THE INSTITUTION OF MECHANICAL ENGINEERS.

In our last impression we brought down our report of the meeting of the Institution of Mechanical Engineers at Leeds to Wednesday night, omitting, however, for lack of space, an abstract of Mr. Davey's paper, and the discussion on Mr. Cochrane's paper, concerning this last not much need be said, inasmuch as it was confined almost entirely to a vigorous attack on Mr. Cochrane's statements by Mr. I. L. Bell, and a reply by Mr. Cochrane.

Mr. Cochrane supplemented his paper with some explanations. High furnaces acted well, he explained, because they kept all their contents in the heat line, the loss at the sides being small, because they were comparatively narrow. At his works drawing back the tuyeres 6in. had effected a saving of £3000 a year in fuel. With 18·34 cwt. of coke per ton of iron, they had made 2508 tons of iron in a month in one furnace, and in another 2414 tons.

The discussion was opened by Mr. I. L. Bell, who contended that Mr. Cochrane's figures were, on the whole, inaccurate, and if the arrangements had not been bad to begin with, no such saving would have been effected, as thus stated, by drawing back the tuyere. An overhang of 16in. was unheard of, at least in Cleveland. He held that Mr. Cochrane was getting less work out of his fuel per unit than was got at the Clarence Ironworks, the ratio of efficiency being for Cochrane 79,829, and for Bell 80,907. He held that it was, in theory, possible to make a ton of iron with 17 cwt. of coke, but the blast must be heated to 2500 deg., which could not be done in practice. At the Clarence Works they got thirty tons of iron per week per 1000 cubic feet capacity of furnace, while Mr. Cochrane got but fifteen tons. As to the great yield of American furnaces, he could only say it was got at the cost of the furnace, which was ruined. In the case of the well-known Isabella and Lucy furnaces, they only lasted two years. Mr. Windsor Richards supported the view taken by Mr. Bell, and insisted on height as conducive to economy. The discussion was adjourned until Wednesday morning, when Mr. Cochrane replied at some length, and very effectively, to Mr. Bell's strictures. He concluded by saying that he had found that increased temperature and capacity of furnace both paid.

When the discussion on Mr. Cochrane's paper ended on Wednesday morning, a paper was read by Mr. Henry Davey, of Leeds,

ON MINING MACHINERY,

The object of this paper was to notice improvements which have been made in machinery for mining purposes, and to discuss the salient requirements of mining machinery generally, with a view to discover the best direction for the further development of invention. The subject was divided by the author under the following heads:—(1) Shaft sinking; (2) pumping; (3) winding; (4) underground pumping; (5) underground hauling; (6) ventilation; (7) economical application of power to mining operations generally. As practical examples of the different machines used for boring with a free-falling tool, the author reproduced from M. Sarran's paper several engravings. It is unnecessary to allude to them here further than to give their general characteristics.* They showed, in side and end elevation, the simplest form of boring tackle. It consists of a simple lever worked by hand. Triangular sheer-legs are erected over the bore-hole, and provided with a windlass for the purpose of drawing the rods; also the same kind of machine, worked by means of a direct-acting steam cylinder instead of by hand. In side and end elevation, a boring tackle provided with a steam winch for raising and lowering the rods and tools; this is the most modern and best form of machine and of the winch itself. The diamond drill was then referred to. The author stated that he has found it very difficult to ascertain the cost of boring in England. He has, however, obtained the following data as to the cost of trial bore-holes for ironstone in the Barrow district with steam winch and free-falling tool:—

Cost of Trial Bore-holes for Iron Ore.

Depth of hole.	Diameter of hole.	Cost per yard.	Cost of labour alone.	Time occupied.
Yards.	Inches.	s. d.	£ s. d.	Weeks.
126	6 to 2	7 10¼	49 10 0	15
124*	,, ,,	9 7	59 8 0	18
50	,, ,,	9 10¾	24 15 0	7½
63	,, ,,	9 5	29 14 0	9
76½	,, ,,	6 0½	23 2 0	7
88	,, ,,	8 3	36 6 0	11
48	,, ,,	11 0	26 8 0	8

Pumping was then referred to, and the merits of various kinds of pumps. There are several methods of dealing with pumps during sinking operations:—First, to fix the rising main or pump trees as the work proceeds, and add pipes above the working barrel as the shaft is deepened. This plan involves a telescopic or flexible suction pipe, or a telescopic pipe above the working barrel. With twin pumps this is a good plan, because one pump can be kept going whilst pipes are added, or whilst a bucket is changed in the other. Secondly, to sling the pumps by ground spears or wire ropes and add pipes at the top of the lift. Thirdly, to use a pilot bucket pump, and fix plungers every forty or forty-five fathoms, as is done in the Cornish mines. Fourthly, to use a pilot bucket pump worked by an independent engine, and fix plunger pumps every forty or forty-five fathoms until the bottom is reached; and then to fix plungers permanently at the bottom, for the whole height of lift. All these plans involve frequent alteration in the balance of the engine, causing considerable trouble and loss of time. The author has accordingly introduced into his own pumping engines a means of giving a different supply of steam to the two ends of the low-pressure cylinder, thus enabling the engine to be worked out of balance during sinking. The device consists simply of a shutter at the back of the low-pressure slide valve, Fig. 1, with means of adjustment outside the valve chest. By shifting the shutter over the forward or backward port of the slide valve, either one or the other may be throttled to suit the want of balance for the load on the engine. The author had devised a means by which, whenever the engine suddenly increases its speed during the stroke, communication between the high and low-pressure cylinders is suddenly closed, thereby not only stopping the admission to the low-pressure cylinder, but also cushioning the steam in front of the high-pressure piston. This retarding apparatus is illustrated in Fig. 2. It consists of a lever, one end of which is attached to a moving part of the engine, while the opposite end is made to actuate the trip of a double-beat valve closing the communication between the high and low-pressure cylinders. To the centre of the lever is attached a subsidiary piston working in a cylinder filled with water. The end of the lever which actuates the trip is held stationary by means of two springs, so arranged as to oppose each other. The engine in working gives the engine end of the lever a reciprocating motion, and thereby causes it to reciprocate the subsidiary piston in the water cylinder; but the motion of this piston is resisted by means of a conical plug throttling the passage that communicates between the two ends of the water cylinder. When the engine is working at its normal speed the conical plug is screwed up until the resistance thereby opposed to the subsidiary piston causes the trip end of the lever to partake of a slight reciprocation, and to be just on the point of tripping the valve. When working under this condition, should the engine happen from any cause to make a quicker movement, the resistance in the water cylinder would be increased, the valve would be instantly tripped, and thereby the admission would be cut off from the low-pressure cylinder, and the steam cushioned in front of the high-pressure piston. Winding was then dealt with, and a very excellent expansive gear which had come under the author's notice in Germany was explained and illustrated. The chief modern improvements and changes in direct-acting winding engines are as follows:—(1) Expansive working; (2) the counterbalancing of the rope by means of a conical drum, and also by means of a tail rope suspended under the cages; (3) the short-rope system, in which the rope makes rather more than half a turn round a single large driving pulley, instead of a number of coils round a drum; (4) the application of separate condensers. Direct winding is done at enormous speeds, as will be seen from the following example. At the Bestwood Colliery, near Nottingham, a pair of direct-acting winding engines, with cylinders 36in. diameter and 6ft. stroke, are employed in raising coal from a depth of 1300ft. One complete run, including charging, is made in 55 seconds. The weight of coal raised each time is 2 tons 2 cwt. Therefore this engine is capable of raising 1150 tons in 8½ hours from the depth of 1300ft. The average speed of the cages while running is 22 miles per hour, and the maximum about 35 miles per hour. As regarded underground pumping the author cited several examples. Mr. Joseph Moore, of San Francisco, who has had very large experience with pumping machinery in the county of Nevada, California, where the mines are probably the deepest in the world, had kindly sent the author the following notes of his experience:—"The type of engine first used was the horizontal geared engine, made to actuate the pumps by means of quadrants. As the mines became deeper the geared engine was replaced by the compound direct-acting engine. A few were made with fly-wheels, but the pumping capacity did not come up to what was expected. The slightest increase of speed over six revolutions per minute would cause a breakdown. In the Yellow Jacket Mine both fly-wheels had the arms jerked out of the wheel, and the whole of the rims and arms fell on the top of the machinery. Again, the engines could not go slower than three revolutions per minute; so that, when water was short part of the water pumped had to be allowed to run back to the bottom of the mine. The engine that has done the best work of any on the mines is a compound direct-acting non-rotative engine of the differential type. It is working 14in. pumps, with perpendicular spears to a depth of 1200ft., the spears then going off down an incline, and reaching to a depth of 3200ft. from surface. The total length of pump rods is over a mile. This engine has kept steadily at work, making as much as six double strokes per minute without any mishap except a spear-rod breaking now and then." The difficulty of keeping spear-rods free from breakages, when of such enormous lengths and carried to such great depths, induced Mr. Moore to propose a hydraulic system for the Savage shaft. His plans were carried out; and from notes which he had kindly sent, the author had been able to prepare the following brief description of the plant. The system consists of a compound differential pumping engines at surface, with 35in. and 70in. cylinders of 10ft. stroke, working four 8½in. plunger pumps, which deliver into an air vessel, whence a supply pipe is taken down to a pair of hydraulic pumping engines at the bottom of the mine. These engines are employed in pumping up direct to the Sutro tunnel, against a head of 813ft., or 352 lb. per square inch. The exhaust water from the hydraulic

FIG. 1.

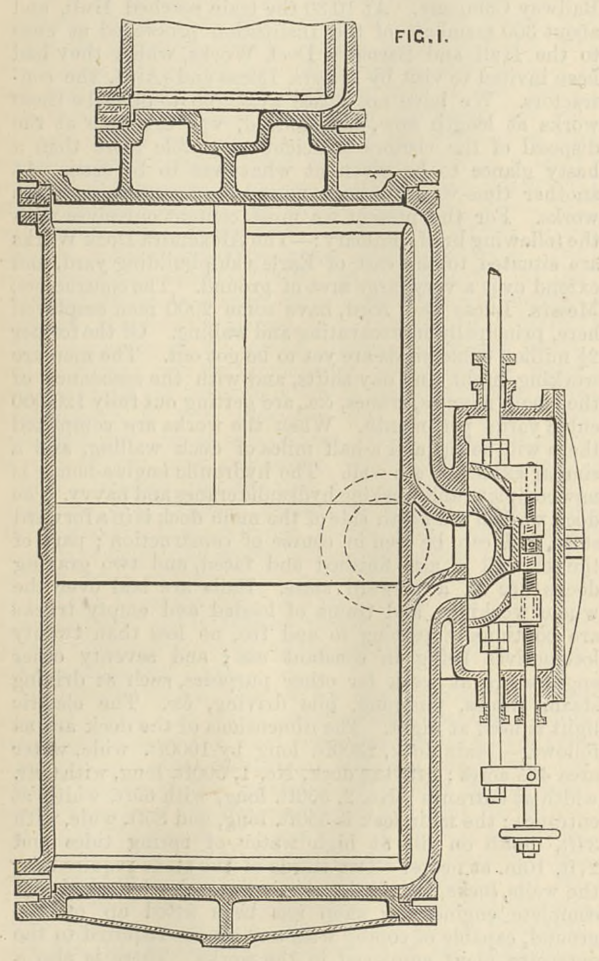
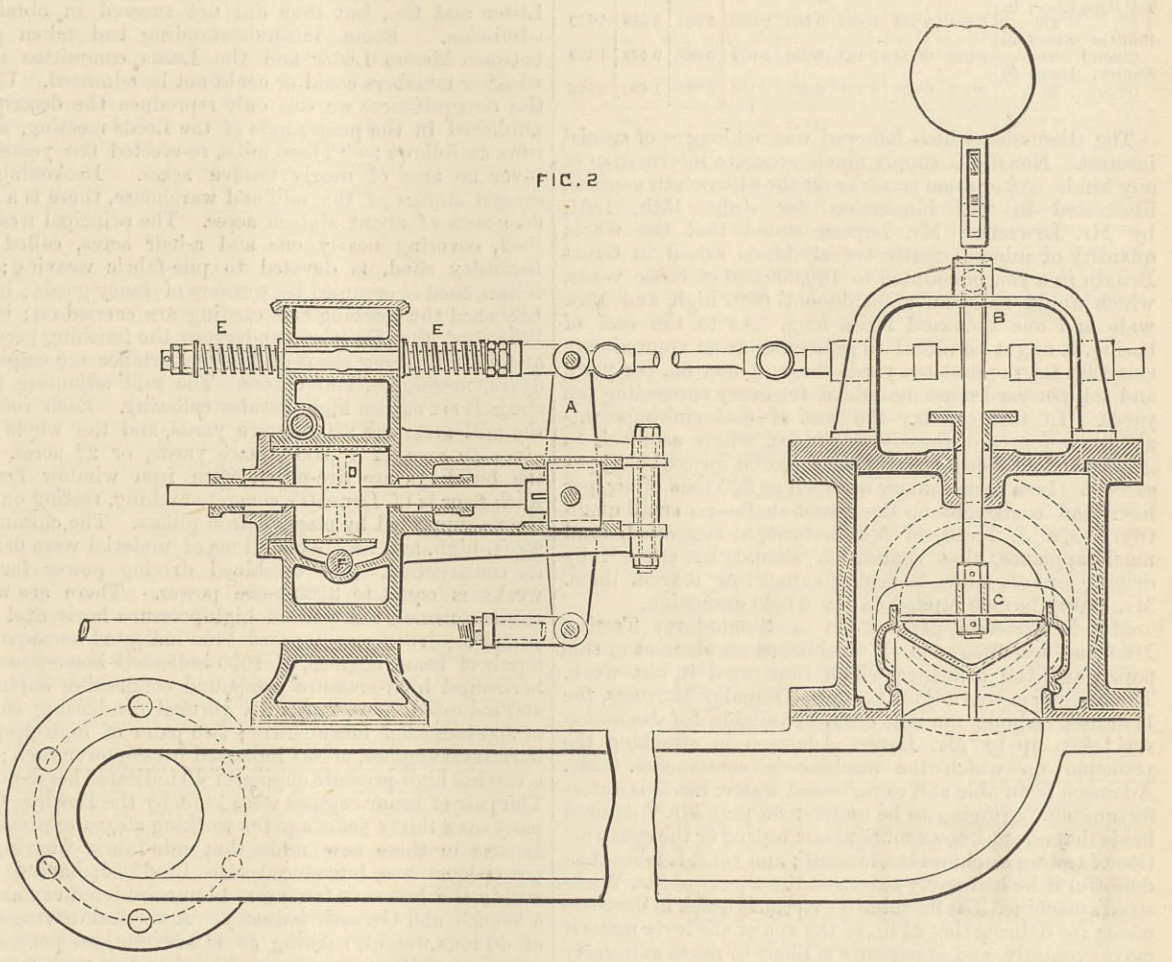


FIG. 2.



* See "Minutes of Proceedings" Inst. C.E., vol. lxvii., pp. 499-502.

* The strata passed through in this hole were as follows, proceeding from the surface downwards:—45ft. pinder, 75ft. red sand, 3ft. white sand, 30ft. red sand mixed with clay, 150ft. red sand, 30ft. red and white sand, 6ft. white sand, 6ft. shale, 4ft. ore, 6ft clay, 1ft. ore, 2ft. stone, 9ft. ore, 2ft. black shale, 3ft. stone; total 372.

engines is delivered to the surface. The several pressures and depths are as follows:—Initial steam pressure, 80 lb. per square inch; pressure in air vessels, 960 lb. per square inch, or 2220ft. head of water; depth of hydraulic pumping engines below ground, 2413ft.; depth of Sutro tunnel below ground, 1600ft.; height of lift from pump to Sutro tunnel, 813ft. The hydraulic pumping engines underground are each provided with four 6½in. power plungers of 10ft. stroke, and each pair of power plungers in turn carries a 14in. pump plunger, for forcing water up through the 813ft. from the bottom of the mine to the Sutro tunnel. It is therefore seen that the efficiency developed by the hydraulic pumping engines, in actual water pumped up through the 813ft. height, in comparison with the power water consumed in them, amounts to 85 per cent.; whilst according to the pressure gauges the friction of the engines is from 12 to 15 per cent., including the friction of the supply and exhaust water columns, each 2413ft. in height. The pumps raise from 1600 to 1700 gallons per minute. Brief notices of underground hauling systems and systems of ventilation brought the paper to a close. Hauling might be done on either of four systems—by the use of a tail rope, an endless chain, an endless rope, or compressed air locomotives. In 1867 a committee of the North of England Institute of Mining Engineers* made a careful investigation into the first three of these systems of hauling, as then in use. The following table gives a summary of their results:—

System of Haulage.	Average Gradient for full Tubs.	Cost in pence per ton per mile.							
		Ropes or Chains.	Tubs.	Grease and Oil.	Coals.	Repairs to Engines and Boilers.	Maintenance of Way.	Labour.	Total.
Tail Rope	Rise 1 in 213	0·276	0·114	0·186	0·558	0·098	0·064	0·583	1·879
Endless Chain	Rise 1 in 59	0·083	0·173	0·155	0·256	0·072	0·068	0 572	1·379
Endless Rope	Rise 1 in 36	0·252	0·309	0·138	0·323	0·196	0·083	1·692	2·993

The discussion which followed was not long or of special interest. Nor did it supply much accurate information of any kind. After some remarks on the Silksworth engines, illustrated in our impression for July 15th, 1881, by Mr. Lawrence, Mr. Lupton stated that the whole quantity of mineral matter of all kinds raised in Great Britain in a year amounted to 180,000,000 of cubic yards, which would make an embankment 60ft. high and 15ft. wide and one thousand miles long. As to the cost of boring, it might be useful to remember as an approximate rule that for the first ten yards the cost was 8d. per yard, and 3d. per yard must be added for every succeeding ten yards. In this country the cost of coal sinkings was about one-fourth of the cost in France, where as much as £840,000 had been spent in one search for coal without success. In a large colliery as much as 300 tons of air per hour had to be got up the upcast shaft—no small quantity. Mr. J. Head, of Middlesbrough, suggested, amid much applause, that ventilation should be effected by driving air *into* mines instead of exhausting it from them. Mr. Davey having replied on the whole discussion,

Mr. Wicksteed's paper "On a Single-lever Testing Machine" was then read. We published an abstract of this paper, and the drawings which illustrated it, last week. The discussion was adjourned until Thursday morning, the 17th inst. Almost the whole time available for discussion was taken up by Mr. Daniel Adamson in attacking the principle on which the machine is constructed. Mr. Adamson is an able and experienced tester, but it is unfortunately beginning to be understood that Mr. Adamson holds that no one knows much about testing or the construction of testing machines but himself; and yet it is more than doubtful if he had really mastered the theory of Mr. Wicksteed's machine. The machine is extremely quick in its movements; so delicate that 2½ lb. at the end of the lever make it move promptly, and apparently is likely to prove extremely useful. Mr. Adamson's reasoning was involved. So far as we comprehended him, he contended that Mr. Wicksteed's machine was bad because it was not capable of testing extremely minute variations in strain. But even if this were the case, it by no means follows that the machine should not serve an excellent purpose. Extremely accurate tests are not so much required in the everyday life of the engineer and the ironmaster, as a ready means of ascertaining, with fair precision and great rapidity, the characteristics of large numbers of specimen bars and plates. Mr. Cochrane, Mr. R. Price Williams, and Mr. J. Head all spoke in high terms of the machine, and from personal inspection of the apparatus we can endorse what they said. In the course of the discussion, Mr. J. Kitson stated that he had found that when clips were used instead of a through bolt to hold specimens, these last bore about 5 per cent. less strain, because the bolt permitted the strains to be more equally diffused through the bars. Mr. D. Greig held that not only should a testing machine but a chemist be employed at all works where steel was used. Mr. Wicksteed replied effectively to Mr. Adamson.

A paper was then read by Mr. Wilson Hartnell, of Leeds, on "Governors." This paper contains so much useful information on the theory of governors, to be obtained nowhere else, that instead of abstracting it we shall publish it in full. It will be found, no doubt, extremely useful for future reference by all who have to do with designing governors. The discussion which followed was of small or no importance in a scientific sense. Mr. Turner and others bore testimony to the efficiency of the Hartnell governors, and asked a few questions. The discussion terminated at 12.45, and the President then announced that it had been decided to postpone the reading of Mr. Hayes' paper on the Fromentin boiler feeder until the next meeting of the Institution. The apparatus was illustrated in our impression for July 21st. He then called for votes of thanks to the local committee, the engineers of Leeds, &c., which were passed with cheers.

* See their "Transactions," vol. xvii., 1867-8, p. 144.

The meeting then adjourned to luncheon in the Town Hall, and during the meal a vote of thanks was proposed to Dr. Spark, who, for the third time, charmed his hearers by his performance on the magnificent organ, which is the pride of Leeds. Dr. Spark replied in a few well chosen words, and expressed the delight which it gave him to find how warmly his efforts had been appreciated.

After luncheon, about 300 members of the Institution proceeded to the Midland Central Station, where a special train for Bradford had been provided by the courtesy of the directors of the Midland Railway. Arrived at Bradford, the visitors broke up into various parties, some proceeding to the Whetley Spinning Mills of Messrs. Daniel Illingworth and Son. The mills were not thrown open to the visitors, the object of attraction being the great Corliss engine, constructed about two years ago by Messrs. Hick and Hargreaves, of Bolton. This is, we believe, the largest single horizontal cylinder engine in the world. Full illustration and description of it will be found in The Engineer for April 29th, 1881. The cylinder is 40in. diameter, with a piston stroke of 10ft., and it was making, at the time of our visit, forty-three revolutions per minute, corresponding to no less than 860ft. of piston per minute; steam pressure, 60 lb.; vacuum, 25in. The fly-wheel is 35ft. in diameter, and weighs 50 tons. Its circumference is grooved and carries twenty-seven ropes, by which power is transmitted to the mill. The speed of these ropes is nearly 4000ft. per minute, or over forty-five miles an hour. The fly-wheel has recently been boarded up, that is to say board discs have been secured at each side of the arms, with the result of reducing the friction diagram of the engine 16 per cent. by removing the resistance of the air from the arms. Steam is supplied by four Lancashire boilers fitted with Martin's fire doors. The engine indicates about 1000-horse power.

Several of the members went to the silk mill of Messrs. Lister and Co., but they did not succeed in obtaining admission. Some misunderstanding had taken place between Messrs Lister and the Leeds committee as to whether members could or could not be admitted. Under the circumstances we can only reproduce the description published in the programme of the Leeds meeting, which runs as follows:—"These mills, re-erected ten years ago, cover an area of nearly twelve acres. Reckoning the several stories of the mill and warehouse, there is a total floor area of about sixteen acres. The principal weaving shed, covering nearly one and a-half acres, called the Beamsley shed, is devoted to pile-fabric weaving; the Green shed is occupied by weavers of fancy goods; in the Lily shed the combing and carding are carried on; in the Blue shed the pile-fabric undergoes the finishing process; and in numerous sheds of less importance are employed dyers, mechanics, and others. The mill adjoining these sheds is six stories high, besides cellaring. Each room in the mill measures 2200 square yards, and the whole mill gives an area of 13,200 square yards, or 2¾ acres. All the buildings are fire-proof, with iron window frames. Each floor is of Dennett's concrete arching, resting on iron beams supported by massive iron pillars. The chimney is 250ft. high, and nearly 8000 tons of material were used in its construction. The combined driving power for the works is equal to 3260-horse power. There are seven engines, namely: A pair of high-pressure horizontal compound condensing engines, of 1400 indicated horse-power; a pair of beam engines, of 1000 indicated horse-power; a horizontal high-pressure compound condensing engine, of 400 indicated horse-power; a vertical condensing engine, of 300 indicated horse-power; two pairs of high-pressure horizontal engines, of 60 indicated horse-power each; and a vertical high-pressure engine, of 40 indicated horse-power. The pair of beam engines were built by the Bowling Company over thirty years ago for working steam expansively. It was in these new mills that pile-fabric weaving by power-loom was introduced into Bradford, having until within the last very few years been considered exclusively a French and German industry. A vertical driving-shaft of 40 tons weight, running at 112 revolutions per minute on a foot of 13in. diameter, was tried at first with cast iron and wrought iron steps, which proved unsuccessful under such a load; Whitworth compressed steel and phosphor-bronze were then substituted, and have answered perfectly."

A large party visited the works of Messrs. Thwaites Brothers, well-known makers of steam hammers and Root's blowers. They had no reason to complain of their reception; on the contrary, they were received with the utmost courtesy, and were shown everything that was to be seen. These works were established in 1855, and employ about 200 hands. They consist of a turning shop, fitting shop, smithy, store-rooms, and pattern shop, and cover a ground area of about two acres. The turning shop, which is 224ft. long by 33ft. wide, is filled with machines of the heaviest description—lathes capable of boring out cylinders up to 100in. diameter; planing machines, of which one, a side planer, can plane to a height of 10ft.; powerful drilling and slotting machines, &c.; overhead, run powerful travelling cranes, one of which can lift 30 tons. The fitting shop, which is 152ft. long by 56ft. wide, is devoted principally to the fitting and erection of steam hammers. For this purpose a pit is sunk in it, so as to leave room above for the travelling crane, which is constructed to lift 50 tons, and to pass over the tops of the steam hammers. In the pit, hammers are erected, with both cast and wrought iron standards, up to 10 and 12 tons weight. This shop is also fitted up with drilling, planing, and slotting machines. Around the smithy, which measures 56ft. by 42ft., are eight blacksmiths' fires, supplied with air by a No. 2 Root's blower. In the centre stands a 12 cwt. cast standard self-acting hammer, which is used for light forging and stamping motion work for steam hammers, &c. In this shop, for still lighter forgings, is a 6 cwt. single-standard double-framed hammer, also fitted with a self-acting valve motion; a punching and shearing machine, Ryder's forging machine, and a circular saw for cutting hot iron. The pattern shop, which is 96ft. long by 56ft. wide, is fitted up with lathes, planing machines, circular and other saws, and various modern wood-working machines. The shops are all well arranged, and there are several special tools; one, for example, is a double boring too which bores the boss hole in a weigh shaft lever at the same time that a set of internal tools set in the boring head round up the boss outside. Another is a large wood planing machine, by which the rotating vanes, if we may so call them, of the larger Root blowers are shaped up with great speed and accuracy, the cutters on the plane disc being ground to the proper form. The erecting shop has been cut out of the side of a hill, and is at one side excavated 50ft. below the surface. All the appliances at these works are good, and the establishment can turn out very heavy mechanism, as, for example, a 35-ton steam hammer, which in 1869 was converted into a 50-ton hammer for the Alexandrovna Works, Russia. We saw in course of construction the 10-ton wrought iron framed hammer, illustrated in The Engineer for July 28th.

After the places we have named had been visited, about an hour and a-half remained before the return of the special train to Leeds, and most of the visitors availed themselves of the opportunity to visit the Bradford Fine Art and Technical Exhibition. We have already said something concerning this Exhibition, and it must suffice to add now that its contents met with full approval. It is, indeed, one of the best provincial Exhibitions ever got up, and is full of objects of interest, alike to the lover of art and the engineer. The special train returned to Leeds at six p.m., reaching Leeds in twenty-three minutes, the distance being fourteen miles, and the train being slowed down for signals twice. Mr. Johnson's four-coupled express engine showed to advantage under these circumstances as the train was heavy. The annual summer dinner of the Institution took place in the evening in the Town Hall, Mr. Westmacott presiding.

On Friday an excursion was made to Hull, a special train being courteously provided by the North-Eastern Railway Company. At 10.30 the train reached Hull, and about 300 members of the Institution proceeded at once to the Hull and Barnsley Dock Works, which they had been invited to visit by Messrs. Lucas and Aird, the contractors. We have not space available to describe these works at length now, nor, indeed, was the time at the disposal of the visitors sufficient to enable more than a hasty glance to be given at what was to be seen. At another time we shall have more to say concerning these works. For the present we must content ourselves with the following brief summary:—The Alexandra Dock Works are situated to the east of Earle's shipbuilding yard, and extend over a very large area of ground. The contractors, Messrs. Lucas and Aird, have some 2000 men employed here, principally in excavating and walling. Of the former 2¼ million cubic yards are yet to be got out. The men are working night and day shifts, and with the assistance of the steam navvies, cranes, &c., are getting out fully 120,000 cubic yards per month. When the works are completed there will be one and a-half miles of dock walling, and a similar extent of sea wall. The hydraulic engine-house is now complete, and working hydraulic cranes and navvy. The dock wall on the north side of the main dock is in a forward state, and can be seen in course of construction; part of the sea wall is also finished and faced, and two graving docks are in a forward state. Rails are laid over the whole workings, and trains of loaded and empty trucks are continually passing to and fro, no less than twenty locomotives being in constant use; and seventy other engines are at work for other purposes, such as driving steam cranes, pumping, pile driving, &c. The electric light is used at night. The dimensions of the dock are as follows:—Main dock, 2300ft. long by 1000ft. wide, water area 46½ acres; graving dock, No. 1, 500ft. long, with 60ft. width at entrance; No. 2, 550ft. long, with 65ft. width at entrance; the main lock is 550ft. long, and 85ft. wide, with 34ft. depth on sill at high water of spring tides and 27ft. 10in. at neaps. Two-thirds of the stone required for the walls, locks, &c., is already on the ground worked. A complete engineering shop has been fitted up on the ground, capable of coping with any repairs required to the extensive plant employed in the works. There is also a special plant for grinding lime for mortar, and for making lime. The steam navvys supplied by Messrs. Ruston and Proctor attracted much attention. A new hydraulic navvy only started that morning was watched with interest. The bucket is worked by a ram, the stroke of which is increased by chain pulley gear. The working pressure is 700 lb. on the square inch, and it has been found worth while to lay down a long length of piping from the accumulator house to work this machine, which performed its duties admirably.

From the docks the visitors proceeded to Earle's shipbuilding yard and engine works. These works have been carried on for upwards of thirty years; they cover an area of about thirty acres, and do the whole of the work in connection with the construction of ships and their engines. The yard is situated on the banks of the Humber, here three miles wide, and has a good river frontage with plenty of water, so that the largest ships can be launched without hindrance. To the west of the yard is the Victoria Dock, and on the east the Alexandra Dock, now in course of construction; there is thus water accommodation on three sides. The works possess facilities for executing the most extensive repairs expeditiously, having four slips, two worked by hydraulic gear and two by steam. The last constructed has only been in use a few months, and is the largest in England, being capable of hauling up a ship of 3500 tons gross register, that is a dead weight of 2500 tons, in an hour and a-half. The other hydraulic slip is adapted to take up ships of 2000 tons dead weight. On the slip was the Othello, 2000 tons dead weight, said to be the largest ship ever hauled up on a slip. She belongs to the Wilson line, and some time ago broke her stern frame in the Atlantic. She contrived to get into New York, where the frame was repaired with two gun-metal patches costing £250 each. She made subsequently two voyages to the Mediterranean. She was then placed in dock, had her stern frame taken out; the space was then filled in with wood, and she was floated round to the slip and hauled up, all the cost which would have been incurred for the continued use of the dock being thus saved.

In the erecting shop not many engines were in progress. All the engines built by the firm are of the same type, with round cast iron pipes supporting the cylinders in front, the back frames being cast with the condenser. The workmanship is sound and strong, but not of high finish. One three-cylinder compound of considerable size, similar in general arrangement to the engines of the Claremont, illustrated in The Engineer for August 4th, is nearly finished. The crankshaft bearings of this engine, instead of being of brass are of cast iron, with white metal run in. The castings are round, and apparently very inadequate means are provided for preventing them from revolving in the plummer blocks should they get hot and seize. We should not like to go to sea in charge of such bearings. But perhaps the theory is that if heating takes place the white metal will all run out, and no seizing can occur. The only advantage gained by the arrangement is the saving of a few sovereigns in the cost of brass, that of fitting up being unaffected. The game does not strike us as being worth the candle. Close by was to be seen a notable example of the injurious effects of steam on cast iron, a pair of cylinders being practically ruined by corrosion in all the ports and passages, in less than three years. We failed to obtain any account of the history of these cylinders, but they told their own story pretty fully.

A large number of omnibuses and other conveyances were provided by the Hull local reception committee, and by these the visitors were conveyed to the Town Hall, where an admirable luncheon had been provided. After luncheon the visitors broke up into two parties, one of which went to see the various objects of interest in the town, while the other went down to the docks, a steamer being provided to convey them to the West Docks, and to see the dock extension works in progress, and the engines of the Hull Hydraulic Power Company, concerning which company we are told the supply of motive power by hydraulic pressure, on the system inaugurated by Sir William G. Armstrong, was commenced in Hull in 1875; and already about one and a-quarter mile of 6in. mains has been laid through the streets bordering the old harbour, where most of the wharves and warehouses are situated, and hydraulic power is being supplied to a large number of premises for various purposes. An important extension will complete the circuit round the docks, and will enable new connections to be made or repairs to be effected without inconveniencing other consumers. The pressure in the mains is 700 lb. per square inch. At the pumping station in Machell-street, are two pairs of engines, together of 60-horse power, each pair having cylinders 12½in. diameter by 2ft. stroke, driving the pumps direct, and delivering into the accumulator 135 gallons of water per minute at the pressure of 700 lb. per square inch. The accumulator is 18in. diameter, with 20ft. stroke, and weighted with eighty tons of slag. Over the engine room is a cast iron tank containing 44,000 gallons of water, which is pumped from the river Hull at low water by two duplicate 8in. Appold centrifugal pumps driven by Brotherhood's three-cylinder engine, each pump being capable of delivering 48,000 gallons per hour to the height of 35ft. when running at 800 revolutions per minute. The Hull Dock Company has laid a main of its own along the Queen's Dock, and is renting power from the Hydraulic Power Company for working the cranes and other lifting appliances at that dock.

At 4.30 the special train left for Leeds, which place was reached about 6.10, when the members separated. Thus terminated one of the most successful meetings ever held by this or any other institution; and this success was due almost wholly to the indefatigable labours of the local committee and of the local secretaries, Mr. John Barber and Mr. J. H. Wicksteed. No less than £1400 was subscribed for the entertainment of the visitors; and the manufacturers of Leeds left nothing undone to satisfy them. To Mr. Henry Davey much of the success of the *conversazione* was due. On the other side, Mr. Westmacott, as President, and Mr. W. R. Browne, as Secretary of the Institution, warmly assisted in carrying out all the arrangements. Under the circumstances, nothing was wanted to ensure a satisfactory result but fine weather, and this, on the whole, was not lacking.

EXHIBITION OF LIFE-SAVING APPLIANCES.—ALEXANDRA PALACE.

No. III.

The third class of exhibits, that is to say those which came under the third section, was composed of appliances and inventions for the prevention or extinction of fire, and for the rescuing of human life in the event of fire, and was composed of about thirty exhibits. Mr. Wilkins, firemaster to the city of Edinburgh, showed a collection of models, including one of an impermeable screen for the prevention of the spread of fire in theatres, &c.; a working model of an old manual fire engine, which was presented to Professor Playfair in 1818, and a working model of the first modern fire engine, introduced into the Edinburgh Fire Engine Establishment in 1825 by the late Mr. James Braidwood, the then firemaster to the city of Edinburgh. Messrs. Chubb, always in the front rank of energetic and enterprising men, showed some appliances for protection from fire and burglars, which included a patent concrete fire-resisting door for use under the Building Acts; a patent electric time lock which contained two chronometer movements, and which could be set to open the lock at any desired moment; and a collection of their well-known safes. The Fire Brigades Association made a formidable display, composed of helmets, axes, hoses, and fire-extinguishing appliances. The Chemical Fire Engine Company exhibited Foster's improved patent chemical fire engine, which works by means of compressed air; also Foster's patent hydro-carbonic attachment for chemicalising, by perfectly harmless chemicals, water from permanent supply mains, steam or manual fire engines. Mr. Sinclair showed Dicks' now well known patent "L'extincteur," and many small and useful appliances for the purpose of preventing the spread of fire. The Metropolitan Fire Brigade showed a hose cart, helmets, &c., and Messrs. Merryweather and Son a fine steam fire engine, whilst Messrs. Shand and Mason, who probably make a larger number, were not to be seen. A large exhibit was made by the United Asbestos Company of various articles of Italian asbestos. Asbestos is a mineral, and is becoming well and deservedly known for its fire-resisting qualities; a large specimen in its natural state, and weighing some 2 cwt., was to be found on the stand. It is absolutely fire-proof, and ropes have been made of it for use in places which are exposed to fire risks, while it is found to be of great value as a packing for steam glands, for firemen's clothes, for drop curtains in theatres, &c. &c. A simple and ingenious domestic fire-escape was exhibited by Mr. Perry and attracted a fair share of attention. It consists generally of a light iron folding ladder and frame, which can be fastened under the window and inside the room, where it may be made to do duty as a table. On the alarm of fire which would cut off communication by the staircase, it would be only necessary to turn this ladder out of the window, and it would then serve not only as a means of escape from the room in which it was fixed, but also from each window on its line to the ground. Dr. Liebermann showed a neat little instrument for testing the point of ignition of petroleum, which, in the absence of any drawing, it would be difficult to explain fully. The remaining exhibits of this class were composed of gas regulators and governors, fire-escapes, and imperishable materials, none of which call for any special mention.

Section 4 was made up of appliances for mining, calculated to ensure the safety of those engaged in mines of all kinds, and included lamps, safety fuses, safety clips for wire rope guides, ventilating apparatus, &c. But as in our mines the greatest danger is usually to be apprehended from explosions caused by defective lamps, it is hardly to be wondered at that the great majority of the exhibits in this class was composed of safety lamps. Following the list, Mr. Purdy's exhibit was the first to attract attention, and on his stand was a clever miners' lamp, which, owing to its design, precludes the possibility of being tampered with, and which, by being fitted with a pneumatic lock, renders its being opened without the necessary apparatus a virtual impossibility. It is a well-known fact that in many mines the arrangements are of so lax a nature that men are able to open their lamps for the purpose of getting pipe-lights, and that no amount of warning appears to be enough to frighten a callous miner. In most mines, however, rigid regulations as to the use of lights are laid down; men dare not go into the pits with matches in their pockets, nor with tools which could be employed to open their lamps, yet in spite of this lamps do get opened, pipes do get lighted, and gases do explode, causing destruction to life and property. Messrs. J. Cooke and Co. showed a good collection of mining lamps, including Williamson's patent double safety, Cooke's patent self-extinguishing lamp, the Universal Clany lamp, and the Davy, Mueseler, Stephenson, Fireman, and other lamps. The Protector Lamp and Lighting Company exhibited a large show-case which contained patent Mueseler protector lamps, Dialling protector lamps, Davy and Stephenson protector lamps, Clany protector lamp, Jack protector lamps, Stephenson, Davy, Clany, and Mueseler oil lamps, and also one 12-light air gas machine, and one 45-light air gas machine. The *Colliery Guardian* showed a number of very interesting exhibits, and afforded opportunities for comparing the different lamps. The Davy lamp has a gauze of very close mesh—784 apertures to the square inch—round the light, and fixed close to the oil vessel below. Owing to the closeness of the meshes, it is most improbable that any flame should come through to cause danger of the gas exploding, but on the other hand the light given out is of a very poor character, and must severely try the sight of those whose lot it is to work by its wretched rays. The Stephenson lamp has a glass surmounted by a cap of perforated copper within the wire gauze. The air enters through small orifices below the gauze, and when highly explosive, extinguishes the light, so giving warning of danger to the miner. In the Clany lamp the lower part round the light is of thick glass, and affords a better light than either of the others above mentioned. Gauze is retained above the glass, through which the air is allowed to enter. The evident danger of the breakage of this lamp has prevented its general adoption for the use of the men, but its improved lighting powers have rendered it a most desirable instrument for the use of overseers, &c. The Mueseler lamp, which is very much used in Belgium particularly, and abroad generally, is made with a little flue or funnel which descends nearly to the light, and causing a draught, improves the brilliancy of the light. Close to the exhibit of the *Colliery Guardian* was to be seen an ingenious safety indicator for collieries, &c. The apparatus is intended to give warning of any increase or decrease of atmospheric pressure or temperature in the pit, and by means of a regulator of a simple kind, the point at which the warning will be given may be altered to suit any circumstance. Bagot's patent safety indicator alluded to above may also be adopted for use on board ships which are fitted with dry air or other patent refrigerators, and it will then give warning should the temperature at which it is desirable to keep the cold chambers be exceeded. The last exhibit which came under this class was the patent improved ventilating apparatus of Messrs. W. Teague and Co., of Poole, Cornwall.

That thorough and systematic ventilation is of the first importance is generally admitted as a theory, but in practice it is to be feared that its value is not as fully recognised as it should be. It does not, for example, receive the same amount of attention as questions which involve the consideration of water supply or drainage. Of course such matters demand close and searching consideration, but it may be very fairly conceded that ventilation as a subject of inquiry should at least claim equal attention. Messrs. Teague and Co., having gone into this subject deeply, made a very interesting show of their apparatus for the ventilation, not only of collieries and mines, but also for railway carriages, ships, &c. The principle most generally adopted for ventilating collieries and other mines is that of the fan which causes a vacuum, and so gives motion to the gas charged atmosphere below, removing it through a shaft. Messrs. Teague supplement this principle by using not one shaft but several pipes of different dimensions, which run into each other. For example, let us suppose a pipe of 9in. diameter leads from the fan into a bunker, and continues to any desired distance, say 20ft.; at about 18ft. this first pipe runs into another, say 4in. larger in diameter, leaving an open annular space of 2in. at the junction. The air passing rapidly through the first pipe into the second causes a partial vacuum at this annular space, and a considerable quantity of vitiated air is taken in. These pipes may be multiplied *ad infinitum*, and a greatly improved system of ventilation be, it is claimed, obtained without any increase in the motive power or in the dimensions of the fan. A steam jet might be readily substituted for the fan, or compressed air might be used with very satisfactory results; indeed, Messrs. Teague exhibited a full-sized ventilator for mines where compressed air is available, and they show the large quantity of foul air which a small pressure of compressed air will exhaust. At a pressure of 5 lb. to the inch it was shown that 92 cubic feet of compressed air per minute exhausted 845 cubic feet of the foul atmosphere. These ventilators were supplied with compressed air by Hathorn's Reliance air compressor, and were at work during the whole time of the Exhibition.

Class 5 was composed of surgical and sanitary appliances, the number of which was legend, and included batteries, special supports, nose instruments, false arms, hands, legs, &c.; ear trumpets, spectacles, chest protectors, artificial eyes, bandages, &c. In this class the Ordnance Department of the Royal Arsenal, Woolwich, made an interesting display, which included pharmacy, surgical, and ambulance wagons, hospital marquee, life-saving rockets, port fires, &c. Captain Norton showed his house and ship ventilator, which consists of a system of pipes connected with the apartments to be purified, and communicating through a clapper valve with an exhausting and forcing device, consisting of a water bell or air chamber, to which a vertical reciprocating motion is imparted by a beam operated by a steam, gas, or water engine. The operation is as follows:—The elevation of the bell causing a partial vacuum draws foul air from any apartment with which the branch exhaust pipes are connected, and by the downward stroke of the bell this foul air is disposed of through the necessary channels, which have been provided for its dissipation. This system is being extensively adopted at present, and anyone who remembers the Criterion Theatre a few months ago, and compares it then with what it now is, will be struck by the excellence of Captain Norton's invention. Many other ventilators were exhibited in the class. Messrs. Boyle and Son made a specially extensive display of some seven and twenty different applications of their inventions.

The sixth and last Class was composed of engineering and miscellaneous safety appliances, and at the head of this class, and, perhaps, the most interesting of the whole, was an exhibit of models and photographs, lent by the Midland Steam Boiler Inspection and Assurance Company, and shown by Mr. E. B. Martin. These models, which have been made by the officers of the company for use at inquests, &c., show the value of inspection. At one end of the stand was a table of no less than 1080 explosions, by which some 1365 people were killed and 2077 injured during the twenty years from 1862 to 1881. Photographs were also shown of exploded boilers, arranged according to the causes of explosion. The models were arranged in separate cases, of which there are twelve, and include locomotive, plain cylinder, Cornish, furnace, Lancashire, and many other boilers, and the whole exhibit afforded both considerable interest and instruction, not only to the general visitors, but to large numbers of engineers. The only other exhibit in this class which calls for any special mention, was Mill's patent non-explosive boiler, which is composed of small upright copper tubes forming the walls and containing the water and steam, connected on the top and bottom by circular rings of gun-metal. These rings are made in half, and can be readily taken apart for cleaning or examination. The entire central space in the boiler is fitted with ⊃-shaped 1in. circulating tubes of copper. The fire is by means of baffle plates made to pass all round the outside of the upright tubes, and the circulation through the inner tubes is so rapid that no scale or deposit remains in them. Many other excellent exhibits were made in this class, but, unfortunately, the space at our disposal precludes further mention, and it would be invidious to name one or two where all were so good.

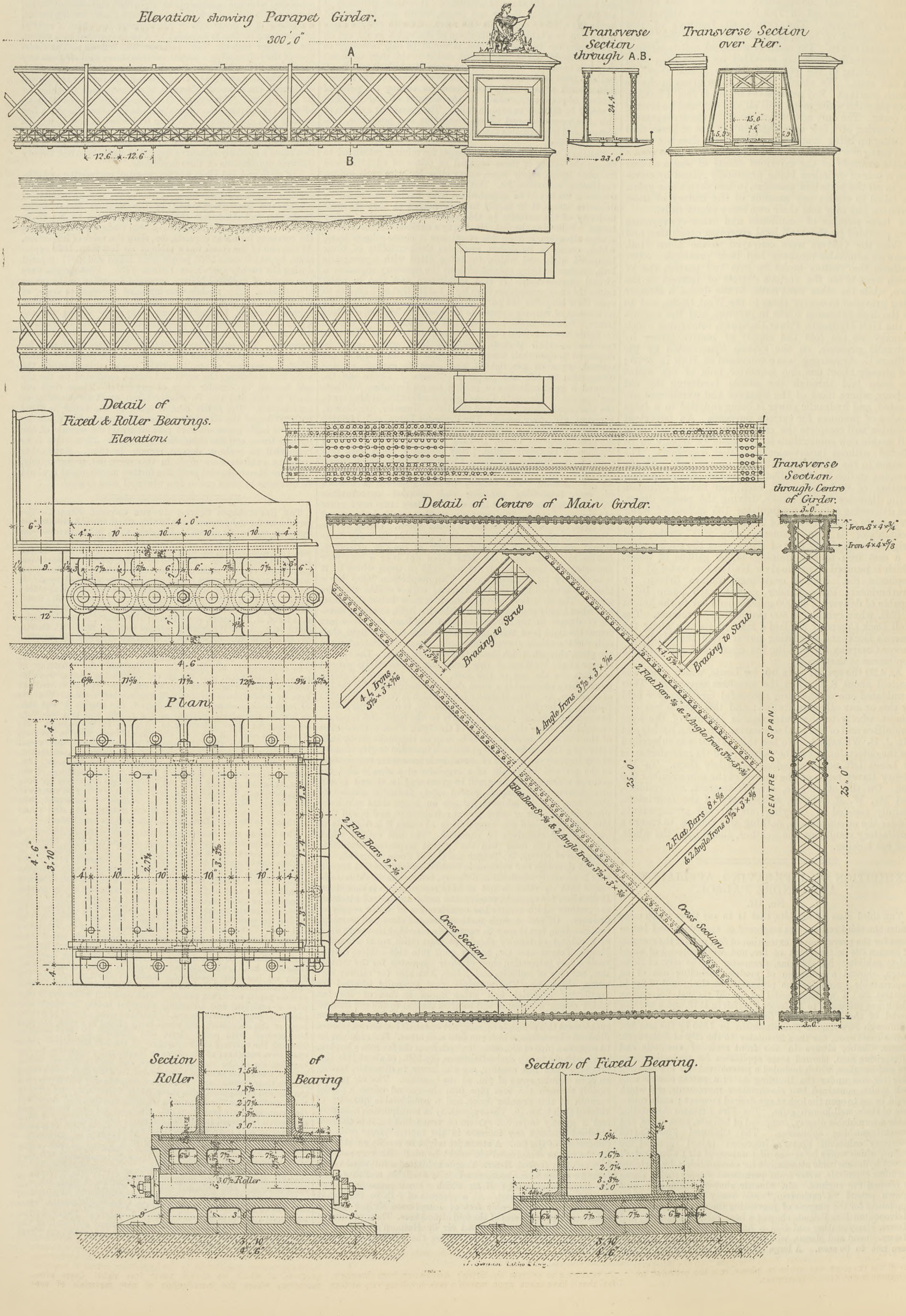
The Engineering School at the Crystal Palace.—The certificates for the summer term in this school were distributed on Saturday last by Sir James N. Douglass, C.E., in the lecture-room of the school. The report was read by Mr. F. K. J. Shenton, and was very satisfactory, showing good work for the term. In the lecture examination on "Railroad and Dock Work," of twenty-one candidates eligible sixteen passed satisfactorily, this being an advance on previous years; the first place was attained by A. J. Allen. The following took the highest honours:—Drawing-office: F. E. Ross, D. Allport; pattern shop: G. C. Borton, F. J. Pigott; fitting shop: J. R. Pratt, J. A. W. Brunton; civil engineering: first term, R. P. Barnes, second term, H. Skinner, E. S. Tiddeman, third term, A. H. Whinfield; colonial section: W. B. C. Caccia, W. C. J. Clifford. Sir James N. Douglass expressed his gratification at the practical nature of the work he had supervised, for he held that real work was the foundation of success in the engineer. The preparation of plans for Parliament, the planning of a railway and dock, and the survey of existing works, was also work of a proper nature to train an engineer. It was carried out here in great fulness in the civil engineering section. The use of hand tools, such as the soldering iron, was taught, he was glad to find, in the colonial division of the school, and this was very necessary for those intending to emigrate to the colonies. He would take care that his own sons should know how to use such tools. He hoped that the colonial students before him would endeavour to develope the resources of the countries they visited, and to train the aboriginal inhabitants to useful work. Mr. Shenton then proposed a vote of thanks to the examiners of the term, thanking not only them but also previous examiners for their kind assistance, to which he in part attributed the great success of the school. Mr. J. W. Wilson, the principal of the school, then made some remarks on the nature of the training, and after a vote of thanks to Sir J. N. Douglass the proceedings terminated.

The Naval and Submarine Exhibition.—During the run of the exhibition which was held at the Agricultural Hall, Islington, under the above title in April last, not the least numerous class of visitors was composed of the official representatives of our and foreign navies, and so much interest did these gentlemen manifest in the various exhibits, that requests were made that Mr. Barnett should send to each of the Governments a collection of the circular price lists, or other papers bearing on the principal exhibits. Mr. Barnett promised to get them, and in fulfilment of his promise he invited the various exhibitors to supply him with sixteen sets of full lists. Upwards of 400 of the most prominent of the exhibitors provided the necessary papers, and Mr. Barnett, who seems to be actuated by a strong determination that everything which he does shall be thoroughly well done, has had these catalogues, circulars, price lists, &c., divided into and arranged in sixteen complete sets. Each set has been handsomely bound in thirteen volumes, the only classification possible having been the arrangement of these various papers according to size. With each full collection is supplied a complete and admirably compiled index, by which any particular paper or circular can be found at once, as well as a catalogue of the Exhibition, the whole being placed in a neat, compact box covered with green cloth, and labelled on the outside. Through the courtesy of the manager of the late Exhibition, these cases have been kept at his offices in Westminster-chambers for the examination of the various exhibitors, and such engineers, naval officers, and others as might be interested, for a few days before being sent to their destinations. Those Governments only which possess a marine will be supplied with these costly collections; and already those destined for the Japanese, Chinese, Spanish, and American Governments have been sent off. Still, several sets remain, and gentlemen interested in our English naval architecture and marine engineering may have an opportunity of seeing them. Few exhibitions have been carried out with so great a spirit of thoroughness—none with greater—than the Naval and Submarine, and few people regard this fact more strongly than those fortunate manufacturers who had the good luck to be exhibitors. Yet, notwithstanding all that Mr. Barnett has yet done for them, his good work is not over, for the second and enlarged catalogue which he promised to his exhibitors and the public at large is, we understand, quite complete, and will be published as soon as all the price lists, circulars, catalogues, &c., of the exhibitors have been despatched. Regarding the work which has been done by the management and staff of the Exhibition, it is safe to prophecy a great success for the next Naval and Submarine Exhibition.

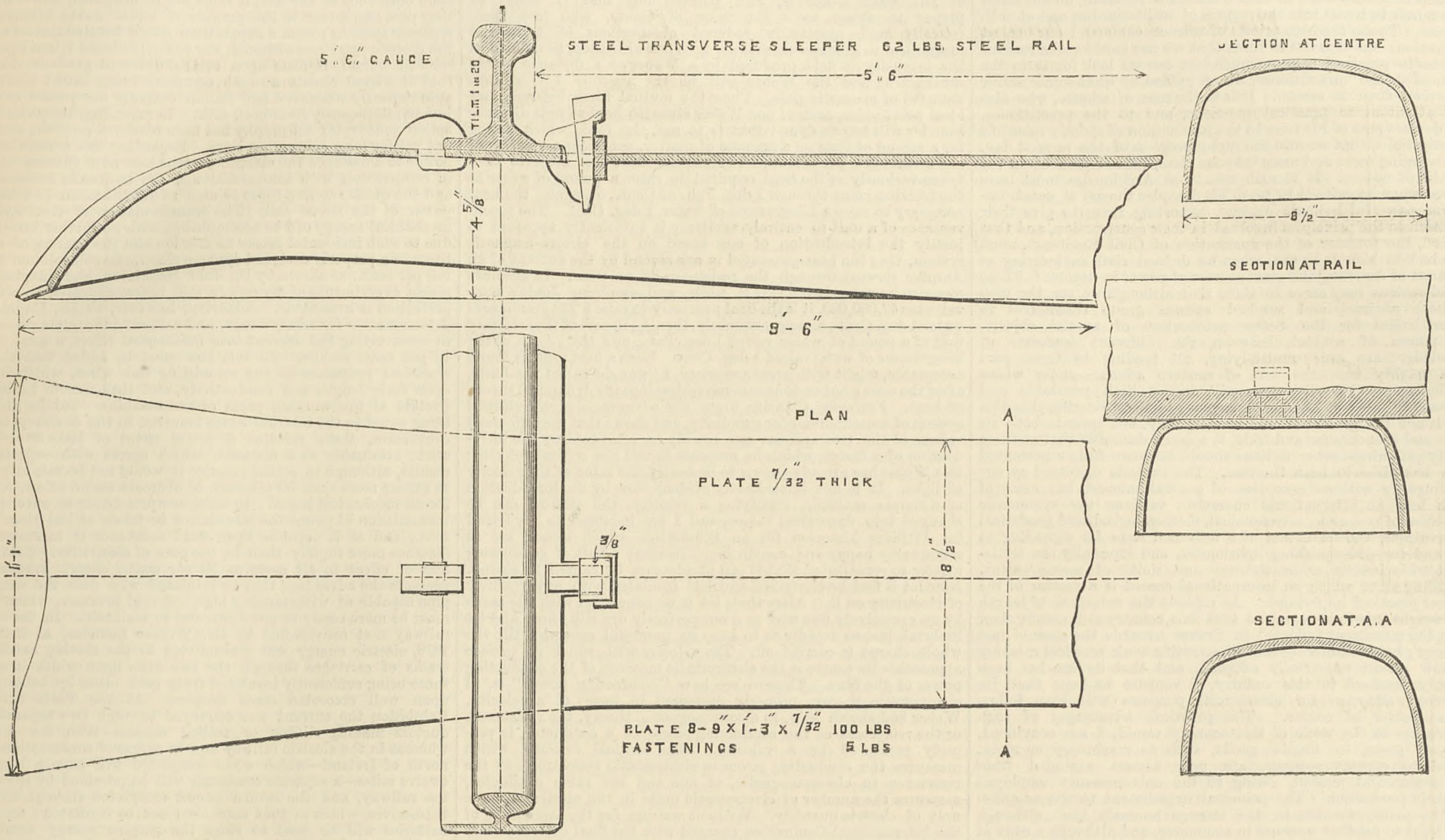
DOM PEDRO II. BRIDGE, CENTRAL BAHIA RAILWAY.

MR. JAMES CLEMINSON, M. INST. C.E., WESTMINSTER, ENGINEER.

(*For description see page* 142.)



PERMANENT WAY—INDIAN STATE RAILWAYS.



CONTRACTS OPEN.

INDIAN STATE RAILWAY AND BHOPAL STATE RAILWAY.

THIS contract is for permanent way materials consisting of transverse steel sleepers and fastenings for 62 lb. and 41¼ lb. steel rails. Drawings of the larger sleeper are given herewith, the smaller sleepers being of the same design and only differing in dimensions.

The work required under the specification comprises the construction, supply, and delivery at London, Liverpool, or Birkenhead, of 68,000 transverse steel sleepers, all with wrought iron fastenings, complete, for 62 lb. and 41¼ lb. steel rails as under, viz. :—50,000 transverse steel sleepers for 62 lb. steel rails, 5ft. 6in. gauge ; 18,000 transverse steel sleepers for 41¼ lb. steel rails, metre gauge.

The complete drawings can be seen and copied at the office of the Director-General of Stores, India Office. Each sleeper is to consist of one transverse steel sleeper with wrought iron rail fastenings complete, as follows :—Two outside rail clips, two inside rail clips, two wedges, and two wedge bearing pieces.

The whole of the materials used for this contract are to be of the best quality and subject to the approval of the Inspector-General of Railway Stores. The steel for the sleepers must be of such a quality that the sleepers when finished shall be free from cracks, splits, flaws, surface pitting, or defects of any kind. The iron for all the fastenings must be of such a strength and quality that it shall be equal to a tensional strain of 24 tons per square inch, with a contraction of 20 per cent. of the tested area at the point of fracture.

The sleepers are to be pressed or stamped out of plates of such thickness that after being stamped they shall be nowhere less than $\frac{7}{32}$in. thick for the 5ft. 6in. gauge sleeper, and $\frac{3}{16}$in. for the metre gauge sleeper, the dies being of such a form that an exact cant of 1 in 20 is given to the rail seats. All the holes in each sleeper are to be punched at one operation, so as to ensure absolute uniformity. Any burrs which may remain on the plates after punching are to be carefully removed. The fastenings are to be clean forgings neatly finished off and made accurately to the sizes shown on the drawing.

The transverse sleeper for the 5ft. 6in. gauge, with fastenings complete, as shown, is estimated to weigh 105 lb. The transverse sleepers for the metre gauge with fastening complete, as shown, is estimated to weigh 53½ lb. No work weighing less than the above weights by more than 2 per cent. will be accepted. Payment will not be made for any weight above that estimated, and the actual weight only will be paid for if the work is under the above estimated weights.

After the work has been inspected and approved, the sleepers must be dipped in a boiling solution of Angus Smith's, or other approved composition. The fastenings are to be dipped into boiling linseed oil, and when dry packed in strong wooden cases. The cases are to be made of 1¼in. thick well seasoned deal boarding, with 1¾in. thick elm ends, the whole nailed together with wire nails ; they are to be strengthened by battens pitched at a proper distance along the sides, tops, and bottoms, each set of which is to be entirely surrounded with one strap of hoop iron. The cases are to have outside end corner posts, and the ends of the cases are to be tied with hoop irons, each stretching across the end and along the sides to meet the first side battens. The hoop iron is to be 1½in. wide, No. 18 B.W.G. thick. The joints of all cases are to be tongued and grooved. The sleepers may go out unpacked. Every sleeper and piece of ironwork is to be marked with the letters "I.S.R." All packages must have such shipping marks put on them as may be directed by the Inspector-General, the marking on all wooden cases being cut or branded, not merely painted. The cost of all cases and other materials required for packing, as well as of all oiling, painting, packing, marking, testing, and delivery, must be included in the contract sum. The contractor is to furnish, with his second delivery, seven complete sets of neatly executed hand-made tracings on cloth, showing the sleepers and fastenings as made. The tracings are not to exceed 25in. in width, and they are to be delivered rolled up on a wooden roller, and not folded in any way.

Tenders are to be delivered at the Store Department in the India Office, Westminster, S.W., on Tuesday, 29th inst., before two p.m., after which hour no tender will be received. They are to be addressed to the Secretary of State for India in Council, with the words "Tender for Transverse Steel Sleepers" on the left-hand corner of the envelope, and are to be placed in a box provided for that purpose in the Store Department.

THE BRITISH ASSOCIATION AT SOUTHAMPTON.

A GREAT deal of work has to be done by the local and general committee of the British Association before the meeting may be said to commence, the arrangements for the reception of visitors, meeting all their requirements, and putting the machinery in order for a very extensive series of sectional gatherings, and for the excursions, involving almost as much work before as during the meeting. On Wednesday matters were in full working order, and the meeting was inaugurated by the formal resignation of the presidency by Sir J. Lubbock to Dr. Siemens, who then delivered his address.

The President's address was given in the Skating Rink, which was fairly well filled, though a wet evening. Visitors seem to be very numerous, and it is considered that the meeting will be well attended, though a number of celebrated frequenters are gone to the Montreal meeting of the American Association for the Advancement of Science. Dr. Siemens' address will be found to contain some very interesting remarks on some past and probable directions of practical applications of the results of scientific research ; but it will hardly be classed among those which marked the meetings of Belfast, Sheffield, and some which preceded these. It will be regarded as important from purely technical considerations, but will not be looked upon with the popular interest, or excite the controversy which marked the Belfast and York addresses.

The following are the names of the presidents, vice-presidents, and secretaries of the various sections :—

A. Mathematical and Physical Science.—President : Right Hon. Professor Lord Rayleigh, M.A., F.R.S. Vice-Presidents : G. H. Darwin, F.R.S.; Professor G. C. Foster, F.R.S. Secretaries : W. M. Hicks, M.A.; Professor O. J. Lodge, D.Sc.; D. McAlister, M.A., M.B., (Recorder) ; Rev. G. Richardson, M.A.

B. Chemical Science.—President : Professor G. D. Liveing, M.A., F.R.S. Vice-Presidents : A. G. Vernon Harcourt, F.C.S.; Professor H. E. Roscoe, Ph.D., F.C.S. Secretaries : P. Phillips Bedson, D.Sc. (Recorder) ; H. B. Dixon, M.A., F.C.S.; J. L. Notter, B.A., M.D.

C. Geology.—President : R. Etheridge, F.R.S., F.G.S. Vice-Presidents : Professor T. Rupert Jones, F.R.S., F.G.S.; Professor J. Prestwich, F.R.S., F.G.S. Secretaries : T. W. Shore, F.G.S.; W. Topley, F.G.S. (Recorder) ; E. Westlake, F.G.S.; W. Whitaker, B.A., F.G.S.

D. Biology.—President : Professor A. Gamgee, M.D., F.R.S. Vice-presidents : Professor W. Boyd Dawkins, M.A., F.R.S.; G. E. Dobson, M.B., F.L.S.; Professor M. A. Lawson, M.A., F.L.S., Professor J. D. Macdonald, M.D., F.R.S. Department of Anatomy and Physiology.—Professor A. Gamgee, M.D., F.R.S. (President), will preside. Secretaries : George Haslam, M.D.; W. Heape ; A. Sedgwick, B.A. (Recorder.) Department of Zoology and Botany.—Professor M. A. Lawson, M.A., F.L.S. (Vice-President), will preside. Secretaries : J. B. Nias, B.A.; Howard Saunders, F.L.S., F.Z.S. (Recorder) ; T. W. Shore, jun., B.Sc. Department of Anthropology.—Professor W. Boyd Dawkins, M.A., F.R.S., (Vice-President), will preside. Secretaries : G. W. Bloxam, M.A., F.L.S. (Recorder); Walter Hurst.

E. Geography.—President : Sir R. Temple, Bart., G.C.S.I. Vice-Presidents : H. W. Bates, F.R.S.; Lieut.-Colonel H. H. Godwin-Austen, F.R.S., F.G.S. Secretaries : E. G. Ravenstein, F.R.G.S.; E. C. Rye, F.Z.S. (Recorder).

F. Economic Science and Statistics.—President : Right Hon. G. Sclater-Booth, M.P., F.R.S. Vice-Presidents : W. E. Darwin, F.G.S.; R. H. Inglis Palgrave, F.S.S. Secretaries : George Baden-Powell, M.A., F.R.A.S., F.S.S.; Professor H. S. Foxwell, M.A., F.S.S.; A. Milnes, M.A., F.S.S.; Constantine Molloy (Recorder.)

G. Mechanical Science.—President : John Fowler, C.E., F.G.S. Vice-President : A. Giles, C.E.; W. H. Preece, C.E., F.R.S. Secretaries : A. T. Atchison, M.A.; F. Churton ; H. T. Wood, B.A. (Recorder.)

Dr. C. WILLIAM SIEMENS, F.R.S., C.E., then delivered his presidential address. He said :—

In venturing to address the British Association from this chair, I feel that I have taken upon myself a task involving very serious responsibility. The Association has for half a century fulfilled the important mission of drawing together, once every year, scientists from all parts of the country for the purpose of discussing questions of mutual interest, and of cultivating those personal relations which aid so powerfully in harmonising views, and in stimulating concerted action for the advancement of science. A sad event casts a shadow over our gathering. While still mourning the irreparable loss science had sustained in the person of Charles Darwin, whose bold conceptions, patient labour, and genial mind made him almost a type of unsurpassed excellence, telegraphic news reached Cambridge, just a month ago, to the effect that our Honorary Secretary, Professor F. M. Balfour, had lost his life during an attempted ascent of the Aiguille Blanche de Peuterey. Although only thirty years of age, few men have won distinction so rapidly and so deservedly. Since the days of the first meeting of the Association in York in 1831, great changes have taken place in the means at our disposal for exchanging views, either personally or through the medium of type. The creation of the railway system has enabled congenial minds to attend frequent meetings of those special societies which have sprung into existence since the foundation of the British Association, amongst which I need only name here the Physical, Geographical, Meteorological, Anthropological, and Linnean, cultivating abstract science, and the Institution of Mechanical Engineers, the Institution of Naval Architects, the Iron and Steel Institute, the Society of Telegraph Engineers and Electricians, the Gas Institute, the Sanitary Institute, and the Society of Chemical Industry, representing applied science. These meet at frequent intervals in London, whilst others, having similar objects in view, hold their meetings at the University towns, and at other centres of intelligence and industry throughout the country, giving evidence of great mental activity, and producing some of those very results which the founders of the British Association wished to see realised. If we consider further the extraordinary development of scientific journalism which has taken place, it cannot surprise us when we meet with expressions of opinions to the effect that the British Association has fulfilled its mission, and should now yield its place to those special societies it has served to call into existence. On the other hand, it may be urged that the brilliant success of last year's anniversary meeting, enhanced by the comprehensive address delivered on that occasion by my distinguished predecessor in office, Sir John Lubbock, has proved, at least, that the British Association is not dead in the affections of its members, and it behoves us at this, the first ordinary gathering in the second half century, to consider what are the strong points to rely upon for the continuance of a career of success and usefulness. If the facilities brought home to our doors of acquiring scientific information have increased, the necessities for scientific inquiry have increased in a greater ratio. The time was when science was cultivated only by the few, who looked upon its application to the arts and manufactures as almost beneath their consideration ; this they were content to leave in the hands of others, who, with only commercial aims in view, did not aspire to further the objects of science for its own sake, but thought only of benefiting by its teachings. Progress could not be rapid under this condition of things, because the man of pure science rarely pursued his inquiry beyond the mere enunciation of a physical or chemical principle, whilst the simple practitioner was at a loss how to harmonise the new knowledge with the stock of information which formed his mental capital in trade. The advancement of the last fifty years has, I venture to submit, rendered theory and practice so interdependent, that an intimate union between them is a matter of absolute necessity for our future progress. Take, for instance, the art of dyeing, and we find that the discovery of new colouring matters derived from waste products, such as coal-tar, completely changes its practice, and renders an intimate knowledge of the science of chemistry a matter of absolute necessity to the practitioner. In telegraphy and in the new arts of applying electricity to lighting, to the transmission of power, and to metallurgical operations, problems arise at every turn, requiring for their solution not only an intimate acquaintance with, but a positive advance upon electrical science, as established by purely theoretical research in the laboratory. In general engineering the mere practical art of constructing a machine so designed and proportioned as to produce mechanically the desired effect, would suffice no longer. Our increased knowledge of the nature of the mutual relations between the different forms of energy makes us see clearly what are the theoretical limits of effect ; these, although beyond our absolute reach, may be looked upon as the asymptotes to be approached indefinitely by the hyperbolic course of practical progress, of which we should never lose sight. Cases arise, moreover, where the introduction of new materials of construction, or the call for new effects, renders former rules wholly insufficient. In all these cases practical knowledge has to go hand in hand with advanced science in order to accomplish the desired end. Far be it from me to think lightly of the ardent students of nature, who, in their devotion to research, do not allow their minds to travel into the regions of utilitarianism and of self-interest. These, the high priests of science, command our utmost admiration; but it is not to them that we can look for our current progress in practical science, much less can we look for it to the "rule of thumb" practitioner, who is guided by what comes nearer to instinct than to reason. It is to the man of science, who also gives attention to practical questions, and to the practitioner, who devotes part of his time to the prosecution of strictly scientific investigations, that we owe the rapid progress of the present day, both merging more and more into one class, that of pioneers in the domain of nature. It is such men that Archimedes must have desired when he refused to teach his disciples the art of constructing his powerful ballistic engines, exhorting them to give their attention to the principles involved in their construction, and that Telford, the founder of the Institution of Civil Engineers, must have had in his mind's eye, when he defined civil engineering as "the art of directing the great sources of power in nature." These considerations may serve to show that although we see the men of both abstract and applied science group themselves in minor bodies for the better prosecution of special objects, the points of contact between the different branches of knowledge are ever multiplying, all tending to form part of a mighty tree—the tree of modern science—under whose ample shadow its cultivators will find it both profitable and pleasant to meet at least once a year; and considering that this tree is not the growth of one country only, but spreads both its roots and branches far and wide, it appears desirable that at these yearly gatherings other nations should be more fully represented than has hitherto been the case. The subjects discussed at our meetings are without exception of general interest, but many of them bear an international character, such as the systematic collection of magnetic, astronomical, meteorological, and geodetical observations, the formation of a universal code for signalling at sea, and for distinguishing lighthouses, and especially the settlement of scientific nomenclatures and units of measurement, regarding all of which an international accord is a matter of the utmost practical importance. As regards the measures of length and weight it is to be regretted that this country still stands aloof from the movement initiated in France towards the close of last century; but, considering that in scientific work metrical measure is now almost universally adopted, and that its use has been already legalised in this country, I venture to hope that its universal adoption for commercial purposes will soon follow as a matter of course. The practical advantages of such a measure to the trade of this country would, I am convinced, be very great, for English goods, such as machinery or metal rolled to current sections, are now almost excluded from the continental market, owing to the unit measure employed in their production. The principal impediment to the adoption of the metre consists in the strange anomaly that although it is legal to use that measure in commerce, and although a copy of the standard metre is kept in the Standards' Department of the Board of Trade, it is impossible to procure legalised rods representing it, and to use a non-legalised copy of a standard in commerce is deemed fraudulent. Would it not be desirable that the British Association should endeavour to bring about the use in this country of the metre and kilogramme, and, as a preliminary step, petition the Government to be represented on the International Metrical Commission.

Next in importance to accurate measures of length, weight, and time, stand, for the purposes of modern science, those of electricity. The remarkably clear lines separating conductors from non-conductors of electricity, and magnetic from non-magnetic substances, enable us to measure electrical quantities and effects with almost mathematical precision; and, although the ultimate nature of this, the youngest scientifically investigated form of energy, is yet wrapt in mystery, its laws are the most clearly established, and its measuring instruments—galvanometers, electrometers, and magnetomers—are amongst the most accurate in physical science. Nor could any branch of science or industry be named in which electrical phenomena do not occur, to exercise their direct and important influence. If, then, electricity stands foremost among the exact sciences, it follows that its unit measures should be determined with the utmost accuracy. Yet, twenty years ago, very little advance had been made towards the adoption of a rational system. Ohm had, it is true, given us the fixed relations existing between electromotive force, resistance and quantity of current; Joule had established the dynamical equivalent of heat and electricity, and Gauss and Weber had proposed their elaborate system of absolute magnetic measurement. But these invaluable researches appeared only as isolated efforts, when, in 1862, the Electric Unit Committee was appointed by the British Association, at the instance of Sir William Thomson, and it is to the long-continued activity of this committee that the world is indebted for a consistent and practical system of measurement, which, after being modified in details, received universal sanction last year by the International Electrical Congress assembled at Paris. At this Congress, which was attended officially by the leading physicists of all civilised countries, the attempt was successfully made to bring about a union between the statical system of measurement that had been followed in Germany and in some other countries, and the magnetic or dynamical system developed by the British Association, also between the geometrical measure of resistance, the—Werner—Siemens unit, that had been generally adopted abroad, and the British Association unit intended as a multiple of Weber's absolute unit, though not entirely fulfilling that condition. The Congress, while adopting the absolute system of the British Association, referred the final determination of the unit measure of resistance to an International Committee, to be appointed by the representatives of the several governments; they decided to retain the mercury standard for reproduction and comparison, by which means the advantages of both systems are happily combined, and much valuable labour is utilised; only, instead of expressing electrical quantities directly in absolute measure, the Congress has embodied a consistent system, based on the Ohm, in which the units are of a value convenient for practical measurements. In this, which we must hereafter know as the "practical system," as distinguished from the "absolute system," the units are named after the leading physicists, the Ohm, Ampère, Volt, Coulomb, and Farad. I would venture to suggest that two further units might, with advantage, be added to the system decided on by the International Congress at Paris. The first of these is the unit of magnetic quantity or pole. It is of much importance, and few will regard otherwise than with satisfaction the suggestion of Clausius that the unit should be called a "Weber," thus retaining a name most closely connected with electrical measurements, and only omitted by the Congress in order to avoid the risk of confusion in the magnitude of the unit current with which his name had been formerly associated. The other unit I would suggest adding to the list is that of power. The power conveyed by a current of an Ampère through the difference of potential of a Volt is the unit consistent with the practical system. It might be appropriately called a Watt, in honour of that master mind in mechanical science, James Watt. He it was who first had a clear physical conception of power, and gave a rational method of measuring it. A Watt, then, expresses the rate of an Ampère multiplied by a Volt, whilst a horse-power is 746 Watts, and a Cheval de Vapeur 735. The system of electro-magnetic units would then be:—

(1) Weber,	the unit of magnetic	quantity	$= 10^8$	C.G.S. Units.
(2) Ohm	,, ,,	resistance	$= 10$	,,
(3) Volt	,, ,,	electromotive force	$= 10^8$	,,
(4) Ampère	,, ,,	current	$= 10^{-1}$	,,
(5) Coulomb	,, ,,	quantity	$= 10^{-1}$	,,
(6) Watt	,, ,,	power	$= 10^7$	,,
(7) Farad	,, ,,	capacity	$= 10^{-9}$	,,

Before the list can be looked upon as complete, two other units may have to be added, the one expressing that of magnetic field, and the other of heat in terms of the electro-magnetic system. Sir William Thomson suggested the former at the Paris Congress, and pointed out that it would be proper to attach to it the name of Gauss, who first theoretically and practically reduced observations of terrestrial magnetism to absolute measure. A Gauss will, then, be defined as the intensity of field produced by a Weber at a distance of one centimetre; and the Weber will be the absolute C.G.S. unit strength of magnetic pole. Thus the mutual force between two ideal point poles, each of one Weber strength held at unit distance asunder will be one dyne; that is to say, the force which, acting for a second of time on a gramme of matter, generates a velocity of one centimetre per second. The unit of heat has hitherto been taken variously as the heat required to raise a pound of water at the freezing-point through 1 deg. Fah. or Cent., or, again, the heat necessary to raise a kilogramme of water 1 deg. Cent. The inconvenience of a unit so entirely arbitrary is sufficiently apparent to justify the introduction of one based on the electro-magnetic system, viz., the heat generated in one second by the current of an Ampère flowing through the resistance of an Ohm. In absolute measure its value is 10^7 C.G.S. units, and, assuming Joule's equivalent as 42,000,000, it is the heat necessary to raise 0·238 grammes of water 1 deg. Cent., or, approximately, the $\frac{1}{1000}$th part of the arbitrary unit of a pound of water raised 1 deg. Fah., and the $\frac{1}{4000}$th of the kilogramme of water raised 1 deg. Cent. Such a heat unit, if found acceptable, might with great propriety, I think, be called the Joule, after the man who has done so much to develope the dynamical theory of heat. Professor Clausius urges the advantages of the statical system of measurement for simplicity, and shows that the numerical values of the two systems can readily be compared by the introduction of a factor, which he proposes to call the critical velocity; this Weber has already shown to be nearly the same as the velocity of light. It is not immediately evident how by the introduction of a simple multiple, signifying a velocity, the statical can be changed into dynamical values, and I am indebted to my friend Sir William Thomson for an illustration which struck me as remarkably happy and convincing. Imagine a ball of conducting matter so constituted that it can at pleasure be caused to shrink. Now let it first be electrified and left insulated with any quantity of electricity on it. After that, let it be connected with the earth by an excessively fine wire or a not perfectly dry silk fibre; and let it shrink just so rapidly as to keep its potential constant, till the whole charge is carried off. The velocity with which its surface approaches its centre is the electrostatic measure of the conducting power of the fibre. Thus we see how "conducting power" is, in electrostatic theory, properly measured in terms of a velocity. Weber had shown how, in electromagnetic theory, the resistance, or the reciprocal of the conducting power of a conductor, is properly measured by a velocity. The critical velocity, which measures the conducting power in electrostatic reckoning and the resistance in electromagnetic, of one and the same conductor, measures the number of electrostatic units in the electromagnetic unit of electric quantity. Without waiting for the assembling of the International Committee charged with the final determination of the Ohm, one of its most distinguished members, Lord Rayleigh, has, with his *collaborateure*, Mrs. Sidgwick, continued his important investigation in this direction at the Cavendish Laboratory, and has lately placed before the Royal Society a result which will probably not be surpassed in accuracy. His redetermination brings him into close accord with Dr. Werner Siemens, their two values of the mercury unit being 0·95418 and 0·9536 of the B.A. unit respectively, or one mercury unit = $0{\cdot}9413 \times 10^9$ C.G.S. units. Shortly after the publication of Lord Rayleigh's recent results, Messrs. Glazebrook, Dodds, and Sargant, of Cambridge, communicated to the Royal Society two determinations of the Ohm, by different methods; and it is satisfactory to find that their final values differ only in the fourth decimal, the figures being, according to

$$\text{Lord Rayleigh} \quad . \quad . \quad 1\ \text{Ohm} = 0{\cdot}98651\ \frac{\text{Earth Quadrant}}{\text{Second}}$$

$$\text{Messrs. Glazebrook, \&c.} \quad ,, \quad = 0{\cdot}986439 \quad ,,$$

Professor E. Wiedemann, of Leipsig, has lately called attention to the importance of having the Ohm determined in the most accurate manner possible, and enumerates four distinct methods, all of which should unquestionably be tried with a view of obtaining concordant results, because upon its accuracy will depend the whole future system of measurement of energy of whatever form.

The word energy was first used by Young in a scientific sense, and represents a conception of recent date, being the outcome of the labours of Carnot, Mayer, Joule, Grove, Clausius, Clerk-Maxwell, Thomson, Stokes, Helmholtz, Macquorn-Rankine, and other labourers, who have accomplished for the science regarding the forces in nature what we owe to Lavoisier, Dalton, Berzelius, Liebig, and others, as regards chemistry. In this short word energy we find all the efforts in nature, including electricity, heat, light, chemical action, and dynamics, equally represented, forming, to use Dr. Tyndall's apt expression, so many "modes of motion." It will readily be conceived that when we have established a fixed numerical relation between these different modes of motion, we know beforehand what is the utmost result we can possibly attain in converting one form of energy into another, and to what extent our apparatus for effecting the conversion falls short of realising it. The difference between ultimate theoretical effect and that actually obtained is commonly called loss, but considering that energy is indestructible, represents really secondary effect which we obtain without desiring it. Thus friction in the working parts of a machine represents a loss of mechanical effect, but is a gain of heat; and in like manner the loss sustained in transferring electrical energy from one point to another is accounted for by heat generated in the conductor. It sometimes suits our purpose to augment the transformation of electrical into heat energy at certain points of the circuit, when the heat rays become visible, and we have the incandescence electric light. In effecting a complete severance of the conductor for a short distance, after the current has been established, a very great local resistance is occasioned, giving rise to the electric arc, the highest development of heat ever attained. Vibration is another form of lost energy in mechanism, but who would call it a loss if it proceeded from the violin of a Joachim or a Norman-Neruda. Electricity is the form of energy best suited for transmitting an effect from one place to another. The electric current passes through certain substances—the metals—with a velocity limited only by the retarding influence caused by electric charge of the surrounding dielectric, but approaching probably, under favourable conditions, that of radiant heat and light, or 300,000 kilometres per second; it refuses, however, to pass through oxidised substances, glass, gums, or through gases, except when in a highly rarefied condition. It is easy, therefore, to confine the electric current within bounds, and to direct it through narrow channels of extraordinary length. The conducting wire of an Atlantic cable is such a narrow channel. It consists of a copper wire, or strand of wires, 5mm. in diameter, by nearly 5000 kilometres in length, confined electrically by a coating of gutta-percha about 4mm. in thickness. The electricity from a small galvanic battery passing into this channel prefers the long journey to America in the good conductor, and back through the earth, to the shorter journey across the 4mm. in thickness of insulating material. By an improved arrangement the alternating currents employed to work long submarine cables do not actually complete the circuit, but are merged in a condenser at the receiving station after having produced their extremely slight but certain effect upon the receiving instrument. So perfect is the channel, and so precise the action of both the transmitting and receiving instruments employed, that two systems of electric signals may be passed simultaneously through the same cable in opposite directions, producing independent records at either end. By the application of this duplex mode of working to the Direct United States cable, under the superintendence of Dr. Muirhead, its transmitting power was increased from twenty-five to sixty words a minute, being equivalent to about twelve currents or primary impulses per second. In transmitting these impulse currents simultaneously from both ends of the line, it must not be imagined, however, that they pass each other in the manner of liquid waves belonging to separate systems; such a supposition would involve momentum in the electric flow, and although the effect produced is analogous to such an action, it rests upon totally different grounds—namely, that of a local circuit at each terminus being called into action automatically whenever two similar currents are passed into the line simultaneously from both ends. In extending this principle of action quadruplex telegraphy has been rendered possible, although not yet for long submarine lines. Regarding the transmission of power to a distance the electric current has now entered the lists in competition with compressed air, the hydraulic accumulator, and the quick running ropes as used at Schaffhausen to utilise the power of the Rhine fall. The transformation of electrical into mechanical energy can be accomplished with no further loss than is due to such incidental causes as friction and the heating of wires; these in a properly designed dynamo electric machine do not exceed ten per cent., as shown by Dr. John Hopkinson, and, judging from recent experiments of my own, a still nearer approach to ultimate perfection is attainable. Adhering, however, to Dr. Hopkinson's determination for safety's sake, and assuming the same percentage in reconverting the current into mechanical effect, a total loss of 19 per cent. results. To this loss must be added that through electrical resistance in the connecting line wires, which depend upon their length and conductivity, and that due to heating by friction of the working parts of the machine. Taking these as being equal to the internal losses incurred in the double process of conversion, there remains a useful effect of $100 - 38 = 62$ per cent., attainable at a distance, which agrees with experimental results, although in actual practice it would not be safe at present to expect more than 50 per cent. of ultimate useful effect, to allow for all mechanical losses. In using compressed air or water for the transmission of power the loss cannot be taken at less than 50 per cent., and as it depends upon fluid resistance it increases with distance more rapidly than in the case of electricity. Taking the loss of effect in all cases as 50 per cent., electric transmission presents the advantage that an insulated wire does the work of a pipe capable of withstanding high internal pressure, which latter must be more costly to put down and to maintain. In the electric railway first constructed by Dr. Werner Siemens, at Berlin, in 1879, electric energy was transmitted to the moving carriage or trains of carriages through the two rails upon which it moved, these being sufficiently insulated from each other by being placed upon well creosoted cross sleepers. At the Paris Electrical Exhibition the current was conveyed through two separate conductors making sliding or rolling contact with the carriage, whereas in the electric railway now in course of construction in the north of Ireland—which when completed will have a length of twelve miles—a separate conductor will be provided by the side of the railway, and the return circuit completed through the rails themselves, which in that case need not be insulated; secondary batteries will be used to store the surplus energy created in running downhill, to be restored in ascending steep inclines, and for passing roadways where the separate insulated conductor is not practicable. The electric railway possesses great advantages over horse or steam power for towns, in tunnels, and in all cases where natural sources of energy, such as waterfalls, are available; but it would not be reasonable to suppose that it will in its present condition compete with steam propulsion upon ordinary railways. The transmission of power by means of electric conductors possesses the further advantage over other means of transmission that, provided the resistance of the rails be not very great, the power communicated to the locomotive reaches its maximum when the motion is at its minimum—that is, in commencing to work, or when encountering an exceptional resistance—whereas the utmost economy is produced in the normal condition of working when the velocity of the power-absorbing nearly equals that of the current producing machine. The deposition of metals from their solutions is perhaps the oldest of all useful applications of the electric current, but it is only in very recent times that the dynamo current has been practically applied to the refining of copper and other metals, as now practised at Birmingham and elsewhere, and upon an exceptionally large scale at Ocker, in Germany. The dynamo machine there employed was exhibited at the Paris Electrical Exhibition by Dr. Werner Siemens, its peculiar feature being that the conductors upon the rotating armature consisted of solid bars of copper 30mm. square in section, which were found only just sufficient to transmit the large quantity of electricity of low tension necessary for this operation. One such machine consuming 4-horse power deposits about 300 kilogrammes of copper per twenty-four hours; the motive power at Ocker is derived from a waterfall. Electric energy may also be employed for heating purposes, but in this case it would obviously be impossible for it to compete in point of economy with the direct combustion of fuel for the attainment of ordinary degrees of heat. Bunsen and St. Claire De Ville have taught us, however, that combustion becomes extremely sluggish when a temperature of 1800 deg. C. has been reached, and for effects at temperatures exceeding that limit the electric furnace will probably find advantageous applications. Its specific advantage consists in being apparently unlimited in the degree of heat attainable, thus opening out a new field of investigation to the chemist and metallurgist. Tungsten has been melted in such a furnace, and 8 lb. of platinum have been reduced from cold to the liquid condition in twenty minutes. The largest and most extensive application of electric energy at the present time is to lighting, but, considering how much has of late been said and written for and against this new illuminant, I shall here confine myself to a few general remarks. Joule has shown that if an electric current is passed through a conductor the whole of the energy lost by the current is converted into heat; or, if the resistance be localised, into radiant energy comprising heat, light, and actinic rays. Neither the low heat rays nor the ultra-violet of highest refrangibility affect the retina, and may be regarded as lost energy, the effective rays being those between the red and violet of the spectrum, which in their combination produce the effect of white light. Regarding the proportion of luminous to non-luminous rays proceeding from an electric arc or incandescent wire, we have a most valuable investigation by Dr. Tyndall, recorded in his work on "Radiant Heat." Dr. Tyndall shows that the luminous rays from a platinum wire heated to its highest point of incandescence, which may be taken at 1700 deg. C., formed $\frac{1}{24}$th part of the total radiant energy emitted, and $\frac{1}{10}$th part in the case of an arc light worked by a battery of 50 Grove's elements. In order to apply these valuable data to the case of electric lighting by means of dynamo-currents, it is necessary in the first place to determine what is the power of 50 Grove's elements of the size used by Dr. Tyndall, expressed in the practical scale of units as now established. From a few experiments lately undertaken for myself, it would appear that 50 such cells have an electro-motive force of 98·5 Volts, and an internal resistance of 13·5 Ohms, giving a current of 7·3 Ampères when the cells are short-circuited. The resistance of a regulator such as Dr. Tyndall used in his experiments may be taken at 10 Ohms, the current produced in the arc would be $\frac{98{\cdot}5}{13{\cdot}5+10+1} = 4$ Ampères —allowing 1 Ohm for the leads—and the power consumed $10 \times 4^2 = 160$ Watts; the light power of such an arc would be about 150 candles, and, comparing this with an arc of 3308 candles produced by 1162 Watts, we find that $\left(\frac{1162}{160}\right)$, *i.e.*, 7·3 times the electric energy produce $\left(\frac{3308}{150}\right)$, *i.e.*, twenty-two times the amount of light measured horizontally. If, therefore, in Dr. Tyndall's arc $\frac{1}{10}$th of the radiant energy emitted was visible as light, it follows that in a powerful arc of 3300 candles, $\frac{1}{10} \times \frac{22{\cdot}0}{7{\cdot}3}$, or fully $\frac{1}{3}$, are luminous rays. In the case of the incandescence light—say a Swan light of 20-candle power—we find in practice that nine times as much power has to be expended as in the case of the arc light; hence $\frac{1}{3} \times \frac{1}{9} = \frac{1}{27}$ part of the power is given out as luminous rays, as against $\frac{1}{24}$th in Dr. Tyndall's incandescent platinum—a result sufficiently approximate considering the wide difference of conditions under which the two are compared. These results are not only of obvious practical value, but they seem to establish a fixed relation between current, temperature, and light produced, which may serve as a means to determine temperatures exceeding the melting point of platinum with greater accuracy than has hitherto been possible by actinimetric methods in which the thickness of the luminous atmosphere must necessarily exercise a disturbing influence. It is probably owing to this circumstance that the temperature of the electric arc as well as that of the solar photosphere has frequently been greatly over-estimated. The principal argument in favour of the electric light is furnished by its immunity from products of combustion which not only heat the lighted apartments, but substitute carbonic acid and deleterious sulphur compounds for the oxygen upon which respiration depends; the electric light is white instead of yellow, and thus enables us to see pictures, furniture, and flowers as by daylight; it supports growing plants instead of poisoning them, and by its means we can carry on photography and many other industries at night as well as during the day. The objection frequently urged against the electric light, that it depends upon the continuous motion of steam or gas engines, which are liable to accidental stoppage, has been removed by the introduction into practical use of the secondary battery; this, although not embodying a new conception, has lately been greatly improved in power and constancy by Planté, Faure, Volckmar, Sellon, and others, and promises to accomplish for electricity what the gas-holder has done for the supply of gas and the accumulator for hydraulic transmission of power. It can no longer be a matter of reasonable doubt, therefore, that electric lighting will take its place as a public illuminant, and that even though its cost should be found greater than that of gas, it will be preferred for the lighting of drawing-rooms and dining-rooms, theatres and concert-rooms, museums, churches, warehouses, show-rooms, printing establishments and factories, and also the cabins and engine-rooms of passenger steamers. In the cheaper and more powerful form of the arc light, it has proved itself superior to any other illuminant for spreading artificial daylight over the large areas of harbours, railway stations, and the sites of public works. When placed within a holophote the electric lamp has already become a powerful auxiliary in effecting military operations both by sea and land. The advantages of the electric light and of the distribution of power by electricity have lately been recognised by the British Government, who have just passed a Bill through Parliament to facilitate the establishment of electrical conductors in towns. Assuming the cost of electric light to be practically the same as gas, the preference for one or other will in each application be decided upon grounds of relative convenience, but I venture to think that gas-lighting will hold its own as the poor man's friend. Gas is an institution of the utmost value to the artisan; it requires hardly any attention, is supplied upon regulated terms, and gives with what should be a cheerful light a genial warmth, which often saves the lighting of a fire. The time is, moreover, not far distant, I venture to think, when both rich and poor will largely resort to gas as the most convenient, the cleanest, and the cheapest of heating agents, and when raw coal will be seen only at the colliery or the gasworks. In all cases where the town to be supplied is within, say, thirty miles of the colliery, the gasworks may with advantage be planted at the mouth, or still better at the bottom of the pit, whereby all haulage of fuel would be avoided, and the gas, in its ascent from the bottom of the colliery, would acquire an onward pressure sufficient probably to impel it to its destination. The possibility of transporting combustible gas through pipes for such a distance has been proved at Pittsburg, where natural gas from the oil district is used in large quantities. The quasi monopoly so long enjoyed by gas companies has had the inevitable effect of checking progress. The gas being supplied by meter, it has been seemingly to the advantage of the companies to give merely the prescribed illuminating power, and to discourage the invention of economical burners, in order that the consumption might reach a maximum. The application of gas for heating purposes has not been encouraged, and is still made difficult in consequence of the objectionable practice of reducing the pressure in the mains during daytime to the lowest possible point consistent with prevention of atmospheric indraught. The introduction of the electric light has convinced gas managers and directors that such a policy is no longer tenable, but must give way to one of technical progress; new processes for cheapening the production and increasing the purity and illuminating power of gas are being fully discussed before the Gas Institute; and improved burners, rivalling the electric light in brilliancy, greet our eyes as we pass along our principal thoroughfares. Regarding the importance of the gas supply as it exists at present, we find from a Government return that the capital invested in gas works in England, other than those of local authorities, amounts to £30,000,000; in these 4,281,048 tons of coal are converted annually, producing 43,000 million cubic feet of gas, and about 2,800,000 tons of coke, whereas the total amount of coal annually converted in the United Kingdom may be estimated at at 9,000,000 tons, and the by-products therefrom at 500,000 tons of tar, 1,000,000 tons of ammonia liquor, and 4,000,000 tons of coke, according to the returns kindly furnished me by the managers of many of the gasworks and corporations. To these may be added, say, 120,000 tons of sulphur, which up to the present time is a waste product.

Dr. Siemens next spoke of the value of the chemical discoveries by which the by-products of the manufacture of gas had become of such great importance. Taking the coal used, 9,000,000 tons, at 12s., equal £5,400,000, it follows that the by-products exceed in value the coal used by very nearly £3,000,000. In using raw coal for heating purposes these valuable products are not only absolutely lost to us, but in their stead we are favoured with those semi-gaseous by-products in the atmosphere too well known to the denizens of London and other large towns as smoke. The most effectual remedy would result from a general recognition of the fact that wherever smoke is produced, fuel is being consumed wastefully, and that all our calorific effects, from the largest down to the domestic fire, can be realised as completely and more economically, without allowing any of the fuel employed to reach the atmosphere unburnt. This most desirable result may be effected by the use of gas for all heating purposes with or without the addition of coke or anthracite. The cheapest form of gas is that obtained through the entire distillation of fuel in such gas producers as are now largely used in working the furnaces of glass, iron, and steel-works, but gas of this description would not be available for the supply of towns owing to its bulk, about two-thirds of its volume being nitrogen. The use of water-gas, resulting from the decomposition of steam in passing through a hot chamber filled with coke, has been suggested, but this gas also is objectionable, because it contains, besides hydrogen, the poisonous and inodorous gas carbonic oxide, the introduction of which into dwelling-houses could not be effected without considerable danger. By resorting to improved means of heating the retorts with gaseous fuel, such as have been in use at the Paris gasworks for a considerable number of years, the length of time for effecting each distilla- may be shortened from six hours, the usual period in former years, to four, or even three hours, as now practised at Glasgow and elsewhere. By this means a given number of retorts can be made to produce, in addition to the former quantity of illuminating gas of superior quality, a similar quantity of heating gas, resulting in a diminished cost of production and an increased supply of the valuable by-products previously referred to. The greater efficiency of gas as a fuel results chiefly from the circumstance that a pound of gas yields in combustion 22,000 heat units, or exactly double the heat produced in the combustion of a pound of ordinary coal. This extra heating power is due partly to the freedom of the gas from earthy constituents, but chiefly to the heat imparted to it in effecting its distillation. Recent experiments with gas-burners have shown that in this direction also there is much room for improvement. The amount of light given out by a gas flame depends upon the temperature to which the particles of solid carbon in the flame are raised, and Dr. Tyndall has shown that of the radiant energy set up in such a flame, only the $\frac{1}{25}$th part is luminous; the hot products of combustion carry off at least four times as much energy as is radiated, so that not more than one hundredth part of the heat evolved in combustion is converted into light. This proportion could be improved, however, by increasing the temperature of combustion, which may be effected either by intensified air currents or by regenerative action. Supposing that the heat of the products of combustion could be communicated to metallic surfaces, and be transferred by conduction or otherwise to the atmospheric air supporting combustion in the flame, we should be able to increase the temperature accumulatively to any point within the limit of dissociation; this limit may be fixed at about 2300 deg. C., and cannot be very much below that of the electric arc. At such a temperature the proportion of luminous rays to the total heat produced in combustion would be more than doubled, and the brilliancy of the light would at the same time be greatly increased. Thus improved, gas lighting may continue its rivalry with electric lighting both as regards economy and brilliancy, and such rivalry must necessarily result in great public advantage.

In the production of mechanical effect from heat, gaseous fuel also presents most striking advantages, as will appear from the following consideration. When we have to deal with the question of converting mechanical into electrical effect, or *vice versâ*, by means of the dynamo-electrical machine, we have only to consider what are the equivalent values of the two forms of energy, and what precautions are necessary to avoid losses by the electrical resistance of conductors and by friction. The transformation of mechanical effect into heat involves no losses except those resulting from imperfect installation, and these may be so completely avoided that Dr. Joule was able by this method to determine the equivalent values of the two forms of energy. But in attempting the inverse operation of effecting the conversion of heat into mechanical energy, we find ourselves confronted by the second law of thermo-dynamics, which says that whenever a given amount of heat is converted into mechanical effect, another but variable amount descends from a higher to a lower potential, and is thus rendered unavailable. In the condensing steam engine this waste heat comprises that communicated to the condensing water, whilst the useful heat, or that converted into mechanical effect, depends upon the difference of temperature between the boiler and condenser. The boiler pressure is limited, however, by considerations of safety and convenience of construction, and the range of working temperature rarely exceeds 120 deg. C., except in the engines constructed by Mr. Perkins, in which a range of 160 deg. C., or an expansive action commencing at fourteen atmospheres, has been adopted with considerable promise of success, as appears from an able report on this engine by Sir Frederick Bramwell. To obtain more advantageous primary conditions we have to turn to the caloric or gas engine, because in them the coefficient of efficiency expressed by $\frac{T - T'}{T}$, may be greatly increased. This value would reach a maximum if the initial absolute temperature T could be raised to that of combustion, and T^1 reduced to atmospheric temperature, and these maximum limits can be much more nearly approached in the gas engine worked by a combustible mixture of air and hydrocarbons than in the steam engine. Assuming, then, in an explosive gas engine a temperature of 1500 deg. C. at a pressure of four atmospheres, we should, in accordance with the second law of thermo-dynamics, find a temperature after expansion to atmospheric pressure of 600 deg. C., and therefore a working range of 1500 deg. — 600 deg. = 900 deg., and a theoretical efficiency of $\frac{900}{1500 + 274}$ = about one-half, contrasting very favourably with that of a good expansive condensing steam engine, in which the range is $150 - 30 = 120$ deg. C., and the efficiency $\frac{120}{150 + 274} = \frac{2}{7}$. A good expansive steam engine is therefore capable of yielding as mechanical work two-seventh part of the heat communicated to the boiler, which does not include the heat lost by imperfect combustion, and that carried away in the chimney. Adding to these the losses by friction and radiation in the engine, we find that the best steam engine yet constructed does not yield in mechanical effect more than one-seventh part of the heat energy residing in the fuel consumed. In the gas engine we have also to make reductions from the theoretical efficiency, on account of the rather serious loss of heat by absorption into the working cylinder, which has to be cooled artificially in order to keep its temperature down to a point at which lubrication is possible; this, together with frictional loss, cannot be taken at less than one-half, and reduces the factor of efficiency of the engine to one-fourth. It follows from these considerations that the gas or caloric engine combines the conditions most favourable to the attainment of maximum results, and it may reasonably be supposed that the difficulties still in the way of their application on a large scale will gradually be removed. Before many years have elapsed we shall find in our factories and on board our ships engines with a fuel consumption not exceeding 1 lb. of coal per effective horse-power per hour, in which the gas producer takes the place of the somewhat complex and dangerous steam boiler. The advent of such an engine and of the dynamo-machine must mark a new era of material progress at least equal to that produced by the introduction of steam-power in the early part of our century. Let us consider what would be the probable effect of such an engine upon that most important interest of this country—the merchant navy.

The President next spoke of the value of the British navies, and of the substitution of iron and then steel for wood, and of improvements in naval architecture. The time allowed me for addressing you on this occasion is wholly insufficient to do justice to the great engineering works of the present day, and I must therefore limit myself to making a short allusion to a few only of the more remarkable enterprises. The great success, both technically and commercially, of the Suez Canal, has stimulated M. de Lesseps to undertake a similar work of even more gigantic proportions, namely, the piercing of the Isthmus of Panama by a ship canal, forty miles long, fifty yards wide on the surface, and twenty yards at the bottom, upon a dead level from sea to sea. The estimated cost of this work is £20,000,000, and more than this sum having been subscribed, it appears unlikely that political or climatic difficulties will stop M. de Lesseps in its speedy accomplishment. Through it, China, Japan, and the whole of the Pacific Ocean will be brought to half their present distance, as measured by the length of voyage, and an impulse to navigation and to progress will thus be given which it will be difficult to over-estimate. Side by side with this gigantic work, Captain Eads, the successful improver of the Mississippi navigation, intends to erect his ship railway, to take the largest vessels, fully laden and equipped, from sea to sea, over a gigantic railway across the Isthmus of Tehuantepec, a distance of ninety-five miles. Mr. Barnaby, the Chief Constructor of the Navy, and Mr. John Fowler have expressed a favourable opinion regarding this enterprise, and it is to be hoped that both the canal and the ship railway will be accomplished, as it may be safely anticipated that the traffic will be amply sufficient to support both these undertakings. Whether or not M. de Lesseps will be successful also in carrying into effect the third great enterprise with which his name has been prominently connected, the flooding of the Tunis-Algerian Chotts, thereby re-establishing the Lake Tritonis of the ancients, with its verdure-clad shores, is a question which could only be decided upon the evidence of accurate surveys, but the beneficial influence of a large sheet of water within the African desert could hardly be matter of doubt. It is with a feeling not unmixed with regret that I have to record the completion of a new Eddystone Lighthouse in substitution for the *chef-d'-œuvre* of engineering erected by John Smeaton more than 100 years ago. The condemnation of that structure was not, however, the consequence of any fault of construction, but was caused by inroads of the sea upon the rock supporting it.

When the British Association met at Southampton on a former occasion, Shönbein announced to the world his discovery of gun-cotton. This discovery has led the way to many valuable researches on explosives generally, in which Mr. Abel has taken a leading part. Recent investigations by him, in connection with Captain Noble, upon the explosive action of gun-cotton and gunpowder confined in a strong chamber, which have not yet been published, deserve particular attention. They show that while by the method of investigation pursued about twenty years ago by Karoyle—of exploding gunpowder in very small charges in shells confined within a large shell partially exhausted of air—the composition of the gaseous products was found to be complicated and liable to variation, the chemical metamorphosis which gun cotton sustains, when exploded under conditions such as obtain in its practical application, is simple and very uniform. Among other interesting points noticed in this direction was the fact that, as in the case of gunpowder, the proportion of carbonic acid increases, while that of carbonic oxide diminishes with the density of the charge. Thus whereas no marked differences are observed in the tension developed by small charges and by very much larger charges of gunpowder having the same density—*i.e.*, occupying the same volume relatively to the entire space in which they are exploded—the reverse is the case with respect to gun-cotton. Under similar conditions in regard to density of charge, 100 grammes of gun-cotton gave a measured tension of about 20 tons on the square inch, 1500 grammes gave a tension of about 29 tons—in several very concordant observations—while a charge of 2·5 kilos. gave a pressure of about 45 tons, this being the maximum measured tension obtained with a charge of gunpowder of five times the density of the above. Messrs. Noble and Abel are also continuing their researches upon fired gunpowder, being at present occupied with an inquiry into the influence exerted upon the chemical metamorphosis and ballistic effects of fired gunpowder by variation in its composition, their attention being directed especially to the discovery of the cause of the more or less considerable erosion of the interior surface of guns produced by the exploding charge. Professor Carl Himly, of Kiel, having been engaged upon investigations of a similar nature, has lately proposed a gunpowder in which hydrocarbons precipitated from solution in naphtha take the place of the charcoal and sulphur of ordinary powder. This powder has, amongst others, the peculiar property of completely resisting the action of water, so that the old caution, "Keep your powder dry," may hereafter be unnecessary. Dr. Siemens next dwelt on the extraordinary difference of condition, before and after its ignition, of such matter as constitutes an explosive agent, leads us up to a consideration of the aggregate state of matter under other circumstances. Still greater strides are being made at the present time towards a clearer perception of the condition of matter when particles are left some liberty to obey individually the forces brought to bear upon them. By the discharge of high tension electricity through tubes containing highly rarefied gases—Geissler's tubes—phenomena of discharge were produced which were at once most striking and suggestive. The Sprengel pump afforded a means of pushing the exhaustion to limits which had formerly been scarcely reached by the imagination. At each step the condition of attenuated matter revealed varying properties when acted upon by electrical discharge and magnetic force. The radiometer of Crookes imported a new feature into these inquiries, which at the present time occupy the attention of leading physicists in all countries. He next referred to the investigations of Mr. De La Rue and Dr. Spottiswoode and Mr. Moulton on electric discharge, and on a source of electric power. He then referred to some recent spectroscopic investigations, which he said to him possessed peculiar interest, for in March last he ventured to bring before the Royal Society a speculation regarding the conservation of solar energy, which was based upon the three following postulates, viz.:—(1) That aqueous vapour and carbon compounds are present in stellar or interplanetary space; (2) that these gaseous compounds are capable of being dissociated by radiant solar energy while in a state of extreme attenuation; (3) that the effect of solar rotation is to draw in dissociated vapours upon the polar surfaces, and to eject them after combustion has taken place, back into space equatorially. It was, therefore, a matter of peculiar gratification to him that the results of observation here recorded give considerable support to that speculation. The luminous equatorial extensions of the sun which the American observations revealed in such a striking manner—with which he was not acquainted when writing his paper—were absent in Egypt; but the outflowing equatorial streams he supposed to exist could only be rendered visible by reflected sunlight, when mixed with dust produced by exceptional solar disturbances or by electric discharge; and the occasional appearance of such luminous extensions would serve only to disprove the hypothesis entertained by some, that they are divided planetary matter, in which case their appearance should be permanent. Professor Langley, of Pittsburg, has shown by means of his bolometer that the solar actinic rays are absorbed chiefly in the solar instead of in the terrestrial atmosphere, and Captain Abney has found by his new photometric method that absorption due to hydrocarbons takes place somewhere between the solar and terrestrial atmosphere; in order to test this interesting result still further, he has lately taken his apparatus to the top of the Riffel with a view of diminishing the amount of terrestrial atmospheric air between it and the sun, and intends to bring a paper on this subject before Section A. Stellar space filled with such matter as hydrocarbon and aqueous vapour would establish a material continuity between the sun and his planets, and between the innumerable solar systems of which the universe is composed. If chemical action and reaction can further be admitted, we may be able to trace certain conditions of thermal dependence and maintenance, in which we may recognise principles of high perfection, applicable also to comparatively humble purposes of human life.

We shall thus find that in the great workshop of nature there are no lines of demarcation to be drawn between the most exalted speculation and commonplace practice, and that all knowledge must lead up to one great result, that of an intelligent recognition of the Creator through His works. So then, we members of the British Association and fellow-workers in every branch of science may exhort one another in the words of the American bard who has so lately departed from amongst us:—

Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labour and to wait.

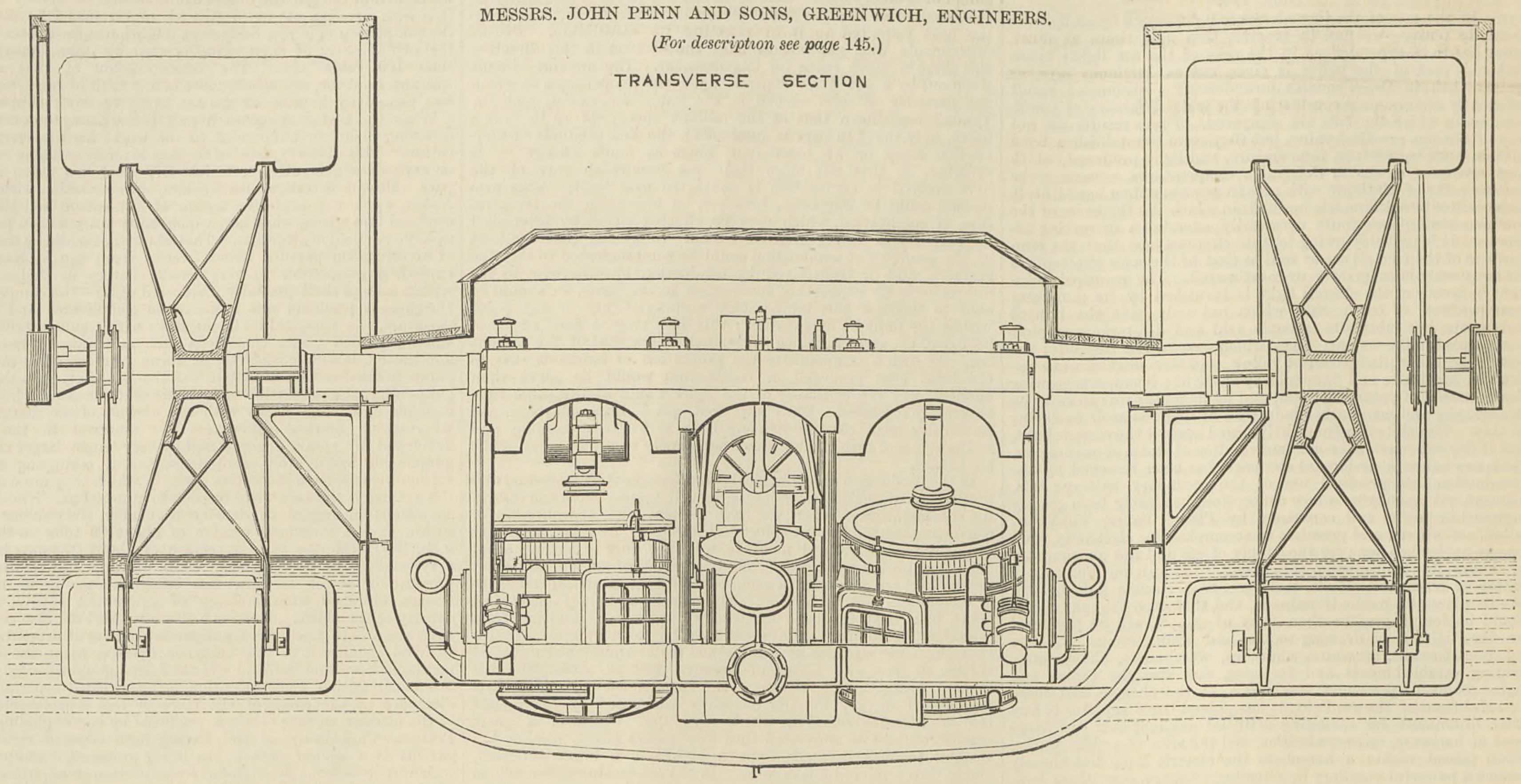
SOCIETY OF ENGINEERS.—The council for the Society are pleased to inform the members that, through the courtesy of the Lords Commissioners of the Admiralty, they have been enabled to arrange for the members and associates and their friends to visit the Dockyard, gunnery, and torpedo vessels, and the other ships in port, at Portsmouth on Wednesday, the 13th September next. Arrangements have been made with the London, Brighton, and South Coast Railway Company for a special first-class express train, to leave Victoria Station at 9.15 a.m., arriving at Portsmouth Harbour Station about 11.30, and returning punctually at 7.5 p.m. The party will assemble at the main entrance to the Dockyard at 1.15 p.m. Dinner will be provided at Cawte's Hotel, adjoining the Southsea Pier, at 5 o'clock. Tickets for the double journey, including dinner, but exclusive of wine, &c., 17s. 6d. All applications for tickets must be paid for, and sent in on or before Monday, the 4th September next.

OSCILLATING ENGINES OF THE S.S. MARY BEATRICE.

MESSRS. JOHN PENN AND SONS, GREENWICH, ENGINEERS.

(*For description see page* 145.)

TRANSVERSE SECTION



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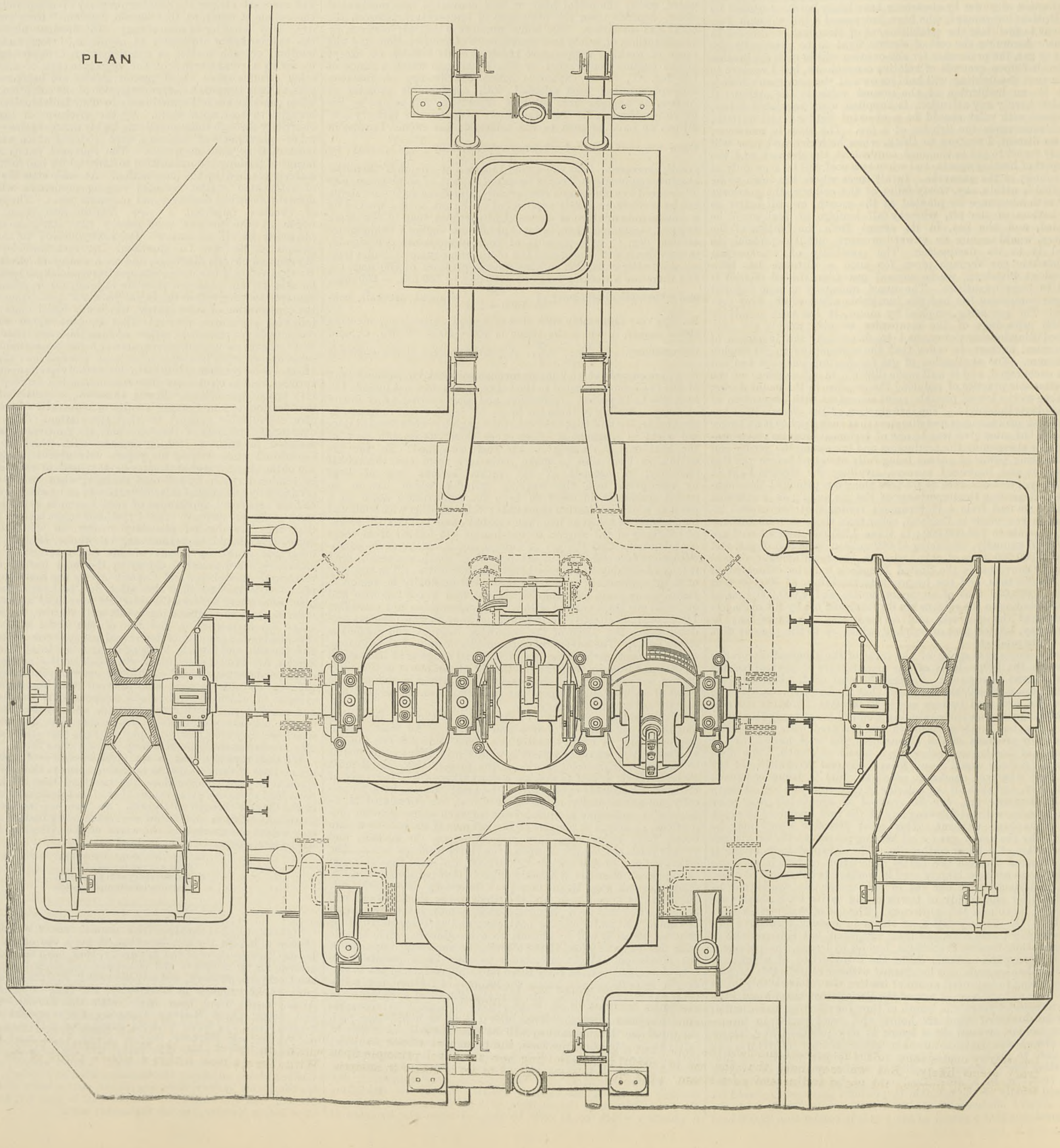

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B.—*No.*

G. (Liverpool).—*So far as we are aware, your automatic coupling is new. On its merits we pronounce no opinion.*

SOAP-MAKING PLANT.

(*To the Editor of The Engineer.*)

SIR,—Would any of your readers kindly favour me with names and addresses of makers of the above? W. G. S.

London, August 21st.

COMPRESSED PAPER.

(*To the Editor of The Engineer.*)

SIR,—Will any of your readers inform me where I can obtain compressed paper for frictional driving? I want a ring for outside of a pulley—10in. external diameter, with 8in. diameter hole and 4½in. thick.

London, August 22nd. R. V.

TRITURATING MANGANESE AND EXTRACTING SILVER FROM MERCURY.

(*To the Editor of The Engineer.*)

SIR,—I shall feel obliged if any of your readers can give me particulars and prices of machines to triturate manganese, and also of an apparatus to evaporate mercury—quicksilver—to extract the silver. MANGANESE.

Lincoln, August 17th.

FANCY CARD BOX AND CUTTING AND FOLDING MACHINES, AND WOOD CHIP AND PILL BOX MACHINES.

(*To the Editor of The Engineer.*)

SIR,—We shall be obliged if any of your correspondents can give us the names of makers of machinery for making card fancy boxes, cutting and folding machines; also wood chip and pill box machines. M. B.

Sheffield, August 18th.

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THE ENGINEER.

AUGUST 25, 1882.

ELECTRICAL LOCOMOTIVES.

THE President of the Institution of Mechanical Engineers, in his address at Leeds, urged the study of what we may term portation. The President of the British Association, in his address, called attention to the use of electrical apparatus in the transmission of power. It might have been assumed that Dr. Siemens would have directed attention to a subject he has been so closely connected with for many years, and it may not be out of place here to consider the present position of electrical apparatus as aiding in the transmission of power. Neither Pope's satire, nor the logic of facts, permit civilised humanity to rest content that "What is is right." Mr. Westmacott, drawing his examples from different directions, showed that there was a constant tendency towards perfection. In lighting tallow gives place to oil, oil to gas, and perhaps gas to electricity. The one takes the foremost place, the others act as subsidiary allies. So mud-paths gave place to acknowledged roads; the roads were macadamised; canals came into use, and railways followed—the latter being now the principals, the others the subsidiaries—all having their uses. But the fiat of progress is omnipotent. That which was first has been superseded, and it would be ridiculous to suppose that supercession has ceased. We do not argue that electricity will necessarily oust steam. At the present moment the contrary seems likely. But we may hold that the use of electricity will increase the use of and necessity for steam

Long before the construction of the magneto-electric machine, and hence before the idea of a dynamo had been mooted, the possibility of utilising electricity for motor purposes had been suggested. Prof. Salvator Dal Negro in 1832 published a paper in which he explained how he employed electro-magnetism to move machinery; while in January, 1833, Dr. Schulsen showed such a machine. Prof. Jacobi was at the same time carrying on his investigations, and in 1838, at the expense of the Russian Government, tried the experiment of propelling a boat by electro-magnetism. The vessel was 28ft. long, 7·5ft. wide, and drew 2·75ft. water. The publication of Jacobi's letter to Faraday called forth one from Prof. Forbes, of Aberdeen, explaining the work of a townsman, Mr. R. Davidson, in the application of electro-magnetism as a moving power. Before describing Davidson's work, we must, however, refer to that of Davenport in the United States. This man, a blacksmith in Philadelphia, commenced in January, 1840, a newspaper entitled *The Electro-Mechanic and Mechanic's Intelligencer.* The paper was published in New York, and was printed by a press worked by an electro-magnet. Previous to this Capt. Taylor, also an American, had obtained patents both in America and in England for an electro-magnetic engine. To return to Davidson's work. This was, so far as we know, the first attempt to utilise electricity in propelling a locomotive. There must, we imagine, be men still living who witnessed the experiments, and although with our wider knowledge in 1882 we know all such attempts were necessarily doomed to fail, it would be interesting to be able to obtain more details. The making of history is always a difficult task; the making of history accurate in all its details is an impossibility. We ought, however, to obtain a fairly accurate account of the introduction of electricity into the mechanical arts, because such introduction is within the memory of living persons.

The central part of the axle on Mr. Davidson's carriage had fixed upon it a cylinder of wood. The wood was grooved longitudinally with several grooves at equal distances apart, and bars of soft iron were fitted into the grooves. The poles of horseshoe-shaped electro-magnets were brought within a short distance on opposite sides of the cylinder, and a commutator make-and-break arrangement designed to, at one moment, render a magnet or set of magnets active, at another to make them inactive was added. The current was obtained from batteries formed of pairs of iron plates with plates of amalgamated zinc between. There were six batteries, three at each end of the carriage, each battery having ten zinc plates, 15in. by 12in. The carriage tried on the Edinburgh and Glasgow Railway, together with the apparatus, weighed over 5 tons, and was 16ft. long by 6ft. broad. The rate of motion obtained was about four miles per hour. The result was by no means satisfactory or startling, but compares favourably with the first results of many experimental trials on a practical scale. We know not what became of Mr. Davidson or his invention, and hope that this article may elicit further information.

A model electric locomotive was exhibited last year in the Belgian exhibits at the Paris Electrical Exhibition. This apparatus was stated to have been constructed in 1840. The Belgian catalogue is reticent of further information. Perhaps we may here again elicit information. We must, however, hasten from the impractical to the practical. It was not till the recent development of the dynamo machine for electric lighting purposes that specially close attention was given to it as a means of transmitting power. Whatever may be the future of electricity as applied in the direction of locomotion, the merit of its first real practical application must rest with the house of Siemens and Halske at Berlin. At Düsseldorf, as is known to many members of the Iron and Steel Institute, at Berlin, at Brussels, at Paris, and at the Crystal Palace, tramways have been worked during a longer or shorter period to show the practical nature of the application. A permanent line is in operation at Berlin, designed and worked by this firm. The principle of the arrangement is exceedingly simple. The current is generated by a fixed dynamo, and carried by conducting wires to, say, one rail of the line, the rails being fairly insulated from each other. The current passes from the rail through the wheel or by brushes to the dynamo fixed to the carriages and through it, causing its armature to revolve, and hence to revolve the wheel, and thus the train by the other rail and its connections to the second terminal of the fixed machine. Objections to this system were raised, because under most climatic conditions the insulation would be bad, and render the working of the line almost or quite impossible. Messrs. Ayrton and Perry have devised means to obtain satisfactory insulation under almost any conditions, and we believe that experiments on a practical scale will soon be carried out in America, if not in England, to test the correctness of their views. At the present time the Binks system is being shown at the Crystal Palace. This is a modification in details of the Siemens and Halske, the principle being the same. We cannot now dwell upon the suggestions and experiments that have from time to time been made to apply the electric current to other mechanical purposes. Suffice it to say that so far the dynamo has been by Hopkinson, by Siemens, by Schwendler, and others, shown to be a fairly economical transmitter of power, and that Siemens believes it may be still further improved. We think there is no doubt as to the improvement, and that it will be found ere long that, good as these machines are, it is not difficult to design a more economical and effective machine than has yet been produced. Historical facts have been dealt with here, theories and possibilities must be reserved for a future occasion.

BRIGHTON BEACH.

As the works now proceeding at Hove approach nearer to completion it is of interest to observe how far they appear likely, when finally out of hand, to fulfil their object; and as the collection of beach by their agency is but a gradual process, their earliest effects cannot but be useful in determining how the novel principle upon which the groynes are expected to act is likely to answer. With this view we have very recently paid the beach a visit, and carefully noted the effects produced during the comparatively short interval since the groynes have been so far completed as to become operative. Considering the difficulties which are now giving rise to such an outcry at Hastings, to which we referred in our leading article in our issue of August 11th, and which afford, to a great extent, a parallel to those which lead to the undertaking at Brighton upon which we have so frequently commented, the experiment with trending groynes, now being carried out at the latter place by Mr. Ellice-Clark, may afford an instructive lesson by which future works required at Hastings may well be guided. It is with satisfaction that we have observed that the works at Hove appear to us already to have attained a large amount of success. Not only is beach accumulating, as was only to be expected, on the windward side—so to term it—of the groynes, but it is doing so also to the leeward of them. This fact affords very strong evidence that there no longer exists that scouring action on the last-named side which has always proved a difficulty with such constructions. Many of these that we have observed are of great height, and it has been no uncommon thing to see a timber erection supporting some 20ft. of beach on its weather face, whilst there has been a total absence of counterpoise on the other. The weight of such a mass of beach has of course operated most injuriously on timber groynes, which, although tied as strongly as circumstances admit, have frequently been known to yield to the pressure.

A very noticeable instance of the collection of beach to leeward is afforded at Hove in the case of the concrete groyne having an extended masonry root, to which we referred in our last article upon this subject. We, when then writing, stated that there seemed to us a probability of beach accumulating there, though the slight collection of it at that date made us uncertain as to whether it had any prospect of permanent lodgment. This, our recent inspection assures us, it has certainly obtained, and the danger we then pointed out as appearing to be imminent of the destruction of the esplanade cliff has been averted so completely that Mr. Ellice-Clark has felt himself to be justified in re-making with earth the slopes formerly destroyed by the inroad of the sea. That these satisfactory results are due to the adoption of groynes placed at an angle to the shore line appears to us to be certain, and we believe that the experiment made by the engineer to the Hove authorities will mark a new departure in the construction of groynes. Not that the plan set forth in Mr. Ellice-Clark's letter to us on this subject appears to have been adopted in its entirety. As far as we were able to judge, the angles of the succeeding groynes do not diverge in any degree to the extent that was sketched out in that letter—a plan which induced us to fear that perhaps the ultimate and penultimate groynes might expose a dangerously broadside face to the blows of incoming waves. It appeared to us, indeed, that these groynes all trend at similar angles—are, in short, parallel in their divergence from the line which would form a true perpendicular with the shore line; and so, if, as we believe to be the case, the principle finally adopted has proved of complete efficacy, the very serious danger we pointed out has been averted. It is extremely interesting to observe how the collection of beach between these groynes is proceeding, and how very different an aspect the beach line between any two of them now in course of formation presents from what would have been apparent had the groynes been run out straight on the old method. When the accumulation has further advanced this difference may not be so noticeable as it now is during the earlier period of collection; and its present condition affords a useful illustration of the course of action induced by the plan adopted by Mr. Ellice-Clarke. Under the old system, the line of beach, commencing from the terminal point on the windward side of one groyne, would proceed, with but a very slight curvature, to the root on the leeward side of the next groyne to windward, and at this latter point destructive action by the sea almost invariably occurred. Now, however, in the instances under remark, while commencing as before at the terminal point of the leeward groyne, a comparatively sharp curve carries the beach line very far along the face of the windward groyne, thus protecting and giving considerable support to what has hitherto been its almost completely bare side. It requires no remarks from us to point out how great an advantage is thereby gained, or the prospect this ensures that the lodgment of the beach will be permanently maintained. The results we have instanced are visible to a greater or less extent throughout the whole series of the protective works, whether of concrete or timber, that extent being evidently only contingent upon the length of time since completion. It remains, of course, to be seen whether the advantages we have described will be as fully maintained when the beach deposits extend further out, and so become more exposed to the sea, owing to their being less sheltered by the length of the groynes; but we see no reason to fear that this should not be the case. The curve named above will probably, we should say, become less strongly defined, because the sweep of the current will become less embayed; and this, which will be a positive advantage, is the only difference which we can conceive as likely to be established under such changed conditions.

Leaving the subject of the successful results obtained by Mr. Ellice Clark's trending groynes, we next proceed to observe upon the effects produced upon the section of the beach within the adjoining parish at the point where the Hove Commissioners' responsibilities end. In our article above referred to upon the Hastings beach, we pointed out the disastrous consequences which have followed the unwise removal of beach for a variety of purposes from the foreshore at that place. This evil example appears to be followed by the Brighton authorities with a recklessness which is greatly to be wondered at. Certainly their borough engineer, Mr. Lockwood, should have very strong grounds for his apparent want of apprehension as to the possible results of the wholesale denudation which is going on just at this, the most vulnerable point of his beach, for here, almost within a stone's throw of the locality of the disaster which has caused Hove so large an expenditure, cartload after cartload of shingle is permitted to be removed for building purposes. In our earlier articles on this subject we prophesied that, sooner or later, and as the effects of the Hove works become developed, the inroads of the sea will be turned on to the unprotected Brighton beach at this very point. As yet this does not appear to be the case, but the re-accumulation at Hove is still too much in its infancy to have had the effect we dreaded and still dread. Whether our forebodings be in the end fulfilled or not, they are not held without strong grounds based on the results of former experience; and we cannot too strongly condemn the practice of removing shingle at the very spot where such experience tells us weakness is pretty certain ere long to be demonstrated. The sale of the beach there is a "penny wise and pound foolish" policy, which the Brighton authorities will probably have as much to regret as do those at Hastings their past proceedings of a similar character. As we have said, up to the present time there has been no denuding action at this point, although the easternmost Hove groyne is, we believe, complete. Three causes may be operative to explain this fact. The first, and that which most strongly recommends itself to our judgment, is that Mr. Ellice-Clark has in this groyne followed very closely upon our suggestion that it should be merely a stay to the beach already *in situ*, and should not be carried out sufficiently far to sea or constructed high enough to force the current into the leeward so as to produce the dreaded scour on its eastward face. The second is that the slightly eastward direction given to it may have considerably modified the liability to that scour, as has been the case with the groynes previously commented upon. The third cause may be as previously suggested, that the destructive action is only deferred pending the advance of the beach to the westward. Whether, however, any of these causes be the right one or not, it passes prevision to be able to say that the present state of things will be much longer continued, and the removal of the beach appears to us, therefore, to be suicidal.

Mr. Ellice-Clark wrote us that it is his intention, if permitted, to read a paper at some future date on the subject of these works to the members of the Institution of Civil Engineers. We feel sure that such a paper is likely to possess extensive interest. We shall learn by it what is the full measure of success attained by what is quite a new departure in the use of groynes, and it may determine the design to be adopted for works of a similar character at many places along our coasts now as seriously threatened as Hove has been. We shall also doubtless learn by that paper the outlay incurred, and shall thereby be able to judge whether the works, economically considered, present advantage over a sea wall covering the entire length of frontage threatened.

THE LIME PROCESS FOR GETTING COAL.

An interesting and important series of experiments has just been made at the Wharncliffe Silkstone Collieries, near Sheffield. These collieries are among the largest in South Yorkshire, and have been in operation for fully twenty-five years. They afford employment for over 600 hands. Though gas is met with in the workings, the collieries have been very free from explosions; but the company, with a laudable desire to leave nothing undone to secure safety to the miners, determined to test the new method of winning coal by the use of compressed lime in the place of blasting powder. The patentees were communicated with, and experiments took place in the presence of the managers of the collieries, Mr. J. Peel and Mr. G. B. Walker, Mr. Todd—Nunnery Colliery—and other officials and workmen. The test took place in the Parkgate seam, where several yards of coal face had been holed. A hole about 3in. in diameter was drilled into the seam to the depth of 4ft. The hole having been thoroughly cleaned out, a perforated iron tube was placed in it; into this tube a cartridge of compressed lime was inserted. The cartridge was originally about 7in. long and 2½in. in diameter; it was compressed by hydraulic power to 3in. long. There is a groove in the cartridge to allow a water tube to pass along it. The lime being rammed home, and the hole filled up, a small pump was used to force water to the bottom of the iron tube and round the cartridge, which was covered with calico. Simultaneously with the injection of the water the rending process began, and in half-an-hour about ten tons of coal came away in a nearly unbroken mass, one piece being 9ft. long. It is estimated that of the whole fall not more than 6 per cent. was "small," while under the wedging system a large percentage of "small" coal is produced. A second trial was made in another part of the workings, which is considered the worst in the pit. Here the results were also exceedingly satisfactory, and the managers resolved to adopt the system at once. The workmen who witnessed the experiments were greatly pleased, and expressed the wish that the system should become general, which it has every chance of doing in the South Yorkshire district.

THE MANCHESTER SHIP CANAL.

An alternative scheme for a ship canal to Manchester, which, it is urged, will be more advantageous to the district and less costly than the proposed course along the rivers Irwell and Mersey through Liverpool, has been set forth by a correspondent in one of the local journals. The writer contends that the loss of time in vessels passing from the mouth of the Mersey at Formby to Manchester will be nearly equal to a tide of twelve hours, whilst the cost of insurance, tug service, lights, port and harbour dues, will be excessive. The cost of constructing a ship canal and contending with water for the whole course will, it is urged, involve more time and money than cutting a greater distance through dry land. To overcome these and other difficulties, the writer would avoid the Irwell and Liverpool altogether and commence at the sea near Preston, passing through the valleys of East Lancashire, where the country offers but few engineering difficulties. This course would serve the towns of Blackburn, Accrington, Burnley, Darwen, Chorley, Bolton, Bury, with many intermediate places, and at the Manchester end it is suggested that the old racecourse in Lower Broughton would offer an eligible site for the docks. This alternative scheme would, it is urged, be accessible from all parts by railway and road, and, as compared with the Irwell and Mersey scheme, the cost, the writer believes, would be one-third less. Another scheme for facilitating the transit of goods between Manchester and Liverpool has been set forth by Mr. F. R. Leyland, shipowner, of Liverpool, in his evidence before the Royal Commission on Agriculture. This is to lay down a sort of plate-way or steam tram along the high road for the especial benefit of farmers and others on the road side. By this scheme laden carts would go on to the plate-way and be picked up by traction engines for conveyance to their respective destinations. A scheme on a small scale, Mr. Leyland stated, has been got up in Liverpool, and if carried out from Manchester and Liverpool he estimated that the cost of transport between the two places could be reduced from 10s. per ton, which the railways now charged, to 5s. per ton.

LITERATURE.

Modern Metrology; A Manual of the Metrical Units and Systems of the Present Century. By Lowis D'A. Jackson. London: Crosby Lockwood and Co. 1882.

As the author remarks in his preface, measures, as exemplified in the pecks, pots, and pounds of the tradesman, may not at the outset appear inviting; but even those who have no special acquaintance with scientific operations demanding the employment of very various measures, or with commercial operations with foreign lands necessitating a knowledge of various systems of representing value, will, after very little consideration, see how much metric units and systems are mixed up with an interesting phase of the history of peoples. In spite of the opposition which English people generally feel to the introduction of the French or continental metrical system of units and measures, there is no doubt that its employment for scientific work is rapidly increasing, and that this is making it more familiar to those employed in engineering and manufacturing industries. There is not, however, probably more than 5 per cent. of our population who would feel much less disconcerted by a compulsory adoption of the French metric system in England now than were most of the French people; for in the reign of Charles X., over thirty years after the legal establishment of the system, it became necessary to sanction the use of selling and buying by certain old standards, chiefly because of the ignorance and inertia of the lowest trading classes and peasants. Thus was the "*système usuel*" sanctioned when the intelligent manufacturing and commercial classes had become thoroughly accustomed to the metrical system. With us there would be more difficulty connected with a similar change, because we have now only one legal system throughout Great Britain, while in France there were at the time referred to many legalised systems. Mr. Jackson's book, however, is not specially concerned with what is known as the metric system, but the systems of measurement adopted all over the world. It is perhaps wrong to say systems, for in some of the countries mentioned all system is wanting, though a number of measures of length, bulk, and value of long-standing acceptation are in use. It is not simply a book of tables of linear, surface, cubic, capacity, and weight measures, or a description of these, but it contains interesting observations on the origin of the different units, and on the changes which have been made. The book consists mainly of two parts, the first containing these historic and critical observations, with the values of any unit used during this century; and the second part containing the common national systems and collections of measures most frequently required. A part of the object, however, in writing the book has obviously been to devote some space to certain proposed reforms which are dealt with in two appendices, one being on a "Proposed English Commercial System," and the other on "The Actual and the Proposed Standard Temperature and Pressure." We cannot discuss the system proposed here, but we may mention that it is largely based on Dr. Miller's foot-weight standard or talent, which is equal to the weight of a cubic foot of water, which should be taken at 39·4 Fah., or 40 C., for both water and vessel, and not 39·4 for the one and 62 for the other as at present, bases which involve an apparent absurdity, which is avoided by calculated compensations for volume and temperature.

The book represents an enormous task in compilation, calculation, and reduction, and is well got up, though it much wants an index. It may be hoped that it will direct attention to possible useful improvements in our metrology, and it will be found of great assistance to all interested in reform in this direction.

BOOKS RECEIVED.

The Modern Applications of Electricity. By E. Hospitalier. Translated and explained by Julius Maier, Ph. D. London: Kegan Paul and Co. 1882.

Electric Lighting. Translated from the French of Le Comte Th. Du Moncel. By Robert Routledge B. Sc. (Lond.), F.C.S. London: G. Routledge and Sons. 1882.

Journal of the Society of Telegraph Engineers. No. 41. April, 1880. Vol. XI. London: E. and F. N. Spon.

The Boilermaker's Ready Reckoner: with Examples of Practical Geometry and Templating. By John Courtenay. Weale's series. Revised and edited by D. K. Clark, C.E. London: Crosby Lockwood and Co. 1882.

Elementary Treatise on the Construction of Roofs of Wood and Iron. By E. W. Tarn, M.A. Weale's series. London: Crosby Lockwood and Co. 1882.

A Treatise on the Transit Instrument as applied to the Determination of Time. For Country Gentlemen. By Latimer Clark, M.I.C.E. London: 6, Westminster-chambers, S.W.

The Metal Turner's Hand-book: A Practical Manual for Workers at the Foot Lathe. By Paul N. Hasluck. London: Crosby Lockwood and Co. 1882.

A Treatise on Shoring and Underpinning. Illustrated by Cecil Haden Stock. London: B. S. Batsford and Co. 1882.

THE DOM PEDRO II. BRIDGE.

On page 136 will be found illustrations of the details of construction of this bridge, an elevation of which, with a brief description, appeared in our last issue.

Our illustrations this week show a partial elevation of the main girder, with transverse sections of the same. The fixed and roller bearings are also shown, as well as a detail of the construction of the main girder. In a succeeding impression we shall further illustrate and describe this bridge.

Naval Engineer Appointment.—The following appointment has been made at the Admiralty:—Henry C. Goldsmith, engineer, to the Starling.

LETTERS TO THE EDITOR.

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

SEWAGE AND THE RIVER LEA.

Sir,—Referring to a statement which appeared in the newspapers on the 14th inst., as to a wholesale destruction of fish by poisoning in the river Lea, and the suggestion that such poisoning occurred through a discharge from the Sewage Works at Tottenham, will you permit me, as the engineer of the district named, to state that Tottenham is in no way responsible for any destruction of fish in the Lea?

The dead fish were found in the old river—not in the stream upon the banks of which the Sewage Works of Tottenham are situated—and quite a mile and a-half distant from the works. Old fishermen believe that something deleterious has been put into the river, either through accident or by design. So far from our sewage works being regarded as injurious to fish, it is a fact that the outfall of the works is a favourite fishing spot, from twenty to fifty piscators at a time being seen there every day during the season—indeed, the *locale* seems to be one of the chief feeding places for the fish, and many are taken there.

In justice to this parish, I ask you to be good enough to find space for this letter in an early issue of your paper.

Combes Croft House, Tottenham, W. A. N. de Pape.
August 18th.

SEWAGE AND AIR.

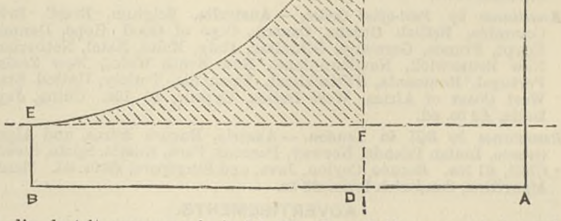
Sir,—The letter of Mr. Hughes, which appeared in your issue for August 11th, referring to the above subject, deals mainly with the credit due to the original invention of the dry closet system. On that point I can have nothing to remark, beyond that the fact of Dr. Lloyd's prior claims over those of the Rev. Mr. Moule were previously unknown to me. Mr. Hughes, however, states that Dr. Lloyd "was undoubtedly the first to advocate the system of separating the urine from the fæces," a system which, if the views put forth in my former letter be correct, is the basis of a great mistake, leading to the imperfect defecation which my experience detected. But it so happens that the attempts made to carry out this system can only be very partially operative. Most certainly they can only be so in the case of latrines resorted to by large numbers; and no information is possessed by me of the results obtained in instances where such separation has been fully effected. Perhaps Mr. Hughes will be able, and in that case obliging enough, to tell us of any such instance known to him, and what was the condition, under such circumstances, of the matters removed.

If there was a markedly improved defecation due to the absence of urine, it would of course go far to disprove my contention—one, it must be admitted, only at present hypothetic—that the fluid and solid matters contain mutually reactionary principles. One word as to your correspondent's statement that the dry sewage system presents no difficulties to its application in large towns. Presuming that the removal presents none, is the supply of the dry material in the large quantities requisite free from them?

St. James's-street, London, S.W., A. F.
August 21st.

MECHANICAL REFRIGERATION OF AIR.

Sir,—I would ask Mr. Lightfoot if he has not made a mistake in stating in his article "On the Mechanical Refrigeration of Air"—The Engineer, July 28th—that the shaded portion E F D represents the work done by a gas expanding from volume D C to A B? I should have thought that Mr. Lightfoot had merely made



a slip, but it occurs again in his Fig. 2, and the same statement is made twice in his second article—The Engineer, Aug. 4th.

The work done by a gas expanding from volume C D to volume A B appears to me to be the whole area E D *d* B.

Sunderland, August 14th. W. Kilrington.

THE FORESHORE AT HASTINGS.

Sir,—The fishermen of Hastings, as well as the owners of house property, owe you a debt of gratitude for your admirable article on this subject. As adviser to the fishermen of the course they have pursued in appealing to the Imperial authorities, may I point out that the danger to life might easily be averted if our Town Council knew anything of the subject, or would follow the advice of Sir John Coode. The only course by which immediate danger to life can be removed is to allow a small portion of the beach at the groynes westward of the pier to travel. There is a surplus in that situation, and sufficient could easily be allowed to go along without any danger to where it is now located. There is, however, I fear no hope, unless Imperial authorities interfere, to prevent the probable sacrifice of life to be apprehended in the case of a south-western gale on a high tide. I thank you very much on behalf of the Hastings fishermen. F. Johnson,
Hon. Managing Sec. to the Society for Investigating Disasters at Sea on our Coasts.
23, Roman-road, St. Leonards-on-Sea,
August 19th.

ENAMELLING CAST IRON PIPES AND CASTINGS.

Sir,—My attention has been drawn to your notice of the new Bohemian invention for the enamelling of cast iron pipes, &c., during the casting in the foundry. In this you say the process is still secret. I beg to inform you that the Bohemian inventors have patented the invention in this country, and forwarded me the particulars for publication, and samples of pipes made in this way can now be seen at my office in Liverpool.

There are various receipts for the enamel, depending upon the purpose for which it is applied. One for water pipes is as follows: twenty-eight parts by weight of silica, eleven calcined carbonate of soda, and six carbonate of lime. Another is: thirty-four silica, eleven carbonate of soda, twelve chalk, and eleven dried pipe-clay, to which boracic acid or lead oxide can be added when a more vitreous enamel is required. The core forming the inner surface of the pipe—and if desirable, the mould too—is coated with black lead, smoothed, and the enamel as a powder, paste, or pigment, applied to the thickness required. The molten iron causes the enamel to soften and firmly adhere to the iron. If it is not necessary that the enamel should be smooth, the black lead is omitted.

The enamelled pipes are much appreciated in Bohemia, as may be seen from the fact that the Municipal Council of Egar have passed a resolution to use no other kind. The enamelled pipes are now being manufactured in several works in Germany and Austria, and arrangements will shortly be completed for licencing one or more firms in this country. W. P. Thompson.
Patent-office, 6, Lord-street, Liverpool,
August 17th.

RAILWAY MATTERS.

MR. HENRY APPLEBY, who for many years was superintendent of the locomotive and carriage department of the Monmouthshire Railway and Canal Company, and for the past few years superintendent of the South Wales division of the Great Western Railway, has been appointed superintendent of the locomotive and carriage department of the Waterford and Limerick Railway.

SINCE the accident a short time back to one of the bridges crossing the new short length of line from the Central Station, Manchester, to Stockport, worked by the Midland Company, it has been decided to rebuild the whole of the bridges along the length. The accident consisted in one of the cast iron girders supporting the bridge giving way and precipitating the bridge over a portion of the line. With the view of preventing the recurrence of any similar accident, the bridges are being strengthened by putting in cast iron girders of stronger sections and increasing the number.

THE general secretary of the Amalgamated Society of Railway Servants having intimated to the Board of Trade the intention of the society to hold an exhibition of improved railway vehicle couplings at Darlington, on October 3rd and following days, and further asked the Board to assist with any models in their possession, has received a reply containing the following:—"The Board of Trade have no working models of appliances for insuring safety to railway servants in performing their duties, but the Board of Trade would be prepared to grant a certificate, either under the International or Industrial Exhibitions Act, for the protection of the patent rights of inventions to be exhibited. The Board of Trade would also direct the attention of their railway inspecting officers to such an exhibition, as I may state that they have every wish to encourage the examination and consideration of such appliances."

AN extraordinary accident happened on the Lancashire and Yorkshire Railway on Monday morning, a short distance from Hindley station. In order to do away with the level crossing at this spot, a large iron foot-bridge had been placed over the line, and the work was nearly completed. The contractors were on Monday fixing rollers underneath the structure to allow for expansion and contraction, when, as is alleged, as one end of the bridge was being lowered on to the rollers a sudden gust of wind caused it to cant, and the structure fell on to the railway, completely blocking the whole of the lines. One workman, who was on the bridge at the time, was precipitated to the ground and sustained a severe shaking, but no one was killed. Breakdown gangs were quickly on the spot, but the task of removing the bridge, which is 132ft. long, was both tedious and difficult. In six hours one line was cleared. The express had only just passed when the accident happened. The structure weighs 30 tons.

ON Saturday night last, between 11 and 12 o'clock, an accident occurred to a heavily laden coal train on the Great Western Railway. While travelling to Birkenhead from South Wales, and when passing a point known as Rossett Mill Race, about three-quarters of a mile from Rossett Station, and about four miles from Wrexham, the axle of one of the trucks snapped. The driver was not able to stop the train at once, it being dragged along to Rossett, tearing up the road for a long distance. When the train came to a standstill it was found that a number of trucks were a complete wreck, the two platforms of the station being greatly damaged, and the contents of eleven trucks being scattered thereon. The signals and wires were destroyed, and the posts of the station gates uprooted. A large number of men had to be engaged in clearing the metals, and the traffic carried on on a single line between Wrexham and Balderton level crossing. A good brake would have saved nearly all this loss, and in America brakes are being applied to goods' wagons.

THE Great Western train leaving Birmingham at 10.5 a.m. met with a serious accident on Monday morning on entering the low level station at Wolverhampton. From a cause as yet unexplained, the engine left the rails near to some points, and after ploughing the ballast for a short distance mounted lines which took it to the wrong side of the platform. The train was composed of five carriages, and of these the first two, getting off the rails altogether, mounted the end of the platform and, coming into violent collision with each other, were wrecked. One of them falling upon the engine driver, George Gibbs, of Leamington, who had jumped, or been thrown from the engine, crushed him so fearfully that death was instantaneous; the stoker remained on the engine uninjured. Six of the passengers in the two leading carriages were more or less shaken or hurt, an elderly tradesman named Joseph Fieldhouse having his arm broken and his face lacerated, besides sustaining a severe shock. Mr. J. H. Love, the company's local surgeon, was at the station immediately after the accident, and was assisted by Mr. Kough in attending to the sufferers. The line was cleared in four hours.

THE works that the Great Western Railway Company has in hand include some that are at the present time of the utmost interest to engineers. It has a very large amount of capital that is sunk in these works, and that cannot be productive till they are completed. On the Severn tunnel it has already spent some £469,617, and the recent rate of expenditure on that great work has approached £20,000 monthly. It is true that the official report states that recently "considerable and satisfactory progress" has been made with that important work, but it is evident that the expenditure will continue for a long time before it becomes productive of any return to the shareholders. The Bala and Festiniog Railway has claimed £150,000; the Cornwall Railway, £202,500; and the Llynvi and Ogmore Railway, £230,040; so that in other subsidiary, but important branches, it will be apparent that there is a very large amount of capital that is idle and unremunerative at present. A further £312,966 is the estimate of the amount needed from the beginning of the present half-year to complete the works that the company has itself in progress; and the subscriptions that are to be made to other railways are expected to reach, in the total £342,689, so that there is a large capital expenditure before the Great Western Railway Company. It must in some degree be a burden to the shareholders of the company at the present time; but as the works are completed they ought to tap fresh streams of traffic, and thus the shareholders of some future period will benefit by the present large capital expenditure.

IN an interesting article entitled "From the Missouri to the Yellowstone," a correspondent of the *Times* at Little Missouri writes:—"The Northern Pacific last year extended its road from the Missouri 230 miles to the Yellowstone, opening up a varied and interesting country, invading the haunts of the Indian, the buffalo, and the antelope, and carrying the traveller among the curious phenomena of "the bad lands." In less than another year the wonders of the Yellowstone Park and the great Montana cattle ranches will be brought within railway reach. The most tedious and costly item in the construction of this western section is the iron bridge spanning the Missouri, which at Bismark is 1200ft. wide, with marshy flats extending nearly a mile on either side. This muddy stream, like the Severn at Bristol, is prone to change its course, to deposit sand-banks, and shortly to sweep them away. These irregularities and the great floes of ice, said sometimes to reach 36ft. high, which in spring come driving down stream, necessitate special precautions to secure solidity and strength. Substantial stone piers are being built in coffer-dams which have to be sunk 60ft. to reach a solid foundation. On the bridge and its approaches 600 men were employed during my visit, receiving 2 dols. 50c. per day. The total cost is estimated at 1,000,000 dols. When so much money is being spent by the railroad it is to be regretted that arrangements cannot be made to supersede entirely the big floats which now deport across the river railway passenger and freight cars, as well as horses and carriages, and provide in connection with the new railroad bridge a way for wagons and foot passengers. The cost might surely be defrayed by a grant from the Territory, or by allowing the railroad company to charge a stipulated toll.

NOTES AND MEMORANDA.

THE *Pharm. Zeitung* says that "a watch with the case opened laid in a vessel covered with benzine for about three hours, going meanwhile, will be perfectly cleaned after that time. The vessel should be covered with parchment-paper, and before removing the watch should be lightly agitated. Afterward the watch should be laid again in benzine, to which a little petroleum oil has been added, to oil the works." This may thoroughly lubricate but it cannot clean.

THE *American Medical Weekly* says that the German preparation called oleoze, so great a favourite in disguising unpleasant remedies and making most compounds pleasant to smell and taste, and one which might be useful to inspectors of sewers, has the following composition:—One part each of the oil of lavender, cloves, cinnamon, thyme, citron, mace, and orange-flowers, 3 parts balsam of Peru, and 240 parts of spirits. This seems to be a pleasant preparation.

THE Tivoli Brewery, near Berlin, whose beers are now to be obtained at many retail establishments in the metropolis, the *Brewers' Guardian* says, is one of the largest on the Continent. Its annual production is about 150,000 hectolitres, equal to about 92,000 English barrels. Although small compared with some of our largest breweries, this necessitates a monster plant. The mash tuns are equal to mashing about 50 quarters at a time, and the coppers hold about 200 barrels. Included in the plant is one of Wetz and Rittner's patent mashing apparatus, which is said to have cost as much as £2000. The whole of the brewery buildings and maltings are connected by electric wires, and the head brewer can sit in his room and from there control the whole of the operations of malting, kiln-drying, mashing, cooling, fermenting, &c.; in this respect the Tivoli Brewery is far in advance of even our largest.

AT a meeting of the Paris Academy of Sciences a paper was read on the "Employment of Photography to Determine the Trajectory of Bodies in Motion, with their Velocities at each Instant and their Relative Positions; Applications to Animal Mechanics," by M. Marey. A body brightly illuminated is set in motion before a dark screen, and its path photographed on a very sensitive plate. Thus M. Marey obtained the path of a stone wrapped in white paper and thrown in the air; such a stone whirled by means of a string; the same while a person walked forward; a black baton with terminal white ball, with which the author traced the letters of his name, &c. To indicate velocity, the light is interrupted, say, 100 times a second, by rotation of a spoked wheel; and to determine synchronism of motion of different parts of a moving body, one of the spokes is broadened to double the length of eclipse at intervals.

THERE has been some difference of opinion as to the colour of perfectly pure water, and Herr Victor Meyer, who has been investigating the matter, finds that the colour is neither blue nor green, but a shade between the two. To demonstrate this he takes five glass tubes, 40 millimetres in diameter and about $1\frac{1}{2}$ metres in length. These are connected by means of rubber tubing, forming a tube about $7\frac{1}{2}$ metres long. Both ends of this tube are closed with glass plates fitted in metal sockets. The latter are furnished with brass nozzles for filling the tube. The tube itself is placed in an exactly horizontal position and covered with a black cloth. Upon looking through the empty tube, the field of vision appears perfectly colourless, the cloth and the metal sockets preventing the colour of the glass from exerting any influence. As soon, however, as the tube is filled with distilled water, an intense bluish-green colour is observed.

A PUMP was recently described by M. Cailletet for condensing gases, in which he uses mercury as a fluid piston, in order to fill every interstice of the pump barrel, and so expel the last atom of gas. Writing to a contemporary, Mr. R. J. Lecky says, "Of course, in this case he would use an ordinary plunger pump, with both the inlet and outlet valves at the top, and the proper quantity of mercury in the barrel, so as to fill it completely in the down-stroke of the plunger or piston. It is curious that a similar pump is figured in the first volume of the *Mechanics' Magazine*, 1823, page 232, as invented by Henry Russell; and I have always understood that a modification of this was used by David Gordon in the unfortunate 'Portable Oil Gas Company,' to condense gas into the reservoir from which his lamps were filled. The patents are Gordon and Heard, 4391—1819, and David Gordon, 4940—1824; a company was formed at the time for using his lamps, and was worked for a few years, but the royalties having much exceeded the profits, the company came to grief."

THE observation by M. Pellat that the surface of a metal undergoes an alteration in its character by the approach of another metal at ordinary temperatures is recorded in *Les Mondes*. The alteration has been shown by measuring the difference of potential between the surfaces of the two metals. If one of them is placed near a third influencing metal, while the other is removed from that influence, it is immediately found after withdrawing the influencing metal that the difference of potential between the two primitive surfaces has changed. This modification requires some minutes to become sensible, and increases with the duration of the influence until it reaches a definite limit. When the influence ceases the modification diminishes rapidly at first, and then slowly. The amount of variation depends upon the influencing metal. The most striking effects have been obtained with lead and iron; zinc produces no change. M. Pellat attributes this modification to a volatile body or vapours emanating from the influencing metal, which would be deposited upon the influenced metal, and would thus change the nature of its surface.

PROFESSOR COLLADON, of Geneva, recently described a curious and little-known experiment, showing the resistance of the air under certain circumstances to the motion of bullets in guns. It resembles a feat that was sometimes performed by soldiers with the old Swiss carbines. M. Colladon fully charged with compressed air the hollow iron breech of an air-gun, serving as reservoir. Having screwed up the gun, he introduced a round lead ball, running freely, but nearly filling the bore; then, placing the gun vertical, he seized the upper end and pressed his thumb vigorously on the mouth. The gun was then "fired" by an assistant; the thumb remained in position, and the ball was heard to fall back in the bore. Thereupon, after recharging the breech and with the same ball, he shot the latter at a pine board about ·4in. thick or a pane of glass, and it passed through. The experiment, M. Colladon says, is without danger, if the operator is quite sure of the strength of his thumb, if the gun is more than 32in. long, and if the ball is spherical, and nearly fills the gun—in which it must act like a piston.

VAN DER MENSBRUGGHE recalls the experiment which was made in 1816 by Dessaignes, of plunging a rod of glass into mercury. The electricity which is shown was attributed by the experimenter to the friction of the glass against the surface of the mercury, but Spring found that if the surface of mercury is covered with lycopodium, so as to diminish the friction, the electricity remains the same. It has, however, been found to vary with the temperature and with the degree of oxidation of the mercurial surface. The *Journal* of the Franklin Institute mentions that Mensbrugghe demonstrated five years ago that every liquid mass, of which the surface is expanding or contracting, becomes the seat of a thermo-electric current; if the variation of surface is produced near a bad conductor, such as glass or air, the current excites phenomena of static electricity. This hypothesis greatly facilitates the explanation of atmospheric electricity, provided that the spherules which constitute mist and clouds are constantly undergoing great variations of surface. Many of the luminous phenomena which accompany the shower of mercury, when forced through a porous cup by atmospheric pressure, or when shaken in a glass vessel in a darkened room, confirm these views, and they may be regarded as a natural introduction to the study of the development of atmospheric electricity, a question of great interest to investigators in all countries.

MISCELLANEA.

FOR the year ending the 31st of March, the stamp duty on patents for inventions yielded £197,474 14s.

WE are informed that the British Electric Light Company has recognised the fact of its infringement of the Edison patents for electric lighting by paying a substantial sum as royalty to the Edison Electric Light Company, Limited.

WE understand that Lieutenant-Colonel C. E. Webber, R.E., has been suddenly called to Egypt as Assistant-Quartermaster-General on Sir Garnet Wolseley's staff. Lieutenant-Colonel Webber served on Sir Garnet's staff out in South Africa in 1879.

THE Coalbrookdale Company, Limited, has taken the premises, Nos. 43 and 44, Holborn Viaduct, as London showrooms for its manufacture, and proposes to keep there a selection of the principal articles in grates, stoves, ranges, gates, railings, &c., made at its foundry.

THE institution which has hitherto borne the title of "The School of Submarine and Military Telegraphy, Telephony, Electric Light, and Technical Instruction Company," located at 12, Prince's-street, Hanover-square, will henceforward be known as "The School of Telegraphy and Electrical Engineering." It is now closed for the summer season; but on the 1st of September the pupils will reassemble, and fresh courses of lectures and instruction will be commenced.

THE *Fifeshire Advertiser* says some interesting experiments have just been carried out at Kirkcaldy by Messrs. Douglas and Grant, engineers, by means of Lightfoot's refrigerator, of which they are the sole makers. A cold chamber was erected in connection with the refrigerator, in which a quantity of fish of various kinds was placed, and although the weather has been warm, the fish were taken out after ten days in perfect preservation, and fit for use on any table. Messrs. Douglas and Grant have completed a large and powerful refrigerator for Messrs. Fry, of Bristol, to be used in their extensive cocoa and chocolate manufacture.

THE Birmingham (Brush) Electric Light Company has not after all been successful in securing the contract for lighting the city of Lichfield. It offered to light twenty-five arc lamps, each of 2000-candle power, for five years at £25 per lamp per annum. The local (Lichfield) Gas Light Company offered to light 200 lamps from the end of August to the end of April, and twenty during the rest of the year for £510, which was a reduction of 4d. for the thousand cubic feet in the price of the gas, as compared with a year previous. The corporation disliked the idea of entering into a five years' contract, and they have just accepted the gas company's offer.

A MEETING has been held at Cradley Heath of representatives of the various operative trade associations in East Worcestershire and Staffordshire, to form a trades council for the whole of the Black Country districts. Delegates were present from the trades following:—Nut and bolt, common nail, cable and small chain, anchor smiths, sheet iron workers, rivet makers, plate-glass workers, and tailors. The object of the council is stated to be "to improve the condition of the working classes in the districts included in the scheme." The secretary of the Glassworkers' Association—Mr. Husselby—was elected president, and a sub-council was appointed to draw up rules.

RECENTLY at Messrs. Brigham and Co.'s agricultural implement works, Berwick, a quantity of scrap metal was in preparation for smelting. Amongst this was a 64-pounder conical shrapnel shell, supposed to be unloaded. This would undoubtedly have been thrown into the furnace along with the other metal without the slightest suspicion of its deadly character, but, fortunately for all concerned, the curiosity of a boy to examine the inside of the shell prevented what might have been a dreadful calamity. After the expenditure of much time and perseverance the youngster succeeded in opening the shell, which was found to contain the usual charge of gunpowder and about 240 lead balls.

AN outbreak of typhoid fever has for the last four months raged in Bangor and the district, and presents no signs of abatement, fresh cases being reported almost daily. The occurrence is a most serious one for hotel proprietors and those dependent upon summer visitors, who seem to shun the town, the lodging-houses being almost empty. Fortunately there are comparatively few fatal cases. The officer of health has for the second time condemned the filter beds at the reservoirs, which, he says, are infected with germs of typhoid, and recommends that the water should be allowed to pass direct from the river, pending a proposal to take it from Ogwen, or one of the large river lakes. This would surely be easy enough to try.

IN connection with the incendiary fires which occurred at Alexandria subsequently to the late bombardment, Mr. John Wallace, the Volunteer Superintendent of the Alexandra Fire Brigade, writes to Messrs. Allen, Alderson, and Co., engineers, of Alexandria and London, bearing testimony to the efficiency of the fire engine there employed. He says that in the extinction of the fires which followed the bombardment of the 11th ult., the engine was in constant work for ten days, using Nile water and sea water. Mr. Wallace also testifies that the engine saved property to the value of £150,000, which would have been burnt had the course of the fires not been arrested. The engine was of the London Fire Brigade pattern, made by Messrs. Merryweather and Sons, and was the only one used during the conflagrations.

A TELEGRAM from Egypt, published in the Bolton *Daily Chronicle* of the 21st inst., states that 150 tons of fresh Australian meat preserved in a frozen state was served out on Thursday last to the iron clad fleet at Alexandria, and the experiment was well appreciated. This meat was shipped at Sidney on the 1st of May last, in the steamship Sorrento, and brought to England through the Suez Canal in the hottest season. It was kept frozen by cold air machinery, designed and manufactured by Messrs. Hicks, Hargreaves, and Co., engineers, of the Soho Works, in this town. The cargo, consisting of 402,000 lb. of beef and mutton, was taken to London, where 150 tons of meat were bought by the Government and sent back to Egypt for our sailors on the ironclad fleet. The Sorrento has sailed again for Australia to bring home another cargo.

THE Edison Foreign Electric Light and Power Company, Lombard-street, has just received from Mr. W. H. Grier, of the Department of Public Works, Cape Town, a letter in which he expresses to the company on behalf of the Government of the colony their satisfaction at the manner in which the company has carried out its system of electric lighting in the House of Assembly in Cape Town, and at the same time to bear testimony to the efforts of the company's electrician—Mr. Hortsck—who spared no pains to carry out the instructions which have been so completely successful. This is, we believe, the first colonial installation. This company has already lighted up a part of Stockholm opposite the King's Palace, with perfect success, and installations for China, Japan, the Straits, and the Dutch and Spanish colonies in the East, together with important places on the Continent, are in treaty for or have already gone forward.

THE Naval Committee have reported favourably to the U.S. Senate on a Bill which provides for the construction of six open-hearth steel cruisers, two of them to be not less than 5000 or more than 6000 tons displacement, and to be armed with four breech-loading rifled cannons of not less than 8in. calibre, and twenty-one breech-loading cannon of not less than 6in. calibre. The remaining four cruisers are to be of not less than 4300 or more than 4700 tons displacement, and to be armed with four breech-loading cannon of not less than 8in. calibre, and fifteen of not less than 6in. calibre. The Bill also authorises the construction of one steel ram of not more than 2000 tons displacement, four steam cruising boats, and four steam harbour torpedo boats. The steel used in the construction of these vessels is to be of home manufacture, and one half of them are to be built in the navy yards, and the others by contract. The estimate for the whole is 10,000,000 dols.

THE DYNAMO-ELECTRIC MACHINE.

During the *conversazione* of the Institute of Mechanical Engineers, to which we have referred last week, a lecture was delivered by Professor Rücker on the above subject. Mr. Rücker said,—

Mr. Chairman, Ladies, and Gentlemen,—You have done me the honour of asking me to address you a few words this evening upon a subject which is now exciting great interest both among students of pure science and also among practical men—I mean the dynamo-electric machine. I must, however, start by disavowing any hope that I shall be able to carry out the rather terrible programme which Mr. Davey has laid down for me, viz., to tell you "all about the dynamo." In the short time which alone the exigencies of an occasion such as this place at my disposal it will only be possible for me to mention one or two points connected with it; and as I see before me an audience numbering, I know, amongst its members, gentlemen who are intimately acquainted with the latest developments of technical electricity, and, on the other hand, containing persons who probably have not paid any special attention to the subject, I have to make a choice. I have either to deal with the more advanced or with the more elementary portions of the subject, and I hope I shall do what will, on the whole, please best if I choose the more elementary.

The scientific facts which lie at the basis of the two new industries which are springing up around us, viz., electric lighting and the transmission of power, are very simple. They may be stated as follows:—If in the neighbourhood of a magnet we move a wire which forms part of a conducting circuit, that is to say, a circuit in which an electric current can pass, then as a general rule a current is produced in the wire. If, on the other hand, we keep the wire stationary, and move the magnet, then as a general rule the same result will follow. Either by moving a wire in the neighbourhood of a stationary magnet, or the magnet in the neighbourhood of a stationary wire, a current can be produced. To these facts, which were discovered by Faraday, we owe the whole recent development of electric lighting, and the electric transmission of power. Let us now see how these simple notions have been developed into the complicated machines of to-day, and here I may perhaps assist both you and myself if I draw attention to a diagram, which is in the form of a sort of genealogical tree of the dynamo-electric machine. In doing so, however, I must guard myself against misconstruction. This diagram represents the logical, and not the historical order of the development of the dynamo. It does not profess to decide upon questions of priority of discovery; it certainly does not for a moment hint that the ideas passed through any particular inventor's mind in the particular order in which they are here set down. It is not complete. If it were it would be unwieldy. All that it professes to do—and that I think it does to a certain extent accomplish—is to show how, after the result has been reached, we may map it out for ourselves, so as to see clearly how some of the principal forms of a machine are logically connected together.

From what I have already said, you will see that there are three ways of producing a current by induction; we may either keep the wire stationary and move the magnet, or we may keep the magnet stationary and move the wire; or we may obtain the same result by moving both, but for the moment I confine myself to the two first cases. Of these, one has been by far the most prolific practically. By far the larger number of inventors have made use of the motion of a wire in the neighbourhood of a stationary magnet rather than of the motion of a magnet in the neighbourhood of a stationary wire. Starting then here with Faraday's discovery, we come immediately to the invention of magneto-electric machines, and they may be divided into two chief classes—those in which the magnets are movable and the wire stationary, to which Pixii's, the first constructed, belonged, and the other in which the coils are movable and the magnet is stationary, to which belong Saxton's, Clarke's, and others. This, then, is the first division of the subject. Confining ourselves to the principal line of development, viz., that of a movable coil, we are at once able to divide the machines into three sub-classes, and these depend upon the way in which the wire is wound.

The machines at the head of each were invented at different dates, but, nevertheless, come logically together. Fig. 1 may be taken as a type of the first class. It is a diagram of Clarke's machine, with everything left out except the essentials. In this first class the wires are wound round two or more coils, and

FIG. 1

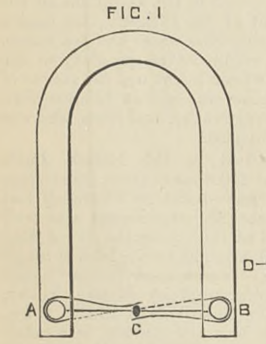
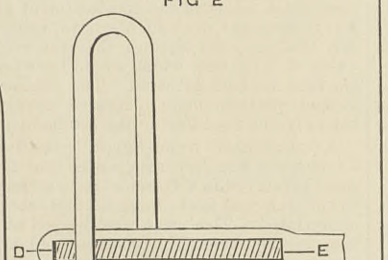
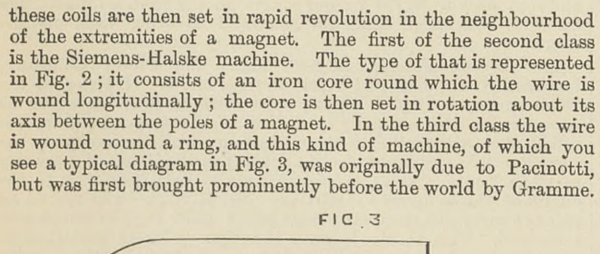


FIG. 2



these coils are then set in rapid revolution in the neighbourhood of the extremities of a magnet. The first of the second class is the Siemens-Halske machine. The type of that is represented in Fig. 2; it consists of an iron core round which the wire is wound longitudinally; the core is then set in rotation about its axis between the poles of a magnet. In the third class the wire is wound round a ring, and this kind of machine, of which you see a typical diagram in Fig. 3, was originally due to Pacinotti, but was first brought prominently before the world by Gramme.

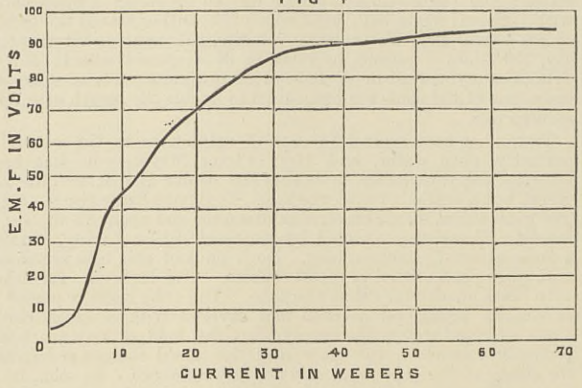
FIG. 3



Here then we have three sub-divisions: the wire wound in coils; the wire wound longitudinally round a single iron core; and the wire wound round a ring. Now, let us follow down the main line of development from the Siemens-Halske machine. The next advance was due to Wilde. His improvement was this: he substituted for the permanent horseshoe magnets which had been previously used an electro-magnet. The machine consists practically of two Siemens-Halske machines. One of them is furnished with permanent magnets, and the current produced by that is used to excite the electro-magnets of the larger machine. They are thus made far more powerful than a permanent magnet would be, and the current produced by the second bobbin is also considerably increased in power. This invention, then, consisted in the supplanting of permanent magnets by an electro-magnet.

The next great step—and this, perhaps, is the most important in the history of the development of the machine—is that which marks the transition from magneto to dynamo-electric machines. Now, as is usual in very great discoveries, this consists of what appears at first sight a comparatively small improvement, and, as is also not very unusual in great discoveries, the idea occurred to several persons at once. The improvement is as follows:—It occurred to Sir Charles Wheatstone and to Dr. Siemens at the same time—their papers were first read on the same day—that it would be possible to do without the smaller machine; and they argued as follows:—A piece of iron which has been magnetised generally retains for a long time a portion of the magnetism which has been given to it. Let us now suppose that, instead of magnetising the iron cores of the electro-magnets in the Wilde machine by passing a current round them, we trust to their own magnetism to begin with, and set the bobbin in rotation, a small current will be produced, because the magnetism will be very weak. But let us so arrange as to pass this current round the wires which excite the electro-magnets. The current will strengthen their magnetism; that will produce in turn a stronger current; that will once more strengthen the magnetism, and the current will again be increased, and thus by the continual process of using the current to strengthen the magnetism and using the magnetism to strengthen the current, we are able to do away with the smaller machine. This process cannot, however, be

FIG 4



carried on indefinitely. We cannot increase the magnetisation of iron beyond a certain point, and when this is reached no further increase in the strength of the current will add to the strength of the magnets. This is illustrated by Fig. 4. In it the machine is supposed to be kept revolving at constant speed, and the strength of the current is altered by varying the resistance through which it has to pass. Horizontal lines indicate the current; vertical lines measure the electro-motive force, or as the speed is constant they may be taken as measures of the intensity of the magnetisation. At first, you see, as the current increases the latter increases, but after awhile it becomes almost constant.

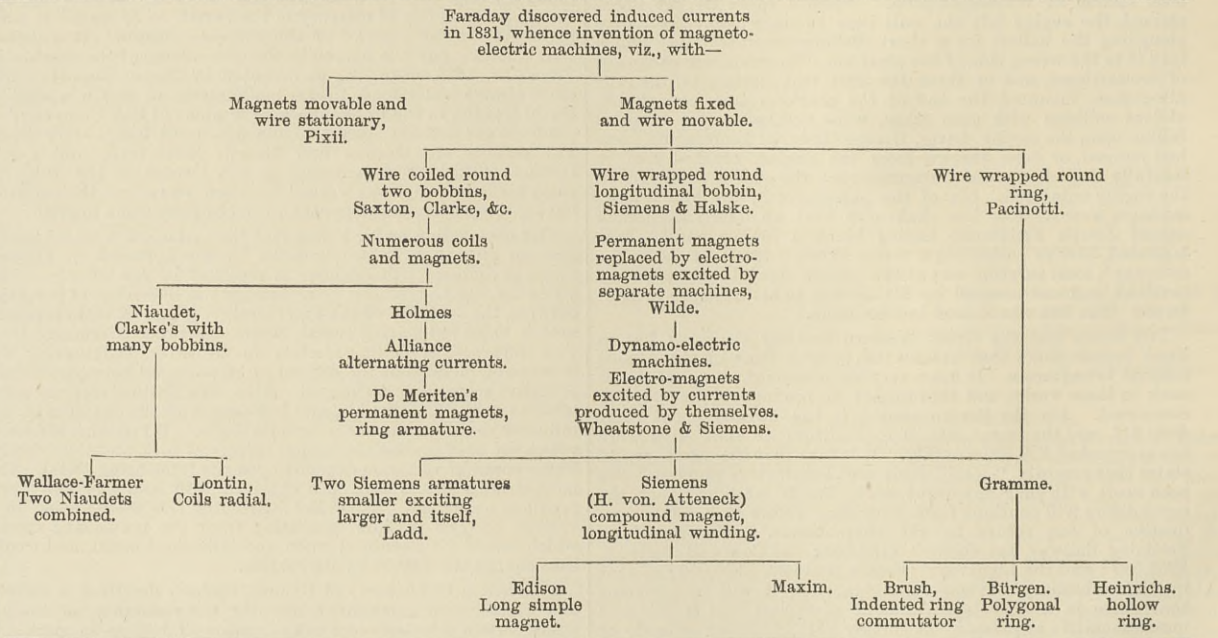
So far, I have carried down the history of the machine to the invention of the dynamo—the machine, namely, in which the electro-magnets are excited by the current which they themselves produce. Here I am afraid I must hurry over my subject more rapidly, both because the differences between the machines become more complicated, and because the time at my disposal will not be sufficient to enable me to deal with them fully. Starting, however, with the dynamo-electric machines, we may divide those which have been invented into two classes, viz., those in which there is a vibrating motion, and those in which there is a rotating motion. With regard to the vibrating motion, as far as I know, only one machine has been proposed of this type. This was a machine suggested by Mr. Edison, but which is very different from the one which now goes by his name. Confining ourselves to the rotating motion, the next important advance was the Gramme machine. It is really a development of the Pacinotti machine, to which I have already referred, and, therefore, I need say little more about it. The essential principle consists in having a revolving ring, round which the wire is wound in a spiral. One of the disadvantages of machines with iron cores round which the wire is wound is that the iron rapidly becomes hot. It is continually being magnetised and demagnetised during the revolution, and this produces heat. A number of other inventors have followed upon Gramme, having among other objects that of diminishing the amount of heat produced in the iron core. The Brush is one of these machines; the Heinrichs is another; the Bürgin is a third.

In the last, in order to prevent the core heating very much, it is made not circular, but polygonal in form; when the wire is wound round it, the angles of the polygon are left bare, so that they are in free contact with the air, and thus it does not get so hot as if it were completely surrounded. This is a type of the kind of improvements that have been suggested. There are, you will see, a number of other machines mentioned which really descend directly from the Clarke machine; into their details I need not enter. The improvements which they embody may be briefly described as an increase in the number of magnets and coils, alterations in their relative positions, and the substitution of electro for permanent magnets. The Niaudet, an early form of the Lontin, and the Wallace-Farmer machines are among them.

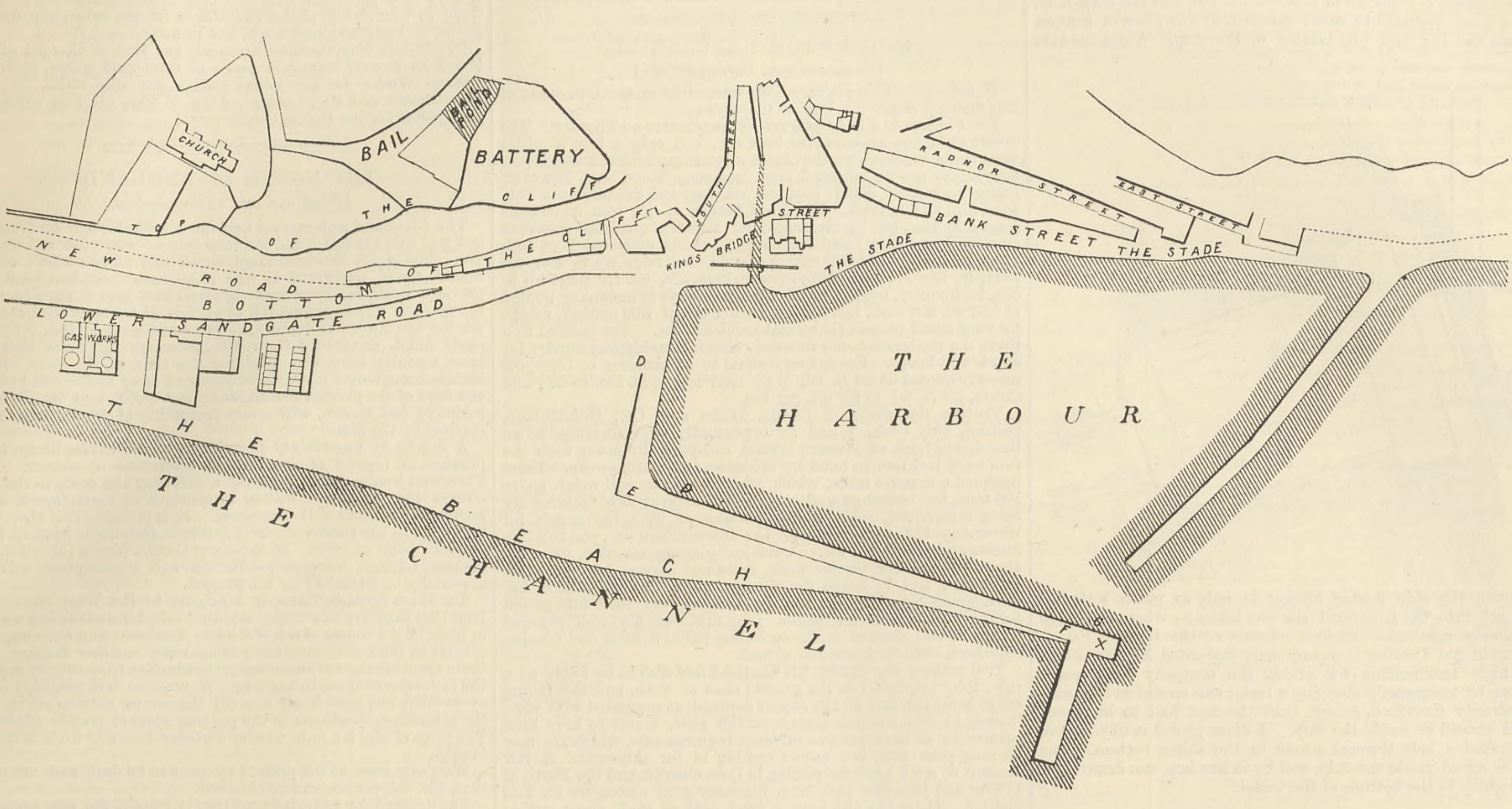
Having now, as briefly as I could, sketched before you the development of the dynamo-electric machine, I must pass on to one or two of the uses to which it has been put; and here the particular subject on which I have been asked to say a few words is the transmission of power. Now this transmission of power by a dynamo-electric machine depends upon a principle which is known as the reversibility of the machine. If we make our wire rotate in the neighbourhood of a magnet we obtain, as I have told you, a current passing through it. Now, let us reverse the process, let us keep the wire near the magnet, and instead of moving it, pass a current through it; under those circumstances the wire begins to move. You see, then, that there are these two closely related, but, as it were, opposite facts—the one, that a wire when moved in the neighbourhood of a magnet has a current produced in it; the other, that a wire through which you convey a current in the neighbourhood of a magnet tends to move. I can illustrate both of these facts by some experiments. For the convenient little instruments before me I am indebted to Mr. Cutriss, an electrician in this town, who makes a small but handy and useful motor. The first point which I wish to illustrate is the fact that by turning the wire we can produce a current. To prove that there is a current I shall illuminate some small Swan lamps, which will glow and thus prove a current is passing. (Experiment.) Let us now come to the opposite fact, viz., that a current will produce motion of the wire. I have under the table a single galvanic cell; the current from that I shall pass into one of Mr. Cutriss's motors which is attached to a small ventilating fan. A piece of cardboard is fastened to the axle of the fan to enable you to see its motion. When it is moving you will also see that the stream of air issuing from the fan will blow out a taper at a considerable distance. (Experiment).

Having, I hope, by these two simple experiments impressed upon you the fact of the reversibility of the dynamo-electric machine, let us for a moment consider how this reversibility can be applied to the transmission of power. By the transmission of power we mean this—the performance of a certain amount of work at one place, and obtaining the equivalent of the whole or a portion of that work at another. We may transmit power in a number of different ways. We may transmit it by means of a rope. If you pull at one end of the rope you can transmit power to the other end. We can transmit power by a belt in machinery. In the transmission of power by electricity we use no rope or belt, but the electric current itself. The transmission is effected in this way. We use one dynamo to produce a current, that current is passed to another dynamo; passing through it, it sets in motion, and that motion can then be utilised to rotate an axle or to set machinery of any kind at work. We have here an experiment illustrating this. Here is a small dynamo connected with a motor. As soon as the wheel of the dynamo is turned, you will see that the motor rotates. Thus we have transmitted the power across the table from one machine to the other. If, however, any mere toy experiments of this kind were all that the transmission of power meant, it is evident that however interesting it might be to scientific men, it would be of little interest or importance practically. But some of our keenest intellects see in the not very far distant future the possibility of this simple experiment being carried out upon a far vaster scale, and of our transmitting the power of our waterfalls, of the tides, and of the winds, from points where it is not wanted to our great centres of industry where it is most urgently needed. There are, no doubt, many practical difficulties which are yet scarcely touched, but when the combined scientific knowledge and mechanical skill of the civilised world is directed to them, they will in all probability give way.

Now, the first and most important question we can ask with regard to the transmission of power is, how much can we transmit? Can we obtain the power which we put into the machine at the other end? If we cannot, how much of it shall we lose? You know that in the steam engine we obtain the work which is done at an enormous expense, that for every ten units of work produced we have to spend an amount of heat which could produce 100 units of work. In other words, we only get one-tenth—in some cases it is rather more, about one-ninth—of the total amount of heat put into the engine expended in work. Now, if there were to be a great additional loss of this kind in transmitting power, it is evident that that would be a very serious defect; but we have a very good hope that the



FOLKESTONE HARBOUR.



power can be transmitted without any such serious loss. A short time ago a calculation was made by a French savant, M. Deprez, which shows that by means of the expenditure of 16-horse power we can obtain a return of 10-horse power at a distance of thirty-one miles by means of an ordinary telegraph wire. Here then, instead of obtaining one-tenth, we obtain, you see, five-eighths of the whole returned to us. Sir William Thomson has also devoted himself to these calculations, and he too holds out the hope that vaster sources of energy, such as Niagara, may be turned to use by sending a portion of that energy by the electric current to centres of industry even 300 or 400 miles distant. On the whole it seems reasonable to hope that about 50 per cent. of the amount of work spent in the first dynamo may be utilised at a considerable distance.

With these few remarks I will conclude what I have to say. I have attempted to deal with only a part of the subject. I have endeavoured in this to be as clear as possible, and if I have conveyed to any of you not well acquainted with the subject some notion of how the dynamo works, and how it may transmit power, my object will have been obtained.

THE FOLKESTONE-BOULOGNE CHANNEL STEAMERS.

TWENTY-ONE years ago the South-Eastern Railway Company commenced to modernise its fleet, which previously consisted of eight vessels of small dimensions, namely, the Queen of the Belgians, the Queen of the French, the Princess Mary, the Princess Maude, the Prince Ernest, the Lord Warden, the Princess Helena, and the Princess Clementine. This was the fleet which the company started with in 1844-46. The first four of these eight vessels were about 160ft. long, 10ft. depth, and 20ft. beam, built by Messrs. Ditchburn and Mare, of Blackwall; and engined by Messrs. Maudslay, Sons, and Field, of Lambeth. The other four were about 180ft. long, 22ft. beam, and 11ft. depth of hold. They performed a regular tidal service to Boulogne and back as at present.

Before 1844 the company had no boats of its own, yet for about two years previously had a service performed by boats chartered from the "Commercial Company," a corporation which at that time competed with the General Steam Navigation Company. As time went on, and trade developed, the eight ships previously mentioned were converted one by one into cargo ships for the night service. In 1860, to meet the requirements of the times, the company ordered the Victoria, 210ft. long, 24ft. beam, 12ft. depth of hold, and 220 nominal horse-power, also the Eugenie, of similar dimensions, which last vessel was disposed of after two years' service, and employed to run the American blockade. After performing her American work at Wilmington, the Eugenie was brought back to England, lengthened and improved, and purchased by the General Steam Navigation Company; her name was altered to the Hilda, and she now runs from London to Margate and Ramsgate. In 1862 the Albert Edward was built of similar dimensions, and in the following year the Alexandra. These three vessels then performed the passenger service during the summer. The winter passages were performed by the best of the first eight ships named, and in 1866 the Napoleon was built to the order of the company for the winter service also. In 1877 it was thought desirable to run the best ships during the winter as well as the summer, discontinuing the use of the old boats for passenger service.

In 1880 another phase in the history of the service commenced by the ordering of the Albert Victor and the Louise Dagmar, each 250ft. long, 29ft. beam, 15ft. depth, 350 nominal horse-power, and 8ft. draught. These vessels were ordered from the same firm as the four previous ships, namely, Messrs. Samuda, Bros., of Poplar, and they were engined by Messrs. John Penn and Son. It is worthy of remark that inasmuch as $2\frac{1}{2}$ hours to Boulogne was considered a wonderful passage with the earlier ships, the present ships have performed the passage in about an hour and a-half. When we have timed them sometimes of late while making their ordinary passages from pier head to pier head, in fine or moderate weather, they have done the run within five minutes under or over the hour and a-half.

The only ship now left of the original fleet is the Princess Clementine, kept for occasional cargo, the cargo traffic being generally conveyed by the two twin-screw steamers, the Folkestone and the Boulogne, built and engined by Earle's Shipbuilding Company, at Hull. They are each 190ft. long, 25ft. beam, 13ft. depth, and 120 nominal horse-power. They do the passage in about two and a-quarter hours.

It is a fact that with regard to the machinery of the Victoria that the main shaft bearings have not worn $\frac{1}{32}$in., and have never been lined up; the same statement will apply to other parts of the machinery.

Within the past few days a third large ship, scarcely distinguishable in external appearance from the other two large ships, the Albert Victor and the Louise Dagmar, has been added to the South-Eastern Railway Company's fleet, namely, the Mary Beatrice, said to be the fastest ship afloat. She is 255ft. long, 29ft. broad, 15ft. 6in. depth of hold, 8ft. 1in draft, 1063 tons burden, 2800 indicated horse-power. She is in fact very much such a vessel as that which we suggested in our impression for July 28th. We then stated that "a vessel with a displacement of 1000 tons could probably be made to steam 23 miles an hour with 3000 indicated horse-power." At the ordinary four runs, at the builder's trial, at the Maplin sands, she is reported to have attained the extraordinary average speed of 19·019 knots, or more than twenty-two miles per hour; the *Observer* newspaper gives her speed as 18·09 knots per hour; from a third source we have been informed that her speed is half a knot per hour greater than that of her sister ships. At all events she is an exceedingly fast boat, and her extra speed over that of the other two ships is partly due to her being 5ft. longer, whereby room was obtained for surface condensers; partly to having rather more boiler pressure, and partly to various small improvements. The boiler pressure of the two older vessels is 30 lb., that of the Mary Beatrice is 32 lb. Her cylinders are 72in. in diameter, and the pistons are of 5ft. stroke; there are 6500ft. of condenser surface, and two engines to drive the water through. The Mary Beatrice was built by Messrs. Samuda Brothers, and her engines, which are of the ordinary oscillating description, were made by Messrs. John Penn and Sons. We illustrate them on page 140.

The photographing of Channel boats under full steam has put the powers for quick work of local photographers to the test. We have seen no good instantaneous pictures of them taken either at Calais or Dover. At Folkestone Mr. Blackall has taken some fairly good ones, but under-exposed. Mons. de Mauny, of Boulogne, has some very fine specimens, and Mons. Grassin, of Boulogne, a gentleman amateur, has taken some excellent instantaneous photographs of them, which have gained for him high commendation from the Photographic Society of Paris.

The three largest Folkestone-Boulogne boats are built of Siemens' steel, and are divided by bulkheads into four watertight compartments, A, B, C, D, as in Fig. 1. The engines,

FIG. 1

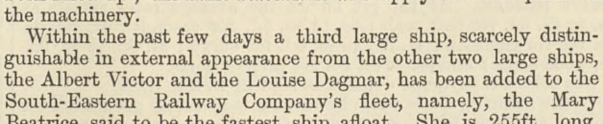
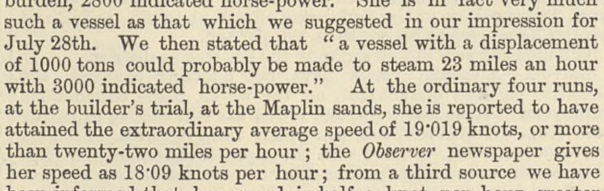


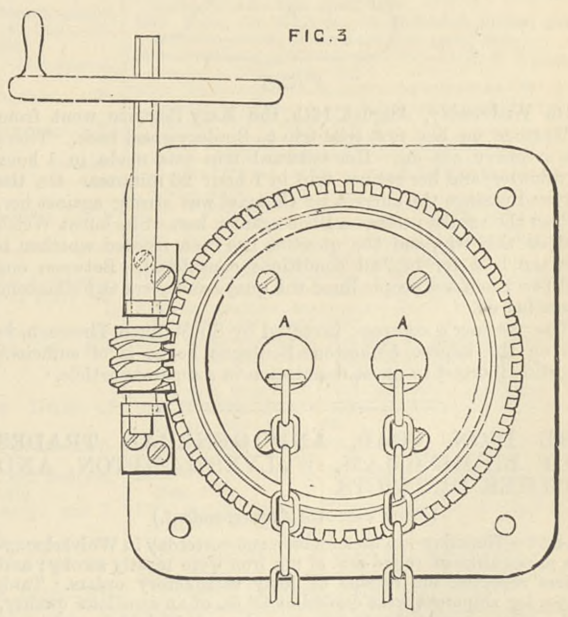
FIG. 2



boilers, and the bases of the funnels, are in the large compartment B, C, so any collision which may let in the water there would put the safety of the ship to the severest possible test. Bulkheads are not only great safeguards to all ships, but they have saved a Channel passenger ship before now. Some years ago the Fanny Buck ran into the Dover-Calais steamship, the Samphire, and stove in her first watertight compartment A, Fig. 2. The effect of this was that when the water entered A the water-line of the ship changed from B B to D D, and the water on the deck at H threatened sometimes to wash over the top of the bulkhead K K into the compartment E. The water was therefore discharged from the boilers in E, whereby the deck water-line H was shifted nearer to N, and the ship was towed into Dover by the stern F.

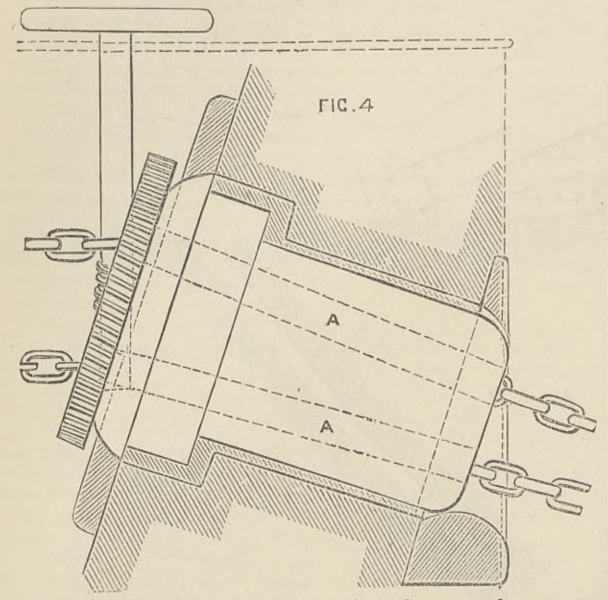
One of the chief features of the larger Folkestone-Boulogne boats is that they have a large airy saloon on deck, as well as the usual saloon accommodation down below. The captains of the three principal ships—Messrs. Jenkins, Dane, and Martleman—have become thoroughly experienced, during a long course of years, in Channel navigation on this particular route.

FIG. 3



To digress a little, for an interesting purpose, from the main subject, it may here be stated that Captain J. A. Boxer, R.N., the marine superintendent of the South-Eastern Railway Company at Folkestone, is the inventor of machinery for preventing the twisting of ship's cables. If two cables be lowered from the stem of a ship they become twisted together as the ship swings with the tide, and this is one of the greatest difficulties to overcome in the attempt to connect lightships with the shore by electric telegraph. At present, when in times of war it is necessary to telegraph by submarine cable from a ship instead of from the shore, it is necessary to moor the vessel fore and aft to prevent her swinging with the tide, but she may then be unpleasantly situated in the event of stormy weather. Various inventors have attempted to overcome the difficulty. Captain Boxer arranges that the cable hawse-holes or pipes A A shall revolve one over the other about an intermediate point, as in Fig. 3. The pipe may be turned either by hand or by steam. By this means, if the tide should make a twist in the cable in the course of the day, it can be untwisted by one turn of the pipe; this it is true will make a twist on deck, but there it is easy to deal with by the ordinary seafaring operation of "clearing hawse." By proper attention now and then to the turning of the pipe, no cable twisting at all need occur off the deck of the ship. Fig. 4 is a longitudinal section of the same piece of machinery in the stem of a ship.

Some years ago one of the Folkestone-Boulogne steamships ran ashore in a fog near Sandgate, and as the tide ran out she settled on a piece of rock, which crushed a hole in her bottom, through which the water would have rushed in beyond control when the tide rose again. Mr. William Earnshaw, who for many years was marine engineer at Folkestone to the South-Eastern Railway Company, prevented the water from getting in by the expedient indicated in Fig. 5. In this diagram A is the rock, B B is the bottom of the ship settling down upon it during the recession of the tide. Mr. Earnshaw put a kind of water-tight box or tub D D over the hole, and kept the box down by means of the timbers E F driven in between the box and the deck K K. India-rubber was used to make water-tight the place of contact between the box and the bottom of the ship. When the tide



rose again the ship floated, letting in only so much water as could get into the box, until she was taken to where she could be properly repaired. Various officials of the Russian Steam Navigation and Trading Company once presented Mr. Earnshaw with high testimonials for saving the company from heavy expenses by temporarily stopping a leak ; this he did on the principle already described, except that the box had to be placed outside instead of inside the ship. A diver placed it in position, and pushed a bolt through a hole in the ship's bottom. The bolt was seized inside the ship, and by it the box was drawn and fixed tightly to the bottom of the vessel.

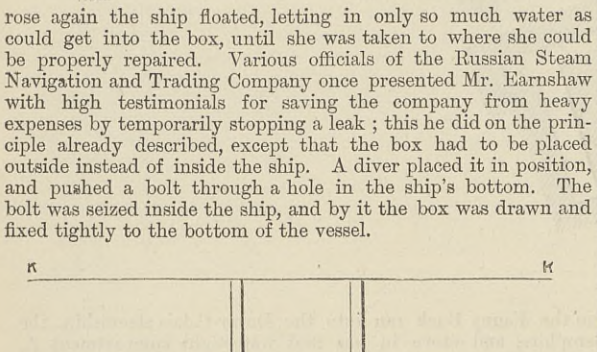


FIG.5

On Wednesday, August 16th, the Mary Beatrice went from Folkestone on her first trial trip to Boulogne and back. There was a heavy sea on. Her outward trip was made in 1 hour 40 minutes, and her return trip in 1 hour 26 minutes. On the outward passage the current up Channel was strong against her, and on the return passage a little against her. She burnt Welsh coal on this trip, and the question has been mooted whether it was the best for her, all conditions considered. Between one and two thousand people lined the quays and piers at Folkestone to see her off.

The mariner's compass, invented by Sir William Thomson, in use on the largest Folkestone-Boulogne boats, is of sufficient scientific interest to merit description in a separate article.

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

(*From our own Correspondent.*)

To-day—Thursday—in Birmingham and yesterday in Wolverhampton prices alike of rolled and of pig iron were mostly strong ; and sellers reported the receipt of fairly satisfactory orders. Tank plates for shipment were quoted at £8 5s. of an excellent quality, and offers at scarcely anything under. "Wright" quality of boiler plates were £8 10s. firm ; "Monmoor" quality £9, and "Monmoor double best" were £10. Stamping sheets were in full request at firm rates. Strips and hoops were in somewhat augmented outturn at £6 15s. for a fair quality.

Smithy bars were procurable at £6 5s. upwards to £7 10s. For good chain bars £7 10s. was required, and for high-class qualities £8 10s. was named. Hurdle bars were from £6 5s. and £6 2s. 6d., down occasionally to £6.

Pigs were not in large sale either to-day or yesterday. Nevertheless for brands in most repute, alike of local and of foreign origin, former quotations were upheld. Yorkshire and Derbyshire approved sorts were not to be got under £2 10s.; £2 2s. 6d., £2 12s. 6d., and £3 2s. 6d. were the quotation for the local brands, mostly used in the forge, the price varying according to the proportion of "mine" in the original admixture. The chief brands of all-mine were £3 5s to £3 7s. 6d. and £3 10s. Barrow hematites were £3 8s. 9d., and Tredegar £3 7s. 6d. Some consumers of this class of raw iron were complaining yesterday and to-day that the deliveries were not equal to their requirements. The supply of local sorts is this week curtailed to the extent of 300 tons a week by the temporary blowing out of one of the Spring Vale plant of Mr. Alfred Hickman.

Ironstone is sought after by blast furnace proprietors, at from 10s. to 12s. Coal keeps very abundant, and has not yet begun to strengthen.

The promoters of the movement for making basic steel of Staffordshire pigs have determined to make a start, but definite arrangements have yet to be completed. The enterprise will have the full benefit of the practical and pecuniary aid of Messrs. Thomas and Gilchrist themselves.

The well-known engine works of Messrs. Tangye Brothers, Smethwick, were fortunately saved on Sunday last from a disastrous fire. About noon a wooden door between the boiler shed and an annealing furnace caught fire, presumably from the heat of the furnace, and the flames quickly spread over the roof of a large shed containing six boilers and the pump stores. Only a dozen hands were on the premises, but the fire bell was sounded, and the members of the fire-brigade, who live close to the works, mustered immediately, and by the aid of the special pump apparatus kept for their use, entirely quenched the fire in a quarter of an hour.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There is very little movement in the iron trade of this district, either one way or the other.

There was only a quiet market at Manchester on Tuesday. The principal buyers appeared to be away, and only a few inquiries were made, chiefly with the object of testing whether some advantage might not be obtained from makers. There was, however, really very little actual business stirring, and makers as a rule were firm at late rates. For local brands of pig iron quotations remain at 46s., less 2½ for forge and foundry qualities delivered equal to Manchester, and for district brands delivered here Lincolnshire makers are still asking 47s. 6d. for forge up to 49s. for foundry, less 2½ ; and Derbyshire makers 48s. 6d. for forge up to 50s. for foundry, less 2½; g.m.b. Middlesbrough is nominally quoted at 52s. 4d. net cash, but it is altogether out of this market, except for very small parcels for special requirements. For finished iron there is a moderate home demand, with a fair shipping inquiry for sheets and hoops. For delivery equal to Manchester or Liverpool bars are quoted at £6 7s. 6d. to £6 10s.; hoops, £6 15s. to £7 ; and sheets, £8 7s. 6d. to £8 10s. per ton.

Visiting the works of Messrs. Hulse and Co., Ordsall-lane, Salford, this week, I had an opportunity of inspecting, in an incomplete form at present, several exceptionally heavy tools the firm have just now in hand for ordnance and marine work. These included a massive lathe, which, when complete, will weigh above 100 tons, for ordnance work, into which several new features are being introduced, especially in connection with the means for traversing the slide rests by the introduction of non-rotating screws and rotating nuts. A vertical planing machine, to weigh about 80 tons, for marine work, contained several improvements in details, and in lathes for turning guns. I also noticed improvements being worked out for bringing the tools into action for taper turning at any angle. The firm were also well engaged on the lighter class of work, including radial drilling and planing machines, both for home and abroad.

Tool makers throughout the district I find also to be kept, as a rule, fully employed on the general class of work, and the falling off in some portions of the export demand, as compared with what it was at the commencement of the year, seems to have been covered by an improvement in home requirements, which are now keeping pace with the orders coming in for shipment. A fair amount of work has been coming in from Canada, and the North of France and Belgium have been tolerably good customers for this district. There has also been a good deal of work given out to tool makers in connection with electrical engineering, and firms who for a considerable period previously had found it difficult to secure employment at all have been kept busy, whilst stocks, which in some cases were held heavily, have been mostly sold out.

Engine builders do not seem to be quite so busy as they were, activity in this branch not having been maintained so well as in tool-making, which is probably in a better position than most other departments of engineering, with the exception of those branches engaged on marine work, which are kept quite as well off as ever.

In the coal trade there is, if anything, rather more doing, but not to the extent to appreciably affect the market, supplies being still plentiful with pits on short time, and low prices taken to secure business. At the pit mouth the average rates remain at 8s. to 8s. 6d. for best coals ; 6s. to 6s. 6d. for seconds ; 4s. 9d. to 5s. 6d. for common ; 4s. 3d. to 4s. 6d. for burgy ; 3s. 6d. to 3s. 9d. for good slack ; and 3s. to 3s. 3d. for inferior sorts.

For coke a fairly good demand is kept up at late rates.

In the shipping trade there has been a moderately good business doing, and but for the scarcity of vessels and the advance in freights this branch would have been fairly active. Prices, however, are still low. Lancashire steam coals delivered at the high level, Liverpool, or at Garston, being offered at 6s. 6d. to 7s., and seconds house coal at 8s. 3d. to 8s. 6d. per ton.

The men are still out on strike in the St. Helens district.

Barrow.—Although prices have not quotably changed, the hematite pig iron market has, on the whole, made considerable improvement since last week, and orders are still coming in in fair bulk from all quarters, but principally from America. Freights are lower, and this, coupled with the approaching end of the shipping season, is producing considerable business transactions in order to effect delivery this year. No. 1 Bessemer is quoted at 59s.; No. 2, 58s.; No. 3, 57s. per ton net, f.o.b. at west coast ports. These prices, however, are exceeded in cases where makers are exceptionally well situated with orders. Stocks are gradually decreasing, and the output is being augmented by the relighting of more furnaces. The deliveries to all parts by sea are large, while the tonnage transmitted per local railways is very heavy, the revenue accounts of the various lines showing a good increase. Steel makers have improved their position, and are securing large contracts for both rails and plates. The demand for the former has been active for some time, while that for plates is improving. Prices are firm at late rates for steel rails. Blooms are selling largely. Iron ore in good demand at unchanged prices. Raisers have concluded some large contracts, and are generally pretty well sold forward. Iron shipbuilders have secured further orders, and are likely to be active shortly. Engineers are busy, as are also boilermakers, ironfounders, and the minor industries. Coal and coke in larger demand. Shipping steadily employed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

Indications of improvement in the iron trade become more frequent, and ironmasters are beginning to be less willing to take orders for immediate delivery. A leading firm in this district a few days ago were asked to complete an order of some magnitude within fourteen days. They wired back their inability to deliver in less than two months, and the order, instead of being taken elsewhere, was given to them. This would not have been the case two months ago.

Messrs. Newton, Chambers, and Co., Limited, of Thorncliffe Ironworks, are at present engaged on a work of considerable interest for the Crown Agents of British Guiana. It is an iron floor for new law courts to be erected at Georgetown, Demerara. In Georgetown, the buildings are of wood, and in the event of a fire the consequences are speedily disastrous. The Government, in their new law building, have resolved to have the first floor fire-proof, the floor itself being composed of iron girders of various suitable sections, and the walls of concrete. The girders, which are all of Belgian and German iron, vary from 2½in. deep and 167lb. per foot to 5½in. deep and 14lb. per foot. The lighter girders were supplied by the Société de la Providence, Marchienne-a-Pont, about four miles from Charleroi, Belgium, and the heavier sections by the Saarbrucken Iron Company, Burbace, Germany. Only one section could be obtained in England, and the price was £16 5s. a ton, while the Providence quotation was £7 15s. per ton delivered at Grimsby. Messrs. Newton, Chambers, and Co. are now engaged rivetting and fitting the girders to form the complete floor, which, in its finished state, will weigh 400 tons. The building is to be in the form of the letter L, and built after the style of a Swiss chalet. On one arm of the L the dimensions will be 228ft. by 74ft. wide, and on the other arm 146ft. by 49ft.

A local firm has recently been invited to send in quotations for plates for water tanks for Egypt. The firm some time ago sent to Demerara twenty-five tanks for holding water, each tank capable of storing 25,000 gallons.

For the Thorncliffe make of pig iron there is at present a brisk demand for Staffordshire and Lancashire, as well as for the Continent. It is used for the finest machine and engineers' castings, and is sold in competition with the best Scotch brands. The local trade in iron piping, plates and sheets for gas retorts, hydraulic mains, and similar girder work, is very active.

The Wilson line steamer, Bassano, has just discharged at the Royal Dockyard, Naples, a cargo of compound plates, from the Cyclops Works, for the Royal Italian war ship Italia. Messrs. John Brown and Co., Limited, Atlas Works, are also supplying Ellis plates for the Italian Government.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The Cleveland iron market held at Middlesbrough on Tuesday last was well attended, and the tone thereof was quiet and steady. The effect of the Stockton races, which laid off the whole of the manufactured ironworks in the immediate neighbourhood the previous week, has been to throw about 9000 tons of pig iron upon the market. The gradual fall of pig iron at Glasgow to about 50s. per ton has tended to depress the value of Cleveland iron. On the other hand, shipments from Middlesbrough and from Scotland have recently been very good for the time of the year. From Middlesbrough over 65,000 tons were sent away in the first twenty-one days of the present month, as against 48,000 tons in a similar period of last month, with every probability of 90,000 tons being reached by the 31st.

A degree of uncertainty prevails as to the course likely to be pursued in respect of a continued restriction of output. The Cleveland ironmasters have held a meeting, and come to the conclusion that they are willing to continue as heretofore if their Scotch competitors will also agree. It is probable that they will, inasmuch as the results so far have been favourable from an ironmaster's point of view. If the event should justify this view, the present relation between production and consumption will not materially be disturbed for the present.

The three furnaces formerly belonging to the West Hartlepool Iron Company are now being rapidly pushed forward, and will be in blast in the course of a few weeks. Cochrane and Co. also, who are not in the association, are getting ready another furnace, and there are other signs of an increase of production from sources beyond the influence of those in the ring. A reaction will probably come eventually, but most likely not till the winter months set in. In the meantime, steadiness in the pig iron market may be expected. The price of No. 3 g.m.b. was on Tuesday 44s. 6d. f.o.b. Middlesbrough.

Warrants seem at the present moment to be dull, and not more than 43s. 6d. per ton can be obtained.

The demand for manufactured iron is steady, the new contracts booked being rather in excess of quantities run off. Ship-plates are offered at from £6 15s. to £7 per ton f.o.t. Middlesbrough, less 2½ per cent. discount. Angles and bars command £6 5s., and sheets £8.

The steel trade continues rather flat, the price of rails being about £5 per ton f.o.b. Middlesbrough.

The coal trade is a little better. The colliers are working more regularly, while prices are firmer, and altogether things are looking a little more prosperous for coalowners.

The National Amalgamated Association of Ironworkers has been having a four days' conference at Leeds. There were delegates present from all the northern ironmaking centres. The conference discussed the sliding scale principle, and passed a resolution approving of it wherever applicable. This, however, was subject to its being founded on what they call "a safe basis," which probably means one favourable to themselves. The action of the general council in regard to the late strike against the "Pease award" in the North of England was discussed and approved. It will be remembered that that action was directed towards influencing the men to go to work on the award, so soon as the latter were beginning to see that they were beaten. The conference seems to have been much moved at the recent notice given by the employers' secretary for a reduction at the termination of the Pease award. It was decided to recommend that the matter should be submitted to arbitration. The difficulty foreseen was that the masters, after their recent experience of repudiated awards enforced only after a strike, might prefer to enforce their claim at once, and without going through the farce of an arbitration as before. The conference, therefore, resolved that "in cases where non-union men refused to give a guarantee to accept loyally any award for the credit of the association, the members should be requested to resign their situations." It is not at all clear what this may mean. If it has any significance at all it surely is that in the opinion of the conference the leaders of the ironworkers have very little power over their followers.

The first cargo of salt from the new salt works at Messrs. Bell Bros., at Port Clarence, has been delivered to a chemical works on the Tyne. The cargo was from 100 to 200 tons. Only a small portion of the evaporating plant which Messrs. Bell Bros. are putting down is as yet complete. Messrs. Alhusen, the well-known chemical manufacturers at Newcastle, have purchased twenty-five acres of land near Port Clarence for the establishment of chemical works. It would, therefore, seem that this new industry, which in time may rival the iron trade, has fairly been commenced.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

In the early part of this week the warrant market was much depressed by rumours that it was unlikely the policy of restriction would be continued beyond the end of next month, when the agreement between the Cleveland and Scotch ironmasters expires. Although there was no reliable authority for this statement, it was at the same time used with considerable effect, and added to the rise in the bank rate, induced large realisations of warrants, and a decline of about 1s. per ton in prices. The market has since been steadier, and the good trade which is being done leads to the belief that quotations are not likely to decline further at present. The ironmasters met on Wednesday, and expressed themselves ready to renew the agreement, and an adjournment took place for a week. The past week's shipments amounted to 14,083 tons, as compared with 13,258 in the preceding week and 10,965 in the corresponding week of last year. There has been more inquiry, both from the Continent and the United States, and a marked reduction of freights to America is favourable to a further development of the trade in that direction. Cleveland iron is also being imported in larger quantity, the demand for the raw material being very good at the manufactured ironworks. In the course of the week the stock of pig iron in Messrs. Connal and Co.'s Glasgow stores has been reduced by about 800 tons.

Business was done in the warrant market on Friday morning at from 49s. 9d. to 49s. 11½d. cash, and 49s. 10½d. to 50s. 1½d. one month, the afternoon quotations being 50s. 1d. to 50s. 3d. cash, and back to 50s., and 50s. 2½d. to 50s. 5d. one month. The market was dull on Monday morning, with transactions at 50s. 1d. to 50s. 3d. cash, and 50s. 3d. to 50s. 5d. one month. In the afternoon the quotations were 50s. ½d. to 50s. 1½d., and down to 49s. 9d. cash, and 50s. 3d. down to 49s. 11d. one month. On Tuesday forenoon business was done at 50s. to 49s. 11½d., and 50s. 1½d. one month, and 49s. 9d. to 49s. 11d. cash, the transactions in the afternoon being at 49s. 10½d. cash, and 50s. to 50s. ½d. one month. On Wednesday business was done between 49s. 10d. and 50s. 1d. cash, and at 50s. 3d. one month. To-day—Thursday—transactions took place at 50s. 1d. to 50s. 3d. cash, and 50s. 4d. to 50s. 5½d. one month.

Makers' prices do not show much alteration on those of last week, the figures being as follows :—Gartsherrie, f.o.b. at Glasgow, per ton, No 1, 62s.; No. 3, 54s. 6d.; Coltness, 65s. 6d. and 55s. 6d.; Langloan, 63s. 6d. and 56s.; Summerlee, 62s. 6d. and 54s.; Calder, 62s. 6d. and 53s. 6d.; Carnbroe, 55s. 6d. and 52s.; Clyde, 55s. and 52s.; Monkland, Quarter and Govan, each 52s. and 50s. 6d.; Shotts, at Leith, 63s. 6d. and 56s.; Carron, at Grangemouth, 53s.—specially selected, 56s.—and 56s.; Kinneil, at Bo'ness, 51s. 6d. and 50s. 6d.; Glengarnock, at Ardrossan, 55s. 6d. and 52s.; Eglinton, 53s. and 51s. 6d.; Dalmellington, 53s. and 52s.

The members of the Mining Institute of Scotland held their annual meeting at Stirling on Saturday, under the presidency of Mr. Ralph Moore, inspector of mines. There were about sixty gentlemen present. A paper was read by Mr. Alex. M'Callum, Niddrie Colliery, illustrated by a model and diagram, "on a New System of Colliery Signals," which he had designed to answer the great depth of the Niddrie pits. The apparatus consisted of an endless chain operating on bells, which could be rung by means of levers fixed at different points in the engine plane, and it was stated that it was suited for all kinds of collieries. Mr. J. T. Robson, assistant inspector of mines, afterwards read a paper on "Explosions of Fire-damp." Meteorological influence, he said, had a certain effect on the conditions of mines, but it was doubtful whether they would affect a mine which was thoroughly ventilated to an extent sufficient to make it dangerous. Where experience had proved the necessity for the exclusion of naked lights, he held that blasting should also be dispensed with wherever practicable. He advocated the great importance of discipline in the mines. While it had not been proved that coal dust had been the sole explosive in any one instance, there did not seem room for doubt that it had been an active agent in some of the larger explosions of the kingdom, and the latest experiment made in England appeared to show that the dangers from that source might be greatly diminished, and apparently without injury to the roads, by an application at intervals of common salt.

The imports of iron ore from Spain are at present upon an extensive scale, no less than 12,500 tons having been discharged at Glasgow from Bilbao in the course of the past week. The hematite trade has, however, been a little quieter, and the prices not quite so firm as those which recently prevailed.

There is a gratifying continuance of activity in the various branches of the manufactured iron trade. The coal trade is active.

The miners of Fife and Clackmannan have directed their secretary to communicate with the employers, asking an advance of wages.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

Tredegar has made its start in steel, and a fine quality of ingot has been turned out. There has been a good deal of time expended in converting the works into a steel making establishment; but the time and capital have been well expended, and I shall expect to hear of substantial results. A good deal of interest was shown last week, when it was known that Plymouth works and collieries remained unsold. Mr. Hankey, as mortgagee, has now no other course than to keep the collieries going himself or effect a private sale. It is understood that he is anxious to dispose of the property, and now that the iron and steel trades are so brisk, and the coal trade prosperous, there may be a good opening to do the latter. As an ironworks, I fancy Plymouth has seen its day, though the bar trade might be revived, and the place is well adapted for tinplate, which is in better condition than it was a month ago. Mr. Hankey has been in the district for several weeks maturing his plans, I imagine, and has appointed a colliery manager who holds high position as a mining engineer—Mr. Bayliss. It is reported that the Messrs. Crawshay are on the eve of concluding negotiations for the Newbridge Rhondda Colliery, one of the largest and most important coal areas in the Rhondda when completed.

A good deal of activity characterises the steel trade, though prices are yet low. Our ironmasters have no reason to be ashamed of their books, most of them being tolerably full.

I note that there has been a falling off in coal traffic to London during the past month; taking the month of last year into comparison the decrease is 136,630 tons. Taking the last three months, however, there is an improvement, and during July 534,432 tons were sent from Wales. In May the quantity was 506,378. A good deal of this was from the Aberdare Valley.

Small Twin-screw Steamers for the Argentine Republic.—In November of last year the Consul-General of France for the above Republic entered into a contract with Messrs. Edwards and Symes, shipbuilders and engineers, Cubitt Town, London, E., for the construction of four iron light-draught twin-screw steamers. Notice of the trial trip of the first of these steamers appeared in our impression of June 16th. The remaining three are much smaller, being only 60ft. long, 12ft. beam, and 6ft. deep, with raised quarterdeck and forecastle, and fitted with bilge keels. One of these—the Mendoza—proceeded down the river on the 29th ult. to the measured knot at Long Reach for her official trial trip, which was most satisfactory. The mean draught of water is only 3ft., and on this very light draught the mean speed of 9·83 knots on four consecutive runs was attained, realising more than the contract speed and the expectation of the builders. The propelling machinery consists of two sets of compound surface-condensing engines, high-pressure cylinder 8in. diameter, and low-pressure 14in. diameter, each set driving a screw 3ft. 5in. in diameter. The engines are supplied with steam from an ordinary marine return tube boiler, which maintained a pressure of 85 lb. throughout the trial, driving the engine 225 revolutions per minute, the vacuum in both condensers being 25in.

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.

15th August, 1882.

3880. Leather, J. Johnson.—(*A. G. Fell, New York.*)
3881. Electric Lamps, F. R. Welles.—(*C. E. Scribner and W. R. Patterson, Chicago.*)
3882. Telephonic Apparatus, F. R. Welles.—(*C. E. Scribner and W. R. Patterson, Chicago.*)
3883. Hats, S. Taylor, Hazelgrove, and R. Wallwork, Manchester.
3884. Boots and Shoes, W. Morgan-Brown.—(*H. R. Adams, Boston, U.S.*)
3885. Car Wheels, W. Morgan-Brown.—(*G. W. Miltimore, Chicago.*)
3886. Spanners, J. Brown, Liverpool.
3887. Axles, &c., J. Mackay, Liverpool.
3888. Lubricating Apparatus, W. R. Lake.—(*T. Holland, Troy, U.S.*)
3889. Photographic Cameras, E. Edwards.—(*P. Rouaix, Paris.*)
3890. Pistons, R. R. Gubbins, New Cross.
3891. Basic Materials, H. Ulsmann, Prussia.
3892. Compound for Butter, H. J. Haddan.—(*S. A. Cochran, U.S.*)
3893. Secondary Batteries, H. J. Haddan.—(*H. Aron, Berlin, Germany.*)
3894. Toys, J. Fleischmann.—(*L. Muth, Berlin.*)
3895. Cigars, S. W. Wood, Cornwall, U.S.
3896. Malt Liquors, L. Varicas.—(*F. Gent, Indiana.*)
3897. Hot-blast Stoves, B. Ford, Middlesbrough, and J. Moncur, Cumberland.
3898. Looms, S. Hollinrake, Burnley.
3899. Cutting Machinery, W. Lake.—(*C. Albro, U.S.*)
3900. Grates, W. I. Henry, London.
3901. Fountain Pens, J. Nadal, London.
3902. Hoisting Machines, W. R. Lake.—(*J. H. Lidgerwood, Morristown, U.S.*)
3903. Carriage Axles, W. Lake.—(*W. Varley, U.S.*)
3904. Bleaching, C. Toppan, Salem, U.S.
3905. Intensifying Colours, C. Toppan, Salem, U.S.
3906. Electric Light, W. R. Lake.—(*P. Tihon and E. Rézard, France.*)

16th August, 1882.

3907. Cigars, O. W. T. Barnsdale, Nottingham.
3908. Gases, W. Sutherland, Birmingham.
3909. Roads, &c., W. Thompson.—(*A. d'Alma, Paris.*)
3910. Substitute for Starch, R. Edwards, Liverpool.
3911. Igniting Fuses, W. Bickford-Smith and G. J. Smith, Tuckingmill, Cornwall.
3912. Strengthening, &c., Electric Currents, P. Adie and W. Simpson, London.
3913. Baking-ovens, J. R. Chibnall, Hammersmith.
3914. Steam Engines, P. Armington, Lawrence, U.S.
3915. Fire-escapes, J. Kennedy, Strabane, Ireland.
3916. Screw Gill-boxes, D., H., & W. Smith, York.
3917. Disinfecting, C. Lowe and J. Gill, Manchester.
3918. Bookholders, H. J. Allison.—(*R. Lambie, U.S.*)
3919. Coffins, S., J., and R. Turner, Rochdale.
3920. Balances, H. J. Haddan.—(*F. A. Roeder, U.S.*)
3921. Fabrics, S. Fisher, London.
3922. Check-reins, A. Clark.—(*H. Harding, Canada.*)
3923. Furnaces, T. Fletcher, Warrington.
3924. Propelling Tram-cars, O. Mobbs and L. G. Moore, Northampton.
3925. Air Vessels, A. H. Williams, Peckham.
3926. Spring Mattresses, W. R. Lake.—(*G. Gale, Canada.*)
3927. Rope Tramways, H. Smith.—(*A. Hallidie, U.S.*)
3028. Steps, C. A. Jones, Gloucester.
3929. Heating Baths, H. Darby, London.
3930. Water-waste Preventer, G. Henderson and D. McNeil, London.

17th August, 1882.

3931. Holding Forgings, A. Mure, Glasgow.
3932. Fireproof Liquid, W. Astrop and R. Ridgway, Homerton.
3933. Safety Apparatus, T. Neuray, Liege, Belgium.
3934. Ring Spinning Machinery, J. McGregor, Manchester.
3935. Shaping Machine, A. T. Graham and A. Frost, Stafford.
3936. Supporting Bottoms of Pantaloons, W. Brierley.—(*R. Kindler, Germany.*)
3937. Meters, J. T. Dann.—(*A. Schmid, Zurich.*)
3938. Washing Gas, S. Holman, London, and C. Hunt, Birmingham, Warwick.
3939. Chineeing Textiles, W. A. Barlow.—(*V. L. Godefroy and L. Lanselle, Paris.*)
3940. Connecting Tappits, J. Bywater and C. Bedford, Rirstall, near Leeds.
3941. Secondary Batteries, N. Cookson, Newcastle.
3942. Pumps, W. B. Tibbits, Clifton.
3943. Separating Cream from Milk, D. Baynes.—(*P. H. McIntosh, Canada.*)
3944. Sash Fasteners, G. J. Dickson, Albany, U.S.
3945. Ventilating Stacks, F. Bust, Winterton.
3946. Receiving Signals, B. H. Chameroy, France.
3947. Busts, G. G. Tanner, Homerton.
3948. Looms, C. Catlow, Burnley.
3949. Supplying Electricity, T. J. Handford.—(*T. A. Edison, New Jersey, U.S.*)
3950. Dynamo-electric Machines, S. Z. de Ferranti and A. Thompson, London.

18th August, 1882.

3951. Water Motors for Generating Electricity, S. S. Allin, London.
3952. Gas Stoves, J. Norman and A. Wortley, London.
3953. Dredging Machinery, H. C. Löbnitz.—(*H. Hersent, Paris, France.*)
3954. Fibrous Substances, P. J. Friedrichs.—(*G. W. Stuvinga, Ter Apel, Groningen, Netherlands.*)
3955. Incandescent Electric Lamps, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
3956. Artificial Stone or Marble, J. H. Johnson.—(*Certaldo Marble Company, Limited, Paris, France.*)
3957. Automatic Pump, E. T. Hughes.—(*Automatic Boiler and Engine Company, New Haven, U.S.*)
3958. Casting and Mixing Metals, J. A. B. Bennett, King's Heath, and B. P. Walker, Birmingham.
3959. Locks, G. J. Dickson, Albany, U.S.
3960. Heating Water, M. M. Brophy, London.
3961. Secondary Batteries, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
3962. Rollers for Spinning, B. J. B. Mills.—(*L. Cunit and J. Culty, St. Etienne, France.*)
3963. Musical Instruments, R. Whalley, Liverpool.
3964. Secondary Batteries, H. T. Barnett, London.
3965. Piercing Holes in Slates, S. Cornforth, Birmingham.
3966. Folding Cases for Furniture, E. P. Alexander.—(*A. F. Potts, Indianapolis, U.S.*)
3967. Watch-chains, A. M. Clark.—(*W. C. Edge, U.S.*)
3968. Hosiery Machines, W. Harrison, Manchester.

19th August, 1882.

3969. Fixing Sheets of Glass, J. Chaffin, Bath.
3970. Machines for Reeling Tobacco, D. and J. Macdonald, Glasgow.
3971. Compositions for Coating Wires, C. J. Allport, London, and R. Punshon, Brighton.
3972. Utilising Heat Contained in Slag, &c., Substances while in a Molten State, G. H. Blenkinsop, Swansea.
3973. Churns, W. McCausland, Belfast.
3974. Dynamo-electric Power-creating Machines, J. E. T. Woods, London.
3975. Secondary Batteries, &c., J. Woods, London.
3976. Electric Lights, T. Handford.—(*T. Edison, U.S.*)
3977. Manufacturing Ammonia, &c., D. Urquhart.—(*L. Playfair, New York, U.S.*)
3978. Furnaces for Reducing, &c., Certain Ores, J. Imray.—(*J. Newbery, J. Morley, and B. Cleveland, Melbourne.*)
3979. Driving Mechanism for Tricycles, &c., W. S. Lewis, Wolverhampton.
3980. Insulation of Wires, &c., J. H. Johnson.—(*J. M. Hirsch, Chicago, U.S.*)
3981. Steam Engines, J. Shanks & J. Lyon, Arbroath.
3982. Electric Signalling Apparatus, R. H. Brandon.—(*H. W. Southworth, Springfield, U.S.*)
3983. Making Bore-holes, J. Waddington and C. Longbottom, Barrow-in-Furness, and J. Ashworth, Dalton-in-Furness.
3984. Tailors' Marking Instruments, H. Searle, London, and T. J. Ironside, Forest-hill.
3985. Grinding Mills, W. Wingfield-Bonnyn, London.
3986. Connecting, &c., Rolling Stock, F. Barnes, Reading.
3987. Utilising Galvanisers' Flux, H. Kenyon, Altrincham.
3988. Raising Sunken Vessels, J. E. Hunter and J. H. Thomas, London.
3989. Pressure-gauges for Steam, &c., G. E. Vaughan.—(*A. Firmston and W. Houston, Paris, France.*)
3990. Facilitating Lighting of Fires, &c., E. Tomlinson, London.
3991. Incandescing Conductors for Electric Lamps, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
3992. Rotary Engines, J. M. X. Terlinden, Berlin.
3993. Door-mat, &c., J. Hopewell, Salford.

21st August, 1882.

3994. Mottled Soap, A. Headley, Gosforth.
3995. Underground Conductors, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
3996. Dynamo, &c., Machines, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
3997. Manufacture of Solid Cumidine, C. D. Abel.—(*Actien Gesellschaft für Anilin Fabrikation, Berlin.*)
3998. Lamps, G. B. Lloyd, Birmingham.
3999. Recovering Caustic Soda, G. Johnson.—(*T. Gibb, Elizabeth, U.S.*)
4000. Rendering Wall Paintings Weather-proof, A. Keim, Munich, Germany.
4001. Rotary Engines, &c., A. W. L. Reddie.—(*N. Tverskoy and P. Weiner, St. Petersburg, Russia.*)
4002. Kitchen, &c., Ranges, R. W. Crabtree, Leeds.
4003. Diminishing Fire Risks, S. Thompson, Bristol.
4004. Brewing, F. E. Whitham, Bradford.
4005. Non-conducting Tubes, J. C. Marsh and R. J. Smith, London.
4006. Velocipedes, J. Stassen, jun., London.
4007. Continuous Centrifugal Machines, F. Wirth.—(*C. von Bechtolsheim, Munich, Germany.*)
4008. Indicating Position of Sunken Ships, W. R. Lake.—(*M. F. Nässjö, Sweden.*)
4009. Barrels, W. R. Lake.—(*N. Myers, New York, U.S.*)
4010. Construction of Cannon, R. H. Brandon.—(*W. E. Woodbridge, Washington, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

3872. Folding Chairs, W. R. Lake, Southampton-buildings, London.—A communication from F. G. Johnson, Brooklyn, and J. H. Hayward, Northfield, U.S.—*14th August*, 1882.
3879. Type-setting, E. W. Brackelsberg, Westphalia, Prussia.—*14th August*, 1882.
3881. Electric Lamps, F. R. Welles, Antwerp, Belgium.—A communication from C. E. Scribner and W. R. Patterson, Chicago, Illinois, U.S.—*15th August*, 1882.
3882. Telephonic Apparatus, F. R. Welles, Antwerp, Belgium.—A communication from C. E. Scribner, and W. R. Patterson, Chicago, Illinois, U.S.—*15th August*, 1882.
3896. Malt Liquors, L. Varicas, Russell-square, London.—A communication from J. F. Gent, Columbus, Indiana, U.S.—*15th August*, 1882.
3904. Bleaching, C. Toppan, Salem, U.S.—*15th August*, 1882.
3905. Intensifying Colours, C. Toppan, Salem, U.S.—*15th August*, 1882.
3914. Steam Engines, P. Armington, Lawrence, U.S.—*16th August*, 1882.
3920. Balances, H. J. Haddan, London.—A communication from F. A. Roeder, Cincinnati, U.S.—*16th August*, 1882.
3944. Sash Fasteners, G. J. Dickson, Albany, U.S.—*17th August*, 1882.
3959. Locks, G. J. Dickson, Albany, U.S.—*18th August*, 1882.
3962. Rollers for Spinning, B. J. B. Mills, London.—A communication from L. Cunit and J. Culty, St. Etienne, France.—*18th August*, 1882.
3967. Watch-chains, A. M. Clark, London.—A communication from W. C. Edge, Newark, U.S.—*18th August*, 1882.

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

3295. Preparing Food for Cattle, J. Y. Betts, Coventry.—*15th August*, 1879.
3296. Driving Mechanism of Locomotive, &c., Engines, S. Geoghegan, Dublin.—*15th August*, 1879.
3300. Woven Fabrics, D. Scott, Manchester, and J. Edelston, Preston.—*15th August*, 1879.
4373. Matches, H. Wildt, Bradford.—*27th October*, 1879.
3438. Deep Sea Fishing, J. W. de Caux, Great Yarmouth.—*26th August*, 1879.
3448. Straining Pulp, J. and R. Wood, Leith.—*27th August*, 1879.
3461. Breaking &c., Stone, G. Dalton, Leeds.—*28th August*, 1879.
3467. Propelling Carriages, G. Dalton and W. E. Kenworthy, Leeds.—*28th August*, 1879.
4375. Heilmann Combing Machine, A. M. Clark, London.—*27th October*, 1879.
3479. Electric Signalling Apparatus, W. Robinson, Boston, U.S.—*29th August*, 1879.
3555. Burners for Gas, &c., Lamps, F. Siemens, Dresden.—*4th September*, 1879.
3320. Steam Steering Gear, A. Higginson, Liverpool.—*18th August*, 1879.
3325. Subaqueous Structures, for Piers, &c., S. Lake and T. W. Taylor, London.—*18th August*, 1879.
3347. Street Lamps, &c., G. Bray, Leeds.—*19th August*, 1879.
3354. Ships or Vessels, C. Tellier, Paris, France.—*20th August*, 1879.
3391. Producing Printed, &c., Matter, J. E. Jefferies, Congresbury.—*22nd August*, 1879.
3399. Ships', &c., Lamps, I. Blake, Birmingham.—*23rd August*, 1879.
3531. Manufacture of Steel, S. G. Thomas, London.—*3rd September*, 1879.
3352. Metallic Boxes, &c., C. R. E. Grubb, London.—*19th August*, 1879.

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

2880. Obtaining Salts of Ammonia, R. O. Paterson and F. W. Brothers, Cheltenham.—*16th August*, 1875.
3049. Drums of Rotary Screens, C. Cousins, Lincoln.—*31st August*, 1875.
2889. Attaching Heels to Boots and Shoes, &c., W. Morgan-Brown, London.—*17th August*, 1875.
3229. Preparing Cotton for Spinning, A. M. Clark, London.—*15th September*, 1875.
3404. Air Engines, J. G. Tongue, London.—*30th September*, 1875.
2923. Fitting Gussets, &c., of Boots and Shoes, H. A. Oldershaw, London.—*19th August*, 1875.
3002. Stopping Motions for Machinery, J. Bullough and J. Smalley, Accrington.—*26th August*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 8th September, 1882.

1798. Boxes for Samples by Post, M. I. Verkouteran, London.—Com. from R. Chapin.—*8th April*, 1882.
1732. Sectional Warping Machines, J. C. Sewell, E. Hulton, & J. Bethel, Manchester.—*12th April*, 1882.
1750. Sheet Lead, W. Burr, Long-Ditton.—*13th April*, 1882.
1751. Window-cleaning Chairs, W. Thompson, Liverpool.—Com. from A. Dormitzer.—*13th April*, 1882.
1757. Water Gauges, J. Thurlow and A. Sykes, Wakefield.—*13th April*, 1882.
1758. Billiard Marking, P. Mara, Putney, and J. Winson, London.—*13th April*, 1882.
1767. Disengaging Boats, F. G. Crofton, Kingstown.—*13th April*, 1882.
1769. Secondary Batteries, J. H. Johnson, London.—A com. from C. Faure.—*13th April*, 1882.
1789. Treating Magmas, W. H. Beck, London.—A communication from C. Violette, A. Buisine, and A. Vinchon.—*14th April*, 1882.
1792. Ventilators, A. W. L. Reddie, London.—A communication from A. Huber.—*14th April*, 1882.
1800. Braces, C. D. Abel, London.—A communication from J. W. Höltring.—*15th April*, 1882.
1802. Obtaining Motive Power, G. Wilson, Brixton.—*15th April*, 1882.
1804. Traction Engines, H. G. and W. Woodbridge, Chipping, Sodbury.—*15th April*, 1882.
1805. Locks, A. Budenborg and A. Timpè, Manchester.—*15th April*, 1882.
1807. Preparing Fabrics, S. Fulda, Bow.—*15th April*, 1882.
1822. Electric Lamps, A. S. Church, London.—A communication from J. King.—*15th April*, 1882.
1825. Pistons, G. W. von. Nawrocki, Germany.—A com. from P. Langenstein.—*17th April*, 1882.
1859. Velocipedes, H. E. Newton, London.—A communication from A. Winkler.—*18th April*, 1882.
1884. Separating Metals, W. R. Lake, London.—A communication from E. Marchose.—*19th April*, 1882.
1941. Crystallised Hydrochlorate, W. R. Lake, London.—Com. from T. Gladysz.—*24th April*, 1882.
1950. Coke Ovens, R. de Soldenhoff, Merthyr Tydfil.—*25th April*, 1882.
1985. Low-water Alarm Apparatus, J. W. Kenyon, Manchester.—*27th April*, 1882.
2021. Cleaning Wool, &c., E. Mansfield, London.—*28th April*, 1882.
2180. Recording Distances, G. C. Lilley, London.—*9th May*, 1882.
2369. Bulge Barrel Machines, E. G. Brewer, London. A com. from R. Hinchliffe.—*19th May*, 1882.
2971. Furnaces, R. Potter, Stairfoot.—*22nd June*, 1882.
3039. Galvanic Batteries, C. P. Nézeraux, Paris.—*28th June*, 1882.
3189. Separating Products, W. Ferrie, N.B.—*6th July*, 1882.
3232. Cameras Stands, J. F. Plucker, Antwerp.—*7th July*, 1882.
3293. Cigarettes, W. R. Lake, London.—A communication from C. and W. Emery.—*11th July*, 1882.
3301. Preserving Ships from Corrosion, T. S. Webb, London.—*12th July*, 1882.
3418. Electric Arc Lamps, S. Ferranti and A. Thompson, London.—*18th July*, 1882.
3460. Crank-shafts, D. Purves, London.—*20th July*, 1882.
3571. Breaking Stone, G. Dalton, Leeds.—*27th July*, 1882.

Last day for filing opposition, 12th September, 1882.

1812. Tricycles, &c., W. Morgan, Birmingham.—*17th April*, 1882.
1813. Traps for Catching Rats, &c., E. A. Brydges, Upton.—Com. from E. d'Aubigny.—*17th April*, 1882.
1826. Process Used in Refining Metals, W. Barlow, London.—Com. from J. Seyboth.—*17th April*, 1882.
1828. Securing Sliding Window Sashes, A. Smith, Huddersfield.—*17th April*, 1882.
1829. Looms for Weaving, W. McNichol, Batley, and J. Hollingworth, Dobcross.—*17th April*, 1882.
1831. Reducing and Purifying Metals, R. S. Ripley, London.—*17th April*, 1882.
1832. Regulating Automatic Lubricators, W. A. Barlow, London.—A communication from F. Holtschmidt.—*17th April*, 1882.
1833. Lixiviating Vegetable Materials, C. Heckmann and E. Hausbrand, Paris.—*18th April*, 1882.
1841. Stretchers for Trousers, T. H. Harris, London.—*18th April*, 1882.
1854. Direct-acting Ram Hydraulic Lifts, J. S. Steven and C. Major, Battersea.—*18th April*, 1882.
1897. Pump, A. Browne, London.—A communication from C. F. Osborne.—*20th April*, 1882.
1957. Steering Steamships, A. W. L. Reddie, London.—A com. from J. Ericsson.—*25th April*, 1882.
2000. Life-saving Appliances, D. P. P. de la Sala, London.—*27th April*, 1882.
2017. Manufacture of Mosaics, H. Haddan, London.—A com. from G. Stanley.—*28th April*, 1882.
2018. Gear-cutting Machines, H. J. Haddan, London.—A com. from A. H. Brainard.—*28th April*, 1882.
2038. Weaving Fancy Fabrics, J. Hamilton, Strathaven.—*29th April*, 1882.
2039. Pens and Holders, M. Fisher, Germany.—*29th April*, 1882.
2058. Gas Engines, A. N. Porteous, Edinburgh.—*1st May*, 1882.
2202. Motor Engines Worked by Gas, S. Clayton, Bradford.—*10th May*, 1882.
2734. Governing Feed of Electric Arc Lights, J. Mathieson, Stratford.—*10th June*, 1882.
2963. Mules for Spinning Fibres, J. S. Cooke and A. Hardwick, Liversedge.—*22nd June*, 1882.
3252. Bottles for Aerated Liquids, H. Codd, London, and D. Rylands, Barnsley.—*8th July*, 1882.
3329. Reproducing Designs, W. P. Bruce, Kinleith Currie.—*13th July*, 1882.
3346. Boot-sewing Machines, W. R. Lake, London.—A com. from W. H. Alden.—*14th July*, 1882.
3434. Electric Meters, C. V. Boys, Wing.—*19th July*, 1882.
3436. Engine Power Meters, C. V. Boys, Wing.—*19th July*, 1882.
3438. Connecting Switches to Railway Rails, J. Pickering, London.—*19th July*, 1882.
3471. Knives and Forks, H. Fielding, Birmingham.—*21st July*, 1882.
3507. Constructing Railway Chairs, J. Revell, Dukinfield.—*24th July*, 1882.
3512. Buoyant, &c., Garments, F. W. Brewster, London.—*25th July*, 1882.
3541. Producing Methylquinoline from Ortho-nitro-benzylidenacetone, J. Erskine, Glasgow.—A communication from the Farbwerke vorm. Meister, and Bruning.—*26th July*, 1882.
3555. Watchmen's Tell-tales, C. R. F. Schloesser, Manchester.—A communication from Messrs. Kreutz and Bauer.—*27th July*, 1882.
3589. Manufacture of Casks, &c., S. Wright, Egremont.—*28th July*, 1882.
3591. Electric Power Machine, J. Imray, London.—*28th July*, 1882.
3617. Flour-dressing Machines, W. B. Dell, London.—A com. from G. T. Smith.—*31st July*, 1882.
3627. Weft Stop-motion for Looms, H. Haddan, London.—A com. from L. J. Knowles.—*31st July*, 1882.
3629. Weft Stop-motion for Looms, H. Haddan, London.—A com. from L. J. Knowles.—*31st July*, 1882.
3881. Electric Lamp Conductors, F. R Welles, Antwerp.—A communication from C. E. Scribner and W. R. Patterson.—*15th August*, 1882.
3882. Telephonic Apparatus, F. R. Welles, Antwerp.—A communication from C. E. Scribner and W. R. Patterson.—*15th August*, 1882.

3896. BREWING MALT LIQUORS, L. Varicus, London.—A com. from J. F. Gent.—15th August, 1882.
3944. SASH FASTENERS, G. J. Dickson, Albany, U.S.—17th August, 1882.
3959. LOCKS, G. J. Dickson, Albany, U.S.—18th August, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 18th August, 1882.*)

20. STITCHING MACHINES, J. Day, Stafford.—3rd January, 1882.
463. TANNING HIDES, W. R. Lake, London.—30th January, 1882.
807. DRYING WOOL, J. B., C. H., and W. Whiteley Lockwood.—20th February, 1882.
812. SOLID LYE, W. H. Beck, London.—27th February, 1882.
821. ELECTRIC TELEGRAPHS, C. N. Talbot, New York, U.S.—20th February, 1882.
848. VELOCIPEDES, J. Humpage, Bristol.—21st February, 1882.
849. GLASS REFLECTORS, F. H. F. Engel, Hamburg.—21st February, 1882.
851. FILES FOR HOLDING LETTERS, &c., R. Settin, Birmingham, and H. Dyer, Bridgwater.—21st February, 1882.
855. MOULDING MACHINES, F. Wirth, Germany.—21st February, 1882.
856. GENERATING ELECTRICITY, J. S. Williams, U.S.—22nd February, 1882.
865. TREATING HAIR FELT, J. Forsyth, Glasgow.—22nd February, 1882.
869. DYNAMO-ELECTRIC MACHINES, C. E. Spagnoletti, London.—22nd February, 1882.
807. RESERVOIR PENHOLDER, O. Bussler, London.—23rd February, 1882.
884. GRIPPERS, J. Hardaker, Leeds.—23rd February, 1882.
887. DIFFUSING ARTIFICIAL LIGHT, J. R. Smith and J. I. Learoyd, Halifax.—23rd February, 1882.
896. FRICTIONAL WHEEL GEARING, W. R. Lake, London.—24th February, 1882.
976. DRILLING ROCKS, W. R. Lake, London.—28th February, 1882.
998. RING SPINNING FRAMES, S. Brooks, Manchester, and A. Holden, Gorton.—2nd March, 1882.
1028. INDICATING FOR PUMPING ENGINES, H. Davey, Headingly.—3rd March, 1882.
1064. DISTRIBUTING MANURE, H. A. Bonneville, London.—6th March, 1882.
1072. ORDNANCE CARRIAGES, T. Nordenfelt, London.—6th March, 1882.
1197. DECORTICATING RICE, A. M. Clark, London.—11th March, 1882.
1218. KNIFE CLEANERS, H. Beech, London.—14th March, 1882.
1313. COAL GAS, R. Morton and C. G. Williams, London.—18th March, 1882.
1874. PRODUCING GAS, W. C. Brown, Sheffield.—19th April, 1882.
2254. PILE FABRICS, T. Anderson, Liversedge.—13th May, 1882.
2270. GALVANIC BATTERIES, R. H. Simons, Brixton.—15th May, 1882.
2604. INCANDESCENT ELECTRIC LAMPS, F. des Vœux, Derby.—2nd June, 1882.
2644. ELECTRICAL CONDUCTORS, L. Varicas, London.—6th June, 1882.
2722. SECONDARY BATTERIES, A. P. Price, London.—9th June, 1882.
2890. LOCOMOTIVE ENGINES, G. Allan and R. E. Dickinson, Sheffield.—19th June, 1882.
2904. TAPS AND VALVES, J. Nixon, Oldham.—20th June, 1882.

(*List of Letters Patent which passed the Great Seal on the 22nd August, 1882.*)

874. MECHANISM FOR MAKING WROUGHT NAILS, J. Maynes, Manchester.—23rd February, 1882.
881. WOOL-COMBING MACHINES, W. R. Lake, London.—23rd February, 1882.
885. TREATING SULPHO-ARSENICAL, &c., ORES, W. A. Barlow, London.—23rd February, 1882.
916. MACHINES FOR FOLDING PAPER, H. M. Nicholls, London.—25th February, 1882.
921. MANUFACTURE OF SULPHATE OF AMMONIA, J. Dempster, Elland.—25th February, 1882.
922. TRANSMITTING, &c., SIGNALS, A. F. St. George, London.—25th February, 1882.
926. CONSTRUCTING OMNIBUSES, A. G. Margetson and W. S. Hek, Bristol.—25th February, 1882.
927. LUBRICATING ENGINES, J. J. Royle, Manchester.—25th February, 1882.
932. TEMPERING HACKLE PINS, T. Crabtree, Leeds.—25th February, 1882.
933. COMPASS CORRECTORS, J. J. Wilson, Sunderland.—25th February, 1882.
936. CARPETS, J. J. Delmar and W. Folliott, London.—27th February, 1882.
941. CONTROLLING SPEED OF ENGINES, J. Richardson, Lincoln.—27th February, 1882.
948. LAMPS AND BURNERS, P. Molloy, Limerick.—27th February, 1882.
952. COMPRESSION PUMPS, C. D. Abel, London.—27th February, 1882.
953. CENTRIFUGAL APPARATUS, C. D. Abel, London.—27th February, 1882.
954. APPARATUS FOR PRODUCING ICE, C. D. Abel, London.—27th February, 1882.
956. VENTILATING APPARATUS, C. D. Abel, London.—27th February, 1882.
958. CUTTING, &c., PAPER, W. W. Colley, London.—27th February, 1882.
964. STEERING SHIPS, &c., T. F. Walker, London.—28th February, 1882.
974. FANS, C. Cockson, Wigan.—28th February, 1882.
981. TREATING DYNAMITE, W. Howitt, Ilford.—28th February, 1882.
984. HOSE COUPLINGS, J. C. Hudson, London.—1st March, 1882.
987. SAVING LIFE AT SEA, &c., W. Wilkins, Tunbridge Wells.—1st March, 1882.
1020. TRANSMITTING, &c., SOUND, J. Rapieff, London.—3rd March, 1882.
1034. GALVANIC CHAINS, C. D. Abel, London.—3rd March, 1882.
1035. STOPPERING BOTTLES, W. W. Macvay and R. Sykes, Castleford.—3rd March, 1882.
1045. STYLOGRAPHIC, &c., PENS, J. D. Carter, London.—4th March, 1882.
1070. IMITATING NIELLO, &c., F. Wirth, London.—6th March, 1882.
1071. FOLDING CHAIR, C. D. Abel, London.—6th March, 1882.
1147. ATTACHMENT OF CARRIAGE WHEELS, &c., J. Mackay, Liverpool.—9th March, 1882.
1151. CASH COUNTERS, &c., C. D. Abel, London.—9th March, 1882.
1564. DRINKING VESSELS, J. Tams, Longton.—31st March, 1882.
1816. TREATING VEGETABLE FIBRES, C. D. Abel, London.—17th April, 1882.
1842. PRESERVING EGGS, H. H. Doty, London.—18th April, 1882.
2418. STAYS, &c., A. Ottenheimer, Stuttgart.—22nd May, 1882.
2659. PRIMARY, &c., BATTERIES, W. B. Brain, Cinderford.—6th June, 1882.
2673. MANUFACTURE OF GAS, &c., W. R. Lake, London.—7th June, 1882.
2690. BRUSHES, J. Wetter, New Wandsworth.—8th June, 1882.
2744. DYNAMO-ELECTRIC MACHINES, &c., J. Imray, London.—10th June, 1882.
2770. TWO-WHEELED VEHICLES, S. Pitt, Sutton.—13th June, 1882.
2794. GREENHOUSE BOILERS, &c., C. Hulsebërg, London.—14th June, 1882.
3132. STEAM ENGINE VALVES, A. M. Clark, London.—3rd July, 1882.

List of Specifications published during the week ending August 19th, 1882.

3880*, 4d.; 5477, 6d.; 5483, 8d.; 5496, 4d.; 5672, 4d.; 11, 6d; 36, 10d.; 87, 6d.; 88, 4d.; 108, 4d.; 111, 8d.; 130, 1s. 6d.; 147, 6d.; 149, 6d.; 151, 6d.; 157, 8d.; 158, 8d.; 165, 6d.; 166, 6d.; 169, 8d.; 170, 6d.; 171, 6d.; 178, 6d.; 182, 8d.; 189, 6d.; 190, 6d.; 191, 9d.; 194, 2d.; 195, 6d.; 200, 4d.; 201, 6d.; 203, 6d.; 208, 6d.; 210, 4d.; 214, 6d.; 215, 4d.; 216, 6d.; 218, 6d.; 219, 8d.; 221, 6d.; 222, 6d.; 225, 4d.; 228, 2d.; 229, 2d.; 230, 2d.; 231, 6d.; 232, 6d.; 233, 6d.; 234, 6d.; 235, 6d.; 236, 4d.; 237, 2d.; 238, 6d.; 241, 6d.; 243, 2d.; 244, 2d.; 245, 6d.; 246, 6d.; 247, 4d.; 248, 4d.; 251, 6d.; 252, 6d.; 253, 6d.; 254, 6d.; 256, 2d.; 257, 6d.; 258, 1s.; 259, 8d.; 260, 2d.; 261, 2d.; 262, 1s. 2d.; 263, 6d.; 265, 2d.; 267, 6d.; 272, 2d.; 273, 6d.; 274, 2d.; 275, 6d.; 276, 6d.; 278, 6d.; 279, 2d.; 280, 4d.; 281, 8d.; 282, 6d.; 283, 6d.; 285, 8d.; 286, 6d.; 288, 6d.; 289, 4d.; 290, 2d.; 291, 2d.; 292, 6d.; 293, 4d.; 294, 6d.; 295, 6d.; 296, 6d.; 298, 6d.; 299, 4d.; 301, 6d.; 302, 4d.; 306, 2d.; 307, 6d.; 309, 4d.; 310, 6d.; 311, 4d.; 312, 6d.; 314, 2d.; 315, 2d.; 316, 6d.; 317, 6d.; 318, 6d.; 321, 6d.; 323, 8d.; 325, 2d.; 349, 6d.; 351, 6d.; 357, 6d.; 392, 6d.; 440, 6d.; 460, 6d.; 877, 6d.; 1529, 6d.; 2026, 6d.; 2042, 1s.; 2303, 6d.; 2374, 6d.; 2388, 6d.; 2399, 8d.; 2416, 6d.; 2430, 6d.; 2470, 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.*

5483. GAS MOTOR ENGINES, *S. Griffin, Bath.—15th December*, 1881. 8*d.*

The slide valve to ignite the charge of explosive compound is provided with an opening at the back, *i.e.*, between the valve and cylinder to admit the air necessary to support the combustion of the igniting flame, such air then entering the ignition chamber of the valve through the same opening and on the same side of the valve as that which at a later period of its travel communicates with the interior of the cylinder for the purpose of igniting the charge. The invention further relates to means of releasing a portion of the compressed charge when starting the engine by holding the exhaust valve slightly open during part of the stroke when compressing the charge; to mechanism for regulating and governing the admission of gas to the working cylinder; to an arrangement for lubricating the piston and slide valves by means of a reciprocating wire and a wiper; and, lastly, to the mode of holding the valve cover and valve against its face by means of a spiral spring enclosed in a tube.

5496. ROVING FRAMES, &c., FOR PREPARING COTTON AND OTHER FIBRE, *J. Cryer, Dukinfield, Chester.—15th December*, 1881. 4*d.*

The object is to communicate motion to the rack, so as to be able to regulate to a nicety the tension of the yarn between the drawing rollers and the bobbins or spools. On the change or tumbler shaft is a bevel wheel gearing with a large wheel on a stud carried by a bracket bolted to the spring piece of the frame. On the boss of the large wheel is a spur pinion, gearing with a spur wheel on the cross shaft which drives the rack. A change wheel on this shaft drives the rack, and has a greater or smaller number of teeth according to the hank roving.

11. DESSICATING, BOILING, DISTILLING, &c., *A. Gontard, near Leipsic.—2nd January*, 1882. 6*d.*

This relates to apparatus for removing the water or other thin liquid parts in the form of vapour or steam from liquid or semi-liquid substances, and while applying heat or not; it also relates to apparatus for evaporating, or forming into steam, water and other liquids, and to distilling apparatus. Circular discs, either plane or corrugated, are caused to rotate in the liquid to be treated, a portion of which is lifted by the discs, and exposed to the air or other atmosphere.

36. SEWING MACHINES, *W. R. Lake, London.—3rd January*, 1882.—(*A communication from the Rotary Shuttle Sewing Machine Company, Mass., U.S.*) 10*d.*

This relates to machines with a rotary shuttle; and comprises mechanism for operating the feed; mechanism for operating the needle bar, the feed bar, and the presser foot; mechanism for driving a continuously rotating shuttle, so as to cause it to travel quick at one part of its travel; a continuously rotating shuttle with an elongated eye; a device for deflecting the needle thread from the path of the shuttle; mechanism for confining and releasing a continuously rotating shuttle in a direction at right angles to its path of rotation; an upper and lower feed bar, the latter working in one direction by and with the former, and in the other direction independently thereof by mechanism of its own; a rotary shuttle carrier to place and keep the needle in its proper line of movement; and a novel construction of race way for the rotary shuttle carrier and its shuttle.

87. VALVES AND VALVE GEAR FOR MARINE LOCOMOTIVE AND OTHER ENGINES, *J. W. Hackworth, Darlington.—7th January*, 1882. 6*d.*

This relates chiefly to improvements on patent No. 2448, A.D., 1859; No. 3237, A.D. 1869; and No. 4246,

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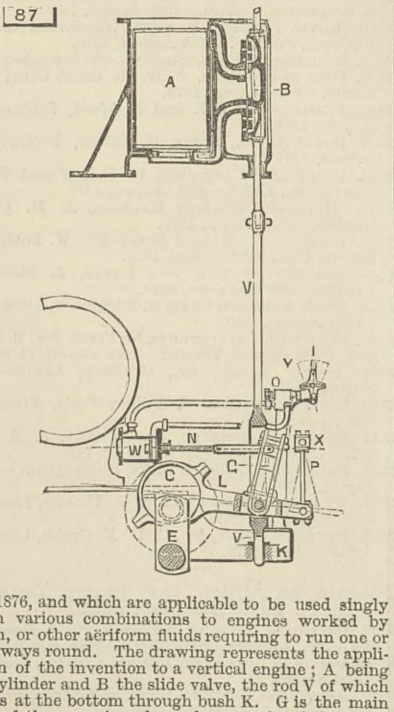

A.D. 1876, and which are applicable to be used singly or in various combinations to engines worked by steam, or other aëriform fluids requiring to run one or both ways round. The drawing represents the application of the invention to a vertical engine; A being the cylinder and B the slide valve, the rod V of which works at the bottom through bush K. G is the main lever of the reversing plane of an equal ended "grasshopper" motion working through a slot opening in valve rod with half length radius rods, connected to inside pins on the valve rod which constitutes the reverse plane. C is an excentric on the main shaft E, its L rod being suspended on the pendulum rod P swinging on pin X. W is a longitudinal section of a reversible and variable expansion cylinder connected to the top end of main lever G by links N. The valve chest O admitts the motive power to cylinder W, and is actuated by hand or by governor attached at Y.

88. CUTTING TOBACCO, *C. J. Fox, London.—7th January*, 1882. 4*d.*

This revolving block usually employed has fixed over it an adjustable block on which the cutting knife descends, and which when worn can be renewed.

108. BURNERS FOR GAS JETS, *W. P. Thompson, Liverpool.—9th January*, 1882.—(*A communication from P. Costes, Bourges, France.*)—(*Not proceeded with.*) 4*d.*

The burner is characterised by the addition of a sort of filtering box divided into many compartments by perforated diaphragms, through which the gas passes, and any impurities it may contain are arrested by the diaphragms. The compartments may be filled with burnt sponge.

111. CRUSHING, &c., MINERAL AND OTHER SUBSTANCES, *J. Spencer and J. Consterdine, near Manchester, and N. G. Kimberley, Hornsey.—9th January*, 1882. 8*d.*

This relates to edge runners or mortar mills, and consists partly in arranging the supporting or bearing surfaces, against which the spindles of the rollers revolve or slide, so as to enable their angle relatively to the vertical axis of the rollers to be varied so as to regulate the crushing and pulverising effect due to the weight of the roller. The wearing surface of the rollers are made renewable. Apparatus is combined with the mill so as to break up large pieces of minerals and deliver them to the rollers for crushing.

130. IMPROVEMENTS IN MACHINERY AND APPARATUS FOR OBTAINING, &c., ELECTRIC CURRENTS FOR ELECTRIC LIGHTING, &c., *W. T. Henley, Plaistow.—10th January*, 1882. 1*s.* 6*d.*

The First part of the invention refers to a dynamo machine, consisting of straight electro-magnets fixed in two brass standards, with a ring of iron made to revolve at each end of these magnets, the rings having recesses for coils of wire. The machine has six distinct electro-magnets revolving at each end of the fixed magnets, the polarity of which changes six times in each revolution of the ring. The inventor

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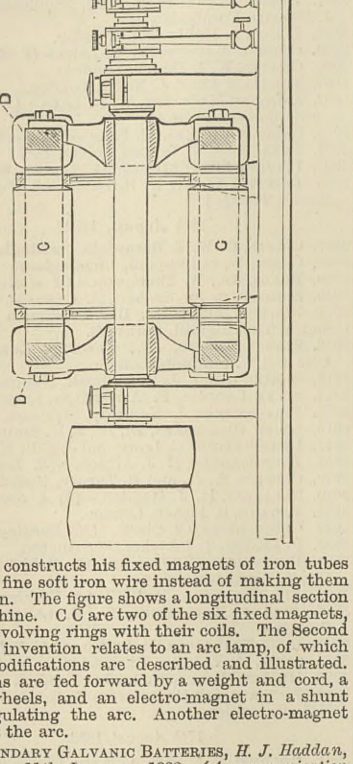

sometimes constructs his fixed magnets of iron tubes filled with fine soft iron wire instead of making them of solid iron. The figure shows a longitudinal section of the machine. C C are two of the six fixed magnets, D D the revolving rings with their coils. The Second part of the invention relates to an arc lamp, of which various modifications are described and illustrated. The carbons are fed forward by a weight and cord, a train of wheels, and an electro-magnet in a shunt circuit regulating the arc. Another electro-magnet establishes the arc.

144. SECONDARY GALVANIC BATTERIES, *H. J. Haddan, London.—11th January*, 1882.—(*A communication from Dr. E. Boettcher, Leipzig.*)—(*Not proceeded with.*) 2*d.*

Applies to the use of zinc vitriol as exciting liquid and of zinc and oxide of lead as electrodes.

147. CRANES KNOWN AS CAT-HEADS, *F. R. Ellis, Liverpool.—11th January*, 1882. 6*d.*

This consists in constructing and mounting the crane so that it can travel in and out from the warehouse, sill wall, or other place where it is erected, such motion being obtained by suitable gearing from the whimsy, jenny, winch, or other machine by which the crane is worked.

149. UMBRELLAS AND PARASOLS, *J. H. Bayzand and G. Boyle, London.—11th January*, 1882. 6*d.*

The end of the rib is provided with a double eye or two eyes, one at each side of and level with its inner face, and by means of which the silk is secured thereto. A catch is employed which serves both to hold the runner when the umbrella is open and to prevent its being pushed too far on opening.

151. CORK BRANDING MACHINES, *C. J. Leclere, Paris.—11th January*, 1882. 6*d.*

The corks are thrown into a hopper, and a feed mechanism carries them one by one down an inclined shoot to a marking appliance, against which a wheel forces the corks, which, when thus branded, are thrown out of the machine and drop into a basket.

158. SEWING MACHINES, &c., *W. R. Lake, London.—11th January*, 1882.—(*A communication from E. Thimonnier, fils, and Vernay, Paris.*) 8*d.*

This relates to a machine which produces a kind of lock-stitch with a single thread, and it consists in providing a hollow spool-holder to receive the spool and carrying a tension device to regulate the supply of thread. The holder has a slot through which the needle works, being connected to a jointed needle bar. A rotating hook surrounds the holder and causes the thread to pass above the needle so as to lock the stitch. An oscillating hook is arranged under the cloth plate, and a curved thread tightener with a hook is also pivotted under such plate. The needle has an eye near the point and a small hook a certain distance above the eye.

165. VALVES FOR PUMPS, &c., *P. Reid, Glasgow.—12th January*, 1882. 6*d.*

This relates principally to the use of teak or other

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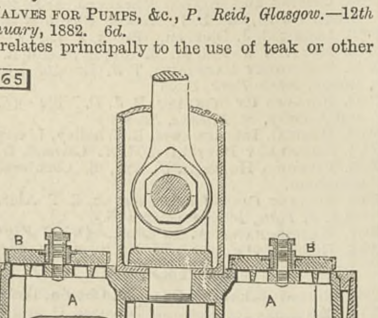

hard woods which do not bend or swell much in hot or cold liquids, for the construction of the moving parts of valves for pumps. The drawing shows a section of an air pump bucket A, for a marine steam engine fitted with hard wood valves B, and mountings applied to the upper surface of the bucket which forms their seat, instead of vulcanised india-rubber, or thick sheet rubber, as at present used.

166. INDICATING THE SPEED AND DIRECTION OF ROTATION OF ENGINE SHAFTS, *L. Swift, Westminster.—12th January*, 1882. 6*d.*

A rotary pump is used in connection with two vessels communicating with the pump barrel by separate ports, and each partly filled with a liquid and partly by air. Each vessel is connected by a pipe communicating with its air space to a gauge capable of indicating when and to what extent the pressure in one vessel differs from that in the other. The gauge scale has divisions representing the number of revolutions of the shaft for units of time that correspond with definite pressures in the vessels. Each port of the pump serves indifferently for suction or delivery according to the direction of rotation of the shaft driving the pump.

170. CABS, &c., *J. Abbott, Bideford.—12th January*, 1882. 6*d.*

The body of the vehicle is arranged so that its centre of gravity is nearly in line with the centre of the main wheels and is kept as near the ground as possible, by which means but little weight is borne by the fore carriage which is attached to the body by bracketted irons supporting a step the whole width but lower than the floor of the vehicle and from which access is had to the interior.

171. LOOMS, *C. Turner, Colne, Lancaster.—12th January*, 1882. 6*d.*

This relates, First, to mechanism for enabling the warp to be let off the beam uniformly and kept at the same tension notwithstanding the varying diameter of the beam; and, Secondly, to the taking-up mechanism, the object being to wind the cloth on to the beam with equal pressure from end to end.

182. FORGING AND FINISHING HORSE NAILS, &c., *F. W. Wallner, Cologne.—13th January*, 1882. 8*d.*

This relates to improvements on machines in which the nails are formed from heated metal rods by rolling and pressing or hammering the blanks so formed, and afterwards punching them through a die. The rod A is heated in a special furnace and passes between rolls

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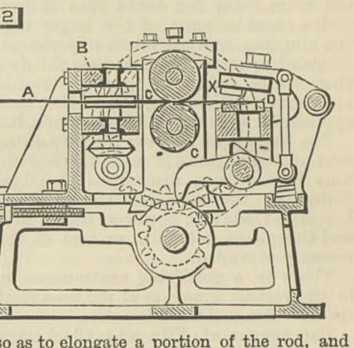


B formed so as to elongate a portion of the rod, and then through rolls C, which complete the formation of the blank, the feed of the rod to the rolls taking place intermittently. The blanks are delivered to anvil D, and acted upon by a die or hammer X, and being then separated by a cutter attached to the hammer.

185. ELECTRIC ACCUMULATORS, *H. J. Haddan, London.—13th January*, 1882.—(*A communication from A. Morel, Roubaix, France.*)—(*Not proceeded with.*) 2*d.*

The gases produced by the current are conserved and recombined.

189. RATCHET BRACES, *C. T. Colebrook, Islington.—13th January*, 1882.—(*Void.*) 6*d.*

This consists in combining with a drilling or ratchet brace of a differential arrangement of gearing, so arranged and combined with the ratchet which turns the drill that in the forward stroke of the ratchet lever the additional or feeding gearing shall have more or less of a start of the ratchet which actuates the drill, and shall thus advance the usual screw and feed the drill up to its work before the ratchet which actuates the drill is in the further forward motion of the handle, turned to effect the required drilling.

190. GAS KILNS AND FURNACES, *D. and W. H. Thompson, Leeds.—13th January*, 1882. 6*d.*

This relates to improvements on patent No. 1719, A.D. 1881, and consists in forming furnaces with a series of flues, regulated by dampers, and fitted with louvres in the chimney for preventing down draught and the necessary number of gas-burners are placed in one or more rows near the level of the floor of the furnace. Flues surround the bottom sides and top of the furnace, so as to economically utilise the heat produced by combustion of the gas. The invention relates also to the application of such furnaces for carrying out "Barff's" process for protecting iron and steel from rust.

191. PNEUMATIC BRAKE APPARATUS FOR RAILWAY TRAINS, *C. D. Abel, London.—13th January*, 1882.—(*A communication from G. Westinghouse, jun., Pittsburg, U.S.*) 6*d.*

This consists in valve apparatus for pneumatic brakes, a piston sliding on the stem of an escape valve leading to the open air, and arranged in combination with the valve and with a second valve leading to the brake cylinder, so that in one position of the piston the escape valve is open, and the cylinder valve is allowed to close, and in another position the cylinder valve is opened and the escape valve is allowed to close. A domed extension of the brake cylinder acts as an auxiliary reservoir, and has a tubular boss in which works a plunger attached to the brake piston.

194. SAFES, *W. R. Ratcliff, London.—13th January*, 1882.—(*Not proceeded with.*) 2*d.*

The safe is made of cast steel in two parts, the door being secured to the body by a hinge bolt passing through lugs.

195. WIRE ROPES, &c., *G. Cradcock and T. Gooder, Wakefield.—13th January*, 1882. 6*d.*

This relates to apparatus having sheave pulleys working on studs, and round which the wire rope is partially wound for mooring, hauling, &c., and it consists in forming frictional disc surfaces on one or both sides of the sheaves, and placing between the frictional disc surface a piece of leather, so that when the disc plates are tightened up and the unequal and great strain put on the ropes by the heaving of the vessel and other causes, the leather will yield sufficient to compensate for the want of elasticity in the rope.

200. MULTIPLYING COPIES OF MATTER PRINTED BY TYPE-WRITERS, &c., *H. E. Tyler, Edmonton.—14th January*, 1882. 4*d.*

The types employed in type-writers are made with numerous points or chisel edges on their faces, which when they strike the paper prick holes through it, the perforated sheet being then used in the well-known manner to multiply copies by causing ink to pass through the perforations on to the surface on which it is to be printed.

201. SKATES, *J. S. de B. Yellohy and A. H. S. Elwes, both in the Royal Navy.—14th January*, 1882. 6*d.*

This relates to combining the facility of putting on and off of the "Acme" with the security and support to the feet only to be obtained by skates secured with straps round the feet, and it consists, First, in the method of articulating the fin of the skate and the body, and using any suitable fastening so that it shall give the means of tightening and releasing the pressure on a strap round the ankle; and Secondly, the action of the fin on a strap which passes over a bridge on the body, so as to tighten such strap, round and over the toes.

203. Distillation of Glycerine, *G. Payne, Millwall.—14th January*, 1882. 6*d*.

In order to prevent the loss at present incurred by the dilution of the glycerine with water resulting from the condensation of the steam which passes over with the glycerine from the still, a vessel is provided in which temperature is maintained which will cause the condensation of the glycerine while preventing the condensation of the steam.

208. Spring Bed Bottoms, *A. M. Clark, London.—14th January*, 1882.—(*A communication from E. T. Slayton, Saint Paul, U.S.*) 6*d*.

This relates to bed bottoms to be detachably seated in the bedstead frame, and it consists in means for staying and preserving the rectilinear position of the marginal springs, which are volute spiral springs. The invention further consists in connecting two sections of a twin spring by links so as to prevent the sections falling apart; also in connecting the head and foot strips to the abutments of the mattress frame by take-up springs; also in making one or more rows of springs at the foot lighter than the others; and lastly in combining a twin spring with a stalled bed bottom frame.

210. Velocipedes, &c., *W. Soper, Reading.—14th January*, 1882.—(*Not proceeded with.*) 4*d*.

This relates, First, to the employment of a safety wheel in front of the driving wheel to prevent the machine overturning; Secondly, to an improved saddle formed with a hollow in the pommel framing covered with a soft or elastic substance; Thirdly, to an improved roller bearing for the journals or shafts; and Fourthly, to an improved compound roller and ball bearing.

214. Steelyards for Weighing Machines, *J. Spencer and J. Consterdine, near Manchester, and J. Greenwood, Salford.—16th January*, 1882. 6*d*.

This relates to steelyards for machines intended to indicate in several distinct national standards or different denominations of weight, and in which one or more revolving bars of triangular, polygonal, or cylindrical form adapted to turn separately, and consists principally in having serrated divisions or notches cut on the faces or edges of the bars, which may be arranged so as to be side by side or one above another. One bar is graduated to indicate the larger denominations of weight and their equivalents and the other their fractional parts and equivalents. A sliding carriage or poise is moved along the principal bar by a handle and secured accurately in position by a catch, which drops into the notches in the bar.

215. Steam Boiler Furnaces, *G. H. Watson, St. Louis, U.S.—16th January*, 1882.—(*Complete.*)—(*Void.*) 4*d*.

This relates to improvements in steam boiler furnaces embodying a steam generator and a feed-water heater, and it consists in placing a feed-water pipe horizontally in front of the furnace and branch pipes extending from it to form a water grate and water sides for the furnace. Other improvements are described.

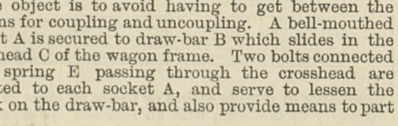
216. Preventing the Fouling of Anchor Chains, &c., *T. Cockshott, East Greenwich, and H. M. Goodman, Catford.—16th January*, 1882. 6*d*.

At a suitable distance from the windlass a tube is carried in fore and aft frames, and through it passes the chain, which is then continued through the centre of a special rotating hawse pipe and thence to the anchor or mushroom mooring.

218. Coupling Apparatus for Railways, *H. E. Newton, London.—16th January*, 1882.—(*A communication from the Société Anonyme des Appareils Automatiques pour Accrocher et Décrocher les Wagons de Chemins de Fer, Paris.*) 6*d*.

The object is to avoid having to get between the wagons for coupling and uncoupling. A bell-mouthed socket A is secured to draw-bar B which slides in the crosshead C of the wagon frame. Two bolts connected with spring E passing through the crosshead are adapted to each socket A, and serve to lessen the shock on the draw-bar, and also provide means to part

218



the train if the draw-bar break. F and G are coupling links placed one over the other and secured by straps, one being longer than the other so as to serve as a safety link in case of the other breaking. The link entering socket A pushes back plate X, when coupling pin H falls and couples the two wagons.

219. Corrugated Tubes and Plates, *S. Fox, Leeds.—16th January*, 1882. 8*d*.

This relates to improvements on patent No. 2520, a.d. 1877, for apparatus for the manufacture of corrugated tubes and plates to be used for internal fire-boxes, flues, and shells of steam boilers. Rolls with corrugating annular grooves and projections are used and suitably driven. The present invention consists, First, in the mode of mounting the upper roll; Secondly, in the combination of hydraulic and compound toggle mechanism to cause the bottom roll to approach the top one during the operation of corrugating, and to recede therefrom when the operation is completed; Thirdly, in the method of mounting a guide roll on each side of the main rolls and actuating it by hydraulic motor and suitably gearing excentrics and links, such guide rolls being brought to bear against and support the tube being corrugated.

221. Weldless Corrugated Tubes, *S. Fox and J. Whitley, Leeds.—16th January*, 1882. 6*d*.

A suitable mould with an outer shell is provided with an inner core mould in two or more parts, a space being left between them of a corrugated form to receive molten metal to form the tube, which, while still hot, is then rolled in a mill to required diameter and thickness.

222. Portable or Table Fountain, *C. H. and C. Kessell, Southwark-street.—16th January*, 1882. 6*d*.

A pump is used to raise water from a lower to an upper chamber, and, by compressing the air therein, cause the water to issue from the jet tube, which projects down to near the bottom of the upper chamber. The water, as it falls after issuing in a jet, flows down a tube back into the lower chamber.

225. Lighting Apparatus, *W. R. Lake, London.—16th January*, 1882.—(*A communication from J. S. Williams, New Jersey, U.S.*)—(*Not proceeded with.*) 4*d*.

This relates, First, to means for controlling, confining, directing, and dividing the flame so as to obtain more perfect combustion; Secondly, to means to prevent the escape of heat until a perfect combustion is effected; Thirdly, in placing the flame in a transparent tube so as to allow the light to be diffused. Various other improvements are described.

228. Metallic Wheels for Vehicles, *E. A. Brydges, Berlin.—17th January*, 1882.—(*A communication from W. Richter, Berlin.*)—(*Not proceeded with.*) 2*d*.

This relates to the construction of wheels in which the spokes are fixed in the nave and secured to the tire—which is fitted with an angle iron in place of the ordinary felly—by means of nuts and screws on their ends, the spaces between such nuts and the heads of the screws being filled in with a suitable non-metallic composition.

229. Tempering Wire made from "Bessemer" or "Omer" Steel, *H. Carter, Manchester.—17th January*, 1882.—(*Not proceeded with.*) 2*d*.

A series of troughs or tubes pass through a furnace, their ends outside being slightly elevated, so that they can be filled with spelter which is kept molten, the wires passing through it, and then through a shallow vessel containing spirits of salts.

230. Lamps, *C. W. Siemens, Westminster.—17th January*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to utilise a large portion of the heat of the products of combustion to heat the air supply to the burner, and it consists in extending the glass chimney by an additional metal chimney, around which is a casing of glass extending down to the level of the burner, and communicating by an external pipe with the closed chamber containing the burner.

233. Apparatus used in Ring Spinning, *E. Clarke, Todmorden.—17th January*, 1882. 6*d*.

The object is to facilitate the spinning of various counts on a spindle without the necessity of changing the traveller for each count, and it consists in making the ring loose upon a foundation ring fastened to the rail, and holding it to the ring by spring clips, so that it can follow the traveller and give the necessary drag.

235. Increasing the Efficiency of, and Protecting Screw Propellers, *R. Griffiths, Bayswater.—17th January*, 1882. 6*d*.

The propeller is surrounded by a covering formed by two cylindrical rings, the diameter of one being such as to just allow the screw to revolve in it, the other being from one-sixth to one-fourth larger, and each ring being one-sixth of the screw's diameter in width, the two rings being attached to each other concentrically by suitable fastenings, so that the after edge of the larger ring overlaps the forward edge of the other. This covering is attached to the screw frame, so that the forward edge of the smaller ring is opposite the middle of the points of the propeller blades, and radial arms may be inserted both in front and behind the propeller to prevent floating substances fouling the screw.

236. Treatment of Maize for an Article of Diet, *W. R. Lake, London.—17th January*, 1882.—(*A communication from L. Chiozza, Austria.*) 4*d*.

The germs and hulls of maize are separated by soaking in hot water until the grain is softened, when it is passed between rollers. The crushed maize is then run over a riddle and washed with water, the mealy portions being washed through the sieve and collected in a tank for use in the manufacture of starch and other products, while the germs and hulls are separated in a winnowing machine, and then dried, partially roasted, ground, and then completely roasted. This product can be used to produce an agreeable infusion or decoction.

237. Window Sash Fastener, *M. Delmard, Plumstead Common.—17th January*, 1882.—(*Not proceeded with.*) 2*d*.

A plate is secured on the meeting bar of the upper sash, and is provided with a hooked stud or lug, and a second plate is secured to the meeting bar of the lower sash and carries an excentric cam rotating on a stud and formed with an opening at one part of the edge to engage with the hooked stud on the other plate.

241. Holding and Affixing Stamps or Labels, *C. A. Drake, Bedford-square.—17th January*, 1882. 6*d*.

This relates to a device to hold a number of postage or other stamps and facilitate the affixing of them to envelopes. The stamps are placed one over the other in a kind of a box, the bottom of which is a spring, a certain part of the bottom stamp being exposed. The envelope is moistened at the point where the stamp is to be affixed, and placed under the box, which is then forced downwards, when the exposed part of the stamp sticks to the envelope. The box is then moved forward, and a roller at the back completes the operation.

243. Looms, *H. Livesey, Blackburn.—17th January*, 1882.—(*Not proceeded with.*) 2*d*.

This consists, First, in building up the "taking up" beams of a sheet metal tube secured to discs placed on a central shaft; and, Secondly, in means whereby the cloth beam or roller is, during the working of the loom, held in true relative position to the taking up beam, facility being provided for detaching or lowering the cloth beam and holding it whilst the cloth is being unwound therefrom.

244. Cartridge Bags, *E. W. Cooke, Liverpool.—17th January*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to knapsacks or other receptacles for carrying cartridges, and consists in fitting them with a regulating feed mechanism, by which, when one cartridge has been withdrawn from the receptacle, another falls into its place and is held until required.

246. Ploughs and Ploughshares, *J. Hornsby and J. Trolley, Lincolnshire.—17th January*, 1882. 6*d*.

The nose or block on the plough to receive the socket of the ploughshare is formed with longitudinal ridges on the top, and the upper part of the socket is formed with corresponding grooves. To cut drains in grass land a plough is used having two circular knives adjustable laterally as well as vertically, and set a distance apart and inclined. These cut the sides of the drain, and the bottom is cut by a ploughshare placed between them.

247. Guns, Gun Carriages, &c., *W. R. Lake, London.—17th January*, 1882.—(*A communication from D. M. Mefford, Toledo, U.S.*)—(*Not proceeded with.*) 4*d*.

This relates partly to carriages for siege and naval guns in which the gun slides on an adjustable tilting frame, and which in recoiling is met by an elastic resistance, and consists in making the resistance to the recoil by compressing air in two cylinders secured to the side bars and provided with pistons connected to the gun. The gun is preferably made of cast iron, but may be fitted with an inner cylinder of wrought iron, steel, or bronze, a space being left between the two cylinders and filled with water or other non-compressible fluid. The shot or projectile so as to more nearly approximate the form of a dart or arrow than those generally used.

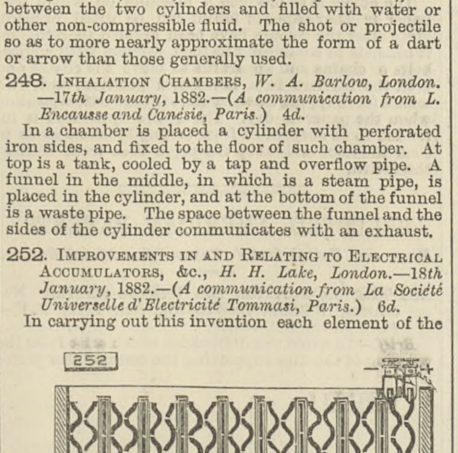
248. Inhalation Chambers, *W. A. Barlow, London.—17th January*, 1882.—(*A communication from L. Encausse and Canésie, Paris.*) 4*d*.

In a chamber is placed a cylinder with perforated iron sides, and fixed to the floor of such chamber. At top is a tank, cooled by a tap and overflow pipe. A funnel in the middle, in which is a steam pipe, is placed in the cylinder, and at the bottom of the funnel is a waste pipe. The space between the funnel and the sides of the cylinder communicates with an exhaust.

252. Improvements in and Relating to Electrical Accumulators, &c., *H. H. Lake, London.—18th January*, 1882.—(*A communication from La Société Universelle d'Electricité Tommasi, Paris.*) 6*d*.

In carrying out this invention each element of the

252



battery is formed of two continuous sheets of lead folded several times and placed in a gutta-percha vessel, in such a manner that a double fold of the one is always contained in a double fold of the other. The sheets are also grooved or undulated, and perforated with holes. To still more increase the surface of the elements, another plate of lead enveloped in lead wire is placed between the two adjacent sides of a fold of the same plate. The battery is illustrated in the accompanying figure.

251. Recording Instruments, *R. Pickwell, Kingston-upon-Hull.—18th January*, 1882. 6*d*.

The object is to apply a mariner's compass or magnetic needle to the purpose of automatically making a diagram showing the direction in which the ship travels, and one method consists in the use of a travelling strip of paper on which the diagram is marked by one of the usual methods for taking diagrams, such as a pencil or other marking point; or by the aid of photography or electricity, care being taken not to interfere with the free working of the compass.

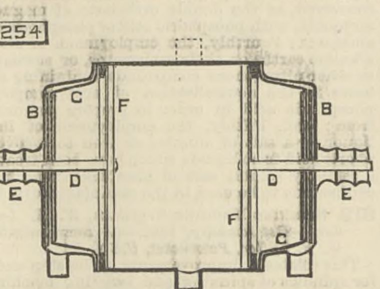
253. Laminated Springs, *H. Woodruff and G. Barson, Sheffield.—18th January*, 1882. 6*d*.

The several plates of steel to form a spring are by pressure moulded to the required form in the position they are to occupy when finished, after which they are allowed to separate a short distance apart and and plunged into water to harden them. They are then tempered and fitted together. A special machine is described for bending the plates and holding them whilst they are being hardened.

254. Operating Brakes of Railway Trains, *W. Wakefield, Dublin.—18th January*, 1882. 6*d*.

This consists principally in substituting in lieu of the reservoir and cylinder usually employed to work automatic and other brakes, a compound vessel or cylinder fitted with diaphragms at either end in a similar manner to the ordinary cylinder; and it further consists of an arrangement for coupling the

254



pipes together on the engine (when the two-pipe system is used) so as to keep a constant vacuum in the reservoir. In the drawing, the body of the vessel is fitted with the covers B containing diaphragms C, pull rods D working through sacks E, and fitted with guides F.

256. Horizontal Steam Boilers, *H. W. Pendred, Dublin.—18th January*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in forming apertures in the shell of a boiler below the water level, and fitting tubes therein to direct the flame and products of combustion from the fire from one side passage to the other in order to utilise all the heat for steam generating purposes on its passage to the up-take or chimney.

257. Obtaining Motive Power from Tidal Waters, *A. J. Lehmann, West Hartlepool.—18th January*, 1882. 6*d*.

Buoyant chambers or vessels are attached to endless chains arranged in pairs and passing over pulleys at top and bottom, those at top being mounted on a shaft above high water level, and the other any suitable distance below such level, so as to allow the chambers to descend with the water, and one shaft being connected by multiplying gear to a shaft from which any suitable machinery may be driven.

258. Stoves for Heating and Ventilating, *R. G. Greig, Dalston.—18th January*, 1882.—(*A communication from the Detroit Stove Works Company, Detroit, U.S.*) 1*s*.

This relates, First, to the combination with the magazine section of a separated plated shell surmounting the same, so as to leave an air space between the two, and permitting air to enter beneath the lower edge and emerge about the upper edge of the shell; Secondly, in combining with the magazine an annular chute or hopper projecting from the top into the magazine so as to leave a small annular opening at the top end of magazine cylinder to permit gases to escape from the top of the fuel and pass down over the top of the cylinder to the combination chamber, yet effectually checking any tendency of a draught in this direction; and Thirdly, in providing a grate of a special construction.

259. Floating Vessel and Apparatus for Raising Sunken Ships, &c., *R. Richards, Manchester.—18th January*, 1882. 8*d*.

This relates to improvements on patent No. 3530, a.d. 1878, for a floating vessel combined with apparatus to raise sunken ships by means of hydraulic power, and it consists in the use of a steam or other vessel fitted with tubes on both sides, passing from the upper deck through the bilges of the vessel to the water, and through them the lifting chains are caused to pass.

260. Rail for Tramways, *A. S. Hamand, Westminster.—19th January*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to tram rails over which the wheels of ordinary vehicles may pass at any angle without being skidded or subjected to injurious strains, and it consists in forming the upper surface of the rail with a broad shallow channel in the middle, bounded on each side by a lip projecting slightly upwards, and by preference, roughed on its upper side to prevent slipping.

261. Decoration of Wall Surfaces and Ceilings, *E. L. Voice, London.—19th January*, 1882.—(*Not proceeded with.*) 2*d*.

The finishing coat for walls or ceiling consists of a composition of cement mixed with colouring matter to form a ground of the desired colour, from which any suitable design is cut out and filled in with plaster of another colour, the outlines being afterwards painted in by hand.

262. Wax Thread Sewing Machines, *H. H. Lake, London.—19th January*, 1882.—(*A communication from D. H. Campbell, Pawtucket, U.S.*) 1*s*. 2*d*.

To adapt this machine to a wide range of service an arch work is provided which is convex laterally and longitudinally, and is so situated with reference to the bed and other part of the frame as to attain many of the advantages of what are known as "post machines," together with such as accompany a flat work plate which can, if desired, be interchangeably employed as an attachment to the arch plate. The shuttle is formed according to patents No. 1795, a.d. 1878; No. 2145, a.d. 1881; and No. 2146, a.d. 1881; so as to secure an increased thread carrying capacity, but instead of being straight the shuttle is curved so as to resemble a segment of a tubular ring.

263. Three-legged Iron Pots, *D. Cowan, Stirling.—19th January*, 1882. 6*d*.

This consists in casting the legs separate from the pot, which is formed with lugs, to which the legs are afterwards secured. The object in making the pot and its legs separate is so that they may take up less room when packed for transport, and be less likely to get broken.

265. Rollers and Fittings for Blinds, *J. Westley, Chorley.—19th January*, 1882.—(*Not proceeded with.*) 2*d*.

To secure the blind to the roller a groove is formed in the latter, and over at the end of the blind is laid and clamped and secured by a strip forced into the groove. A lever engaging with ratchet teeth on a pulley secured to the roller end, and actuated by a cord, is used to raise and lower the blind.

267. Cages or Hoists, *J. Lindley, Clifton, near Manchester.—19th January*, 1882. 6*d*.

To the top rods of cages or hoists a peculiar arrangement of safety catch is fitted and is capable of gripping the pin of a staple connected to the winding rope. This catch consists of a pair of levers or jaws jointed horizontally together and their lower arms jointed to the top rods, while one of their upper arms is formed on the inner side with an open slot to receive the pin mentioned, whilst the other upper arm is provided with a catch or cam having a similar slot, and which can be placed in position when required to close the safety catch. If the cage is overwound the lower arms are forced together so as to open the jaws and release the pin, whereby the slotted cam is turned on its axis and prevents the jaws closing again. To prevent the cage falling should the rope break the lower ends of the top rods are connected to a pair of levers mounted on each side of the cage, the other arms of these levers being forked and connected to opposite ends of a pair of links which embrace the guide rods.

272. Moving Targets, *S. T. Lander, Wilts.—19th January*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to apparatus intended more particularly to represent a pigeon flying from a trap.

273. Umbrellas and Parasols, *H. J. Haddan, Kensington.—19th January*, 1882.—(*A communication from C. Neumeister, Leipzig.*) 6*d*.

This consists chiefly in the combination of two runners, a spiral spring, and two sets of stretchers in such a manner that the umbrella is opened automatically by releasing the lower runner from the handle.

274. Apparatus for Holding Coins, Medals, &c., *H. J. Haddan, Kensington.—19th January*, 1882.—(*A communication from J. Guttmann, Berlin.*)—(*Not proceeded with.*) 2*d*.

This relates to a holder consisting chiefly of a ring with a rim on one side to support the coin or medal, and a double screw thread on the other side for attaching a movable cover.

275. Amalgamating and Extracting Gold and Silver, *L. F. Gowans, London.—19th January*, 1882. 6*d*.

This relates to machinery for amalgamating or extracting the particles of gold or silver from their crushed ores by means of metallic mercury; and it consists of a vertical hollow shaft revolving in a frame, and fitted with a hopper at top to receive the powdered ores, together with a supply of water. From the bottom of the shaft the ore and water passes through a block to a suitable number of outlets, and is delivered to a circular horizontal fan. The upper part of the block is formed with a collar supporting a horizontal muller or grinding plate made in segments, each of which is fitted at the bottom with a flat copper plate, the lower surface being amalgamated with mercury, and adjusted to revolve at a suitable distance from the bottom of the pan, which contains mercury, the pressure of the water forcing the sand through such mercury, and so bringing the particles of gold in contact with the same.

276. Ventilating Water-closets, Urinals, Drains, &c., *T. Rowan, London.—19th January*, 1882. 6*d*.

This relates to improvements on patents No. 5303, a.d. 1880; No. 162, a.d. 1881; and No. 505, a.d. 1881; and consists chiefly in employing a jet or jets of water for producing an induced current for carrying off foul air and gases from water-closets, &c., and washing the same before they escape.

279. Pendant Lamps, &c., *D. C. Defries, London.—19th January*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to basket or other shaped pendant or hanging lamps formed of rows of crystal drops surrounding a central light, and it consists particularly in the use of a glass or other transparent inverted cone fitted within such circle of drops, whereby the flame is protected from vacillating or being extinguished by lateral currents of air, such cone being used in conjunction with a cup arranged beneath it, so as to deflect any upward draught. The cone may also be used to direct any desired colours upon the surrounding drops to produce brilliant illuminating effects.

280. Band Log Saw, *F. C. Glaser, Berlin.—19th January*, 1882.—(*A communication from Isaakson and Co., Hamburg.*)—(*Not proceeded with.*) 4*d*.

This consists of a band saw to be used as a horizontal log saw, being made to pass over two pullies placed side by side a certain distance apart, and made adjustable to or from the bed of the machine on which the log is fed forward by suitable mechanism.

281. Self-acting Grabs, &c., *J. H. Johnson, London.—19th January*, 1882.—(*A communication from C. W. Maclean, Melbourne.*) 8*d*.

This relates to the contrivances through which the grappling portion of grabs receives its necessary motions of opening, closing, hoisting, and lowering, and it consists, First, in the substitution of a counterbalance barrel supported on pinions running in racks at the back of the crane for the ordinary counterbalance weight, and in so arranging such barrel that it assists instead of retards the engine in all the operations of working the grabs; and, Secondly, in a modified construction of crane for working the grabs, in which it is made a portable machine.

282. Pick-headed Shelter Trench Spade, *N. W. Wallace, Major of H.M. King's Royal Rifles.—19th January*, 1882. 6*d*.

The extremity of the handle is provided with a pick, consisting of a wooden crosshead fitting on to a tongue in the handle, and provided with steel points formed from steel sheeting, which covers the top and bottom of the crosshead, and is then continued down on each side and secured to the handle. Just above the spade blade a steel projection is formed on the back to protect the knuckles when stooping down to work near the ground, and the top of the blade is turned over to form a flange for the foot of the worker.

283. Making Trenches for Drain Pipes, *A. M. Clark, London.—19th January*, 1882.—(*A communication from M. E. Pidgeon, Saugerties, U.S.*) 6*d*.

This relates to a machine for making narrow trenches for drain pipes, and consists in the use of a tapering weighted drop knife sliding between vertical posts resting on a platform mounted on wheels, and carrying a steam or hand windlass, by means of which the knife can be alternately raised and dropped.

285. Carriage Lamps, *W. Howes and W. Burley, Birmingham.—19th January*, 1882. 8*d*.

This consists, First, in casting the bottom of the lamp body and the barrel to take into the socket of the lamp iron in one piece. The top and chimney of carriage lamps may also be similarly cast in one piece; Secondly, in the mode of connecting the lamps to the socket so as to make a waterproof junction and prevent the barrel becoming fixed by corrosion therein.

286. Forges, *L. C. Gomant, Paris.—19th January*, 1882. 6*d*.

This relates to improvements in forges to enable the use of hydro-carbon and volatile oil vapours for blow-pipe purposes, and it consists in providing a metal cylinder containing a cylindrical leather bellows actuated by a pedal to direct a blast on to the hearth of the forge, or part of such blast may be caused to pass through a vessel containing liquid hydro-carbons or volatile oils, and be delivered through a blow-pipe nozzle attached to a flexible pipe, together with a part of the blast.

288. Bleaching and Dyeing Cotton, &c., *J. Auchinvole, Glasgow.—20th January*, 1882. 6*d*.

The object is to obtain improved results with fewer operations and less waste than hitherto; and it consists, First, in bleaching and dyeing yarns of cotton or other vegetable fibre when in the cop form, the cops being upon tubes of vegetable parchment, or of paper or cloth treated with gelatine and bichromate of potash; Secondly, in the combination of two or more processes, the yarns in the cop form being put through the several processes in the same quantities arranged in perforated boxes without being opened or separated between such processes; Thirdly, in the combination of two or more processes in dyeing or bleaching cotton, &c., in a loose wool-like state, the fibres being placed in perforated boxes as described; Fourthly, the mordanting and dyeing of vegetable fibres by means of dies or other substances dissolved in liquids consisting of methylated spirit or other analogous penetrative solvent; and Fifthly, the mordanting and dyeing of vegetable fibres as described, the air having been previously exhausted.

291. Apparatus for Recording Speech, *H. J. Haddan, Kensington.—20th January*, 1882.—(*A communication from J. D. Morel, Roubaix, France.*)—(*Not proceeded with.*) 2*d.*

This relates to phonographs; and consists chiefly in placing the marking pin of the vibrating lever over a roller grooved in the centre and carrying on its surface a travelling band of paper, tin, or other suitable material, which is pressed against the borders of the roller by two narrow upper rollers.

292. Rudders, *H. Lumley, London.—20th January*, 1882. 6*d.*

This relates particularly to the rudder described in patents No. 1150, A.D. 1862, and No. 3013, A.D. 1863, the object being to provide improved controlling or guiding mechanism, and to arrange the same so that it is brought on the deck of the vessel instead of beneath the "counter." The tail post is provided with a bar acting as a supplementary tiller and arranged to work in and out of a guide free to turn on its axis according to the movement imparted to the bar, such guide being held in a bearing on the deck, whereby, as the body portion is moved, the bar acting as a supplementary tiller will work in and out of the guide and control the motion of the tail, thus producing the recessing movement of the rudder. Modifications are described.

293. Hook Fastener, *J. McKenny, Dublin.—20th January*, 1882. 4*d.*

The hook fastener is suitable for horse chains and other purposes where an easy and secure mode of fastening is required, and it consists of two hooks with straight ends working in the centre on a pivot, so that when closed by a lateral motion they overlap each other and form a complete ring. The straight ends have a slide swivel key passed over them so as to secure the two hooks when closed.

294. Heating Water and other Fluids, &c., *G. H. Nussey and W. B. Leachman, Leeds.—20th January*, 1882. 6*d.*

This is applicable for heating or boiling the liquids in dye pans or other vessels, and it consists in injecting therein a combination of hot air and superheated steam by means of an injector. The steam being applied and passing through the injector, draws with it the hot air from a chamber, and the two are then directed into the pan or other vessel.

295. Water-closets and Urinals, *S. H. Terry, Whitehall.—20th January*, 1882. 6*d.*

This consists in actuating the moving parts of closets, urinals, &c., by means of a pedal instead of the usual handle.

296. Stoves for Singeing Hogs, *F. H. F. Engel, Hamburg.—20th January*, 1882.—(*A communication from J. H. and J. D. Koopmann, Hamburg.*) 6*d.*

The stove is built of bricks, is rectangular in shape, and is enclosed by cast iron plates lined with firebricks. Fireplaces are formed on opposite sides, the flames from them passing through grates of fireproof material into the singeing room and thence into the chimney.

298. Copying Presses, *F. H. F. Engel, Hamburg.—20th January*, 1882.—(*A communication from P. Schneider, Hamburg.*) 6*d.*

This consists of a square box formed of two iron frames with upright sides hinged together, so as to fold like a book. The copying book is placed in the free space of the bottom frame, and the top frame forced down on it by means of a lever.

299. Utilisation of Phosphatic Metallic Slags, *S. Pitt, Sutton.—20th January*, 1882.—(*A communication from G. Rocour, Liege.*) 4*d.*

The object is to utilise phosphatic metallic slags by extracting from them in a commercial form the metallic oxides and phosphoric acid which they contain, and it consists, First, in concentrating the slags into a matt, and then treating them by humid process; Secondly, in obtaining the phosphoric acid and phosphate of potassa from the slags by the combustion of hydrogen phosphide; and Thirdly, the employment of basic slag in place of lime to precipitate acid phosphatic solutions of iron and of manganese.

301. Sewing Buttons to Cloth, &c., *H. J. Haddan, Kensington.—21st January*, 1882.—(*A communication from J. Mathison, Massachusetts.*) 6*d.*

This relates to a machine for sewing buttons to cloth, &c., whereby the buttons are fed to the needle and their attachment effected by the loop of a single thread in a locked stitch. The loop of thread is drawn up through the material and the eye of the button, and then forced down through the material outside the eye of the button, after which the thread is passed through the loop and the stitch tightened by drawing on the thread, the button being simultaneously withdrawn from the feeding device. The invention further relates to the mode of feeding the buttons to the needle, to the mechanism to operate the shuttle driver, to feed the work, to turn the buttons, and release them from the feeder when they are secured to the fabric.

306. Application of Earthenware Pipes for Conveyance of Gas, Water, Sewage, &c., *G. Smith, Bradford.—21st January*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to laying earthenware pipes in concrete, and regulating the pressure in them by employing cisterns fitted at suitable levels and distances, and supplying each separate level from the one immediately above it by means of self-feeding cisterns having self-acting ball valves. Means are provided for preventing the sudden emptying of a body of water in the event of a leak in one place by employing cisterns coupled together.

307. Looms, *T. Sutcliffe, Todmorden.—21st January*, 1882. 6*d.*

This relates, First, to means to arrest the forward movement of the picker sticks after they have delivered their picks, without the intervention of the picker bands; Secondly, to means for returning the picker sticks into position for again delivering their picks; and, Thirdly, to reducing the outlay in picker

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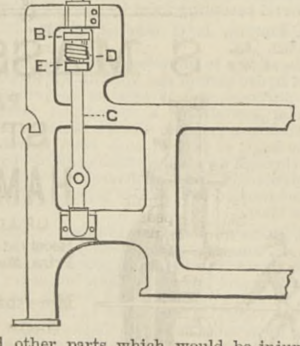

bands and other parts which would be injuriously affected if the picker bands were used to arrest the forward movement of the picker sticks. When the picker stick A is in its normal position the projection on collar B stands away from the loom side, but during its forward movement the collar rotates with the picker stick shaft C until the projection is in contact with the loom side, and its movement thereby arrested. The spring D then acts through the clamped collar E and opposes a suitable resistance to the rotation of the shaft C.

309. Boxes, *H. Stevenson, Manchester.—21st January*, 1882. 4*d.*

The object is to strengthen the corners of boxes made of pasteboard, &c., and consists in inserting wire in the angles of such boxes.

310. Governors for Steam Engines, *W. Knowles, Bolton.—21st January*, 1882. 6*d.*

The object is to reduce to a minimum the variation of the speed of steam engines through increase or decrease of pressure or load, and it consists in automatically operating the nut, which is formed with a left and right-handed thread, and which connects the two portions of the rod which connects the ordinary governor to the cut-off, or a supplementary governor is caused to act on this rod.

311. Treatment of Phosphatic and Nitrogenous Substances for the Manufacture of Manure, &c., *H. Y. D. Scott, Sydenham.—21st January*, 1882. 4*d.*

This consists, First, in the production of manure by acting on the double carbonate of magnesia and ammonia with phosphoric acid or sulphuric acid or both; Secondly, in using the carbonic acid evolved from the carbonate of magnesia or ammonia in the preparations of the carbonate of magnesia to be used in the manufacture of fresh quantities of the double carbonate; Thirdly, the mode of treating ammoniacal liquids from which part of the ammonia has been recovered, as the double carbonate of magnesia and ammonia, with phosphoric acid or phosphoric acid and ammonia; Fourthly, the employment of alkalies or alkaline earths or their carbonates, or sewage sludge or other nitrogenous compounds containing chemical bases in the neutralisation of acid compounds of phosphoric acid in order to prepare manures therefrom; and, Fifthly, the employment of lime, gas liquor, or a salt of alumina or iron to recover phosphoric acid from liquids which have been treated with a partially soluble salt of phosphoric acid to obtain compounds to be used in the manufacture of manure.

312 Spinning Machine Spindles, *W. R. Lake, London.—21st January*, 1882.—(*A communication from G. H. Miller, Pawtucket, U.S*) 6*d.*

This relates to improvements in the step and bolster for spindles of spinning and twisting machines, and it consists in the use of a tube in which a step is secured by a pin on which it is pivotted. The bolster tube is connected with the step also by a pin, passing through the step at right angles to the first pin, so as to form a gimbal or universal joint, and allow the bolster tube to adjust itself in any direction.

316. Improvements in Telephone Transmitters, *E. G. Brewer, London.—21st January*, 1882.—(*A communication from J. Olmsted, New York.*) 6*d.*

This invention relates, First, to a novel construction of telephone, in which is employed a series of independently pivotted electrodes forming together a compound electrode, resting against an opposite electrode

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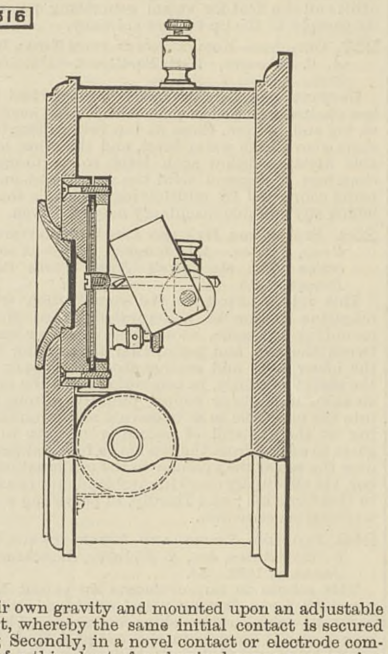


by their own gravity and mounted upon an adjustable support, whereby the same initial contact is secured for all; Secondly, in a novel contact or electrode composed of a thin sheet of carbonised paper, or a number of such sheets arranged side by side, mounted so as to rest against the opposite electrode. The figure represents a partial vertical section of an instrument so constructed.

314. Boots and Shoes, *W. T. Haynes, Leicester.—21st January*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the formation of channels in the soles opening at one end into the outer air and at the other inside the boot or shoe, the object being to ventilate the same.

315. Rocking Car, *E. O. Hallett, Weymouth.—21st January*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a rocking car to be used instead of a rocking horse, and capable of carrying a number of children at the same time. A seat is pivotted at each end of the rockers, and a cradle or basket is secured in the central part.

317. Sanitary Trough Closets, *J. Holroyd, Leeds.—21st January*, 1882. 6*d.*

This relates to means for preventing accumulation of excreta in the sanitary troughs described in patent No. 2915, A.D. 1879, and consists in providing an outlet or trap from the trough at a point above the bottom, so that a few inches of water will always remain therein to prevent the excreta adhering to the bottom. One end of the trough is curved upwards to direct the material to the outlet.

318. Collecting and Checking Money, *J. Kaye, Kirkstall.—21st January*, 1882. 6*d.*

This relates to improvements on patents No. 1005 and No. 4118, both in the year 1874, and consists, First, in the use of a hopper in which it is impossible to introduce a knife or other instrument to extract money from the box; and, Secondly, in placing the registering indices so that they are visible outside the box.

319. Construction of Secondary Batteries, *J. S. Sellon, London.—21st January*, 1882. 2*d.*

Relates to supports or frames employed in secondary batteries.

321. Brace Buckles, &c., *T. Walker, Birmingham.—21st January*, 1882. 6*d.*

This consists, First, in connecting the front tabs to the buckles by making at the lower edge of the buckle frame in one piece therewith, a perforated disc-shaped end with an eyelet, on to which the front tabs of the brace are passed and secured; Secondly, the fastening of the back tabs to a similar eyelet connected to the metallic loop of the suspender.

323. Spinning Machinery, *B. A. Dobson, E. Gillow, and D. Davies, Bolton.—23rd January*, 1882. 8*d.*

This relates, First, to an improved method of regulating the drag of the yarn during spinning on ring and traveller throstle frames, and consists in the use of drag plates or rings or wire curls or forks fixed on a rail held in supports fixed to the lifting rail crosshead, so as to obtain the same reciprocating movement; Secondly, to laying the fibres of yarn by placing between the drawing rollers and the point of the spindles a roller revolving in a trough containing water; Thirdly, to doffing full bobbins in "Dobson-Marsh" spinning spindles when used for spinning on paper tubes placed on the spindle, without breaking the threads between the ring and the rollers by winding a few turns of yarn on to the sleeve above the wharve; Fourthly, to applying a catch box on the front roller between the driving wheel and the fluted roller so as to prevent loss of twist in ring spinning frames; Fifthly, to an improved clearer for top rollers; and, Sixthly, to a method of piecing broken ends by stopping the revolution of the spindle.

325. Chenille for Manufacture of Carpets, *J. R. Lawson, Glasgow.—23rd January*, 1882.—(*Not proceeded with.*) 2*d.*

This consists partly in improved machinery of a semi-automatic character for the production of the chenille. The worsted to form the fur is interwoven as weft with spaced sets of warps, preferably of linen threads. After being woven the fabric is cut along the spaces between the sets of warp threads, so as to form separate strips.

349. Boots and Shoes, *H. Loads, Norwich.—24th January*, 1882. 6*d.*

This relates to making the heels renewable, and consists in constructing them of a fixed part, and a detachable top piece secured by a screw or other suitable means.

351. Tanks for Flushing and Ventilating Drains, *J. Holroyd, Leeds.—24th January*, 1882. 6*d.*

The flushing tank is made of glazed earthenware pipes placed below the ground either horizontally or vertically. When fixed horizontally an outlet valve is provided near the bottom to get the water or sewage away when flushing the drain or sewer. The outlet valve is withdrawn periodically and flushes the drain.

357. Fastenings for Cravats and Neckties, *J. Hinks, T. Hooper, and F. R. Baker, Birmingham.—24th January*, 1882. 6*d.*

One improvement consists in attaching a metallic arm to the piece of metal or millboard forming the body of the cravat, such arm being jointed thereto at one end, the other end forming a clip, the two branches of which pass on opposite sides of the body and grip the band of the necktie or cravat.

392. Improvements in Obtaining Light by Electricity, &c., *W. P. Thompson, Liverpool and London.—26th January*, 1882.—(*A communication from the Union Electric Manufacturing Company, New York.*) 6*d.*

This relates to an arc lamp in which the upper carbon is connected with a regulating apparatus, consisting of a drum, mechanically connected with the carbon holder, and an armature and clamping lever connected together and pendulously suspended from the axis of the said drum, this lever being intended to act against the inner periphery of the drum, when the armature is attracted by an electro-magnet placed close to it, wound with thick and thin coils, and placed in the main circuit. This lamp was illustrated and described in our columns a short time since under the name of the "Diamond" lamp.

440. Abstracting Ammonia from the Gaseous Products of Combustion in Furnaces, *G. Neilson, Summerlee, N.B.—28th January*, 1882. 6*d.*

This consists, First, in treating hot furnace gases for the recovery of ammonia by passing acidulated liquor through the gases; Secondly, in the apparatus to be employed for the above purpose, and in which a series of sheets are arranged and combined within a closed vessel, through which the gases are led, while dilute acid is discharged over the surfaces of the plates and through the vessel.

460. Converting the Fibres of Various Plants into Paper Pulp, *F. Bauman, Budapesth.—30th January*, 1882. 6*d.*

A quantity of reed or sedge is placed in a vessel with a diluted solution of caustic soda and a diluted solution of caustic potash, which is heated and forced through a tube arranged centrally in the vessel, and passing through perforations in such tube acts on the mass of fibre and reduces it to a well bleached pulp.

877. Alarum Bells for Bicycles, &c., *H. Lees Ashton-under-Lyne.—23rd February*, 1882. 6*d.*

The clapper of the bell is suspended from a chain which when raised draws it up tight against the top of the inside of the bell, and so prevents the vibration of the velocipede causing it to strike against the side of the bell. The chain may be raised either separately or through the action of applying the brake.

1221. Anti-friction Roller Bearings, &c., *T. F. Hemwich, Reading.—14th March*, 1882.—(*Complete.*) 6*d.*

This relates to that class of bearings which are provided with a series of anti-friction rollers, and consists in a novel construction and mode of arranging the same, and of the surfaces on which they act.

1437. Electric Accumulator, *S. Cohné, London.—25th March*, 1882. 4*d.*

Mercuric sulphide—H_9 S—or sulphate of mercury—$H_9{}^2O\ S\ O^3$—are used to place upon the lead electrodes.

2303. Drying Wall Paper, *A. M. Clark, London.—16th May*, 1882.—(*A communication from J. S. Warren, W. H. Fuller, and J. H. Lange, New York.*)—(*Complete.*) 6*d.*

The object is to produce a machine on which wall paper or other paper or fabric can be dried immediately after the colours have been applied thereto, and it consists in combining festoon carriers with endless belts or chains and apparatus to move the chains and hold the carriers in a horizontal position, and with means for dropping these carriers into a vertical position when the paper is dry. The entire apparatus is intended to be suspended from ceiling brackets so as to clear the floor and keep the paper free from contact therewith.

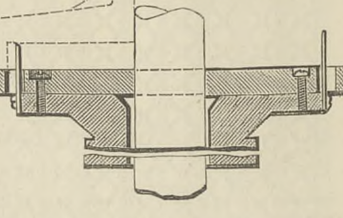
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

261,712. Commutator for Dynamo-electric Machines, *William Hochhausen, New York, N.Y.—Filed March 2nd*, 1882.

Brief.—To avoid the difficulties which arise from the warping of the disc supporting the commutator plates

261.712

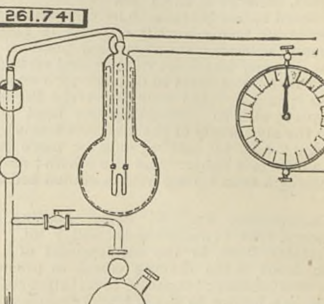


in commutators of this character when heated by the action of the machine, employs a disc of stone, which is practically unaffected by this cause.

261,741. Mode of Making Electric Lamps and Carbons for the same, *Hiram S. Maxim, Brooklyn, assignor to the United States Electric Lighting Company, New York, N.Y.—Filed February 14th*, 1881.

Claim.—(1) The process of preparing carbons for electric lamps, which consists of, First, removing the occluded gases by means of heat and the air-pump, then subjecting the conductors to a high heat in an attentuated atmosphere of hydrocarbon vapour or other equivalent carbonaceous gas, and afterwards exhausting the surplus gases, substantially as set forth. (2) In the preparation of electric carbons, the cementing and consolidation of the conductors by the deposition of pure carbon from an attenuated atmosphere of hydrocarbon vapour or other equivalent carbonaceous gas, substantially as and for the purpose set

261.741



forth. (3) The above-described process of regulating the resistance of electric carbons, which consists in heating them in a hydrocarbon or equivalent gas by means of an electric current until their resistance is brought to the required standard, as indicated by a galvanometer acted on by the same current. (4) The herein-before described method of making carbon conductors for electric lamps of a standard resistance, which consists in preparing such conductors of an approximately uniform size and of a higher than the standard resistance, and then subjecting them to the action of an electric current in a hydrocarbon or equivalent gas until the resistance is reduced to the required point, substantially as set forth.

261,785. Locomotive Window, *John M. Taylor, Fredericton, New Brunswick, Canada.—Filed April 15th*, 1882.—*Patented in Canada February 27th*, 1882, *No.* 14,274.

Brief.—A heating coil of pipe is placed between double panes, and is provided with inlet and outlet connections and stop-cocks. *Claim.*—The improved window for locomotive, steamboat, and other cabs,

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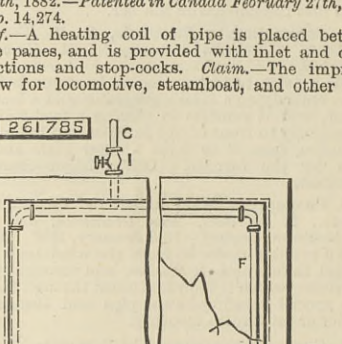

consisting of double sashes or panes of glass or other transparent medium, with an inclosed space between said sashes or panes containing a heating coil of pipe F, having inlet and exhaust connections G H and stop cocks I, substantially as specified.

CONTENTS.

The Engineer, August 25th, 1882.

The Institute of Mechanical Engineers 133
On Mining Machinery. (Illustrated.) 133
Exhibition of Life-saving Appliances, Alexandra Palace. No. III. 135
Contracts Open—
Permanent Way, Indian State Railways. (Illustrated.) 137
The British Association 137
Leading Articles—
Electrical Locomotives.. 141
Brighton Beach.. 141
The Lime Process for Getting Coal 142
The Manchester Ship Canal 142
Literature—
Modern Metrology. By Lowis D.'A. Jackson .. 142
Books Received 142
The Dom Pedro II. Bridge 142
Letters to the Editor—
Soap Making Plant.. 141
Compressed Paper 141
Triturating Manganese.. 141
Box-making Machines 141
Sewage and the River Lea.. 142
Sewage and Air.. 142
Mechanical Refrigeration of Air 142
The Foreshore at Hastings.. 142
Enamelling Pipes and Castings.. 142
Railway Matters 143
Notes and Memoranda 143
Miscellanea 143
The Dynamo-electric Machine (Illustrated.) .. 144
Folkestone and Boulogne Channel Steamers. (Illustrated.).. 145
The Iron, Coal, and General Trades of Birmingham, Wolverhampton, and District .. 146
Notes from Lancashire 146
Notes from Sheffield 146
Notes from the North of England 146
Notes from Scotland 146
Notes from Wales and Adjoining Counties .. 147
The Patent Journal 147
Abstracts of Patent Specifications. (Illus.) 148
Abstracts of American Patent Specifications. (Illustrated.) 150
Paragraphs—
The Engineering School at the Crystal Palace .. 135
Naval and Submarine Exhibition 135
Society of Engineers 139
Naval Engineer Appointment 142
Twin Screw Steamers for the Argentine Republic 147

The Electric Light at the Post-office.—On the evening of the 21st inst. an exhibition was made of an important installation of the Edison electric light in the "Press Department" of the Telegraph-office, St. Martin's-le-Grand. The lighting is part of a "system" supplied at a distance from the place lighted, the Edison Electric Light Company having its centre on Holborn Viaduct. The extension to the top room of the General Post-office, which was accomplished on Monday night, is the greatest yet made from one centre, the distance from the dynamo-room of the company's office to the "Press Room" of the General Post-office being 1950ft.