LINKS IN THE HISTORY OF THE LOCOMOTIVE.

No. XII.

WE have, in gathering up stray links in the history of the locomotive, said nothing as yet of the broad gauge—7ft.—engines of the Great Western Railway; however, not only have these locomotives played an important part in their time, but they are still engaged in working the fastest railway traffic in England, and, we believe, in the world.

When Brunel projected a railway from London to Bristol, he resolved that the speed attained on it should be greater than had been previously contemplated. To this end he made his road 7ft. wide, in order to secure great stability; and he proposed to obtain a perfectly level permanent way by carrying the rails on the tops of piles driven deep into the ground. It is stated that he intended to run over this road when it was finished a truck fitted with two large revolving grindstones, which were to remove every roughness and imperfection from the surface of the rails. It is matter of history that these schemes were not put in practice, a short length of pile road was tried and proved a dismal failure; then the continuous sleeper was adopted. Brunel, after much opposition, carried his point and laid his rails 7ft. apart. One argument, which he used with great effect on his directors, was that by using an exceptional gauge they could keep all competitors out of the South-west of England. In this anticipation he was mistaken; and in order, among

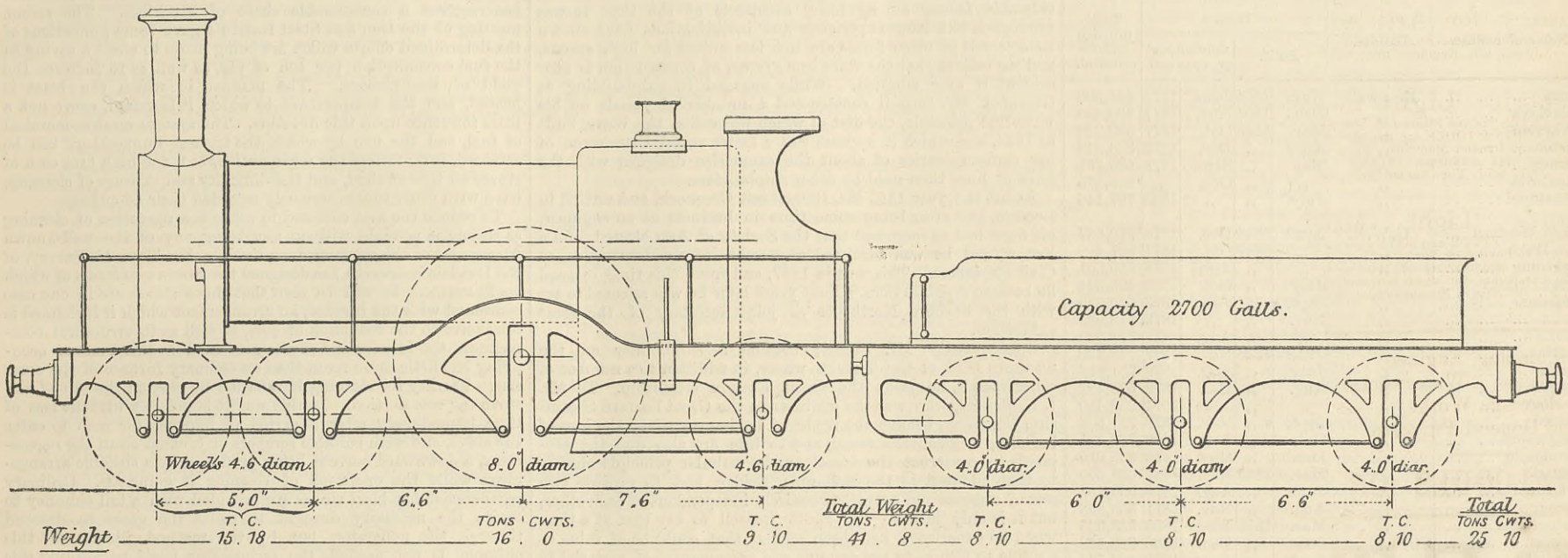
At one period a determined effort was made to extend the use of the broad gauge, and in 1847-48 the battle of the gauges was fought. It was sought to be shown that the resistances on the broad gauge were less than on the 4ft. 8½in. roads. It was contended, in reply, that the narrow gauge could not carry a very powerful locomotive. The answer to this was the Great Liverpool, built in 1848 by Messrs. Bury, Curtis, and Kennedy, from the design of Mr. Crampton. This was the biggest engine made up to that time. It had 18in. outside cylinders, 24in. stroke, 8ft. driving wheels behind the fire-box, and 2260 square feet of heating surface. It had a wheel base of 18ft., and weighed 35 tons, carried on eight wheels. It worked on the London and North-Western for some time, but roads were not then what they are now, and it proved too much for light rails without fish-plates, and was soon discarded. Mr., now Sir Daniel, Gooch had designed and constructed, in 1846, the Great Western, and it is with this class of engine that we are now concerned. It was followed by others of the same type, as will be seen by the annexed tables, for which we are indebted to Mr. Dean, the locomotive superintendent of the Great Western Railway. They had cylinders 18in. diameter by 24in. stroke, a single pair of driving wheels 8ft. in diameter, four leading wheels arranged in a group but not in a bogie, and a pair of trailing wheels; 21 square feet of fire-grate divided into two portions by a transverse mid-feather, over the top of which the grate furthest from the foot-plate is fired; and 153ft. of fire-box surface and

In 1855 Mr. Gooch put another type of engine known as the "Abbot" class on the road. These engines were named, with one exception, after Sir Walter Scott's novels or characters in them. They were, it will be seen from the skeleton diagram, intended to be to some extent coupled "Almas," being designed on the same general principles, but they had two pairs of 7ft. driving wheels instead of one pair of 8ft. wheels. These were, we believe, the largest driving wheels ever coupled. Only ten of these engines were built. They were not successful and have not been perpetuated. The following table gives their performance:—

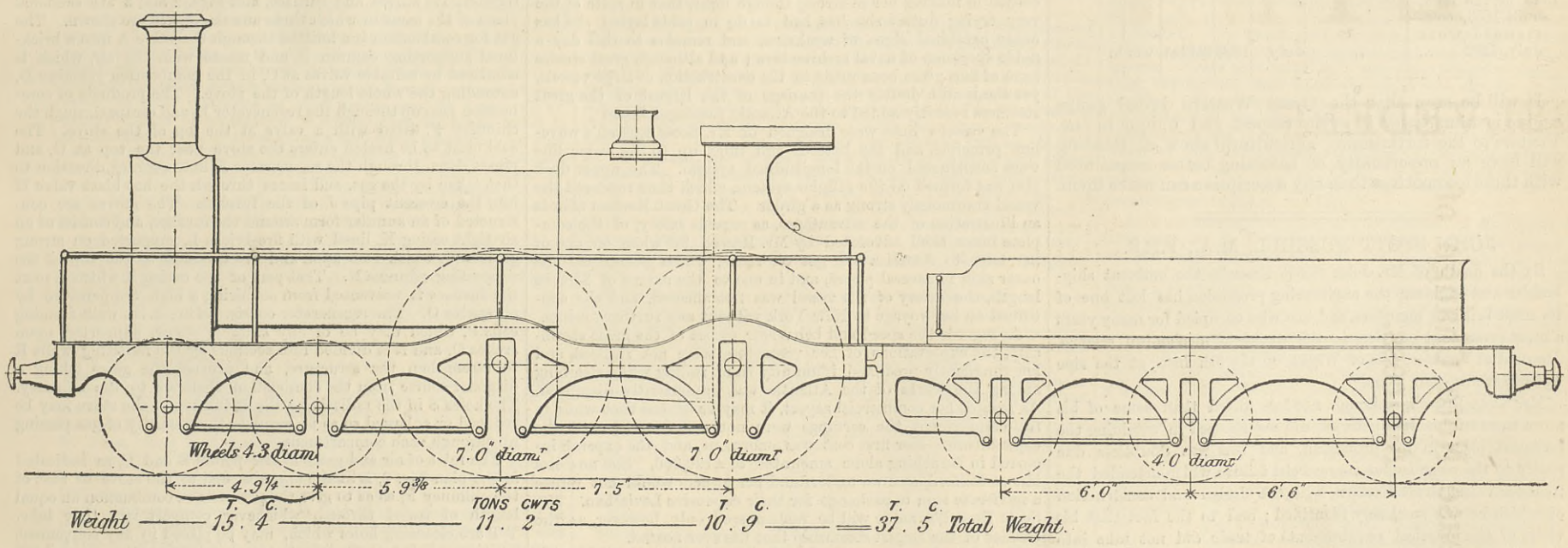
Broad Gauge Engines—"Abbot" Class.

Name of engine.	Builder.	Date. Built.	Date. Condemned or renewed.	Total mileage before renewal.
Lalla Rookh	Stephenson	Feb. 1855	Dec. 1872	430,649
Ivanhoe	,,	Mar. ,,	Sept. 1876	523,862
Robin Hood	,,	,, ,,	Nov. ,,	529,374
Rob Roy...	,,	April ,,	June 1872	451,952
Waverley	,,	,, ,,	,, 1876	516,256
Cœur de Lion ...	,,	May ,,	,, ,,	592,398
Pirate	,,	,, ,,	,, ,,	404,183
Abbot	,,	June ,,	Oct. ,,	520,824
Red Gauntlet ...	,,	,, ,,	Nov. ,,	475,816
Antiquary	,,	July ,,	June ,,	526,458

As we have said, the present Great Britain, illustrated



EXPRESS ENGINE "ALMA" CLASS



EXPRESS ENGINE, "ABBOT" CLASS.

several reasons, to couple the Great Western system with others, it has been found necessary to relay the whole line with a third rail at enormous expense. Why the 7ft. gauge has been retained at all has puzzled many engineers; but the true explanation seems to be, that as a great deal of 7ft. rolling stock existed, it would be unwise to waste it by taking up the broad gauge all at once. Consequently it has been suppressed by degrees, as stock wore out. But it is indisputable that a considerable section of the travelling public likes the wide gauge, and it has been retained over a portion of the system, and engines and carriages have been built from time to time to suit it. The new broad-gauge carriages of the Great Western Railway are the most luxurious in the world; while their great breadth undoubtedly gives steadiness in travelling, and freedom from oscillation to a remarkable degree. It will be readily understood that should one rail be higher than another, say by ¼in., the angle of inclination of the carriage floor would be twice as great if the rails were 4ft. apart as if they were 8ft. asunder. The vertical unevenness of the permanent way may be regarded as a constant quantity, depending for its amount on other conditions than width of gauge; and this being the case, it follows as a natural consequence that mere increase of space between rails is an element of steadiness and promotes the comfort of passengers. The first engines put on the Great Western Railway were of comparatively small size, and many of them were at work until recently on branch lines. Concerning these engines, their construction and history, we may have more to say at another time.

1800ft. of tube surface, made up of 305 tubes 2in. diameter and 11ft. 3in. long. We publish as a supplement this week an ink photograph of one of the best known of these engines. It may be said that it is practically a new locomotive, having been built in 1880; but is in almost all respects like its predecessor. As first constructed, all these engines had small pistons coupled to the slide valves to take some of the pressure off the faces; but the links and pins could not be made to last, and the scheme was abandoned. The driving wheels have no flanges, and the crank shaft has a bearing in the centre between the cranks to take longitudinal but not vertical strains. The guide bars are two in number for each cylinder, arranged one above and the other below the piston rod, which has a block crosshead, the end of the connecting rod being forked, the jaws receiving the crosshead between them; the guide bars are far enough apart to permit the play of the connecting rod. The valves are worked by Gooch's fixed link, too well known to need description. We give a skeleton diagram of one of these engines with the leading dimensions.

It will be seen that the annual mileage of these engines has been very high. Thus, the Sebastopol was at work for twenty-five years, and averaged 28,286 miles per annum. The Lightning ran 816,601 miles in thirty-one years, or 26,343 per annum. Considering the exceptionally high speeds at which these engines have been run, we believe it will not be easy to cite a better performance, even of the very best modern engines.

this week, is a new engine; it was built in September, 1880, but the majority of the engines of this class have had new boilers put upon them. They are employed in working the fast through trains between Paddington and the West of England. The majority have been renewed, but in all essential features the engines now working are similar to the original design; the Lord of the Isles, which was exhibited in the 1851 exhibition, is still running with the original boiler, the total mileage being 789,309.

The fastest trains upon the Great Western system are the 11.45 a.m. and the 3.0 p.m. from Paddington; the latter makes the journey to Plymouth, 246 miles, in six hours, including stoppages; the speed of these trains averages 53 miles per hour between London and Swindon, including starting and stopping and running through Didcot at reduced speed, the distance being 77¼ miles, and the time occupied 87 minutes. The 11.45 a.m. is usually made up from London of one eight-wheeled luggage van, and four eight-wheeled first and second-class composite carriages; and the weight may be taken as follows:—

	Tons.	Cwts.	
Engine and tender in full working order, 2700 gallons water	65	18	
One eight-wheeled van	16	0	} empty
Four eight-wheeled composites	88	0	}
Total	169	18	

It is a noteworthy fact that these engines appear to be among the most economical ever run. Many years ago Mr. Gooch carried out elaborate experiments with them to

ascertain what their performance was; for details we may refer our readers to Mr. D. K. Clark's "Railway Machinery." The following revised table from Clark's "Rules, Tables, and Data," will be found to contain interesting matter. The experiments were made as far back as 1850 with the original Great Britain :—

Notch.	Actual ratio of expansion.	Weight of steam per I.H.P. per indicator.		Total initial pressure at time of cut-off per square inch.
		As cut-off.	As expanded.	
		lb.		
1st	1·45	29·94	30·24	103
,,	,,	32·79	31·65	101
3rd	1·90	25·72	24·86	102
,,	,,	26·32	23·86	87
5th	2·94	21·71	22·70	104
,,	,,	21·88	18·44	78
,,	,,	20·14	18·19	80
Averages :				
1st Notch.		31·36	30·94	102
3rd ,,		26·02	24·36	95
5th ,,		21·24	19·78	87

We may add that the pressure in the valve chest frequently exceeded that in the boiler, a result due to the momentum of the steam. The consumption of fuel seems to have been very low, not much exceeding 2½ lb. per horse-power per hour.

Broad Gauge Engines—"Alma" Class.

Name of engine.	Builder.	Date. Built.	Date. Condemned or renewed.	Total mileage before renewal.
Alma	Rothwell	Nov. 1854	June 1872	444,600
Balaclava	,,	Dec. 1854	Nov. 1871	406,425
Inkerman	,,	Mar. 1855	Oct. 1877	650,220
Kertch	,,	April ,,	Dec. 1872	326,246
Crimea	,,	May ,,	Sept. 1878	605,701
Eupatoria	,,	,, ,,	Oct. ,,	618,275
Sebastopol	,,	July ,,	,, 1880	707,148
Great Western	G.W.R.	April 1846	Dec. 1870	370,687
Iron Duke	,,	,, 1847	Oct. 1871	607,412
Lightning	,,	,, ,,	April 1878	816,601
Great Britain	,,	July ,,	Oct. 1880	403,644
Emperor	,,	Sept. ,,	June 1873	690,225
Pasha	,,	Nov. ,,	,, 1876	613,038
Sultan	,,	,, ,,	Aug. ,,	727,300
Courier	,,	June 1848	Nov. 1877	746,120
Tartar	,,	July ,,	Aug. 1876	731,817
Dragon	,,	Aug. ,,	Dec. 1872	670,757
Warlock	,,	,, ,,	June 1874	639,410
Wizard	,,	Sept. ,,	Nov. 1875	711,908
Rougemont	,,	Oct. ,,	Aug. 1879	772,401
Hirondelle	,,	Dec. ,,	May 1873	605,010
Tornado	,,	Mar. 1849	Mar. 1881	688,000
Swallow	,,	June ,,	Aug. 1871	569,232
Timour	,,	Aug. ,,	Nov. 1871	569,893
Prometheus	,,	Mar. 1850	June 1870	538,025
Perseus	,,	June ,,	Dec. 1880	722,458
Estafette	,,	Sept. ,,	June 1870	504,544
Rover	,,	,, ,,	,, 1871	461,344
Amazon	,,	Mar. 1851	July 1877	729,840
Lord of the Isles, built 1850, commenced work July, 1852	,,	July 1852	Still at work.	

It will be seen that the Great Western broad gauge engine is remarkable in every respect and unique in one. Visitors to the forthcoming agricultural show at Reading will have an opportunity of becoming better acquainted with these locomotives than any description can make them.

JOHN SCOTT RUSSELL, M.A., F.R.S.

By the death of Mr. John Scott Russell, the eminent shipbuilder and engineer, the engineering profession has lost one of its most brilliant members, and one who occupied for many years a most prominent position in the world of mechanical science. He died at Ventnor, Isle of Wight, on the 8th inst., at the ripe age of seventy-four years.

Mr. Scott Russell, although not less gifted than some of his more successful contemporaries, did not succeed in attaining the foremost place in his profession, and this was doubtless due partly to the conspicuous commercial failure which attended the monster vessel Great Eastern, with the design and construction of which he was so closely identified; and to the fact that his views of the practical requirements of trade did not take into account the prejudices from a financial point of view which attend extraordinary enterprises. However, that Mr. Brunel was mainly responsible for the commercial failure involved in the design of that vessel, there can, we think, be no question.

Mr. Scott Russell was born in the Vale of Clyde in the year 1808, when steamship construction was in its infancy, and he lived long enough to see a marvellous development in ocean steam navigation which his wildest dreams could not have contemplated in his youth, but in which he has since so largely assisted. His father, the Rev. David Russell, of Braidwood, found that the future constructor of the Great Eastern and Vienna dome, took an early interest in mathematics and the mechanical sciences; and the Scotch minister consented to his son adopting the profession of mechanical engineering. Young Russell was still assiduous in his scientific studies, and entered the Scotch University, and succeeded in graduating at Glasgow at the early age of sixteen. Only eight years later he had progressed so rapidly in the theory and practice of his profession that, upon the death of Sir John Leslie, Professor of Natural Philosophy in Edinburgh, Mr. Russell was elected to fill the vacant Chair until the permanent appointment of Sir John's successor. In this position Mr. Russell won the high appreciation of those with whom he came in contact for his ability and urbane manners. After relinquishing the post he had temporarily occupied in favour of Professor Forbes, Mr. Russell commenced shipbuilding on the Clyde, and became manager of a shipbuilding yard at Greenock, and began his now famous investigations into the nature of wave motion, and after a long series of experiments, he communicated the results of his researches to the British Association in a paper which he read before them in 1835. This paper contained so much that was novel, and excited so much interest amongst the members of the Association, that Mr. Russell was invited to join Sir John Robinson in extending the experiments at the Association's expense. These experiments were of a most exhaustive character, and it was in conducting these that Mr. Scott Russell discovered the so-called "Wave of Translation," which has ever since been identified with his name. In 1837 Mr. Russell read a paper before the Royal Society of Edinburgh, "On the Laws by which Water Opposes Resistance to the Motion of Floating Bodies," and received the gold medal of the society, and was elected a member of the council. He also read a further paper before the British Association embodying the results of the experiments undertaken on behalf of the association, and describing the positive and negative waves of translation which he had discovered. With the aid of the wave of translation Mr. Scott Russell was enabled to enunciate his wave-line theory as to the best forms of ships—a theory upon which the lines of most of the vessels of his own construction were designed. In the "Transactions" of the Institution of Naval Architects for 1860 and 1861, as well as in his "Manual of Naval Architecture," the author explains with much clearness the application of his principle to the construction of ships. The water-lines of the fore body he made curves of sines and those of the after body trochoids, these curves having been found by experiment to approximate very closely to the outline of the wave of translation. By this principle the lengths of the fore and after bodies of a vessel were made to depend upon the intended speed. The fore body was made equal in length to the wave of translation having the same speed. Mr. Russell claimed for this form of vessel that it offers the least possible resistance to motion through the water, and as the theory appeared to be based on sound mathematical principles it was received with considerable favour among naval architects at the time it was published, but later experience and investigations have shown that vessels of other forms are not less suited for high speeds, and we believe that the wave line system of construction is now seldom if ever adopted. While engaged in shipbuilding at Greenock Mr. Russell constructed a number of vessels on his wave-line principle, the first of which was called the Wave, built in 1834, and which it appears was a faster vessel than some of her contemporaries of about the same size designed with the form of lines then used by other shipbuilders.

About the year 1845 Mr. Russell left Greenock, and settled in London, and after being some time in business as an engineer, his fame had so increased that the Society of Arts elected him a Fellow, and he was admitted a member of the Institution of Civil Engineers. This was in 1847, and from this time onward he became a public man. Four years later he was selected to act with Sir Stafford Northcote as joint secretary of the great exhibition.

Subsequently Mr. Russell became a shipbuilder on the northern bank of the Thames, where, in addition to a number of other vessels, he built the Great Eastern steamship. To Mr. I. K. Brunel, who was the engineer to the Great Eastern Steamship Company, belongs the credit of having conceived the idea of building so gigantic a vessel, and to him are also due the proposals to construct the vessel on the tubular principle similar to that adopted in the Britannia Bridge, and to provide two sets of engines and propellers entirely independent of each other, but it is only just to Mr. Scott Russell to say that at a time when no experience had been gained that could be of value as a guide to him as to the amount and arrangement of material to be put into the hull of so enormous a vessel, compared with which all previous vessels were quite insignificant, he yet succeeded in making her so strong though light, that in spite of the very trying duties she has had to do in cable laying, she has never exhibited signs of weakness, and remains to this day a noble specimen of naval architecture; and although great strides have of late years been made in the construction of large vessels, yet she is still double the tonnage of the largest of the great steamers recently added to the Atlantic passenger fleets.

The vessel's lines were designed on Mr. Scott Russell's wave-line principle, and the bottom and sides up to the water line were constructed on the longitudinal system. The upper deck also was formed on the cellular system, which thus rendered the vessel enormously strong as a girder. The Great Eastern affords an illustration of the advantages, as regards safety, of the complete inner shell advocated by Mr. Russell, for when on one of her trips to America she got on rocks, which penetrated the outer skin in several places, and in one to the extent of 85ft. in length, the safety of the vessel was not affected, and she continued on her voyage to New York without any further mishap.

As regards the speed and behaviour at sea of the great steamship, the expectations of her promoters were not realised, and her confidently predicted immunity from rolling while steaming among the waves of the Atlantic was unpleasantly disproved. As regards her commercial aspect, it may be stated that while in full employment the earnings were not sufficient to cover the expenditure. Her first cost was enormous, and the expense incurred in launching alone amounted to £120,000. She now lies idle at Milford, and we understand her owners would not refuse a moderate sum in exchange for their expensive Leviathan. Mr. Scott Russell's name will be remembered only, however, as the builder of the largest steamship that has ever floated.

Probably the most successful of the undertakings with which the name of Mr. Russell is identified is the great dome of the Vienna Exhibition of 1873. This dome he designed on what he called "the conic form of maximum strength," and it has a span of about 118 yards, and rises to a height of about 195ft. above the top of the iron columns by which it is supported. The span of this dome is nearly three times that of the dome of St. Paul's, and more than twice that of the dome of the London Exhibition of 1862. The roof is of the form of a truncated cone, and weighs over 4000 tons. It is supported by thirty-one columns, the pressure on each of which is nearly 110 tons. From these particulars some idea of its immense magnitude may be had.

Another of the continental successes of Mr. Scott Russell was the design of a steamer to carry railway trains across Lake Constance, between the stations forming the railway termini on the German and Swiss sides of the lake. This plan obviates the necessity of unloading the cargo, with its attendant delay and inconvenience, and has proved completely successful, and is still in operation.

Mr. Scott Russell was one of the first to insist upon the great superiority of iron as compared with wood in the construction of war ships, and frequently urged upon the Admiralty, at a time when they were continuing to build wooden line-of-battle ships, to effect a change in their system of construction; and when, after much delay, the building of the Warrior was decided upon, he was invited to assist, with his wide knowledge of iron ship construction, the professional advisers at the Admiralty in preparing the vessel's design. Associated with iron shipbuilding almost from its commencement, Mr. Scott Russell introduced most of the important improvements which were effected down to the date when he abandoned the actual building of ships. He was the first to introduce the longitudinal system of construction of ships with a complete inner and outer skin; and it may be added that a modification of this principle has been employed in the construction of a large number of steamers for carrying water ballast.

Mr. Russell was one of the founders of the Institution of Naval Architects, of which he held the office of vice-president. He has probably contributed more papers to the "Transactions" of the Institution than any other of its members, and always took a leading part in the discussions.

Mr. Russell, in addition to contributing a large number of papers on professional subjects to the several scientific societies, was the author of a book on "Modern Naval Architecture for Commerce and War," and he wrote the section in one of the editions of the "Encyclopædia Britannica" dealing with the steam engine.

His writings are full of clear, able reasoning, and his immense book on naval architecture will always be of interest to those who study the subject, as the most elegantly written book of its kind.

Mr. Scott Russell was a man of attractive manners and of rare eloquence. As a debater he possessed the power of expounding his views with remarkable force; and as a public speaker, as well as an eminent engineer and naval architect, he will long be remembered by the professions and scientific associations to which he belonged as one of the most brilliant of their members.

HARVEY'S HOT BLAST STOVE.

The keen competition which has for some years prevailed in the iron trade has forced the question of economical manufacture upon the attention of those engaged in that industry. Among the ways by which they have sought a reduction of expenses, the rendering more efficient the blast furnace and its accessories has received a considerable share of attention. The recent meeting of the Iron and Steel Institute gave some indications of the determined efforts which are being made to effect a saving in the fuel consumption per ton of pig, as well as to increase the yield of the furnace. The manner in which the blast is heated, and the temperature to which it is raised, exert not a little influence upon this question. The system most economical of fuel, and the one by which the highest temperature can be attained, is doubtless the regenerative, but the high first cost of stoves on this method, and the difficulty and expense of cleaning, have with other causes seriously retarded their adoption.

To reduce the first cost and to make the operation of cleaning as simple as possible, without sacrificing any of the well-known advantages of the regenerative principle, Mr. Thos. F. Harvey, of the Dowlais Ironworks, has designed the stoves two forms of which we illustrate. It will be seen that these stoves are in one case combined with the furnace, an arrangement which it is claimed is conducive to the reduction of cost, as well as to structural compactness, the furnace and stoves combined in this manner occupying but little more room than an ordinary furnace of the same size. Facility for cleaning is afforded by making the top of the stove the cool portion. In this way it is possible without loss of time, immediately after a period of blowing, for men to enter the stove, and with suitable scrapers or brushes clean the regenerator, a downward current being produced by a suitable arrangement while the operation of cleaning is going on. Ordinary regenerative hot blast stoves are provided with a tall chimney to create the necessary draught to cause the gases to descend through the generator, but by the method illustrated this chimney is not needed, the regenerator itself performing this function.

Fig. 1, page 436, is a sectional elevation of the combined regenerative stoves and furnace, and Figs. 2 and 3 are sectional plans of the same in which three annular stoves are shown. The gas for combustion is admitted through the valve A into a brick-lined supporting column B, and meets with the air, which is admitted by suitable valves at C, in the combustion chamber D, extending the whole length of the stove. The products of combustion pass up through the regenerator E, and escape through the chimney F, fitted with a valve at the top of the stove. The cold blast to be heated enters the stove near the top at G, and passes down through the regenerator E in a contrary direction to that taken by the gas, and issues through the hot blast valve H into the crescent pipe J of the furnace. The stoves are constructed of an annular form around the furnace, and consist of an air-tight casing K, lined with fire-bricks L, supported on strong girders M, which rest upon and are fastened to the top of the supporting columns N. That part of the casing K which is next the furnace is prevented from acquiring a high temperature by air spaces O. The regenerator consists of fire-brick walls forming cells P, which may be of any suitable shape, supported upon arches Q, and it is divided into sections by the radiating walls R to strengthen the structure, and prevent the gases taking a diagonal course from the combustion chamber to the chimney. The holes S in the radiating walls at the top of the stove may be reduced or enlarged so as to regulate the quantity of gas passing up through each compartment.

The inlet of air and gases at the points B and C, as indicated in the plan Fig. 2, is at the opposite end of the stove to that of the chimney F, so as to give the products of combustion an equal length of travel through whichever compartment they take. T T are cleansing holes which, may be placed in any convenient position. U is a short deflecting arch fixed over the air and gas inlet to prevent the escape of unburnt gases up the first compartment of the stove. This system is also applied to separate stoves, concerning which we may have more to say at another time.

Fig. 4 is a vertical section of a separate regenerative hot-blast stove. The gas for combustion enters through the valve X into the flue A, and the air is admitted by a suitable valve placed at T into the flue B. The gas and air meet at C in the combustion chamber D. Th eproducts of combustion pass out through openings O and up into and through the regenerator E, and escape through the chimney F fitted with a valve at the top of the stove. The cold blast to be heated enters the stove near the top at G, and passes down through the regenerator E in a contrary direction to that taken by the gas, and issues through the hot-blast valve H into the hot-blast pipe leading to the furnace. The stove consists of an air-tight casing L lined with fire-bricks resting upon a foundation M. The regenerator consists of walls forming cells J, which may be of any suitable shape, supported upon arches K. Openings are formed above the combustion chamber at N to allow the gas to ascend into the middle compartment of the stove, and the products of combustion have a nearly equal length to travel, whether they go up through the middle or outside compartment of the regenerator E. S S are small openings over the air flue B to prevent the escape of unburnt gases, and ensure their perfect combustion. T T are cleaning holes fitted with air-tight doors, which may be placed in any convenient position.

Naval Engineer Appointments.—The following appointment has been made at the Admiralty:—Edward Williams, engineer, to the Asia, additional, for the Snake, and Robert Pattison, engineer, to the Asia, as supernumerary.

RAILWAY MATTERS.

THE New South Wales Railway accounts for the year 1881 show a net return of 5¼ per cent. on total capital invested.

THE Compagnie du Nord is considering plans for the conversion of the "Imperial" train, which has been laid by since 1870, into a sleeping car train.

A GOODS train proceeding from Burntisland to Perth, on the North British Railway, on Friday last parted in two near the Bridge of Earn. The two portions of the train subsequently came in collision, and twenty wagons were thrown off the rails. Extensive damage was done to the rolling stock and goods, and the line was blocked till the afternoon.

AS rapidly as we introduce American fashions on our railways, Americans are introducing ours, and the last is the extensive introduction and use of Hansom cabs in Philadelphia, Pa., by the Pennsylvania Railroad Company. The cabs are to be constructed on the English pattern, and a contract for thirty has been given to a Connecticut firm of carriage builders. The Pennsylvania Railroad Company intend by means of these cabs to transport passengers from their new depôt to various parts of the city at a very low price.

THE unsightly London and North-Western bridge at the Bailey-street station, Manchester, is to be removed in connection with the widening of the line. The present bridge is a heavy structure, with attempts at decoration in the shape of panels carrying huge griffins in bas-relief, whilst iron columns upon which it is carried over the roadway have long impeded the traffic below. Iron columns and griffins are now to disappear, and the railway traffic is to be carried over the roadway in one span by a bridge of more modern construction and design.

THE Great Western Railway Company having raised the whole of their third-class fares to the west of England stations on which they are not in competition with other lines, a city meeting was yesterday held at Exeter, under the presidency of the mayor, and attended by representatives from other towns, to protest against the action of the company. Instead of charging a penny per mile the fares are on the basis of one penny and an eighth per mile. The course the company have taken was condemned in the strongest terms, and the meeting decided to send a deputation to the directors.

A LOCOMOTIVE boiler exploded on Wednesday on the Pontop and Jarrow Railway. It was thrown up on an embankment and rebounded, smashing the railway plates upon which it fell. The bottom of the boiler was torn like a piece of paper, and the gearing underneath was destroyed. The driver, Joseph Laverick, and fireman, George Snowball, were thrown into the gutter clear of the engine, and escaped with trifling injuries. Two wagons, each containing about four tons of coal, were blown over, and damage was also done to a second train; these wagons, however, saved a cottage close by, which was inhabited by a brickmaker and his family.

ON Friday afternoon last a driver and a fireman were on a London and North-Western engine outside the Walsall station, which, it is said, they were unable to start. In a few minutes they saw a goods train coming towards them, and, fearing an accident, both the men jumped off the engine, which was standing. Immediately afterwards it started off, and dashed through Walsall Station at the rate of twenty miles per hour. The signalman telegraphed to the nearest siding at Cranhall, about two miles outside Walsall, and the pointsman received the message in time to turn the runaway engine on to a siding, where it was soon brought to a standstill without any damage to property or person.

THE Board of Trade report has been published on the collision that occurred on the 25th ult. at Portskewet Pier station of the Great Western Railway, when the 6.40 p.m. train from Cardiff ran against three empty coaches that were standing near the stop-buffers at the south end of the pier, one of the empty coaches being driven over the stop-buffers on to the platform. In concluding the report, Colonel Rich says:—"The collision was caused by the vacuum brake failing to act when it was required. These brakes should not be used when trains are running into terminal stations or up to junctions, or into stations where they are required to run up to the same platforms as other trains may be drawn up at, except in cases of emergency. I believe that the brake failed to act in consequence of there being a very small amount of vacuum in the pipe and cylinders, possibly none, as the train approached the pier, after the driver had applied it three times during the short journey from the junction. I think the efficiency of this brake has been materially interfered with by the hole in the piston-rod, which allows it to leak off in a short time."

THE Swiss *Railway Gazette*—the *Eisenbahn* of Zurich—reports that the Heberlein automatic friction brakes, which were introduced on trial on the Berne-Chaux-de-fonds line about five months since, "have given such thoroughly satisfactory results that the direction of the Jura Berne Lucerne Railway has decided on the gradual adoption of these brakes; and as a commencement, the express and passenger trains on the Berne Lucerne line are being fitted up in readiness for this season's traffic. By the adoption of these powerful brakes, which admit of stopping trains more quickly at the stations and of descending steep inclines at greater speed, a considerable acceleration of the train service can be secured, which, in the case of the Berne Lucerne line—which is 95 kilos. long and has seventeen intermediate stations and inclines of 1 in 50—will amount to a reduction of half an hour in a journey of three hours and a-half. It results from the above that continuous brakes are not only valuable in the case of express trains, but also more especially in that of such passenger trains as have to stop frequently at stations only short distances apart, and which consequently run very often between the stations with even a greater speed than the actual express trains." The Heberlein brake has undergone important modifications since we illustrated it in our columns, and is daily making important progress on numerous railways, chiefly on the Continent. On the Royal Prussian railways a large quantity of new stock is being fitted with the Heberlein automatic brake, and the Imperial German Board of Control for Railways seems to be wholly in favour of this mechanical brake, instead of brakes using vacuum or air pressure.

OUR amusing contemporary *Punch* has the following on "The Wags of Waterloo Again":—"It is not very startling news that last week Ascot Races were held. Most people knew the date beforehand and made their arrangements accordingly. Not so the Wags of Waterloo. Late on Monday night one of them must have seen a newspaper contents bill with the words, 'Ascot Races' on it, when possibly the following scene occurred:—Literary Wag (bursting into Traffic Manager's room): I say, I believe Ascot Races come off to-morrow.—Traffic Manager (doubtfully):—No, really. (Blows through tube.) Send for the *Sporting Times*.—Literary Wag: If it is so, I suppose we ought to do something.—Traffic Manager (sternly): Leave that to *me*. Do you know, sir, that there is now a train from Shepperton which does the distance, eighteen miles, in one hour.—Literary Wag: Come! come! you're chaffing.—Traffic Manager: No! fact upon my word. (*Sporting Times* arrives.) By Jove! Ascot Races *are* to-morrow! (Blows through tube.) Stop all the regular trains. Make everybody generally uncomfortable. Blow the season-ticket holders, and above all *double all the fares*.—Literary Wag (going): Wonderful man! What a head for business! Wonderful! Wonderful! This is what we suppose must have occurred, or otherwise we cannot understand the hopeless bungle of unpunctuality and discomfort into which the traffic of the Waterloo Loop Line was reduced during 'Royal Ascot.'" This bungle does not seem to have been confined to a small radius round Waterloo, for intending passengers from as far as Reading found the ordinary train service so out of gear that they had to return home and wait until next day.

NOTES AND MEMORANDA.

THE Westminster clock continued during the year 1881 to perform well, its errors having been under one second on 40 per cent. of the days of observation, between one second and two seconds on 44 per cent., between two seconds and three seconds on 14 per cent., and between three seconds and four seconds on 2 per cent.

THE value of imports in the Australian Colonies in 1881 was given in the following figures:—New South Wales, £13,950,075; Victoria, £14,556,894; South Australia, £5,581,498; Queensland, £3,087,296; Tasmania, £1,369,223; Western Australia, £353,669; New Zealand, £6,162,011; total £45,060,666.

THE greatest difficulties connected with the use of the rhea, or China grass, is the small proportion of textile filament which it possesses, and the separation of the gummy material in which it is embedded. To reduce the time and expense of preparation, M. Favier, retired captain of Engineer Corps, places the stalks, freshly cut to lengths of 5ft. to 10ft., in a wooden receptacle, to which steam is then admitted. The outside covering is afterwards removed easily by children.

THE number of chronometers now being tested at the Greenwich Observatory is 214; 168 of which—120 box chronometers, twenty-three pocket chronometers, and twenty-five deck watches—belong to the Government, and are being rated after repair previous to being issued to the Navy. The remaining forty-six are placed there for the annual competitive trial, and of these eighteen are fitted with Airy's supplementary compensation. In addition to the above, six chronometers have been placed on trial for the Mauritius Observatory, and five chronometers have been tested for the Japanese Government.

SOME old bricks having been observed to affect the compass needle by Herr Kepner, at Salzburg, in the Tyrol, he then had two bricks made from each of eight varieties of clay in the neighbourhood, one brick in each case being baked. The unbaked bricks did not affect the needle, but seven of the eight baked bricks proved polarly magnetic. Some further experiments have been made by Herren Kell and Trientl. Particles of powder of the magnetic bricks adhered to a steel magnet. Breunerite, mica-slate, argillaceous iron-garnet, chlorite, and hornblende were, before heating, unmagnetic, but intense heating produced a magnetic polarity, the axis of which seemed to be perpendicular to the plane of stratification.

MR. W. W. WELDON has recently devised a process for the manufacture of chlorine on a large scale. It consists in the addition of lime to the residual liquors resulting from the treatment of peroxide of manganese with hydrochloric acid, while a strong current of cold air is blown through the liquid. The hydrate of manganous oxide precipitated by this process is rapidly oxidised by the abstraction of atmospheric oxygen, and forms calcium manganite. After allowing the latter to subside, and after running off the supernatant chloride of calcium which was formed in the decomposition of the protochloride of manganese, of which the residual liquor chiefly consists, it is ready for chloride-making afresh, by the addition of hydrochloric acid. This process is repeated indefinitely, and even a change of vessels is not required.

THAT gases do not mix very rapidly by diffusion alone may be illustrated by placing a strip of white paper moistened with lead acetate solution inside a tall glass stoppered cylinder, so that when the cylinder is inverted the paper extends from the bottom (which now forms the uppermost end) not more than one-third of the total length of the cylinder. A little sulphuretted hydrogen water is placed in the hollow stopper of the cylinder, and the stopper is inserted loosely into its place. After ten to fifteen minutes the production of brown lead sulphide on the white paper shows that the sulphuretted hydrogen gas has risen two-thirds of the height of the cylinder. *Nature* says, paper moistened with starch and potassium iodide, and chlorine water, may respectively replace the lead acetate paper and the sulphuretted hydrogen water (C. von. Than, *Berichte*, xii. 1414).

IN the European postal statistics for 1881 the order of the countries is much as formerly. In England (the first) each inhabitant allows an interval of 10 days between two letters; in Switzerland 14 days; in Wurtemberg, 17; in Germany, 20; in Russia, 280; in Bulgaria, about three years. In newspaper traffic per head of the population, the leading States are Switzerland (18·72), Wurtemberg (14·60), Bavaria (14·54), Denmark (13·56), &c.; France comes 9th, and England 13th. The number of post-offices in 1880 was 55,479; on an average, one to every 454·8 square kilometres and 5859·9 inhabitants. England had 14,212; Germany, 9462; Austria-Hungary, 6326; France, 5913; Russia, 4374; Italy, 3348; &c. In nearly all the States there was an increase. In Switzerland—which is first—there was a post-office to every 998 inhabitants; Norway, 2056; England, 2463; Sweden, 2558; Holland, 3049; Luxemburg, 3175, &c.; France, 6292; Russia, 19,569; Bulgaria, 48,734.

M. BREMOND states as a general law that, by reason of rarefaction of air, "gas loses at least one litre of illuminating power per 50 metres of altitude." He gives the details of an interesting experiment made on the Northern Railroad of Spain, observations being taken at various altitudes on the way from Madrid, 595 metres above sea-level, to La Canada, a station 1373 metres above sea-level. The following table, in which Paris is taken as a unit of comparison, gives some of the results of his experiments:—

City.	Altitude, metres.	Barometric pressure, millimetres.	Illuminating power.
Paris	0	0·754	105
Vienna	68	0·747	103
Moscow	235	0·732	99
Madrid	573	0·705	87
Mexico	2212	0·572	30

FROM a recent work on "Metal Alloys," published in Germany, the author, Mr. Guetlier, gives a few suggestions on the subject of fusing the metals, with which the *Jewellers' Journal* prefaces the recipes selected. (1) The melting pot should be red-hot—a white heat is better—and those metals first placed in it which require the most heat to fuse them. (2) Put the metals in the melting pot in strict order, following exactly the different fusing points from the highest degree of temperature required down to the lowest, in regular sequence, and being especially careful to refrain from adding the next metal until those already in the pot are completely melted. (3) When the metals fused together in the crucible require very different temperatures to melt them a layer of charcoal should be placed upon them, or if there is much tin in the alloy a layer of sand should be used. (4) The molten mass should be vigorously stirred with a stick, and even while pouring it into another vessel the stirring should not be relaxed. (5) Another hint is to use a little old alloy in making new, if there is any on hand, and the concluding word of caution is to make sure that the melting pots are absolutely clean and free from any traces of former operations.

IN the opinion of Herr W. Hempel the hardening of vulcanised india-rubber, which takes place with piping and other goods after a short period of use, is caused by the gradual evaporation of the solvent liquids contained in the india-rubber, and introduced during the process of vulcanisation. Herr Hempel has made experiments for a number of years in order to find a method of preserving the india-rubber. He now finds that keeping in an atmosphere saturated with the vapours of the solvents answers the purpose. India-rubber stoppers, tubing, &c., which still possess their elasticity are to be kept in vessels containing a dish filled with common petroleum. Keeping in wooden boxes is objectionable, while keeping in air-tight glass vessels alone is sufficient to preserve indiarubber for a long time. Exposure to light should be avoided as much as possible. Old hard india-rubber may be softened again by letting the vapour of carbon bisulphide act upon it. As soon as it has become soft it must be removed from the carbon bisulphide atmosphere and kept in the above way. Hard stoppers, the *Journal* of the Society of Chemical Industry says, are easily made fit for use again in this manner, but the elastic properties of tubing cannot well be restored.

MISCELLANEA.

A USEFUL illustrated guide for the various tours which may be made by Macbrayne's steamers from Glasgow to the islands and Highlands, has been published by D. Macbrayne, of Hope-street, Glasgow.

WE understand that M. S. Philippart has retracted every expression and withdrawn every accusation which has been brought by him relating to M. E. Volckmar and his connection with secondary batteries.

THE Hudson River Tunnel has now reached a distance beneath the river of 839ft. in the north tunnel and 700ft. in the south tunnel. The *Scientific American* says the work is progressing at the rate of 4½ft. per day.

FORTY-FIVE years ago, the first sale of Crown lands took place in Melbourne, when £35 was the average price of half-acre town lots. It is some indication of the prosperity of the colony that the value of land in the city is now reckoned by the square inch.

WE understand that the compound tubular boiler of Mr. F. Bone, Bermondsey, which we illustrated a short time since, is about to be employed in the Woolwich Arsenal, and that the Belgian Government has also adopted it for use by the War Department at Antwerp.

MR. A. T. WALMISLEY has arranged to give a course of eight lectures on "Surveying and Levelling" in the rooms of the Society of Engineers, 6, Westminster-chambers, Victoria-street, S.W., and upon the same terms as those now being delivered by Mr. Adams, on "Strains in Ironwork." The lectures will be given on Monday and Friday evenings.

IT is stated that the Indian Government will be prepared to resell the Bengal Ironworks, recently purchased, to any company which may be prepared to take them over with a sufficiently large capital—say 40 to 50 lacs—to give some promise of successfully working and extending them. The works would be resold at cost price. The Government are said to contemplate offering the Chanda and other iron-fields to private companies.

ON Monday the new docks completed on the east side of the Swansea river, which were inaugurated and named in October last by the Prince and Princess of Wales, were formally opened. The docks have a water area of 23 acres, with a depth of 32ft., the total cost being £300,000. The financial statement of the Harbour Trust for the past month shows a surplus of revenue over expenditure amounting to £1500, and this, with one single exception, is the largest monthly profit ever realised by the Trust.

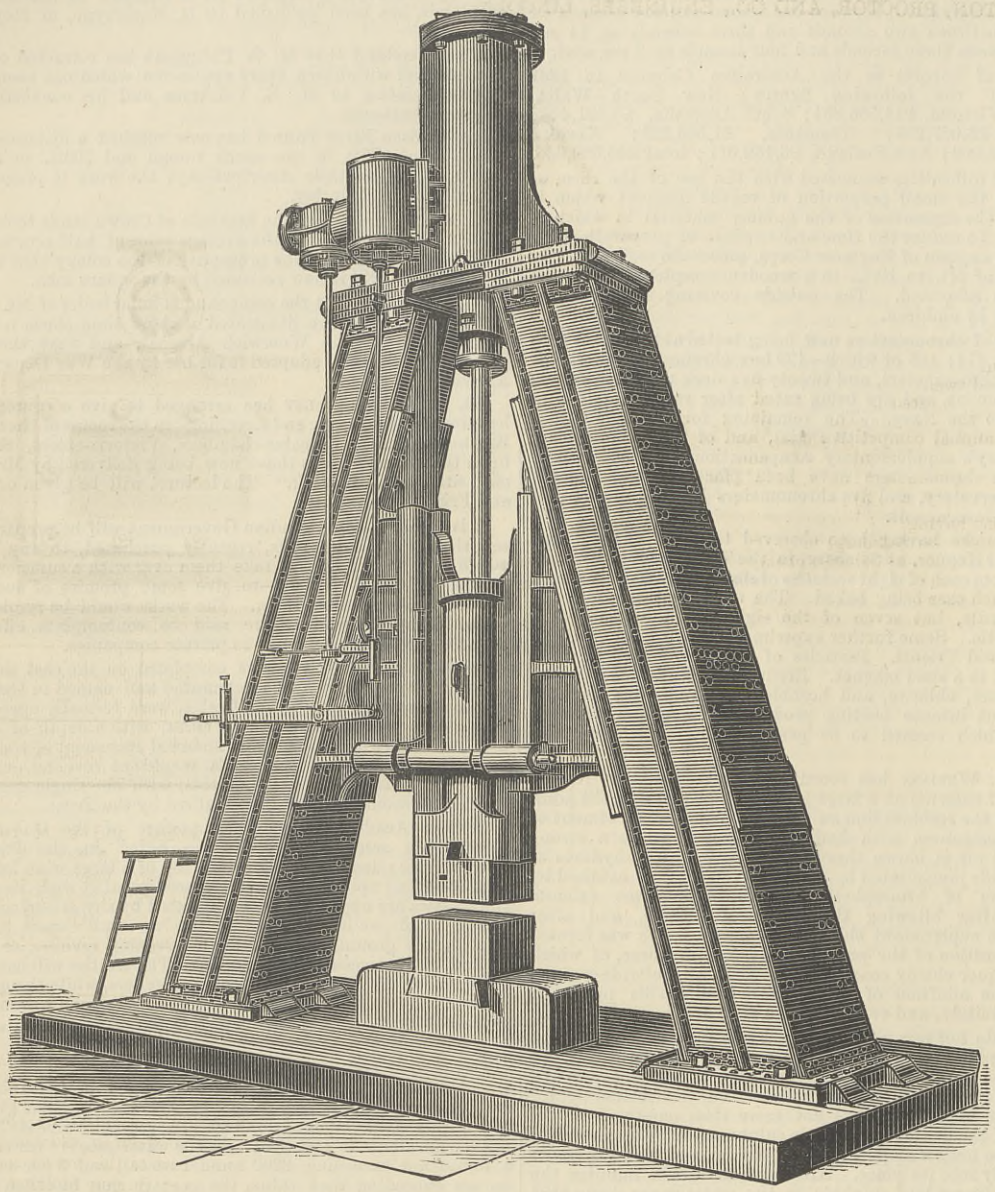
IN the Academy there is a picture of the Queen of the Revels, the same as "*a la plus belle*," in the Paris *salon*, in which the queen is sitting on the top of a large wine butt. This butt is resting upon two trestles placed parallel with its axis, and the trestles are apparently not connected by any crosspiece, so that the next time we look at that picture we shall expect to see the butt on the ground, or with an intervening reveller, or parts of several, and between the two trestles. The trestles will have slipped away on to the legs of some other revellers, while the queen will have taken up a new position, which, from technical inaptitude, we cannot quite define, having only a dim conception that it will be a "miscellaneous" one.

THE *City Press*, commenting upon the decision of the Court of Queen's Bench, that water can be charged for only on the net rateable value of a house, points out that the "annual gross value of property in the City is £4,169,000. The rateable value is £3,531,000, being a difference of £638,000. As the water rate is 4 per cent. upon a house not exceeding £200 annual rental, and 3 per cent. upon houses exceeding that value, the average may be taken at 3½ per cent., and 3½ per cent. upon £638,000, being over £22,000, that represents the annual saving to the citizens of London, if this just decision be carried out. Some thirty years ago, when the New River Company obtained its last Act of Parliament, it contracted under its provisions to supply the City with water at an average of 3½ per cent. on its then annual value, which was somewhat about £1,300,000. The water rent, therefore, at that time, exclusive of extra charges for extra accommodation, was about £45,000 per annum. Years have rolled on; men have ceased to reside in the City, but let out their houses to others who also do not reside in the City. The consumption of water is thus largely diminished, but instead of the charge for it being therefore diminished, if change there was to be, the company, taking advantage of the mere letter of their Act, utterly regardless of its spirit, actually claim the right to increase their charge for a diminished supply from £45,000 per annum to £146,000, that being 3½ per cent. on the present gross rental of the City."

AT a meeting of the Cleveland Institution of Engineers on the 12th inst., Mr. E. W. Richards explained a set of drawings relating to the blast furnace plant of the Edgar-Thompson Works in America. The plant consists of two blast furnaces, 80ft. high and 20ft. in the bosh, the diameter at the hearth being 11ft. 6in. Each furnace has its own lift for supplying it with minerals. The two furnaces are some distance apart, and between them, arranged in a row, are six Cowper's stoves made unusually high. Near these is the boiler-house containing twenty-four boilers, and beyond, the engine-house containing six vertical blowing engines with room for a seventh. The blast mains are of unusual size, and by this means there is only half a pound per square inch difference between the pressure at the blowing engines and that at the tuyeres. At the latter place the pressure is easily maintained to 10 lb. per square inch. The pressure of steam in the boilers is 90 lb. per square inch. The boilers are all roofed in, so are the pig beds, and so are the bunkers in which the stock of materials is kept. The third week after setting to work this blast furnace plant each furnace made 1470 tons of grey Bessemer pig iron. The coke, although the best produced in America, contains a great deal more ash than the best English coke, nevertheless only 22 cwt. was consumed for every ton of iron made. The iron ore contains from 52 per cent. to 54 per cent. of metallic iron and is obtained partly from American and partly from European sources. It is expected that the furnaces will run two years before needing to be relined. The total cost of the blast furnace plant was £200,000, but in England they would not have cost more than £100,000.

AT a meeting of the Cleveland Institution of Engineers, held at Middlesbrough on Monday evening, the 12th inst., Mr. J. E. Stead, F.C.S., read a paper "On a Rapid Method of Estimating Phosphorus." He described the old method of testing for phosphorus, which occupied two days for each estimation. He then explained the new plan he had devised, whereby the same results can be obtained in two hours. In testing for phosphorus in basic steel, there is a special advantage in dealing with such material because it contains no silicon, and under such circumstances the phosphorus can be determined in a single hour. The principal saving of time arises from the absence of any necessity for artificial drying. Mr. Stead then read another paper upon a new apparatus designed by himself for analysing blast furnace gases. The apparatus is in two portions—one portion being used for collecting samples of gas from the mains, and the other portion for dealing with it in the laboratory. Mr. Stead stated that during the production of one ton of pig iron combustible gases weighing nearly 7 tons pass off from a Cleveland blast furnace, and that the calorific power of these gases is equal to that furnished by the combustion of 11½ cwt. of coal. In the production of one ton of pig iron, 5½ tons of air are forced into the furnace, and the combustible gases drawn off from the top of the furnace require 4¾ tons more air to complete their combustion. The total final products of combustion weigh 11¾ tons, and these pass into the atmosphere as waste gases. Mr. Stead advocated strongly the systematic examination of blast furnace gas, stating that he had occasionally detected that one-third of the combustible gas produced was passing into the atmosphere unconsumed. This was equivalent to throwing away about 70 tons of coal per week for each furnace producing 400 tons per week of pig iron.

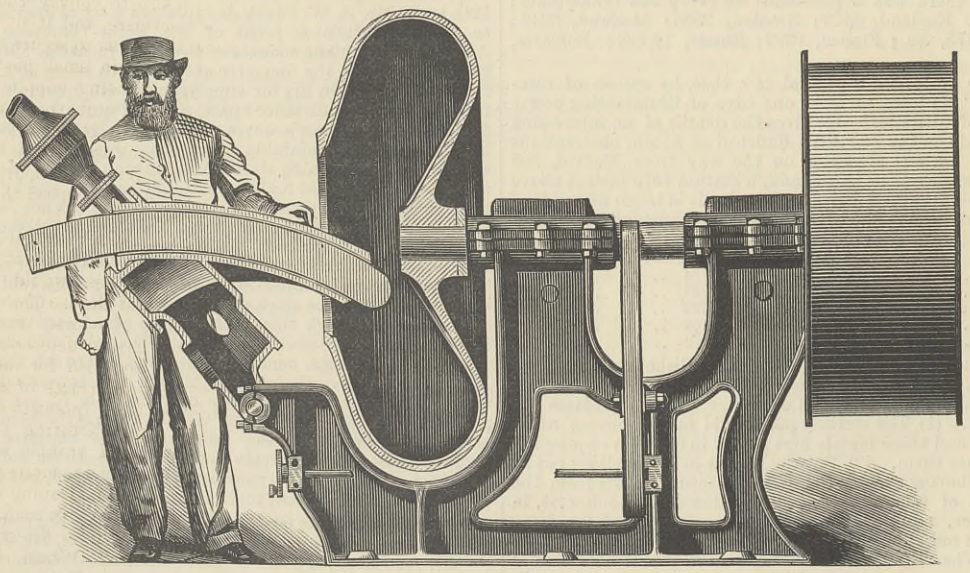
MASSEY'S PATENT WROUGHT IRON FRAMED STEAM HAMMER.



THE framing of this hammer, made by Messrs. B. and S. Massey, Openshaw, Manchester, differs from the ordinary so-called wrought iron framing in having the wrought iron carried right up from the base plate to the cylinder. It has been usual to make the lower part of the framing of hammers in wrought iron, consisting of two pillars and a girder beam, and then to erect upon this a superstructure of cast iron which carries the cylinder, and this cast iron part is, of course, just as subject to breakage as before, as is well known by managers of steel works especially.

In the hammer now illustrated the upper as well as the lower parts of the framing are of wrought iron, cast iron being only used for the slides, and being so introduced that it might be removed altogether without destroying the framing. The wrought iron also is in the form of girders put together on a patented system, thus avoiding any transverse joints. The flanges, which are bolted upon the base plate, are also wrought iron, instead of being of cast iron as usually made. Altogether the hammer has about as strong a framing as it well could have. The engraving is taken from a photograph of a hammer recently made by Messrs. B. and S. Massey for a well-known Russian works.

DUC'S PATENT DISINTEGRATOR.

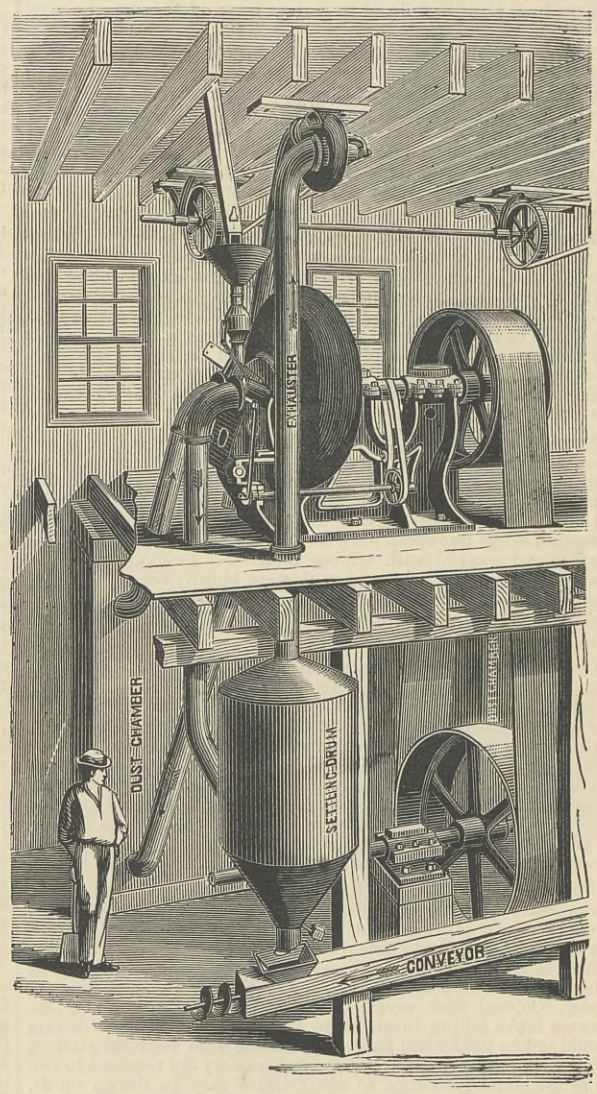


THE machine which we illustrate by the accompanying woodcut is described by the *Scientific American* as one of the most successful of the many machines recently brought to the notice of American milling people. It is the invention of Mr. Henry A. Duc, jun., of Charleston, S.C., and was designed to meet the requirements of the artificial manure manufacturers of the State of South Carolina.

Heretofore, and at the present time in fact, the immense quanties of phosphate rock mined in the neighbourhood of Charleston have been ground for the purpose of manufacture into fertilising material by means of the ordinary burr stones, a slow and expensive method. The Duc mechanical atomiser, as it is called, is certainly worthy of notice. It is purely an "attrition mill," that is, one in which the material grinds itself, thereby relieving the machine from all excessive wear, a great detriment to most of the mills designed for this class of work, in which the machine itself must take half the wear, and the material to be ground the other half. The action of the machine may be best understood by reference to the illustrations. The material to be ground is broken to about the size of chestnuts, dried, and then fed into the mill from the storage bins, the amount of feed being regulated by means of a variable feed movement the same as would be necessary for burr stones.

The broken rock enters the cast iron shell—which is revolved at about 150 turns per minute—and is acted upon by centrifugal force, which causes it to form a ring or belt of rock, adhering to the inner surface of the shell, and revolving with it. The belt is allowed to accumulate to the thickness of 1½in., and is prevented from becoming any thicker by the plough bar—a segmental bar of chilled iron—which extends into the shell, and to within about 1½in. of its inner periphery. This bar is stationary and of the hardest material, to prevent undue wear of its lower extremity in contact with the revolving ring of rock. To compensate for the unavoidable abrasion, it can be inserted further in as may be found necessary, and in time, when worn out, may be replaced at very small cost in two or three minutes' time. The broken material is fed into the shell, and falling in front of the plough bar is prevented by it from turning with the shell, and banks up in a pile, which is kept in a state of rest; meanwhile the ring or belt of rock before alluded to is passing under this pile, and the two surfaces are subjected to severe attrition, which reduces them to a powder in an exceedingly short space of time. The dust produced by this wearing action of the particles of rock among themselves is removed from the mill by means of a partial vacuum induced by a small rotary exhauster, which sucks the air out of the mill case, by which means the ground rock is floated out of the shell and conducted by a pipe to a settling chamber underneath the floor. Here the velocity of the air current is so greatly reduced that the particles of dust are deposited, and by accumulating, gain weight enough to open the valve in the bottom of the chamber, and run out into a screw conveyor, or any proper receptacle.

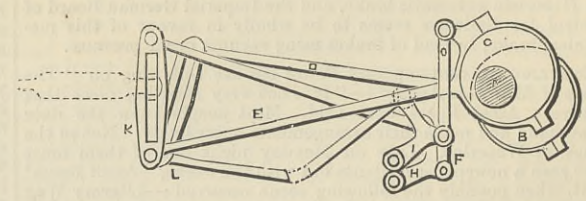
Meanwhile the air, relieved of its load of ground material although still holding in suspension a certain amount of the finest particles of dust, passes through the exhauster, and thence to a chamber consisting of a frame covered with coarse cloth, technically termed a "dust chamber." This portion of the apparatus may be located in any convenient place, and serves as a settling chamber for the finer particles of dust which were not deposited in the first chamber. To compensate for the air taken out of the shell, a pipe is connected from the dust chamber to the "return air port" of the mill, by means of which a "belt of air," so to speak, is formed, which is continually entering the mill, where it is laden with dust, and upon coming out deposits it



in the settling chambers, and again enters the mill on a similar errand. The amount of rock ground with the Duc atomiser in a given time, and by the application of a given power, is, according to the above quoted authority, much greater than the output of burrstones or other devices used for that purpose, and the degree of fineness much more satisfactory; the ground material is quite uniform in grade, due to the fact that the exhauster maintains a constant amount of vacuum sufficient to draw from the mill only such particles of material as have attained the requisite degree of fineness. The usefulness of this machine is not limited in its adaptation to phosphate rock alone, but it has worked successfully on ores, quartz, marble, soapstone, &c. &c., and, in fact, may be employed for any refractory material which it is necessary to reduce to a powder. We should imagine, however, that some materials would be reduced to an impalpable powder before the harder particles would be reduced. Would it act, for instance, for Portland cement?

RENSHAW'S LOCOMOTIVE VALVE GEAR.

THE accompanying engraving illustrates an arrangement of excentrics and levers by which one excentric only is required for each cylinder, and more room for main bearings thus secured. The illustration is thus described in the patent specification—2800, 1881—of Mr. G. P. Renshaw, of Nottingham:—A is the crank axle; B, the fore excentric, giving motion forward to, say, the right-hand engine; C, the back excentric, giving motion

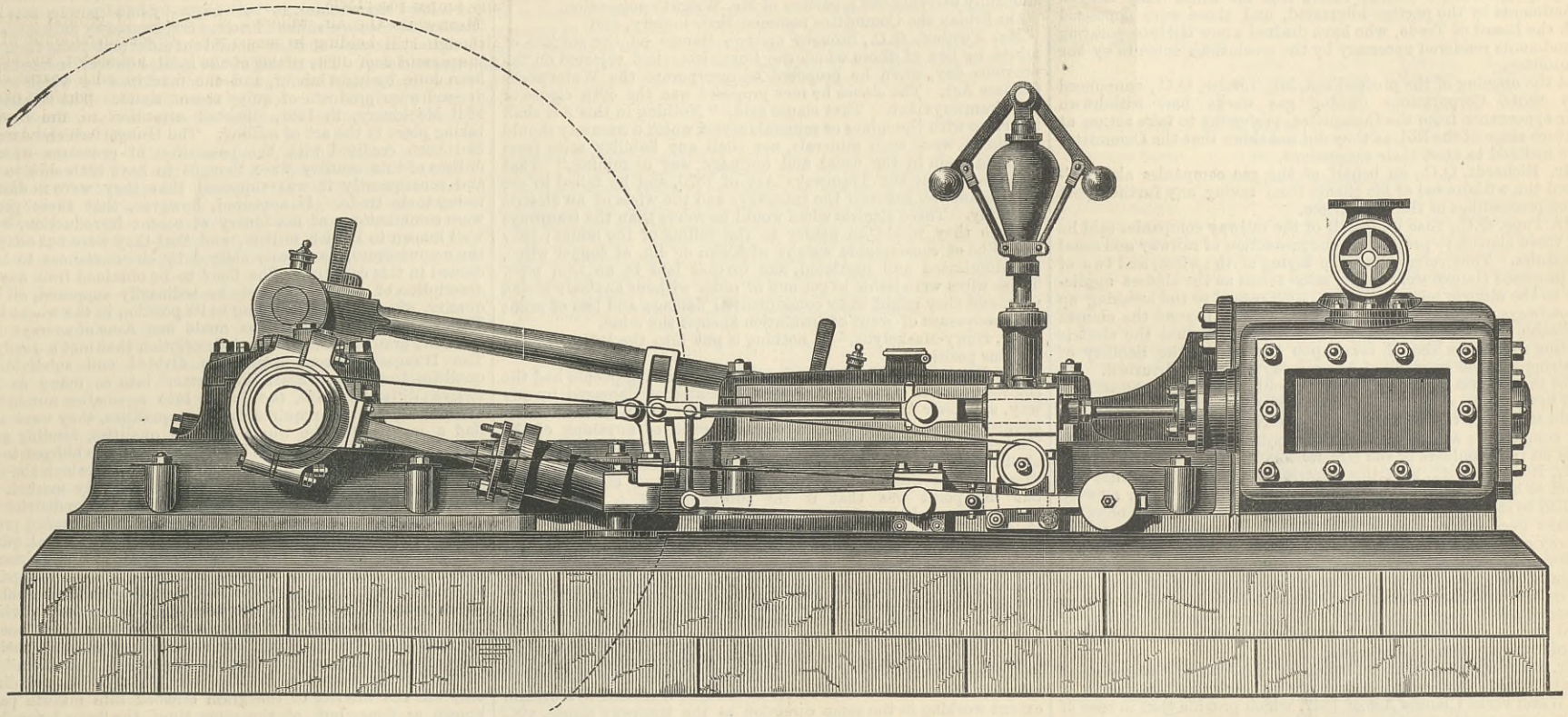


backwards to, say, the left-hand engine; then as the cranks are—as usual—at right angles, it follows that a link F and lever H moved at a suitable angle from the forward excentric B will serve to actuate the upper end of the link K, and in like manner a link G deriving its motion at a suitable angle from the excentric C will serve to actuate through the lower end of the link L the B engine for its back gear motion through the link G and lever I.

UNIVERSITY COLLEGE, BRISTOL.—At a meeting of the council of this college, held on May 24th, Mr. H. S. Hele Shaw, lecturer on mathematics, mechanics, and engineering, was appointed professor of engineering, and Mr. Edward Buch, B.A., of Hertford College, Oxford, was elected lecturer on mathematics. These appointments were made in consequence of the resignation of Professor Main, M.A., D. Sc., who has been appointed assistant professor of mechanics at the Normal College of Science and Royal School of Mines at South Kensington.

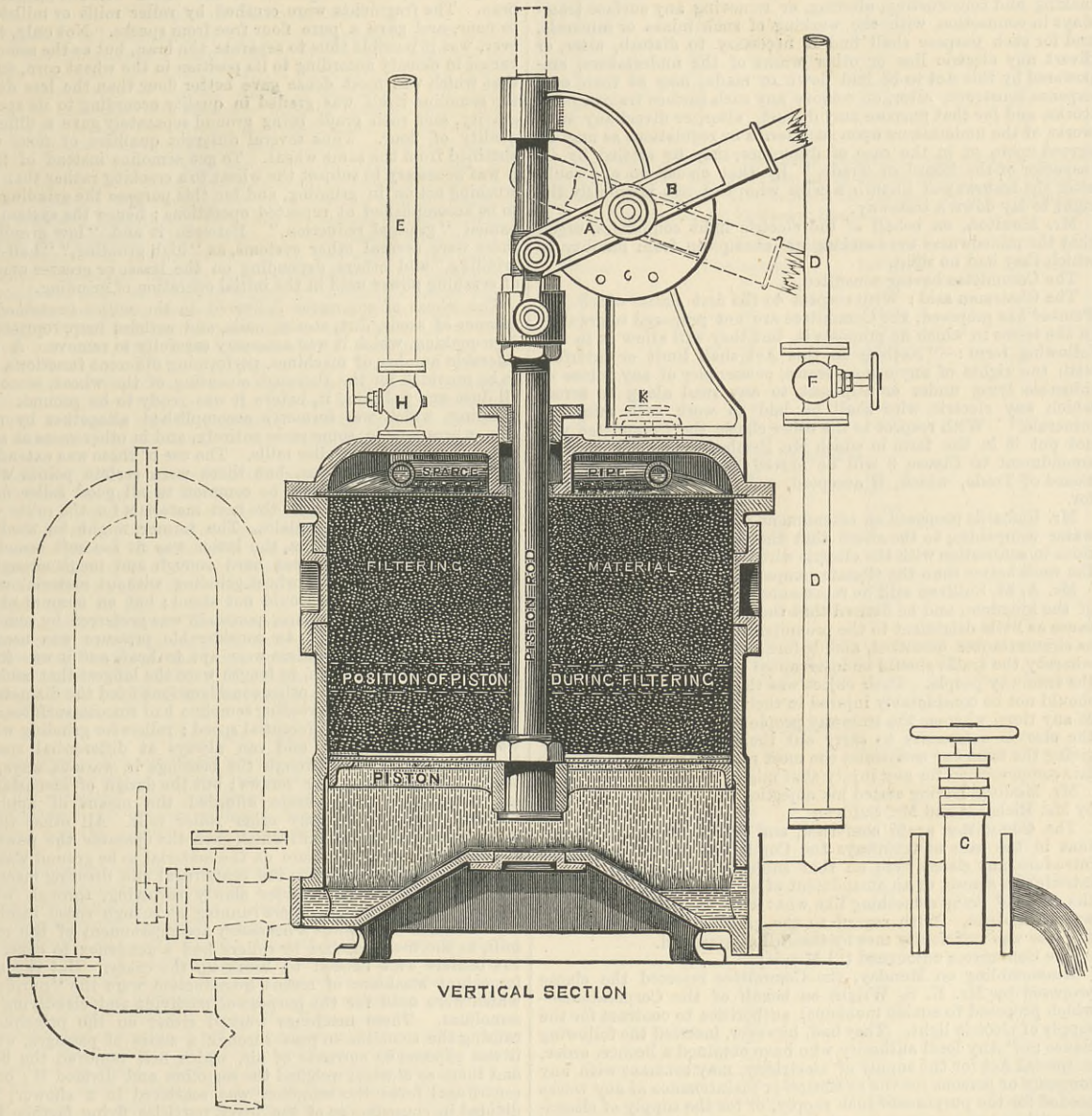
HORIZONTAL ENGINE WITH AUTOMATIC EXPANSION GEAR.

MESSRS. RUSTON, PROCTOR, AND CO., ENGINEERS, LINCOLN.



We illustrate above a type of engine for which Messrs. Ruston and Proctor, of Lincoln, have acquired a considerable reputation. It is made in various sizes from 10-horse power nominal up. The finish and proportions of these engines are all that can be desired. The pedestal of the governor acts as a guide for the valve rods. The cut-off is made variable by the link gear shown. This link rocks on a pivot hidden in our engraving by the feed pump. The weight of the die and the valve connecting rod is balanced by the lever and counterweight. The governor is heavy, and runs at a high speed so as to be able to exert considerable force, and thus determines the power of cut-off with certainty. This is a very essential feature in this class of expansion gear, as the tendency of the die to traverse along the inclined plane of the well lubricated link instead of remaining at rest is in all cases well marked, and must be combatted energetically by the governor, and a neglect of this precaution has proved fatal to more valve gears than one. All the wearing surfaces about the engine are very large and well arranged, and steel has been freely used. One of these engines will, no doubt, be shown at Reading next month and will deserve attention.

THE "THAMES" FILTER.



VERTICAL SECTION

There are many situations whereat it is necessary to use water containing considerable quantities of solids in mechanical suspension because no other can be obtained except at great cost. This is the case with many riverside mill owners, owners of tugs and other vessels employed in the lower reaches of tidal rivers and in harbours, and with the proprietors of baths. The result of the use of such waters is a much more rapid deterioration of boilers than would take place with clean water; in paper mills it causes much inconvenience and cost for filtering, and in tugs and similar steam vessels it not only causes the more rapid wear of boilers, but the vessels have to lie by at frequent intervals for boiler cleaning. A filter that will efficiently remove the suspended matter from such waters has thus long been a requirement, and several attempts have been made to construct one. Filters containing close woven cloth as a filtering medium have been made, but the trouble attending the removal of the deposit or mud from these cloths when filtering very muddy water has been found too great, and attended by so much labour and cost, that filters so constructed even when arranged to be cleaned by reverse currents of water, have not given continued satisfaction. To overcome these objections the Pulsometer Engineering Company has returned to the use of sponge. Every one knows that as against mechanically suspended solids a pressed sponge makes a good and rapid filter. Like any other material, it becomes choked with mud more or less quickly, according to the quantity of water passed through it in a given time. Owing, however, to the expansive power of the sponge when relieved of pressure, it offers a filtering material which can be rapidly cleaned under alternate compression and relief in presence of water. For this then the means are provided in the Thames filter, as it is called by the makers, one arrangement of which is shown in the accompanying section, from which the general arrangement may be gathered. It will be seen that the filter consists of a cast iron cylindrical copper-lined vessel in which is placed a perforated diaphragm which has the motion of a piston given to it when it is necessary to clean the sponge. When ready for filtering, this diaphragm is raised by the piston rod and lever A B, and the sponge between it and the perforated or gauze diaphragm in the upper part of the vessel is compressed. In this position it remains fixed during filtering by a pin in quadrant C, which engages with the lever A B. The dirty water passes down the pipe D, up and through the filter, and issues clean into the pipe E. To clean the filter the valve F admitting the dirty water is closed, and the valve G is opened. The air valve K is also opened. The lever A B is now moved up and down, which causes the piston to alternately compress and allow the expansion of the filtering material. The clean water returning through the pipe E and valve H, enters the upper part of the vessel through the sponge pipe and washes the mud out of the filter through the valve G. This valve is closed during filtering and the F closed during cleansing. In many cases it is preferable to adopt the form of wash-out pipe shown by dotted lines, so as to keep the filter full whilst cleansing. In very large filters the piston rod has a reciprocating movement given to it by an attached steam engine or by other source of power. The pipe E shown as conveying clear water, from the filtered water tank, to wash the filtering material, serves also to convey the filtered water from the filter to a tank or elsewhere, and it usually has an elevation of at least 10ft. given to it so as to secure a head for washing out. The sponge employed is in small pieces, and the cost for renewal is small, the sponge being supplied at about 4d. per lb., the cost per annum being quite nominal. One of the filters of about 2ft. in diameter we recently saw deliver 127·3 gallons in fifteen minutes into a tank arranged as above described, or at the rate of about 500 gallons per hour, which will be allowed to be a high speed. At this speed the filter removed every trace of turbidity, the effluent being bright, but to say that we have seen this filter remove all turbidity from very turbid Thames water taken in at Nine Elms, is only to say what everyone can see would be the result of the arrangement of the filter and the use of compressed sponge as a filtering medium. It is not of course proposed that this filter will render turbid water having deleterious constituents fit for drinking, or what would be called for such purposes perfectly bright, but that it removes all traces of suspended solids at a great speed, so that very large quantities as required for boilers, paper mills, and other manufacturing purposes may be filtered, and so prevent the losses and trouble which follow the use of turbid water. This it does most successfully, and when the sponge is clogged the operation of cleaning in the size above referred to is done in a few minutes by one man.

Amongst others who are using these filters, Messrs. Coles, Shadbolt and Co., of the Thornhill Wharf, Caledonian-road, whose boilers are supplied from the Regent's Canal, find that their boilers, which are 36ft. in length, may run two months and be almost clean at the end of that time, while previously the boilers were constantly cracking and requiring costly repairs, as well as constant cleaning. The smaller sizes of filters are being employed on river boats of various kinds at home and abroad, but larger sizes up to 4ft. in diameter are made for manufacturing purposes, and where large numbers of boilers are in use.

Silloth New Dock.—The proprietor of the Silloth dock, the North British Railway Company, has determined to make an alteration in its shape and size—to increase the area from five and a-quarter to six and a-half acres. The original width will be contracted and the length increased. The ground has been staked out in accordance with the improved plan.

Examinations for Local Surveyors and Inspectors of Nuisances.—At an examination held by the Sanitary Institute of Great Britain on June 8th and 9th thirteen candidates presented themselves. The Institute's certificate of competency to discharge the duties of local surveyors was awarded to Frank Hubber and J. W. Witts, and the Institute's certificate of competency to discharge the duties of inspectors of nuisances was awarded to H. Abrams, W. Atkins, J. Baxter, Samuel C. Fairchild, A. Finlay, T. Lightfoot, G. Steers, and Noah Wright.

THE ELECTRIC LIGHTING COMMITTEE.

On Thursday, June 8th, the Electric Lighting Committee of the House of Commons—presided over by the Hon. E. Stanhope—resumed their inquiry into the draft Bill of the Government on electric lighting. On the last occasion on which the Committee sat they announced certain resolutions on which they desired amendments by the parties interested, and those were deposited with the Board of Trade, who have drafted a new bill incorporating amendments rendered necessary by the resolutions come to by the Committee.

At the opening of the proceedings, Mr. Littler, Q.C., announced that those Corporations owning gas works had withdrawn their appearance from the Committee, preferring to take action at a future stage of the Bill, as they did not think that the Committee were inclined to meet their suggestions.

Mr. Richards, Q.C., on behalf of the gas companies also intimated the withdrawal of his clients from taking any further part in the proceedings of the Committee.

Mr. Pope, Q.C., then on behalf of the railway companies said he had three clauses to propose for the protection of railway and canal companies. They referred to the laying of the wires, and two of the proposed clauses were in the same terms as the clauses applicable to the electric telegraph wires, with regard to the breaking up of roadways. The third proposal went a little beyond the clauses applicable to telegraph wires, because it required that the electric lighting companies should take upon themselves the liability of repairing for ever so much of the railway as they disturbed. No doubt the electric lighting companies would be bound to reinstate a road in the same condition in which they found it, but the law would still leave the liability for maintenance in the hands of railway companies; and this liability the railway companies desired to place on the shoulders of the electric companies.

Mr. Rodwell, Q.C., said the electric lighting companies did not object to have the same restrictions imposed upon them as were applied to others who stood in the same position, but they objected to take over the perpetual maintenance of roadways for which railway companies were at present liable.

The Chairman, after consultation, announced that they would retain in the Bill a provision which was in the original draft that the railway and canal authorities should have notice of the laying of wires, and if they were found to interfere with the railway or canal then the parties should be heard before the Board of Trade in order to have the matter settled.

Mr. Pember, Q.C., next, on behalf of the Mining Association of Great Britain, proposed to incorporate clauses 18 to 27 inclusive of the Waterworks Clauses Act of 1847, which provide that in case of water companies laying pipes the mineowners should be relieved in case they were damaged by subsidence, or the water companies could adopt the alternative of purchasing the mines. This power he asked for insertion in the Electric Light Bill. The other proposal was that where the mineowners desired to alter or remove surface tramways or other works in connection with the working of the mines, and they found it necessary to disturb the electric lighting wires, this should be done by arrangement with the electric lighting companies.

Mr. Chamberlain said the Bill only proposed to deal with public roads, and no question could arise as to private lands. It could only arise in case of a tramway or other wire work being on or under a public road, and at the same time the electric wires were also on that public road.

After consultation, the Chairman said the Committee were of opinion that the proposed clauses of the Waterworks Clauses Act should not be inserted in the Bill, but they would consider the question of disturbance of tramways and other mining works with a view to giving the Mining Association what they wanted.

Mr. R. S. Wright then, on behalf of Corporations not possessed of gas undertakings, desired to have a provision to preclude persons who have patents from excluding all competition in districts by taking out an exclusive licence. To illustrate his proposal, he said Mr. Lane Fox obtained a patent for the distribution of light, and that patent claimed with respect to any possible kind of generator at one end and any possible kind of burner, the use of the secondary battery, which, according to the evidence given before the Committee, was practically the only best known means of distributing properly and effectually and safely the electric light from the generator to the private houses. Assuming that that patent was held good, the obvious consequence would be that Mr. Lane Fox by granting to any one company or any one person an exclusive licence to use the secondary battery—to the district of Liverpool, for instance—could make it impossible for any company or person whatever to enter into competition for any purpose that included domestic lighting, because, according to the evidence, the only way of working domestic lighting would be by using the secondary battery. Neither a Corporation nor a private company who sought the privileges of this Bill ought to have an exclusive licence.

Mr. Moulton, for the electric lighting companies, said this suggested amendment not only went beyond any scheme of electric lighting, but it reality was a proposal to alter and to a great extent repeal the patent laws. He did not understand why the municipalities should ask that a company or person should not be allowed to establish a system of electric lighting because they objected to an exclusive right of some person to use his invention. He was perfectly certain that the proposal did not come from municipalities, but must have come from someone opposed to the patent laws. In the first place there was no patent in the world which suggested the exclusive right of any one person to use secondary batteries. Electric lighting was not dependent upon the efficiency of any one patent; and that was proved by the evidence given before the Committee. They had had before them witnesses representing different systems, who all said that it was feasible to work electric lighting safely with their system. There was no such thing in the electric system as its being tied to one invention or any group of inventions. Supposing there was only one, why was a person to have his patent damaged by not having an exclusive licence for Liverpool? To put in an electric lighting Bill a proviso that a person who had bought a patent was not to use it, was absurd. What possible right was there to hamper the rights of patentees in a Bill of this kind? What would justify such a sweeping amendment of the patent laws? The persons who had got patents had licences thereunder. This proposal would take away from a patentee not only the largest market but the most remunerative market for his invention. He could not see that any ground had been brought forward for such a totally new piece of legislation, and he felt quite certain the Committee would not adopt it.

Mr. R. S. Wright, in reply, said that exclusive licences were things of a very sweeping character. The ordinary way for a patentee to get his profit was to grant the patent to all persons; but exclusive patents were for the sake of extortion. Here there was no interference with property. But it was fair that when a man came to have the benefit of a Bill like this, which gave exceptional power of interference not only with public but with private property, that his monopoly should be restricted. In fact, the electric lighting system might be made wholly useless to the public if some check was not placed on this system of exclusive patents.

In answer to Mr. Story-Maskelyne,

Mr. Moulton said that he knew of five forms of secondary batteries that had been patented, and he believed there were something like thirty patents which were not yet published, the six months not having elapsed for their publication.

Mr. Wright: The particular point of Mr. Lane Fox's patent is that he claims the combination of all possible secondary batteries for all possible generators.

Mr. Moulton: Indeed he does not.

Mr. Wright: As my friend Mr. Moulton advised on the validity of the patent he is a good authority.

The Chairman said the Committee had decided not to insert this proviso.

Mr. Wright next proposed an amendment which was to make provision for all work of breaking up or interfering with streets being done by the local authorities for the undertakers instead of by the undertakers.

The Chairman promised that the Committee would adopt an amendment which would be drawn up by one of its members, substantially carrying out a portion of Mr. Wright's suggestion.

On Friday the Committee resumed their inquiry, and

Mr. Pember, Q.C., brought up two clauses on the subject of mines in lieu of those which the Committee had rejected on the previous day, when he proposed to incorporate the Waterworks Clauses Act. The clause he now proposed was the 59th clause of the Tramways Act. That clause said, "Nothing in this Act shall interfere with the mines or minerals across which a tramway should be laid to work such minerals, nor shall any liability arise from working them in the usual and ordinary way of mining." That was inserted in the Tramways Act of 1870, and he failed to see any distinction between the tramways and the wires of an electric company. These electric wires would be worse than the tramways because they would be nearer to the ceiling of the mines; they would be of considerable weight with 3in. or 4in. of copper wires, and duplicated and insulated, and further laid in an iron pipe. These wires were liable to get out of order without anybody seeing why, and they might show consequential damage and loss of profit in consequence of want of insulation against the mine.

Mr. Story-Maskelyne.—If nothing is put into the Bill what will be your position?

Mr. Pember replied that if these electric lighting people had the slightest notion of their wires being insulated or damaged in any way, and their business had suffered wholly or in part in consequence of any working of mines, subsidence, or anything of the kind, they would immediately have a right of action against the electric companies. At the same time he quite conceded that there was a difference between tramways and electric wires; but his point was that if the subsidence of a road caused by mining would let down a tramway, it would let down the electric wires, and the consequential damages in the latter case would be far greater. However, if the Committee considered that that went too far, he had another form of clause which would perhaps meet their views: "Nothing in this Act shall be construed to interfere with or obstruct the efficient working of mines, or to impose upon the owners, lessees, or workers of mines any burden of support or liability in respect of electric lines or works over or near to any mines, unless such mines have been purchased or the right of support expressly acquired by the undertakers." When he saw that clause he thought it seemed to a certain extent working in the same direction as the tramway clause, viz., that it seemed to give an immunity. In order to make it perfectly clear that no such immunity was given, but on the other hand that no fresh burden was imposed upon the mineowners, and that both the mineowners and the electric lighting companies should be left to their legal rights outside the statute, he recommended keeping the section as it was, but with this proviso: "Provided always that this enactment shall not be taken to alter, lessen, or remove any liability which the owners, lessees, or workers of such mines would otherwise have been subject to at common law or under the provisions of any statute." Then as the Committee were opposed to his amendment of Clause 14, he had altered that amendment, and it would now read as follows: "The owners, lessees, or workers of any mines of coal or other minerals who at any time after the passing of this Act may have the right and shall be desirous of making and constructing, altering, or removing any surface tramways in connection with the working of such mines or minerals, and for such purpose shall find it necessary to disturb, alter, or divert any electric line or other works of the undertakers, empowered by this Act to be laid down or made, may at their own expense construct, alter, or remove any such surface tramways or works, and for that purpose may disturb, alter, or divert any such works of the undertakers upon such terms or regulations as may be agreed upon, or in the case of difference, may be settled by an inspector of the Board of Trade." By that clause no one could alter the tramway or disturb a wire who had not previously the right to lay down a tramway.

Mr. Moulton, on behalf of the electric light companies, urged that the mineowners were seeking an exemption from liability to which they had no right.

The Committee having consulted,

The Chairman said: With respect to the first clause which Mr. Pember has proposed, the Committee are not prepared to grant it in the terms in which he proposes it, but they will allow it in the following form:—"Nothing in this Act shall limit or interfere with the rights of any owner, lessee, or occupier of any mines or minerals lying under or adjacent to any road along or across which any electric wire shall be laid to work such mines or minerals." With respect to the other clause the Committee will not put it in the form in which Mr. Pember proposes it; but an amendment to Clause 9 will be moved by the President of the Board of Trade, which, if accepted, will give all that is asked for.

Mr. Richards proposed an amendment on behalf of the gas and water companies, to the effect that they should make any alterations in connection with the electric wires, because they understood the work better than the electric companies.

Mr. A. M. Sullivan said he represented the tramway companies of the kingdom, and he desired that the electric companies should cause as little detriment to the promoters and lessees of tramways as circumstances admitted, and before they commenced any work whereby the traffic should be interrupted notice should be given to the tramway people. Their object was that the tramway company should not be considerably injured in their traffic by interruptions at any time, whereas the tramway people offered every facility for the electric companies to carry out their necessary works, only giving the tramway companies the most reasonable notice and any fair compensation for any injury that might be done.

Mr. Moulton having stated his objection to the clauses proposed by Mr. Richards and Mr. Sullivan,

The Committee again conferred, and the Chairman announced that in the case of tramways the Committee did not propose to introduce any clause here on that subject, but they proposed to introduce a clause, or an amendment of a clause, which might have the effect of doing something like what was applicable to the roadway authorities. With regard to the gas and water companies, the case was sufficiently met by the Bill as amended.

The Committee adjourned till Monday.

Reassembling on Monday, the Committee rejected the clause proposed by Mr. R. S. Wright on behalf of the Corporations—which proposed to enable municipal authorities to contract for the supply of electric light. They had, however, inserted the following clause:—"Any local authority who have obtained a licence, order, or special Act for the supply of electricity, may contract with any company or persons for the execution or maintenance of any works needed for the purposes of such supply, or for the supply of electricity within any area mentioned in such licence, order, or special Act, or any part of such area; but no local authority, company, or person shall, by any contract or assignment, transfer to any other company or person, or divest themselves of any legal power given to them, or any legal liabilities imposed upon them, by this Act, or by any licence, order, or special Act."

The remaining amendments proposed were agreed to, and the chairman was directed to report the Bill as amended to the House.

THE INSTITUTION OF CIVIL ENGINEERS.

WHEAT GRINDING.

At the meeting on Tuesday, the 16th of May, Sir Frederick Bramwell, vice-president, in the chair, the first paper read was "On the Various Systems of Grinding Wheat, and on the Machines used in Corn Mills," by Mr. W. Proctor Baker.

The author stated that it was impossible to discuss exhaustively in a short paper the different processes and all the various machines used in modern corn mills; but a general sketch of the conditions under which the trade was carried on in the United Kingdom, compared with those of competing countries, and a description of the systems in vogue and of the machines in use might be attempted. Wheat, originally ground in a pestle and mortar, or between rollers and a hard stone tablet, in both cases by hand-power, was by the Romans, at the time of the Christian era, ground by millstones, and a thousand years ago the millstone did not differ materially from that of the present day. The sifting of the meal, however, seemed to have been done by hand labour, and the machines by which flour was dressed were products of quite recent times. The Exhibition of Mill Machinery, in 1881, directed attention to the revolution taking place in the art of milling. The Hungarians and Americans had been credited with the possession of processes which the millers of this country were thought to have been slow to adopt, and consequently it was supposed that they were in danger of losing their trade. It appeared, however, that these processes were combinations of machinery of recent introduction, but still well known to British millers, and that they were not adapted to the manufacture, as it was obliged by circumstances to be conducted in this country. The flour to be obtained from any given description of wheat was not, as ordinarily supposed, all of one quality, which varied according to its position in the wheat kernel. The methods in general use made one flour of average quality from the grain, which was of a description that met a ready sale. The Hungarians and Americans divided and subdivided the qualities from one wheat, the former into as many as ten or twelve different sorts, the latter into a smaller number; and as different markets required different qualities, they were able to find a market for the whole series of qualities, sending each to an appropriate market. But the home miller was obliged to make, for his own local demand, the particular quality which the district required, because the home market was his only market. As a rule, only one quality of flour being required in the district within reach of a mill, the home miller was debarred from using processes whose success depended on finding markets for several qualities, and especially on selling the very fine flours at high prices. The system in general use up to about ten years ago was low grinding, by which it was sought at one operation to crush the kernel of the wheat into flour, and at the same time completely divide the flour from the bran. Lately, the tendency had been not to complete the grinding at one operation, but rather to proceed on a system known as "gradual reduction." The reason for the change of practice was, that in low grinding not only was the interior of the grain crushed into minute particles known as flour, but, at the same time, the bran being brittle, broke, or a portion of it was broken, into equally small particles, and these became inextricably mixed up with the flour and could not be separated from it. The presence of these particles in the flour gave a dark colour to bread made from it. A system based on the Hungarian procedure had come into use in order to avoid this disadvantage. It was sought, while dividing the bran from the interior of the grain, to break up the latter, not into flour, but into fragments of the size of a very small pin's head, known as "semolina," or "middlings." But in doing this, particles of bran were still broken up and mixed with the semolina. The semolina was, however, large enough to be subjected to a winnowing operation, performed by an appropriate machine called a "purifier;" this separated the branny particles, and left the "semolina" pure, being, in fact, small fragments of the wheat without mixture of bran. The fragments were crushed by roller mills or millstones to flour, and gave a pure flour free from specks. Not only, however, was it possible thus to separate the bran, but as the semolina varied in density according to its position in the wheat corn, and as that which was most dense gave better flour than the less dense, the semolina itself was graded in quality according to its specific gravity, and each grade being ground separately gave a different quality of flour. Thus several different qualities of flour were obtained from the same wheat. To get semolina instead of flour, it was necessary to subject the wheat to a cracking rather than to a crushing action in grinding, and for this purpose the grinding had to be accomplished at repeated operations; hence the system was named "gradual reduction." Between it and "low grinding" there were several other systems, as "high grinding," "half-high grinding," and others, depending on the lesser or greater amount of crushing power used in the initial operation of grinding.

The wheat of commerce delivered to the miller contained all manner of seeds, dirt, stones, nails, and articles inappropriate for flour-making, which it was necessary carefully to remove. A considerable number of machines, performing different functions, had to be provided for the thorough cleansing of the wheat, removing all dust and polishing it, before it was ready to be ground. The grinding, which was formerly accomplished altogether by millstones, was now in some cases entirely, and in other cases at some stages, performed by roller mills. The use of these was extending. The designs were various, but there were certain points which experience had shown must be common to all good roller mills. It had been established that the best materials for the roller were chilled cast iron or porcelain. The former might be used for grinding wheat or semolina, the latter was fit for soft semolinas only. The chilled iron was hard enough and tough enough to bear the severe friction of wheat-grinding without material wear, a friction that porcelain would not stand; but on account of the slight porosity of the surface, porcelain was preferred by some for grinding soft semolina. As considerable pressure was used in grinding semolina, the rollers were apt to heat, and it was found that rollers of about 15in. in length were the longest that could be usefully employed, while other considerations fixed the diameter at about 9in. Rollers for grinding semolina had smooth surfaces, and might run at equal or differential speed; rollers for grinding wheat were grooved or fluted, and ran always at differential speeds. Pressure was applied through the bearings in various ways, by levers, wedges, springs, or screws; but the design of Mechwart of an antifriction ring-pressure afforded the means of applying heavier pressure than any other roller mill. All other things being equal, the roller mill which gave the operator the power of putting the greatest pressure on the material to be ground was the best. Another novelty was the centrifugal silk dressing machine, which consisted of a cylinder slowly revolving, through which the flour was driven by beaters running at a high speed inside it. This machine was almost a necessary accompaniment of the roller mill, as the meal ground by rollers had a tendency to cake, and the beaters were needed to break up the cakes. But the most important machines of recent introduction were the "purifiers," which were used for the purpose of purifying and classifying the semolinas. These machines worked either on the principle of causing the semolina to pass through a series of passages, where it was exposed to currents of air, which first removed the bran, and then, as it were, weighed the semolina and divided it; or by centrifugal force the semolina was scattered in a shower, and divided in consequence of the heavy particles flying farther than the light ones; or by an arrangement by which the semolina was made to traverse a long sieve, which had a rapid joggling or oscillating motion. In the latter case the motion caused the heavier particles to sink to the surface of the sieve, and the lighter ones to float on the heavier ones. A pressure of air was kept up under the sieve just sufficient to prevent the light particles from falling through the meshes, while the heavier particles which were heavy enough to overcome the air pressure fell through the sieve and were collected at the bottom of the machine. An exhaust above the sieve carried away the lightest particles, and all but the lightest and the heaviest passed away into a receptacle at the lower end of the sieve. The purifier was of more importance in the modern processes than the roller mill, for the work of the latter might be done by the millstone, while without the purifier neither the millstone nor the roller mill could make pure or the finest flour. As the taste for whiter bread appeared to be on the increase, an extension of the high-grinding systems might be expected.

REPORT ON THE INCANDESCENT LAMPS EXHIBITED AT THE INTERNATIONAL EXPOSITION OF ELECTRICITY PARIS, 1881.*

I.—DESCRIPTION OF THE LAMPS.

THE only lamps in the Exhibition which were purely incandescent in character were those of Edison and Maxim, in the United States section, and those of Swan and Lane-Fox, in that of Great Britain. The idea represented in these lamps is essentially the same in all of them, the differences being, for the most part, details of construction. They all consist of a glass envelope more or less spherical in form, in which is enclosed a carbon loop made of carbonised organic material, and supported upon wires of platinum sealed into the glass. The space in the interior of the lamp is very perfectly exhausted.

A. *The Edison Lamp.*—The Edison lamp is pear-shaped in form. The carbon filament is long and fine, and is bent into the shape of a U. It is made from Japanese bamboo, cut to the requisite size in a gauge. In section it is nearly square, being about 0·3 millimetre on a side, the ends being left considerably wider. The fibre is carbonised in moulds of nickel, and is attached to the conducting wires by copper, electrolytically deposited upon them.

B. *The Swan Lamp.*—The Swan lamp is globular in form, the neck being quite long. The carbon filament is made from cotton thread, parchmentised before carbonisation by treatment with strong sulphuric acid. The ends of this filament are very much thickened, and the loop has a double turn at the top. Its ends are clamped in a pair of metal holders, supported laterally by a stem of glass which rises through the neck to the base of the globe. Below, these holders are fastened to wires of platinum which pass through the glass.

C. *The Maxim Lamp.*—The Maxim lamp is also globular in form, but it has a short neck. Within the neck rises a hollow cylinder of glass, supporting upon its summit a column of blue enamel, through which pass the conducting wires of platinum which carry the carbon. The filament is made from cardboard cut by a punch into the form of an M. In section, therefore, it is rectangular, and several times as broad as it is thick. It is carbonised in a mould through which a current of coal gas is passed. After carbonisation the filament is placed in an attenuated atmosphere of hydrocarbon vapour and heated by the current. The vapour is decomposed, and its carbon is precipitated upon the filament. In this way not only are inequalities obliterated, but the resistance of the filaments may be equalised, and brought to any standard required.

D. *The Lane-Fox Lamp.*—The Lane-Fox lamp is ovoid in shape, the neck being in length intermediate between the two lamps last described. The carbon is in the form of a horseshoe, and is circular in cross section. It is made from the root of an Italian grass, largely used in France for making brooms. After carbonisation the filaments are classified according to their resistances. They are then heated in an atmosphere of coal gas, by which carbon is deposited upon them, as in the filaments of the lamps last described. The filament in the lamp is supported by platinum wires, to which it is attached by sleeves of carbon encircling both. These wires pass through tubes in the top of a hollow glass stem. Just below the extremities of these tubes are two small bulbs containing mercury, forming the contact between the platinum wires sealed into the glass above and the copper conductor which enters from below. These conductors are held in place by plaster, which fills the base of the lamp.

II.—METHODS OF MEASUREMENT.

The question to be determined was simply the efficiency of these lamps. The efficiency of a lamp is the ratio of energy produced to to energy consumed, *i.e.*, the quantity of light given by the lamp for each horse-power of current which it consumes. The data required to calculate this efficiency may be obtained when the electromotive force of the current, the resistance of the lamp when giving its light, and its illuminating power have been determined.

1. *Electromotive Force.*—The electromotive force, or fall of potential through the lamp, was measured by Law's method. A suitable condenser was charged by being put in communication with a standard Daniell cell, and then discharged through a high resistance galvanometer, the deflection of the needle being noted. This condenser was then connected to the two wires of the lamp, and again discharged through the galvanometer, the deflection being made the same as before by means of a variable shunt connected with the galvanometer. Since, with a given condenser, the charges it receives are proportional to the potentials of the charging currents, and since the discharge deflections of a galvanometer represent the quantity of these charges, it follows that the electromotive forces are proportional to these discharge deflections. If, however, as in the present case, the discharge deflections are made equal by means of shunts, then the electromotive forces are proportional to the multiplying power of the shunts.

2. *Resistance.*—The resistance of the lamp, when giving its light, was obtained by making the lamp one side of a Wheatstone's bridge, through which the main current was flowing. The second and fourth sides were formed of fixed resistances of known value, and the third side of an adjustable resistance. When the bridge is balanced the product of the two fixed resistances, divided by the adjusted resistance, gives the resistance of the lamp at the given candle-power.

3. *Illuminating Power.*—The illuminating power of the lamp was measured on a Bunsen photometer. At one end of the bar was the lamp itself, at the other two standard candles, placed nearly in line. The plane of the carbon filament was placed at 45 deg. to the length of the bar, and each lamp was measured at 16 and 32 candles.

III.—APPARATUS EMPLOYED.

1. *Condenser.*—The condenser used in these measurements had a capacity of 1 microfarad, divided into sections of 0·4, 0·3, 0·2, and 0·1. The dielectric was paraffined mica, and the brasswork was supported on ebonite pillars. Made by Latimer Clark, Muirhead, and Co., London, and exhibited in their section at the Exhibition.

2. *Galvanometer.*—The galvanometer was a Thomson double-coil astatic instrument, enclosed in a square case with glass sides. Measured resistance, 6550 ohms. Used with lampstand and scale in the ordinary way. Made by Elliott Brothers, London.

3. *Standard Cell.*—An ordinary Daniell cell, the copper plate being immersed in a saturated solution of pure copper sulphate, contained in the porous cell, and the zinc plate amalgamated in a saturated solution of pure zinc sulphate in the outer jar. One of a battery of ten cells forming a part of the Edison exhibit.

4. *Resistance Coils* —(*a*) A set of standard coils, measuring from 1 ohm to 5000 ohms. All other resistances employed were standardised by these. Made by L. Clark, Muirhead, and Co., and a part of their exhibit. (*b*) A set of coils used in the Wheatstone's bridge. Compared carefully with set (*a*). These coils formed a part of the exhibit of Edison.

5. *Wheatstone's Bridge.*—Four conducting wires of large size arranged on the table in the form of a rhomb. A test galvanometer was inserted between the obtuse angles of the rhomb, and a pair of shunt wires from the main conductors were attached at the acute angles. The first side of the rhomb contained the lamp to be measured, standing in its place on the photometer; the second side contained a fixed resistance of 5 ohms; the third side contained a variable resistance (resistance *b*); and the fourth side a fixed resistance of 950 ohms. This bridge formed a part of the Edison exhibit.

6. *Photometers.*—The photometer employed was of the Bunsen form, having a double bar, 80in. long, graduated in inches and in candles. The disc was of paraffined paper, with a plain spot in the centre. The disc box was movable on rollers, and contained inclined mirrors to facilitate the adjustment. The candles used were of spermaceti, made by Sugg, of London, to burn 120 grains —7·776 grms.—per hour. The entire apparatus was surrounded with heavy black cloth. Also a part of the Edison exhibit.

7. *Dynamo-Electric Machine.*—An Edison 60-light machine was used to furnish the current required. In this machine the field magnets, which are very long and heavy, stand vertically. The field is maintained by a shunt current, regulated by an adjustable resistance in its circuit. The bobbin is wound on a cylinder like that of Siemens, from which it differs, however, in its details. Its resistance was only 0·03 ohm, and the current delivered, at a speed of 900 revolutions, had an electromotive force of 110 volts. A part of the Edison exhibit.

IV.—RESISTANCE OF LAMPS COLD.

The resistance of the lamps cold was measured on a Wheatstone's bridge of the ordinary form and in the usual way. The Edison lamps were taken at random from the stock on hand. The Swan lamps were furnished by Mr. Edmunds, the Lane-Fox lamps by Mr. Stewart, and the Maxim lamps by Mr. Lockwood. Twenty-four of each were taken—except the Lane-Fox, of which only fifteen were furnished—and ten selected from these for the tests. The measurements of the Edison and Swan lamps were made by Mr. E. G. Acheson; those of the Lane-Fox and Maxim lamps by Mr. H. Crookes. The following are the results obtained:—

Number.	Edison.	Swan.	Lane-Fox.	Maxim.
1	237	74	53	73
2	233	50	56	84
3	268	54	56	76
4	260	73	56	74
5	251	55	54	74
6	228	72	50	71
7	227	39	53	68
8	249	67	52	63
9	219	55	57	65
10	237	52	63	73
Means	241	59	55	72

V.—MEASUREMENT OF EFFICIENCY.

1. *Experimental Results.*

A. *The Edison Lamp.*—In this measurement the entire condenser was employed. When charged with the standard cell and discharged through the galvanometer without shunt, a deflection of 310 scale divisions was obtained, as a mean of ten closely accordant experiments. The photometer readings were made by Mr. Crookes, the bridge readings by Major R. Y. Armstrong, and the galvanometer readings by Prof. G. F. Barker.

(*a*) *At* 16 *candles.*

Number of lamp.	Photometer reading.	Bridge reading.	Galvanometer reading.
1	16—14·75	35—34·5	75
2	16—15	35·0	74
3	16	30·5	74
4	16	32·3	73
5	16—17	33·4	73
6	16—17·5	36·0	73
7	16—15	36·6	78
8	16	34·5	75
9	16—19	37·5	74
10	16	37·7	74

(*b*) *At* 32 *candles.*

1	32	37·2	66
2	32	37·2	65
3	32	32·2	66
4	32	34·3	64
5	32	35·2	67
6	32	37·9	69
7	32	38·5	69
8	32	36·3	69
9	32	38·9	69
10	32	38·8	69

B. *The Swan Lamp.*—The entire condenser was used in these measurements also, the deflection being 310 divisions. The photometer was read by Mr. H. Crookes, the bridge by Mr. Crookes, and the galvanometer by Professor Barker.

(*a*) *At* 16 *candles*—

Number.	Photometer.	Bridge.	Galvanometer.
1	16	119·5	136
2	16	161·7	145
3	16	148·8	137
4	16	113·5	122
5	16	145·9	134
6	16	122·1	138
7	16	229·0	179
8	16	135·1	145
9	16	159·5	146
10	16	171·0	145

(*b*) *At* 32 *candles*—

1	32	123·5	121
2	32	167·2	122
3	32	155·2	121
4	32	116·0	116
5	32	154·7	115
6	32	129·7	120
7	32	237·0	146
8	32	137·5	128
9	32	163·0	127
10	32	175·2	120

C. *The Lane-Fox Lamp.*—The entire condenser was employed, and the deflection was the same, 310 divisions. Mr. H. Crookes read the photometer, Mr. Crookes the bridge, and Prof. Barker the galvanometer.

(*a*) *At* 16 *candles*—

Number.	Photometer.	Bridge.	Galvanometer.
1	16	172·0	150
2	16	168·7	145
3	16	177·6	161
4	16	171·7	157
5	16	171·0	156
6	16	189·5	156
7	16	179·0	156
8	16	181·1	164
9	16	161·7	146
10	16	164·7	148

(*b*) *At* 32 *candles*—

1	32	178·7	135
2	32	175·5	129
3	32	181·2	149
4	32	175·2	148
5	32	175·7	143
6	32	192·3	143
7	32	186·2	146
8	32	184·5	146
9	32	167·3	133
10	32	172·0	129

D. *The Maxim Lamp.*—The entire condenser was used, as in the previous cases; but the deflection obtained was 315 divisions, owing probably to the higher temperature of the room. Photometer read by Mr. H. Crookes, bridge by Mr. Crookes, galvanometer by Prof. G. F. Barker.

(*a*) *At* 16 *candles*—

Number.	Photometer.	Bridge.	Galvanometer.
1	16	111·8	115
2	16	111·3	119
3	16	106·2	111
4	16	124·7	120
5	16	111·9	122
6	16	138·5	121
7	16	122·0	122
8	16	115·6	118
9	16	120·6	123
10	16	103·0	111

(*b*) *At* 32 *candles*—

1	32	114·6	102
2	32	114·8	106
3	32	109·7	100
4	32	128·6	112
5	32	114·5	113
6	32	140·8	113
7	32	126·9	110
8	32	120·4	105
9	32	126·5	110
10	32	109·7	102

E. *The Candle Record.*

	Candle-power.	Loss in Grammes.	Time in Minutes.	Loss per Minute.
1. Edison Lamp	16	18·13	73	0·2483
	32	21·22	84	0·2526
2. Swan Lamp	16 and 32	34·15	126	0·2695
3. Lane-Fox Lamp	16 and 32	40·70	153·75	0·2647
4. Maxim Lamp	16 and 32	26·90	104	0·2586

2. *Methods of Calculation.*

1. *Illuminating Power.*—The standard candle should burn 7·776 grms. spermaceti per hour, or 0·1296 grm. per minute. The two candles used should burn 0·2593 grm. per minute. The corrected candle-power of the lamp, therefore, is obtained by the proportion: As 0·2592 is to the amount actually burned per minute, so is the observed candle-power to the corrected candle power.

2. *Resistance (hot).*—From the theory of the Wheatstone bridge, the resistance of either side is equal to the product of the adjacent sides divided by the opposite side. In the bridge used for the measurement the resistances in the two adjacent sides were 950 and 5 ohms. Hence by dividing their product, 4750, by the reading of the variable resistance observed, the resistance of the lamp hot is obtained.

3. *Electromotive Force.*—In Law's method the electromotive forces are proportional to the multiplying power of the shunts employed. Since with the Daniell cell no shunt was used, the multiplying power of the shunt used with the lamp-current represented directly the electromotive force through the lamp, in terms of the standard shell. The multiplying power of a shunt is the sum of the galvanometer resistance and the shunt resistance, divided by the shunt resistance. In this case the resistance of the galvanometer was 6550 ohms. Hence if S represents the resistance of the shunt, obtained by experiment, $\frac{6550 + S}{S}$ will represent the electromotive force. Since the electromotive force of a Daniell cell is not 1 volt, as here assumed, but 1·079 volts, strict accuracy would require the figures given to be increased in that ratio. Moreover, the small error arising from the inductive action of the needle on the galvanometer coils has been regarded as unimportant.

4. *Current.*—By the law of Ohm the current strength is the quotient of electromotive force by resistance. Dividing the electromotive force in volts by the resistance in ohms the current strength is obtained in Ampères.

5. *Electrical Energy.*—The work done by a current is proportional to the product of the square of the current-strength into the resistance of the circuit. Or, since the electromotive force is equal to the product of the current-strength by the resistance, the energy is represented by the product of the electromotive force in volts by the current-strength in Ampères. This gives the energy in Volt-Ampères.

6. *Mechanical Energy.*—Since an absolute unit of work is done per second by an absolute unit of electromotive force in a circuit of one absolute unit of resistance, 1 Volt-Ampère represents 10^7 absolute units of mechanical work per second, or 0·10192 kilogrm.-metre. By multiplying the Volt-Ampères by 0·10192, the product is the mechanical work done in the lamp in kilogrm.-metres.

7. *Lamps per Horse-power of Current.*—One horse-power is 75 kilogrm.-metres per second. By dividing 75, therefore, by the number of kilogrm.-metres of work done in the lamp per second, the quotient is the number of such lamps maintained by a horse-power of current.

8. *Candles per Horse-power of Current.*—The number of candle-lights per horse-power of current is obtained, of course, by multiplying the number of lamps per horse-power of current by the corrected candle-power of each.

9. *Normal Lamps per Horse-power of Current.*—Conversely, by dividing the number of candles per horse-power of current by the normal value of the lamp in standard candles—in the present case 16 or 32—the number of normal lamps per horse-power of current is obtained.

Summary of Results.

(*a*) *At* 16 *candles.*

	Edison.	Swan.	Lane-Fox.	Maxim.
Candles	15·38	16·61	16·36	15·96
Ohms	137·4	32·78	27·40	41·11
Volts	89·11	47·30	43·63	56·49
Ampères	0·651	1·471	1·593	1·380
Volt-Ampères	57·98	69·24	69·53	78·05
Kilogram-metres	5·911	7·059	7·089	7·939
Lamps per horse-power	12·73	10·71	10·61	9·48
Candles per horse-power	196·4	177·92	173·58	151·27
Lamps of 16 candles per horse-power	12·28	11·12	10·85	9·45

(*b*) *At* 32 *candles.*

Candles	31·11	33·21	32·71	31·93
Ohms	130·03	31·75	26·59	39·60
Volts	98·39	54·21	48·22	62·27
Ampères	0·7585	1·758	1·815	1·578
Volt-Ampères	74·62	94·88	87·65	98·41
Kilogram-mètres	7·604	9·67	8·936	10·03
Lamps per horse-power	9·88	7·90	8·47	7·50
Candles per horse-power	307·25	262·49	276·89	239·41
Lamps of 32 candles per horse-power	9·60	8·20	8·65	7·48

VI.—CONCLUSIONS.

The following conclusions seem to be sustained by the results which have now been given:—

1st.—The maximum efficiency of incandescent lamps in the present state of the subject, and within the experimental limits of this investigation, cannot be assumed to exceed 300 candle-lights per horse-power of current.

2nd.—The economy of all lamps of this kind is greater at high than at low incandescence.

3rd.—The economy of light-production is greater in high resistance lamps than in those of low resistance, thus agreeing with the economy of distribution.

4th.—The relative efficiency of the four lamps examined, expressed in Carcel burners of 7·4 spermaceti candles each, produced by one horse-power of current, is as follows:—(A.) At 16 candles: Edison, 26·5; Swan, 24; Lane-Fox, 23·5; and Maxim, 20·4. (B.) At 32 candles: Edison, 41·5; Lane-Fox, 37·4; Swan, 35·5; and Maxim, 32·4. To double the light given by these lamps, the current-energy was increased—for the Maxim and Lane-Fox lamps, 26 per cent.; for the Edison lamp, 28 per cent.; and for the Swan lamp, 37 per cent.

* By an Experimental Committee, consisting of Messrs. George F. Barker, William Crookes, and others.

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DESIGNED BY MR. T. F. HARVEY, DOWLAIS IRONWORKS.

(*For description see page* 430.)

FIG. 1.
SECTIONAL ELEVATION ON LINE A.B.

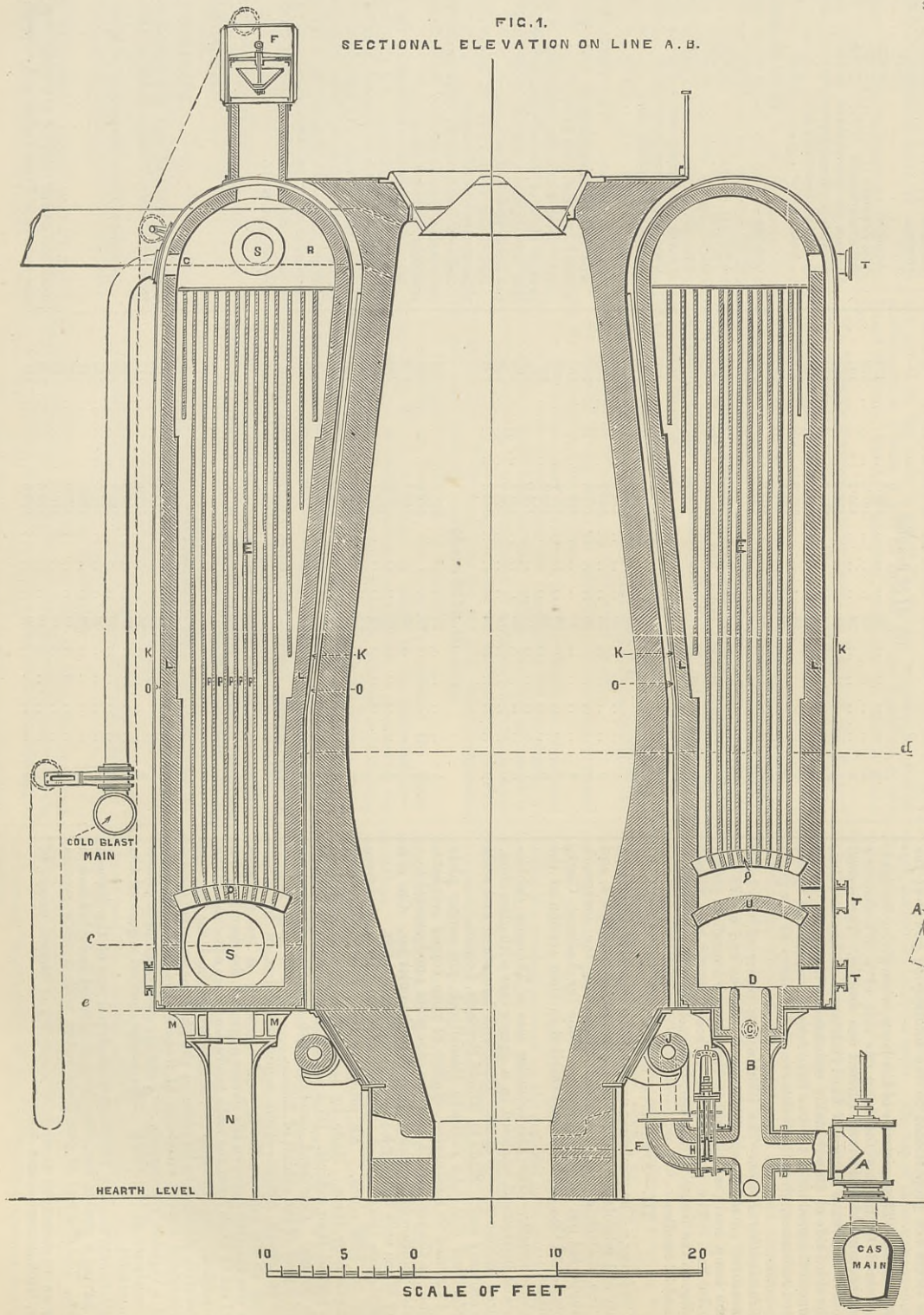


FIG. 2.
SECTIONAL PLAN ON LINE C.D.

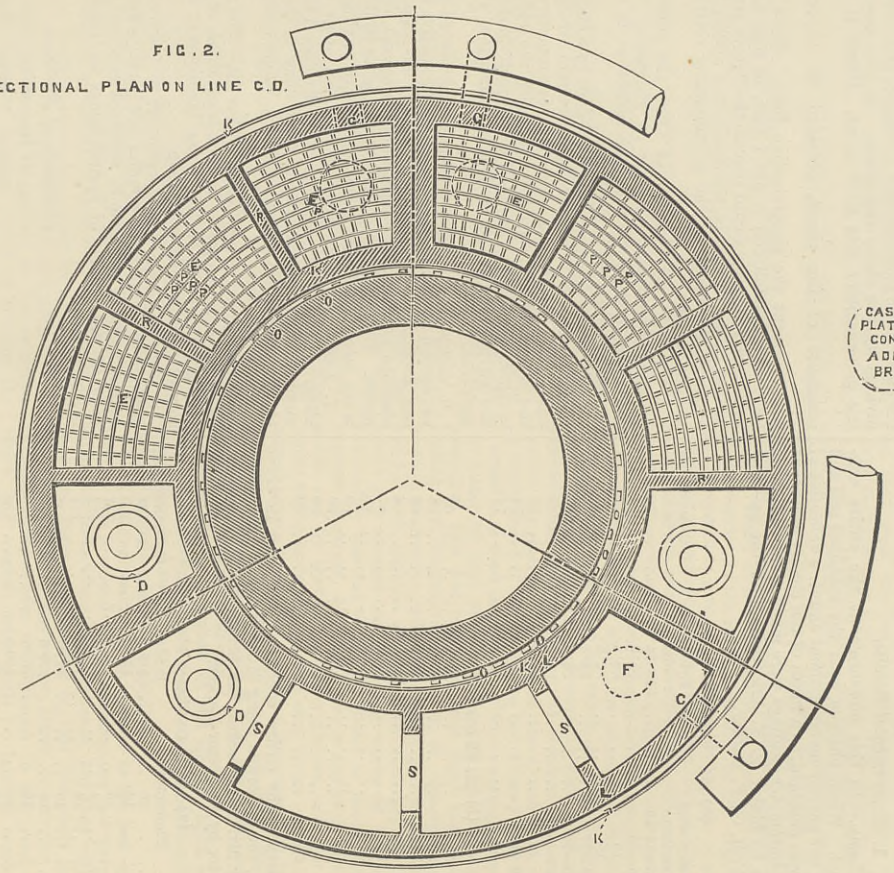


FIG. 3
SECTIONAL PLAN ON LINE E.F

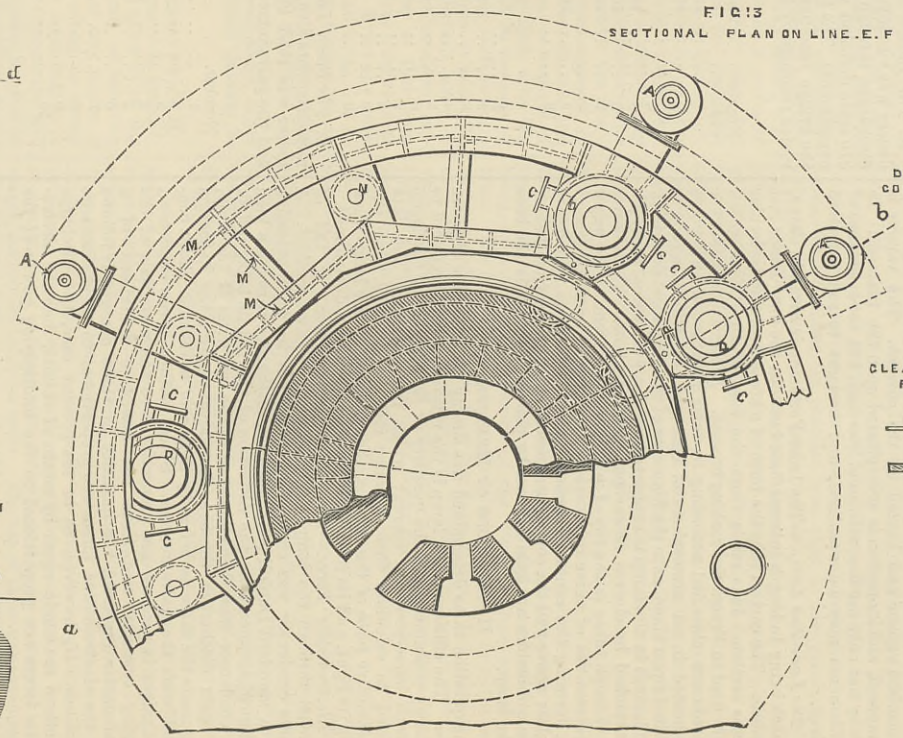
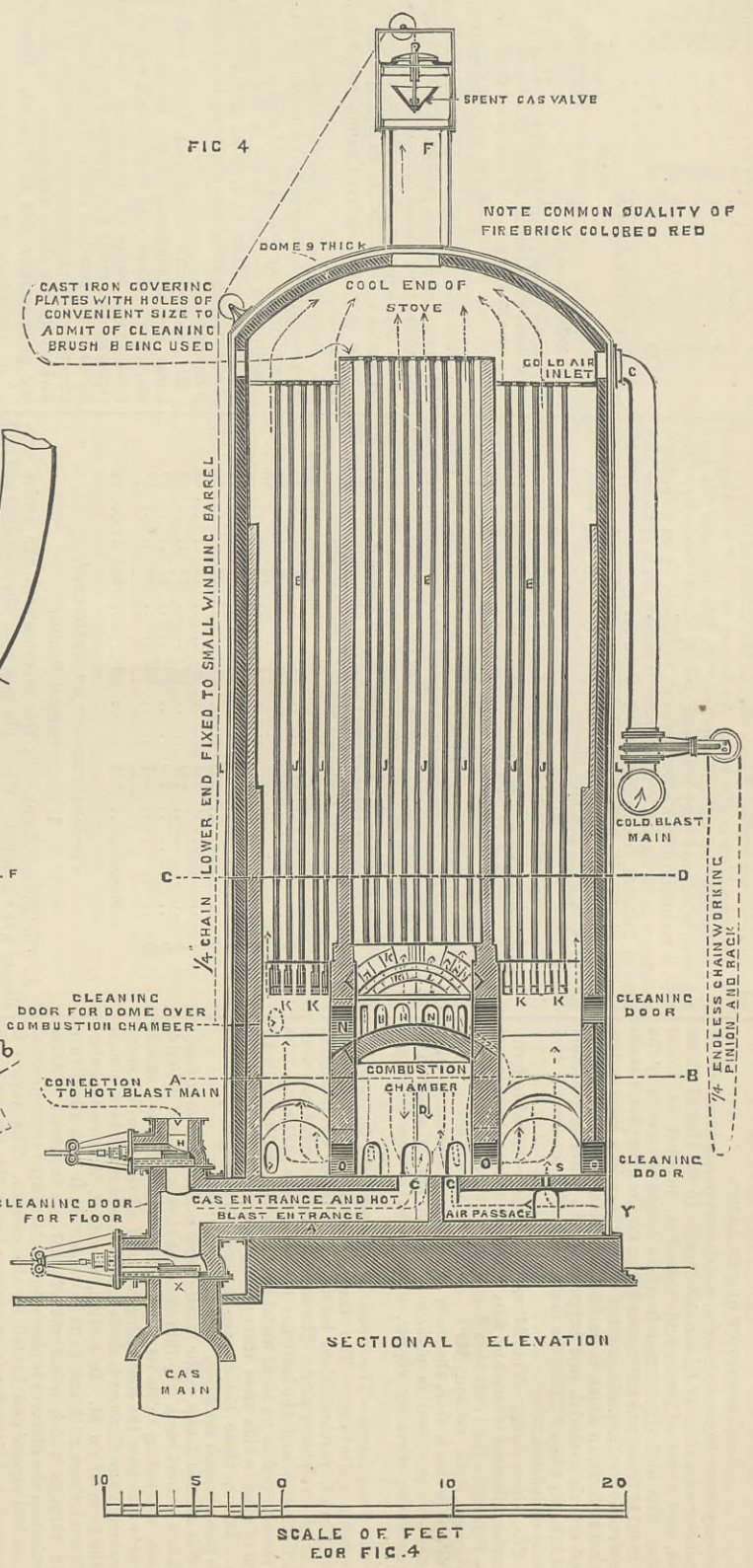
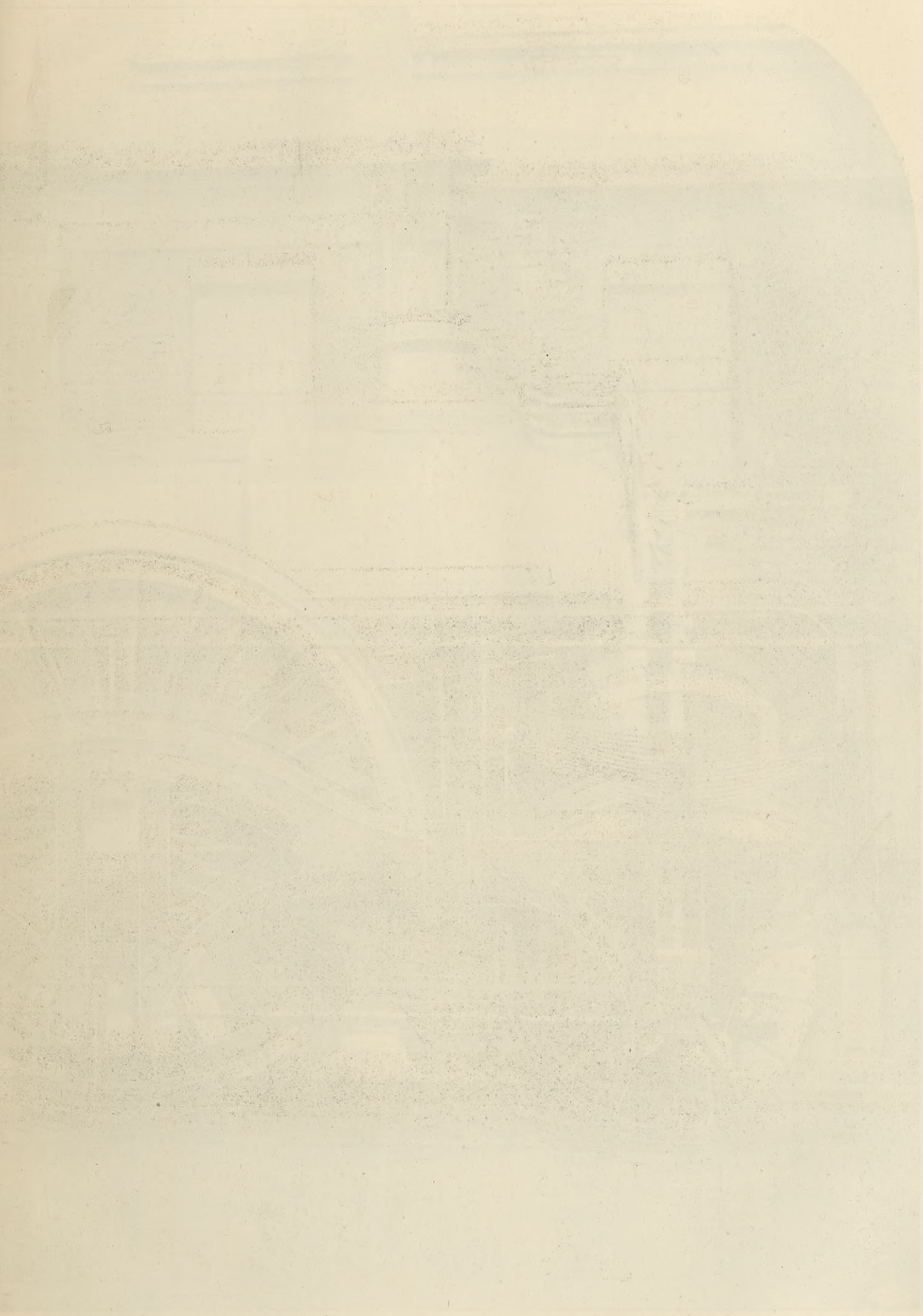


FIG 4





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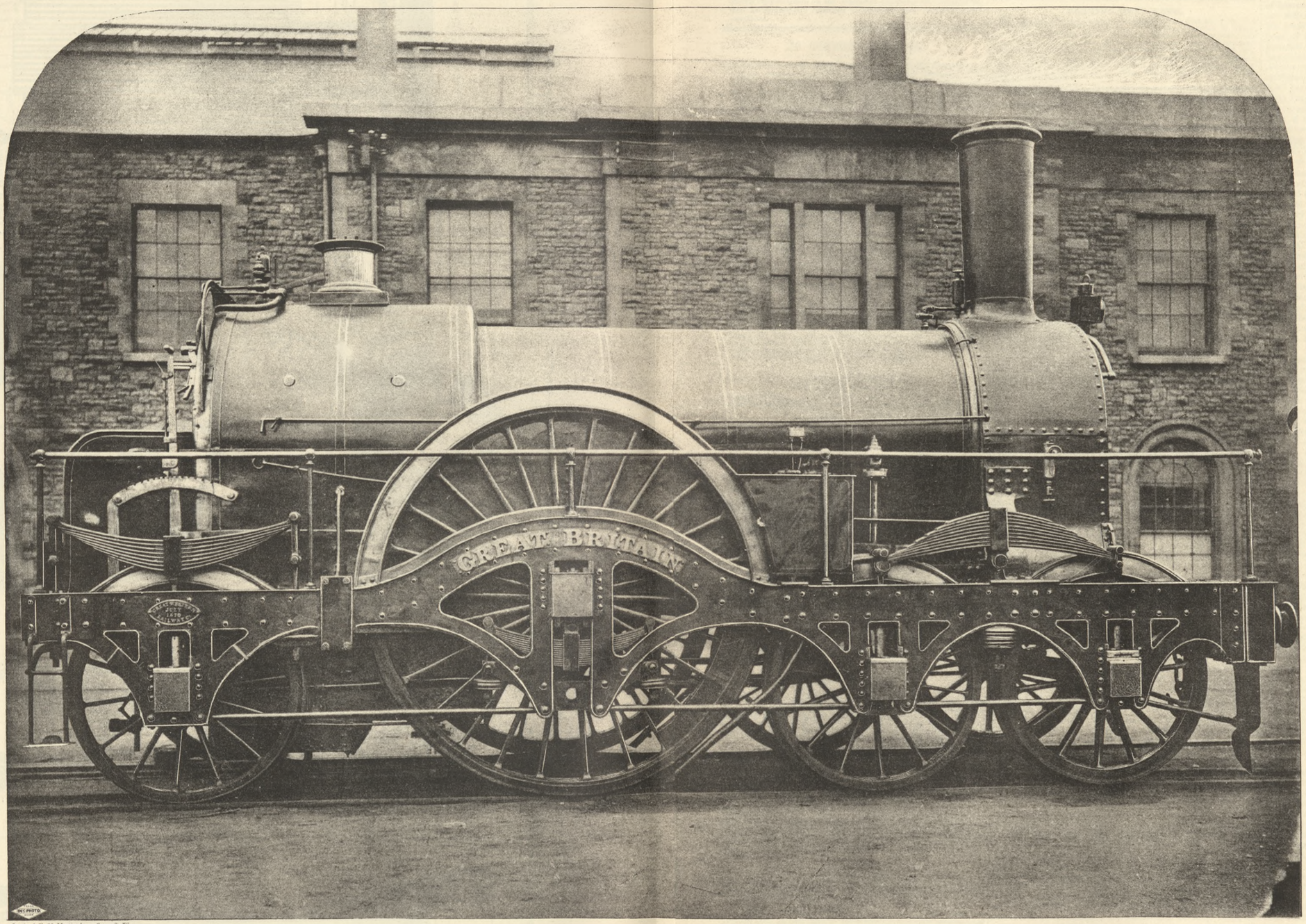
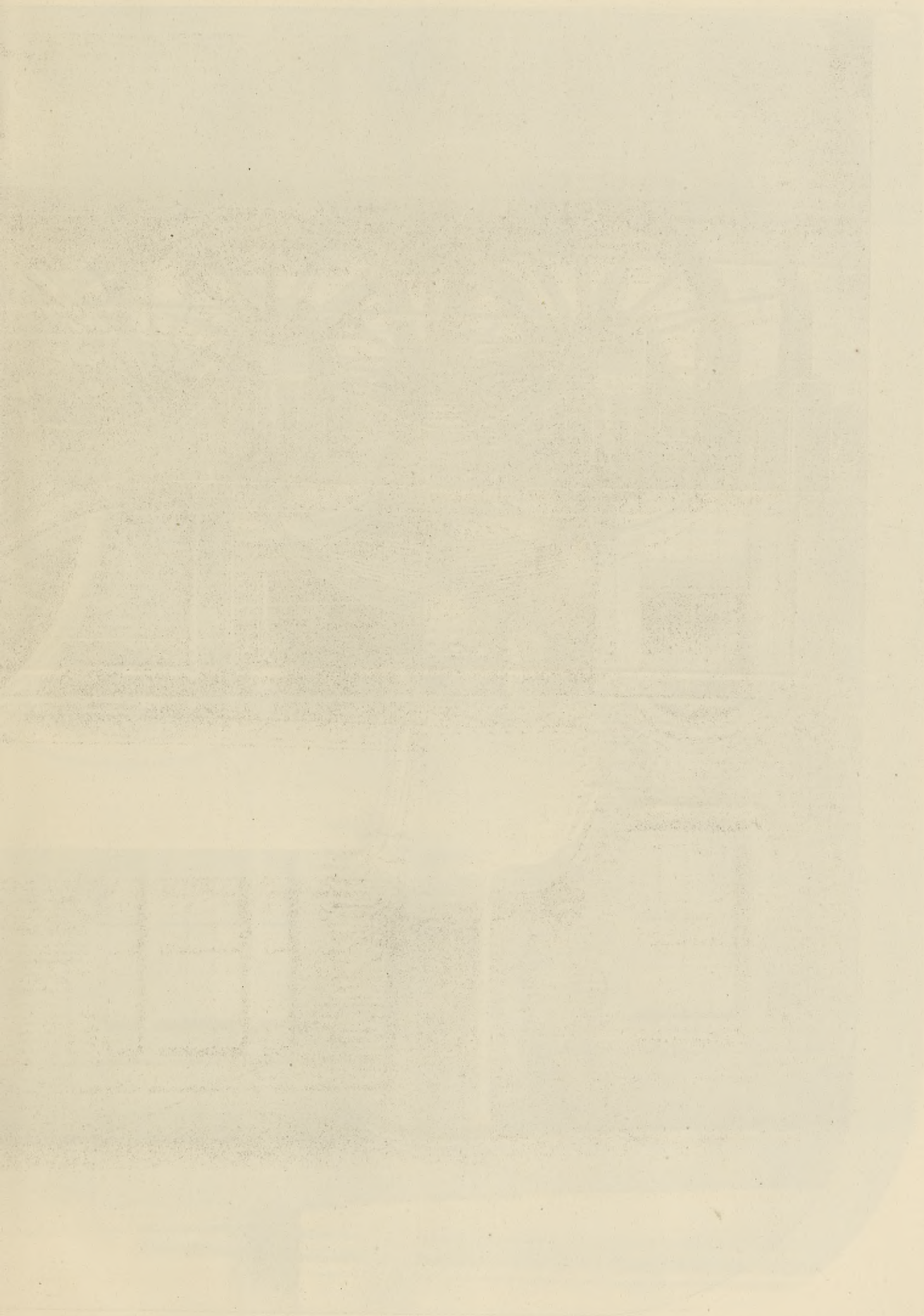


Sprague & Co. 22, Martins Lane, Cannon St. EC.



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TO CORRESPONDENTS.

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W. H. (Warrington).—*We have no doubt you can obtain a copy by applying to the Secretary,* 25, *Great George-street, Westminster.*

N. A. V.—*His chances would be almost as good at civil engineering as at any other of the overstocked professions. Everything will depend on his own abilities and the interest he can bring to bear to obtain him employment.*

J. F.—*You can use a pitch chain if you like, but a leather belt will answer the purpose much better. We assume that you can use two riggers a little over* 5*ft. in diameter, say* 16*ft. in circumference. At* 140 *revolutions per minute, this gives an angular velocity of* 2240*ft. per minute, and the pull on the belt to give* 12*-horse power will be only* 177 *lb., besides that required to keep it tight. Under such conditions a* 4*in. wide single belt will do all you want easily.*

C. S. (Stockton-on-Tees).—*If you have a good draught now you need not fear that the introduction of the heater will do harm, but there is every probability that the tube will become so heavily coated with soot that you will gain very little by its use. However, it ought not to be difficult to make arrangements by which the surface of the tube may be kept clean, as, for example, by a scraper, to be pulled from one end to the other every morning by a chain coming outside. The water ought to be raised in temperature by about* 130 *to* 150 *deg., and a good deal of deposit will take place in the tube to the advantage of the boilers. There can be no objection to using the exhaust steam as you propose, provided you do not let grease get into the boilers, and you do not object to the additional first cost.*

WIRE ROPE TRAMWAYS.

(*To the Editor of The Engineer.*)

SIR,—I should be greatly obliged if you would allow me to ask the following questions:—(1) Can any of your readers inform me by what method the suspended tubs pass the supports of the wire on the wire tramway? (2) Is there any wire rope tramway at work in the Midland Counties?

ALPHA.

Derby, June 14th.

STEAM RUBBER TUBE.

(*To the Editor of The Engineer.*)

SIR,—Can any of the readers of THE ENGINEER give me information as to whether rubber tubing can be procured, and where, to stand steam? I have some attached to an iron for ironing clothes, but in about three months it is rendered unserviceable. I have tried several makes, but all alike in a short time become practically useless from their getting very hard and stiff.

I herewith enclose a piece of tubing after being in work three months, thereby giving you a practical illustration of the result. The inside, as you will observe, remains soft and pliable, losing none of its elasticity, while the outside becomes dry, hard, and shrivelled, and ultimately perishes.

EXPERIMENTAL.

Manchester, June 9th.

TREATING DISTILLERY REFUSE.

(*To the Editor of The Engineer.*)

SIR,—I am in search of a method for drying and baking the residue of a distillery so that it may be stored for cattle food. The distillery works on the German system, and the residue on leaving the still contains about 40 per cent. Indian meal and malt husks—the malt being used without previous drying—and 60 per cent. water. The plant required should first afford the means of getting rid of a large portion of the superfluous water by filtering, a press for further reducing the moisture and making the stuff into a stiff paste, a machine for cutting up the paste into shapes, and, finally, an oven for baking. If any of your readers can suggest any plan for doing this work, or any part of it, economically, I should be glad to treat with them.

F. C. B.

Corfu, June 6th.

ELECTRO-MAGNETS.

(*To the Editor of The Engineer.*)

SIR,—Your correspondent "Farad" does not ask a question sufficiently limited to admit of a definite answer, but perhaps the following may assist him:—(1) Let him take the whole volume in cubic millimetres available for winding his wire. This is limited by the distance of the shanks of a horseshoe magnet from one another. (2) Let him find out the relation of the diameter of covered wire to the true diameter of that wire, supposed of copper, and let him square this number, and multiply the square into the volume in (1). (3) Divide the product by the external resistance in Ohms. (4) Multiply the result by ·00002. (5) Take the fourth root as the result. He thus obtains the diameter in millimetres of covered wire to be used for making his electro-magnet strongest with a fixed external resistance and constant electromotive force available, successive layers not breaking joint with each other. As an example, suppose the straight shanks of the magnet to be 50mm. long each, 20mm. apart, and composed of 10mm. diameter round iron. Let the outside diameter of his covered wire be 1·4 of the diameter of the wire itself, and let the external resistance = 5 Ohms. Then the thickness of the coil can only be 10mm., and its volume will be 63831·8 cubic mm. Multiply this by $(1·4)^2$, the product is 123150. Divide by 5—result 246·30. Multiply by ·00002—result ·49260. Whose cube root = ·837mm. = diameter of covered wire and diameter of wire itself = ·6mm.

THOS. H. BLAKESLEY.

June 14th.

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MEETING NEXT WEEK.

THE METEOROLOGICAL SOCIETY.—Wednesday, June 21st, at 7 p.m.: "A New Metal Screen for Thermometers," by the Rev. Fenwick W. Stow, M.A., F.M.S. "On the Effect of Different Kinds of Thermometer Cribs and of Different Exposures in Estimating the Diurnal Range of Temperature at the Royal Observatory, Cape of Good Hope," by Mr. David Gill, LL.D., F.R.A.S. "Account of a Cyclone in the Mozambique Channel, January 14th-19th, 1880," by Mr. Charles S. Hudson. "Rainfall of Frere Town, Mombassa, East Coast of Africa, 1875-81," by Mr. R. H. Twigg, M. Inst. C.E., F.M.S.

THE ENGINEER.

JUNE 16, 1882.

THE TREATMENT OF RIVERS.

IN a recent issue we gave some account of the views as to the history and treatment of rivers propounded by M. Cotard to the Société des Ingénieurs Civils of Paris. These views have been further elucidated in the discussion which followed; and it seems worth while to return to them, especially as M. Cotard's own prescription for the treatment of rivers was not dealt with in our former article. It will be remembered that he considered the life of rivers to be divisible into three stages, in the earliest of which it was practically a chain of pools, while in the latest it was a torrent, full and violent in time of rain, shallow and shifting in ordinary weather. It is obvious that the first is the most favourable both for navigation and agriculture; and the conclusion arrived at was that it behoved engineers to retard as far as possible—certainly never to accelerate—the natural progress of degradation by which rivers are slowly passing from better to worse. We have already pointed out that M. Cotard's whole investigation must really be limited to the case of rivers in hilly districts having a rapid fall and subject to great floods; but even with this limitation the question is one of large and increasing interest. M. Cotard's recommendations may be summed up in one word—canalisation. A canal is, of course, a chain of pools, like the first stage of a river, the difference being that they are connected by locks instead of shallows. This is an advantage in securing the safety, if not the speed, of navigation, and also assisting agriculture; and therefore to turn a river into a canal is to restore it to something still better, for the purposes of man, than its pristine and original condition. This is what M. Cotard would do whenever possible, and as far as possible; and he cites the opinions of other eminent engineers—Janicki, Pasquean, &c.—in support of his view. In the course of the discussion, M. Cotard put this plan in the sharpest possible contrast to that which has been actually followed in many rivers—notably the Rhone—and which consists in dredging out shallows, and confining the river between dikes, &c., with the view of obtaining, as far as possible, a constant slope of velocity in all parts of its course. The two views are in all respects opposed to each other. We may illustrate the actual condition of such rivers by that of an ancient staircase, of which all the steps are more or less worn, while some are broken away, and thus the passage is irregular and dangerous. Two architects are called in to advise as to repairs; one recommends to re-construct the steps, the other to cut them all down, so as to form an inclined plane for the whole ascent. Which counsel are we to follow?

If, however, we look more narrowly into the question, it will appear that the illustration just given is not quite perfect. If it were possible to give to a river one uniform slope from source to sea, it is conceivable that it might be an effectual mode of dealing with it. As a matter of fact it is not possible; the condition of the country through which it runs forbids the attempt, especially in the case of hilly districts such as we are considering. The inclination of the river bed will always be much greater in the higher parts of its course than after it has descended into the low grounds, and is approaching the sea. Nor will any artificial works have much influence on the level of the head waters, where the river is split up into a crowd of insignificant rivulets. What such works may do is to lower the general level in the middle of the course—that is while the streams are winding through the wide vales which lead gradually from the uplands to the sea marshes; and since navigation usually ends where these vales divide into comparatively steep and narrow dells, it may be thought that this, for navigation at least, is a real improvement, and represents all that the labour of man can expect to achieve. A vessel coming up from the sea will thus be enabled to advance as far as possible into the interior, with the least possible resistance in the way of a descending current. But experience and observation show that other and very different effects follow on such a policy. The lessening of the inclination in the middle reaches must imply an increase of slope in the parts above—that is in the mountain streams and rivulets already alluded to. Each of these will become a torrent—in flood time fiercer and more violent than before, but expending its force more quickly, and therefore shallower and feebler in dry weather. The violence of its floods will moreover cut down and deepen its channel with much greater rapidity; for it is well known that the erosion of river beds is accomplished almost entirely during floods, and not by the direct action of the water itself, but rather by the grinding of the stones and gravel it bears along in its course. But the deeper such a channel is scored into the trench of its valley, the more freely will the waters drain into it from the slopes above, and the more rapidly will the rainfall pass off into the river, and so into the sea. Hence arises evil to all parties concerned. For those who feed their flocks on the uplands the droughts are found to be longer and more severe, because the rain is more rapidly carried away; hence the roots of the grass have greater difficulty in obtaining their proper moisture, and the pasturage declines in richness and value. Those who live lower down in the dells and vales find a similar effect in the dry seasons, while after heavy rains their lands are overrun by floods, which not only drown the herbage for the time, but leave behind them continually accumulating drifts of barren and unsightly gravel. Those who live nearer the sea suffer similar inconveniences to a less extent, while the inhabitants of towns lying on the river find the disposal of their sewage seriously impeded. In floods it is pounded back into the sewers, and may even rise into the basements of the houses; in droughts there is an insufficient supply of river water to bear it away. Lastly the navigators of the stream, for whose benefits all these results have been risked, find that during a great part of the year their barges are continually getting aground, while during the remainder they can barely make headway against the fury of the current. A good instance of this last fact is the river Loire, where the level falls so rapidly that a dredging barge may find itself stranded at any moment, and left high and dry for some weeks until a new freshet comes to float it off.

It thus appears that the method of procedure which might at first sight seem to offer the best results is really opposed to the interests of all concerned. The aim should be, as M. Cotard has already put it, to counteract and delay by every available means the continual process of degradation which is tending to convert a mountain river into a mountain torrent. Of all such means certainly the most effectual is that which he proposes, namely, canalisation, or the turning of the river into a series of still reaches by weirs built at convenient intervals. Locks must, of course, be provided, as well as weirs, for the part through which navigation extends. So far, indeed, is this effectual in checking erosion that the objection likely to be raised, especially in England, is that it introduces the opposite evil, and that a river thus treated is in danger of silting up. It need not be denied that this danger exists, but we are convinced that it is quite insignificant, except in some very rare cases. As an example of these latter, the Rhone is thus canalised, for a portion of its course, by the barrier of rock which forms the Lake of Geneva, and in consequence the river forms at the upper end of the lake a delta of flat land, which is continually encroaching further and further upon its waters. But the Rhone is a glacier river, bearing downwards in a day as much silt as an English river of like size would carry in a year; and its performances are, therefore, quite exceptional. Moreover, were the barrier cut down and the lake drained to-morrow, will anyone assert that this silt—at least all but the finest particles—would ever find its way into the deep waters of the Mediterranean? It would doubtless be carried past Geneva, and through the rapid declivity about Bellegarde; but the greater part would subside in the plains of Provence, and all, or nearly all, the rest in the marshes of the Bouches du Rhone. The result would be that the masses of *débris* which now settle harmlessly at the head of Lake Leman would be deposited at intervals all along the lower course of the river. For the present, no doubt, they would disappear from view and from remembrance; but how as to the future? Gradually, throughout the lower course of the river, the level of the bottom would rise; the section of the channel would no longer be sufficient to carry away the maximum discharge; the flooding of adjacent lands would become more frequent and more injurious; and remote posterity would have reason to curse the ill-directed zeal which deprived the river of the splendid settling basin nature had provided for it. The same will be true, though the process be a much slower one, of every mountain-born stream. In fact it is obvious that no art of ours can prevent the silt from getting into the head-waters, and thus descending into the lowlands; nor, in most places, can we hope that any great part of it will be taken yet further, and harmlessly deposited in the sea. It will thus be seen that in ordinary mountain-born rivers two actions are continually in progress—the erosion of the bed in the region within the hills, and the deposition of the silt thus obtained in the plains below. Each of these is in itself an evil, and an evil which gets worse and worse as time goes on. To arrest this evil the expenditure of labour and money are of course necessary; and it remains to be shown that they can be expended more judiciously than in the process of canalisation. As far as this process can be carried upwards, the evil of erosion is completely checked, while the counter evil of deposition is at the same time confined to the one reach above the highest weir on the river. Here the silt brought down from the hills will descend into comparatively still water, and will therefore, in great measure, come to rest. It is obvious, however, that it may be attacked and removed much more easily when thus concentrated at one spot than when the deposit is spread irregularly all along the course of the river. The vacuum dredger used so successfully for harbours at Lowestoft and Dunkirk, and for rivers in the Loire and elsewhere, would seem to be specially suited for this work, drawing, as it does, very little water, and requiring no expensive plant. It appears that even in harbours gravel and sand can thus be dredged for somewhere about 2d. per ton, and in a canalised river, where the work could go on without any interruption from bad weather, &c., and where the depth would be small, the cost should be considerably reduced. There are, however, very few districts where tolerably clean sand and gravel, delivered into barges, would not be worth 2d. per ton—in many places its value would be a great deal more; and thus the work to be done in dredging would be in large measure, if not wholly, remunerative.

The objection to canalisation, from the fear of silting up, is thus shown to be illusory; and, as a matter of fact, the evils arising from this cause in the many rivers which have been treated in this manner, even in England, would

appear to be trifling. Another objection to the erection of weirs, namely, that they impede the discharge in floods, is still less worthy of acceptance. In point of fact, by the simple expedient of movable weirs, as commonly used in France, every reach in the river can be turned into a reservoir, immensely increasing its capacity of holding water at the times of greatest discharge. One thing is of course essential if this or any other scheme of treating rivers is to be permanently successful, namely, that for the whole or greater part of its course the river shall be under the control of some one competent engineering authority. This condition obtains in France, but it is needless to state that it is comparatively unknown in England; and hence it is not so much to the discredit of English engineers if they are a good deal behind their brethren of the Ponts et Chaussées in matters of river engineering. It is in the hope that, at no very distant day, knowledge of this kind will become essential to a large number of English engineers, that we have given so much prominence to French theory and practice in this matter. We regret to notice, indeed, that the little bark of the Rivers' Conservancy Bill has already gone down in the whirlpool of politics; but the project cannot fail to be revived, and the time, we trust, will soon come when the maintenance and improvement of our English rivers will be a duty seriously undertaken and successfully carried on.

THE METROPOLITAN AND SUBURBAN GAS COMPANIES.

Mr. John Field continues to publish, year by year, his excellent analysis of the accounts of the metropolitan gas companies, supplemented during the last two years by the accounts of sundry suburban companies. The analysis of the accounts for 1881 has just made its appearance, and shows no further diminution in the number of the metropolitan companies, though negotiations have long been pending, which would, if carried to a successful conclusion, result in the absorption of the London Company by the Chartered, thereby reducing the original thirteen as low as three. For the present there are four companies supplying the metropolis with gas, namely, the Gas Light and Coke Company, better known as the Chartered, the South Metropolitan, the London, and the Commercial. We have enumerated them in the order in which they were incorporated, the Chartered commencing its career in 1810, and the Commercial in 1847. The total capital raised by the four companies considerably exceeds thirteen millions, of which the Chartered Company takes rather more than nine millions and a-half, and the South Metropolitan above two millions. The capital of the London Company is between eight and nine hundred thousand pounds, while that of the Commercial borders on three-quarters of a million. The total increase for the year is nearly one hundred and fifty thousand pounds. Of this sum more than ninety thousand pounds were added to the South Metropolitan account, the Chartered taking fifty thousand, and the London about seven thousand, the Commercial remaining unaltered. We have only to go back a dozen years in order to find the total capital of the metropolitan gas companies considerably under eight millions, the average growth from that time exceeding four hundred thousand pounds per annum. An interesting fact in relation to this subject consists in the appearance of £236,000 as "premium capital," obtained under the "auction clauses," and bearing no dividend. From this source the South Metropolitan Company gets more than £42,000 of the increase in its capital account for the year. The Chartered Company has now as much as £193,000 of this kind of capital. The total loan capital of the four companies exceeds two millions. The stock and share capital entitled to a 10 per cent. dividend—or more under certain circumstances—is £8,865,000, while that which is entitled to lesser rates, ranging from 4 to 7 per cent., is about two millions. Taking the capital of all kinds, it appears that for every 1000ft. of gas sold in 1869, the amount of capital employed was 15s. 10d., whereas the amount now is 14s. In 1874, for which year we have more accurate figures than in 1869, the capital per 1000ft. of gas was as high as 16s. 9d. The gas unaccounted for then was 8·75 per cent. on the make. Last year this was reduced to 5·62 per cent.

The coals carbonised last year present the enormous total of more than 1,983,000 tons. The percentage of cannel shows an increase for the year; yet the quantity of gas per ton has somewhat decreased, being 10,198 cubic feet per ton instead of 10,220. Price has fallen, the charge to the consumer in 1880 ranging from 3s. to 3s. 4d. per 1000ft. for common gas, while last year the range was from 2s. 10d. to 3s. 2d. Cannel gas fell from 4s. 2d. to 3s. 11d. Coke sold better in 1881 than in 1880, the average price obtained per chaldron being 5s. 6d. instead of 4s. 10d. Tar and its allied products showed a drop, the sum realised being at the rate of 2s. 4d. per ton of coal instead of 2s. 10d. Ammonia and its products experienced a rise, going up from 2s. 3d. per ton of coal to 2s. 6d. On the whole, the residual products brought in nearly 10s. per ton of coal carbonised, as compared with less than 9s. 7d. in 1880. The price of coal to the companies averaged rather more than 14s. 9d. per ton, being an advance of quite 1¾d. The total outlay for coal was £1,467,000, and the receipts from residuals £987,000, while the gas rental, after deducting the cost of lighting and repairing the public lamps, was £2,911,000. The working expenses were £1,220,000, showing a slight increase for the year, being 12s. 3·60d. per ton of coal instead of 12s. 2·78d. Deducting the receipts for the residuals from the cost of coals and the working expenses, we get a balance of £1,700,000, or about £1,200,000 less than the gas rental. A trifle more than £96,000 goes for interest on borrowed monies, and £7000 for insurance fund, leaving finally a net profit of £1,105,600. Of this amount the standard dividends take £1,015,000, and the additional dividends under the sliding scale more than absorb the remainder. At the tail of the account there is a sum of £760,000 specified as "reserve fund and balance on net revenue account after providing for dividend," in addition to which the "insurance and other funds" amount to £155,000. Among the "exceptional charges" in the current account, the Chartered Company put down £1190 for experimental street lighting, and the South Metropolitan £6817 for "compensations." Parliamentary and law charges, of which nearly half appertain to the South Metropolitan, amount to £6266. In the previous year this fund exceeded £8000; bad debts figure for nearly £21,000, or more than £1000 in advance of 1880. The Chartered Company charge £6000 as superannuation to retired officers.

In the working expenses, the cost of purifying shows a sensible decrease, being under £65,000, or nearly £4000 less than in the year preceding. Wages advance in the aggregate, but not in the ratio to the work done. The ratio of the charge for wear and tear rises, and, on the whole, the manufactory charges show a slight advance in their ratio. Under the head of distribution the ratio declines, but rent and taxes show a considerable rise, perhaps owing to the diligence of the vestries in putting up the assessments for the rates. The increase in this respect amounts to one-third of a penny on every 1000ft. of gas. The management charges show a decline in their ratio, directors and auditors exhibiting a reduction even in the absolute amount. The collectors take ½d. on every 1000ft. of gas, or 5d. on every ton of coal. The directors and auditors get rather less than half this.

Of the fourteen suburban gas companies, priority of age appertains to the Brentford, dating from 1821, while youth belongs to the Lea Bridge Company, incorporated in 1878. The total capital raised exceeds two millions, of which the Brentford Company takes the largest amount—£542,000, and the Woolwich Equitable the least—£22,500. Next to the Brentford we have the Crystal Palace Company, with £313,000. The fourteen companies altogether have power to raise more than four millions of capital. The companies in question are enumerated as follows:—Barnet, Brentford, Bromley, Colney Hatch, Croydon, Crystal Palace, Lea Bridge, Mitcham, Richmond, Tottenham, Wandsworth, West Ham, Woolwich Consumers, and Woolwich Equitable. Their charge for gas last year ranged from 3s. 3d. per 1000ft. up to 5s. 9d., the latter price falling to 5s. 6d. at Midsummer. The lighting power is given as generally 14 candles. To this rule there are only two exceptions, the Woolwich Equitable giving 12-candle gas, and the Richmond Company giving gas of 15-candles. But these statements are vague, unless we know what kind of burner is used when the light is measured. The gas made is 10,051ft. per ton of coal, which is a somewhat lower figure than that of the metropolitan companies. The percentage of cannel coal is 5·27, while the London Company, professedly supplying gas of 12-candles only, carbonises cannel coal in the proportion of 6·24 per cent. The gas unaccounted for by the suburban companies is just under 6 per cent., and is therefore a little in excess of the waste in London. The revenue from residuals, in proportion to the gas sold, exhibits a ratio slightly under that of the metropolitan companies. The gross cost of coals runs nearly 3d. higher per 1000ft. of gas sold. Coke and breeze fetch a better price than in London, and purifying costs rather less, while wages run higher as compared with the extent of manufacture. The ratio of the cost of management is 3d. per 1000ft. of gas in the suburbs, compared with 1¼d. in London. Per ton of coals the ratio is still higher, being more than 2s. 4d. per ton, in contrast with 1s. in the metropolitan district. It is an instructive fact that these suburban companies, selling about one-seventh the quantity of gas sold by the metropolitan companies, expend more than £31,000 on management, while the London companies spend less than £99,000. Possibly some of the expense of distribution comes under the head of management in the case of the suburban companies, but the allowance to be made cannot greatly affect the result. The superior economy of management when working on a large scale is illustrated by the fact that the largest of the suburban companies, namely, the Brentford Company, show a charge for management of 2·18d. per 1000ft. of gas sold, while the Colney Hatch Company, whose operations are the smallest of any, incur a charge for management of 6·55d. per 1000ft. The Lea Bridge Company, also working on a small scale, have a charge of 6·44d. per 1000ft. of management. Rent and taxes likewise have a somewhat higher proportion in the suburbs. Altogether the costs and working expenses, less the sum received for residuals, leave a net charge of 27·42d. per 1000ft. in the suburbs, which is nearly 6d. higher than in London. The Woolwich Consumers contrast somewhat favourably with the London Company in this respect, but this is the only instance of the kind. The gas rental in the suburbs runs as high as 45·65d. per 1000ft., compared with 37·62d. in London, and hence the gross profit on gas appears 17·29d. instead of 15·43d. per 1000ft., while the net profit becomes 16·78d., as against 14·09d.

A feature of some note, as shown by Mr. Field's calcutions, is the small percentage of cannel coal—only 2·77, used by the South Metropolitan Company in the production of their 16-candle gas. This is less than the proportion of cannel used by the same company in the year preceding, besides being considerably less than the proportion carbonised by the Commercial and the London, the ratio of the former being 6·87, and of the latter 6·24. The London Company, it should be observed, only undertakes to supply 12-candle gas. In productiveness, the London Company somewhat exceeds the South Metropolitan, the gas made per ton of coal being respectively 9942ft. and 9864ft. Another discrepancy presents itself in the Lea Bridge Company, which uses as much as 13 per cent. of cannel to produce 10,189ft. of 14-candle gas from a ton of coal. The Woolwich Consumers' Company produces rather more gas than this, of equal lighting power, with only 7·57 per cent. of cannel. A question may be raised as to the quality of the common coal. But there is nothing to show that this will effect an alteration of the discrepancy. In comparing the South Metropolitan with the London and the Commercial, we find that the average price of the coals per ton is lowest with the first of these three, being 13s. 2·78d. per ton, as against 14s. 8·81d. and 14s. 11·41d. The average of the Chartered is of course higher, owing to the larger proportion of cannel, a circumstance rendered necessary by the fact that the Chartered Company still supplies cannel gas to the extent of 4·50 per cent. of its total make. But the Commercial, which supplies no cannel gas, are not much below the Chartered in the proportion of cannel coal, the ratio being 6·87 as against 7·86. The Chartered Company also has the higher production of gas, the yield being 10,327ft. per ton as against 10,274ft In like manner we find the Lea Bridge Company paying 1s. 4d. per ton for its coal more than the Woolwich Consumers. There is a high yield of gas at Croydon, where the company get as much as 10,999ft. of 14-candle gas per ton of coal, the proportion of cannel coal being only 2·49 per cent. The lowest proportion of cannel coal is at Colney Hatch, where it is only 0·71 per cent. Yet the yield is 10,137ft. of 14-candle gas per ton. The Barnet Company does still better. They use no cannel, and yet obtain 10,660ft. of 14-candle gas from a ton of coal. The Croydon coals average 17s. 11·24d., the Colney Hatch 15s. 5·81d., and the Barnet 15s. 11·29d. per ton.

A financial element of some value consists in the fact that whereas the capital employed by the metropolitan gas companies in 1874 amounted to £7 6s. 10d. per ton of coal, last year it was only £6 12s. 10d. In the former year the net proceeds of residuals on the cost of coals was 38·4 per cent. in the case of the Chartered Company, whereas last year it was 63·84 per cent. The average for all the metropolitan companies in 1877 was 59·2 per cent., and last year it was 66·28 per cent. The gas sold per ton of coals was not quite so high last year as in 1880, and was practically the same as in 1877. It seems very regrettable that 5·62 per cent. of the gas made in 1881 should be actually "unaccounted for," so that out of the wonderful total of more than twenty thousand millions of feet, considerably above a thousand millions should be lost. The missing gas last year was higher than in any year since 1877.

CROMWELL-ROAD BRIDGE, SALFORD.

This bridge, already described and illustrated in The Engineer, the nineteenth that has been thrown over the Irwell within the Salford district, was formally opened on Saturday last by the Mayor of Salford. The objects sought to be attained in its construction are: First, to develope the Pendleton district, and, by inducing speculators to build, to increase the rateable value; and secondly, to afford more easy and direct communication between Pendleton and Broughton. In fact, the Cromwell-road, to which the new bridge now forms a fitting complement, constitutes the connecting link between Pendleton and the Cheetham, Collyhurst, Harpurthy, and Crumpsall districts, as well as Higher Broughton, Kersal, and Prestwich. The new bridge has a span of 125ft., which is greater than the average width of the river; but it was judged advisable to provide for an additional width of 10ft., which will be necessary when the river is dealt with. It is high enough to discharge a flood equal to the greatest that has occurred within the memory of man; and this has had the effect of making rather a steep gradient at the Broughton side, which, however, will scarcely be felt owing to the short length. The contract price of the bridge is £10,600; and its total cost £10,827, which compares very favourably with other bridges over the Irwell. For instance, Trafford Bridge, of 116ft. span, cost £29,660; Walness Bridge, of 112ft. 7in., £25,220; and Irwell-street Bridge—by the Manchester Corporation—of 116ft. span, £23,000. In the Cromwell-road Bridge, which consists of lattice girders weighing 409 tons laid on Yorkshire stone abutments, a considerable saving has been effected by casting in iron the ornamental portions of the piers, which form a pleasing contrast to the stone. The bridge has been constructed to the drawings of the borough engineer, Mr. Arthur Jacob, M. Inst. C.E., by Messrs. S. J. Pilling and Co., of Manchester, the ironwork having been sub-let to Mr. John Butler, of Stanningley, near Leeds, and the asphalting of the ironwork under the paving having been executed by Messrs. Hitken and Co., of Liverpool.

GAS MANUFACTURE BY CORPORATIONS.

The yearly report of the general manager of the Stockton gasworks affords an opportunity of testing the results of the manufacture of gas by corporations. Stockton Corporation has for a long period had the gas manufacture in its own hands, and for a considerable number of years there has been a steady growth in the production and sale of gas. In the past year the production was to the extent of 175,300,000 cubic feet; and out of this quantity over 142 million cubic feet were sold by meter. The leakage was to the extent of 9¼ per cent., and the remainder was used in the public lamps of the district, and for other public lighting purposes. The price of gas had been reduced during the year by 4d. per thousand cubic feet. The total receipts for the year 1881 had been £31,671—out of which £24,778 had risen from gas rents, £2793 from sale of coke, and £2123 from the sale of tar. The total expenditure amounted to £26,356 for the past year, and a balance of £5314 was carried to the credit of the borough fund. In the financial year just ended there had been £31,835 received—increased receipts from coke, tar, and ammonia water having counterbalanced the falling off in the receipts for gas owing to the reduction above indicated. There still remained a balance of over £3750 to hand to the borough fund, so that the loss by the reduction is small, and does not prevent the gasworks materially lessening the rates. A further reduction is contemplated, though the price is now lower than it is in neighbouring towns where the gasworks are owned by companies. It is evident that there is still shown an increasing demand for gas, and when that is stimulated by cheapness and by reductions in the price, there is a large field that may be increasingly filled by the gas companies. Whilst the effect of the electric light may be to cause a diminution of the consumption of gas for the lighting of large works and spaces, there are indications that gas for cooking and allied purposes will be more used, and that it will still further compete with oil and candles as an illuminator in small areas, and thus enlarge the demand for it continuously.

THE THOMAS-GILCHRIST PROCESS IN STAFFORDSHIRE.

Trials have been made during the past fortnight at Wednesbury to ascertain the suitability of ordinary Staffordshire cinder pig for conversion into the higher qualities of steel and ingot iron by the Thomas-Gilchrist process. On Friday last a number of leading South Staffordshire ironmakers were present to witness the operations and to test the quality of the steel manufactured. Charges of 3½ tons of cinder pig, containing 3 per cent. phosphorus, were blown, and samples of the steel produced submitted to a variety of tests. At a meeting subsequently held all

present testified to the very high quality of the metal produced. Amongst the samples shown were some rolled into plates and bent close cold four successive times without a crack. Mr. Hingley, the chairman of the Ironmasters' Association; Mr. Wales, the manager of the Patent Shaft and Axle-tree Company's Works—by whose courtesy the trials have been carried out—and other gentlemen, expressed their perfect satisfaction with the results obtained. The experiments were carried out under the superintendence of Mr. Gilchrist, and were specially intended to show that not only could ordinary Bessemer steel be produced, but a special soft metal of great ductility and readily weldable, well suited to replace the highest class of puddled iron for sheets, tin-plates, wire, chain cables, &c. It is estimated that the cost of soft steel ingots, made by this process, in Staffordshire, would be about 70s. a ton. It is probable that arrangements will be made for immediately carrying out the new process on a large scale in Staffordshire.

LITERATURE.

Treatise on Modern Horology in Theory and Practice. Translated from the French of Claudius Saunier by JULIEN TRIPPLIN and EDWARD RIGG, M.A. London: J. Tripplin, Bartlett's-buildings. 1881.

[FIRST NOTICE.]

EVERYONE carries a watch in the present day, and the house in which at least one clock is not to be found must indeed be exceptional. We have thus a very ingenious mechanical arrangement, we might almost say obtruded, on our attention, and the manufacture and sale of clocks and watches gives employment to many thousands of men, women, and children; yet the literature of horology was very narrow. It consisted mainly of now obsolete treatises, popular little works on the history of clocks and watches, and collections of anecdotes concerning them. To these were added a few mathematical investigations of escapements, treatises on the theory of the pendulum, and so on. But of good standard authorities, which can prove of service to the watch and clock maker, scarcely one existed. M. Saunier therefore supplied what was very much wanted when he prepared his splendid treatise, and M. Tripplin and Mr. Rigg have conferred a boon on the English horologist by producing the translation which lies before us.

The volume is a large octavo of 844 pages, and is illustrated by twenty-one coloured folding plates, and seventy-eight woodcuts. It is printed in good type, on thick paper, and is very well arranged for reference. It is divided into three Parts and an Appendix. The first Part is devoted to Escapements, the second to Depths, and the third to Miscellaneous Articles. The author commences the first Part with a short treatise on mechanics. The fact that Mr. Rigg has translated the work is sufficient guarantee that the statements contained in this treatise are trustworthy, and this we say without for a moment hinting that M. Saunier is not a competent authority on such matters; but it is an old and true saying that two heads are better than one, and an error which might pass M. Saunier was sure to be detected by the translator. A little further on we come to Theoretical and Practical Considerations, which have a special bearing on horology; and before going further it will be well to stop here for a moment and consider in what respect watches differ from other machines—clocks we put on one side for the moment.

The watch consists of a train of five wheels and four pinions. The first wheel is driven by a coiled spring supplying the motive power, the last is the scape wheel causing the oscillations of the balance, and the coiling and uncoiling of the balance spring. The wheels and pinions constitute, in the engineer's sense of the word, so much gearing, and it is found in practice that precisely the same rules for shaping the teeth apply to watchwork as to the machinery of the cotton mill or the forge. The watch has this special feature about it, however, that while the motive power is small, the intervals during which the machinery must run without re-lubrication are very long, longer than is the case with any other known form of mechanism; and one result is that although the teeth are shaped just as the teeth of large wheels ought to be shaped, the journals are formed on very different principles, in order that they may retain the lubricant in the proper place. M. Saunier investigates the law of capillarity of oil very fully and arrives at the following conclusions, which are worth the attention of engineers: "Oil resting on a hard well-polished surface spreads but little, and does not adhere firmly; but if this surface be ground the polish is destroyed and the oil adheres better. On a metal just filed, and therefore scored by the teeth of the file, the liquid rapidly spreads, for each line is evidently a longitudinal section of a capillary tube. It should be noted that the more a given extent of surface is covered with roughnesses, the greater the number of points of contact does it offer to the oil. . . . . It will be evident from this why one and the same kind of oil will remain at the points of contact in one watch, whereas in another, subjected to a higher temperature and rough wear, it spreads or runs away along the axis." M. Saunier then goes on to show what forms ought to be given to pivots and other wearing surfaces in order that they may retain the oil. Thus, for example, a pivot working in an end-stopped hole should be larger at the point than at the shoulder, otherwise the oil is liable to creep up the pivot and out of the hole. In other cases the pivot should be enlarged at the middle, which will keep the oil from running away at each end, and so on. We have not space to deal more at length with this very curious and interesting subject, which has been fully handled by our authors.

The system adopted by M Saunier in dealing with escapements is the same throughout. He first gives some preliminary particulars concerning each, then states the proportions adopted by the best watchmakers, then criticises these proportions, pointing out the differences in the practice of the authorities he names, and finally gives a complete treatise on the construction of each. The first escapement he deals with is the verge, or that found in old vertical watches, so called, because the plane of the scape wheel is "vertical" to that of the dial. This escapement is of great antiquity, and is never applied in the present day to good watches. M. Saunier apologises, indeed, for taking up space with a consideration of its properties, and excuses himself on the ground that there is a very large number of these watches in use in the French provinces. In the canton of Berne there are still made over 300,000 verge watches. Consequently M. Saunier points out the watchmaker will, for a long time to come, find himself called upon to repair them, and ought to know something about them; and to those who take an interest in the peculiarities of mechanism we can recommend the chapters devoted by our author to the consideration of the verge escapement. It might be supposed that the better the materials of which it was made the better would be its performance, but M. Saunier shows that this is not the case. Thus while in all other watches the staff or axis carrying the balance always rotates in jewels, one at each end, jewelling the staff of the balance of a verge watch tells against its accuracy of performance.

Many watch escapements have been invented and tried, but there are only four which have ever enjoyed much favour. These are the verge, the horizontal, the duplex, and the detached lever. The first, as we have said, is practically extinct in this country; the second is more commonly met with than any other; the third, while almost unequalled for time-keeping qualities, is expensive to make, because if not of very superior workmanship it is one of the worst escapements in existence, and being only used with success in costly watches, it may, too, be said to have died out. The detached lever is the escapement fitted in the present day to all English, and many French and Swiss watches. It can be made to perform very well in watches sold at a moderate price—good silver lever watches can be had for £4 each—while it gives admirable results combined with a compensation balance, when its workmanship is of the highest type of excellence. It is doubtful, however, if the best modern lever watches keep as good time as the duplex watches of such old firms as Arnold and Dent, which, as we know by personal experience, are still met with capable of keeping time to one minute a year, a performance nearly equal to that of a chronometer. To realise what this means, let us suppose that the space passed over every hour by the point of the minute hand was 6in. Then in 365 days it would traverse a space of 4380ft. If we suppose that it lost one minute in that time, then the difference between the space actually traversed and that which ought to have been traversed would be 0·1in., or $\frac{1}{525,600}$ of the whole distance traversed. A statement such as this will help our readers to realise the perfection to which horology has been carried. M. Saunier does not do justice to the duplex escapement, which he regards as little better than the horizontal, which last is not to be compared with it. But M. Saunier admits that French duplex watches were not properly made, and this explains his adverse criticism. He says of the duplex escapement, after explaining that steel will not make a good scape wheel, because it is liable to form an oxide if the oil is not perfect: "Although such a disadvantage is not possessed by a brass wheel, it has another almost as serious, namely, the difficulty experienced in cutting it. Brass is always distorted by a kind of molecular change set up by the impacts and pressures which are unavoidable in cutting a wheel. Hence it is exceedingly difficult to form accurately teeth that are so fine as those of the resting wheel. The best wheels that have been made up to the present were made in England. They are beautifully finished. The methods and tools, however, employed in their construction are kept secret by the workmen in whose possession they are. The metal of which they are formed is an alloy resembling well-hammered brass, but better able to resist distortion when the wheel is being cut. It is known in France as English brass—*laiton Anglais*." This is interesting testimony to the skill of the English watchmaker.

The cylinder or horizontal escapement is made in vast numbers. The performance of watches fitted with it is quite good enough for most people, who are perfectly contented with a watch that does not require to be set more than once a week. But no horizontal watch will satisfy the demands of those who require anything approaching to accuracy. To obtain this a compensated balance is indispensable; but the errors due to the variation in dead friction caused by changes in the fluidity of the oil are so great in the horizontal watch that a compensated balance cannot be used. Indeed, the best results are obtained by using gold for the balance, as unless the balance expands the watch will gain in hot weather as the oil becomes more fluid, and lose in cold weather as the oil becomes thick, which result is directly opposite to that which takes place in watches using little or no oil, and with detached escapements. M. Saunier deals exhaustively with every conceivable question that can arise concerning the horizontal escapement. It is a remarkable circumstance that, although the escape wheel is of very peculiar form, and the balance staff complicated by the presence of the cylinder, such is the perfection to which watchmakers' tools have been brought, that it is one of the cheapest escapements which it is possible to make.

Here for the moment we must suspend our notice of M. Saunier's volume. We shall return to its consideration in an early impression.

ELECTRICAL ACCUMULATORS OR SECONDARY BATTERIES.

BY PROFESSOR OLIVER J. LODGE, D.SC.

No. III.

To understand fully the action going on in a Faure cell it is necessary to know something about the salts of lead; for at the present time lead seems by far the most suitable material for secondary batteries.

The protoxide of lead is called litharge, and is of a yellow or puce colour. Its constitution is Pb O, and its atomic weight therefore 223. The intermediate oxide is red lead, or minium, and its constitution appears to vary from $Pb_2 O_3$ to $Pb_3 O_4$; but it is most commonly the latter, and its atomic weight therefore 685. The peroxide, or black oxide, or heavy lead ore, is $Pb O_2$, atomic weight 239; and it differs from the two preceding oxides in being a conductor of electricity, just as the peroxide of manganese $Mn O_2$ is.

The sulphate of lead, $Pb SO_4$, is also important in the present connection. It is a dirty white non-conducting substance, slightly soluble in strong sulphuric acid, but quite unsoluble in dilute acid and in water. It will be formed, of course, as soon as red lead or litharge are put into dilute sulphuric acid; and unless there is an excess it may happen that all the acid gets used up in this way, leaving only water, in which case the liquid will cease to conduct. A Faure cell must therefore contain a considerable space for the acid liquid in addition to the space occupied by the plates and their coatings. But even then the strength of the dilute acid will become gradually weaker if a new Faure cell is allowed to stand for some time before a current is sent through it; and its resistance will accordingly be pretty high when you begin to charge. While the current is passing, however, the $Pb SO_4$ formed while standing will be gradually decomposed, the lead being either reduced or oxidised, and the acid being reformed; so that the resistance of the cell will gradually diminish for this reason. It will also diminish for two other reasons, one of which is that the liquid is warmed by the current, and the average number of dissociated atoms thereby increased; while the other is that the spongy lead formed on the — plate, and the peroxide formed on the + plate, are both conductors; and hence the acting surfaces of the plates are practically slowly advancing to meet each other all the time the current is charging the cell, and the layer of non-conducting oxides and sulphate is gradually diminishing in thickness. Hence the urgent necessity for the flannel or felt between the plates. For if ever, in the process of charging, any portion of the peroxide were to reach across to a portion of the spongy lead, a bridge of metallic conduction would be completed, and the cell would be short circuited. It would be as reasonable to try and charge up a bit of copper wire as such a cell.

We perceived in the last article that a current of one Ampère was able, in 108 hours, to oxidise a pound of litharge to peroxide on the positive plate of every cell through which it is passed, and to reduce a pound to metallic lead on the negative plate in the same time.

The oxidation of a pound of minium ($Pb_3 O_4$) to the peroxide can be effected by a rather less quantity of electricity, namely, by $\frac{48,000}{685} = 70$ Ampère-hours; there being four bonds joined up when $Pb_3 O_4$ is oxidised to 3 ($Pb O_2$). But to reduce minium to metallic lead requires a greater quantity—eight bonds having to be loosed—namely, $\frac{96,000}{685} = 140$ Ampère-hours. Hence, provided there is no waste and no gas given off, twice as much minium will be oxidised in each cell by a given current as is in the same time reduced. But with litharge the quantities oxidised and reduced are equal. When minium is used, therefore, either the coat of it on the + plate must be considerably thicker than the coat on the negative, or else the + plate itself must be expected to be eaten into somewhat before the reduction on the other plate is finished, and must be made of sufficient thickness to stand it.

Every pound of metallic lead thus oxidised to peroxide will require $\frac{48,000}{207} = 230$ Ampère-hours of electricity.

If any gas is given off, every pound of hydrogen collected accounts for 12,000 Ampère-hours; or, as a pound of hydrogen occupies about 180 cubic feet under ordinary circumstances, we may reckon the electricity necessary as 67 Ampère-hours per cubic foot of hydrogen. If any free oxygen is detached, the electricity may be reckoned at the rate of 134 Ampère-hours per cubic foot, or 1500 Ampère-hours per pound.

Now let us take a single Faure cell charged with minium, and pass through it a measured current of C Ampères for an observed time of T hours. Let the gas evolved be collected, and found to consist of h cubic feet of hydrogen and g cubic feet of oxygen. Let the weight of minium reduced to metallic lead on the negative plate be called x, and the weight oxidised to peroxide on the positive plate be called y, both being expressed in pounds avoirdupois. Further, let z pounds of the + plate itself be oxidised to peroxide; let a small quantity, say u pounds, of hydrogen remain associated with the negative plate, either mechanically as bubbles, or as a sort of alloy; and let v be the weight of oxygen likewise liberated but unable to escape, or else used up in some indirect way. Then the following two equations render a full account of all that has gone on, as far as electrical laws can express it:

$$C T = 70 y + 230 z + 1500 v + 134 g$$
$$C T = 140 x + 12,000 u + 67 h$$

The quantity g is probably zero if a properly weak current has been used in charging. The quantities u and v will also probably be small;* and, therefore, perhaps, for practical purposes it may be sufficient to write

$$C T = 70 y + 230 z$$
$$C T = 140 x + 67 h$$

Now h, the volume of gas evolved, can be easily collected and measured. There remain then the three unknown quantities $x y z$. The above two equations are of course not sufficient to determine them, but they show us the kind of relation which must exist between them, on the hypothesis that u and v are negligible. Especially we learn how much the + plate will have been attacked at any time after the whole of its minium layer has been reduced.

The most direct way of determining C T is to insert in the circuit some kind of voltameter, say a couple of large copper plates immersed in a solution of sulphate of copper; then by the time that one of the plates has gained, and the other lost, P pounds in weight, the quantity which has passed will be

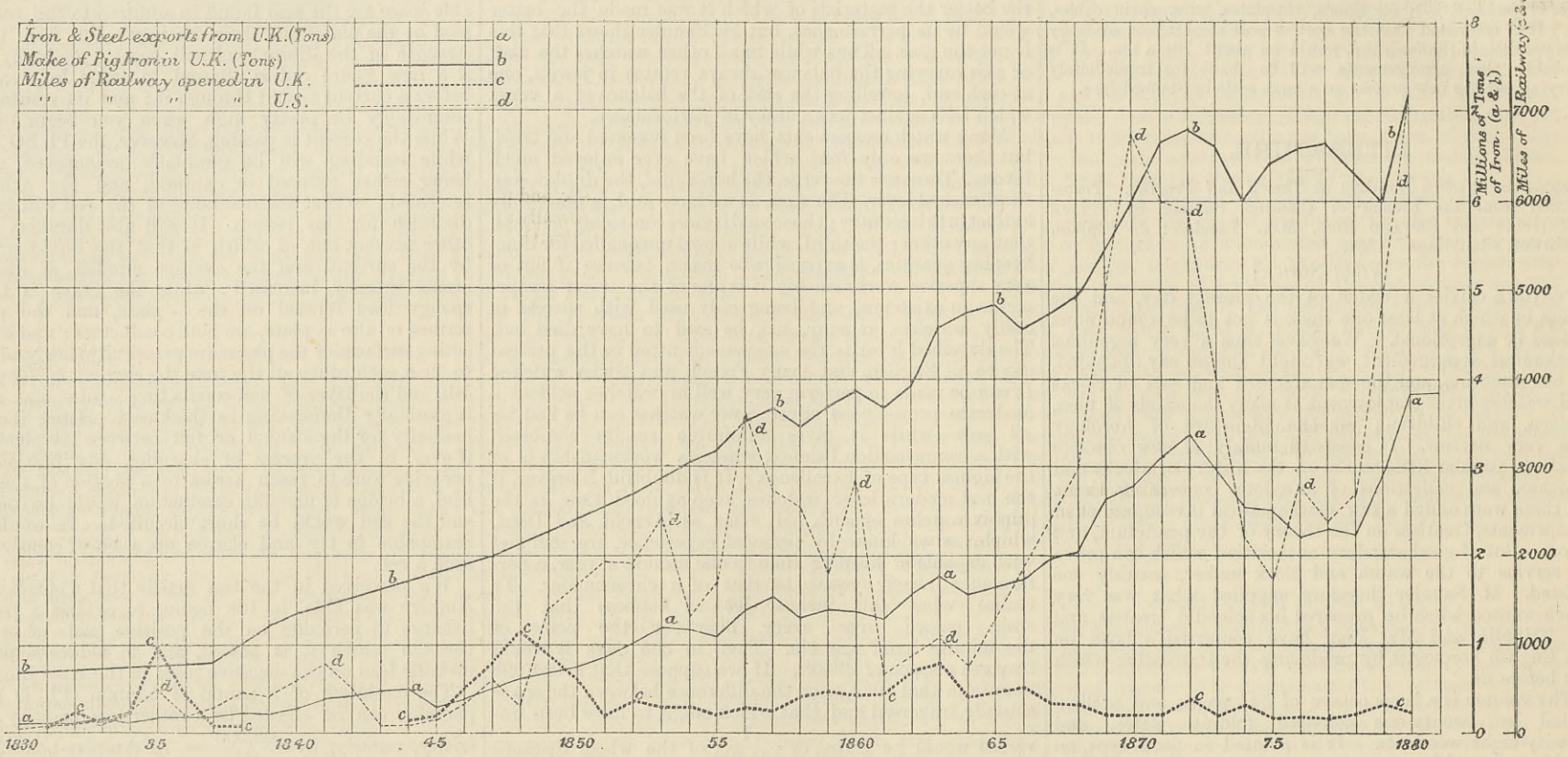
$$C T = \frac{24,000}{63·5} P = 377 P \text{ Ampère-hours.}$$

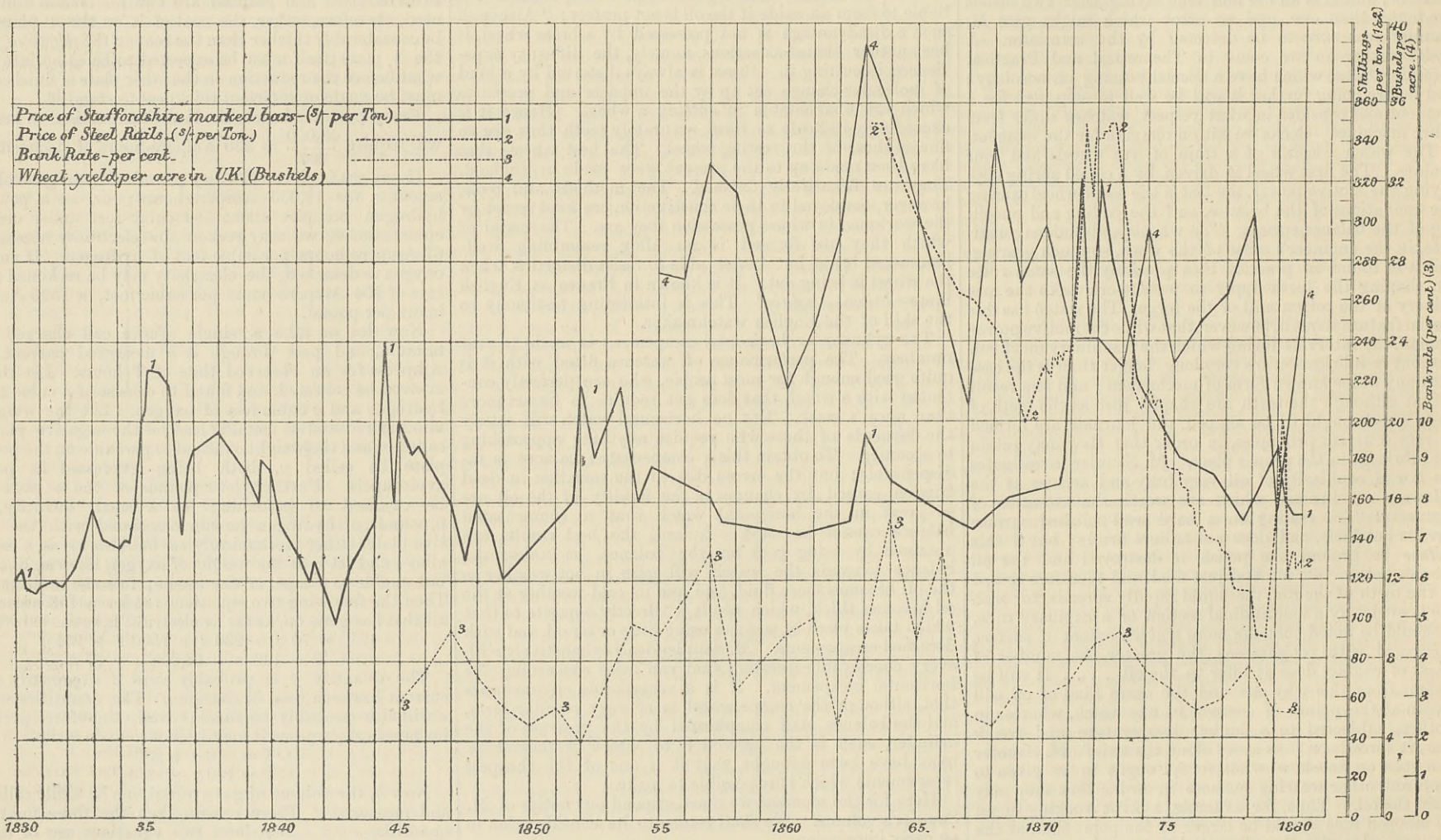
Liverpool. O. J. L.

* They are multiplied by large coefficients though, and I am by no means sure how far it is practicable to neglect them. I believe the reduced lead is alloyed pretty strongly with hydrogen.

CAUSES OF AND REMEDIES FOR BAD TRADE.

In his paper recently read before the Society of Arts, Mr. Walter Browne gave a remarkable comparative table of the fluctuations, during the last half century, which have occurred in the iron trade, in the bank rate, and in the harvests of England, and also in the railway enterprise both of England and the United States. This table has since been published in the Society's *Journal*, and we shall not reproduce it; but its results are more clearly and effectively conveyed by means of the two diagrams annexed, in which the successive years are given along the bottom, and the rise and fall of the various lines mark the rise and fall in the quantities or values of the various items which are tabulated. Thus in the first table we have represented for each year the number of tons of pig iron made, the number of tons of iron and steel exported, and the number of miles of railway opened both in the United Kingdom and the United States; while in the second table we have the price of Staffordshire marked bars and of steel rails, the bank rate of discount, and the yield of wheat in the United Kingdom in bushels per acre.





The object of bringing together this particular set of items was to give in one view the progress of the manufacturing prosperity of England, and the influence exercised upon that progress by some of the chief causes which have been assigned for it. By a careful study of the diagrams much may be learnt on these questions. It is necessary, however, to settle the preliminary question—whether we are right in taking the condition of the iron trade as the best index to the general condition of trade in our country? On this, however, engineers, at any rate, will not feel very much doubt. To measure the trade of the country, as a whole, is impossible, since of its largest factor—the home trade—no general record is kept. Some trade, of which records are accessible, must therefore be selected to represent the total; and the iron trade is the best, for this simple reason, that iron in one form or another enters into the apparatus and means of manufacture of every other trade, and therefore a variation in any other trade has a direct influence upon the demand for iron. Moreover, as the whole of the raw material is produced, and the manufacture carried on, in our own country, the trade is practically independent of political or foreign complications. Thus if the cotton trade, vast as it is, had been selected as the standard, it is obvious that the years of the "cotton famine" would appear as the very worst in the history of trade; whereas that famine was produced by a purely artificial scarcity in that particular article, and the general trade of the country was sound and increasing.

Taking, then, the iron trade as our standard, three items connected with it are given, as gauging, amongst them, its true condition and progress. These are—the amount of pig iron made, the amount of iron and steel exported, and the price of Staffordshire marked bars, as the most authentic representative of the price of finished iron generally. Of course, after taking account of all these, the results are still very rough, and liable to be modified in various ways; but of all the materials existing for a theory of trade the same may be said.

Let us see in the first place how far the two causes usually adduced for fluctuations in trade are shown by the diagrams to have a real effect. These are, in the briefest terms, harvests and currency. As to the first we need go no further back than last year—the returns for which are necessarily not included—for an example of a real and general revival of trade at the very moment of a bad harvest almost throughout the world. Again it will be seen that bad harvests in 1869-1873 did not hinder the enormous wave of prosperity in 1872; and it also appears that good harvests in 1868 and 1848 did not avail to remove the depression existing at those periods. Hence, while no one would dispute that a good harvest is a good thing, and must at least tend to promote activity in trade, it appears by the unanswerable evidence of facts that it is not really an important factor in the case. The same may be said, with even more confidence, of the other alleged cause, namely the currency. This, in fact, is little more than a figment of the financial speculators and doctrinaires, who delight in fancying that they govern the affairs of the world. To show its falsity, we need only remember that the greatest change of modern days, so far as currency is concerned, was the discovery of Australian gold about 1848. But the whole effect which can possibly be ascribed to this is an abrupt rise in iron for a few months in 1848, followed by a fall to below its former level. The make of pig iron, and the amount of exports, are absolutely unaffected by it. Again, the exceeding lowness of the Bank rate in 1867-8, and again in 1874-6, was powerless to renew enterprise and bring about a return to prosperity. The City of London, in fact, is not the heart of England; her commercial life, happily for herself, is dependent on no such limited and feverish an organ.

The same will follow with regard to another cause, not touched on in the paper alluded to, viz., the fiscal arrangements of the country. It must be somewhat of a shock to our ardent free traders to see that Sir Robert Peel's great change of policy, so much fought over then and since, fails to make itself known, by the very slightest trace or indication, in these tables of assured facts as to England's progress. To say that the great extension of English trade, especially her foreign trade, began with the era of free trade—that is about 1848—is simply untrue. A glance will show that it dates, not from 1848, but from 1837; by 1848 both the make of pig iron and the exports of iron and steel had attained a steady and assured rate of increase, shown by uniformly rising lines, upon which the great fiscal change does not make the slightest impression of any kind. We are often told that a nation cannot be made sober by Act of Parliament; and that a nation cannot be made prosperous by Act of Parliament is at least as certain a truth.

It remains to say a word on the proposition which formed the thesis of Mr. Browne's paper, and on which he founded the deductions which we quoted in our issue of February 3rd. This is that the extension of new industrial enterprises was the real and immediate cause of the prosperity of trade; and this he exemplified by the case of railways, as constituting by far the largest development of new enterprise which has taken place in our era. The facts of the diagram certainly lend themselves

strongly to this view. The development of English trade begins, as we have seen, in 1837 ; and this was just at the close of the first great era of railways in 1835, when they had therefore become an accepted field for enterprise, and their immense services in cheapening transport had been fully recognised. Another great rise in prices, and also an increase of exports, marks the second era of rapid extension, beginning in 1844 ; and a heavy fall in prices followed its termination, though, as will be seen, the total make of pig iron still continued to increase. It would seem therefore that this crisis was rather a financial than a commercial one. Of late years it has been American rather than English railways that have shown their influence upon trade. The effect of the enormous extension of United States railways in 1869-70, and again in 1878-9, is most clearly demonstrated by the great advance in prices and production that immediately followed—thus showing it to be a result, and not a cause. The origin of both these great movements in trade has been much debated; but these figures, we think, make the matter clear at a glance. A great contrast is afforded by the uniformly low level of the line representing English railway extension, which in itself throws much light upon the long-continued dulness of the trade in English railway plant of every description.

Our readers will doubtless be able to utilise these diagrams yet further for themselves, as a means of tracing out what may be termed the natural history of trade fluctuations.

THE UNION PACIFIC RAILWAY AND THE COLORADO STATE.

As most of our readers are aware, railway enterprise is very active now in Colorado, and the following notes on the railways and the country through which they are passing, written by Mr. J. Causley in the Union Pacific Railway engineers' camp on the Snake River, will be found of interest.

The State of Colorado is nearly equally divided between mountainous and prairie land, the western half being mountainous, the eastern prairie. In the mountains are many rich mineral districts and a number of mining towns, to which new ones are added every year. At the foot of the mountains is a strip of good arable land, on which fine crops of wheat are raised, particularly in the valleys of the Cache la Poudre, Big and Little Thompson Boulder, Clear Creek, and Platte rivers ; in the northern part of the State irrigation is, however, generally necessary. In this district are several flourishing towns, of which the City of Denver, the capital of the State, is the largest and chief railroad centre. It is situated on the south fork of the river Platte, sixteen miles east of the mountains and a little south-east of the middle of the northern half of the State. In the southern half, Pueblo is the chief town, and becoming an important railroad centre also.

There are coal mines near the mountains west and north-west of Denver, at Golden Boulder, Erie, &c. In the south at Trinidad and Cañon City, in the west on the Gunnison, also in other parts of the State, coal beds have been found and are being opened. The railroad communication with the east is in the south by the Atchison, Topeka, and Santa Fe, which comes to Pueblo; in the north by the Kansas Pacific, owned by the Union Pacific Company, which passes through Wyoming territory, a little to the north of the State of Colorado. From Cheyenne —516 miles from Omaha—on this line, the Denver and Pacific, owned by the Union Pacific—runs south, passing through the farming towns of Gruby on the Cache la Poudre river and Evans on the south fork of the Platte to Denver. From Colorado Junction west of Cheyenne—on the Union Pacific—the Colorado Central, worked by the Union Pacific under a lease, runs south-west, then south through the towns of Fort Collins on the Cache la Poudre, Loveland on the Big Thompson, Longmont on the St. Vrain, Boulder on the Middle Boulder, to Golden on Clear Creek, west of Denver and sixteen miles from it by railroad, and thence to Denver.

From Golden the narrow gauge line of the Colorado Central—3ft. gauge—runs west up Clear Creek Cañon to Blackhawk and Central, two adjoining towns, which have grown into one, and form one of the oldest and most important mining centres in the mountains. There is a large amount of fine milling gold ores in this district which is worked in with stamp amalgamating mills, while the rebellious ores, of which there is a quantity also, are sold to the smelters in Golden and Denver ; Central is twenty-four miles from Golden. A branch of this line goes also to Georgetown, another mining town, thirty-four miles from Golden. From Georgetown to the Continental Divide at Loveland Pass—elevation 11,874ft.—is sixteen miles. A line further west has been located by this route, and nine miles of the grading let. Another company is making a tunnel through the pass and has 310ft. of headings and about 300ft. of approaches completed.

The Union Pacific Company has bought the Denver and South Park Railroad, which runs through several mining towns in the mountains to Leadville, the centre of the Carbonate district, which has grown so enormously during the last four years, and now contains fully 30,000 inhabitants. Besides these there are other small branches.

From Denver the Denver and Rio Grande runs south, passing Colorado Springs to Pueblo, then further south to Trinidad—noted for its coking coal—and New Mexico, with branches into the mountains, also from Pueblo it has western branches passing Cañon City—where there are large coal mines—and running to different mountain mining towns, the principal of which is Leadville. Last year the Union Pacific completed the Julesburg cut-off, 151 miles long, from Julesburg on the main line to Evans on the Denver Pacific, shortening the distance from Omaha to Denver 57 miles, *i.e.*, from 626 to 569 miles, and also greatly reducing the grades and sharpness of the curves, for this line has no curve over 1 deg. – 5730ft. radius—and no grade steeper than 16ft. to the mile. Last year this company did location and construction on what it has named the Gruby Salt Lake and Pacific Railroad, that is, lines leaving the Colorado Central Railroad at Fort Collins and at Boulder. From Fort Collins it located and graded a line east to Gruby, nearly 25 miles, to connect with the Julesburg cut-off. A quarter of this has the bridges and culverts in, and about two miles of iron are laid. It will be completed when the ties come down from the mountains on the spring freshets. As the iron is laid the material will be sent on, also the steam pile drivers to drive the piles for the bridges. West from Fort Collins a continuation of this line has been located up the Cache la Poudre river into the mountains, of which twelve miles have been graded, the bridges and culverts put in, and the iron laid on six miles of it. West of Fort Collins in the Hogbacks—a local name for the sharp ridges, generally north and south in direction at the foot of the mountains caused by the silting up of the strata—are some excellent sandstone quarries giving both flag and dimension stone. To reach these a branch line was built last year and opened last winter. It leaves the line of the Gruby, Salt Lake, and Pacific at five miles west of Fort Collins and runs south along a north and south valley west of the first line of Hogbacks for ten miles. Starting from near the end of this line is a mile of switch back up to some of the quarries. On this line, running north—in which direction the the full trucks will go—there are down grades as steep as 1 in 50, while there is no up grade heavier than 1 in 200. From Boulder a narrow gauge line—Gruby, Salt Lake, and Pacific Railroad—gauge 3ft., has been located and is being constructed westward in the mountains through Boulder and Four Mile Cañons up Pennsylvania Gulch, &c., of which to station 804—100ft. stations—is graded and the graders at work further on. This line, as did the Colorado Central from Golden to Black Hawk and Georgetown when it was constructed, encounters great engineering difficulties ; miles of 1 in 25 grade are used, and in places the grade is as steep as 1 in 22. At Boulder the elevation is 5370ft., while at station 804 it is 8010ft. The curves also are very sharp, up to 30 deg.—radius 193ft. There is one curve reversing from a a 28 deg. to a 30 deg.; also to gain elevation between stations 700 and 1200 there are loops requiring eleven miles of road to gain four miles in distance.

On the Union Pacific broad gauge, *i.e.*, standard gauge 4ft. 8½in., where the ground is difficult 1 in 50 for incline and 10 deg. for curves are generally considered the maximum, but in the Poudre Cañon there is a curve of 11 deg. The road bed in embankment is 12ft. wide for low fills ; for fills over 4ft. or 6ft., according to traffic, &c., 14ft.; side slopes generally 1½ to 1, flatter when required. In excavation the base is generally 16ft., to allow for a 2ft. ditch on each side. In ordinary ground, side slopes in excavation generally stand very well at 1 : 1, which is reduced for harder material, and to ¼ : 1 for rock.

In earth most of the grading is done with plough and scraper, and where earth can be got readily it is seldom hauled more than 600ft., but borrowed at the sides of the embankments and wasted at the sides of the cuttings. Cuts 15ft. or 16ft. deep are made with the scraper, inclined runways being scraped out at intervals at the sides. In earth excavation the first 100ft. at each end of a cut is not paid for. The number of cubic yards in the embankment and excavation is estimated. Here—east of the mountains of North Colorado—the work is generally paid about 14c. per cubic yard earth ; 50c. per cubic yard loose rock, and 1 dol. 25c. to 1 dol. 50c. solid rock. Solid rock in cutting is subgraded 1ft.

The ordinary low bridges on the extensions and side lines are usually of wood. Where piles cannot be driven they are composed of baulks of 12in. stuff with cap, sill, two vertical, and two inclined posts, framed together, placed 16ft. or 20ft. apart, and stringers on which the ties are laid. There are two stringers when the baulks are 16ft. apart, each made of three pieces of 16ft. by 6in. by 14in. stuff bolted together, with packing blocks between them. When the baulks are 20ft. apart, 20ft. by 7in. by 16in. stuff is used. These are employed for bridges to about 30ft. in height. Those near that height are braced with sway and diagonal braces. Above that height two tiers of posts are used, five generally support a cap every 16ft. or 20ft. They are generally driven as far as they will go with a 24 cwt. or 26 cwt. hammer, fall about 20ft.

Ties are placed 2ft. apart, centre to centre, and the rails spiked to them with two spikes per rail to each tie. The rails are connected with fish-plates. The ties are generally laid down on the grade without ballast under them, and surfaced up to their tops with the adjacent soil. On the main line the rails are steel ; on branch lines generally 56 lb. iron. Stone, or wooden box culverts are put in according to circumstances. The Union Pacific is not working strongly on the eastern slope this spring, but is devoting its attention chiefly to the extensions west. The Oregon short line is being pushed forward with great energy to reach Baker City, Oregon ; then it will probably be extended to the Pacific. Last year there was a great railroad building excitement in Colorado. The Denver and Rio Grande had an army of men working there and further south, and filled the mountains with surveying parties.

The Atchison, Topeka, and Santa Fe were working. The Denver and New Orleans did a great deal of grading.

Amongst smaller companies in northern Colorado, the Denver, Western, and Pacific built from Denver to Erie and up the St. Vrain, about forty miles. The Denver, Salt Lake, and Pacific, narrow gauge companies, completed a line up the South Boulder to the mouth of the Cañon, about thirty miles. A narrow gauge was built from Denver to Longmont ; but they are doing hardly anything now.

LETTERS TO THE EDITOR.

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

BOILER INSPECTION.

SIR,—Some strange remarks were made in two letters which appeared in last week's ENGINEER—one signed by Mr. John Swift and one signed "Engineer." The letters appear to be in answer to the article in THE ENGINEER respecting boiler insurance, and generally contradict the sensible and just remarks in that article. No prudent man will think for a moment that an insurance company, having over 20,000 boilers under their supervision, will, for the sake of the profit derived from the insurance of a boiler, give a guarantee that the boiler is in order, and safe to work at such or such a pressure, knowing at the same time that it is not so.

From the remarks of "Engineer," he would lead people to think that such a company's inspectors are not reliable, and also states that the inspectors of the Manchester Steam Users' Association and those of another company are better men. "Engineer" is not aware that there are men in the Steam Users' Association who have been inspectors for other companies, and that there are also men in other companies who have been inspectors for the Manchester Steam Users' Association.

All inspectors are generally taken from one class of men, and are generally of average intelligence, that is, good practical mechanical engineers, with, of course, some theoretical knowledge. "Engineer" knows little of boiler inspecting when he talks of a boiler being hammered all over by an inspector. Boilers in some ironworks have not the best care and attention, they are often in the open air with a slight brick covering, through which the rain soon reaches the plates and flues, seldom any treatment to get rid of scale, and little attention to regular cleaning or use of blow-out taps; heavy night and day working, often fired from a puddling, ball, or mill furnace. From the latter I have seen a red flame after passing through tube and bottom and side flues of a Cornish boiler.

Respecting the Radcliffe explosion, a boiler may take serious harm from one inspection to another—that is, twelve months. I know a case which came under my own notice; a Lancashire boiler was under an insurance company, but owing to an entire change in the firm, it was taken from the insurance company's care. Eighteen months after their last inspection I made an examination of the boiler, and found the plates over the seatings to be corroded almost through, caused by dampness in the flues. From the active nature of the corrosion, I am quite sure it had all taken place in the eighteen months above stated. INSPECTOR.

Manchester, June 12th.

SIR.—Your correspondent John Swift, in his letter of 7th June, is evidently very bitter against the boiler insurance companies. He does not mention, however, that not twenty years ago he was in the employment of one of these companies, and seems to forget that within three years he applied for an agency of a boiler insurance company. His own words will best explain his views at that time: "If I could insure, I have no doubt I could do very much more business, as rightly or wrongly, the majority of boiler users have decided in favour of boiler insurance in addition to boiler inspection." SECRETARY.

Manchester, 14th June.

CONTINUOUS BRAKES ON METROPOLITAN RAILWAYS.

SIR,—I have read your article on "Continuous Brakes" with interest. Permit me to say that you have overlooked the influence of want of repair. While the brake tackle is in good order the trains run quietly enough, but there is none of it in good order on either line, and the result of slack joints is a jumping and kicking of the carriages, which you will find quite perceptible in houses near the line. If the Duke of Westminster can induce the locomotive and carriage superintendents of the metropolitan railways to do their duty and keep the brakes in order, he will have no further cause of complaint. G. K.

Earl's Court, June 14th.

THE PHYSICS OF THE EARTH'S CRUST.

SIR,—The reviewer of my "Physics of the Earth's Crust," says, at the bottom of p. 420 in your issue of the 9th instant, that, assuming my calculated estimate of the radial contraction of the globe, viz., 3479ft. (p. 72)—"If we put r = radial contraction, we should then have, even upon this calculation of the quantity of material at disposal for elevations above datum or deep sea bottoms, an average height of elevation of $r+(2{\cdot}88r)=13{,}498$ft., which is considerably above 9504ft."—my estimate of the existing elevations above datum, if spread over the whole globe. 2·88 is here the ratio of the water area to the land area, or of 146 millions of square miles to 51 millions. The above equation means that the volume by which the entire globe has been diminished by contraction, is the same as that of a block of the area of the continents, and 13,498ft. high. The conclusion which he draws from this calculation seems to require that the volume, by which the globe, as a whole, has contracted, should be available towards forming elevations. This is not according to the supposition upon which my estimate of the said radial contraction has been based ; for that supposes an absolute loss of volume to that amount through cooling.

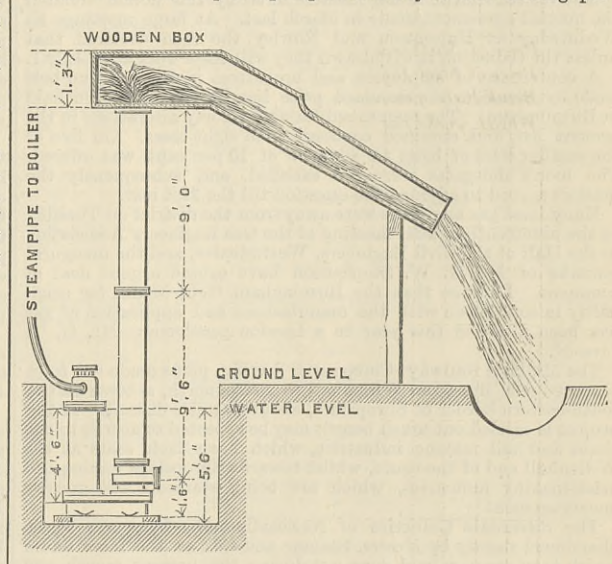
It is a very important question whether or not the water of the ocean can gain access, and supply the steam which is the motive power in volcanic eruption. I have given what seem to me good reasons why it cannot. I am not alone in that opinion. It would have been more satisfactory if the reviewer had replied to my arguments, instead of merely stating that he did not consider them worth mention.

My work does not claim to be a record of experiments. Experimental results are the materials which the mathematical reasoner is permitted to make use of. It is an ordinary case of the division of labour. O. FISHER.

Harlton, Cambridge,
13th June.

TRIAL OF KIDD'S STEAM PUMP.

SIR,—On Saturday last we tried, as in annexed, one part of the elevator I am on the point of erecting at the Sewage Works, Watford, and which is very similar to that I exhibited at the Naval and Submarine Exhibition, and which you illustrated at the time, with the following results :—(1) With a steam pressure in the boiler of 8 lb. per square inch, the column of water 9in. in diameter and 18½ft. above the valve was raised fully 6in. (2) With 18 lb. pressure the action is violent, and the strokes about 25 per minute. (3) With 40 lb. pressure the action is very violent, the stream continuous, and the strokes much increased ; the 7-horse power portable engine and boiler we used would not supply steam fast enough, because we had to keep the pump continually at work forcing perfectly cold water into the boiler at each stroke. (4) The temperature of the pumped water in each case was 60 deg. at the inlet and at the outlet ; it was repeatedly tested with a couple of newly 62 deg. adjusted thermometers. (5) When left to itself and working automatically with 20 lb. steam pressure, the temperature was increased to 71 deg., or 11 deg. more at the outlet than the inlet. The cylinder, which is alternately the steam and water chamber, is 12in. in diameter and 4½ft. in length. JOHN H. KIDD.



Westminster-buildings, Wrexham, 12th June.

INJECTION CONDENSERS.

SIR,—Having observed your remarks in THE ENGINEER of the 2nd and 9th inst., relative to injection for condensing engines, I beg to hand you what little experience I have had on the subject. I have always thought that there could be no better pump or water-lifter than the condenser of a good working engine, the flow of water being steady in one direction, and not getting a check, as it does each stroke of a pump. I once placed a 6-horse power condensing engine on the top of a hill, and at fifty yards' distance there was a pool of water, when full, 20ft. lower than the condenser, and the engine would work down to 24ft. to 25ft., perhaps more, only I had to return part of the water, and of course it got a little warm. The suction pipe was 2in. lead pipe, and I had a hand-pump for starting with, and when the engine was fairly started I opened the communication betwixt condenser and pool, and closed that with the pump-clack. On another occasion I had to do with a 25-horse power compound engine, 12in. internal and 24in. external cylinders. In this case a cylinder had to be sunk in the bed of the Thames, 100 yards distant, and the engine was obliged to be kept 25ft. above this ; and at low tide the top of the cylinder was dry, so that all the water had to come through the sand. The vacuum was generally 28in. The engine was started from a cistern, and generally went on during low tide, unless the barometer was very low, when a little water had to be taken from the cistern. GEORGE HUNTER.

Egham, June 13th.

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

(From our own Correspondent.)

IN the iron trade sheets continue to lead in activity, and this industry is so widespread in South Staffordshire, and affects so many brands, that its condition is of the utmost importance. Its present busy condition is therefore the more satisfactory. Galvanisers and merchants are alike this week again in the market, the latter buying on Russian and Indian account in much part. To Australia also big consignments are being made of sheets in the block. Most of the mills are now making full time, and can see orders "ahead" for a comfortable distance.

Sheet prices on 'Change this afternoon were quite as strong as a week ago. Singles were £8 to £8 5s., doubles £8 10s. to £9, and lattens £9 10s. to £10. Galvanisers reported the receipt of good foreign orders, chiefly on South American and Antipodean account. For sheets of 22 w.g. to 24 w.g., bundled, delivered Liverpool, prices of galvanised sheets ranged from £14 to £14 10s. and £15, according to quality; £2 additional was required for 26 w.g., and a still further £2 for 28 w.g.

Boiler plates were dull this afternoon, and indeed there is but little relief in the comparative stagnation which has overhung this branch of the trade for a long time. Common plates were to be had as low as £8 per ton, but the minimum for boiler qualities was £8 10s. Superior sorts ranged from £9 up to £9 10s. The competition of the North Stafford makers in this branch is rather severe.

Some engineering sections of iron, such as Tee and rivet iron, were in fair inquiry—inquiry which was an improvement on a month ago. Common sorts of Tee iron ranged from £7 10s. to £8, and marked sorts from £8 10s. to £9 10s. Rivet iron, ordinary, was £8 to £8 15s.; marked sorts, £9 to £9 10s.; and double best sorts, £9 15s. to £10.

Hoops are being rolled in good bulk for the home markets, for coopers' use, and for shipment. For export, hoops were to be had at as low as £6 15s., but for home consumption £6 17s. 6d. to £7 was demanded.

The bar trade is reviving a little. The "list" houses, however, as a whole, still continue behind the makers of medium and common bars in the amount of work which they are doing. List quotations stand at: £8 2s. 6d. to £7 10s. for ordinary marked bars, £9 for best ditto, and £10 for double best. Best chain bars are also £9, and double best £10.

Some Lincolnshire and Nottingham—"Best Wood" brands—pigs were quoted 50s., but the figure was 2s. 6d. per ton in advance of buyers' pockets. Leicestershire pigs were 48s. at railway stations, and 49s. at works. Derbyshire pigs—Clay Cross and Ainsworth brands—were priced at 47s. 6d., and this was really the top price that could be obtained for any of these foreign brands, except in a few special cases. South Staffordshire pigs were quiet at 37s. 6d. to 40s. for cinder sorts; 50s. to 52s. 6d. easy for part mines; 57s. 6d. for best three-part mine pigs, and 65s. to 67s. 6d. for all-mine hot-blast sorts.

Hematites showed a little more life, and consumers were less reluctant to give vendors' prices. Actual selling prices ranged from 62s. 6d. to 65s. Tredegar and Wigan hematites were "quoted" at this latter figure, and the former were firm at the price. Barrow hematites were quoted 67s. 6d., but the price could not be obtained. Blaina hematites were priced at 62s. 6d., and Brymbo ditto at 60s.

Coal is unimproved in demand, and the prices are very low. The "list" price for blast furnace sorts remains at 10s. to 9s. 6d., but supplies are abundant at 8s. 6d. to 8s. in a general way. Forge coal is 5s. 6d. to 6s. 6d. per ton at the pits, and steam coal mined on Cannock Chase is as low as 5s. per imperial ton. A 10,000 ton contract has just been accepted at this figure from the London and North-Western Railway Company.

The masters in the Staffordshire and Warwickshire chain trade have recently reduced wages by from 10 to 15 per sent. The operatives contend that the masters have by this action violated the mutual agreement made in March last. At large meetings on Wednesday at Halesowen and Rowley the men declared that unless the reduction is withdrawn they will cease work after July 1.

A conference of employers and operatives in the nut and bolt trade to reconsider the standard price list has recently been held in Birmingham. The men asked for about forty alterations in the present list, and obtained concessions in eight cases. On five of the smaller sizes of bolts an advance of 10 per cent. was offered. The men's delegates were not satisfied, and subsequently the masters agreed to adjourn the question till the 21st inst.

Many local gas engineers were away from the district on Tuesday at the nineteenth annual meeting of the Gas Engineers' Association in the Hall of the Civil Engineers, Westminster, and the inaugural remarks of Mr. G. W. Stephenson have caused a good deal of comment. I notice that the Birmingham Gold Medal for originality in connection with the manufacture and application of gas has been awarded this year to a London gentleman—Mr. G. T. Livesey.

The Midland Railway Company is having plans made out for a proposed new line from Willenhall to Bridgenorth, a town on the south-eastern border of Shropshire, about 20 miles distant. If the project is carried out much benefit may be expected to accrue to the chain and nail making industries, which have their seats at the Willenhall end of the route, whilst towards Shropshire mining and brick-making industries, which are being started, will receive encouragement.

The Silverdale Collieries of Newcastle-under-Lyne are to be abandoned shortly by Messrs. Stanier and Co., as the lease under which they are now held runs out during the present month and the proprietors do not intend to renew. The extensive ironstone and coal-mining plant on their Apedale property will be kept on as usual, as also the six blast furnaces there. The Knutton mills and forges have lately been improved, and they have now a greater capacity for the production of plates, bars, angles, tees, hoops, and other description of finished iron.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—Although the weight of business actually doing is not more than moderate, the market seems to have taken a healthy turn. Makers all round are firmer than they were, and are not now disposed to book orders at the low figures which last month they were willing to take, advances of 1s. to 2s. per ton being asked in some cases. Buyers, however, do not show much inclination at present to follow any material upward movement of the market; but although advanced rates tend to check business, there is a good deal of inquiry stirring, which would no doubt result in operations to a considerable extent upon the basis of old rates, and fair sales have been made during the week at an improvement upon recent prices.

Lancashire makers of pig iron are firm at 45s. to 46s., less 2½, for forge and foundry qualities delivered equal to Manchester, but they are doing very little business, and stocks are accumulating at works. Lincolnshire makers are holding out for an advance in prices, and business has been done on the basis of about 45s. and 45s. 6d. for forge up to 46s. 6d. for foundry, less 2½, delivered into this district, which is about 1s. per ton above what orders were being placed at prior to the holidays, and in some cases 1s. to 1s. 6d. per ton above these figures is being asked. Derbyshire iron is very irregular in price, but I do not hear of any business of importance being done in this branch; north country irons are also still kept practically out of this market by the relatively higher prices ruling at Middlesbrough.

In the finished iron trade business is still only quiet, and the usual June stock takings at many works probably to some extent interfere with the orders being given out just at present. Makers, however, are firmer than they were. Although sales have been made during the week at as low as £6 5s. per ton for bars delivered into the Manchester district, this is a figure which very few makers are now disposed to take, and iron offering in the market at this price is chiefly through merchants; manufacturers' quotations average £6 16s. up to £7 per ton.

The engineering branches of trade generally throughout this district continue tolerably supplied with work, locomotive builders, boiler-makers, and tool-makers being mostly busy. The present unsettled state of affairs in Egypt is, however, interfering considerably with orders which usually come into this district for heavy machines connected with packing and shipment of cotton, and this causes some firms to be slack who would ordinarily be busy. Cotton machinists in some cases report rather a falling off in the quantity of work given out, and small jobbing founders complain that they are not getting very many orders.

In connection with the proposed Employers' Liability Act Amendment Bill now before Parliament, and the recent decision of Mr. Rupert Kettle, which, if sound in law, would have rendered unnecessary an amendment of the Act with the view of prohibiting any contracting out of its provisions, I may mention that an authoritative legal opinion has been taken with regard to the question thus involved, the result of which has been to condemn on legal grounds the decision given by Mr. Kettle. The ground upon which this is done is that it appears Mr. Rupert Kettle was proceeding on the provisions of Lord Campbell's Act, which only gives the surviving members of a family or the executors of a deceased man the power to sue for the recovery of anything that the deceased could have sued for had he been alive, and for nothing else; therefore if a man during his life and having control of his actions had signed away his right to proceed against his employers by mutual contract, the survivors or executors would under Lord Campbell's Act have no remedy.

The important extensions in connection with the new Salford station of the London and North-Western Railway Company, and the enlargement of the Victoria Station of the Lancashire and Yorkshire Railway Company, have now made considerable progress. The contractors, Messrs. R. Neill and Son, of Manchester, have completed the substructure of the new Salford station, and the construction of the bridges crossing several adjacent streets is proceeding. The most important of these is a massive straight plate-girder bridge, crossing Chapel-street and Gravel-lane on the skew, and which at the widest part will have a span of 157ft. The main girders which carry the bridge commence with two plates, and run up to eight in the centre, and have a depth throughout of 12ft. 8in. For their size the girders are comparatively light in construction, the longest girder—157ft. 6in.—weighing 125 tons; but this is slightly increased where the girders shorten, the next one, of 147ft., weighing 127 tons, as a greater weight of traffic will have to pass over this portion of the bridge. In the long girder I noticed a peculiarity of construction in the introduction at either end of internal stays running from top to bottom. Of these there are nine, five at one end and four at the other, and diaphragm stays extending 3ft. from the bottom are carried through the remaining portion of the girder, which at either end will rest upon a sliding bed-plate to allow for expansion and contraction. The ironwork for the bridges is being supplied by Messrs. Heenan and Woodhouse, and the work of fixing is being done by Mr. Morris Owen, both local firms. The Victoria Station extension, which is in the hands of Mr. J. D. Nowell, of Manchester, is progressing rapidly with the foundations, which have been a difficult operation, and one-half of the new bridge which will carry York-street over the extension is completed, and the remaining portion which is in hand will be ready for traffic in the course of another month, when the only break to the completion of the Manchester Tramway system will be removed. The Lancashire and Yorkshire Railway Company has also just completed a large new goods station in Oldham-road. This station, which covers an area of 138ft. by 144ft., consists of five floors besides the basement, and there are six lines of way into it, besides wide cartways on either side for the discharge and loading of goods. Steam power has been very extensively adopted for dealing with the traffic, the stages being fitted with a large number of steam cranes, whilst special arrangements for shunting as much as possible without the aid of locomotives have been made by the introduction of a number of constantly revolving capstans. The station has been built by Messrs. R. Neill and Son, and the machinery for dealing with traffic has been supplied by J. D. Wood, of Victoria Foundry, Bolton.

In the coal trade, although the little extra pressure following the holidays has kept the pits rather better employed, business itself is very quiet, and in the best and second qualities of round coal there are a good many reductions going on. Commoner sorts for ironmaking purposes and engine classes of fuel are very plentiful, with low prices also ruling. At the pit mouth the average prices are as under:—Best coals, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common, 4s. 9d. to 5s. 6d.; burgy, 4s. 3d. to 4s. 9d.; and good slack, 3s. 3d. to 3s. 9d.; with common sorts, about 2s. 9d. to 3s. per ton.

Shipping is very quiet, and there is a scarcity of vessels which also interferes with business. Extremely low prices are being offered at the high level, Liverpool, or at Garston docks, at 6s. 6d. to 7s. per ton.

Coke is in moderate demand, with prices easier, to the extent of about 1s. per ton, good hard cokes averaging 11s., and common, 9s. at the ovens.

Barrow.—I note a further improvement visible in the iron trade of this district, the demand from all quarters being increased. From information which reaches me, however, I hear that the business at the works has not changed since one or two furnaces were blown out a short time since, and I think the upward tendency in prices may to some extent be owing to that; but no doubt the American and continental inquiry being larger has been the main cause of the rise of 2s. per ton all round in comparison with the prices of five or six weeks ago. Prices this week are—No. 1, 56s.; No. 2, 55s.; No. 3, 54s. net per ton, f.o.b. at west coast ports, in a three months' delivery. I am informed that there has been but moderate business done during the week, but that the tone of the market has been much improved by the large contracts which have quite recently been entered into. There are about 50,000 tons in stock; but I am told that merchants and others hold a great quantity of it, and I am informed there will be a reduction of tonnage on the wharves and in the makers' yards by the shipments to America and elsewhere, which will take place in the course of the next few weeks. In the steel trade large numbers of orders are held throughout the district, and I notice great briskness in consequence; but although iron is buoyant, steel prices do not improve, the net quotations for rails being this week £5 10s. There is steadiness of tone and prices, so far as iron ore is concerned, 13s. 6d. being the quotation for inferior qualities; best ore, 15s. 6d., and containing 70 per cent. of metal. Steadiness prevails in the coal trade.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THERE was a good attendance at the Cleveland iron market held at Middlesbrough on Tuesday last. The tone was cheerful, but there was not a great amount of business done. The ironmasters were firm to the prices to which they have held for some time, viz., 43s. 6d. for No. 3 g.m.b., prompt delivery, and 1s. less for forge quality. Merchants who quoted 43s. 3d. last week now ask 43s. 4½d. For forward delivery somewhat less was asked. Buyers, however, were reluctant to purchase except to cover their immediate wants, and offers to sell forward at low prices were simply regarded as operations by "bears." Warrants were offered at 43s. 3d., but not many changed hands. Connal's stocks have decreased during the week by 3333 tons, the quantity of Cleveland pig iron now held at their Middlesbrough stores being 13,073 tons. The manufactured iron trade continues steady. Plates command £7 to £7 5s. for immediate delivery and £6 15s. to £7 for forward delivery, all being f.o.t. Middlesbrough less 2½ per cent. discount. Angles are £6 7s. 6d. and bars £6 5s., both less 2½ per cent.

Steel rails are not much in demand, and can be had in heavy sections for £5 10s. per ton.

The coal trade remains steady, without any change in quoted prices.

On Tuesday afternoon the first general meeting of the creditors of Messrs. Johnson and Reay, iron manufacturers and colliery owners, of Stockton-on-Tees, was held at the Queen's Hotel, Middlesbrough. Mr. John Stevenson presided. Mr. W. B. Peat, provisional liquidator, presented a statement of affairs. This showed that the total liabilities of the firm amounted to £168,397 0s. 8d., whereas the total assets amounted only to £4835 8s. 8d. The peculiarity of this case is that the works and collieries apparently belonging to the firm in question are really in the possession of two banking firms, viz., Lambton and Co., of Newcastle, and J. Backhouse and Co., of Darlington. In both cases the loose plant also belongs to the bankers under an allotment clause, the existence of which was, until the failure, unknown to the public or other creditors. This is one explanation why, with apparent control of so much property, the liquidating firm have so little to show for their unsecured creditors, when the full state of the case is revealed. It appears that secret allotment clauses were legal six or seven years ago, when these were made, but are illegal now, unless they are published as bills of sale. This, however, is small consolation to the suffering unsecured creditors. The general result of the meeting was that Mr. W. B. Peat, of Middlesbrough, was appointed trustee, with a remuneration to be afterwards fixed by his consultative committee. Upon that committee Messrs. T. H. Richardson, of Bolckow, Vaughan, and Co., H. A. Swan, of J. E. Swan and Bros., J. Stevenson, of Stevenson, Jaques, and Co., T. C. Hutchinson, of the Skinningrove Iron Company, and T. Kirk, of the Carlton Iron Company, were placed.

On Tuesday afternoon the Westbourne Ironworks, Stockton, recently in the occupation of Messrs. J. Holdsworth and Co., was sold by auction by Mr. C. Willman, in the Board-room of the Royal Exchange. The first bid was by Mr. Gladstone, of West Hartlepool, who offered £8500, but the works were knocked down to Mr. Wm. Whitwell, of South Stockton, for £100 more.

At the Stockton Forge Company's works, on Tuesday last, a man named Jackson was carrying a ladle full of molten iron into the moulding shop. By some means or other the ladle was upset, and all the molten iron was poured among some standing water. Of course it flew in all directions, and injured Jackson so severely that he had to be taken to the hospital. Several of the other workmen had a narrow escape.

Mr. Charles Hill, managing director of the Stockton Malleable Ironworks, died at his residence at Hartburn, near Stockton, on Sunday last, after a somewhat protracted and painful illness. Mr. Hill, who was a Welshman, was first known in the north as mill manager of the Walker Ironworks, when Messrs. Losh, Wilson, and Bell were the proprietors. He afterwards became works manager at Consett, when Mr. Priestman was managing director. About the year 1860 he was selected to superintend the construction of the new works to be erected for the Stockton Malleable Iron Company. On completion thereof he was retained as manager, and subsequently as managing director, which post he held till his death. Mr. Hill was highly respected for his ability and energy, and his loss will be keenly felt. The works which owe their existence and successful continuance to his skill and care are among the largest in the Cleveland district. Their output is about 1500 tons per week. Mr. Hill leaves a large family to lament his loss. Mr. Alfred Hill, manager of the Hartlepool Malleable Ironworks, and Mr. John Hill, manager of the West Stockton Ironworks, are both his sons. The loss of another son who died recently is said to have so deeply affected his father as to have precipitated his death. He was interred at the Stockton Cemetery on Wednesday.

The Middlesbrough Town Council are about to build a new town hall and other public buildings to cost £100,000. They recently advertised for plans, offering prizes for the best three sets of plans, and took the sensible course of engaging Mr. Alfred Waterhouse, the celebrated architect, to decide on their relative merits. Mr. Waterhouse awarded the first prize to Mr. G. G. Hoskins, F.R.I.B.A., of Darlington; the second to Messrs. G. Nichols and Sons, of London; and the third to Mr. L. W. Ridge, of London. In accordance with the above decision the public buildings sub-committee was instructed on Tuesday last to advise the Council as to how they should proceed to carry out forthwith Mr. Hoskin's design.

The American strike does not as yet seem to have had much effect upon the manufactured iron trade of the North of England. A certain inquiry for 1000 tons of plates from 00 to 6 b.w.g. has been in the market during the past week; but as it has been repeated through a great many channels, and has not yet been placed, it is believed to be merely a "feeler." It is the kind of specification required for grain tanks, such as are common at the shipping ports of the United States.

The liquidators of the Darlington Iron Company have issued a circular announcing a further dividend of 6s. in the pound, payable at the offices of Messrs. R. M'Kay and Co., Middlesbrough. A previous dividend of 10s. in the pound has already been paid. It is expected that in many cases creditors will accept debentures for the remaining 4s.

At the Rise Carr Ironworks, Darlington, a rather serious accident has occurred. A number of men, including a foreman named Skidmore, were breaking up lumps of iron with a steam hammer on Saturday afternoon last, a heavy piece flew up, and striking Skidmore fractured his skull. He was taken home and lies in a precarious condition.

It is stated that Messrs. R. Dixon and Co., shipbuilders, Middlesbrough, have obtained an order to build three large steamers for a Dutch East India firm. They have previously built several for the same owners.

The last meeting for the session of the Cleveland Institution of Engineers was held on Monday last. A discussion took place upon a paper recently read by Mr. Thomas Allison, of Guisbrough, upon "The Geology of Middlesbrough and its Surroundings," after which Mr. J. E. Stead, F.C.S., read two papers on chemical subjects; and then Mr. E. W. Richards, the president, exhibited drawings of some American blast furnaces, and made observations upon their structure and performance.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE improvement in trade noticed last month, as evidenced by the Board of Trade returns, is still further proved by the returns for May. The total value of iron and steel exported was £2,780,661, the increase being rather over 13 per cent. In rails and railway iron there was a slight falling off, the quantity last month being only 79,591 tons, against 88,715 a year ago. A heavy decline in the shipments to the United States accounts for the falling off; other markets show an increase. Steel, including Bessemer blooms and billets, was 50 per cent. more than a year ago. Hardware and cutlery have increased to the value of nearly £27,000—the improving markets being Germany, Australia, and the United States; Russia, France, Spain, and India were less. Steam engines showed an increase of £36,000; Russia, Germany, Holland, France, Belgium, Spain, and the United States showing improvement; in general machinery Germany, Russia, Holland, Belgium, France, Australia, India, and the United States all took largely-increased values, the increase on the month being not far from 29 per cent.

Referring specially to the Sheffield trade with the United States, there is again an increase to be reported in May. The total value of exports from the Consular district of Sheffield during last month was £125,329, an increase of £3949 on May of last year. Steel was exported to the value of £41,937, and cutlery to the value of £21,623—increases respectively of £11,834 and £2836.

An adjourned meeting of the coalowners of West and South Yorkshire was held at Barnsley on the 14th inst., when the committee appointed to wait upon the railway companies to represent to them the necessity for a reduction in railway rates presented their report. The committee stated that they had seen the directors of the Great Northern Company, who had promised to give the subject the most careful consideration. As yet no reply has been received from the company, and the meeting was further adjourned.

It is not often that a public company does well in the hands of the liquidator. A pleasant exception to the general rule is the Northfield Iron and Tire Company, Limited, which lost some £50,000, including shareholders' capital, before Mr. G. W. Knox, chartered accountant, Sheffield, took charge of the concern as official liquidator. He has worked the business to a profit of nearly £1800 on a turnover of £46,000; and in his new duty of manufacturing, has hit upon a compound iron and steel tire, which he has patented. This, he expects, will compete successfully, both as to quality and price, with the Bessemer tire. Mr. Knox has drafted a scheme for the reconstruction of the company, with which the debenture-holders, creditors, and shareholders agreed on Tuesday, and the sanction of the Court has now to be sought. The Northfield assets are to be transferred to a new company, and a prosperous future is anticipated.

The statistics of Sheffield exports to the States, as given in my last letter, for May, were very satisfactory; but those for the previous month, which have not been published, are not quite so pleasing. The total value in April, 1882, was £82,731, or £24,712 less than in April, 1881. Steel was exported to the value of £31,527, and cutlery £12,124—an increase in steel of £3358, and a decrease in cutlery of £2576.

The Mayor of Sheffield recently presided over a meeting in London of municipal corporations who are supplied with gas by gas companies, and pledged the Sheffield Corporation to a part of the responsibility associated with being represented before the select committee. The Corporation have approved of his worship's action in the matter. The Electric Lighting Bill has caused much interest in this district, particularly since Chesterfield practically applied the light to its public places, and there is every prospect of the provisions of the Bill, when it becomes law, being taken advantage of, either by private enterprise or the Corporation.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

A DECIDED change for the better has come over the Scottish pig iron market since the date of my last report. A week ago the position of the trade seemed rather gloomy, the exports had fallen to a comparatively low figure, and the increase of makers' stocks at Middlesbrough exercised a distressing influence. On Friday last, however, the Associated Ironmasters of Scotland, including all the iron-making firms, with two exceptions, issued an official report showing that since Christmas their private stocks of pig iron had been decreased by fully 40,000 tons. This intimation strengthened the market considerably towards its close on Friday, and the tone of business was still further improved early this week by the discovery that the shipments of pig iron had very materially improved, being some 3000 tons larger on the week than was expected. Prices of both warrants and makers' iron have consequently been increasing, although there is less speculation than might have been expected in the circumstances.

The small imports of Middlesbrough iron into Scotland, resulting from the maintenance of a high minimum price on the Tees, operates very favourably in the consumption of Scotch No. 3, for which there is a large and steady demand. The improvement that has taken place in the hematite trade has likewise had a very good effect upon the market, inasmuch as it has led several ironmasters to transfer furnaces from the manufacture of ordinary pig iron to that of hematite pig. The stocks in Connal and Co.'s stores have increased by only about 60 tons in the course of the week. There is a rather better inquiry for pig iron from abroad, and the market, on the whole, wears a much more cheering aspect than it did a week ago.

Business was done in the warrant market on Friday forenoon at from 47s. 3d. to 47s. 1½d. cash, and in the afternoon from 47s. 1½d. to 47s. 3d. cash and 47s. 4d. eight days, and from 47s. 4d. to 47s. 5½d. one month. On Monday morning business was done at from 47s. 3d. to 47s. 4½d. cash and 47s. 5½d. to 47s. 6½d. one month, the quotations in the afternoon being 47s. 3d. to 47s. 5d. cash. On Tuesday a large business was done from 47s. 5d. to 47s. 9d. cash. The market was quiet on Wednesday with business between 47s. 7d. and 47s. 10d. cash, and 47s. 9d. and 48s. one month. To-day—Thursday—the market was strong, with business up to 48s. 3d. cash, and 48s. 4½d. one month.

The improvement in the tone of the market noticed above appears in the quotations of makers' iron, which are nearly all advanced this week, and are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 58s. 3d.; No. 3, 53s. 3d.; Coltness, 59s. and 55s.; Langloan, 59s. and 54s.; Summerlee, 57s. and 50s. 6d.; Calder, 54s. and 51s.; Carnbroe, 52s. and 48s. 6d.; Clyde, 51s. and 49s.; Monkland, 48s. 6d. and 47s.; Quarter, do. do.; Govan, at Bromielaw, 49s. and 47s.; Shotts, at Leith, 59s. and 55s.; Carron, at Grangemouth, 49s. 6d. (specially selected, 52s.) and 48s. 6d.; Kinneil, at Boness, 47s. 6d. and 46s. 6d.; Glengarnock, 51s. 6d. and 48s. 6d.; Eglinton, 49s. and 47s.; Dalmellington, 49s. and 48s.

It is too soon as yet for the malleable trade to be sensibly affected by the firmness in pig iron, but there is no doubt that if the improvement in the latter should be maintained the slackness in the values of iron manufactures will to some extent disappear. A very good business is being done in the machinery trade.

The coal trade continues fairly active, there being a comparatively good demand for all coals.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

A STIMULUS has been given to the iron and steel trades by the strike in America, and orders are increasing, and prices hardening in consequence. There is a better demand for bar iron; prices from £5 5s. to £5 10s., f.o.b. Inquiries for steel rails are on the increase, and less difficulty is found in arranging terms, while for scrap and old iron there is a much more active demand. Good shipments of iron took place last week to Valparaiso, New York, Dieppe, and Oscarshamn. In all, the total iron exports from Welsh ports last week amouted to 6533 tons.

Some ferment was caused in the district of Plymouth Ironworks by the report that a syndicate was being formed to restart them. This was due to the presence of Mr. Hankey, who has a large stake on the Plymouth property, and others, including the Lord Mayor of London. Nothing so far has come of it.

There are no less than nineteen tin-plate works idle in Wales and Monmouthshire, and prices are drooping again. Swansea is doing slightly better during the present week, and some large shipments of plates have taken place. Last week, principally from Swansea, 11,314 boxes of tin-plate left for Montreal, 70,504 for New York, and a few to other destinations. In blooms and wire, too, business is brisk.

The local authorities have given notice at Swansea to withdraw the permission to use steam on the tramways conceded a short time ago. This is the result of the accident notified, but such a measure will be only carried with difficulty, as it must first be shown that such accidents are probable under ordinary circumstances.

The Llynvi and Tondu Company has struck the 4ft. coal in its new pit near Maesteg.

There is every inducement for colliery enterprise at present. The demand for best coal is well sustained, and the effect of the new sliding scale has been materially to improve conditions. The coal trade is more hopeful than it has been for some time, and the last week's exports show this in a forcible manner.

A fine pumping engine has been placed by the Neath Abbey Iron Company at one of the pits of Messrs. Henry Crawshay and Sons in the Forest of Dean. The pit is 600ft. deep, and the pump, which has a stroke of 12ft., discharges 2700 gallons of water per minute. The fly-wheel is 20ft. diameter and weighs 32 tons.

There is a rumour at Resolven, Neath Valley, of deep sinkings being planned. The present coal is not of best quality, but it is thought that by a moderate expenditure the better seams might be reached. Another case of spontaneous coal combustion is being tried at Swansea.

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.

6th June, 1882.

2643. SECONDARY BATTERIES, H. Woodward, London.
2644. ELECTRICAL CONDUCTORS, L. Varicas.—(*G. Richardson, Pennsylvania, U.S.*)
2645. MARKING LAYS, W. J. Dann, Leeds.
2646. BRAKES, S. Pitt.—(*H. Hinckley & E. Culver, U.S.*)
2647. METAL TUBES, J. Robertson, Govan.
2648. BATHING MACHINES, H. Westman, Birmingham.
2649. SEWING MACHINE, J. Helyar, Yeovil.
2650. UMBRELLAS, J. Wetter.—(*H. Papke, Berlin.*)
2651. CIGARETTES, B. Posner, P. Rosenburg, and W. Ludski, London.
2652. INDICATORS, W. R. Lake.—(*J. Cussons, U.S.*)
2653. TROUSER HOLDER, W. G. Stone, Bath.
2654. ELECTRIC LIGHTING, R. J. Hatton and A. L. Paul, London.
2655. ELEVATING MACHINERY, J. V. Hope, Wednesbury.
2656. WINDOW HOLDER, J. Harris, London.
2657. RAILWAY BRAKES, A. E. Harris, London.
2658. SECONDARY BATTERIES, A. Muirhead, London.
2659. SECONDARY BATTERIES, W. B. Brain, Cinderford.

7th June, 1882.

2660. CARBON BURNERS, J. Wetter.—(*W. Stanley, U.S.*)
2661. ELECTRIC CURRENTS, J. Blyth, Glasgow, and D. B. Peebles, Bonnington.
2662. KILNS, J. Davies, Kearsley Moor.
2663. DRYING, &c., APPARATUS, J. Farmer, Salford.
2664. SULPHIDE OF SODIUM, G. W. von Nawrocki.—(*The Verein Chemischer Fabriken, Mannheim.*)
2665. TABLES, E. E. Frost, London.
2666. WICKS, J. T. Reeve, London.
2667. PORTABLE SOLES and HEELS, G. H. Ellis, London.
2668. CHAFF ENGINES, R. Maynard, Whittlesford.
2669. ANTISEPTIC COMPOUNDS, J. Jeyes, Plaistow.
2670. PLUGS, C. J. T. Hanssen, Flensburg.
2671. CENTRIFUGAL GOVERNORS, W. P. Thompson.—(*J. Selwig, Brunswick.*)
2672. LOOPED FABRICS, W. R. Lake.—(*C. Young, U.S.*)
2673. GAS, W. R. Lake.—(*A. Binnie, Maori Hill.*)
2674. ARC LAMPS, E. de Pass.—(*J. Gloker, Paris.*)
2675. TELEPHONES, H. Alabaster, South Croydon, T. E. Gatehouse, Camberwell, and H. R. Kempe, Barnet.
2676. ELECTRODES, A. M. Clark.—(*J. M. A. Gérard-Lescuyer, Paris.*)
2677. ROTARY ENGINES, R. Hodson, Blackwall.
2678. RAILWAY RAILS, F. C. Winby, London.
2679. ATTACHING HANDLES to CUTLERY, T. and J. Brooke, Sheffield.
2680. WHEELS, R. Wood and J. Whyte, Manchester.
2681. TESTING APPARATUS, E. Edwards.—(*M. Dupont, Paris.*)

8th June, 1882.

2682. TREATING ORES, H. Aitken, Falkirk.
2683. TILLING MACHINE, W. H. Sleep, Crofthole.
2684. SHIPS' STEERAGE BERTHS, A. Nickels, Liverpool.
2685. FEEDING BOTTLES, G. Falconnier, Nyon.
2686. ELECTRIC LAMPS, M. A. Wier, London.
2687. ARM STRAP, E. Clark, London.
2688. VOLTAIC BATTERIES, C. G. Gumpel, London.
2689. ELEVATORS, W. E. Gedge.—(*J. W. Paine, U.S.*)
2690. BRUSHES, J. Wetter.—(*The Eagle Metallic Brush Company, Massachusetts, U.S.*)
2691. PLUGGING BOILER TUBES, D. McMillan.—(*N. McMillan, Marseilles.*)
2692. PURIFYING CASKS, J. and B. La Mert, London.
2693. COMPRESSING LIME, C. S. Smith, Leicester.
2694. ELECTRIC MACHINES, W. R. Lake.—(*E. Weston, U.S.*)
2695. FIXING DRILLS, J. Swaine, Handsworth.
2696. STILLS, F. Lennard, Shoreham.
2697. PROPELLING VELOCIPEDES, &c., C. H. Brooks.—(*W. Chew, Norwood, South Australia.*)
2698. AXLE BEARINGS, W. J. Brewer, London.
2699. HARROWS, J. Howard & E. T. Bousfield, Bedford.
2700. IRON, P. J. Ogle, Yniscedwyn.
2701. EXHAUSTING APPARATUS, A. R. Leask, London.
2702. LEVELLING MOLEHILLS, T. Morgan.—(*A. Royer, Paris.*)
2703. HEATING APPARATUS, J. W. Morris, Liverpool.
2704. EXHIBITING ADVERTISEMENTS, H. Griffin, London.

9th June, 1882.

2705. ADVERTISING, J. Sinico, London.
2706. TREATING ORES, J. M. Stuart, London, and J. Elliott, Reigate.
2707. SPINNING APPARATUS, R. Scaife, Colne.
2708. TREATING SULPHATE of STRONTIA, F. J. Bolton, London.
2709. TREATING GASES, F. J. Bolton and J. A. Wanklyn, London.
2710. CUTTING STONE, G. Anderson, Arbroath.
2711. ROLLS, J. Tinn.—(*W. E. Harris & E. Evans, U.S.*)
2712. LAMPS, W. R. Lake.—(*F. Kirizik and L. Piette, Pilsen.*)
2713. GUNPOWDER, W. R. Lake.—(*N. Wiard, U.S.*)
2714. TILLS, B. W. Webb, London.
2715. TREATING REGULUS, E. A. Parnell, Swansea.
2716. TRAM-CARS, &c., T. E. Knightley, London.
2717. WATER-CLOSET APPARATUS, J. Casey, London.
2718. FURNACES, &c., T. Ogden, Burnley.
2719. COUPLING APPARATUS, W. R. Lake.—(*E. H. Janney, Fairfax, U.S.*)
2720. RAISING WINDOWS, G. H. Garrett, London.
2721. MASH TUBS, A. Gillman and S. Spencer, London.
2722. SECONDARY BATTERIES, A. P. Price, London.
2723. ELECTRIC LAMPS, C. G. Gumpel, London.
2724. SEWING MACHINES, W. A. Barlow.—(*L. Gühring and W. Köhrer, Stuttgart.*)
2725. GRANULATING GLUCOSE, J. M. Cameron and H. Anderson, London.
2726. BILGE WATER ALARMS, A. M. Clark.—(*A. H. L. Oudry, Paris.*)

10th June, 1882.

2727. STEAM GENERATOR, H. Aydon, Hounslow, and E. Field, London.
2728. WASHING HOUSES, M. Cockburn, Falkirk.
2729. STEEL INGOTS, I. Beardmore, Glasgow.
2730. TREATING WASTE LIME, G. R. Hislop, Paisley.
2731. REVOLVERS, E. G. Brewer.—(*J. Turbiaux, Paris.*)
2732. MOVING TARGETS, R. Morris, Blackheath.
2733. UTILISING the CASES of SPENT CARTRIDGES, R. Morris, Blackheath.
2734. LAMPS, J. Mathieson, Stratford.
2735. COMPRESSED AIR MACHINES, S. Mason, Birmingham.
2736. NEGRO POTS, &c., R. Clayton, Deepfields.
2737. ANTIFRICTION BEARINGS, W. J. Brewer, London.
2738. THROWING BALLS, F. W. Wruuck, Anclam.
2739. ADJUSTING ROLLERS, J. Higginbottom and O. Stuart, Liverpool.
2740. ELECTRIC LIGHTING, G. Zanni, London.
2741. ILLUMINATING CONDUCTORS, G. Zanni, London.
2742. LANTERNS, W. E. Heavens, London.
2743. FINISHING TEXTILE FABRICS, E. Edwards.—(*C. and J. Chollet, France.*)
2744. DYNAMO-ELECTRIC MACHINES, J. Imray.—(*J. J. and T. J. McTighe, Pittsburgh, U.S.*)
2745. ARTIFICIAL FLOWERS, P. K. Klein.—(*G. Bittner, Munich.*)
2746. FOWLING PIECES, L. Gye, London.
2747. RIGGING SAILING VESSELS, W. H. Hall, Kew.

12th June, 1882.

2748. BURNING PYRITES, E. Bramwell, St. Helens.
2749. CAPSULES, C. Cheswright, Holloway.
2750. SAFETY LAMPS, W. Morgan, Pontypridd.
2751. GAS ENGINES, P. Braham and R. H. Seaton, Bath.
2752. ELECTRIC LAMPS, J. Lane, Fulham.
2753. GAS-MOTOR ENGINES, C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.
2754. PRINTING APPARATUS, H. Faulder, Stockport.
2755. ELECTRIC LAMPS, W. Chadburn, Liverpool.
2756. VOLTAIC BATTERIES, C. G. Gumpel, London.
2757. GAS BURNERS, J. Imray.—(*C. Clamond, Paris.*)
2758. EXTRACTING GLYCERINE, A. M. Clark.—(*E. Brochon and Co., Milan.*)
2759. LAMPS, H. H. Lake.—(*R. R. Moffatt, U.S.*)
2760. POSTS, H. H. Lake.—(*J. G. Richard, Paris.*)
2761. PAPER BAG MACHINES, M. and L. Campe, Berlin.
2762. VOLTAIC BATTERIES, D. G. Fitz-Gerald, Brixton.
2763. PEROXIDE of LEAD, D. G. Fitz-Gerald, Brixton.
2764. SINGLE RAIL RAILWAYS, A. M. Clark.—(*C. F. M. T. Lartigue, Olieste.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

2623. COUPLING, &c., ARMATURES and COMMUTATORS, W. R. Lake, London.—A communication from J. J. Wood, Brooklyn, U.S.—*3rd June*, 1882.
2632. ELECTRIC LAMPS, T. R. Lake, London.—Com. from J. J. Wood, Brooklyn, U.S.—*5th June*, 1882.
2644. ELECTRICAL CONDUCTORS, L. Varicas, London.—A communication from G. Richardson, Philadelphia, U.S.—*6th June*, 1882.
2646. CAR BRAKES, &c., S. Pitt, Sutton.—A communication from H. Hinckley and E. Culver, Philadelphia, U.S.—*6th June*, 1882.
2671. CENTRIFUGAL GOVERNORS, W. P. Thompson, London.—A communication from J. Selwig, Brunswick.—*7th June*, 1882.
2690. BRUSHES, J. Wetter, New Wandsworth.—A communication from the Eagle Metallic Brush Company, Massachusetts, U.S.—*8th June*, 1882.
2719. COUPLING, &c., APPARATUS, W. R. Lake, London.—Com. from E. H. Janney, U.S.—*9th June*, 1882.

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

2250. SEWING MACHINES, J. Hesse, San Francisco, U.S.—*6th June*, 1879.
2299. RAILWAY AXLE-BOXES, K. S. Austin, Birmingham.—*10th June*, 1879.
2360. VALVES, G. Westinghouse, jun., London.—*14th June*, 1879.
2356. COMPRESSING FLUIDS, J. K. Kilbourn, Brixton.—*14th June*, 1879.
2402. ELECTRIC LIGHTS, T. A. Edison, New Jersey, U.S.—*17th June*, 1879.
2447. BRUSHES, C. A. Watkins, London.—*19th June*, 1879.
4576. ELECTRIC LAMPS, T. A. Edison, New Jersey, U.S.—*10th November*, 1879.
2286. COATING the BOTTOMS of SHIPS, &c., T. and W. H. Wilson, Liverpool.—*10th June*, 1879.
2341. CELLULOSE or PITHY MATTER, A. M. Clark, London.—*12th June*, 1879.
2422. DISTRIBUTING GAS, C. Horsley, Highbury New Park.—*18th June*, 1879.
2265. COLOURED PAPERS, &c., J. Jeffs, London.—*9th June*, 1879.
2270. SCREW PROPELLERS, G. J. Stevens and J. S. Smith, London.—*9th June*, 1879.
2529. ERECTING METALLIC FENCING, P. M. Justice, London.—*24th June*, 1879.
2812. CARRIAGES, U. Scott, London.—*10th July*, 1879.
2342. PREPARING FURZE, &c., W. McBride and J. Mackenzie, Cork.—*13th June*, 1879.
2456. LUBRICATORS, C. W. Cadman, Liverpool.—*20th June*, 1879.
2887. SCREW COLLARS or SOCKETS, G. Hookham, Birmingham.—*16th July*, 1879.
2297. SAFETY VALVES, T. Lee, Nottingham, and J. W. Jones, Holloway.—*10th June*, 1879.
2301. ELECTRIC LIGHTING, R. Werdermann, Surrey.—*10th June*, 1879.
2302. TABLES, &c., T. McIlroy, London.—*10th June*, 1879.
2329. PROJECTILES, C. A. McEvoy, London.—*12th June*, 1879.
2428. GAS BURNERS, G. Joslin, Colchester.—*19th June*, 1879.
2464. FIXING, &c., SMALL WHEELS, W. Eyre, Sheffield.—*20th June*, 1879.

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

2270. GAS FURNACES, J. R. Wright, Uddingston.—*22nd June*, 1875.
2163. ELASTIC WEBS, E. France and A. Bradsworth, Leicester.—*12th June*, 1875.
2486. SUGAR, G. T. Bousfield, Sutton.—*10th July*, 1875.
2153. CHECKING APPARATUS, E. Lofts, Cambridge.—*12th June*, 1875.
2154. CONDENSING EXHAUST STEAM, E. P. Alexander, London.—*12th June*, 1875.
2155. WASHING, &c., MACHINES, J. Summerscales, D. Marks, and W. Smith, Keighley.—*12th June*, 1875.
2171. STEAM CARRIAGES, E. P. Alexander, London.—*14th June*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 30th June, 1882.

527. PRESSING, &c., HAY, A. V. Wagner, London.—Com. from P. C. Hudson.—*3rd February*, 1882.
541. ELECTRIC or MAGNETIC MOTOR, T. Morgan, London.—Com. from J. C. Cuff.—*3rd February*, 1882.
560. BOILERS, &c., J. S. Williams, London.—*14th February*, 1882.
562. VELOCIPEDES, E. R. Settle, Coventry.—*6th February*, 1882.
567. BLASTING, E. S. Clark, Cefn-y-bedd.—*6th February*, 1882.
570. PURIFYING GASES, W. S. R. Jackson, Llansamlet.—*6th February*, 1882.
571. FULLING, &c., MACHINERY, J. W. Crawford and W. Mellor, Leeds.—*6th February*, 1882.
572. DRYING WOOL, &c., J. Shaw, Huddersfield.—*6th February*, 1882.
577. COCKS or VALVES, T. Morgan, London.—A communication from La Société Anonyme de produits Chimiques (Etablissement Maletra).—*6th February*, 1882.
579. GAS ENGINES, J. H. Johnson, London.—A communication from A. de Bisschop.—*7th February*, 1882.
584. BRAKE BLOCKS, &c., J. Heald, Cardiff.—*7th February*, 1882.
586. LASTS, J. L. Sharman, Northampton.—*7th February*, 1882.
587. WEIGHING MACHINES, T. Williams, jun., London.—*7th February*, 1882.
593. TREATING COAL, T. Rowan, London.—*7th February*, 1882.
595. WELDED BOILERS, Z. Sugden and E. Binns, Halifax.—*7th February*, 1882.
606. FLUID METER, C. D. Abel, London.—A communication from A. Kaiser.—*8th February*, 1882.
612. TREATING DANGWAY BEANS or SEED, R. R. Carew, Watford.—A communication from E. B. Sladen, R. McLeod, and C. H. White.—*8th February*, 1882.
620. TRIPLE ALLOYS of MANGANESE, G. Scott, London.—*8th February*, 1882.
621. ELECTRIC CURRENTS, J. B. Rogers, London.—*8th February*, 1882.
626. ELECTRIC LAMPS, A. A. Common, London.—*9th February*, 1882.
645. PUDDLING, &c., IRON, R. Thompson, Wigan.—*10th February*, 1882.
669. DISTILLING ALCOHOL, &c., P. Claes, Brussels.—*11th February*, 1882.
716. PURIFYING COAL GAS, T. E. Jones, London.—*14th February*, 1882.
722. NIGHT COMMODE, &c., J. W. Rundall, Chatham.—*14th February*, 1882.
745. REGULATING the SPEED of WARP BEAMS in LOOMS, H. H. Lake, London.—A communication from Mm. Tassigny frères et Campagne.—*15th February*, 1882.
767. CANS, J. J. Gates, London.—Com. from H. K. and F. B. Thurber and Co.—*16th February*, 1882.
789. POTATO-PLANTING MACHINES, G. W. Murray, Banff, N.B.—*18th February*, 1882.
822. CASTING INGOTS of STEEL, J. D. Ellis, Thurascoe Hall, near Rotherham, and Messrs. J. Brown and Co., Sheffield.—*20th February*, 1882.
979. WASHING COAL, H. J. Allison, London.—A communication from E. Coppée.—*28th February*, 1882.
1123. PAPER, J. H. Annandale, Midlothian.—*8th March*, 1882.
1601. AIR ECONOMISER, W. Teague, jun., Tincroft, Redruth.—*1st April*, 1882.
1690. NICKEL, P. C. Gilchrist and S. G. Thomas, London.—*6th April*, 1882.
1793. VELOCIPEDES, J. White, Coventry.—*14th April*, 1882.
1949. BESSEMER CONVERTERS, S. G. Thomas, London.—*25th April*, 1882.
2002. EXCAVATING, &c., MACHINES, T. R. Crampton, London.—*27th April*, 1882.
2027. FOG-SIGNAL APPARATUS, T. Whittingham, Stansley Wood, Rugeley.—*28th April*, 1882.
2054. ROLLER MILLS, J. A. A. Buckholz, London.—*1st May*, 1882.
2124. LOCKS, J. M. Hart, London.—*5th May*, 1882.
2216. SUPPLYING WATER to WATER-CLOSETS, T. C. Summers, Portsea.—*11th May*, 1882.
2222. TREATING OFFAL, &c., H. J. Haddan, London.—Com. from J. N. B. Bond, jun.—*11th May*, 1882.
2233. ELECTRIC LAMPS, J. M. Stuart, London.—*11th May*, 1882.
2272. STENCH TRAPS, J. M. Hale, London.—*15th May*, 1882.
2300. PREVENTING the PASSAGE of HEAT to or from PIPES, &c., W. T. Whiteman, London.—A communication from J. L. Lee.—*16th May*, 1882.
2365. CEILINGS, W. R. Lake, London.—A communication from J. Budd.—*19th May*, 1882.
2596. ORGAN PEDALS, W. C. Dyer, Weston-super-Mare.—*1st June*, 1882.
2644. UNDERGROUND ELECTRICAL CONDUCTORS, L. Varicas, London.—A communication from G. Richardson.—*6th June*, 1882.

Last day for filing opposition, 4th July, 1882.

250. TESTING ALCOHOLIC LIQUIDS, H. J. Haddan, London.—A communication from J. A. J. B. Devèze.—*18th January*, 1882.
583. TRICYCLES, B. Roberts, Wolverhampton.—*7th February*, 1882.
600. TRICYCLES, J. G. Smith, Eccles.—*8th February*, 1882.
614. GAS ENGINES, W. B. Haigh and J. Nuttall, Oldham.—*8th February*, 1882.
615. DOOR, &c., FRAMES, J. H. Miles, Southampton.—*8th February*, 1882.
622. LEATHER SOLES, E. A. Brydges, London.—Com. from Heller and Atzler.—*8th February*, 1882.
628. TWIN-SCREW SHIPS, T. R. Oswald, Southampton.—*9th February*, 1882.
637. SHAFT COUPLINGS, W. R. Lake, London.—A communication from F. O. Deschamps, E. L. Clark, and E. H. Burr.—*9th February*, 1882.
641. PRESSES, S. Mart, Sutton-at-Hone, and C. W. Bradley, London.—*10th February*, 1882.
658. SLABS or PANELS, A. McLeon, London.—*10th February*, 1882.
678. GAS ENGINES, W. Watson, Leeds.—*11th February*, 1882.
679. HORSESHOES, J. Gavett, London.—A communication from J. Kiernan.—*11th February*, 1882.
685. RAISING WATER, A. M. Clark, London.—A communication from J. Decoudun.—*11th February*, 1882.
693. ROLLER MILLS, J. Qualter, Barnsley.—*13th February*, 1882.
713. VALVE-COCK, W. R. Lake, London.—A communication from A. Bénoist.—*14th February*, 1882.

718. CAUSING NAPS, &c., to ADHERE to HAT BODIES, E. K. Dutton, Manchester.—A communication from G. Atherton —14*th February*, 1882.
730. OVENS, C. D. Abel, London.—A communication from W. Lorenz.—14*th February*, 1882.
732. SULPHATE of ALUMINA, W. Gentles, Widnes.——15*th February*, 1882.
734. LOOMS, W. H. Hacking and E. Grube, Bury.—15*th February*, 1882.
753. TRAVELLING CIRCUS, C. H. Keith, Bradford.—16*th February*, 1882.
783. FOUNTAIN INK-HOLDERS, F. F. Benvenuti, Swansea.—17*th February*, 1882.
790. ILLUMINATING LIGHTHOUSES, J. R. Wigham, Dublin.—18*th February*, 1882.
793. CONDENSERS, &c., A. Craven, Bradford, and G. J. Warburton, Heckmondwike.—18*th February*, 1882.
814. COLOURING MATTER, C. D. Abel, London.—Com. from Dr. E. Jacobsen.—20*th February*, 1882.
855. MOULDING MACHINE, F. Wirth, Germany.—A communication from J. G. Sebold and F. Neff.—21*st February*, 1882.
891. PROJECTILES, T. Nordenfelt, London.—23*rd February*, 1882.
901. TREATING MAIZE, A. G. Fraser, London.—24*th February*, 1882.
950. WINDOW, &c , FASTENINGS, W. P. Bonwick, London.—27*th February*, 1882.
1011. ROTARY ENGINES, A. M. Clark, London.—A communication from the Elastic Wheel and Manufacturing Company.—2*nd March*, 1882.
1010. COLOURING MATTERS, C. D. Abel, London.—A communication from C. A. Martius.—3*rd March*, 1882.
1055. SUGAR, H. H. Lake, London.—A communication from L. Frères.—4*th March*, 1882.
1269. FITTING the TURNING-PINS of PIANOFORTES, &c., G. Wilde, Selston.—16*th March*, 1882.
1314. COAL GAS, R. Morton and C. G. Williams, London.—18*th March*, 1882.
1413. UMBRELLAS, &c., J. Willis, Bournemouth.—23*rd March*, 1882.
1461. EXPLOSIVE COMPOUNDS, E. Turpin, Paris.—27*th March*, 1882.
1494. TREATING GASES, P. Spence, Manchester.—28*th March*, 1882.
1650. MARINE STEAM ENGINES, J. Penn, Greenwich.—5*th April*, 1882.
1672. CIGARETTES, P. Everitt, London.—6*th April*, 1882.
1803. INCANDESCENT LAMPS, A. R. Leask, London.—15*th April*, 1882.
1842. PRESERVING EGGS, H. H. Doty, London.—18*th April*, 1882.
1886. SHOWING the ILLUMINATING POWER of GAS-BURNERS, C. W. Morley, London.—20*th April*, 1882.
2064. MEASURING SURFACES, H. H. Lake, London.—Com. from V. von Reitzner.—2*nd May*, 1882.
2151. GAS PRODUCERS, F. W. Dick and G. S. Packer, Glasgow.—8*th May*, 1882.
2215. SIGHTS for RIFLES, T. Gilbert, London.—11*th May*, 1882.
2245. LIFE-BOATS, &c., J. R. Hodgson, London.—12*th May*, 1882.
2278. OXIDE of LEAD, H. H. Lake, London.—A communication from G. T. Lewis.—15*th May*, 1882.
2294. DISINTEGRATING APPARATUS, R. Prentice, Stowmarket.—16*th May*, 1882.
2296. COMPOUND FUNNELS, F. Livet, London.—16*th May*, 1882.
2319. BARBED FENCING WIRE, E. G. Rock, London.—A communication from J. Lees, J. W. Rock, and C. G. Moore.—17*th May*, 1882.
2357. ASCENDING CHIMNEY STACKS, &c., T. W. W. Barrett, London.—19*th May*, 1882.
2407. EXPLOSIVE COMPOUND, H. H. Lake, London.—A communication from J. Gemperlé.—22*nd May*, 1882.
2623. COUPLING, &c., ARMATURES of DYNAMO, &c., MACHINES, W. R. Lake, London.—A communication from J. J. Wood.—3*rd June*, 1882.
2632. ELECTRIC LAMPS, W. R. Lake, London.—A communication from J. J. Wood.—5*th June*, 1882.
2646. BRAKES, &c., S. Pitt, Sutton.—A communication from H. Hinckley and E. Culver.—6*th June*, 1882.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 9th June, 1882.)

3023. LATHE, J. A. Armstrong, Blackheath.—9*th July*, 1881.
5408. ILLUMINATING GAS, J. F. G. Kromschröder, London.—10*th December*, 1881.
5423. LOOMS, G. Geissler, Kirkburton, near Huddersfield —12*th December*, 1881.
5425. PRESERVING MEAT, &c., H. H. Lake, London.—12*th December*, 1881.
5426. TWO-WHEELED CABS, A. Forder, Wolverhampton.—12*th December*, 1881.
5443. STEAMING, &c., WOVEN FABRICS, H. Webster and J. Clegg, Dewsbury.—13*th December*, 1881.
5445. GALVANIC BATTERIES, O. C. D. Ross, London.—13*th December*, 1881.
5446. GAS FITTINGS, &c., J. H. Royle, Manchester.—13*th December*, 1881.
5449. SPINNING SILK, &c., H. H. Lake, London.—13*th December*, 1881.
5471. COLLARS for ANIMALS, T. Loveday, Islip.—14*th December*, 1881.
5481. SECONDARY BATTERIES, D. G. GitzGerald, London.—14*th December*, 1881.
5501. PNEUMATIC, &c., RAILWAYS, T. W. Rammell, London.—16*th December*, 1881.
5523. SEPARATING AMMONIA, G. Chapman, Glasgow.—17*th December*, 1881.
5541. TIP-VANS or WAGONS, W. Bowen, Southwark.—17*th December*, 1881.
5564. CUTTING METALS, W. W. Hulse, Manchester.—21*th December*, 1881.
5589. DESTROYING INSECTS, H. H. Lake, London.—26*th December*, 1881.
5599. FEEDING APPARATUS, J. Hurt and A. M. Strathern, Glasgow.—28*th December*, 1881.
5703. STOVES, F. Brown, Farley-hill, Luton.—28*th December*, 1881.
13. COATING SHIPS' BOTTOMS, W. G. Little, Doncaster, and B. Nickels, London.—2*nd January*, 1882.
149. UMBRELLAS, &c., J. H. Bayzand and G. Boyle, London.—11*th January*, 1882.
220. ARTIFICIAL IVORY, &c., F. W. Cottrell, London.—16*th January*, 1882.
363. CONNECTING RECIPROCATING into ROTARY MOTION, A. M. Clark, London.—24*th January*, 1882.
462. STOPPING TUBES, J. Turner, Plaistow.—30*th January*, 1882.
609. CRIMPING, &c., METAL CARTRIDGE CASES, W. W. Greener, Birmingham.—8*th February*, 1882.
853. SAFETY APPARATUS, A. M. Clark, London.—21*st February*, 1882.
877. ALARUM BELLS, H. Lees, Ashton-under-Lyne.—23*rd February*, 1882.
902. ASBESTOS FABRICS, H. J. Haddan, London.—24*th February*, 1882.
996 SEWING FLAT BUTTONS to FABRICS, E. H. Brandon, Paris.—1*st March*, 1882.
1009. SHIPS, H. H. Lake, London.—2*nd March*, 1882.
1046. CUTTING HOLES in and SHAPING PLATES of METAL, J. Rowland, Sunderland.—4*th March*, 1882.
1264. HEATING ZINC FURNACES, W. R. Lake, London.—15*th March*, 1882.
1373. RAILWAY CHAIRS, H. Bridgewater, Watford.—21*st March*, 1882.
1439. SUSPENDING PORTABLE MACHINES, J. Fielding, Gloucester.—25*th March*, 1882.
1472 GOVERNORS, W. Lyon, Sheffield.—27*th March*, 1882.
1501. STARCH, H. H. Lake, London.—1*st April*, 1882.
1635 MECHANICAL TOYS, W. R. Lake, London.—4*th April*, 1882.
1657. PLAYING PIANOFORTES, &c., W. R. Lake, London.—5*th April*, 1882.
1865. PRINTING and BOOKBINDING, W. R. Lake, London.—18*th April*, 1882.

(*List of Letters Patent which passed the Great Seal on the 13th June*, 1882.)

5339. CHECKING the RECEIPT of MONEY, A. J. T. Wild, London.—6*th December*, 1881.
5454. REPAIRING, &c., BOOTS, J. Lewis, Birmingham.—14*th December*, 1881.
5457. SEPARATING the DUST DISCHARGED from MILLSTONES, &c., R. Howarth, Rochdale.—14*th December*, 1881.
5473. OPENING and CLOSING TAPS, T. G. Sharpe, Huddersfield.—14*th December*, 1881.
5475. WHEELS, G. L. Scott, Manchester.—14*th December*, 1881.
5483. GAS-MOTOR ENGINES, S. Griffin, Bath.—15*th December*, 1881.
5487. GAS ENGINES, W. Watson, Leeds.—15*th December*, 1881.
5495. TRANSPARENT, &c., SHEETS, E. V. Emery, London.—15*th December*, 1881.
5505. SECURING the ENDS, &c., on METAL CANS, W. R. Lake, London.—16*th December*, 1881.
5511. ASCERTAINING the PITCH of SCREW PROPELLERS, D. B. Hutton, Poplar.—16*th December*, 1881.
5521. SECONDARY, &c., BATTERIES, G. Grout and W. H. Jones, London.—17*th December*, 1881.
5531. FLYERS for SPINNING FIBRES, S. Ingham, Luddenden.—17*th December*, 1881.
5540. SLIDE RULES, J. H. Thomson, Shoeburyness.—17*th December*, 1881.
5559. FABRICS, C. B Warner, London.—19*th December*, 1881.
5585. REGULATING the TRANSMISSION of MOTIVE POWER, H. J. Haddan, London.—21*st December*, 1881.
5613. FIRE-ARMS, B. J. B. Mills, London.—22*nd December*, 1881.
5620. LIFTING the SAFETY-VALVE of BOILERS, T. Rogers, Smethwick.—23*rd December*, 1881.
5624. NAILS, J. W. Summers, Stalybridge.—23*rd December*, 1881.
5633. SPREADING SAND, &c., on STREETS, R. G. Garvie, Aberdeen.—23*rd December*, 1881.
5641. ROTARY ENGINES, B. J. B. Mills, London.—23*rd December*, 1881.
5642. REFRIGERATORS, G. C. Roberts, London.—23*rd December*, 1881.
5662. SHAFTS for VEHICLES, A. M. Clark, London.—24*th December*, 1881.
5680. MIDDLING PURIFIERS, C. D. Abel, London.—27*th December*, 1881.
5692. APPLYING DESIGNS to SURFACES, T. Jones, London.—28*th December*, 1881.
5714. OVENS, J. H. Johnson, London.—29*th December*, 1881.
5720. FIRE-LIGHTERS, F. Holmes, London.—30*th December*, 1881.
5741. STEAM BOILERS, G. H. Lloyd, Birmingham.—31*st December*, 1881.
5747. ROOFS, A. M. Clark, London.—31*st December*, 1881.
46. OPEN FIREPLACES, W. Haughton, London.—4*th January*, 1882.
95. ELECTRIC LAMPS, W. J. Mackenzie, Glasgow.—7*th January*, 1882.
382. WITHERING, &c., TEA, J. H. Johnson, London.—25*th January*, 1882.
421. FELLOES and TIRES, G. Perks, Perry Barr.—27*th January*, 1882.
484. FINGER RINGS, &c., W. R. Lake, London.—31*st January*, 1882.
526. WEIGHING, &c., MACHINERY, F. Wheeler, Isle of Wight.—3*rd February*, 1882.
776. MARINE ENGINES, G. A. P. H. Duncan, London.—17*th February*, 1882.
1024. SWITCH APPARATUS, W. E. Irish, Sunderland.——3*rd March*, 1882.
1026. GAS ENGINES, P. Niel, London.—3*rd March*, 1882.
1374. LOOMS, J. Stansfield, Colne.—21*st March*, 1882.
1390. REGULATING SPEED, J. B. Rogers, London.—22*nd March*, 1882.
1393. OBTAINING SULPHUR, F. B. Rawes, Stratford.—22*nd March*, 1882.
1437. ELECTRIC ACCUMULATOR, S. Cohné, London.—25*th March*, 1882.
1582. PRODUCING COPIES of WRITINGS, M. Farmer, London.—31*st March*, 1882.
1844. ROLLING MILLS, W. Deighton, Workington.—12*th April*, 1882.

List of Specifications published during the week ending June 10th, 1882.

4509, 6d.; 4515, 6d.; 4607, 6d.; 4641, 6d.; 4654, 6d.; 4658, 6d.; 4673, 6d.; 4678, 6d.; 4690, 10d.; 4691, 6d.; 4708, 6d.; 4722, 6d.; 4745, 6d.; 4753, 6d.; 4760, 6d.; 4764, 8d.; 4777, 2d.; 4781, 2d.; 4796, 6d.; 4800, 1s.; 4806, 2d.; 4815, 4d.; 4818, 2d.; 4819, 6d.; 4821, 8d.; 4825, 6d.; 4826, 6d.; 4829, 8d.; 4846, 6d.; 4849, 6d.; 4851, 8d.; 4856, 6d.; 4860, 2d.; 4861, 6d.; 4865, 6d.; 4869, 6d.; 4871, 6d.; 4872, 8d.; 4874, 6d.; 4875, 2d.; 4878, 4d.; 4879, 2d.; 4881, 2d.; 4882, 8d.; 4884, 8d.; 4885, 2d.; 4886, 2d.; 4889, 10d.; 4890, 2d.; 4892, 2d.; 4893, 2d.; 4894, 6d.; 4895, 2d.; 4896, 6d.; 4897, 2d.; 4899, 2d.; 4900, 6d.; 4904, 6d.; 4905, 8d.; 4907, 6d.; 4908, 6d.; 4909, 6d.; 4911, 6d.; 4915, 2d.; 4916, 6d.; 4917, 1s.; 4920, 6d.; 4921, 6d.; 4922, 4d.; 4923, 2d.; 4925, 2d.; 4927, 4d.; 4928, 2d.; 4929, 2d.; 4930, 2d.; 4932, 6d.; 4934, 6d.; 4935, 2d.; 4936, 4d.; 4938, 6d.; 4939, 6d.; 4940, 4d.; 4941, 8d.; 4942, 6d.; 4943, 2d.; 4944, 2d.; 4045, 6d.; 4947, 4d.; 4950, 6d.; 4951, 2d.; 4952, 6d.; 4953, 4d.; 4955, 2d.; 4956, 2d.; 4957, 6d.; 4959, 6d.; 4960, 6d.; 4961, 8d.; 4963, 6d.; 4964, 6d.; 4965, 2d.; 4966, 6d.; 4969, 2d.; 4970, 6d.; 4971, 6d.; 4975, 2d.; 4976, 2d.; 4979, 6d.; 4981, 4d.; 4982, 6d.; 4983, 2d.; 4984, 2d.; 4985, 6d.; 4986, 4d.; 4992, 6d.; 5003, 6d.; 5010, 6d.; 5022, 6d.; 5028, 6d.; 5038, 4d.; 5057, 2d.; 5428, 6d.; 268, 10d.; 465, 8d.; 478, 4d.; 931, 6d.; 995, 6d.; 1245, 6d.; 1337, 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.*

4509. SHEAF-BINDING MACHINERY, *J. Hornsby, J. Innocent, and G. J. Rutter, Grantham.*—15*th October*, 1881. 6*d.*

This relates to improvements on patent No. 1426, A.D. 1881. According to one part of the invention, a conical friction or tension roller is provided, over which the string, cord, or binding material passes from the box to the binder arm, whereby a definite and uniform tensile strain is secured, so as to prevent any unnecessary slack during the binding and tying operations. Another part relates to improvements in, and simplification of, the packing mechanism. Further improvements consist in arranging the working of the knotting apparatus so as to be independent of the resistance of differential spring power. Other improvements are described.

4515. APPLYING COLD AIR for the MANUFACTURE of ICE, *J. Sturgeon, Liverpool, and J. W. de V. Galwey, Warrington.*—17*th October*, 1881. 6*d.*

The invention consists partly in subdividing the chamber into a number of small insulated compartments, or they may be several small separate chambers, and applying the cold air from the cold-producing apparatus to these chambers or subdivisions in detail through pipes provided with means to enable any one of these chambers to be acted upon by the cold-producing apparatus separately from the others.

4658. WATCHES, *S. M. Morgan, Kingsland.*—25*th October*, 1881. 6*d.*

The movement is surrounded with a stout ring of brass or other metal of about the same height as the movement, in which ring the pillar plate is accurately fitted in the same way that it now fits in the case itself. On the other side of this ring, in a rebate or groove turned therein, is fitted the dome. The movement is thus enclosed in a box formed of the pillar plate, the ring, and the dome, which box is in turn enclosed in the ordinary case.

4673. MACHINERY for MIXING and KNEADING, *J. Melvin, Glasgow.*—25*th October*, 1881. 6*d.*

This consists in the combination of three mixers placed with their axes at about the same level, the two lateral or outer mixers having three longitudinal bars, two of which are diametrically opposite and equally distant from the centre, the third being in or close to the centre, whilst the middle mixer has a single bar, which in rotating comes nearly in contact with the central bars of the lateral mixers.

4678. HEATING, COOKING, &c., BY GAS, *S. Leoni, London.*—26*th October*, 1881. 6*d.*

This consists partly of a concentric burner formed of an outer tube and a perforated inner tube, with a sufficient space between the two for the proper admixture of air and gas. Other forms of burners are described.

4690. COUPLING BUFFERS for RAILWAY VEHICLES, *G. Turton, Westminster.*—26*th October*, 1881. 10*d.*

This relates to buffers of the class described in patents No. 3113, A.D. 1879, and No. 1975, A.D. 1880. Fig. 1 is a side elevation and Fig. 2 a plan of the improved apparatus. A is the buffer or buffer head, B the coupling hook, C C are springs, and D D are

4690 FIG.1.

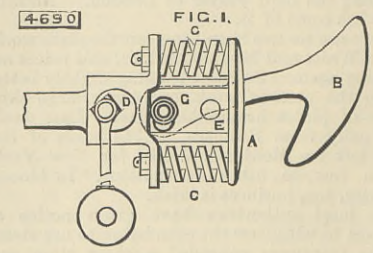
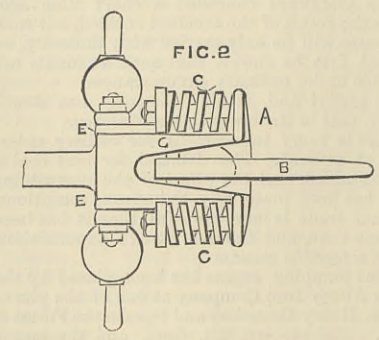


FIG.2



excentrics. Longitudinal grooves are formed in the buffer head, and in each groove and slot is fitted a slide plate E capable of sliding endwise therein. In each of these plates are formed two or more holes, and the plates are so arranged that the holes in one plate will be exactly opposite to the corresponding holes in the other plate; these holes are designed to form the bearings for the transverse pin G, which in this arrangement serves at one time to carry the coupling hook B, and at another time—that is to say, when the latter is removed—to receive the hook of the buffer of the adjacent vehicle. Other improvements are described.

4691. CUTTING and FORMING CORKS for MOUTHPIECES for CIGARS, &c., *H. Gardner, London.*—26*th October*, 1881.—(*A communication from J. S. Elkins and C. G. Clark, New York, and E. C. Hine, Brooklyn, U.S.*) 6*d.*

The machine is constructed to cut the tubular cork cylinder from a sheet or piece of cork, to free the said cylinder from the sheet, and then to expel the cylinder and the core from the cutters.

4708. ARRANGING, FIXING, and PROTECTING SCREW PROPELLERS, &c., *J. M. Leishman, London.*—27*th October*, 1881.—(*A communication from E. Cousteau, Bordeaux.*) 6*d.*

This relates to the method of arranging and protecting a screw propeller so as to avoid resistance when at rest by enclosing it in a case or recess formed in the stern post of the vessel.

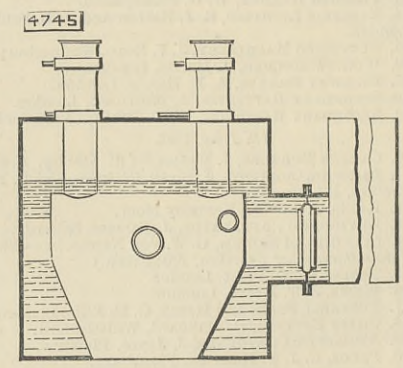
4722. VELOCIPEDES, &c., *F. W. Jones, Exeter.*—28*th October*, 1881. 6*d.*

This consists, First, in an improved form of bearing for the wheels, pedals, and other surfaces; Secondly, in an improved steering head and self-contained brake for bicycles; Thirdly, in an improved construction of pedal; Fourthly, in the method of and apparatus for shifting the rider's centre of gravity in a tricycle; Fifthly, in the method of actuating the cranks so that they become foot-rests at will.

4745. APPARATUS for HEATING WATER, &c., *R. T. Gillibrand, Darwen.*—29*th October*, 1881. 6*d.*

The apparatus comprises a furnace connected by pipe or flues with a steam or hot water boiler placed at some distance from the furnace. The pipes referred to act as flues or smoke ways leading from the furnace

4745



through the boiler, and such pipes or smoke ways are fitted with fire-clay blocks or slabs; these blocks or slabs are for the purpose of consuming the smoke, and so assist in generating steam, around and about which the heated gases circulate during its passage through the boiler. Along or in the furnace are openings or air entrances, through or by aid of which the smoke is fired and consumed within the flues of the boiler.

4753. AIR COMPRESSOR, with PNEUMATIC SELF-ACTING REVERSING GEAR, *M. Bauer, Paris.*—31*st October*, 1881.—(*A communication from C. A. Mayrhofer, Paris.*) 6*d.*

The inventor claims, First, a safety apparatus for the automatic closing of the water-cock by the overflow water and the electric contact connected therewith. Secondly, the pneumatic reversing gear of two cocks, the means of automatically balancing the air pressure at a third cock, and the means of automatically closing a fourth cock by any excess of pressure in a reservoir.

4760. APPARATUS for FACILITATING the REMOVAL of YEAST from BREWERS' FERMENTING VESSELS, *P. Smith, Sevenoaks.*—31*st October*, 1881. 6*d.*

As the yeast is formed it passes out from the vessel through two tubes at the side of the vessel, and is conducted away.

4764. ROCK DRILLING APPARATUS, *W. Morgan-Brown, London.*—1*st November*, 1881.—(*A communication from L. B. Stone, Marblehead, Mass., U.S.*) 8*d.*

This relates, First, to the construction of the tripod; and Secondly, in the construction of the drilling engine.

4781. FRILLING and TRIMMINGS, &c., *E. A. Cooper, Westminster.*—1*st November*, 1881.—(*Void.*) 2*d.*

The frilling or trimming is produced by means of a new frilling or trimming machine, which consists of the stitching parts of a sewing machine (omitting the feed motion) and combined with other suitable mechanism.

4796. LAVATORIES and URINALS, *G. H. and S. Jennings, Stangate.*—2*nd November*, 1881. 6*d.*

This consists in the method of mounting tipping basins with pivots U from recesses and retaining flanges, so arranged that in one position the basin is free to be lifted, but not otherwise.

4800. PNEUMATIC SYSTEM of REMOVING NIGHTSOIL and OTHER MATTERS from CESSPOOLS, &c., *A. M. Clark, London.*—2*nd November*, 1881.—(*A communication from La Cie. Générale de Salubrité, Paris.*) 1s.

The chief feature of the invention consists in the employment of an extensive system of pneumatic tubing for conveying the nightsoil from the cesspool or place where it is deposited to the works, to be converted into chemical products and manure.

4806. HOLDERS for LEADS and CRAYONS, *A. P. Hausen, Cheapside.*—3*rd November*, 1881.—(*Not proceeded with.*) 2*d.*

Two semi-tubes are employed, preferably provided with a corrugated inside surface: one semi-tube is permanently fixed in the inside of any convenient shaped holder, the other semi-tube is capable of being moved longitudinally in the inside of the holder and is connected to the first-named semi-tube. The longitudinal movement of such movable semi-tube from the top or point of the holder is preferably caused by the action of springs.

4815. CARRIAGES EMPLOYED in BOBBIN NET or TWIST LACE MACHINES, *W. Spowage, Nottingham.*—3*rd November*, 1881. 4*d.*

This relates to the construction of carriages with one or more studs near each breast of the carriage projecting from one or both sides of the carriages.

4818. PRIMING PERCUSSIVE ROCK DRILLS, *T. R. Jordan, London.*—3*rd November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists essentially in the combination of an hydraulic motor with any percussive rock boring or drilling machine in which air or springs are alternately compressed and allowed to expand to give the blow.

4821. APPARATUS for MEASURING WATER, &c., *W. Jones, Manchester.*—3*rd November*, 1881. 8*d.*

This consists, First, in meters for measuring water or other fluids provided with two pistons, connected together, in placing the valve by which the movements of such pistons are controlled between the aforesaid pistons, such pistons actuating the said valve by means of a spring; Secondly, in mounting the valves upon a part traversed to-and-fro by the pistons of such meters, thereby dispensing with the usual thoroughfares, formed upon the cylinders, within which the aforesaid pistons traverse.

4826. SPRING MATTRESSES, *G. Lowry, Salford.*—3*rd November*, 1881. 6*d.*

The mattresses consist of a series of horizontal chains, ropes, or bands with a compressive or elastic spring at one or both ends and attached to the bedsteads without hooks or links, or on a light metallic or wooden frame made to fit on the bedsteads.

4829. TRICYCLES, &c., *A. Archer, Birmingham.*—3*rd November*, 1881. 8*d.*

This relates to the construction of the cranked axles and framing so that the cranks may be collapsed for the purpose of passing the vehicle through narrow doorways, &c.

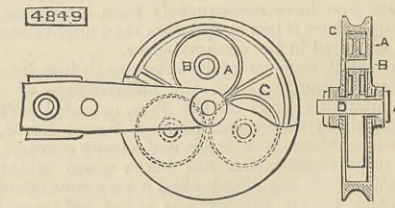
4846. PLEATING and FRILLING MACHINES, *O. McC. Chamberlain, Notting-hill.*—4*th November*, 1881. 6*d.*

The improvement consists in providing a reciprocating nipper or carrier, which tucks the fabric in pleats or folds between a pair of rollers or presses, whilst controlling mechanism determines the formation of the pleat or fold upwards or downwards.

4849. REDUCING the FRICTION of REVOLVING WHEELS, &c., *W. J. Brewer, London.*—5*th November*, 1881. 6*d.*

The antifriction device consists of three or more antifriction wheels A carried loosely on axles B. These axles are fitted into or run loose in bearings in the main wheels at C, with which they revolve. The

4849



axles may be constructed radially adjustable towards the centre. The journal D of the main wheel bears upon the peripheries of the antifriction wheels A by a collar or directly; the pressure thus transferred to the antifriction wheels is borne at a greatly reduced speed, and consequent reduction of friction, at the ultimate rubbing contact B, which may be further fitted with known antifriction rollers or balls. A lubricating device is also described and claimed.

4856. SHIPS' SLEEPING BERTHS, &c., *W. R. Lake, London.*—5*th November*, 1881.—(*A communication from J. H. Porter, Boston, U.S.*) 6*d.*

This consists in the combination of a beam pivotted centrally to a suitable support and extended outwardly or laterally at its ends from the said support, a berth or its equivalent pivotted to the said extended ends and thereby suspended away from the support of the beam so as to leave an unobstructed space overhead, and friction rollers arranged to prevent the beam from binding on its bearings in consequence of the leverage exerted by the said berth.

4860. FASTENING ELASTIC TIRES to VELOCIPEDE WHEELS, &c., *J. K. Starley, Coventry.*—7*th November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in making the tire with a longitudinal groove on its inner periphery, and over the space so formed vulcanising a strip of cloth or other strong material. A wire (or wires) is passed through said groove and bent round the rim of the wheel. A hole (or holes) is bored in the felloe towards the centre of the wheel, and the ends of the wire are drawn tight through it (or them) and secured by a nut (or nuts) just inside the felloe.

4865. FORKS of BICYCLES, &c., *S. Armstrong, Birmingham.*—7*th November*, 1881. 6*d.*

This relates to the forging the forks in suitable dies.

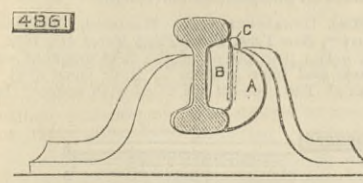
4869. PACKING for MAKING STEAM or WATER JOINTS, *J. R. Williams and H. Dansey, London.*—7*th November*, 1881. 6*d.*

This relates to the construction of packing for the purpose of making joints, in the form of strips of suitable shape, consisting of a sufficient number of parallel bars or wires of circular, rectangular, or other suitable section, connected continuously together.

4861. RAILWAYS, &c., *J. Whiteford, Greenock.*—7*th November*, 1881. 6*d.*

This consists in fixing the rails of permanent way

laterally in their chairs by means of a bearing block or check plate A, tightening key B, and retaining cottar or pin C, and either with or without retaining plate and



pins, or projections and notches for retaining the rails longitudinally at their end joints.

4871. FRAMES AND TRAPS FOR DRYING AND ROASTING FRUIT, *Right Hon. W. H. Earl Poulett, Crewkerne.—7th November*, 1881. 6*d*.

This relates to the construction and employment of skeleton frames on wheels or rollers, and meshed trays, for drying and roasting dates and like fruit within a closed oven or retort.

4872. "ACTIONS" OF SMALL-ARMS, *H. A. Silver and W. Fletcher, London.—7th November*, 1881. 8*d*.

This relates to certain details of construction and arrangements of appliances in and connected with the "actions" of small-arms, to enable the hammer or hammers, strikers, triggers, and safety bolts, and in some cases the barrel or barrels also, to be locked and released.

4874. MOULDING OR EARTHING PLOUGHS, *F. Wolff, Copenhagen.—8th November*, 1881.—(*A communication from J. L. Jensen, Copenhagen.*) 6*d*.

This relates, First, to the application to earthing ploughs of the adjustable wing-shaped boards for regulating the height and the width at top and bottom of the ridges formed by the plough; Secondly, to the adjusting of the mould-boards relatively to the beam, so that with the same plough earthing up may be done at will to both sides simultaneously, or to one of the sides by changeable mould-boards, and also the means by which the adjusting is obtained.

4875. APPARATUS FOR SUPPLYING THE FEED-WATER TO STEAM OR OTHER BOILERS, *J. Adams, Watford.—8th November*, 1881.—(*Not proceeded with.*) 2*d*.

Two feed or supply cisterns are employed, one, which is by preference open and placed above the other, which is closed and adapted to bear the same pressure as that of the boiler to be fed. There is a passage capable of being opened from the close vessel to the boiler, and from the close vessel to the open vessel. When communication is closed between the close vessel and the boiler, the close vessel may be readily filled as required from the open vessel.

4878. BRICKS, *J. P. Bayly, Paddington.—8th November*, 1881.—(*Not proceeded with.*) 4*d*.

This invention consists of a contrivance to be bedded in mortar, each brick being fitted or locked one into the other.

4879. VENT OR TAP HOLE FITTINGS FOR CASKS, *J. W. Kenyon, Manchester.—8th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates principally to the casks in which liquor is stored or supplied, and has for its principal objects to facilitate the "tapping" and to prevent the free communication at times between the outer air and the interiors of the casks.

4881. APPARATUS FOR TESTING THE PURITY OF THE BREATH, *A. C. Henderson, London.—8th November*, 1881.—(*A communication from A. F. L. Plagne, France.*)—(*Not proceeded with.*) 2*d*.

The apparatus consists of a porcelain vase, furnished with two apertures diametrically and vertically opposed to each other; the upper one is destined for the mouth for breathing into the vase, and for the nose to then test the purity of the breath, and the lower opening is for the escape of the breath blown into the vase.

4884. APPARATUS FOR TRANSMITTING MOTION AT VARIABLE SPEEDS, *D. Young, London.—8th November*, 1881.—(*A communication from E. Brosser, Paris.*) 8*d*.

The apparatus consists essentially in two shafts suitably supported in bearings, and each provided with a convex disc, the one shaft being driven by the motor, and the other by the frictional contact of the two discs, which are adjustable for transmitting motion at variable speeds. The second shaft transmits the motion to the machine to be driven at a speed regulated by the adjustment of the said discs.

4886. UMBRELLAS, &c., *F. Wolff, Copenhagen.—8th November*, 1881.—(*A communication from A. Malmros, Sweden.*)—(*Not proceeded with.*) 2*d*.

The umbrella stick is made in several pieces, which can be separated and folded up again, or it may be provided with telescopic parts.

4889. MINING OR GETTING MARLS, CLAYS, SANDS, AND GRAVELS, &c., *J. Mills, Hanley, and T. D. Brown, near Wellington.—8th November*, 1881. 10*d*.

This consists in sinking a series of rows of vertical shafts, pits, or holes, each row of shafts or pits being sunk close to the next row, and the shafts or pits of each row being sunk near to each other, the sinking and working of the shafts or pits of each row and the sinking and working of the several rows being effected by preference by the method of alternation.

4890. FILTER PRESSES, &c, *A. G. Salamon, Clapham Park.—8th November*, 1881.—(*Not proceeded with.*) 2*d*.

A rapid outlet is provided for the filtered fluid in all directions, thus utilising the entire surface of the grooved plates or perforated backing for the filter cloth.

4892. CHAIR FOR INVALIDS, *A. M. T. Amherst, Brandon.—8th November*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in hinging the back as well as the sides or arms of the chair, so as to fold down flat on to the seat when required to be packed for transport, the back first folding down on to the top of the seat and the two sides or arms folding one over the other on to the folded back.

4893. LOCKS, &c., *R. H. Clive, Birmingham.—8th November*, 1881.—(*Not proceeded with.*) 2*d*.

This refers to locks and combined locks and latches, and is principally applicable to combined locks and latches in which the advance motion of the latch bolt is produced by a weighted lever instead of by the spring ordinarily employed. The parts are so arranged that the weighted lever is made to operate the tumbler of the lock or key bolt as well as the latch bolt.

4894. KNITTING MACHINES, *W. Harrison, Manchester.—8th November*, 1881. 6*d*.

The objects are, First, to enable the operator to knit double or twice the width of web or plain open work automatically; Secondly, to enable the little heel to be knitted more easily; Thirdly, to give a longer or shorter stroke to the crank that works the machine which lengthens or shortens the travel of the carriages, which reduces friction; Fourthly, to enable the cam carriage to work more easily and with greater durability.

4895. EXHIBITING NOTICES, &c., *F. W. Hembry, London.—8th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to rotating frame fitted with advertisements.

4896. PREPARATION OF PHOTOGRAPHIC EMULSIONS, *J. Plener, London.—8th November*, 1881. 6*d*.

The following are some of the important points:—First, in the application of centrifugal force for the isolation of silver salts from an emulsion; Secondly, in the application of the same force for the division of an emulsion into several parts, according to the different size of the grains of silver salts; Thirdly, the emulsion may be made to contain the boiling or digesting unlimited quantity of water and gelatine, and thus is obtained the fine granular state of the silver salts in emulsion; Fourthly, eliminating the decomposed gelatine and replacing it by fresh gelatine, all the defects in dry plates caused by the decomposition of gelatine, viz., frilling, faintness of images, &c., are got rid of.

4897. AGEING PADDED, DYED, OR PRINTED TEXTILE OR FIBROUS MATERIALS, &c., *W. R. Lake, London.—8th November*, 1881.—(*A communication from P. St. A. Basquin, Paris.*)—(*Not proceeded with.*) 2*d*.

The fibrous materials which have been impregnated, padded, prepared, or printed with mordants or colours or preparations containing gases, vapours, or volatile compounds are caused to travel through a chamber where they are submitted to the action of air and aqueous vapour mixed or not mixed with other gases or vapours at various degrees of temperature below the atmospheric pressure, which thus affects the disengagement of the acetic acid or other gases, vapours, or volatile compounds, and collect the said acetic acid, gases, vapours, or volatile compounds by means of condensers connected by suitable means with the chamber.

4899. COLOURING MATTERS, *J. Imray, London.—9th November*, 1881.—(*A communication from H. Koechlin, Germany.*) 2*d*.

This consists in the manufacture of colouring matters by the action of the nitrosed derivatives of the vertiary amines or their compounds on tannan or its analogues.

4900. MACHINERY FOR EXCAVATING, *J. W. H. James, Westminster.—9th November*, 1881. 6*d*.

This consists in the construction and arrangement of an excavating machine wherein the bucket or scoop operated by hydraulic power is combined with the oscillating thrust arm or lever, also operated by hydraulic power to regulate the cutting and penetration of the basket or scoop, the whole being mounted on a trolley fitted with a roller path round which the excavator is capable of being swung.

4907. GENERATION OF WATER-GAS, &c., *P. Jensen, London.—9th November*, 1881.—(*A communication from The European Water-gas Company, Stockholm.*) 6*d*.

This consists essentially in the continuous mode of generating water-gas by the combination with the two systems of regenerators of one common generation.

4908. MANUFACTURE OF KIDDERMINSTER CARPETS, &c., *J. S. and S. Smith, Glasgow.—9th November*, 1881. 6*d*.

This consists in the weaving or manufacture of Kidderminster, Scotch, or ingrain carpets, and other similar two or three-ply fabrics with clearly defined patterns, on the two outer sides of the fabric.

4909. FLOATING APPARATUS FOR DRAWING-OFF LIQUIDS FROM VATS, &c., *J. Webster, Solihull.—9th November*, 1881. 6*d*.

The object is to draw-off liquids of different gravities as required from vessels or reservoirs without disturbing the sediment at the bottom thereof by means of a floating apparatus.

4911. CARDING ENGINES FOR CARDING COTTON, &c., *W. T. Cheetham, Manchester.—9th November*, 1881.—(*A communication from J. Konshin and W. Charnock, Serpokoff, Russia.*) 6*d*.

This consists in arrangements whereby the motion of the doffer and feed rollers may be arrested should the "taker-in" roller or doffing comb become from any cause stopped while the main cylinder of the carding engine is in motion.

4915. PREPARATION OF FARINACEOUS FOOD TO BE USED AS A SUBSTITUTE FOR COFFEE, &c., *E. Edward, London.—9th November*, 1881.—(*A communication from F. Maire, Lyons.*)—(*Provisional protection not allowed.*) 2*d*.

The preparation is composed of edible chestnuts, potatoes, Bohemian lentils, maize, and vanilla.

4916. BREECH-LOADING FIRE-ARMS, *J. Lang, Pall Mall.—9th November*, 1881. 6*d*.

This consists in the method of cocking the strikers or striker levers by a slide or bar acted upon by the "fore end" or by a projection on the barrels, said slide or bar being caused to act upon a safety catch or bolt, and being withdrawn from the strikers or striker levers.

4917. BICYCLES, &c., *L. E. Broadbent, London.—9th November*, 1881. 1*s*.

The invention relates to improvements in bicycles, tricycles, quadricycles, &c., the object being to obtain a direct propulsion action by both feet and arms upon the crank shaft, and to make the vehicle easily convertible from one kind to another, or according to the construction for the one particular sort of machine, and to furnish means for carriage for a certain quantity of luggage with facility.

4920. LIFEBOATS, *J. T. Baharie and W. Adamson, jun., Sunderland.—9th November*, 1881. 6*d*.

The boat is clinker-built of larch in the ordinary manner. Cork is then fitted in between each timber, the thickness of the ribs from stem to stern, and from keel to gunwale. The boat is then lined with a suitable thickness of sheet india-rubber from stem to stern fastened to the keel up to gunwale and to every rib, and in this manner a false keel of india-rubber is also produced. Air-boxes are fitted at each end and round the sides. A tank is fitted amidships divided into three compartments, with a small hole at the bottom of each partition, thus allowing the water to flow from one compartment to the other, thereby keeping the water always on a level.

4921. RAISING WATER, *W. Tasker, near Andover.—9th November*, 1881. 6*d*.

This consists in improvements in machinery or apparatus for raising water, consisting of the combination with well machinery of a force pump, so connected and combined therewith that both the said machinery and the pump are worked together or by one and the same operation.

4922. REFINING IRON, *A. M. Clark, London.—9th November*, 1881.—(*A communication from J. Garnier, Paris.*) 4*d*.

The invention relates to a process of refining pig iron and scrap iron containing phosphorus upon a neutral or basic hearth by the employment of a false hearth of limestone, which is oxidising and basic, and acts, moreover, mechanically.

4923. HOISTS, *J. Gordon, Glasgow.—10th November*, 1881.—(*Not proceeded with.*) 2*d*.

The invention consists in the adaptation of a revolving shutter, blind, or screen to the hoist or elevator cage, whereby the well is entirely closed throughout its depth, excepting at that part which is represented by the depth of the cage itself and by its situation in the well.

4925. APPARATUS FOR RAISING STAMP HEADS OR DROP HAMMERS, *S. Jellyman, Cannock.—10th November*, 1881.—(*Not proceeded with.*) 2*d*.

An iron or steel band passes over a pulley, which band is operated upon by means of a small roller attached to the main shaft, upon which the pulley is hung by side straps connected by two metal straps with a forked lengthening screw, thus ensuring a direct pull from the main shaft upon the operating roller; the roller is carried upon an excentric shaft which is operated on by levers. A catch is employed to hold up the stamp or drop hammer.

4927. MANUFACTURING ARTIFICIAL STONE, *E. de Pass, London.—10th November*, 1881.—(*A communication from R. H. Stone, Colony of Victoria.*) 4*d*.

This invention relates to the process of manufacturing artificial stone, the essence of which consists in the use and application of heated water, with or without lime in solution to such combinations—of lime and silicates—to form a mixture of silicate of lime or hydro-silicate of calcium.

4928. STOVES FOR HEATING SADIRONS, &c., *J. Thompson and C. Morris, Birmingham.—10th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the general construction of stoves for heating sad irons, drying rooms, and boiling water.

4929. STOVES, *H. J. Haddan, Kensington.—10th November*, 1881.—(*A communication from J. Schneur, Paris.*)—(*Not proceeded with.*) 2*d*.

The object is to prevent the discharge of carbonic oxide into the atmosphere of the rooms in which the stove is placed, and to keep the air moist.

4930. APPLIANCES FOR REPRODUCING OR MULTIPLYING COPIES OF DRAWINGS, LETTERS, &c., *R. Kimm, Dabry, N.B.—10th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the employment of sheets of paper coated with a suitable composition.

4932. GOVERNING APPARATUS FOR TRAMWAY ENGINES, &c., *T. Hunt, near Manchester.—10th November*, 1881. 6*d*.

The invention consists in controlling the speed by acting upon the controlling mechanism by means of a wheel or wheels rolling upon the rail or road, and separate from and independent of the ordinary carrying and driving wheels of the engine.

4934. TUNE-PLAYING TOPS OR GYROPHONES, *M. A. Wier, London.—10th November*, 1881. 6*d*.

This relates to the employment of a tune-plate fitted with reeds or other sound-producing devices.

4935. SUCTION OR FILTERING APPARATUS FOR FLOUR MILLS, &c., *F. Wirth, Frankfort.—10th November*, 1881.—(*A communication from G. Baier, Ulm.*)—(*Not proceeded with.*) 2*d*.

This consists in providing a double filtering and self-acting aspirating apparatus, chiefly designed to be connected with millstones by an automatic disconnecting arrangement, by means of which the dust filter is cleansed of dust at definite times through an excentric shaking motion.

4936. EXTRACTING GLYCERINE, OLEINE, &c., FROM VARIOUS SUBSTANCES, *W. R. Lake, London.—10th November*, 1881.—(*A communication from M. C. A. Ruffer, Paris.*) 4*d*.

The essential feature of this invention is the employment of centrifugal power combined with a current of gas or steam at a temperature suitable to ensure the liquefaction of one of the substances if dry or fatty materials are being treated, or the desiccation of a liquid if the material is combined with water or other fluid which it is not desired to retain or preserve.

4938. STOPPING AND RE-STARTING TRAMWAY CARS, &c., *C. E. Davison, Stamford Hill.—11th November*, 1881. 6*d*.

This relates to the employment of compressed air and a special gearing.

4940. MUSICAL INSTRUMENT, *F. Pool, Charleston, U.S.—11th November*, 1881.—(*Not proceeded with.*) 2*d*.

Two spheres of different but proportionate dimensions are joined together at their respective ends and are perforated in a special manner to produce the required sound.

4941. VENTILATING APPARATUS, *W. Cunningham, Dundee.—11th November*, 1881. 8*d*.

This consists in connecting two propellers and driving them in concert by means of an endless belt or belts combined with pulleys on the shafts of the propellers, the belt or belts being fitted or formed with projections or equivalents, or with holes to engage with holes or notches or projections on the pulleys.

4943. COMPOUND FOR PREVENTING ESCAPE OF STEAM, &c., FROM JOINTS, *G. Tall, Brixton.—11th November*, 1881.—(*Not proceeded with.*) 2*d*.

The compound consists of a suitable proportion of mineral fibre, such as asbestos, ground talc, plumbago, boiled linseed oil, raw linseed oil, and mineral oil, to which is added resin, whiting, blue clay, pipe-clay, fire-clay, and brown earth. The ingredients are mixed together and passed through cold rollers, and subsequently through hot rollers.

4944. MANUFACTURE OF MIXTURE YARNS, *W. Blackburn, Cleckheaton, York.—12th November*, 1881.—(*Not proceeded with*) 2*d*.

The object is to secure a perfect and complete admixture of the variously coloured fibres, so as to avoid the irregularities, and imperfections of mixture resulting in what are known as "spears."

4945. HAND RAKES FOR HAYMAKING, &c., *W. R. Lake, London.—12th November*, 1881.—(*A communication from C. Bergstrom, Sweden.*) 6*d*.

This consists essentially in a hay or garden rake constructed with double or single bent or T-shaped pegs by inserting them in holes provided in the head or cross bar, and afterwards bending the plate over the horizontal part of the pegs.

4950. COLLAPSIBLE AND EXPANSIBLE BASKETS, &c., *H. S. Bale, London.—11th November*, 1881. 6*d*.

This relates to the construction and arrangement of basket, trunk, box, or travelling bag with flaps hinged or loop jointed, whereby it can be reduced in bulk or capacity.

4951. WASHING MACHINES, *A. Fortune, Keighley.—12th November*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in the arrangement of washing machines, in such a manner that the component parts of the rotary agitator can be secured together before being placed inside the wash tub.

4952. PACKING CASE FOR BOTTLES, &c., *G. Robson, Liverpool.—12th November*, 1881. 6*d*.

The invention consists essentially in the combination of an outside rectangular case or covering, with two or more cell frames so constructed that by reversing or turning the said frames end for end with each tier of bottles or vessels, the necks or ends of less area of one tier of bottles or vessels shall be between the necks or ends of less area of another tier.

4953. VENTILATOR FOR CHIMNEYS, &c., *H. W. Yates, Brighton.—12th November*, 1881. 4*d*.

This consists in the combination of a cylindrical body and a head or top in the form of a frustrum of a hollow cone, whose section is octagonal or of other figure, the said cone being open at top and bottom, its diameter at the base being considerably larger, and its base being above the level of the top of the body.

4955. MANUFACTURE OF GAS, *B. Russ, London.—12th November*, 1881.—(*Not proceeded with.*) 2*d*.

The invention relates to the production of gas by the decomposition of chemicals, and its application in combination with atmospheric air as a motive power, and for heating and lighting purposes.

4956. VELOCIPEDES, *R. H. Lea and G. Singer, Coventry.—12th November*, 1881.—(*Not proceeded with.*) 2*d*.

The invention relates to the driving gear of tricycles and other velocipedes, and is more especially designed to meet the difficulty of varying roads. It also relates to the method of attaching the framework of velocipedes to the bearings thereof.

4959. CONVEYING OR ELEVATING GRAIN, &c., *J. Higginbottom and O. Stuart, Liverpool.—12th November*, 1881. 6*d*.

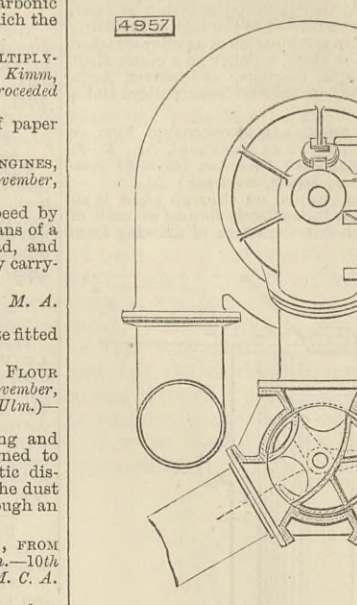
This relates to an elevator having a chain of buckets, and which is provided with a weighted bottom pulley or head capable of rising and falling, but destitute of legs or other framework connecting the bottom pulley with the upper part.

4960. CLEANING CARPETS, &c., *C. D. Abel, London.—12th November*, 1881.—(*A communication from J. Zacherl, Vienna.*) 6*d*.

This consists in the process and apparatus for, First, beating the carpet simultaneously upon both sides while the carpet is travelling in a vertical or nearly vertical direction; Secondly, brushing the upper and underside of the carpet simultaneously but upon different parts, and while the carpet is travelling in a horizontal or nearly horizontal direction; and lastly, distributing over the nap side of the carpet, and while travelling in the said horizontal or nearly horizontal direction, an insecticide powder.

4957. SHIIPS' PUMP VALVES, *J. Gwynne, London.—12th November*, 1881. 6*d*.

The inventor claims in a valve, whose casing or shell is provided with two inlets and one outlet, the use of stops so arranged as to prevent the possibility of the two inlets being put in communication with



each other, and to wedge or force the valve when in its extreme positions against the inlet that is closed.

4961. APPARATUS FOR NAILING BOXES, &c., *F. W. Blood, Liverpool.—12th November*, 1881. 8*d*.

This relates, First, to the nail receivers or holders; Secondly, to the nail receptacles or sockets placed near to the nail receivers or holders; Thirdly, to the manufacture of a nailing machine in which the nail-box rises and falls while the table remains rigid.

4963. BAKERS' OVENS, &c., *J. L. Hancock, London.—12th November*, 1881. 6*d*.

The shell of the oven is made of circular shape, or nearly so, and fitted therein is a circular shelf or shelves, either on a central pivot or on edge rails, so that it or they may be rotated therein.

4964. FRICTIONAL COUPLING, &c., *W. J. Fraser, London.—12th November*, 1881. 6*d*.

This consists in the combination of two band wheels and a friction wheel or wheels adjustable as to pressure on the band wheels by means of a screw or screws or levers, thereby constituting a frictional coupling for conveying and controlling power and reducing friction on the bearings.

4965. BINDERS OR HOLDERS FOR LETTERS, &c., *G. Hayes, London.—12th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to binders with leaves to which the letters are cemented.

4969. MACHINE FOR SYRUPING GINGER BEER, &c., *J. Murrell.—12th November*, 1881.—(*Not proceeded with.*) 2*d*.

The apparatus consists essentially of a measuring cylinder or barrel of a given capacity, preferably made of glass, so that its contents can be seen, and in which a cup leather or other suitable piston is fitted to work, having a tubular stem for the passage of the syrup.

4970. PHOTOGRAPHIC CAMERAS, *A. M. Clark, London.—12th November*, 1881.—(*A communication from E. Enjalbert, Montpellier, France.*) 6*d*.

This consists in the combination with a photographic camera of a plate-holding box which is open at the inner end and closed at the outer end, and fitted to slide in and out of the camera; and of a series of plate-holding frames fitted to slide in and out of the box.

4971. GAS STOVES, &c., *C. W. Torr, Birmingham.—12th November*, 1881. 6*d*.

This consists in the combination with the body of a gas stove made of terra-cotta or other non-metallic material, the said tubes crossing the body of the stove and being open at both ends and in communication only with the atmosphere external to the body of the stove.

4975. STEAM ENGINES, *J. Shanks and J. G. Lyon, Arbroath.—14th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to a steam engine in which a double piston is used, each of the two heads of which work in a single-acting cylinder, the two cylinders being arranged in a line at opposite ends of the engine, and provided with separate slide valves—operated in unison—for controlling the induction and eduction of the steam.

4976. CHURNS, *F. Levavasseur, Paris.—14th November*, 1881.—(*Not proceeded with.*) 2*d*.

The invention consists essentially in giving a double rotary movement to the axle or spindle carrying the blades, arms, or workers by which the cream is agitated.

4979. COMPOSITORS' RULES AND TYPE AND SPACE HOLDERS, *J. C. Mewburn, London.—14th November*, 1881.—(*A communication from L. K. Johnson, Brooklyn.*) 6*d*.

This relates partly to a compositor's rule provided with a combined guide and protector.

4981. HOPPERS, &c., FOR STORING GRAIN IN GRANARIES, *J. Higginbottom and O. Stuart, Liverpool.—14th November*, 1881. 4*d*.

This consists in the construction of the sylos, hoppers, or bins for storing grain, built of brick, masonry, concrete, or other suitable building material, with endless metallic bands embedded therein.

4982. MARKING KEY GROOVES, &c., *J. Roemmele, Glasgow.—14th November*, 1881. 6*d*.

The objects are first to find by means of convenient tools the line crossing the centre of the axle hole, and to mark out by means of another tool on both sides of such centre line the key groove corresponding with the diameter of the shaft or axle to be fastened.

4983. FIRE-ARMS, *F. Wirth, Frankfort.—14th November*, 1881.—(*A communication from N. Jaberg, Germany.*)—(*Not proceeded with.*) 2*d*.

This relates to various novel features in the construction and arrangement of breech-loading fire-arms.

4984. MANUFACTURING CARPET AND OTHER SIMILAR FABRICS, *J. J. Delmar, London.—14th November*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to improvements in the mode of manufacturing that class of carpet and other similar looped, piled, or corded fabrics which are made from hair.

4985. TEETH BRUSHES, *E. Pierrepont, London.—14th November*, 1881. 6*d*.

The object is to make the brushes so that the tufting will conform to the contour of the dental arch, whether for the inside or for the outside thereof.

4986. PICKERS FOR LOOMS, *E. Hallas, Huddersfield.—14th November*, 1881. 4*d*.

This consists in making the hole in the picker for the reception of the india-rubber of an oval form, and placed in a vertical position in the picker, by which means the shuttle has more surface to strike against, and the danger of striking the flange is rendered impossible.

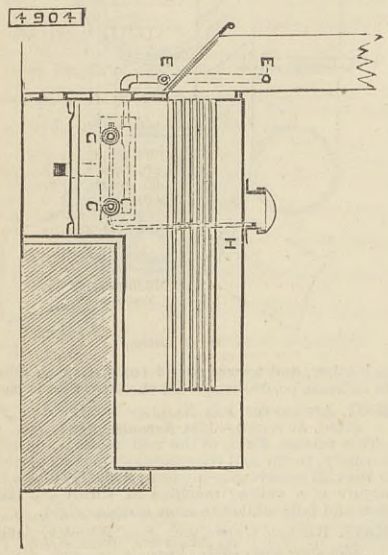
4992. CENTRIFUGAL DRYING MACHINES, &c., *A. Fryer, Wilmslow, and J. B. Alliott, Nottingham.—15th November*, 1881. 6*d*.

This consists in a centrifugal drying machine,

wherein the cage or revolving cylinder is attached to a spindle or shaft that rests upon at one end or is suspended from a kind of ball-and-socket or equivalent arrangement, so that though the outer casing be fixed, limited vibration is permitted to the cage or revolving cylinder; of the use in combination of a pulley attached to the said spindle or shaft, a pulley on a crank shaft supported in suitable bearings, and driven by a reciprocating engine, an intermediate pulley, and a belt or strap.

4904. CONSUMING SMOKE AND ECONOMISING FUEL IN CONNECTION WITH BOILER FURNACES, &c., *E. P. Alexander, London.—9th November*, 1881.—(*A communication from J. Elliott, Montreal.*) 6*d.*

Upon steam being turned on through pipes H an exhaust or vacuum is immediately formed at each of the nozzles G, which has the effect of drawing from



the stack through the pipes E E air and whatever unconsumed smoke and gases may escape from the fire, and discharge same mingled with the jets of steam through the nozzles G G over the grate, hot air being also sucked out of air chambers and down through tubes in the same direction.

5003. WATER-CLOSETS, &c., *H. Barron and H. Raimes, Kilburn.—15th November*, 1881. 6*d.*

This relates to the construction of water-closet deodorising or disinfecting apparatus, consisting of chamber for liquid, chamber for paper, branch delivery pipe (forked at one and protected at the other extremity), and down flow pipe, valve, controlling lever, and subsidiary apparatus.

5010. PNEUMATIC MACHINERY FOR THE SEPARATION OF MINERALS, &c, *R. W. Hart, Kildare-terrace.—15th November*, 1881. 6*d.*

This consists principally in the employment of a covered sieve bed with suitable discharge apertures for the separation of materials of different densities by the action of compressed air.

5022. COLD-AIR MACHINES, *E. Hesketh, Dartford.—16th November*, 1881. 6*d.*

This relates to the machines in which cold-air is produced by compressing air, cooling it, and then expanding it while it performs work.

5038. CLIPS FOR SHEARING HORSES, DOGS, &c., *F. Guillaume, Paris.—17th November*, 1881. 4*d.*

This relates to a special arrangement for tightening up and facilitating the putting together and taking to pieces of the parts of the apparatus.

5057. MANUFACTURE OF GALVANO-NICKEL-PLATED SHEET IRON, &c., *W. Morgan-Brown, London.—18th November*, 1881.—(*A communication from E. Schroeder, Leipzig.*) 2*d.*

The process consists in rolling the sheet zinc, sheet iron, or tin-plate to an equal thickness after having deposited a film or coat of nickel of one-tenth millimetre thickness direct on the cleaned surface without the ordinary coat of copper and without the use of any welding powder or any annealing process.

5428. BURNERS FOR PETROLEUM OILS, &c., *R. H. Brandon, Paris.—12th December*, 1881.—(*A communication from L. Sepulchre, Liege, Belgium.*)—(*Complete.*) 6*d.*

This relates to improvements of burners in which the wick is enclosed between two concentric tubes. A guide is employed to maintain the tubes concentric.

5600. IMPROVEMENT IN ELECTRIC LIGHTING APPARATUS FOR RAILWAY TRAINS AND OTHER PURPOSES, *S. Pitt, Sutton.—21st December*, 1881.—(*A communication from L. F. Starr, Philadelphia.*) 6*d.*

This relates to a mode of generating electricity for lighting trains and storing a portion of the electrical energy for use when the train is at a standstill. The inventor places his dynamo under the tender of the engine, where it is driven from an axle as long as the train goes forward, but not when the engine is reversed and travels backwards. The dynamo is connected with an electric lamp on the funnel of the engine, and one at the rear of the train, and also with a storage battery. When the train is in motion the current lights the two lamps, whilst a portion goes to the battery, and does work there which can be afterwards utilised when the train is at a standstill. An interrupter placed in the circuit of the tail light causes it to flash at regular intervals, thus denoting the rear of the train, and also, as the interrupter is driven from an axle of the train, the speed at which said train is going.

268. EXTRACTING SUSPENDED MATTER FROM REFUSE WATER, &c., *P. Lowe, Darwen.—19th January*, 1882. 10*d.*

This relates to a machine for the extraction and removal of solids, flocculent matter, or other refuse from water polluted by manufactories, or from the sewage of towns and other waste liquids. The machine is a self-acting strainer consisting of a perforated plate or plates laid on a frame fixed at a slight inclination with the flow of the liquid. The plate or plates may be formed of perforated zinc, gauze, wire, or other metal or substance suitable to the nature of the fluid to be operated upon.

380. IMPROVEMENTS IN AUTOMATIC ELECTRO-MAGNETIC PIANO AND ORGAN PLAYERS, *C. N. Andrews, San Francisco.—25th January*, 1882. 6*d.*

This consists in an improvement on the method of playing organs, &c., by means of a strip of paper, with slots corresponding to the length of note required, &c., revolving on a cylinder in connection with positive pole of a battery, and a rod in connection with the negative pole, so that when the paper is moved and the rod makes contact with the cylinder through a slot, a note is played. The keys or valves of the instrument are operated by an automatic circuit closing and breaking apparatus, consisting of an electro-magnet and armature mounted on a lever arm connected to the key or valve to be operated. This apparatus is illustrated in the specification.

448. SCREW NAILS, *H. H. Lake, London.—28th January*, 1882.—(*A communication from the American Screw Company, Providence, Rhode Island, U.S.*)—(*Complete.*) 4*d.*

This consists of a screw nail provided with a head so formed that the nail can be turned axially with a screw-driver or equivalent tool, a pointed or driving end, and a shank composed partly of threaded or serrated longitudinal sections, and partly of longitudinal sections without threads or serrations, which latter sections are at a less radial distance from the axis of the nail than the said threaded sections.

465. KNITTING MACHINES, *J. Byfield, London, Canada.—31st January*, 1882. 8*d.*

The object is to provide mechanism capable of producing automatically various patterns of work either in machines having stationary or rotary needle cylinders.

478. DISINTEGRATING JUTE AND FIBROUS STALKS, *H. J. Haddan, Kensington.—31st January*, 1882.—(*A communication from A. Angell and W. B. Cunningham, New York.*)—(*Complete*) 4*d.*

This consists in splitting the stalks and then removing therefrom the pith, and the shell, skin, or bark. A machine is employed consisting of elastic feed rollers, knife for splitting the stalks, and interlocking scrapers for simultaneously removing the pith, &c.

479. AUTOMATIC FEED APPARATUS FOR STEAM BOILERS, *J. Hayes, London.—31st January*, 1882.—(*A communication from E. Fromentin, Paris.*)—(*Complete.*) 6*d.*

This relates to improvements on patent No. 2179, A.D. 1879, and consists of two vessels arranged on one axis, and which by automatically oscillating by the passage of the water effects itself the distribution. The axis is provided with circular plates or discs, with orifices to regulate the distribution of steam and water as the apparatus oscillates. Cataracts or water-compressing cylinders are placed under each vessel so as to regulate the stroke and act as a buffer.

507. CLOCKS, *R. H. Lake, London.—1st February*, 1882.—(*A communication from A. M. Lane, Winsted, U.S.*)—(*Complete.*) 6*d.*

This consists in the combination of two main wheels arranged on the same shaft and concentric with each other, a main spring arranged between them so that one end engages with one wheel and the other end with the other wheel, so as to cause them to revolve in opposite directions. A train of gearing leading from one wheel imparts rotation to the escapement wheel shaft, and to the hour and minute hands, while a second train of wheels leading from the other wheel to a shaft from which an arm projects outward, so as to engage with the teeth of a wheel on the escapement shaft, from which teeth the arm escapes by the rotation of the escapement shaft produced by the first train, and by such escapement imparts an intermittent movement to the said second train, which movement is communicated through the latter to an independent second hand on the central shaft.

616. PURIFYING MIDDLINGS, *W. R. Lake, London.—8th February*, 1882.—(*A communication from The Electric Purifier Company, Incorporated, New Haven, U.S.*)—*Complete.*) 6*d.*

This relates to improvements on patent No. 727, A.D. 1880, in which rolls are caused to present an electrified surface to the material to be operated upon, and which is kept agitated, so that the lighter particles are attracted by the rolls which convey them away; and the First part consists in the use of reciprocating plates in place of such revolving rolls; the Second part of the invention relates to the use of stationary electrified plates instead of a moving belt, the receiver carrying the material to be treated being caused to reciprocate beneath such plates.

832. PROPELLING VESSELS, *W. R. Lake, London.—21st February*, 1882.—(*A communication from J. B. Root, New York.*)—(*Complete.*) 6*d.*

This consists in the method of propelling vessels by means of the combination of a screw arranged to move the water transversely to the line of movement of the vessel and an inclined propelling surface of the hull for receiving the increase or decrease of pressure produced by such movement of the water, such surface being inclined to the fore and aft line or line of movement of the vessel, whereby the latter will be driven in one direction by throwing the water against such inclined surface, and in the opposite direction by drawing it away from such inclined surface.

932. LOOMS, *T. Hanson, Bradford.—4th March*, 1881. 6*d.*

This relates to appliances to be employed in connection with mechanism for effecting a positive motion to the heald staves in their downward as well as their upward movement, that is to say, a "positive dobby," and the apparatus is so constructed as to raise and depress any one or more of the heald staves and healds required, and to securely lock and hold such staves and healds in such position until the pattern being woven requires a charge.

995. OBTAINING STARCH FROM GRAIN FOR THE MANUFACTURE OF GRAPE SUGAR, &c., *W. R. Lake, London.—1st March*, 1882.—(*A communication from W. T. Jepp, Buffalo, U.S.*)—(*Complete.*) 6*d.*

This relates to a combination of processes and suitable machinery.

1245. CREELS FOR SPINNING MACHINERY, *W. R. Lake, London.—14th March*, 1882.—(*A communication from J. O'Neill and G. M. Stewart, St. Louis, U.S.*)—(*Complete.*) 6*d*

This consists in a creel having a series of bobbin posts arranged in sets on parallel lines, the outer post of each set being arranged intermediate between the posts of the succeeding sets and serving as thread guides for the succeeding bobbins, whereby the thread is conducted to the loom in a direct line, and undue friction is avoided.

1337. TWISTED AND WOVEN FABRICS, &c., *A. M. Clark, London.—18th March*, 1882.—(*A communication from A. Urbahn, Paterson U.S., and A. G. Jennings, Brooklyn, U.S.*)—(*Complete.*) 6*d.*

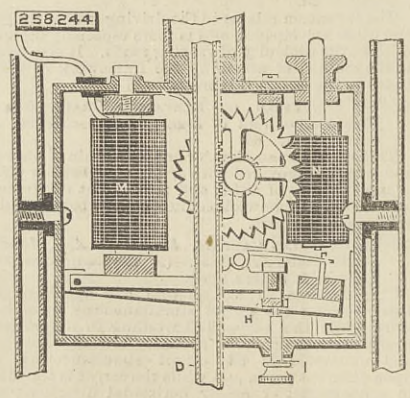
This relates to the manufacture of a twisted fabric constructed of an inner core of an envelope of costly yarn wound loosely around said core to form projecting loops, and of a binding thread wound around the core and partly around said enveloping yarn but in opposite direction to the latter.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

258,244. ELECTRIC ARC LAMP, *Richard R. Moffat, Brooklyn, N.Y.—Filed December 13th*, 1881.

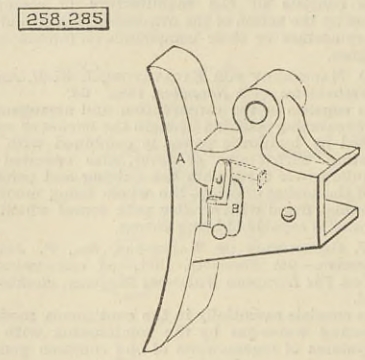
Claim.—(1) In an electric lamp, the combination of



the electro-magnet N, forming part of a derived circuit, its armature N, a device for breaking and closing said circuit, the moving frame H, escapement G, escapement wheel E', pinion E, racked carbon-holder A, and means for allowing the armature to move a sufficient distance to insure the working of the escapement and the operation of the feed mechanism before breaking the circuit, and which also permit said armature to return to or near its normal position before closing said circuit, substantially as specified. (2) In an electric lamp, the combination of an electro-magnet N, forming part of a derived circuit, its armature N, a device for breaking and closing said circuit by said magnet, mechanism for feeding the carbons, and means for moving and adjusting the magnet N for the purpose of increasing or diminishing the space between said magnet and its armature, substantially as specified. (3) In an electric lamp, the combination, with the carbon-holder D, of the moving frame H, guide rods C C, wheel E^1, escapement G, armature frame V, and the electro-magnet M, substantially as and for the purpose specified. (4) In an electric lamp, the combination of the carbon-holder D, the moving frame H, wheel E^1, guide rods C C, armature frame V, electro-magnet M, and the adjusting screw I, substantially as and for the purpose specified.

258,285. BRAKE SHOE, *James Denver, New Haven, Conn.—Filed August 4th*, 1880.

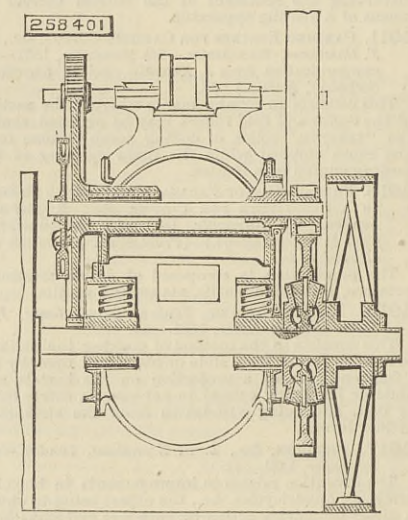
Claim.—The combination of shoe A, shank B,



receiving-box G, and pressure-lever J, its shank K, and nut L, constructed and operating together substantially as and for the purpose described.

258,401. TRACTION ENGINE, *Abraham O. Frick, Waynesborough, Pa.—Filed March 7th*, 1882.

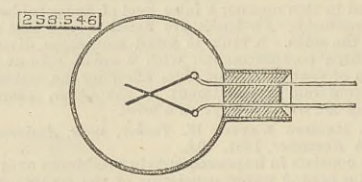
Claim.—The engine cylinder, crank shaft, and slotted side plates, all connected together for transmitting the strain to the axle independently of the boiler, in combination with the axle, springs supporting the weight of the engine, a radially-movable



counter shaft having one end extended through and made vertically movable in a slot in the said plate, and a link connecting the counter shaft at this end to the axle, substantially as and for the purpose described.

258,546. ELECTRIC INCANDESCENT LAMP, *Emile Berliner, Boston, Mass.—Filed March 31st*, 1882.

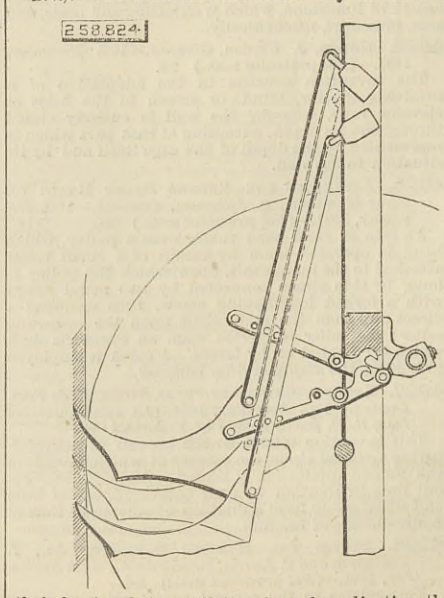
Claim.—(1) An electric lamp consisting of two electric carbons in loose contact with one another and enclosed in a transparent or semi-transparent vacuous chamber. (2) An electric lamp consisting of two conductors overlapping and in loose contact with one



another and enclosed in a vacuum. (3) In an electric lamp, a vacuous chamber containing a conductor consisting of an elastic carbon, as described, and in loose contact with another conductor, substantially as described.

258,824. SEEDING MACHINE AND CULTIVATOR, *Joseph W. Thomas and Abraham R. Ludlow, Springfield, Ohio, assignors to Thomas, Ludlow, and Rogers, same place.—Filed January 9th*, 1882.

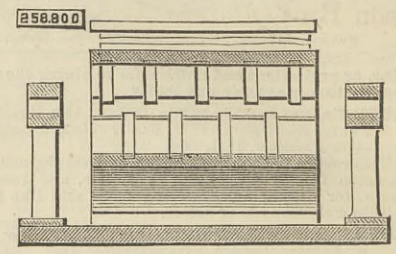
Brief.—The draw-bars are alternately attached at



their front ends to oscillating bars for adjusting the teeth in and out of line. Near the rear ends of the drag-holes are attached jointed pressure rods secured to a transverse rock shaft, which is oscillated to elevate or depress the teeth, they being attached to allow each an independent movement.

258,800. DYNAMO-ELECTRIC MACHINE, *William S. Parker, New York, U.S.—Filed March 4th*, 1882.

Brief.—The pole pieces of the field magnets are of cast iron and have grooves in their faces next the armature. The grooves are filled with soft iron bars.



The carriers for the armature coils are formed of thin iron turned up at the edges and having slots cut through the turned-up edges.

THE SOCIETY OF ARTS CONVERSAZIONE took place in the South Kensington Museum on Wednesday evening. Various entertainments were provided for the guests, who were received in the Architectural Court by Sir Frederic Bramwell, including the Hungarian band and the band of the 1st Life Guards, a concert with hand-bell ringing in the Lecture Theatre, and a pianoforte recital by Miss Helen Hopekirk in the Picture Gallery. The attendance was very large, nearly three thousand persons being present.

TWIN-SCREW STEAMERS FOR THE SERVICE OF THE GOVERNMENT OF THE ARGENTINE REPUBLIC.—In November of last year the Consul-General of France for the Argentine Republic entered into a contract with Messrs. Edwards and Symes, shipbuilders and engineers, Cubitt Town, London, for the construction of four iron light-draught twin-screw steamers. On the 20th May the first of these steamers, which is named La Capital, is 85ft. long, 15ft. beam, and 7½ft. deep, with raised quarter deck and forecastle, being nearly completed, proceeded down the river to the measured mile at Long Reach for her first official trial trip, and although the weather was unfavourable for the trial of such a light-draught vessel, yet she realised the expectations of her builders. The mean draught of water was under 3½ft., the mean speed attained on six consecutive runs being as nearly as possible 11¾ knots. On the 8th inst. she again proceeded down the river for her second official trial trip, having been loaded with 22 tons of cargo; mean draught of water 4ft., mean speed attained on six consecutive runs was 11 knots. The propelling machinery consists of two ordinary independent compound surface condensing engines, high-pressure cylinder 11in. diameter and low-pressure 20in. diameter, each set driving a screw 4ft. diameter. The engines are supplied with steam from an ordinary marine return tube boiler which maintained a pressure throughout the trials of 90 lb. driving the engines 195 revolutions per minute, the vacuum in both condensers being 26in., the whole of the machinery working first-class during the whole time the vessel has been under steam. The second vessel of the four ordered, which is the first of a smaller class of the above type, will proceed down the river for her first official trial next week.

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