and basic iron 72,490 tons; total, 229,480 tons. This gives an increase of 4954 tons over November. Stocks have increased 28,733 tons since November 30th, the total quantity of iron in stocks and stores being on December 31st 266,179 tons. On December 31st, 1881, the entire stocks amounted to 378,170 tons; they have, therefore, been reduced 111,991 tons during the year 1882. The output of iron in the Cleveland district for the year 1882 reached the enormous total of 2,688,650 tons. Of this 1,772,239 tons were Cleveland iron, and 916,411 tons hematite and basic.

Messrs. Monkhouse, Goddard, and Co. have just issued their certificate under the Northumberland miners' sliding scale, which shows that the net average selling price of coal for the three months of September, October, November, 1882, was 5·3s. per ton, being a decrease of 0·98d. per ton upon the average for November, 1878. The wages will therefore remain unaltered.

The accountant's certificate as to the selling price of Cleveland pig iron for October, November, and December, was issued on the 6th inst. The ascertainment shows that the net average realised price of No. 3 Cleveland iron was 43s. 6·35d. per ton. This gives an increase of 4·31d. per ton on the previous quarter. On this decision the miners will receive an advance of the twentieth part of a penny per ton. Blast furnacemen's wages remain the same as before.

The Springfield Ironworks at Darlington, which are worked by the Darlington Iron and Steel Company, were set to work on Monday last, after having been idle for about two months. It is said that large orders have been booked for tramway rails and fish-plates.

It is rumoured that the Witton Park Ironworks are to be removed to Eston shortly. The conditions under which they were established have changed considerably, and the business there carried on could without doubt be much more advantageously done at Eston.

The salt industry is likely to be largely developed at Middlesbrough. Messrs. Bell Bros. are making rapid progress with their works at Port Clarence, and Messrs. Bolckow, Vaughan, and Co. have again taken the matter up at their works at Middlesbrough, and hope to be able to produce salt before the close of the year. Boring operations are also about to be commenced by Mr. Edward Williams, of the Linthorpe Ironworks, at a point not far from the river. Other firms in the district are also said to be contemplating operations.

The liquidators of the West Hartlepool Iron Company have published a final statement of accounts. The total receipts amount to £146,818 9s. 1d., including the sale of works. The first and second dividends were 4s. and 1s. 6d. in the pound respectively, and a final dividend of 5½d. in the pound has now been paid.

Mr. Waterhouse's quarterly ascertainment of the realised price obtained in the manufactured iron trade during the last quarter of 1882 is expected shortly, and it is thought it will show a fall compared with the previous quarter. It is expected that the announcement will be immediately followed by a claim on the part of the employers for a reduction of wages to come into operation from the 1st of March. Ironworkers' wages are still 1s. 9d. above shillings for pounds, and it is contended that in the absence of a sliding scale, and in the present condition of the labour market, they should not be more than 1s. above.

It is a matter of general regret that Mr. E. Trow, operative secretary to the Board of Arbitration, is seriously ill and quite unable to attend to his duties. He is at present at Harrogate undergoing medical treatment.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

BUSINESS in the iron trade has not yet thoroughly recovered itself after the holidays. There has been little animation in the iron market in the course of the week; the prices of warrants, which recovered at the close of last week, have since been declining. This is due to a variety of courses. As stated above, the trade is really not yet fully employed, and the failures that have taken place here in the iron trade and in other industries have exercised an unsettling effect. By these means holders of warrants have been induced to sell, and so prices have been depressed. But the legitimate iron trade is in a fairly satisfactory condition, and that the year should begin with low prices does not occasion much discouragement, seeing that at the opening of last year the quotations of iron were comparatively high and afterwards greatly declined. It would be better, it is felt, to begin with a low range of values, so that the improvement might come with the actual demand, than that a growing inquiry should be arrested by too high prices. The stocks in Messrs. Connal and Co.'s Glasgow stores continue to decrease, having fallen about 1200 tons during the past week. There are now 109 furnaces in blast as against 105 at the same date last year.

Business was done in the warrant market on Friday forenoon at from 48s. 8d. to 49s. cash, and 48s. 10d. to 49s. 2½d. one month, the afternoon quotations being 49s. to 49s. ½d. cash, and back to 48s. 11½d. On Monday morning the market was flat with transactions at 48s. 9d. to 48s. 10d. and 48s. 8½d. cash, and 48s. 11½d. one month. In the afternoon the prices were 48s. 7d. to 48s. 6½d. and 48s. 7½d. cash, and 48s. 9½d. one month. Business was done on Tuesday forenoon at 48s. 6d. to 48s. 7d. and back to 48s. 4½d. cash, and 48s. 10d. to 48s. 7½d. one month, transactions being effected in the afternoon at 48s. 4d. to 48s. 5d. cash, and 48s. 6½d. to 48s. 7½d. one month. The market was flat on Wednesday, with business between 48s. 4d. and 48s. 1d. cash. To-day — Thursday — business took place at 48s. 4½d. to 48s. 2d. cash, and 48s. 4d. one month.

There is a fair demand for makers' iron, the quotations of which are firm, as follow:—Gartsherrie, f.o.b. at Glasgow, per ton No. 1, 64s. No. 3, 54s. 6d.; Coltness, No. 1, 67s. 6d.; No. 3, 56s.; Langloan, 67s. 6d. and 56s.; Summerlee, 63s. and 52s. 9d.; Chapelhall, 63s. and 54s.; Calder, 63s. and 52s. 3d.; Carnbroe, 56s. and 51s. 6d.; Clyde, 53s. 9d. and 51s.; Monkland, 50s. 6d. and 49s.; Quarter, 50s. and 48s. 6d.; Govan, at Broomielaw, 50s. and 48s. 6d.; Shotts, at Leith, 65s. 6d. and 56s.; Carron, at Grangemouth, 53s. (specially selected, 57s. 6d.) and 52s.; Kinneil at Bo'ness, 49s, 6d. and 48s. 6d.; Glengarnock, at Ardrossan, 56s. and 50s. 3d.; Eglinton, 51s. 6d. and 49s. 6d.; Dalmellington, 51s. 6d. and 50s.

The shipments of pigs compare favourably with those of the corresponding week of last year, and the arrivals from Cleveland are still comparatively small.

The malleable ironworks are only beginning operations after the holidays, but they have in most instances every prospect of doing a fair business. The same may be said with reference to the majority of the branches of the manufactured iron trade.

As was to be expected, the past week's business in the coal trade has been on a limited scale, but both the inland consumption and the exports will now assume their proper proportions. There is no change in price. In Lanarkshire work was pretty generally begun by the miners on Thursday of last week, although in not a few cases the holiday was prolonged to the beginning of the present week. At Burntisland the coal shipments for the twelve months have been ascertained to be 665,214 tons, an increase of 39,742 over those of the preceding year. The week's exports from the Fife and Firth of Forth ports have been small.

Another effort is to be made to induce the Scotch miners generally to adopt short time as a means for curtailing the output of coals, but there is small chance of such a movement being successful.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

I HAVE now before me the business returns of 1882, and they not only compare favourably with the past, but yield reasonable prospects for the future. Trade seems to have attained a regular settled condition, both as regards quantities and prices, and if the spring should bring any change it will be in the nature of a substantial advance; this more especially as regards coal, which is decidedly looking up.

The pumping engines are being placed in the Prince of Wales Colliery, Abercarne, and operations are expected to begin at once.

During last week the coal and iron trades have been very good, and large shipments have been made. Newport sent one large cargo of iron, 3000 tons, to Baltimore, and 14,000 tons of foreign ore were received at the Welsh port.

The West of England and South Wales Railway Bill has been abandoned, but not, I am informed, permanently. Considerable expense has been incurred by the promoters, but the scheme required more time to have it brought properly before the commercial interests of Wales.

The Barry Dock scheme is to be vigorously opposed. Seven memorials have been lodged against the Bill, and a lively time may be expected in committee. The opposition includes the Taff Vale, Marquis of Bute, Mr. Wingfield—Dynevor estate—Lewis's Merthyr Colliery, Mr. David Joseph, Mr. Billups, and others.

The important Bill brought forward by Mr. W. T. Lewis for the Marquis of Bute, to provide extra storage and sidings, has also several petitions put in against it.

A new exchange is in contemplation for Cardiff, and the site suggested is the present Bute Dock offices.

The total iron furnaces now in blast in Glamorgan amount to thirty, more than two-thirds of the number erected—97—being out of blast. Monmouthshire has fifty-one furnaces, of which thirty-three are in blast.

Good steady work is being carried on at Tredegar and Dowlais. Cyfarthfa will soon have three furnaces ready on the newest principles.

Mr. Hirst, who has been mill manager at Dowlais, has resigned on account of ill health. He has been in active and able service for forty years.

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.

2nd January, 1883.

26. SPINNING, &c., MACHINERY, F. Jenkin.—(*J. A. Ewing, Tokio, Japan.*)
27. COMBS, &c., for LADIES' WEAR, L. Birnstingl.—(*M. Birnstingl, Paris.*)
28. SAFE TRANSIT of CARGOES, T. Rowan, London.
29. UTILISING WASTE HEAT ESCAPING from FLUES of STEAM BOILERS, W. Hall, Cardiff.
30. REFRACTORY or FIRE-BRICKS, &c., J. Williams, Liverpool.
31. THILL-COUPLINGS, HORSE DETACHERS, &c., D. Green, Cincinnati, U.S.
32. LAMPS for DENTAL, &c., PURPOSES, G. W. von Nawrocki.—(*R. Telschow, Berlin.*)
33. MAKING IMITATION IVORY, S. Hahn, Berlin.
34. ELECTRIC LAMPS, W. R. Lake.—(*C. A. Hussey and A. Dodd, New York, U.S.*)
35. COILING WIRE ROPES on BOARD SHIP, W. H. Harfield, London.
36. GENERATING, &c., ELECTRIC CURRENTS, S. Z. de Ferranti Shepherd's Bush.
37. CHRONOGRAPH, A. G. Golay, Brassus, Switzerland.
38. VESSELS for HOLDING MINERAL, &c., OILS, G. A. J. Schott, Bradford.
39. CARBONS for INCANDESCENT ELECTRIC LAMPS, J. Wavish, Forest Gate, Essex, and J. Warner, Whitechapel.

3rd January, 1883.

40. STITCHING, &c., MACHINES, H. Clarke, Leicester.
41. WINDOW-SASH, &c., FASTENINGS, J. Butler, Birkenhead.
42. VENTILATING RAILWAY CARRIAGES, J. Livesey, London.
43. FRICTION DEVICE for SECURING LOOMS, &c., AGAINST BREAKAGE, T. Hardcastle, Kidderminster.
44. KNITTING MACHINES, H. J. Allison.—(*C. H. Carter, Colborne, Ontario, Canada.*)
45. MACHINES for CUTTING WOOD, T. Andrew, London.
46. INCANDESCENT ELECTRIC LAMPS, J. R. H. Williamson and E. Böhm, London.
47. MARINERS' COMPASSES, S. Heimann, London.
48. SAFETY GEAR for STARTING or TURNING ENGINES, J. Musgrave and R. Gregory, jun., Bolton.
49. DYNAMO-ELECTRIC MACHINES, &c., T. Rowan, London, and S. Williams, Newport.
50. APPARATUS for SEIZING, &c., LIGHT OBJECTS, A. M. Clark.—(*A. Dubois, Paris.*)

4th January, 1883.

51. FEEDING HORSES, &c., J. Milbourne, Manchester.
52. CHURNING APPARATUS, E. Buckland, London.
53. TREATING VEGETABLE FIBRES, W. E. Gedge.—(*L. Aubert, Lyons, France.*)
54. SEWING MACHINES, W. E. Gedge.—(*C. Guy, Paris.*)
55. CUTTING and DRESSING STONE, M. Kellow, Penrhyndeudraeth, Merionethshire.
56. MEASURING ELECTRIC CURRENTS, St. G. L. Fox, Westminster.
57. LUBRICATORS, T. Duff, Upton.
58. OIL CANS, I. Webster, Kirkstall, near Leeds.
59. ROAD TRACTION, &c., ENGINES, M. Shillito, Leeds.
60. COUNTING, &c., the REVOLUTIONS of ROTATING SHAFTS, &c., G. D. Kittoe, London.
61. GAS HEATING ARRANGEMENTS for HEATING WATER or AIR, E. A. Brydges.—(*D. Grove, Berlin.*)
62. CROSSINGS for TRAMWAYS, A. Hill, Rowan, London.
63. ADJUSTABLE SPANNERS, J. Malin, Sheffield.
64. STARTING and STOPPING TRAMCARS, B. F. Cocker, Sheffield.
65. MOTIVE POWER ENGINES, C. Ingrey, Fulham, and W. Adlam, Clifton.
66. SHADES for LAMPS, J. H. Johnson.—(*E. Lefebvre, Paris.*)
67. GOVERNORS for STEAM ENGINES, R. E. B. Crompton, London, and J. W. Kempster, Chelmsford.
68. MOWING, &c., MACHINES, J. E. Phillips, London.

5th January, 1883.

69. WELDING BOILER, &c., SHELLS of CYLINDRICAL and other FORMS, S. Alley, Glasgow.
70. CRANK SHAFTS for TRANSMITTING POWER, G. Allibon and T. Turton, Liverpool.
71. SEAMS for UNITING the COVERS of LAWN TENNIS, &c., BALLS, J. Neville, London.
72. APPARATUS for GENERATING STEAM, H. J. Haddan.—(*A. A. Daussin, Lille, France.*)
73. LAMPS APPLICABLE to VELOCIPEDES, J. B. Young and W. T. J. Burgess, Birmingham.
74. FIRE-SCREENS, J. Betjeman, London.
75. OILING CRANK-PINS, W. P. Thompson.—(*C. H. Parshall, Detroit, Michigan, U.S.*)
76. ENVELOPES, W. H. Hook, London.
77. LOOMS for WEAVING, W. Priestley and W. Deighton, Laisterdyke, Bradford.
78. ELECTRIC FIRE-ALARM APPARATUS, W. C. Gordon, London.
79. PRODUCING COLOURING MATTERS, C. D. Abel.—(*Farbwerke, vormals: Meister, Lucius, and Brüning, Hoechst-am-Main, Germany.*)
80. CURLING TONGS, &c., C. Carter, Clapham Junction.

6th January, 1883.

81. BUCKLE LOCKS, W. A. Shaw, Nottingham.
82. SOLVENT or EMULSIVE for USE with PAINTS, &c., W. Johnstone, King's Lynn.
83. RIDDLES, E. de Pass.—(*H. Schmid, Budapest.*)
84. MAKING FLAT WIRE ROPES, J. Lang, Wakefield, and J. Lang, Hyde, Chester.
85. FOLDING-BOXES, A. A. Barratt and G. Greenshields, Ditton, Surrey.
86. SEWING MACHINES, J. Imray.—(*R. Leavitt, Boston, and E. Flather, Bridgeport, U.S.*)
87. INDICATING the PRESENCE of EXPLOSIVE GASES in COAL MINES, &c., J. Catz.—(*F. Libin, Gand, Belgium.*)
88. METAL ROLLERS for PRINTING and EMBOSSING, &c., D. Appleton, Manchester.
89. INSTRUMENTS for MEASURING ANGLES by REFLECTION, J. H. Johnson.—(*E. A. Amagat, Paris.*)
90. INKSTANDS, F. Wirth.—(*H. Meidinger, Germany.*)
91. MACHINERY for COOLING ATMOSPHERIC AIR, A. B. Wilson, Ireland, and J. Sturgeon, London.
92. CARPET LOOMS, G. W. Grosvenor, and J. Bedford, Kidderminster.
93. INDICATING NAMES of STATIONS to PASSENGERS in RAILWAY TRAINS, A. P. Hodgson, London.

8th January, 1883.

94. DRILLING MACHINES, W. Cooke, Dundee.
95. ATTACHING VARIOUS UTENSILS, &c., to their HANDLES, J. Lee, Hampstead.
96. MAKING SULPHURIC ACID, W. Weldon.—(*G. Lunge, Switzerland.*)
97. ALUMINIUM and ALLOYS of ALUMINIUM, W. Weldon, Burstow.
98. CHLORATES, W. Weldon, Burstow.
99. RECOVERY of SULPHUR from ALKALI WASTE, W. Weldon, Burstow.
100. RECOVERY of SULPHUR from ALKALI WASTE, W. Weldon, Burstow.
101. APPLICATION of EOSINE in PHOTOGRAPHIC PROCESSES, C. D. Abel.—(*P. A. Attout, Paris.*)
102. FACILITATING the ACTION of SPRING ROLLERS for WINDOW-BLINDS, G. D. Peters, London.
103. PRODUCING DESIGNS on GLASS, D. Reich, Berlin.
104. BOOTS and SHOES, H. J. Haddan.—(*M. R. Ethridge, Massachusetts, U.S.*)
105. REGULATING SUPPLY of GAS and AIR to GAS BURNERS, J. Lewis, Brockley.
106. PETROLEUM LAMPS, H. H. Lake.—(*A. A. Lemarre, France.*)
107. PORTABLE ALARM SIGNALLING APPARATUS, W. J. Brewer, London.
108. PRIMARY VOLTAIC BATTERIES, G. André, Dorking.
109. PLOUGHS, T. Sheldrake, Ipswich.

Invention Protected for Six Months on Deposit of Complete Specifications.

12. TOILET APPARATUS for SEA-GOING VESSELS, H. J. Haddan, Kensington, London.—A communication from D. Wellington, Boston, Massachusetts, U.S.—*1st January*, 1883.
13. CLEANING and SEPARATING the FIBRES of Tow, &c., F. C. Glaser, Berlin.—A communication from Th. Calow and Co., Bielefeld, Prussia.—*1st January*, 1883.
17. ELECTRIC LIGHTING and POWER DISTRIBUTING SYSTEMS, S. Pitt, Sutton.—A communication from E. T. Starr, Philadelphia, and W. J. Peyton, Washington, Columbia, U.S.—*1st January*, 1883.

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

21. MAGNESIAN FIRE-BRICK, T. Morgan, London.—*2nd January*, 1880.
27. PAVING SETTS, J. Lindsay, Edinburgh.—*3rd January*, 1880.
55. HORSE-SHOE NAILS, J. H. Johnson, London.—*6th January*, 1880.
315. GENERATING, &c., ELECTRICITY, W. R. Lake, London.—*23rd January*, 1880.
554. ATTACHING and WORKING GUNS, &c., A. Longsdon, London.—*9th February*, 1880.
47. TREATING CAOUTCHOUC, &c., H. Gerner, New York, U.S.—*6th January*, 1880.
184. WELDED IRON and STEEL TUBES, C. E. Smith, Wednesbury.—*15th January*, 1880.
251. COLOURING FIBROUS MATERIALS, &c., J. H. Johnson, London.—*20th January*, 1880.
38. FILTER-PRESSES, S. H. Johnson, Stratford.—*5th January*, 1880.
40. MINERS' SAFETY LAMPS, W. Tate, Blackwell.—*5th January*, 1880.
42. TREADS or STEPS for STAIRS, H. Hedges, Bow.—*6th January*, 1880.
66. BLEACHING COTTON, &c., C. E. Bennett, Stockport. *7th January*, 1880.
131. TREATING COTTON YARNS for PREVENTING MILDEW, D. S. Bles, Manchester.—*12th January*, 1880.
44. SCREW-CUTTING MACHINES, W. Morgan-Brown, London.—*6th January*, 1880.
57. DYEING MIXED TEXTILE FABRICS, &c., E. Posselt and R. Peters, Bradford.—*7th January*, 1880.

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

7. MOTOR ENGINES WORKED by COMPRESSED AIR, &c., F. E. B. Beaumont, London.—*1st January*, 1876.
48. MAKING PAPER, G. Holloway Chartham.—*5th January*, 1876.
158. STEAM BOILERS, C. J. Galloway, Manchester.—*14th January*, 1876.
33. SOAP or SAPONACEOUS COMPOUNDS, A. Robottom, Birmingham.—*4th January*, 1876.
119. ROCK-BORING MACHINES, J. R. Schram, London.—*11th January*, 1876.
39. PURIFYING COAL GAS, W. Marriott, Huddersfield.—*4th January*, 1876.
64. PERMANENT WAY, &c., of TRAMWAYS, J. Kincaid, London.—*6th January*, 1876.
93. CLIPPING LAPPETS, J. and A. Blair, Glasgow.—*8th January*, 1876.
176. CLOSE, BLIND, or MUFFLE SALTCAKE, &c., FURNACES, H. Deacon, Widnes.—*17th January*, 1876.
81. PIGMENTS, H. Knight, Kingston-upon-Hull.—*7th January*, 1876.
83. LOOMS for WEAVING, R. L. Hattersley, Keighley, and T. Pickles, Denholme.—*7th January*, 1876.
123. COMBING WOOL, &c., I. Bailey and D. Smith, Keighley, and L. Smith, Bradford.—*11th January*, 1876.

Notices of Intention to Proceed with Applications.

(Last day for filing opposition, 26th January, 1883.)

4056. SPINNING, TWISTING, or DOUBLING FIBRES, H. Illingworth, Bradford.—*24th August*, 1882.
4136. INDICATOR for VEHICLES, J. Finney, Manchester.—*30th August*, 1882.
4138. DEODORISING and DISINFECTING APPARATUS, G. Nobes, Paddington.—*30th August*, 1882.
4146. EXTRACTING JUICE from SUGAR CANE, H. H. Grierson, Manchester.—A communication from C. Hughes.—*30th August*, 1882.
4150. STEERING GEAR, J. Granroth, Greenock.—*31st August*, 1882.
4160. TELEPHONIC INSTRUMENTS, J. D. Husbands, London.—*31st August*, 1882.
4165. STEAM and HOT-WATER APPARATUS, W. R. Lake, London.—Com. from E. Osborne.—*31st August*, 1882.
4172. FRAMES of BAGS, V. Huppe, Offenbach-on-the-Main.—*1st September*, 1882.
4173. CONSTRUCTING SHIPS or VESSELS, C. D. Abel, London.—A communication from E. Lavarenne.—*1st September*, 1882.
4178. SECONDARY BATTERIES, D. Fitz-Gerald, Brixton, and T. Jones, London.—*1st September*, 1882.
4193. CUTTING, PLEATING, and SEWING the LININGS of HATS, W. H. Beck, London.—A communication from L. Chosson.—*2nd September*, 1882.
4195. PAPER BAGS, T. Coates, Carlisle, and N. Chandler, Hednesford.—*2nd September*, 1882.
4196. RECORDING VOTES, L. Lazenby, Darnall.—*2nd September*, 1882.
4199. DREDGERS, W. R. Kinipple, Westminster.—*4th September*, 1882.
4226. TREATING SOAPS, W. Green, Thanet.—*5th September*, 1882.
4246. ELECTRIC SIGNALLING APPARATUS, W. R. Lake, London.—Com. from J. Cary.—*6th September*, 1882.
4252. PAPER-CUTTING MACHINERY, W. H. and F. C. W. Latham, Bolton.—*7th September*, 1882.
4315. APPARATUS for HEATING WATER, COOKING, &c., M. J. O'Riordan, Cork.—*11th September*, 1882.
4338. FACILITATING the DISPENSING of GASEOUS LIQUIDS, W. R. Lake, London.—A communication from L. Bergen.—*12th September*, 1882.
4395. STOCKS and DIES, C. Neil, Sheffield.—*15th September*, 1882.
4419. ELECTRIC ARC LAMPS, J. Brockie, Brixton.—*16th September*, 1882.
4492. PRODUCING, &c., ELECTRIC CURRENTS, A. R. Sennett, Worthing.—*20th September*, 1882.
4602. VESSELS for HOLDING OILS, &c., G. A. J. Schott, Bradford.—*28th September*, 1882.
4972. BRAKES, E. C. and T. Blackmore, Cardiff.—*19th October*, 1882.
5467. APPARATUS for BASTING MEAT, &c., J. Reynolds, Worcester.—*17th November*, 1882.
5559. ORDNANCE, J. Vavasseur, Southwark.—*22nd November*, 1882.
5757. INSULATED ELECTRIC CONDUCTORS, &c., E. T. Truman, London.—*2nd December*, 1882.
5927. BICHROMATE of POTASH, F. C. Glaser, Berlin.—A com. from P. Römer.—*12th September*, 1882.
5968. VERTICAL STEAM BOILERS, A. H. B. Sharpe and F. Palmer, Lincoln.—*14th December*, 1882.
5989. BICHROMATE of SODA, C. D. Abel, London.—A communication from F. Glaser.—*15th December*, 1882.
17. ELECTRIC LIGHTING and POWER - DISTRIBUTING SYSTEMS, S. Pitt, Sutton.—A communication from E. T. Starr and W. J. Peyton.—*1st January*, 1883.

(Last day for filing opposition, 30th January, 1883.)

3470. TWO-PLY and THREE-PLY CARPETS, J. H. Braithwaite, Airethwaite.—*21st July*, 1882.
4209. STARCH and FOOD for ANIMALS, H. H. Lake, London.—Com. from W. Jebb.—*4th September*, 1882.
4211. CONSTRUCTING SIGNALS, P. Lofthouse, Radcliffe.—*5th September*, 1882.
4214. APPARATUS for the MANUFACTURE of CHEMICAL SALTS, J. Forbes, Old Ford.—*5th September*, 1882.
4216. ROLLING WIRE RODS, W. Morris, Oakengates.—*5th September*, 1882.
4218. SEPARATING DUST from AIR, W. B. Dell, London.—A communication from G. T. Smith Middlings Purifier Company.—*5th September*, 1882.
4219. DECORATING BRICKS, TILES, &c., I. B. Shaw, Tunstall.—*5th September*, 1882.
4223. ELEVATING GRAIN, &c., G. J. Hone, Poplar.—*5th September*, 1882.
4224. MANUFACTURE of STARCH, W. R. Lake, London.—A com. from J. H. Ross.—*5th September*, 1882.
4228. SHUTTLE-BOX SHIFTING MECHANISM for LOOMS, D. Anderson, Glasgow.—*6th September*, 1882.
4239. HOLDERS for WIRE ROPE, T. Archer, jun., Gateshead.—*6th September*, 1882.
4243. SPRIT SAILS, W. Rowden, Whitstable, and C. E. Doughty, Margate.—*6th September*, 1882.
4244. APPARATUS for DRYING and CONDITIONING GRAIN in BULK, &c., G. M. Capel, Passenham.—*6th September*, 1882.
4248. GALVANIC BATTERIES, G. C. V. Holmes and S. H. Emmens, London.—*6th September*, 1882.
4254 VOLTAIC BATTERIES, F. W. Durham, New Barnet.—*7th September*, 1882.
4264. BOXES or TRUNKS, C. H. Stanbury, London.—*7th September*, 1882.
4275. MANUFACTURE of WHITE LEAD, W. V. Wilson, London.—*8th September*, 1882.
4276. TREATING RETENE for the OBTAINMENT of ANTHRACENE, &c., R. Irvine, Edinburgh.—*8th September*, 1882.
4277. TREATING STARCHY SUBSTANCES RELATING to BREWING and DISTILLING, W. Lawrence, London.—*8th September*, 1882.
4311. STEERING ENGINES, T. Davison, Glasgow.—*11th September*, 1882.
4333. MEASURING and RECORDING the MEASUREMENT of FABRICS or PIECE GOODS, R. Murdoch, Glasgow.—*12th September*, 1882.
4345. LANTERNS, A. J. Boult, London.—A communication from H. Lages.—*12th September*, 1882.
4350. APPARATUS for VISUALLY INDICATING ELECTRICAL SIGNALS, B. J. B. Mills, London.—A communication from J. U. Mackenzie.—*12th September*, 1882.
4380. SUSPENDING HORIZONTAL BARS, G. Welling, Camberwell.—*14th September*, 1882.
4396. MANUFACTURE of CERTAIN ALLOYS of GOLD, A. Guye, London.—A communication from P. A. Guye.—*15th September*, 1882.
4446. ELECTRICAL METERS, T. J. Handford, London.—A com. from T. A. Edison.—*19th September*, 1882.
4478. SELF-ACTING TACKLE HOOKS, J. T. Roe, Wandsworth.—*20th September*, 1882.
4494. GRAPE SUGAR and GLUCOSE, &c., W. R. Lake, London.—Com. from W. Jebb.—*20th September*, 1882.
4497. GAS LAMPS, I. Spielmann, London.—*21st September*, 1882.
4510. LAMPS BURNING MINERAL OILS, J. Imray, London.—A communication from R. Ditmar.—*21st September*, 1882.
4578. DREDGING BUCKETS, W. Clark, London.—A communication from W. H. Wood.—*26th September*, 1882.
4674. STEAM ENGINES, T. J. Handford, London.—A com. from T. A. Edison.—*2nd October*, 1882.
4884. DISTRIBUTING ELECTRICITY, T. J. Handford, London.—Com. from T. Edison.—*14th October*, 1882.
4977. SHIVES and VENT-PEGS for BARRELS, W. Rose, Halesowen.—*19th October*, 1882.
5267. COUPLINGS, W. Wright and J. Pethick, Plymouth.—*4th November*, 1882.
5384. COMPOSITION of BEARINGS, A. M. Clark, London.—A com. from F. E. Canda.—*11th November*, 1882.
5720. MACHINERY for MAKING RAILWAY SLEEPERS, J. Bunten and A. Russell, Glasgow.—*1st December*, 1882.
5849. CONNECTING ANIMALS to VEHICLES, J. Rexford, Edmonton.—*7th December*, 1882.
5866. ELECTRIC COMMUTATORS, J. Gordon, jun., Dundee.—*8th December*, 1882.
5957. TABLES, A. Thomson, Glasgow.—*13th December*, 1882.
6008. OBTAINING AMMONIA, F. Lorenz, Rendsburg, Prussia.—*16th December*, 1882.

Patents Sealed.

(List of Letters Patent which passed the Great Seal on the 5th January, 1883.)

3208. SEPARATING HAIR from the SKINS of ANIMALS &c., J. T. Tussaud, London.—*6th July*, 1882.
3212. MANUFACTURING GAS, T. Thomas, Bodmin, and C. J. Ennor, Oporto.—*7th July*, 1882.
3213. VALVES, J. Thomas, Bodmin, and C. J. Ennor, Oporto.—*7th July*, 1882.
3214. SULPHATE of AMMONIA, J. Coates, London.—*7th July*, 1882.
3225. CONSTRUCTING CABS, &c., J. Abbott, Bideford.—*7th July*, 1882.
3237. TIPPING CARTS, WAGONS, and VANS, W. Vincent, Arborfield.—*7th July*, 1882.
3239. TENTERING, STRETCHING, &c., FABRICS, J. Ashworth, Rochdale.—*8th July*, 1882.
3242. PRODUCTION of TAPE LADDERS, J. Carr, Hulme.—*8th July*, 1882.
3249. LOOMS for WEAVING, C. Thompson, Halifax.—*8th July*, 1882.
3257. INTERNAL BOTTLE STOPPERS, A. T. King, Nottingham.—*10th July*, 1882.
3259. PICKERS and PICKING BANDS, E. Booth, Manchester.—*10th July*, 1882.
3267. HEELS for BOOTS and SHOES, J. J. Gascoine, Leicester.—*10th July*, 1882.
3275. COMPOUND and SURFACE CONDENSING ENGINES, A. W. Robertson, West Ham.—*11th July*, 1882.
3279. ELECTRIC LAMPS, J. S. Beeman, London.—*11th July*, 1882.
3284. DEVICES for SECURING SCREW NUTS on FISH-PLATES, W. R. Lake, London.—*11th July*, 1882.
3287. REGULATING the SUPPLY of GAS to a GAS FLAME, W. Cheyne, Briton Ferry.—*11th July*, 1882.
3297. BREECH-LOADING GUNS and CARTRIDGES, A. N. Gavard and H. Millon, Paris.—*12th July*, 1882.
3305. AMMONIA, J. P. Rickman and J. B. Thompson, New Cross.—*12th July*, 1882.
3307. ROTARY ENGINES and PUMPS, P. Goldschmidt, G. Hahlo, and A. Heussy, Manchester.—*12th July*, 1882.
3322. PRODUCING, MEASURING, and DISTRIBUTING ELECTRIC CURRENTS, J. M. M. Munro, Glasgow.—*13th July*, 1882.
3349. INCANDESCENT ELECTRIC LAMP APPLIANCES, J. S. Beeman, London.—*14th July*, 1882.
3350. ELECTRIC LAMP HOLDERS, J. S. Beeman, London.—*14th July*, 1882.
3351. AUTOMATICALY SHUNTING ELECTRIC CURRENTS, &c., J. S. Beeman, London.—*14th July*, 1882.
3363. HOOD JOINTS of PERAMBULATORS, C. E. Gibson, Birmingham.—*15th July*, 1882.
3420. DYNAMO-ELECTRIC MACHINES, W. P. Thompson, London.—*18th July*, 1882.
3430. DETECTING LEAKAGE of PIPES, &c., A. Q. Ross, London.—*19th July*, 1882.
3433. OPERATING MICROPHONES, P. M. Justice, London.—*19th July*, 1882.
3444. ARTIFICIAL STONE or CONCRETE PAVEMENT, &c., E. L. Ransome, San Francisco.—*20th July*, 1882.
3453. IMPROVED BEVERAGE, J. Lane, Liverpool.—*20th July*, 1882.

3463. CORSETS, &c., R. Hunting, London.—21*st July*, 1882.
3465. ACCUMULATION and DISTRIBUTION of ELECTRICITY, L. H. M. Somzée, Brussels.—21*st July*, 1882.
3467. ACOUSTIC and STENTOROPHONIC INSTRUMENTS, F. Wirth, Frankfort-on-the-Main.—21*st July*, 1882.
3534. DYNAMO-ELECTRIC MACHINES, &c., O. W. F. Hill, Gunnersbury.—27*th July*, 1882.
3574. ENGINE GOVERNORS, W. R. Lake, London.—27*th July*, 1882.
3590. ROLLER MILLS, A. W. L. Reddie, London.—28*th July*, 1882.
3625. CENTRAL FIRE CARTRIDGES, C. S. Bailey, Waltham Abbey.—31*st July*, 1882.
3673. WROUGHT IRON and STEEL RODS, E. Deeley, Walsall.—2*nd August*, 1882.
4263. MULE-THROSTLE SPINNING and DOUBLING MACHINERY, W. Lancaster, Accrington, and E. Slater, Burnley.—7*th September*, 1882.
4598. UTILISING HEAT, H. Gruson and R. Handrick, Buckau.—27*th September*, 1882.
4623. PREPARATIONS of ANIMAL VACCINE, E. T. Darke, Charing Cross.—28*th September*, 1882.
4879. PIGMENT, J. B. Freeman, Tottenham.—13*th October*, 1882.
4915. SWITCHES for ELECTRIC LAMPS, T. W. Cowan, Rotherham.—16*th October*, 1882.
4982. GAS-HEATED FURNACES, C. Madge, Swansea.—19*th October*, 1882.
5015. IRON and STEEL TUBULAR TELEGRAPH POLES, J. C. Johnson, Wednesbury, and R. Martin, West Bromwich.—21*st October*, 1882.
5102. STUDDED CHAINS, T. H. Ward, Tipton.—26*th October*, 1882.
5119. CABLE TRACTION RAILWAYS and TRAMWAYS, J. Wright, London.—27*th October*, 1882.
5144. COCKS or VALVES, W. H. Moseley, Derby.—30*th October*, 1882.
5201. APPARATUS for the MANUFACTURE of PAPER, F. Wrigley and J. Robertson, Bury.—1*st November*, 1882.
5230. SIGNALLING by ELECRICITY THROUGH the MEDIUM of GAS, W. R. Lake, London.—4*th November*, 1882.
5340. RECIPROCATING CYLINDER PRINTING PRESSES, S. Sydney, Sutton.—8*th November*, 1882.

(*List of Letters Patent which passed the Great Seal on the 9th January*, 1883.)

3258. RETAINING STOCKINGS, &c., in POSITION, J. Parry, London.—10*th July*, 1882.
3266. PARING the CURLS of HAT BRIMS, J. Cree, Denton.—10*th July*, 1882.
3290. DRESSING the STEMS and LEAVES of PLANTS, J. G. Jebb, London.—11*th July*, 1882.
3324. GAS STOVES, C. Portway, Halstead.—13*th July*, 1882.
3335. TELEPHONES, S. M. Yeates, Dublin.—14*th July*, 1882.
3341. TENON-CUTTING MACHINERY, J. G. Hirst, Leeds.—14*th July*, 1882.
3352. IRON and STEEL, J. M. Bennett, Glasgow.—14*th July*, 1882.
3354. CRUDE or PIG IRON, J. M. Bennett, Glasgow.—14*th July*, 1882.
3404. HOLDING and GRINDING TOOLS, R. Rawlinson, Salford.—18*th July*, 1882.
3414. ELECTRIC TELEGRAPH SIGNALLING APPARATUS, H. E. Newton, London.—18*th July*, 1882.
3440. DRYING COFFEE, F. H. F. Engel, Hamburg.—19*th July*, 1882.
3452. SCREW PROPELLERS, R. Duncan, Glasgow.—20*th July*, 1882.
3471. KNIVES and FORKS, H. Fielding, Birmingham.—21*st July*, 1882.
3505. CENTRIFUGAL MACHINES, J. H. Johnson, London.—24*th July*, 1882.
3548. EXTINGUISHING FIRE, A. M. Clark, London.—26*th July*, 1882.
3993. DOOR MAT, BOOT, and SHOE CLEANER, J. Hopewell, Salford.—19*th August*, 1882.
5107. INDICATING EXCESSIVE VARIATIONS of TEMPERATURE, W. T. Goolden and C. F. Casella, London.—27*th October*, 1882.

List of Specifications published during the week ending January 6th, 1883.

4666*, 4d.; 2178*, 4d.; 643*, 4d.; 1278, 2d.; 1334, 2d.; 1480, 2d.; 1585, 6d.; 1612, 2d.; 1642, 6d.; 1660, 2d.; 1772, 4d.; 1898, 6d.; 1914, 2d.; 1980, 2d.; 1986, 2d.; 2025, 2d.; 2192, 4d.; 2230, 6d.; 2295, 6d.; 2360, 2d.; 2363, 4d.; 2426, 6d.; 2440, 1s.; 2460, 6d.; 2474, 6d.; 2475, 6d.; 2503, 2d.; 2519, 6d.; 2522, 2d.; 2523, 2d.; 2525, 6d.; 2527, 6d.; 2528, 2d.; 2529, 6d.; 2532, 2d.; 2533, 8d.; 2535, 2d.; 2537, 6d.; 2538, 2d.; 2539, 2d.; 2540, 6d.; 2542, 2d.; 2543, 6d.; 2545, 6d.; 2546, 2d.; 2547, 6d.; 2548, 6d.; 2550, 4d.; 2551, 4d.; 2553, 6d.; 2553, 6d.; 2554, 4d.; 2555, 2d.; 2557, 2d.; 2560, 4d.; 2562, 4d.; 2564, 6d.; 2566, 4d.; 2568, 8d.; 2569, 6d.; 2571, 4d.; 2573, 6d.; 2574, 6d.; 2575, 6d.; 2576, 6d.; 2577, 6d.; 2579, 2d.; 2580, 6d.; 2581, 2d.; 2582, 1s.; 2583, 2d.; 2586, 4d.; 2587, 4d.; 2588, 4d.; 2589, 6d.; 2590, 6d.; 2591, 4d.; 2593, 6d.; 2595, 2d.; 2597, 6d.; 2599, 4d.; 2601, 2d.; 2602, 4d.; 2603, 6d.; 2605, 6d.; 2606, 2d.; 2607, 6d.; 2609, 2d.; 2611, 2d.; 2612, 6d.; 2614, 2d.; 2616, 4d.; 2617, 10d.; 2618, 6d.; 2619, 2d.; 2621, 4d.; 2622, 6d.; 2624, 6d.; 2629, 2d.; 2631, 6d.; 2635, 4d.; 2640, 4d.; 2642, 4d.; 2648, 4d.; 2655, 2d.; 2658, 4d.; 2662, 2d.; 2664, 2d.; 2666, 2d.; 2667, 6d.; 2669, 4d.; 2674, 4d.; 2677, 2d.; 2680, 2d.; 2681, 2d.; 2683, 2d.; 2686, 2d.; 2688, 2d.; 2691, 6d.; 2692, 2d.; 2704, 2d.; 2710, 2d.; 2712, 6d.; 2717, 2d.; 2720, 2d.; 2726, 6d.; 2777, 2d.; 2847, 10d.; 3137, 6d.; 3617, 4d.; 4014, 6d.; 4442, 6d.; 4728, 4d.; 4857, 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.*

1278. CIGAR CAP, *H. J. Haddan, Kensington.—16th March*, 1882.—(*A communication from O. Ehrentraut, Leipzig.*)—(*Provisional protection not allowed.*) 2*d.*

The object is to put out a cigar, so that it can be put into a cigar case without danger, and it consists in applying a cap over the burning end.

1334. APPLIANCES for the ARTIFICIAL REARING of OYSTERS, *A. J. Boult, London.—18th March*, 1882.—(*A communication from A. Laurent, Bordeaux.*)—(*Provisional protection not allowed.*) 2*d.*

This relates to the construction of boxes for rearing oysters, of plates or tiles of ceramic ware.

1480. VENTILATING MINES, TUNNELS, BUILDINGS, &c., *W. Teague, Cornwall.—28th March*, 1882.—(*Provisional protection not allowed.*) 2*d.*

An ordinary fan has fitted to the outer pipe one or more concentric pipes or rings, to each of which an intake pipe is attached. The air is drawn in through the intake pipe, and discharged through the outlet pipe into the concentric rings, in which it creates a vacuum, and causes a rapid current of air in each intake pipe and ring.

1585. NEUTRALISING, SEPARATING, OR ABSORBING THE PRODUCTS OF COMBUSTION OF COAL, GAS, &c., *J. F. Allan and W. B. Adamson, Glasgow.—1st April*, 1882. 6*d.*

The products of combustion from a gas stove or burner are led through a chamber containing strips or plates of zinc or iron.

1612. EMBROIDERED CRAVATS, *W. R. Lake, London.—3rd April*, 1882.—(*A communication from E. Demonchaux, France.*)—(*Provisional protection not allowed.*) 2*d.*

This consists in ornamenting cravats, &c., with paintings and embroidery combined.

1642. IMPROVEMENTS IN INCANDESCENT ELECTRIC LAMPS, *W. H. Akester, Glasgow.—5th April*, 1882 6*d.*

This relates to a novel method of fixing the carbon filament and conducting wires into the glass globe, and of sealing the globe after they are in place.

1660. ARTICLE OF FOOD MADE FROM FISH, &c., *W. McDonnell, Limerick.—5th April*, 1882. —(*Provisional protection not allowed.*) 2*d.*

The fish is boiled, and then boned and minced, and after being suitably seasoned, is made into "brawn" or sausage, and freely boiled and pressed into suitable forms.

1772. BALLOONS, &c., *T. Wilkins, Poland-street.—14th April*, 1882.—(*Provisional protection not allowed.*) 4*d.*

The object is to enable gas or hot-air balloons to be steered and propelled by suitable mechanism.

1898. STOPPERS for BOTTLES, *J. Ballard, Nottingham.—21st April*, 1882. 6*d.*

Several forms of stoppers are described, one of which consists of a stud stopper of china or glass with a groove to receive an india-rubber washer, and perforated throughout, the upper part being smaller than the lower, which is partly stopped by a wood ferule, between which, and the upper part, a spherical piece of india-rubber is free to move.

1914. FUNERAL CARS, *J. Whitehead, Westminster.—21st April*, 1882. —(*Provisional protection not allowed.*) 2*d.*

This relates to cars which may be used either as an open or closed car, the sides being of glass fitted with blinds and capable of folding up.

1980. THERMOMETERS, *C. Townsend, Bristol.—26th April*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This relates to thermometers which have the scale marked on the tube, and consists in marking the corrections also on the tube, when the instrument is corrected by a standard thermometer.

1986. SAFETY MATCHES, *J. L. Field, Dorset.—27th April*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This consists in constructing safety matches with a portion of the igniting composition attached to its sides, so that one match may be ignited by rubbing or striking it on another.

2025. ORNAMENTING GLASS, *C. J. Bishop, Lancaster.—28th April*, 1882. —(*Provisional protection not allowed.*) 2*d.*

This relates to the ornamentation of glass by a combined process of printing and frosting by a sand blast.

2192. IMPROVEMENTS IN THE MANUFACTURE OF BRIDGES OR LOOPS FOR INCANDESCENT ELECTRIC LAMPS, *C. J. Allport, London.—10th May*, 1882. 4*d.*

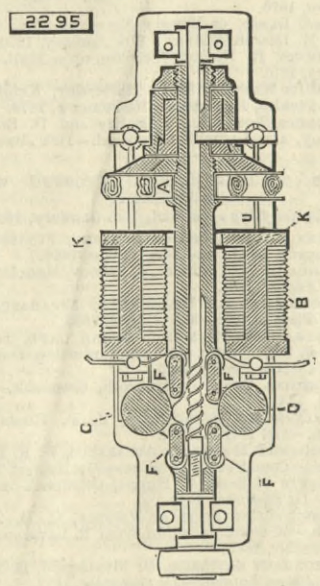
This relates partly to patent No. 4850, 1881. It consists in the construction of filaments or bridges composed of asbestos in combination with carbon. The carbon is combined with the asbestos by mixing compounds containing carbon and hydrogen with the latter, and then combining the compounds. Other methods are also described and claimed.

2230. WINDING ENGINES for STEAM PLOUGHING, &c., *T. Perkins, Hitchin.—11th May*, 1882. 6*d.*

The general arrangement is similar to ordinary traction and winding engines, the main axle is behind the fire-box and has two spur wheels, one on each side, with which pinions on a countershaft engage. The spur wheels drive the winding drums, gearing with toothed rings thereon. The drums are behind the main axle, and are mounted upon excentrics, by shifting which the drums are thrown in or out of gear. Spring brakes are kept applied to the drums when out of gear. The spur wheels on the main axle are also used to drive the road wheels when desired.

2295. IMPROVEMENTS IN COMPENSATING DYNAMO-ELECTRIC MACHINES, *B. H. Chameroy, Maisons Lafitte, France.—16th May*, 1882. 6*d.*

The inventor claims a dynamo-electric machine in which the strength of the current is controlled by causing the variations of said current to regulate the distance between the exciting coils and the electro-magnets, either directly by the influence of the



current in the machine, or by the intervention of mechanical devices. The figure gives a sectional plan of one method. The electro-magnets are movable, and supported on axles C C; they are capable of moving away from armature A. If any lamps connected with the dynamo are extinguished so as to increase its resistance, the lower part of electro-magnets K K will, by reason of their magnetisation, move towards the metallic masses F F1, and the separation of K K from A diminishes the current in A.

2360. APPARATUS FOR MAKING COFFEE AND TEA, *W. H. Crispin, Hampstead.—19th May*, 1882.—(*Not proceeded with.*) 2*d.*

The vessel is of tin, and has a draw-off tap at bottom, and a ledge to receive an inner vessel with perforated bottom to receive the coffee or tea. A weighted cover rests on the coffee or tea and prevents it rising to the surface of the water, while a second cover closes the outer vessel.

2363. TOBACCO PIPES, *J. Stanley, Manchester.—19th May*, 1882. 4*d.*

A hole is bored in the stem large enough to receive a separate piece, in which the smoke passage is provided in a helical form, and which can be removed when required for cleaning.

2440. ROTARY ENGINES, *H. J. Haddan, Kensington.—23rd May*, 1882.—(*A communication from L. J. Wing, Washington, U.S.*) 1*s.*

This relates to the general construction of a rotary engine, in which a rotary piston disc is used in combination with a rotary abutment disc arranged at right angles, suitable mechanism to impart continuous rotary motion thereto, and the periphery of the abutment disc being arranged to snugly fit the periphery of the piston disc. There are fifty-five claims.

2426. BOTTLING FERMENTED LIQUIDS, *F. Foster, Hoxton.—23rd May*, 1882. 6*d.*

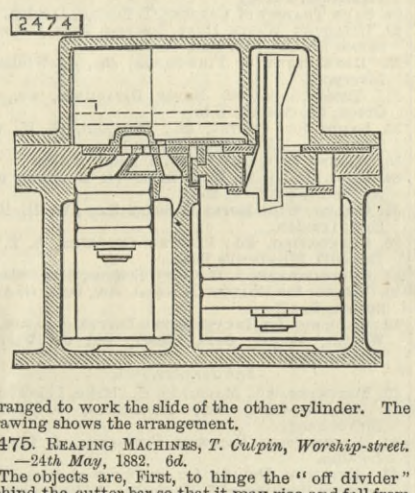
This relates to a novel combination of aërating cylinder, gas pump, and bottling machine, by means of which fermented liquids can be taken direct from a cask and undergo a process first of exhausting the air from the liquid, then of charging the liquid with carbonic acid gas, and subsequently of filling the liquid into bottles capable of being closed with screw stoppers.

2460. THRASHING MACHINES, *P. Gibbons and A. S. F. Robinson, Wantage.—24th May*, 1882. 6*d.*

This relates especially to the "smutter," the final dresser, and parts connected therewith. The dressing riddles (of extra large size) are placed immediately below the smutter in the middle of the machine. The grain raised by the elevator is delivered by an incline into the wire gauze cylinder of the smutter, is carried on by the blades and rubbers on the revolving axis within the smutter, and delivered at the end of the cylinder. It falls into a hopper which leads it back to the riddle. An exhaust fan is provided on the axis of the smutter at its further end, and draws air through the smutter and delivers it with the dust through a grating at the periphery. An inclined cover plate is introduced between the smutter and the dressing riddles, the dirt and seeds falling thereon and being separated.

2474. FLUID METERS, *C. D. Abel, London.—24th May*, 1882.—(*A communication from C. Schreiber, Paris*) 6*d.*

This consists in the construction of a fluid meter with two cylinders and pistons, each piston being



arranged to work the slide of the other cylinder. The drawing shows the arrangement.

2475. REAPING MACHINES, *T. Culpin, Worship-street.—24th May*, 1882. 6*d.*

The objects are, First, to hinge the "off divider" behind the cutter bar so that it may rise and fall from that point and find its own touch upon the ground without reference to the angle at which the knives or the platform may be set; Secondly, to adjust the hinged "off divider" so that it may be set with its point at any desired elevation for dividing the straws at any height from the ground; Thirdly, to make the "off divider" in sections and hinging them near the point, so that it may be spread outward or upward as desired; and, Fourthly, to control the dummy and rake arms automatically by a segmental plate or its equivalent by the switch.

2503. LEADS for PENCILS, *G. Daubenspeck, Middlesex.—26th May*, 1882. 2*d.*

This relates to pencils capable of being used for making copies, the object being to enable a black copy to be made, and it consists in forming the leads of 100 parts of nigrosine, 7½ parts phosphine, 25 parts graphite, 35 parts castile soap, and 5 parts pure aniline.

2515. HAY-MAKING MACHINES, *S. H. Dening, Chard.—26th May*, 1882. 6*d.*

The principal object is to enable the main shaft of the rake drum to be prolonged through and beyond the main travelling wheels (without removing it from its ordinary position excentric thereto), and thereby admit of rake heads working outside the main wheels as well as between them, thus increasing the working width of the machine without increasing the breadth of the framework.

2516. IMPROVEMENTS IN THE PREPARATION OF MATERIALS FOR ELECTRIC INSULATION, &c., *G. S. Page, Stanley, Jersey State, U.S.—26th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the use of a mixture composed of finely divided dry organic material with mineral substances, carbon, hydrocarbons, resinous materials, &c.

2519. IMPROVEMENTS IN AND CONNECTED WITH AIR-EXHAUSTING APPARATUS TO BE USED IN PREPARING INCANDESCENT ELECTRIC LAMPS, *W. H. Akester, Glasgow.—27th May*, 1882. 6*d.*

This relates to improvements in a mercury air pump, by which the concussive action causing leakages through joints and stuffing-boxes is avoided.

2522. WASHING AND WRINGING MACHINES, *M. and C. Staveley, Yorkshire.—27th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to cover washing and wringing machines with a box or casing so as to conceal them from view.

2523. DYEING, BLEACHING, &c., *J. C. Mewburn, London.—27th May*, 1882.—(*A communication from L. M. Nouvelet and L. Fay, Reims.*—(*Not proceeded with.*) 2*d.*

The materials to be treated are placed on perforated tubes through which the liquid for dyeing or bleaching them is forced under pressure by a jet of steam which produces a suction of the liquid in the trough and drives it through the perforated tubes around which the materials are wrapped.

2525. APPARATUS USED IN THE MANUFACTURE OF FELT HATS, &c., *J. C. Bramall, near Stockport, and W. G. Bywater and J. Teale, Holbeck.—27th May*, 1882. 6*d.*

In manufacturing felt hats a revolving inner hollow perforated block receives the felt, over which another cone or hollow block acts on the felt by a reciprocating up-and-down motion. The present invention consists in employing an upper cap, cover, or cone, which is capable of a reciprocating rotary motion.

2527. PRODUCTION OF INFLAMMABLE GAS, AND APPLYING ITS COMBUSTION FOR THE PRODUCTION OF MOTIVE POWER, *H. Davey, Leeds.—27th May*, 1882. 6*d.*

This relates to apparatus for generating inflammable gas under pressure, and applying it in conjunction with compressed air to produce motive power. A cylindrical vessel has introduced into it at top carbonaceous fuel, and at the base of the vessel is a hopper valve to discharge the ash. In the lower part of the vessel under the fuel is an inverted cup-shaped vessel, into the hollow of which compressed air and steam are introduced, and rising through perforations in the vessel and through the fuel, produce gas which is utilised in an engine of special construction.

2528. EXHAUST FANS, *R. A. Lister and G. Richmond, Gloucester.—27th May*, 1882.—(*Not proceeded with.*) 2*d.*

The usual casing is abolished, and one inlet only is employed, and opens into the fan itself, to which it is connected by a joint consisting of two faces with an interposed washer of leather. The air drawn in at inlet is discharged off the vanes of the fan.

2529. DIGGING OR CULTIVATING MACHINES, *W. Doubleday, Chelmsford.—27th May*, 1882. 6*d.*

A traction engine is employed, and at the back a shaft is mounted with a number of bosses, each having a number of slotted projections or bearings for the inner end of a suitably constructed spade or tine. The shaft is operated from the engine, and the depth of cut is regulated by a worm and wheel.

2530. DOMESTIC STOVES OR FIREPLACES, *H. Ransford, Brighton.—27th May*, 1882. 6*d.*

This consists of a disc having a fire basket fixed upon it.

2532. AN IMPROVED METHOD OF TREATING CERTAIN MATERIALS TO RENDER THEM DIELECTRICAL, *E. W. Beckingsale, Bedford Park, Middlesex.—27th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the injection of hydrocarbons into bricks, stones, and other porous materials, so as to render them non-conducting.

2533. PONTOON DOCKS, &c., *R. Turnbull, South Shields.—27th May*, 1882. 8*d.*

The pontoon is constructed in the bottom with the usual air and water chamber and valves, but with only one side and two ends, to allow of the vessel being docked broadside on or at an angle, the upper side of the pontoon having an incline with rails to correspond to the rails of the slipway. The end or ends of the open side are provided with wings to open outwards. The Second part relates to a lever for steadying pontoons at the quay or jetty. The invention further relates to slipways for receiving pontoons and shifting them from one position to another.

2534. PAPERMAKERS' DRYING FELTS, *F. Aitken, Helmshore.—27th May*, 1882. 2*d.*

This relates to raising the fibres on the working surface of the felt.

2535. LOOMS, *H. Lomax, Darwen.—27th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to means of weighting the warp beam so as to dispense with the springs usually employed, and it consists of a chain attached at one end to the weighted lever and passing around the neck of the "ruffle" of the beam any desired number of times, the other end of the chain being then attached to the pendant part of the chain above the weight.

2537. COMPRESSED GUNPOWDER, *W. R. Lake, London.—27th May*, 1882.—(*A communication from H. Gruson, Germany.*) 6*d.*

This consists, First, in the improved press for manufacturing compressed gunpowder, in which a cushion of elastic material is employed so as to enable the excentrics to perform a portion of their revolution without moving the plungers, and thereby maintain the maximum pressure on the powder temporarily constant; Secondly, in heating the moulds or matrices of the press by steam or water.

2538. CARRIAGES AND WAGONS FOR USE ON PUBLIC ROADS, &c., *T. Horrex, Gracechurch-street.—27th May*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in constructing wagons or carriages with more than two pairs of wheels, and providing means to raise the front part of the body of the carriage and the intermediate wheels off the ground, so as to facilitate the turning of the vehicle.

2539. HANGING BASKETS FOR FLOWERS, VASES, &c., *E. W. Warsop, Bristol.—27th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to form hanging baskets so that they are simple, strong, and capable of being folded into a small space.

2540. FURNACES OR FIRE-GRATES, *G. F. Janes, Finsbury.—27th May*, 1882. 6*d.*

Two boxes are used, and support the ends of the fire-bars, which are hollow, of a V shape, and faced with margin-pieces arranged so as to leave openings to conduct air to the fuel. Beneath the front box are two spindles fitted with hand levers, and connected with the fire-bars, so that by actuating either lever one-half of the fire-bars are caused to slide.

2542. DRYING GRAIN, &c., *Sir H. Scholfield, Nottingham.—30th May*, 1882.—(*Not proceeded with.*) 2*d.*

Two forms of apparatus are described — one for drying grain and fruits, and the other for drying fibres or fabric, and in the former a travelling hopper is employed to supply an uniform depth of grain to the drying chamber, where it is subjected to the action of heated air.

2543. LOOMS, *W. R. Stitt and J. Lees, Belfast.—30th May*, 1882. 6*d.*

This relates to the delivery of yarn to the loom, the object being to regulate the yarn beam according to the pace at which the yarn is required. A revolving shaft is attached to the loom by brackets, and connected to the beam by bevel wheels, and upon it is a hollow cone. A second cone is made to slide freely along the shaft, and pass into the former cone, so as to act as a brake. The second cone is attached to the loom by slotted arms, on which it is adjusted and maintained in position with the aid of a screw, and by a connection between it and the lower shell, the latter, when lifted by the yarn, acts on the lever and weight.

2545. MIXING AND WORKING COFFEE BERRIES, &c., *E. J. Humphery, London Bridge.—30th May*, 1882. 6*d.*

The substances to be mixed are caused to pass through openings communicating with one shaft, in the passage through which they become thoroughly mixed.

2546. TRACTION WAGONS, *J. and H. McLaren, Leeds.—30th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to form wagons so that their load may be readily discharged or tipped, and it consists in mounting the body on rollers running on an inclined frame, so that the body runs back and overhangs the frame, and can be readily tipped.

2547. THRASHING MACHINES, *J. H. Johnson, London.—30th May*, 1882. —(*A communication from M. Epple, Munich.*) 6*d.*

The object is to provide means for working the vibrating parts of thrashing machines so that the first cleaning arrangements are operated by a single shaft in such a manner that the energies of the vibrations and oscillations compensate or balance each other, whereby motion may be directly transmitted by the one shaft to the several vibrating parts without the employment of connecting links.

2549. BUILDING CONSTRUCTION, LIGHTING, FIREPROOFING, &c., *T. Hyatt, London.—30th May*, 1882. 8*d.*

This consists in the employment of distributing mirrors in combination with receiving or daylight reflectors.

2550. SIFTING VARIOUS MATERIALS, *M. Shearer, sen., and M. Shearer, jun., Old Kent-road.—30th May*, 1882. 4*d.*

This consists of a rotating sifting cylinder, to which a compound oscillating and excentric action is imparted.

2551. DENTAL INSTRUMENT, *G. Poulson, Hamburg.—30th May*, 1882.—(*A communication from J. W. Lench, Hamburg.*)—(*Not proceeded with.*) 2*d.*

This relates to instruments to hold the cofferdam rubber in the mouth, the object being to keep it in its right position, to facilitate opening the mouth by preventing it tiring the patient, and to introduce into the mouth a reflector which is fixed to the instrument, thus leaving the dentist with both hands free for operation.

2552. STEERING QUADRANTS OR TILLERS, *J. Cook, jun., Washington, Durham, and W. Prosser, Newcastle-upon-Tyne.—30th May*, 1882. 6*d.*

The whole quadrant, consisting of a boss (to key or rudder head), the radial arms, and the sector (with guides for the steering chains) is made in one solid steel casting.

2553. MANUFACTURE OF HINGES, *A. J. Boult, London.—30th May*, 1882.—(*A communication from E. Salamon and E. Armant, Montreal, Canada.*) 6*d.*

This consists in enclosing the blanks and pivot pins between gripping jaws, bending the said blanks

partly around the pin by means of a former moving the gripping jaws and partly formed hinge forward, and finishing the hinge by the succeeding blow of the former against a concave anvil.

2554. VULCANISING INDIA-RUBBER, *J. H. Johnson, London.*—30*th May*, 1882.—(*A communication from H. M. F. J. Compte de la Tour du Breuil and A. M. A. Vicomte de la Tour de Breuil, Paris.*) 4*d.*

This consists in employing at atmospheric pressure a bath composed of water and an inert soluble salt which possesses the property of retarding the ebullition of the water, and thus enables the temperature of the latter to be raised to from 140 to 150 deg C., or to a point at which the sulphur and india-rubber combine.

2555. BLOCKING TUNNELS, *F. Barnett, London.*—30*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in forming the tunnel with one or more dips from each side of the tunnel, so as to have two inclines meeting, and the spaces between these inclines may be flooded when necessary.

2556. WINDOW SCREENS, *G. L. Reynolds, California.*—30*th May*, 1882. 6*d.*

This consists partly in journalling a screen or curtain rollers upon the top of the upper and the bottom of the lower sashes respectively, and in attaching one balance weight cord to the journal of the roller and the other to the sash, the rollers being protected by grooves in the sashes, and by enclosing plates which project beyond the sashes.

2557. ILLUMINATION OF RAILWAY CARRIAGES, *M. A. Wier, London.*—30*th May*, 1882.—(*Not proceeded with.*) 2*d*

This relates to a method of distributing throughout a train of railway carriages the illuminating power derived from lamps at the extremity or extremities of the train, and consists in the employment of reflectors and prismatic refractors.

2559. TREATMENT OF FATTY SUBSTANCES, *R. H. Brandon, Paris.*—31*st May*, 1882.—(*A communication from A. Marix, Paris.*) 6*d.*

The object is to obtain stearine and glycerine oxide from tallow and other fatty or oily substances.

2560. IMPROVEMENTS IN ELECTRIC LAMPS AND ELECTRODES THEREFOR, *S. Hallett, London.*—31*st May*, 1882. 4*d.*

This relates primarily to incandescent lamps, and consists of improvements on the inventor's patent No. 4017, 17th September, 1881. He now claims the manufacture of electrodes (1) from cocoanut shell; (2) from pulverous carbonaceous matter prepared with gelatine or glue, and the admixture of tannic acid forming the carbon mass, which is then moulded and recarbonised; (3) from ligneous or vegetable pulp treated with dilute mineral acids, and mixed with gelatine or glue, &c; and (4) the mounting of the electrodes for incandescent lamps with sockets and connections, also contact breaker switch device as described in this patent.

2562. COMMUNICATING A ROTARY MOTION TO BRUSHES FOR HAIR, &c., *R. F. Heney, London.*—31*st May*, 1882. 4*d.*

The brush is caused to revolve by means of a small electric motor placed in the internal part thereof, to which an electric current is conveyed by means of a wire from a battery or other generator of electricity.

2564. BARGES, &c., *E. Moxon, Tunbridge Wells.*—31*st May*, 1882. 6*d.*

This consists, First, in constructing iron and steel barges, &c., with spaces or cells in the sides for containing cork or other buoyant materials; Secondly, in the application and use of an automatic electric signaling device for announcing the presence of water in the barge, &c.

2566. WEAVING CLOTH FOR TAPESTRY, *D. A. Guille, London.*—31*st May*, 1882. 4*d.*

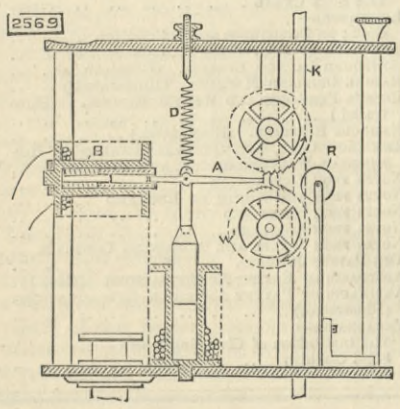
The object is to produce a fabric which shall enable artists to imitate the Gobelin tapestries.

2568. BARRELS AND KEYS OF LOCKS AND LATCHES, &c., *G. Bolton, Wolverhampton.*—31*st May*, 1882. 8*d.*

The improvements which relate to the barrels and keys of locks and latches consist in forming the barrel with a groove down each side of it, in line with the key-hole, and with a solid part down the centre, instead of the usual pin-hole down the centre with a single groove therefrom to one side; and in forming the key with a flat bit without the usual cylindrical part or pin, and with a slot up the bit of the key corresponding to the solid part down the centre of the barrel. The solid part down the centre of the barrel is cut away for a short distance at the end, so as to allow for proper strength of metal at the inner end of the slot in the key. Other improvements refer to the latching mechanism.

2569. IMPROVEMENTS IN ELECTRIC LAMPS, *T. E. Gatehouse, Camberwell, and H. R. Kempe, Barnet.*—31*st May*, 1882. 6*d.*

The accompanying figure shows the inventor's lamp. The solenoid B is connected through any make or break arrangement, so that it is intermittently excited, attracting its core in opposition to the spring shown in the figure, and thus giving a reciprocating to-and-fro motion to arm A. Lower solenoid is of high resistance and is placed in a shunt from the main circuit. Its core is drawn upward by an adjustable



spring D. When the carbons are too near, this solenoid is weak, and spring D raises arm A, so that a tooth at its end engages as a pawl with the teeth of W. By the reciprocation of arm A this wheel is caused to turn upwards the same way as the arrow, thus raising the carbon and enlarging the arc. The reverse takes place when the arc is too long, and the solenoid strong. Wheel B simply presses carbon K against wheels W and W1. The invention also relates to a novel method of including an incandescent lamp in a shunt circuit as part of the resistance thereof.

2571. IMPROVED METHOD OF MAKING THE INSULATING BODIES OF ELECTRIC LIGHT CONDUCTING WIRES NON-INFLAMMABLE, *W. A. Phillips, Homerton, and S. E. Phillips, Charlton.*—31*st May*, 1882. 4*d.*

This invention consists in passing the wires, covered or uncovered, through a solution of tungstate of soda. According to another part of the invention a concentrated aqueous solution of tungstate of soda is prepared and poured into boiled linseed oil, which is heated and kept stirred until the water has evaporated. A portion of this fluid is then mixed with the insulating compound used to cover the wire.

2573. A NEW OR IMPROVED DYNAMO-ELECTRIC MACHINE, *S. Hallett, London.*—31*st May*, 1882. 6*d.*

This relates to improvements whereby currents of varied intensity can be obtained from the same machine, thus enabling the electrolytic deposition of metals to be carried on in two or more vats containing different solutions by the currents from the same machine.

2574. DECORTICATING GRAIN, *J. Wetter, New Wandsworth.*—31*st May*, 1882.—(*A communication from W. Ager, Washington, U.S.*) 6*d.*

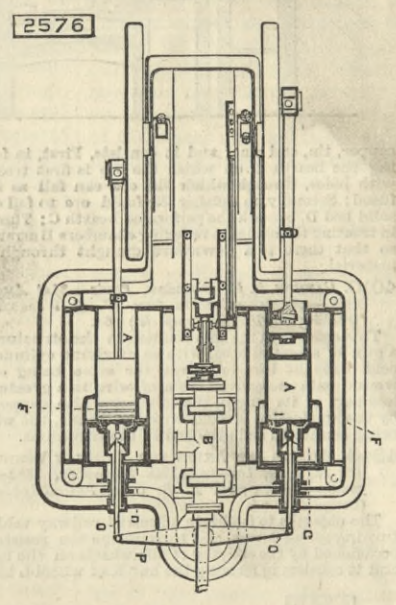
The process consists, First, in subjecting the grain in a mass sufficient to make its own weight a factor for keeping it against the decorticating surfaces with a pressure sufficient to remove all of the impurities; Secondly, in maintaining an equal feed and discharge of the grain; Thirdly, in subjecting the grain to abrading surfaces receiving a relatively fast and slow motion; and Fourthly, in the withdrawal by air currents of the impurities through the screen cylinder.

2575. REMOVING VEGETABLE MATTER FROM WOOL, *J. Wetter, New Wandsworth.*—31*st May*, 1882.—(*A communication from A. Snoeck, Belgium.*) 6*d.*

This consists in subjecting wool to chemical processes having for their object to clean the wool from vegetable matter adhering to it, not while the wool is in locks, yarns, or woven tissue, but when it has been worked into fleeces or slivers by the carding or combing machines, so that the chemical action takes place while the wool is in a state of division favourable for the destruction of the vegetable impurities.

2576. COMPRESSING AIR AND OTHER GASEOUS FLUIDS, &c., *W. Darling and R. Sellers, Keighley.*—31*st May*, 1882. 6*d.*

Two compressing cylinders A are placed side by side, and between them is the steam engine cylinder B, for driving the air compressors. At the ends of cylinders A are enlarged chambers F, in which work delivery valves G, the chambers serving as guides for the valves, in which holes are made to allow the compressed air to pass to both sides of the valves. The



inlet valves I are carried in a cylindrical guide formed at the central part of the delivery valves, the stems of which are tubular to admit the air. The two inlet valves are coupled by links O and lever P. Springs are attached to the tubular stems of the delivery valves, so as to insure the proper closing of such valves before the pressure of the air is sufficient to effect this object.

2577. APPARATUS FOR WASHING AND RINSING BOTTLES, *E. Lofts, Cherryhinton.*—31*st May*, 1882. 6*d.*

This relates to improvements in the general construction of the apparatus described in patent No. 1448, A.D. 1872.

2579. REVERSIBLE CLOAKS, *T. H. Harrison, London.*—31*st May*, 1882.—(*A communication from H. F. Bindseil and L. Weil, New York.*—(*Not proceeded with.*) 2*d.*

The object is to furnish a lady's silk cloak lined with fur, &c., which may be readily reversed, and a waterproof cover brought to the outside when necessary.

2580. FENCE POSTS, *S. Pitt, Sutton.*—31*st May*, 1882.—(*A communication from O. Shepard, Boston, B. W. Peck, G. H. Morse, W. A. Crombie, E. R. Powell, and T. S. Peck, Burlington, U.S.*) 6*d.*

The invention has reference to fence posts made of metal, and adapted to be driven into the ground; and consists in improvements in the shares or wings, and in the way in which they are attached to the standards, in the form of the standards, and in the devices by which the wire longitudinals are set in place and held, these being equally effective where lengths of broad fencing are substituted for wire.

2581. DISINFECTANT LITTER FOR HORSES, &c., *C. W. G. Ernst, Hanover.*—31*st May*, 1882.—(*Not proceeded with.*) 2*d.*

The inventor employs 2 to 5 per cent. of acid sulphate of sodium, sulphate of magnesia, and gypsum, each substance alone or conjointly with the other substances, or ferrous sulphate in the proportion of 2 to 50 per cent. of quicklime and carbolic acid may be employed, each either alone or mixed with the other substances before mentioned.

2582. MEASURING, RECORDING AND INDICATING THE SPEED OF RAILWAY TRAINS, *F. C. Glaser, Berlin.*—31*st May*, 1882.—(*A communication from the Werkzeug und Maschinenfabric-Oerlikon, Switzerland.*) 1*s.*

The speed measurer consists of a system of branch elements or apparatus, which is attached to a revolving axle, and is held by a spring in different positions at different degrees of tension of the same, which positions correspond to the various velocities of revolution. These different positions are made use of so as to allow of the speeds being read off and recorded, the latter in combination with a clock.

2583. STARTING, STOPPING, AND REVERSING STEAM ENGINES, &c., *W. H. Allen, R. Wright, and W. L. Williams, London.*—1*st June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the general construction of the cylinder, piston, and gear.

2586. SUGAR CANE MILLS, *E. Hunt, Glasgow.*—1*st June*, 1882.—(*A communication from J. Thompson and J. Black, Campos, Brazil.*) 4*d.*

This consists in the combination of a pair of deeply grooved preparatory rolls, with the three rolls of ordinary sugar cane mills.

2587. CATCHES FOR ACTING ON RATCHET WHEELS, *J. F. Davies, Blackburn.*—1*st June*, 1882. 4*d.*

The inventor claims casting or otherwise forming the lever head and the catch each in one piece, and providing one or the other (or both of them) with a lug or projection (or with lugs or projections) or with hooks or slips, so that two may be jointed together when the catch is not in its working position, and that when the said catch is moved to its working position, it is prevented by the said lugs or projections, or hooks or clips, from being displaced in a lateral direction, and all pins, rivets, nuts, or bolts dispensed with.

2588. COMBINATION GARMENT, *F. W. Brewster, Westminster.*—1*st June*, 1882. 4*d.*

This consists in the combination with an entire outer and generally serviceable garment of suitable means of floatation, principally disposed about the body portion, so that the wearer should have about her or him in, and as a part of such garment, a means of keeping afloat when in the water.

2589. SCREW BUTTONS, *F. Wirth, Frankfort.*—1*st June*, 1882.—(*A communication from L. E. Hunrath, Darmstadt.*) 6*d.*

This consists of a screwed socket connected to the foot-plate or disc by two pieces, in combination with the upper part or head, provided with a screwed stem adapted to fit into the said socket.

2590. GLAZING, *T. H. P. Dennis, Chelmsford.*—1*st June*, 1882. 6*d.*

This consists partly in the manufacture and use of sash-bars and caps and other appliances in the formation of skylights.

2591. WATER GAUGES, *W. R. Lake, London.*—1*st June*, 1882.—(*A communication from L. M. Fleet, Boston, U.S.*) 4*d.*

One half of the exterior surface of the glass tube is ground to form a background for enabling the column of water to be seen to better advantage. The tube is provided with a hollow ball or float.

2593. WRENCHES, *P. Lawrence, London.*—1*st June*, 1882. 6*d.*

This relates to "monkey wrenches," in which the adjusting screw is stationary, and operates in a nut formed in the front of the sliding jaw; and it consists partly in such a construction that the screw may be readily disengaged from the nut without changing the normal position of the hand while operating, whereby the adjustable jaw may be quickly changed from one position to another by the disengaged hand of the operator, or the jaw be allowed to drop as desired by simply inclining the wrench, when the screw is again allowed to resume its position either to lock the jaw or for use in the ordinary manner.

2595. IMPROVEMENTS IN PREPARING CERTAIN MATERIALS FOR USE IN SECONDARY BATTERIES, *W. Boggett, Chelsea.*—1*st June*, 1882.—(*Not proceeded with.*) 2*d.*

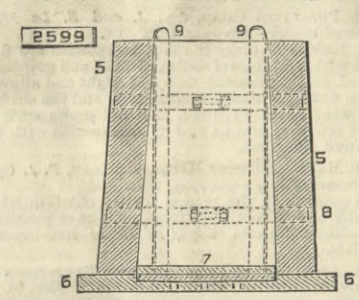
This relates to the production of finely divided lead by mechanical means, viz., either by pressing a tool against a rotating disc of lead, or cutting thin sheets of lead and subsequently cross-cutting the same.

2597. STOPPERING BOTTLES OR FLAGONS, *G. Falconnier, Nyon, Switzerland.*—1*st June*, 1882. 6*d.*

This relates to a bayonet-closing system for bottles.

2599. MOULDS FOR CASTING STEEL, *A. Patrick, Glasgow.*—2*nd June*, 1882. 4*d.*

As shown in the drawing the body 5 of the mould consists of a tubular piece of thick fire-clay, and rests upon a cast iron sole plate 6, a fire-clay slab 7 being fitted to the bottom of the mould to protect the cast iron sole plate at that part, there being holes in the plate beneath the fire-clay slab to allow gas to escape. The body 5 of the mould is strengthened by iron hoops



8, which are tightened by screw bolts, and can be slackened as required for expansion. Vertical iron straps 9, bolted to the sole plate 6, also assist in strengthening the mould, and are formed with eyes at their upper ends for the attachment of chains for hoisting the mould by.

2601. APPENDAGE FOR PURSES FOR ATTACHING THE SAME TO GLOVES, *S. Cooke, London.*—2*nd June*, 1882. 2*d.*

This relates to the employment of a metal "lip" projecting from one side of the purse, and by a movement of the hand allowed to slide down the opening of the glove at the top of the palm of the hand; also by a chain attached to the side of the purse, at the end of which chain is a small metal hook. This is placed between the second and third fingers and half encircles them at the bottom, and so pulls in the opposite direction to the "lip" before mentioned.

2602. IMPROVEMENTS IN SECONDARY BATTERIES, &c., *Sir C. T. Bright, London*—2*nd June*, 1882. 4*d.*

The inventor divides each cell of his battery into two parts by a porous diaphragm, each part being filled with a number of leaden granules and dilute sulphuric acid. Leaden plates are placed in each part of the cell. Another part of the invention consists in covering the surface of plates with dioxide of lead by first exposing them to the warm vapours of acetic acid and carbonic acid gas, thus converting the outer surface into carbonate of lead, and afterwards treating it with chlorine gas. Another improvement consists in mixing dioxide of lead in the form of powder with the leaden granules above described.

2603. VALVES OR COCKS, *J. Hitch, Battersea.*—2*nd June*, 1882. 6*d.*

In one form of valve two truncated cones are mounted on the same spindle, and close on suitable seatings, the pressure of water acting between them so as to hold the valve in equilibrium.

2605. IMPLEMENTS FOR CULTIVATING LAND, *G. P. Blake, Exeter.*—2*nd June*, 1882. 6*d.*

An endless apron is caused to travel behind a plough, and carries the slice of earth turned up by the plough into a revolving screen, which breaks it up, the fine earth passing through the meshes, while the large stones and weeds are carried up into a receiver.

2606. DRYING HAY, *T. Perkins, Hitchin.*—2*nd June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the withdrawal of moist and heated air from stacks of hay and other crops by means of a fan, the inlet of which is connected by a trunk to a cavity formed in the centre of the stack.

2607. FLOORINGS FOR BRIDGES, *W. H. Lindsay, Paddington.*—2*nd June*, 1882. 6*d.*

This consists in forming the floorings of bridges of alternate V and inverted V troughs connected together, the apex of both being made of flat horizontal plates.

2608. FOLDING SLATES, *C. D. Abel, London.*—2*nd June*, 1882.—(*A communication from W. Shickle, Worms, Germany.*) 6*d.*

This relates partly to a mode of jointing together folding slates or writing tablets, so that the two parts shall be capable of being turned over and folded together in every direction.

2609. TOY OR INSTRUCTION RIFLES, *A. J. Boult, London.*—2*nd June*, 1882.—(*A communication from A. Griveau, France.*)—(*Not proceeded with.*) 2*d.*

This relates to a model breech-loading rifle made of wood, so as to enable the manipulation of real arms to be understood by the user.

2611. DISTILLATION OF COAL, *W. J. Cooper, Westminster.*—2*nd June*, 1882. 2*d.*

This relates to the distillation of coal in and for the manufacture and production of coal gas, and consists in the admixture and use of lime in the form of hydrate of lime or of slacked lime with coal.

2612. STOVES FOR HEATING THE BLAST OF BLAST FURNACES, *C. Lister and T. Wardle, Middlesbrough.*—2*nd June*, 1882. 6*d.*

This relates to the class of stoves described in patent No. 3866, A.D. 1880, and it consists in arranging the combustion and regenerative portions of such stoves so as to provide the passage of the gas or blast through the stove in long vertical currents; and further in preventing the accumulation of deposit on the heating surfaces of the stoves by utilising the scouring effect of the blast when suddenly exhausted through valves previous to admitting a fresh supply of gas.

2614. DOMESTIC STOVES OR FIREPLACES, *C. E. Green, London.*—3*rd June*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to cause domestic stoves to consume the products of combustion, and it consists in causing the latter to pass to a flue behind the fire, and then by suitable flues causing a draught to carry them through the fire to the main flue.

2616. CHURNS, *G. Hathaway, Chippenham.*—3*rd June*, 1882. 4*d.*

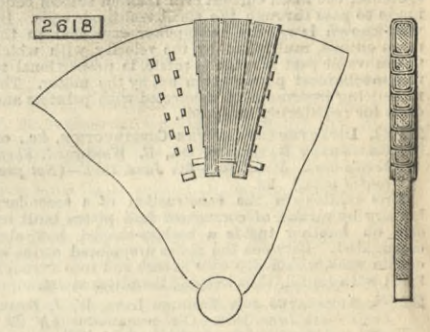
This relates to the cover of revolving end-over-end churns, the object being to reduce the weight and size thereof, and it consists in fixing a ring in the open end of the churn and providing suitable means for securing the lid or cover in place. A detachable metal box is provided to receive sand and balance the churn.

2617. SEWING MACHINERY, *A. Greenwood and J. W. Ramsden, Leeds.*—3*rd June*, 1882. 10*d.*

This relates to machines for producing a lock stitch with waxed thread, the object being to simplify the action and increase the precision of the working parts, thereby allowing them to be driven at a higher speed, and it consists of a machine with a hooked needle and using a locking thread situated above the work; a cop case with a lip at front to facilitate its entrance into the loop of the needle thread, and carried by a fixed holder, the cop case being used in combination with a reciprocating pointed instrument for dividing and spreading the loop, the same being slotted to receive the hooked needle, and furnished with a shoulder for retaining the loop of the needle thread, and working in conjunction with a fixed projection for supporting the loop of the needle thread just prior to the release of the divider and spreader from the loop.

2618. IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, *R. E. B. Crompton, London.*—3*rd June*, 1882. 6*d.*

This relates to an improved method of winding disc armatures. The inventor divides the disc into as many segments as there are intended to be separate coils, and on each segment he winds as many equal and parallel turns of wire as its inner circumferential



width will admit of; he then continues the winding through a series of holes pierced through the disc, or steps cut in the segments, in such manner that each successive turn is shorter than the one preceding it. In this manner he fills up the otherwise unoccupied triangles with winding in a series of turns arranged stepwise, as shown in the accompanying figure.

2619. IMPROVEMENTS IN APPARATUS CONNECTED WITH ELECTRIC LIGHTING, *R. E. B. Crompton, London.*—3*rd June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to arc lamps, and to the regulation of both carbons by means of pulleys and cords, &c.

2621. HORSESHOE NAILS, &c., *H. P. Fenby, Leeds.*—3*rd June*, 1882. 4*d.*

This relates to machinery for the manufacture of horseshoe nails and other like articles by forging from hot rods or pieces of metal, and it consists of a plate sliding vertically and carrying suitable dies, while corresponding dies are fixed to the frame of the machine. The articles are by means of toothed wheels and an endless chain caused to turn over and have each side acted upon successively.

2622. IMPROVEMENTS IN THE METHODS, &c., OF ARRESTING AND DETAINING A PERSON ATTEMPTING TO SURREPTITIOUSLY OPEN A DOOR, &c., *E. L. Missonier, Coventry-street.*—3*rd June*, 1882. 6*d.*

This relates to the combination of batteries, wires, and contact pieces, in such a way that a thief trying to force a door with a key or jemmy, completes the circuit, and is held prisoner by the power of the current contracting his muscles so that he cannot move.

2624. WATER GAUGES, *H. Slater, Derby.*—5*th June*, 1882. 6*d.*

In order to prevent the tubes connecting the water gauge with the water space of the boiler becoming choked, the gauge tubes are fitted in valve boxes or cocks with vertical passages, and the horizontal tubes dispensed with. The cocks or valves are secured in a vertical box let inside the front of the boiler.

2625. CLEANING KNIVES, *C. Spong, Lewisham.*—5*th June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a tray in which the knives are placed and cleaned by means of a traveller.

2626. COMBINED FLUID MEASURER AND LUBRICATING INJECTOR, *J. N. Holliday, Sunderland.*—5*th June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a reservoir containing the lubricant; at the lower part is a charge aperture whence the lubricant is admitted to the measuring capacities or chambers formed by a number of sliding and revolving plugs or blocks having ground faces formed thereon; these plugs are actuated either by hand or mechanically by aid of a shaft, and turn in a cylinder.

2627. REGENERATIVE STOVES FOR HEATING THE BLAST FOR BLAST FURNACES, *B. Ford, Middlesbrough-on-Tees.*—5*th June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a means of removing the deposit from the heating surfaces.

2628. IMPROVEMENTS IN APPARATUS FOR COLLECTING AND TRANSMITTING ELECTRIC FLUID, &c., *H. Defty, Middlesbrough.*—5*th June*, 1882.—(*Not proceeded with.*) 2*d.*

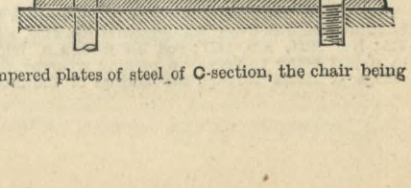
This invention relates to apparatus for collecting electricity from the natural chemical combinations of metals and ores, and transmitting the same for illuminating and other purposes.

2629. INTENSIFYING FLUORESCENT OR PHOSPHORESCENT ELECTRIC LIGHTING, &c., *R. Kennedy, Glasgow.*—5*th June*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a means for intensifying the light produced by discharging high tension electricity in vacuo between two or more metal or carbon bodies, &c.

2631. ELASTIC WEDGES FOR WEDGING UP RAILS, *A. E. Siné, Paris.*—5*th June*, 1882. 6*d.*

This consists in forming the wedges of hardened or

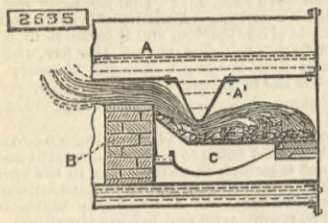


tempered plates of steel of C-section, the chair being

formed to suit the shape of the rail and the elastic wedge, as will be seen in the drawing.

2635. STEAM BOILERS AND STEAM BOILER FURNACES, &c., *F. Brown, Luton.—5th June*, 1882. 4d.

The internal flue A is formed with a hollow projection



A1 extending across the upper part of the interior in front of the ordinary bridge B, near the rear end of the feed bars C.

2640. CORRUGATING OR SHAPING METAL SHEETS, *G. M. Edwards, London.—5th June*, 1882.—(*Not proceeded with.*) 4d.

This relates to machinery for forming, in metal sheets, corrugations in the shape of three sides of a square, or of a dovetailed form, so as to be capable of retaining materials inserted in a plastic or fluid condition, and which will afterwards set or harden.

2642. CONTRIVANCES FOR REGISTERING THE AMOUNT OF WORK GIVEN ELECTRICALLY TO ANY PART OF AN ELECTRIC CIRCUIT WITHIN A GIVEN TIME, *W. E. Ayrton and John Perry, Finsbury.—5th June*, 1882. 4d.

The invention consists of a machine shaped like a dynamo-electric machine, the movable field magnet of which is wound with moderately thick wire. The fixed armatures are wound with a wire of 200 ohms resistance or more. The cores may be of very soft iron. The ends of the high resistance bobbin are connected with the extremities of the portion of a circuit whose supply of energy it is wished to measure, the main current or a fraction thereof being made to pass through the small resistance coils. By well-known laws, the horse-power expended in the main circuit, multiplied by the velocity with which the movable part is made to rotate, is proportional to the mechanical power given out by the motor. The measuring instrument is connected with pointers and dials for registering its speeds.

2643. IMPROVEMENTS IN THE CONSTRUCTION, &c., OF SECONDARY BATTERIES, &c., *H. Woodward, Shepherd's-bush, Middlesex.—6th June*, 1882.—(*Not proceeded with.*) 2d.

This relates to the construction of a secondary battery by means of corrugated lead plates built up one on another inside a beehive-shaped box also corrugated. Between the plates are placed strips of cotton wick which dip over at each end into a trough filled with liquid, thus keeping the plates moist.

2645. APPARATUS FOR MARKING LAYS, *W. J. Dann, Leeds.—6th June*, 1882.—(*Not proceeded with.*) 2d.

Holes are made in the pattern, which is then used as a stencil plate upon the cloth.

2648. BATHING MACHINES, *H. Westman, Birmingham.—6th June*, 1882. 4d.

The machine is made with a sliding door at one or both ends, and outside the door are steps arranged in a spiral and leading down from a platform situated below the level of the floor of the machine, and in connection with which suitable screens are arranged.

2651. CIGARETTES, *B. Posner, P. Rosenberg, and W. Ludski, London.—6th June*, 1882.—(*Not proceeded with.*) 2d.

This relates to the application of a metal mouthpiece.

2655. ELEVATING MACHINERY, *J. V. Hope, Wednesbury.—6th June*, 1882.—(*Not proceeded with.*) 2d.

This consists in preventing the backward slipping of materials being raised by archimedian screw elevators, by the use of plates working in a slot formed in the case of the screw, and occupying the space between the screw threads, such plates being connected together outside by links, so as to form an endless chain.

2658. IMPROVEMENTS IN THE MANUFACTURE OF SECONDARY BATTERIES, *A. Muirhead, Westminster.—6th June*, 1882. 4d.

The inventor claims the preparation and formation of the metallic electrodes of secondary batteries by placing the plates in a vat, through which a stream of a solution containing lead is caused to flow, and then producing deposits upon the plates from the said solution by the electrolysis of the liquid.

2660. IMPROVEMENTS IN CARBON BURNERS FOR ELECTRIC LAMPS, *J. Wetter, New Wandsworth, Surrey.—7th June*, 1882.—(*A communication from W. Stanley, jun., Bergen, New Jersey, U.S.*) 4d.

The inventor takes hairs, preferably human, and immerses them in an alkaline bath to remove greasy matter. They are then laid straight on a plate of glass till dry, and subsequently carbonised in moulds.

2662. KILNS FOR BURNING BRICKS, *J. Davies, near Manchester.—7th June*, 1882. 2d.

This relates to square kilns, and consists in building them with fire-holes on one side only. Inside the ordinary flues smaller flues are formed, and communicate with air-holes left beneath the fire-holes, and also with other holes left in the blank side of the kiln, so that the air entering is heated before passing to the main flue.

2664. SULPHIDE OF SODIUM, *G. W. von Nawrocki, Berlin.—7th June*, 1882.—(*A communication from the Verein Chemischer Fabriken, Germany.*) 2d.

The residue from the manufacture of soda—tank waste—is mixed with ground sulphate of soda in proportions equivalent to the sulphide of calcium contained in the tank waste, and water added sufficient to dissolve the sulphate of soda. The mixture is exposed in closed vessels to steam-pressure, so as to produce the mutual decomposition of the sulphide of calcium and the sulphate of soda.

2665. TABLES, &c., *E. F. Frost, London.—7th June*, 1882.—(*Not proceeded with.*) 2d.

This consists in constructing tables in such manner that their height can be adjusted to suit persons of different ages.

2666. WICKS USED IN OBTAINING ILLUMINATION OR HEAT, *J. T. Reeve, London.—7th June*, 1882. 2d.

This relates to the formation of wicks of asbestos, preferably in combination with cotton or other fibre.

2667. PORTABLE SOLES AND HEELS FOR BOOTS AND SHOES, *G. H. Ellis, London.—7th June*, 1882. 6d.

The object is to form wearing surfaces which may be fixed by the wearer to the soles and heels as desired, and it consists in providing pieces of waste leather with eyelet holes, into which screws may be inserted to secure them in position.

2669. ANTISEPTIC, PRESERVATIVE, CURATIVE, AND CLEANSING COMPOUNDS, *J. Jeyes, Plaistow.—7th June*, 1882. 4d.

This relates to compounds in which the active agent is naphthaline.

2674. IMPROVEMENTS IN ELECTRIC ARC LAMPS, *E. de Pass, London.—7th June*, 1882.—(*A communication from J. Gloker, Paris.*)—(*Not proceeded with.*) 2d.

This relates to an arc lamp in which the upper carbon is regulated by means of two solenoids and an armature.

2677. ROTARY ENGINES, *R. Hodson, Blackwall.—7th June*, 1882.—(*Not proceeded with.*) 2d.

This relates more particularly to improvements in the rotary engines described in patents No. 4458, A.D. 1875; No. 3224, A.D. 1877; and No. 3920, A.D. 1881; the object being to provide a packing whereby the leakage of steam through the bearings of the main shaft, or of the oscillating valve spindle, will be avoided, while at the same time the bearings will be efficiently lubricated, heating prevented, and the friction reduced.

2680. WHEELS OF PERAMBULATORS, BICYCLES, &c., *R. Wood and J. Whyte, Manchester.—7th June*, 1882.—(*Not proceeded with.*) 2d.

The rim of the wheel is of metal, and receives an india-rubber tire, which is secured by the outer ends of some of the spokes projecting through the rim into the tire, and receive nuts. The other ends of the spokes are inserted in holes on one side of the nave in a fixed collar, and in a loose collar on the other side, capable of being pressed towards the former by a screw cap.

2681. TESTING THE CAPACITY OF THE LUNGS, *E. Edwards, London.—7th June*, 1882.—(*A communication from M. Dupont, Paris.*)—(*Not proceeded with.*) 2d.

This relates to an apparatus by which the capacity of the lungs is ascertained, by causing water to pass from one vessel to another by breathing into the first vessel.

2683. TILLING, RAISING POTATOES, &c., *W. H. Sleep, Cornwall.—8th June*, 1882.—(*Not proceeded with.*) 2d.

This relates to the general construction of a machine for tilling, raising potatoes, &c.

2686. IMPROVEMENTS IN ELECTRIC LAMPS, *M. A. Wier, London.—8th June*, 1882.—(*Not proceeded with.*) 2d.

This relates to arc lamps. The inventor causes one or both carbons to revolve on its own axis. The centrifugal force thereby generated causes the incandescent particles to be thrown outwards, whereby the light is spread out and rendered better and steadier.

2688. IMPROVEMENTS IN VOLTAIC BATTERIES, *C. G. Gumpel, Leicester-square.—8th June*, 1882.—(*Not proceeded with.*) 2d.

This relates to the construction of batteries so as to render them portable, and consists in placing the plates in the shape of circular discs in their proper order within a caoutchouc tube, vulcanite discs being inserted between the plates.

2691. STOPPING OR PLUGGING THE ENDS OF BOILER TUBES, *D. McMillan, Govan, N.B.—8th June*, 1882.—(*A communication from N. McMillan, Marseilles.* 6d.

In order to stop leaky boiler tubes a short copper tube is inserted at each end, and fitted to a washer, which closes its inner end. Through the washers a bolt passes from one tube to the other, and its ends each receive a conical plug, which by means of a nut working on one end of the bolt are caused to enter the end of the short tubes, and force them firmly against the ends of the boiler tubes.

2692. PURIFYING CASKS, &c., *J. and B. La Mert, Dorset-square.—8th June*, 1882. 2d.

The insides of casks or other receptacles are first coated with a mixture of shellac, alcohol, and powdered charcoal, and the coating then set alight and allowed to burn until the alcohol is consumed and the surface of the wood slightly charred. An antiseptic such as boracic acid may also be used in combination with the compound described.

2700. MANUFACTURE OF MALLEABLE IRON, *P. J. Ogle, Swansea Valley.—8th June*, 1882. 4d.

This consists in the process for the obtainment of malleable iron direct from forge cinders or puddling and balling furnace slags, or other iron-bearing materials.

2704. APPLIANCE TO FACILITATE THE EXHIBITION OF ADVERTISEMENTS, USEFUL ALSO AS A FAN, *H. R. Griffin, London.—8th June*, 1882.—(*Not proceeded with.*) 2d.

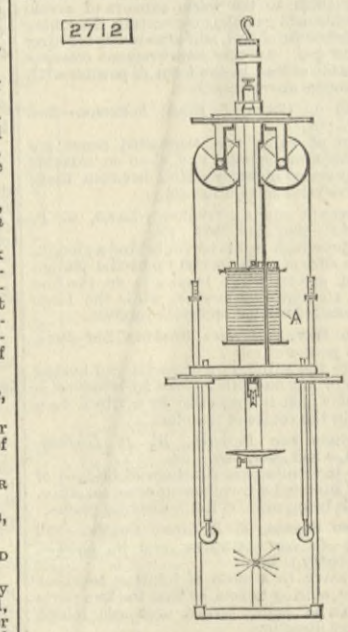
A circular or polygonal card is divided into segments, each containing an advertisement, and supported so as to be capable of revolving in a forked support, whereby any advertisement may be brought into the upright position.

2710. CUTTING OR DRESSING STONE, *G. Anderson, Arbroath, N.B.—9th June*, 1882.—(*Not proceeded with.*) 2d.

This relates to machines with a reciprocating table, and it consists in forming the same of wood to which are secured racks cast with two sets of teeth, the pitch of one being greater than that of the other, and with them gear corresponding pinions of the same diameter. By this arrangement there will be no free space or "back lash" between the teeth.

2712. IMPROVEMENTS IN ELECTRIC LAMPS, *W. R. Lake, London.—9th June*, 1882.—(*A communication from F. Krizik and L. Piette, Pilsen, Austria.*) 6d.

This relates to an improved means of regulating the arc. The upper carbon is attached to an iron case, thick at the bottom, but tapering to a point at its top, which works in and is the core of electro-magnet A. This core is also connected by the pulleys and cords, shown in the figure, to the frame carrying the lower carbon. When a current flows through the



coil the core is attracted upward and the arc struck, and the balance between the attractive force of the coil and the weight of the frame carrying the lower carbon equalised. As the arc increases the current weakens, and the weight of the iron core overcomes the attraction of the coil sufficiently to let the carbons approach so as to again equalise the balance.

2879. PRINTING MACHINES, *J. H. Johnson, London.—19th June*, 1882.—(*A communication from E. Anthony and J. E. Harvey, New York.*)—(*Complete.*) 10d.

This relates to printing by means of the same machine and from two, three, four, or more rolls of papers of various numbers of pages, and also to folding longitudinally, without stopping the motion thereof, a travelling web or sheets in tapes.

2717. WATER-CLOSET APPARATUS, *J. Casey, London.—9th June*, 1882.—(*Not proceeded with.*) 2d.

The object is to provide means for applying a "douche" to the person while seated on a water-closet

2720. DOORS OF CARRIAGES, *G. H. Garrett, Wandsworth-road.—9th June*, 1882.—(*Not proceeded with.*) 2d.

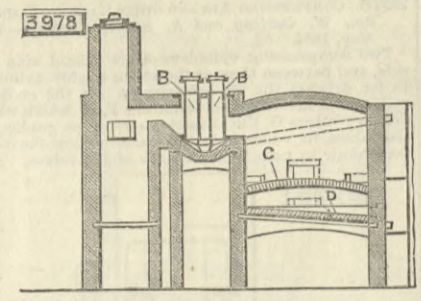
This relates to spring apparatus fitted to the doors of carriages to facilitate the raising and lowering of carriage windows, and to retain them at any desired height.

2736. NEGRO POTS, DUTCH STOVES, CAMP OVENS, &c., *R. Clayton, Stafford.—10th June*, 1882. 6d.

This consists, First, in forming such cooking utensils with loose iron legs attached to a plate connected to the bottom of the utensil; Secondly, in forming the cover so that it may serve as a frying-pan; and, Thirdly, in forming their ears by casting two wedge-formed bits or snugs one on the underside of the rim and the other on the belly of the utensil, the two running together at the point so as to form round ears.

3978. FURNACES FOR REDUCING AND SMELTING ORES, *J. Imray, London.—19th August*, 1882.—(*A communication from J. C. Newbery, J. L. Morley, and B. Cleveland, Melbourne.*)—(*Complete.*) 6d.

This relates to improvements in furnaces for reducing and smelting metallic ores, especially those which form oxides or compounds that may be reduced by heated charcoal, such as ores of antimony, bismuth,



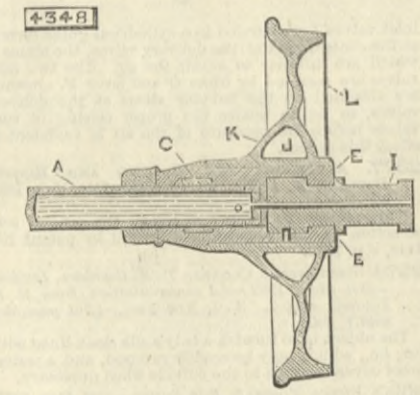
copper, tin, and zinc; and it consists, First, in forming the hearth C, on which the ore is first treated, with holes, through which the ore can fall as it is fused; Secondly, in causing the fused ore to fall on a solid bed D, beneath the perforated hearth C; Thirdly, in treating the oxides in reducing chambers B arranged so that there is a downward draught through the material.

4010. CANNON, *R. H. Brandon, Paris.—21st August*, 1882.—(*A communication from W. E. Woodbridge, Washington, U.S.*)—(*Complete.*) 6d.

This consists in the combination in the structure of a gun of a central tube, with an overlying cylinder of cold wrought bars or staves, the same being over-wound with successive layers of wire in a greater or less part of its length, the tube being also supported by the application of cold wrought bands, the whole being connected and attached to the trunnions.

4348. WHEELS AND AXLES FOR RAILWAY VEHICLES, *W. R. Lake, London.—12th September*, 1882.—(*A communication from R. B. Orne, Philadelphia.*)—(*Complete.*) 6d.

The object is to facilitate wheels of railway vehicles turning round curves, and to overcome the resistance occasioned by the slipping of the wheels on the rails; and it consists in forming the hub K of wheel L larger



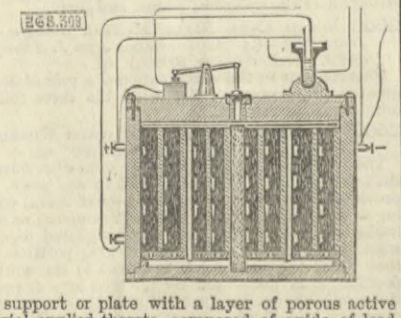
than usual to receive a split bearing E made in two halves, and forming together a round core within the hub. Recesses are formed in the core to fit collars C J and the body of the axle A, which is made hollow and contains oil. The ends I of the axle are connected by pins to cores E, so as to prevent them turning therein, and their outer extremities fit the axle-boxes. Holes are provided to allow the oil to pass from the axle A to the bearings.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

268,308. SECONDARY BATTERY, *Eli T. Starr and E. Eugene Starr, Philadelphia, Pa.—Filed October 6th*, 1882.

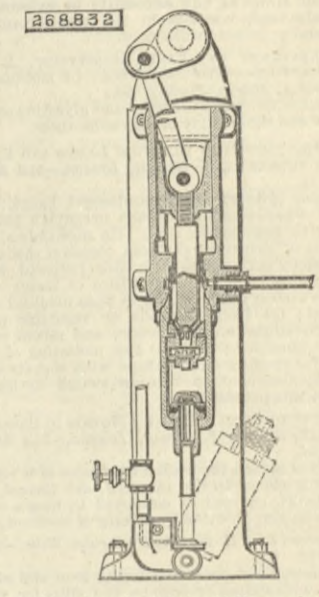
Claim.—(1) The combination, substantially as hereinbefore set forth, of a closed battery vessel containing electrodes or elements, a valve closing an opening in said vessel, an electro-magnet to control said valve, and an electric circuit, substantially as described, including said electrodes and said magnet, whereby during the time the battery is giving off gas the said valve will be automatically opened to permit of its escape and at other times will be closed. (2) The combination, substantially as hereinbefore set forth, of an air-tight secondary battery vessel, electrodes contained in said vessel, a valve-closing a valve opening in said vessel, an electro-magnet mounted on said vessel to control said valve, and a line in which said electro-magnet is situated, by which the charging current is conducted to said battery, whereby while the charging current is passing to the battery the valve will be raised to permit the escape of surplus gases generated in the battery by said current, and when the charging current is cut off said valve will be closed. (3) An element or electrode for secondary batteries, consisting



of a support or plate with a layer of porous active material applied thereto, composed of oxide of lead or its equivalent, mixed with fibre or filaments—in contradistinction to pulverised coke or sawdust—whereby the porous mass is bound together and held more securely to its support or plate. (4) The improved porous active composition for secondary batteries, consisting of a mixture of oxide of lead or its equivalent with or fibre filaments, substantially as described. (5) The combination, substantially as hereinbefore set forth, in a secondary battery, of the battery vessel, the positive and negative electrodes thereof, each electrode consisting of a series of plates coated with porous material to be acted upon by the charging current, and each electrode being provided with a space extending through it for the free escape of the surplus gases, and the porous partition separating said electrodes. (6) The combination, substantially as hereinbefore set forth, in a secondary battery, of the closed battery vessel having a valve opening at its top for the escape of its surplus gases generated in charging the battery, the perforated partition forming a space at the bottom of the battery, the electrodes of said battery supported by said partition, and terminating below the top of the battery vessel to form a space thereat, and tubes or openings affording free communication between said spaces at the top and bottom of the battery. (7) The combination, substantially, as hereinbefore set forth, in a secondary battery, of the battery vessel, the electrodes of the battery terminating at top, so as to leave a space for the collection of the surplus gases generated in the battery, and vertical tubes or spaces extending through the electrodes to facilitate the collection of the gases in the space at the top of the battery.

268,832. PUMP, *William Sellers, Philadelphia, Pa.—Filed 27th February*, 1882.

Claim.—(1) The combination of a fixed discharge chamber, a pump barrel detachably connected thereto and supported thereby, a valved piston, a piston-rod having half the cross sectional area of the piston, and a valved inlet pipe connected by a telescopic joint to



the working barrel, substantially as described. (2) The combination of a fixed discharge chamber, a pump barrel detachably connected thereto and supported thereby, a valved piston, a piston-rod having half the cross sectional area of the piston, and a valved and pivotted inlet pipe connected by a telescopic joint to the working barrel, substantially as described.

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