THE UNITED STATES CRUISERS.

WE are happy to say that the U.S. cruiser Chicago will not be fitted with engines of the designs we have criticised. How far this result has been brought about by our strictures we shall not pretend to say. We learn from the United States *Army and Navy Journal* that engines upon the model of those in the Trenton are to be substituted for those recommended for the Chicago by the Advisory Board. On this subject the *New York Herald* says:—"We knew it would happen. The engines designed for the new cruiser Chicago, which vessel was to be the beginning of a new and effective navy, have already been tinkered and reconstructed on paper to such an extent that the designer has resigned his position as a member of the Naval Advisory Board. It is said that the Navy Department will have difficulty in finding any one to fill the vacancy. It certainly will, unless it will accept some one with a rage for remodelling engines. To 'improve' engines of war vessels so that their effectiveness in point of speed may be lessened seems to be, and always to have been, the most fascinating of the many industries of the Department. Why a war vessel should be as slow as the heaviest tub afloat is beyond the comprehension of men who know most about steam navigation; but there must be some purpose in it, otherwise there would not always have been a determined effort to rob our ships of all chances to make fast time. There are people uncharitable enough to believe that rebuilding engines is merely an excuse to make work at navy-yards at election time, or to help rich machinists who contribute largely to campaign funds; but even if this is so, why should all the improvements work backward?"

Of course we have been called hard names by some persons in the United States for presuming to criticise American inventions; but we have certainly said nothing as bad as the *Herald* has said. In dealing with the question we have pointed out defects in the designs of the Chicago and her machinery, without imputing motives of any kind. It is gratifying to find that wise counsels prevail; and that experimental engines will not be put into the new ship. We do not know why American engineers should be ashamed to take a lesson from their English brethren. We can only account, however, for the designs of the Chicago's engines on the hypothesis that it was held to be absolutely necessary to produce machinery of an entirely novel type, and that no matter how good anything might be, it must not be adopted if it was used by English engineers. No system more absurd or more likely to end in disappointment could be adopted.

The truth is, that American engineers have no experience worth naming in the construction or design of iron-clads or screw engines. In this there is nothing of which they need be ashamed Their country has elected not to have a Navy, consequently engineers and shipbuilders have turned their attention in a different direction. It has also elected not to have a mercantile marine worth naming; and for this reason Americans capable of designing and building a good large compound engine may be counted on the fingers of one hand. It is doubtful, indeed, if they exist at all; if they do then they have been trained in this country. On the other hand, and as we have already said, no engineers in the world can compete with Americans in the design and construction of river steamers of all kinds. The United States do not lack talented men, but all the talent in the world will not produce a successful man-of-war, unless it is backed up by experience. All the men-of-war which have been designed in the United States from the Monitor down to the Wampanoag have supplied evidence of the possession of talent—or even genius—by their designers; but they have also illustrated in the most forcible way a lack of that knowledge which can only be obtained by experience. Thus, for example, in one case an engineer holding that plenty of surface ought to be put in a bearing, made the brasses of a screw shaft 5ft. long in one piece. The intention was admirable; the theory perfect; the practical result disastrous, for reasons which will be obvious to every experienced marine engineer without a word of explanation. It is simply impossible for American engineers to build a thoroughly satisfactory man-of-war without copying English practice. It can no more be done than we could build a great river steamer which could cross a prairie on the dew—to use an American figure of speech—without copying Brother Jonathan. The thing cannot be done, and American engineers need not feel ashamed that they do not possess an education which they have had no opportunity of acquiring. On the contrary, they should be thankful that they can enjoy the fruits of our dearly bought experience for next to nothing. They need not even thank us for them.

COCOA POWDER.

FOR the past year we have been anxious to give some information on the subject of this remarkable powder, but the very honourable reticence of those who have had to deal with it officially has made this impossible. We are now, with the consent of the manufacturers themselves, able to say a little—we wish it might be more.

In 1880 it appears that experiments were first begun with the substance in question by the United Rhenish Westphalian Gunpowder Company at Cologne, their rivals, the Rottweil Hamburg Company, also taking up the same investigation. The respective managers of these companies are Herrs Heidemann and Dutten. In 1883 the powder was sufficiently perfected to be brought to the notice of the German and English Governments, both of whom have had large supplies of prismatic powder of the usual composition. The so-called "cocoa" powder then earned its name by its brown colour and strong resemblance to cocoa or chocolate. Its composition and method of manufacture are kept secret. If analysed it yields sulphur, saltpetre, and charcoal in proportions varying slightly according to the sample of powder selected, but there is no other ingredient to be detected unless it is a suspicion of resinous matter. Its physical properties are chiefly remarkable in its liability to absorb moisture in greater proportion than ordinary powder—that is to say, to the extent of 1·5 to 2 per cent. under fairly favourable conditions, when ordinary prismatic powder would absorb from 1 to 1·3 per cent. It is found, however, that with the respective quantities of moisture the action of cocoa powder is less affected than that of the other; also it bears travelling and rough usage better. Perhaps our readers may conclude that the cocoa powder owes its qualities mainly to having charcoal in some new form and less perfectly burnt. We can only say that we have not the least notion if this is the case.

Of course, the main question is, What are the ballistic qualities of this explosive? We give herewith two tables, A and B, the former A showing the relative results obtained by brown prismatic cocoa powder and ordinary black prismatic; and the latter, B, showing the results obtained with two classes of cocoa powder—H and T. The first aim of the company is to secure uniformity as to results, the next a maximum velocity in proportion to the pressure and strain on the gun. Quantity of powder is, of course, quite a subordinate consideration. Scientifically there is no doubt that this is the proper order of importance in results; but practically it is so great an object to get the maximum work safely out of our guns, that a powder giving a high result in this way might probably be preferred to one standing only on the merit of regularity, and much inferior as to work developed. Indeed the Italian progressive powder owes its credit to low pressure rather than regularity. Of course, a powder possessing both requirements must stand first in everyone's estimation, and for the cocoa powder both may be claimed in the highest degree, we believe.

The standard of accuracy insisted on in Germany is a high one—namely, a variation in velocity under 10 metres per second (32½ft.). We hope to be able to show the actual attainments in this respect shortly, when we give some results recently obtained at Spezia in comparison with progressive powder. In the meantime a velocity of nearly 2000ft. with a pressure of little over 14 tons, and 1922ft. with one of about 12 tons, speak in a way that calls for no comment from us.

TABLE A.

Comparative Results obtained by Westphalian Cocoa and ordinary Prismatic Powder, at Ridsdale, by Sir W. Armstrong, Mitchell, and Co.

Length of bore.	Armstrong 10in. B.L. guns.	Description of powder.	Weight of Charge.	Weight of Projectile.	Muzzle velocity.	Pressures on End of chamber.	Pressures on Base of shot.
in.	No.		lb.	lb.	ft.	tons.	tons.
300	4065	brown prismatic H 295 IV.	250	451	2133	16·24 / 16·09	not recovered.
,,	,,		270	401	2300	16·63 / 17·04	15·26
296·5	4078	brown prismatic T 295 I.	250	452	2113	16·01 / 16·47	12·67
,,	,,		270	454	2215	18·05 / 18·23	14·97 / 15·05
300	4065	ordinary black prismatic C 175	230	456	1995	17·04 / 17·37	15·41 / 15·48 / 15·26
296·5	4078		230	450	2010	17·12 / 17·62	15·26

TABLE B.

Results obtained with United Rhenish Westphalian Gunpowder at Woolwich in October, 1883, and subsequently.

Powder.	Gun.	Charge.	Projectile.	Velocity.	Gravimetric density.	Moisture.	Pressures—Tons. at end of bore.	at end of bore.	Middle of gun.	at the muzzle.
		lb.	lb.	ft.						
H c/83	9·2in. B.L. gun	150	320	1817	33·6 / 0·825	2·2⅜	11·4	11·7	9·1	3·7
H c/83*	,,	170	,,	1997			14·4	14·2	11·1	5·5
H c/83	,,	190	,,	2105			16·2	16·5	13·4	6·5
T	,,	150	,,	1782	33·6 / 0·825	1·8⅝	10·3	10·7	9·3	4·3
T*	,,	170	,,	1922			12·2	11·1	11·5	5·6
T	,,	190	,,	2088			16·3	16·6	14·1	5·9

HADFIELD'S MANGANESE STEEL.

IN our last impression brief reference was made to some specimens of steel of remarkable properties exhibited at the recent meeting of the Institution of Mechanical Engineers. Some further particulars will be of interest. This manganese steel is really a new steel, and a few years ago could not have been made. It is only through the new manufacture and introduction of higher percentages of ferro-manganese that it can be now made a commercial success. It is sufficiently well known that manganese has been employed for many years in the manufacture of steel in various proportions, but anything exceeding 1 per cent. it has been generally believed would render the metal under treatment worthless, and any further addition thereof in excess of this proportion has been considered impracticable. In fact, Dr. Siemens had stated publicly, on many occasions, that the use of manganese was simply a cloak to cover the impurities in steel making, that it covered a multitude of sins, and this was the general opinion of the steel trade. Messrs. Hadfield, however, engaged in a long series of experiments and tests, with the object of discovering its truth, and after a considerable expenditure of time and capital, discovered that by adding the ordinary ferro-manganese of commerce to iron or metal, either wholly or to a great extent decarbonised and refined, and treated by any of the ordinary processes, or to steel produced by such processes, in increased proportions sufficient to obtain or produce in the steel or decarbonised iron under treatment a percentage of manganese varying from 7 to 20 per cent., that the most beneficial results could be obtained. Such percentage is regulated according to the purpose for which the steel is required—for instance, to produce a steel suitable for armour-plates, and other purposes, as we mentioned last week, they add about 10 per cent. of rich ferro-manganese, containing, say, 80 per cent. of manganese, thus obtaining a steel containing about 10 per cent. of manganese. For railway purposes they add about 11 per cent., for steel toys and tools, about 12 per cent. They pour this ferro-manganese into the molten steel under treatment, thoroughly incorporating it therewith, and then run it into ingot or other suitable moulds, and allow it to cool, after which it is ready for use, as it requires neither tempering, rolling, forging, or hardening. This treatment of steel in suitable proportions, according to requirements, appears to be novel, and renders the steel so manufactured harder stronger, denser, and tougher than most steel now manufactured, even when forged and rolled. This steel may, however, be forged and rolled in the ordinary manner. For casting it has the advantage that it possesses greater freedom from honeycombs and similar defects; but the most peculiar property is its great toughness, combined with extreme hardness. It is through this that the hitherto indispensable processes of rolling, forging, hammering, hardening, and tempering may be dispensed with, thus effecting for many articles an enormous economy in time, labour, and expense. In casting its fluidity enables fine steel castings to be made without misrunning, and approaching in smoothness iron castings. As far as has been yet observed, it does not, when cast, settle so much, nor does it draw like ordinary steel castings at the junction of the thick and thin parts. It would thus appear that steel so manufactured is specially adapted for making steel rolls to replace those of chilled metal, iron, armour plates, the larger edge tools, and articles known in the steel trade as steel toys. Its value for agricultural wearing parts will be at once seen, as these may be cast therefrom without requiring either forging or tempering, for like large edge tools they will be ready for use after grinding.

It appears that this use of manganese renders the use of silicon to obtain soundness unnecessary. Amongst the samples of the steel placed on the table at the meeting of the Mechanical Engineers were a sample test bar containing 12 per cent. manganese, bent double when cold, though hard enough for turning iron; a sample from same ingot, tested by Mr. Vyle, and showing tensile strength of 42 tons per square inch, with 20·85 per cent. elongation; several hammered pieces; a manganese adze, containing 20 per cent. manganese, just as it left the mould; an axe, containing 12 per cent. manganese, just as cast in the rough, had chopped through ½in. square iron. This, like the others, had not been hardened or tempered, only the edge ground. There were also a large size, about 1½in. wood chisel, which had been used in the pattern shop fifteen months. This was of steel, containing 14 per cent. manganese; a corve wheel which had been tested with sixty heavy blows, and showed a peculiar crystallisation. It contained 12 per cent. manganese. None of this steel has the slightest magnetic capacity; it is a very poor conductor of electricity, worse than iron wire, yet fine drillings or scrapings from it are attracted by the magnet. We are informed that it does not seem to oxidise easily, though tested by Messrs. Hadfield in sea water. It is said not to corrode as much as ordinary steel, which is exactly what would not be expected from the many statements to the effect that manganese made steel easily corrodible. It is said not to tarnish easily, and it is found that heating it to a white heat and quenching in cold water instead of hardening it, causes it to become softer and tougher. The tested sample mentioned above was heated to a white heat and allowed to cool down on the shop floor.

It is rather curious that the properties hereinfound should only be now found, and after finding a steel that is at the same time very hard, very tough, not attracted by the magnet, and with considerable elongation, we may next expect anything to turn up to upset one's ideas as to the characteristics of steely materials.

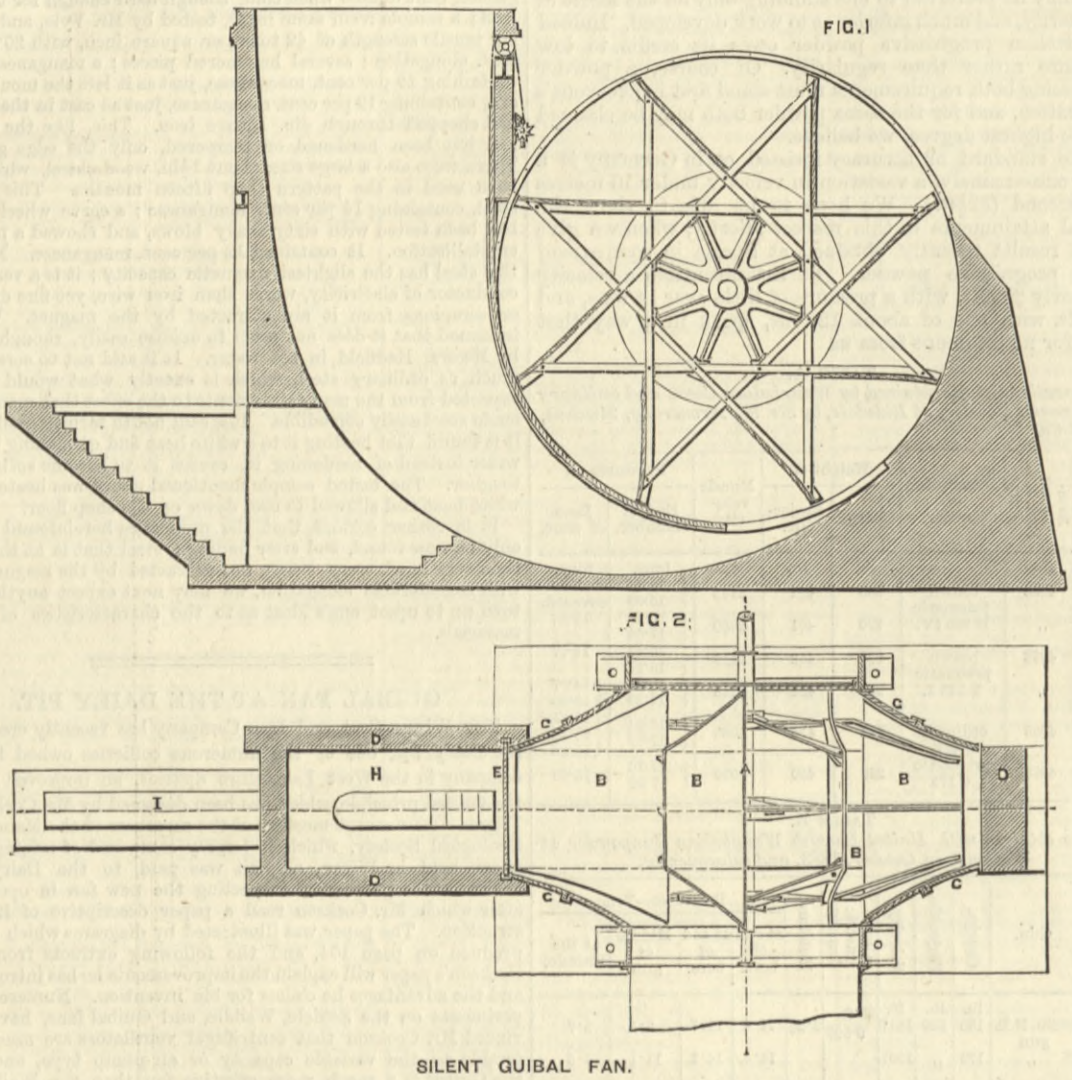
GUIBAL FAN AT THE DAIRY PIT.

THE Wigan Coal and Iron Company has recently erected at its Dairy Pit, one of the numerous collieries owned by the company in the West Lancashire district, an improved fan on the Guibal principle, which has been designed by Mr. Cockson of Wigan. At a recent meeting of the members of the Manchester Geological Society, which is largely composed of mining engineers, held in Wigan, a visit was paid to the Dairy Collieries for the purpose of inspecting the new fan in operation, after which Mr. Cockson read a paper descriptive of its construction. The paper was illustrated by diagrams which we reproduce on page 104, and the following extracts from Mr. Cockson's paper will explain the improvements he has introduced, and the advantages he claims for his invention. Numerous experiments on the Schiele, Waddle, and Guibal fans, have convinced Mr. Cockson that centrifugal ventilators are much preferable to the variable capacity or air-pump type, and that the Guibal is a much more effective fan than the Waddle or the Schiele. There is, however, one main objection to the use of the Guibal, and this is the great size, weight, and expense of a fan required to do heavy work; the advocates of the Schiele having had a decided advantage to claim over the Guibal, as at some collieries it would be practically impossible to put up a Guibal fan on account of the space and depth of excavation required. With the view of removing this objection, Mr. Cockson has designed his improved type of Guibal, which he has termed the "silent Guibal," for which he claims that while it has all the advantages of the Guibal, it is at the same time a silent and non-vibrating fan like the Schiele, and can be constructed of much smaller dimensions than is required for an ordinary Guibal. The Wigan Coal and Iron Company, having in view an alteration of the system of ventilation at the Dairy Pit, an opportunity was afforded to Mr. Cockson for carrying out his ideas, and after a number of experiments with models, it was determined to put up one of the new fans, and instead of an ordinary Guibal of 40ft. to 50ft. diameter, which it had been thought would be necessary, a "silent Guibal," of 30ft. diameter was put up. This fan was completed in August last, since which time it has been working satisfactorily, and it is described by Mr. Cockson as follows:—

"The Dairy Pit fan is 30ft. in diameter, has a close-fitting casing, expanding chimney, and adjustable shutter, just like the Guibal, but the blades of the fan are to taper from a width of 15ft. at the inlet end of blade to a width of 7ft. at the tip; this tapering of the blades being so proportioned as to give an equal area of air passage throughout the fan; and it is in this that the main alteration lies, and it is owing to this that the fan is a silent one. This particular fan draws its air through one inlet 14ft. in diameter, the fan being connected to the upcast by a circular iron tube of that size. The upper half of the fan casing is made of iron plates cast to the outline of the curve of the blades and roofed with wood lags, while the lower half and fan race and chimney are built in brickwork to the same curve. The fan itself is constructed on the usual lines; in fact it is the framework of a Guibal fan, which the company had on their hands. Such is the fan, and it was put up to produce 5in. of water gauge, and to be able to pass 300,000 cubic feet of air per minute. In order to get this excessive water gauge the fan has to run at fully eighty revolutions per minute, and as it was not thought wise to couple up the engines we had direct to the fan, it was decided to drive the fan with grooved pulleys and cotton ropes, so proportioned that with the engine at fifty the fan runs at eighty revolutions per minute. The ropes are fifteen in number, each 2in. in diameter, and are amply strong enough to transmit 365 horse-power per minute at eighty revolutions of driven pulley, which is 9ft. 4in. in diameter. The engines are

* 12/10/83

in duplicate, horizontal, and condensing, having cylinder 30in. diameter and 36in. stroke. This plant was erected to take the place of two underground furnaces, having a fire-bar area of 129 square feet, on which 12 tons 17 cwt. of Arley mine mixture were burnt per twenty-four hours, producing with the furnaces very hard fired 142,570 cubic feet of air per minute, the cost for wages being 19s. 3d., and for fuel £4 3s. 7d., or a total cost of £5 2s. 10d. per twenty-four hours, which, multiplied by 365, will be £1876 per annum. When the fan was started it was found after careful testing that it got the same quantity of air as the furnaces when running at fifty-two revolutions per minute, burning 4 tons 2 cwt. of rough buzzard slack per twenty-four hours, and costing for wages 10s. 6d., and fuel 15s. 4d., or a total per day of £1 5s. 10d., which multiplied by 365 gives a cost of £471 per annum, or a saving by the use of the fan on the two items of fuel and labour of £1495 per annum. Of course from this an allowance ought to be made for interest, depreciation, stores, &c. In addition to this great saving we were able to increase the quantity of air in the mine enormously, the fan producing at eighty revolutions per minute (at which speed it works quite noiselessly and easily) an increase of 56 per cent. in the quantity of air, namely, from 142,570 with the furnace to 222,750 with the fan ; the latter quantity being produced under a water gauge of 4·7in. in the fan drift, and 4·95in. at the fan side next to engines ; the useful effect calculated on the lesser water gauge in fan drift being 70·3 per cent. of the steam power in cylinder of 234 horse-power. This test was made



SILENT GUIBAL FAN.

soon after the fan started, at which time the upcast (230 yards deep) was unbricked, and 9ft. in diameter for half its depth, and 10ft. in diameter bricked for the remaining half, and in order to lessen the friction of air in the upcast it has since then been enlarged to 14ft. in diameter, and when this work was about half completed another test was made, and the fan was found to be giving 74 per cent. of useful effect; this result being obtained from an average of eleven diagrams taken at certain intervals during the whole duration of measurements of air, which were taken with carefully tested and corrected anemometers underground, on account of the difficulty of accurately measuring the air close to the fan."

This enlargement of the upcast shaft has been carried on continuously since August, and as this work has not necessitated any stoppage of the operations in the work ventilated, it has afforded a fairly good test of the strength and capabilities of the fan. The advantages which Mr. Cockson claims for his silent fan he sums up as follows :—

"(1) Fans of this type, of from 12ft. to 20ft. in diameter, are able to do, at the same blade-tip speed, just as much work as any Guibal fan of the usual size of, say, from 30ft. to 50ft. in diameter. (2) That on account of their less size and weight they are not so liable to break down and injurious straining, and for the same reasons are much more economical than the larger Guibal or any other type of fan, as if my fan is properly proportioned for the work it has to do, there is no reason why it should not get 70 per cent. of useful effect as compared with the results of 40 per cent. up to 52·95 per cent. given in the report of the North of England Committee. (3) They are less costly to erect on account of the less size of the fan gearing, and the requisite foundation, excavation, &c., than a Guibal would be to do the same work. (4) They can be made as small and light as the Schiele, and will give equal water gauges and quantities of air at an average of two-thirds of the speed that would be required by a Schiele to do the same work."

A short discussion followed the reading of the paper, in which Mr. Hilton, of the Wigan Coal and Iron Company, said he could endorse all that had been stated in the paper as to the results obtained by the fan ; Mr. Hedley, Inspector of Mines, also said that so far as they could judge at present, the result seemed to be very good indeed, but he suggested that when the pit was in proper working order, official tests should be made of the fan, and they would then have a better basis of comparison as to the work done by this and other fans. Mr. Cockson said he should be most willing to comply with the suggestion made by Mr. Hadley subject to the sanction of the Wigan Coal and Iron Company, and the discussion shortly afterwards closed.

THE METROPOLITAN SEWAGE.

THE report of the Royal Commission to inquire into the pollution of the river Thames by the discharge of the sewage of the metropolis, which was presented to the Queen on Saturday, has been laid on the table of both Houses of Parliament. The following is a summary of the general conclusions which the Commissioners have arrived at in regard to the first two subjects of their inquiry :—

1. That the works of the Metropolitan Board, for the purpose of carrying the sewage of London to the respective outfalls at Barking Creek and Crossness, have been executed in a highly creditable manner, and have been of great benefit to the metropolis.

2. That the storm overflows allow the occasional discharge into the river within the metropolis of considerable quantities of solid fœcal matter accumulated in some of the sewers ; but this has not caused, under present circumstances, serious damage or offence.

3. That the sewage from the northern outfall is discharged partly over the foreshore, and not, as was originally intended, "through submerged pipes terminating below low-water mark ; this arrangement increasing the risk of nuisance from the discharge.

4. That the discharge of the sewage in its crude state during the whole year, without any attempt to render it less offensive by separating the solids or otherwise, is at variance with the original intention, and with the understanding in Parliament when the Act of 1858 was passed.

5. That the discharge from the main outfalls becomes very widely distributed by the motions of the water both up and down the river being traced in dry seasons through the metropolis and almost as high as Teddington; and that it oscillates for a long period before getting finally out to sea.

6. That the dilution of the sewage by the land and sea-water, aided by the agitation produced by the various motions in the river, effects a partial purification of the sewage by oxidation; and that this purification is carried further by the action of animal and vegetable organisms.

7. That the sewage, which becomes distributed to the higher and to the lower portions of the river, thus gradually loses its offensive properties. The limits above and below the outfalls where this purification becomes efficient vary with the meteorological conditions ; but it may be stated that, in general, above Greenwich and below Greenhithe the river does not afford ground for serious complaint.

8. That between these limits the effects of the sewage discharge are more or less apparent at all times.

9. That in dry seasons the dilution of the sewage is scanty and ineffective, especially at neap tides.

10. That it does not appear that hitherto the sewage discharge has had any seriously prejudicial effect on the general healthiness of the neighbouring districts. But that there is evidence of certain evil effects of a minor kind on the health of persons employed on the river ; and that there may reasonably be anxiety on the subject for the future.

11. That in hot and dry weather there is serious nuisance and inconvenience, extending to a considerable distance both below and above the outfalls, from the foul state of the water consequent on the sewage discharge. The smell is very offensive, and the water is at times unusable.

12. That foul mud, partly composed of sewage matter, accumulates at Erith and elsewhere, and adheres to nets, anchors, and other objects dropped into it.

13. That sand dredged near the outfalls, which used to be obtained in a pure state, is now found to be so much contaminated with sewage matter as to be unusable, compelling the dredgers to go farther away.

14. That for these reasons the river is not, at times, in the state in which such an important highway to a great capital, carrying so large a traffic, ought to be.

15. That in consequence of the sewage discharge fish have disappeared from the Thames for a distance of some fifteen miles below the outfalls, and for a considerable distance above them.

16. That there is some evidence that wells in the neighbourhood of the Thames are affected by the water in the river; and, although there is no proof of actual injury due to the sewage, that anxiety may be felt on that point.

17. That there is no evidence of any evil results to the navigation of the river, by deposits from the sewage discharge ; but that this discharge adds largely to the quantity of detritus in the river, and so must increase the tendency to deposit.

18. That the evils and dangers are likely to increase with the increase of population in the districts drained.

19. That it is desirable we should inquire further "what measures can be applied for remedying or preventing" the evils and dangers resulting from the sewage discharge,

20. That before we proceed to this further branch of our inquiry we should allow some time for the consideration of this our first report, and of the remedies which may be suggested for the evils we have pointed out.

The report is signed by Lord Bramwell, Sir John Coode, Colonel C. B. Ewart, Dr. Alex. W. Williamson, Mr. F. S. B. F. de Chaumont, Dr. Thomas Stevenson, and Mr. James Abernethy. It was not signed by Sir P. Benson Maxwell, who is absent from England on public duty ; but the substance has been discussed with him, and he has written a letter expressing entire concurrence in the report.

CONTRACTS OPEN.

NARROW GAUGE BRIDGE, INDIAN STATE RAILWAYS.

THE Indian Government want tenders for the bridge which we illustrate on page 105. Tenders are to be sent in to the India Office in the usual way before 2 p.m. on the 12th inst. We believe the bridge has been designed at Cooper's Hill, and it will be seen to be novel in some respects, and well adapted for piecemeal transport across country. More bridges, it will be understood, are wanted than that which we illustrate. The work required under this specification comprises the construction, supply, and delivery in England, at one or more of the parts named in the conditions of tender, of the whole of the ironwork for ten plate girder spans of 6ft. in the clear, thirty-three plate girder spans of 20ft. in the clear, seventy-six plate girder spans of 40ft. in the clear, forty-two triangulated girder spans of 100ft. in the clear—one of which we illustrate—and all the rivets required to complete the erection of the bridges in India, all bolts required to secure the sleepers to the girders, all kerb bolts and planking bolts, and all holding down bolts, with, in each case, an allowance of 50 per cent. on the net quantity of rivets, and of 10 per cent. on the net quantity of bolts required for waste. Hook bolts, in number sufficient to provide for the sleepers being placed 18in. apart centre and centre, and including an allowance for waste, are to be supplied with each of the smaller spans, viz., with each 6ft. span twenty-seven bolts, with each 20ft. span seventy bolts, and with each 40ft. span 130 bolts. With each 100ft. span are to be supplied 120 square-headed sleeper bolts 8in. long, sixty kerb bolts 7in. long, 350 planking bolts 4½in. long, and twenty holding-down bolts. Service bolts and ordinary platers' washers, to be selected by the Inspector-General of Railway Stores for use in the erection of the work in India, are also to be supplied with the different spans, in the following proportions :—With each 6ft. and 20ft. span, 14 lb. of bolts and nuts and 7 lb. of washers ; with each 40ft. span, ½ cwt. of bolts and nuts and ¼ cwt. of washers ; and with each 100ft. span, 3 cwt. of bolts and nuts and 1½ cwt. of washers. Two bed-plates, each 6ft. 4in. long, are to be supplied with each 100ft. span. The timber work and permanent way are not included in the contract. The spans are delineated on four sheets of drawings, numbered A 383, A 336, A 341, and A 370, which may be seen at the office of the Director-General of Stores, India-office. The contractor will be required to make his own copies of these drawings, and also to prepare, at his own expense, such further drawings as in his opinion, or in that of the Inspector-General, may be necessary for the proper execution of the work. The drawings so prepared must receive the approval of the Inspector-General before being worked to.

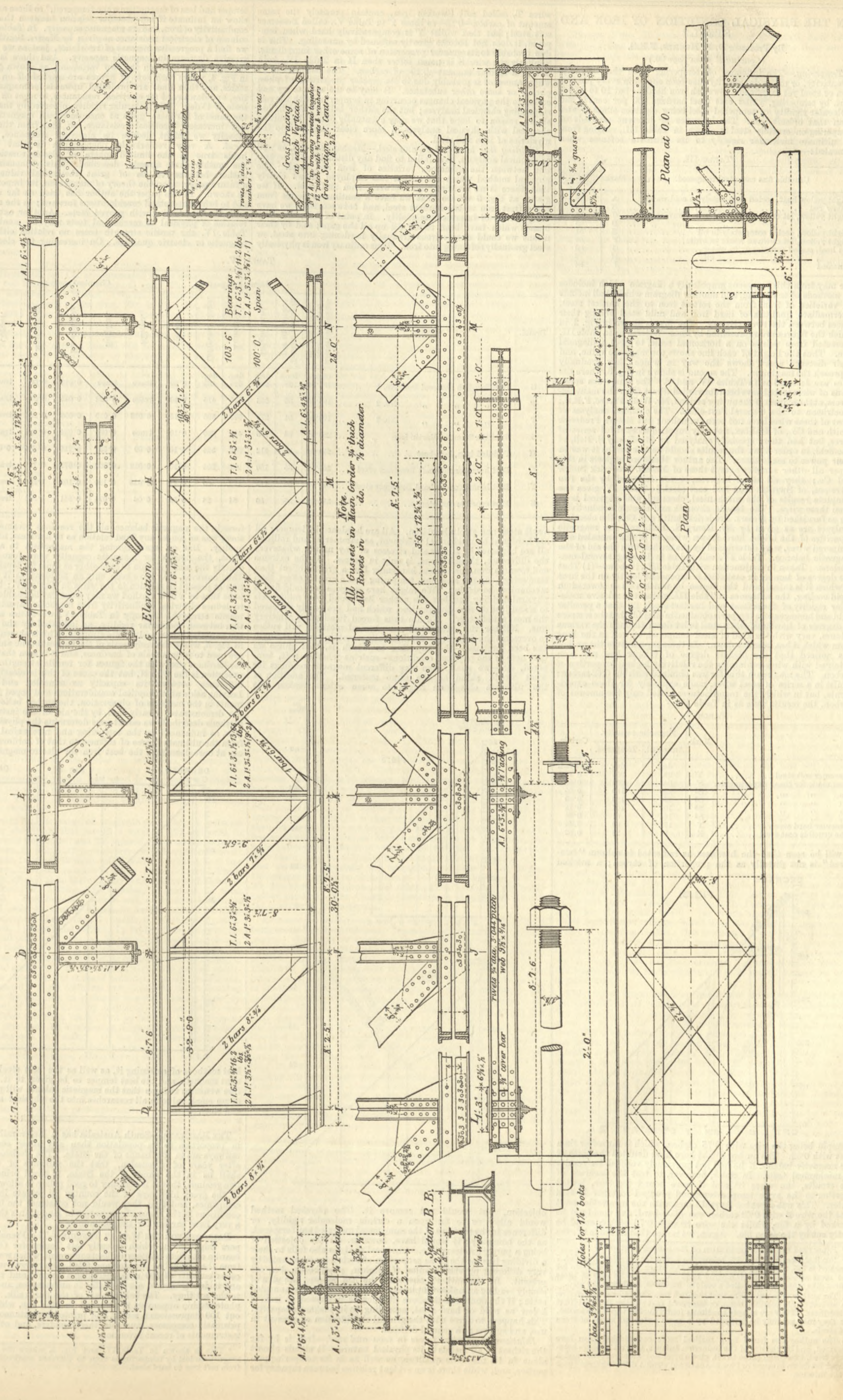
The wrought iron is to be well and cleanly rolled to the full sections shown on the drawings or in the specification, and free from scales, blisters, laminations, cracked edges, and defects of every sort, and the name of the maker is to be rolled or stamped on every piece. It must be of such strength and quality as to be equal to the following tensional strains, and to indicate the following percentages of contraction of the tested area at the point of fracture : —Round and square bars, and flat bars under 6in. wide, 24 tons tensional strains per square inch; percentage of contraction of fractured area, 20. Angle and tee bars, and flat bars, 6in. wide and upwards, 22 tons tensional strains per square inch ; percentage of contraction of fractured area, 15. Plates 21 tons tensional strains per square inch ; 10 percentage of contraction of fractured area. Plates across grain, 18 tons tensional strains per square inch ; 5 percentage of contraction of fractured area. Sample pieces of angle iron are also to be tested, each with one hole, of a diameter proportioned to the rivets to be used in the bridge, punched in the centre of the area to be tested. The iron intended to be used for the rivets must, whilst cold, be capable of being bent double without showing signs of failure. The tests are to be conducted at the works of the contractor or elsewhere. The remaining conditions are those always laid down in Indian State railway specifications.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Feb. 2nd, 1884 :—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,373; mercantile marine, Indian section, and other collections, 2835. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 4 p.m., Museum, 1335; mercantile marine, Indian section, and other collections, 213. Total, 14,756. Average of corresponding week in former years, 13,405. Total from the opening of the Museum, 20,751,153.

SPECULATORS AND THE ELECTRIC LIGHT.—What, however, counts more than anything else against the future progress and ultimate triumph of the electric light is the speculative element which has, thus far, been mixed up with the commercial side of it. It has been the prey of the market operator more than any other form of enterprise of recent date, not excepting the gold mines. The operator is rarely or ever anything but a source of trouble to the enterprise he undertakes to assist. He is least of all a good friend to a new invention, because his object is not the development of an industry of any kind, but an immediate profit. It is no part of his business to find the means with which to pursue costly and protracted and scientific investigations. If a man has invented anything and patented it, and if this invention attracts public notice, so that there is a chance of selling it to ignorant persons at a magnificent profit, then the market will advance its money, and do its best to make the operation what it calls a success. But a "success" in the Stock Exchange sense is often a most ruinous affair for investors, and it has been so in the case of the electric light. Speculators of every description, from the convinced enthusiast downwards, have rushed to make money out of the shares of companies started to work one or other of the numerous patents which the *furore* made it profitable for real or sham inventors to take out. Companies were started with apparently no other object than the promotion of other offshoot companies. Patents were sold and re-sold a dozen times over, and for a brief space all seemed to be doing an excellent business. But much of this kind of trading was unreal and factitious. It led to nothing because there was no substance behind it. The various companies could not obtain remunerative contracts, and without these it was neither wise nor expedient to continue, for mere advertising purposes, contracts that yielded a loss. All the prosperity, in a word, was on paper ; and in a very short time the discovery of this fact worked a revolution in popular sentiment towards electric lighting enterprises which must check progress for some time to come. From being blindly confident, the investor has become absurdly suspicious, and it is pardonable that he should be so, considering what he has suffered. All the more reprehensible are these manœuvres of the market by which a thing good in itself is brought into discredit. Apart from market influences, there was nothing to have hindered electric lighting enterprises from entering on a modestly prosperous career. Invention would have been stimulated instead of checked, and distressed shareholders would have been under no necessity to deal with the best means of writing off old losses and preventing the accumulation of new ones.—*Standard.*

CONTRACTS OPEN-BRIDGES, 100-FEET SPAN, INDIAN STATE RAILWAYS.

(For description see page 104.)



ON THE PHYSICAL CONDITION OF IRON AND STEEL.*

By Professor D. E. HUGHES, F.R.S.

(*Concluded from page* 90.)

Tempering.—The influence of tempering upon the magnetic retentivity, or molecular rigidity, has been shown in every piece of iron or steel yet examined. Swedish iron hardens but 10 to 20 per cent. by tempering, whilst cast steel hardens 300 per cent;† the molecular rigidity of tempered steel being eighteen times greater than that of soft iron. The influence of different methods of tempering on crucible steel is shown in Table III., ranging from its ultimate molecular rigidity to its ultimate softness when annealed:—

TABLE III.

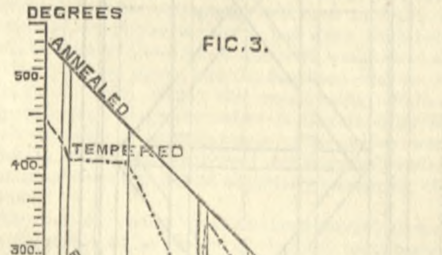
Crucible fine cast steel tempered.	Mark.	Magnetic capacity.
Bright yellow heat, cooled completely in cold water ..	A	28
Yellow red	B	32
Bright yellow, let down in cold water to straw colour ..	C	33
" " " blue " ..	D	43
Bright yellow, cooled completely in oil	E	51
Bright yellow, let down in water to white..	F	58
Red heat, cooled completely in water	G	66
" " " oil	H	72
Annealed	J	84

We may from this represent graphically a diagram which includes all methods of tempering, and another diagram which shall include all varieties of iron, from the softest iron to the hardest steel, intermediate qualities of hard iron and mild steel finding their places between the two extremes. The first is shown in Fig. 2, in which the figures are represented by lines—lettered as in Table III. —erected from points on a horizontal scale, to meet a diagonal line. Thus the height of each line shows the magnetic value, and their distance apart shows the way in which they gradually approach the maximum. The second is shown in Fig. 3, where the lines are lettered as in Tables IV. and V. The numerous specimens of wires tested have been forwarded direct from the manufacturers, at the request of the author's friend, Mr. W. H. Preece, F.R.S., Electrician to the General Post-office. The chemical analyses of most of these wires have not been furnished; but Messrs. Frederick Smith and Co., of Halifax, not only supplied a beautiful series of wires, but had them specially analysed by Mr. Henry S. Bell, of Sheffield, in order that the results should be as exact as it was in their power to make them. The author therefore neglects in this paper all other samples except those of Messrs. Frederick Smith and Co.; they all stand between, or are included by the two extremes, of Swedish iron and cast steel.‡ Table IV. gives the complete results of the mechanical, chemical, and physical tests upon these wires. The tensile strength and electric conductivity are as furnished by Messrs. Frederick Smith and Co., the chemical analyses are as given by Mr. Henry S. Bell, and the magnetic capacities of the bright hard-drawn wires, as of the annealed and tempered wires, were determined by the author with the aid of the magnetic balance. Table IV. will aid us in drawing several conclusions. Taken in conjunction with Table III., it shows—(1) That the degree of temper in cast steel is dependent jointly on the heat to which it is raised, and the degree by which this is lowered in rapid cooling, the extremes in Table III. giving the relative molecular rigidity of the softest and hardest steel; (2) that a peculiar mild and homogeneous temper is obtained in oil;§ (3) that the tempers or degrees of hardness, when steel is let down through the various colours, vary with the kind of steel tempered, as well as the heat from which it has been let down. In these experiments the author has noticed that the highest degree of temper has not been obtained with wires containing the relatively highest proportion of carbon. The maximum thus far was obtained with but 0·62 carbon; whilst in a series of steel wires, made expressly for these experiments, but in which the manufacturer stated only the amount of carbon, the results were as in Table V.:—

TABLE V.

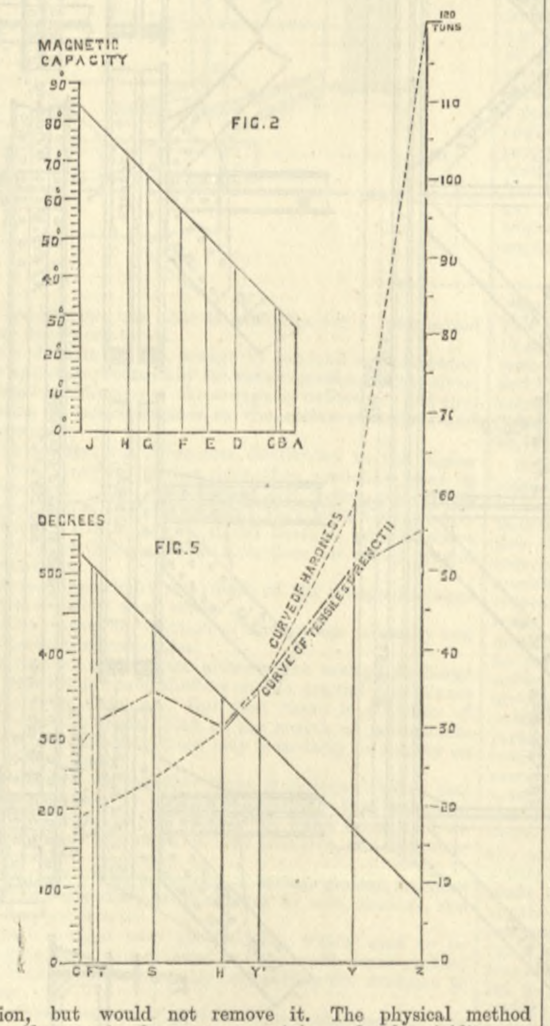
	Mark.	Magnetic capacity.		Carbon.
		Annealed.	Tempered.	
		deg.	deg.	per cnt.
Bessemer soft steel	Y′	291	255	0·15
Steel made for these experiments.	S′	348	206	0·40
" " " "	S^2	250	160	0·55
" " " "	S^3	209	133	0·60
" " " "	S^5	195	107	0·75
" " " "	S^4	144	61	0·65
Bessemer hard steel..	Y	172	60	0.44
Fine crucible cast steel	Z	84	28	0.62

It will be seen that the hardness as indicated in column "tempered" is not directly as the proportion of carbon; a marked



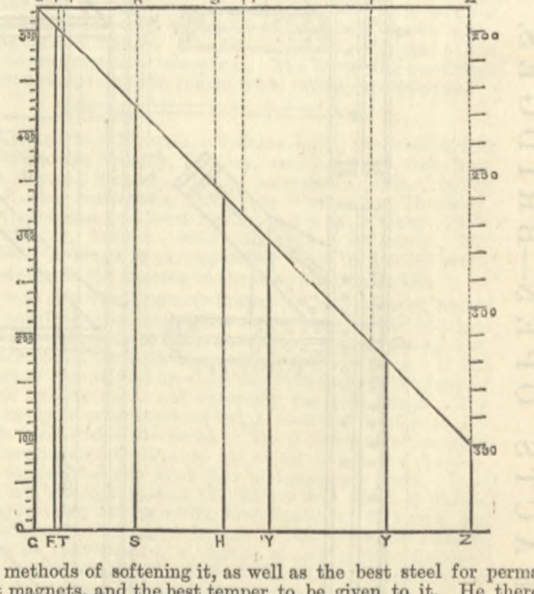
example being the wire with 0·75 carbon, which is far softer than that with 0·62. The author might here have doubted the truth of the magnetic balance if he had not previously verified its results by mechanical tests. In order, however, to test the accuracy of the results, the wires S^5 and Z were bound together, heated together to the same temperature, and plunged together in cold water. This was repeated several times, with the invariable result that the wire Z with 0·62 carbon was glass-hard, and could not be marked by a file, whilst the wire S^5 with 0·75 carbon could be easily cut by the same file. Again, we notice that in Table IV. the wires T, called soft Swedish iron, contain precisely the same amount of carbon—0·15—as those Y′ in Table V., called Bessemer soft steel; but that whilst Y′ is comparatively hard when tempered, it does not become greatly softened by annealing. This is due probably to its greater proportion of some other ingredients. Similarly the wire S is much softer than H in Table IV., both having a similar amount—0·10—of carbon. The hardness of H when annealed is probably due to its greater proportion of phosphorus or some other substance. It may be too soon to try and correlate the physical changes occurring in tempering with the corresponding chemical analyses; but the author believes that he has shown reason to hope that we may eventually obtain, by uniting chemical with physical analysis, a more clear insight into the mysteries of iron and steel.

Dividing line between iron and steel.—Mechanical tests, as well as chemical analyses, have failed to find any distinct line of separation between the numerous varieties of iron and steel. The physical method which the author has employed shows clearly that there is no dividing line between iron and steel. If we glance at Fig. 3 we see that we have a continuous series from the softest iron to the hardest steel, and between them we have every variety of intermediate quality. In point of fact, the sixty brands which have been tested fill up all the gaps; and by their means we could choose irons gradually hardening into steel, or steel gradually softening into iron. Thus ordinary iron is physically a soft steel, and steel a hard iron. All are hardened by temper; all are hardened by mechanical treatment, as hammering and rolling; all are hardened by strains and stresses of any nature whatever: the difference, though large, is only in degree. At the extreme end towards iron, mechanical hardening has a greater effect than tempering. At the steel end, tempering has a greater effect than mechanical hardening. We might here suppose we could find a physical dividing line, but the author has found some mild steels to stand just on that dividing line, which had previously appeared the most satisfactory. We are thus forced to adopt an arbitrary line. Neither the mechanical nor physical methods will suffice to overcome the difficulty. Mechanically a certain tensile strength has been proposed—the objection to which is, that unless we take note of the physical conditions—such as whether soft, tempered, &c.—we shall have very different magnetic readings for what would stand as the same material. The addition of the ultimate elongation might to some extent weaken this



objection, but would not remove it. The physical method would allow us to fix upon a certain molecular rigidity, or difference in the readings of the same metal annealed and tempered, as the boundary; it would have, however, all the objection of being a purely arbitrary line. Chemical analysis also fails to show a dividing line, as the same proportion of carbon is accompanied by very different physical results, if sulphur, phosphorus, &c., are present. In the author's researches he has adopted the plan of simply reading an unknown piece of iron or steel in its annealed state; if the figure stands above 400 deg. it is classed as iron, if below as mild or hard steel, according to its magnetic capacity. This happens to agree with the general classification at present in use, and suffices as a general division.

Relations of physical forces in iron and steel.—Iron is by far the richest of all metals in its physical nature. It stands almost alone in its magnetic qualities, as well as in its tempering properties, and, while there is an evident relation between capacity for temper and loss of magnetism when tempered,* so these experiments show an intimate if not absolute relation between the electrical conductivity of iron, and its magnetic capacity. In Table IV, in the column of electrical resistance as given by Messrs. Smith and Co., we find a progressive increase of resistance, just as we find a progressive decrease in magnetic capacity. And there is an exact correspondence between the two variations, as shown graphically in Fig. 4, where both sets of figures are marked off on horizontal scales, and then lines are projected upwards for magnetic capacities, and downward for electrical resistances, to meet on a common scale at 45 deg. The molecular rigidity, observed by the author as the cause of hardness, gives at once decreased magnetic capacity and increased electrical resistance, so that from the magnetic capacity we might deduce its electrical resistance, and *vice versâ*. A very remarkable phenomenon is that this only holds true in the limited sphere of elastic rotation, which the author has already described. This demonstration the author believes to be of great theoretical value, and in a future paper, upon the theory of magnetism, its importance will be shown. In this paper the author has tried as far as possible not to bring theoretical considerations forward; in the results presented we are dealing with proved facts. Another extraordinary relation of physical to mechanical tests may be mentioned. In Table IV. the tensile strength bears no relation either to the magnetic or electric qualities. On increasing the electro-motive force in the magnetic balance, all the readings became confused; there was no longer any fixed relation as to hardness, nor any other quality. But on again forcing the magnetism to a very high point, the figures for magnetic capacity were fouud to bear exactly the same relation to each other as those for tensile strength. This, however, may have been only an accident, as it only seems true at present in relation to the wires in Table IV.; but it gives hope that by a new method we may some day be enabled, not only to deduce electrical conductivity from magnetic capacity, but also tensile strength. Already in Table IV. we notice a close relation between molecular rigidity, as indicated by the figures for the annealed wires, and tensile strength. This is shown graphically in Fig. 5, where the reciprocals of the figures for the annealed wires are used to form a scale of hardness, and it is seen that the figures for hardness rise with the figures for tensile strength. The only exception is the wire H, but the cause of this is clearly the small difference between its capacity as annealed and tempered. Leaving aside all theoretical considerations and hoped for improvements in the methods of observation, the author believes that he has demonstrated clearly that, by the aid of the instrument and methods described, we can at once determine the physical state of iron, as influenced by the tempering and mechanical hardening, from the ultimate degree of softness to that of hardness: that we can at once determine the best iron for electro-magnets, and the



best methods of softening it, as well as the best steel for permanent magnets, and the best temper to be given to it. He therefore ventures to hope that the magnetic balance will prove an aid of no small value in all researches into the physical state of iron and steel.

TABLE IV.

Brand.	Quality.	Electrical resistance per mile of ·040 diam.	Tensile strength per sq. inch.	Magnetic capacity. Bright hard.	Annealed.	Tempered hard.	Chemical analysis. Carbon.	Silicon.	Sulphur.	Phosphorus.	Manganese.	Copper.	Iron.
		ohms.	tons.	deg.	deg.	deg.							
G	Best Swedish charcoal iron, No, 1	191·52	28	230	525	485	0·09	trace	trace	0·012	0·06	trace	99·69
F	" " " No. 2	198·40	30	236	510	415	0·10	trace	0·022	0·045	0·03	trace	99·70
T	" " " No. 3	199·62	31	275	503	395	0·15	0·018	0·019	0·058	0·234	trace	99·44
S	Swedish Siemens-Martin iron	226·32	34	165	430	390	0·10	trace	0·035	0·034	0·324	trace	99·60
H	Puddled iron, best best	259·92	30	212	340	328	0·10	0·09	0·03	0·218	0·234	0·015	99·11
Y′	Best homogeneous soft Bessemer steel ..	266·52	35	150	291	255	0·15	0·018	0·092	0·077	0·72	trace	98·74
Y	Best homogeneous hard Bessemer steel ..	312·69	50	115	172	60	0·44	0·028	0·126	0·103	1·296	trace	98·20
Z	Fine crucible cast steel ·..	350·08	55	50	84	28	0·62	0·06	0·074	0·051	1·584	trace	97·41

THE RAILWAYS.—South Australia has a larger railway mileage in proportion to its population than any other country. The railways are in the hands of the State. The decision arrived at after years of discussion, that the railways of the country shall be in the hands of the State, is based principally upon two grounds, that it is contrary to good policy to allow a monopoly of the great highways of the country by private individuals or companies, and that they would not construct the lines without conditions in the shape of guarantees or land grants that would be a very hard bargain for the community.

BALLOONS FOR THE WAR IN TONQUIN.—The French war transport ship Poitou, which recently left Toulon for China, had on board a complete military balloon equipment, which was despatched from the arsenal at Meudon and filled nine railway wagons. The corps consists of 100 men, including a colonel and two captains, and it is intended to act specially in ambuscades, and is attached to the artillery. The balloons are of the finest silk. A complete photographic apparatus is attached to each car, which can turn out 100 impressions a second and printed instantaneously, besides prismatic compasses, aneroids, thermometers, and other scientific instruments of recent invention.

* Paper read before the Institution of Mechanical Engineers.

† For instance, in Table IV. below, the figure for Swedish iron No. 7 annealed is 525, tempered hard 425. On the other hand, the figure for cast steel annealed is 84, tempered hard 28. The reciprocals of these figures give what may be called a scale of hardness, as shown in Fig. 5.

‡ The author does not desire that Swedish iron should be considered as the softest of all possible irons, or tempered cast steel as the final limit of hardness. They are simply the limits found during these researches, but they may possibly be widened by a more extended series of irons and steels.

§ The author has found by a method more complicated than here described, and by the use of the induction balance, that all tempers heretofore tried, excepting those in oil, give a steel not homogeneous: and a temper let down to straw or blue has external strains differing from those of the interior.

* This is shown in Table IV. and Fig. 3, where the proportion of magnetism lost by tempering is seen to increase markedly as we pass from soft iron to hard steel.

RAILWAY MATTERS.

THE half yearly report of the directors of the Belfast and Northern Counties Railway gives the toal cost of locomotive power as £15,300, and the total train mileage as 475,645.

A BRANCH railway from Compiègne to Pierrefonds has just been opened which it is thought will multiply the visitors to the old castle restored by Viollet Le Duc; as well as to the mineral spring in its vicinity.

AN accommodation train of three cars on the Indianapolis and Chicago Railroad broke through a bridge at White's Creek, near Indianapolis, on the 31st ult. Part of the wreck was submerged; the other portion caught fire. Six persons were burnt or drowned, and nine were injured.

THE Brussels correspondent of the *Times* says:—"A company, with a capital of 1,440,000fl., has been formed at the Hague for constructing railways in Java. The founders have subscribed the capital. It is stated that there is some talk at Amsterdam of the foundation of a company, with 50,000,000fl."

TWO of the ventilators on the District Railway, and these the two nearest to the Houses of Parliament, have been removed, and the roads restored to their original condition. One of these two ventilators was opposite to the north door of Westminster Abbey, and the other between the Westminster Palace Hotel and the Royal Aquarium.

THE *American Manufacturer*, Pittsburgh, says:—"Messrs. McIntosh, Hemphill, and Co. are interested in the construction of a tank car for transportation of natural gas. The car is being built at the Swissvale Car Works. It is an ordinary flat car containing a cylindrical tank of ⅜in. steel, 10ft. in diameter, and 35ft. long. The tank is to be filled at the Tarentum wells, and is capable of containing 20,000 cubic feet. Mr. Hemphill considers the scheme a practical one. At any rate, he purposes making the trial."

IT appears that the Arlberg Tunnel will be finished by the end of May, and the Arlberg Railway by the end of October. The measurements which have been made since the meeting of the two headings of the tunnel show a horizontal divergence of 43 millimetres. A re-levelling from the central part of the tunnel also shows that the datum adopted at the eastern part of the works has an elevation of 164 millimetres above that of the western end. The total length of the tunnel is 5·68 metres less than was estimated before the boring was finished.

A DIVISION according to classes of trains and accidents on American lines last November is given by the *Railroad Gazette* as follows:—

Accidents.	Collisions.	Derailments.	Other.	Total.
To passenger trains ..	2	30	—	32
To pass. and freight ..	12	—	—	12
To freight trains	36	40	2	78
Total	50	70	2	122
Casualties:				
Killed by	22	12	—	34
Injured by	60	175	—	235
Total	82	187	—	269

This shows accidents to a total of 172 trains, of which 46, or 27 per cent. were passenger trains, and 126, or 73 per cent., were freight trains. There were 68 accidents in daylight and 53 at night, while in one case the time is not definitely given. The hours of daylight were nearly at their shortest during the month.

IN connection with the forthcoming Turin Exhibition, a tramway is to be constructed from the Piazzo Carlo Felice to the principal entrance. The motive power will be supplied by accumulators, the invention of Signor Nigra, which differ from those of M. Faure in that the lead is used in the form of hanks or festoons of wire, thus presenting a large surface. A correspondent says: "With a Schuckert dynamo and thirty accumulators weighing 10 kilogrammes—22 lb.—each, Signor Nigra has been able to run a four-wheeled car, carrying three persons, at 20 kilometres—12½ miles—an hour, while at the same time maintaining an electric lamp of sufficient power to light the vehicle." This is the sort of thing we have now been hearing of for about three years. Accumulators appear with a flourish of trumpet paragraphs, telling what they have been able to do for a few hours, and after this very little is heard. In the above-mentioned accumulator, in which large surface is obtained by dividing the lead used up into wires, the invention is old; the surface is, after all, exceedingly small compared with that of the compressed porous lead used in one form of English battery, and the wires, moreover, drop to pieces with a quickness which is the greater in proportion to their electric efficiency, namely their smallness.

THE *Railroad Gazette* record of accidents on American railways in November shows for that month a total of 122 accidents, in which 34 persons were killed and 235 injured. It contains accounts of 50 collisions, in which 22 persons were killed and 60 injured; 70 derailments, in which 12 were killed and 175 injured, and two other accidents, in which no one was either killed or hurt. These accidents are classed as to their nature and causes as follows:—Collisions: Rear, 35; butting, 12; crossing, 2; passing, 1; total collisions, 50. Derailments: Broken rail, 4; broken bridge, 4; spreading of rails, 4; broken wheel, 6; broken axle, 4; broken truck, 1; accidental obstruction, 7; cattle, 3; wash-out, 3; landslide, 1; wind, 1; misplaced switch, 7; bridge floor removed for repairs, 1; rail purposely removed, 3; switch purposely misplaced, 3; malicious obstruction, 3; unexplained, 15; total derailments, 70. Other accidents: broken coupling rod, 1; car burned while running, 1; total, 2; total accidents, 122. As usual, a very large portion resulting from the most fruitful cause of accident, namely, derailment, were unexplained. Eight collisions were caused by trains breaking in two; four by mistakes in giving or receiving orders; three by cars blown out of siding; three by misplaced switches; two by cars carelessly left on the main track; two by failures to use signals; two by fog; one each by carelessness in running and by carelessness in putting cars on a siding. Of the four broken bridges one was partly consumed by fire just before it gave way; the other three were wooden trestle bridges, calling for no especial remark. Ten accidents—seven derailments and three collisions—were caused by misplaced switch, which do not appear to diminish in number.

IT is curious to learn how slowly Americans learn some things. The *National Car Builder*, for instance, makes the following remarks on large wheels for passenger cars:—"When 42in. wheels were first used in this country under passenger cars, there was a good deal of fruitless discussion about their utility as compared with that of smaller wheels. What discussion failed to make clear, however, has been determined by use and the knowledge thereby obtained. Much can now be said in favour of large wheels, showing their superiority to small ones for passenger service, that could not have been said with the same confidence a few years ago. English practice could, of course, be referred to as being conclusive, so far as the style of 'carriages' on English roads was concerned. But our cars are altogether different in size, weight, and construction. Probably no road in this country has given 42in. wheels a more thorough trial than the Boston and Albany, and we are informed that with these wheels such a thing as hot journals is practically unknown on that road, none having been reported for a long time. This is attributed to the fact that the journals revolve slower, their surface speed with the 42in. wheels at forty miles an hour being no greater than that of journals with 33in. wheels at thirty-one miles an hour. This is a moderate speed if the journals are well packed, and they ought therefore to run cool. It is also asserted that passengers perceive a difference in the riding of cars having the larger or smaller wheels, and that they prefer those with the large ones. This is significant if not conclusive. But there is still another thing that many observing people have noticed, and that is, that large-wheel trains appear to move at a comparatively moderate speed, when the distance covered shows a speed of forty and forty-five miles an hour."

NOTES AND MEMORANDA.

IN America during the last year no less than 2890 petroleum wells were put down, as compared with 3260 in 1882, and 3852 in 1881. In 1883, 245 dry holes were "found," against 180 in 1882, showing that the limits of the different oil fields are now pretty well defined, and, an American paper remarks, the prospector who goes outside of them has a pretty good chance to fail in "striking oil."

SO much has been said of the chalk well water supply of London that it will surprise many to know how comparatively insignificant is the total quantity so supplied. Including the wells south of London, it is only 12 per cent. of all that is distributed to central and greater London. From the Thames and springs in the Thames Valley come 50 parts of the whole; from the river Lee and springs in the Lee Valley, 38 parts; the chalk wells north and south only supplying each six parts.

THE report of Dr. Frankland on the water supplied to different parts of London during December shows that some of the river water contained rather more so-called "organic impurity" than in the preceding two months. The greatest quantities during this month of pulverised weeds, leaves, and woody fibre, &c., constituting organic impurity, amounted to less than one-quarter of one seventy-thousandth of a gallon per gallon, or 0·007 of one pound per ton of water. The albuminoid ammonia—the real test of purity—in the water was only about two one-hundredths of one part per million, or in 455 tons of water there are two one-hundredths of one pound of albuminoid ammonia. If a man drank 2 lb. of the water per day, it would at this rate take him about 1600 years to get the two one-hundredths of a pound.

IN 1862 Count de Lauture tried to simplify the Chinese language so that it could be used for telegraphing, but he was unable to solve all the difficulties of the problem. In 1866 M. Viguier experimented with autographic telegraphs, and proposed to employ a cypher code, by which the 44,000 Chinese characters could be transmitted by the Morse apparatus. This code was first published in 1870, when a cable was laid between Shanghai and Hong Kong. Every Chinese character is composed of two parts—one is called the radical or key, the other is phonetic. Every Chinese character can be classed under one of 214 radicals. In his first essay Viguier used three numbers to represent each character—that of the radical, that of the column under the radical, and that of its order in the column. This system required the use of numbers varying from three to six cyphers, which rendered the transmission of despatches slow and difficult. By eliminating the characters which are rarely used, and employing those which occur in ordinary correspondence, he was able to simplify his system, so as never to require more than four figures for a single character. To this improved method he added Chase's system of holocryptic cyphers, so that messages can now be sent readily and with perfect secrecy.

THE following method of colouring soft solder, so that when used for soldering brass, the colours may be about the same, is given by the *Metallarbeiter*:—First prepare a saturated solution of sulphate of copper—bluestone—in water, and apply some of this on the end of a stick to the solder. On touching it with a steel or iron wire it becomes coppered, and by repeating the experiment the deposit of copper may be made thicker and darker. To give the solder a yellow colour, mix one part of a saturated solution of sulphate of zinc with two of sulphate of copper, apply this to the coppered spot, and rub it with a zinc rod. The colour can be still further improved by applying gilt powder and polishing. On gold jewellery or coloured gold, the solder is first coppered as above, then a thin coat of gum or isinglass solution is applied and bronze powder dusted over it, which can be polished after the gum is dry and made very smooth and brilliant; or the article may be electro-plated with gold, and then it will all have the same colour. Quoting from a German source, the *Scientific American* says:—On silverware the coppered spots of solder are rubbed with silvering powder, or polished with the brush and then carefully scratched with the scratch brush, then finally polished.

IN an article on Gutta-Percha in the *Journal of the Society of Arts*, Mr. James Collins says:—"Dr. Oxley calculated that to supply the 6918 piculs—1 picul equal 133⅓ lb.—exported from Singapore, from the 1st of January, 1845 to 1847, 69,180 trees were sacrificed; and, according to the *Sarawak Gazette*, 3,000,000 trees were required to supply the 90,000 piculs exported from this district during 1854 to 1874. These are only two instances, the first, showing the trade in its infancy; and the second, that of a limited and comparatively small producing locality. In fact, the gutta-percha tree has only been saved from utter annihilation because trees under the age of twelve years do not repay the trouble of cutting down. Still, it is clear that the growth of young trees of the best varieties has not kept pace with the destruction, but are becoming much scarcer, so that recourse now, more than ever, has to be had to the products of very inferior varieties. At the present time there is a great difficulty in obtaining sufficient supplies of the best varieties, especially for telegraphic purposes. The Indian Government, acting on the advice of the late Mr. Howard, F.R.S., Mr. Markham, Dr. Spruce, and others, have taken up the india-rubber question. The Colonial Government should now take up the question of gutta-percha."

AN enormous monument, with a statue of Liberty at the top, is being erected by the Americans. The report of Colonel Casey, accompanying that sent to Congress by the Washington Monument Commission, shows that the structure has now risen to a height of 410ft., and that the balance available from the appropriation—153,375·06 dols.—is sufficient to complete the shaft and roof, the interior staircase and platform, the masonry of the well, the paving of the floor, and the passenger elevator, but not to provide for any embellishment of the doorways, the terrace and approaches to the structure, the insertion in the walls of the presentation stones, the final disposition of the boiler-house, or of appliances for lighting the interior of the shaft. One thousand one hundred and twenty blocks of marble, containing 27,718 cubic feet, and 490 blocks of granite, containing 13,438 cubic feet, were built into the structure during the working season. Since the completion of the foundation, 31,543 tons have been added to the weight of the then existing structure, and the settlement of the shaft has been as follows:—South-west corner, 1·62in.; south-east corner, 1·64in.; north-east corner, 1·67in.; north-west corner, 1·68in.—an average for the entire structure of 1·65in. The total pressure on the "bed of foundation" is now 78,060 tons—nearly 97 per cent. of the entire weight to be placed upon it.

IN illustration of the tendency of dust to move from hot and to deposit itself on cold surfaces, the following experiments were recently described before the Royal Society of Edinburgh by Mr. J. Aitken:—Two mirrors, one hot and the other cold, fixed face to face and close to each other, were placed in a vessel filled with a dense cloud of magnesia, made by burning magnesium wire. After a short time the mirrors were taken out and examined. The hot one was quite clean, while the cold one was white with magnesia dust. In another experiment a cold metal rod was dipped into some hot magnesia powder; when taken out it had a club-shaped mass of magnesia adhering to its end, while a hot rod attracted none. This tendency of dust to leave hot surfaces and attach itself to cold ones explains a number of familiar things; among others it tells us why the walls and furniture of a stove-heated room are always dirtier than those of a fire-warmed one. In the one case the air is warmer than the surfaces, and in the other the surfaces are warmer than the air. This effect of temperature is even necessary to explain why so much soot collects in a chimney. It explains something of the peculiar liquid-like movements of hot powders, and perhaps something of the spheroidal condition. For practical application, it is suggested that this effect of temperature might be made available in many chemical works for the condensation of fumes, and that it might also be used for trapping soot in chimneys.

MISCELLANEA.

MESSRS. THOS. ROBINSON AND SONS, of Rochdale, have been awarded a gold medal at the Calcutta Exhibition for their set of wood-working machinery there exhibited.

IN connection with the opening of the Turin Exhibition, the Italian Government offers a prize of £400 to the inventor of the most practicable method for the transmission of electricity to a distance. The competition will be international.

A BRUSSELS correspondent of the *Times* says it is seriously proposed at Antwerp to bring there during the Universal Exhibition in 1885 the Great Eastern as a floating restaurant and hotel.

A COMPANY has been formed at Duesseldorf for the production and sale of Delta metal under the German patents of Mr. Alexander Dick. The title is "Deutsche Delta Metall Gesellschaft," Alexander Dick & Co., and it counts amongst its members some of the most influential persons in German industry.

THE death is announced of Mr. Julius Pintsch, of Fuerstenvalde and Berlin, the originator and successful patentee of the now widely-used system of lighting railway carriages and floating buoys by means of compressed air. He was widely known in Germany as a successful gas engineer, but for a good many years Mr. Richard Pintsch, his eldest son, has been the chief worker and the designer of most of the work, including some of the most important gas works in Germany, executed by the firm known as Julius Pintsch. Mr. Pintsch was seventy years of age.

THE leading organ of German free trade, commenting on the recent discussion in the Chamber of Deputies on the coalition of the steel rail works, remarks that since the new iron duties came into operation in 1879, the German steel works have drawn about sixty millions of marks from the ratepayers in the shape of subventions. That is to say, that almost invariably, when quoting for foreign contracts, German steel manufacturers have quoted about 30 to 60 per cent. less than they charged for the same goods to German railways, being enabled by the heavy customs duties to take advantage of the latter.

THE Danube Regulation Committee has decided to spend the sum of 1,488,000fl. on works of regulation along the river in 1884. These works will extend from Stein to Deutsch-Altenburg, on the Hungarian frontier. The chief of them are the continuation of the inundation dikes below Vienna, to which 600,000fl. are to be devoted, and the great regulation works at Deutsch-Altenburg, on which, as a first instalment, 168,000fl. are to be expended this year. According to the opinion of experts, the imperfections experienced near Vienna are entirely owing to the works not having been carried out to a sufficient distance down stream.

A CORRESPONDENT writing upon the recent heavy storm round our coasts, after describing some of the resulting wrecks and horrors, says:—"For sailors I need not point the moral of these facts. For landsmen I may say that a shingle mole run out from Dungeness—which might have been done at small cost any time during many years past, and has been long and loudly called for by the maritime public—would have completely protected all these vessels, as well as hundreds more in past tempests, so that when the brief but destructive blast was over they could have tripped their anchors and gone on their voyage without the loss of a spar or of a fathom of chain. To us, living on this sad and tragical shore, it is more and more a sorrow and a marvel that this ship-trap should continue unprotected for a single year. Our Home Secretary has some thousands of spare convicts on his hands with whom he does not know what in the world to do, while this, the most frequented point on the shores of England, is its most unprotected point."

A JOINT for driving bands, in which great strength is combined with an even surface, has lately been offered to the public, although it has been used privately for upwards of five years. Messrs. Bailey Bros., of Chancery-lane, were applied to by a large firm of mill-band makers to supply a cement, so modified from that which they have long made for mending china and glass, that it might be used for joining machine belts. The ends of the belt to be joined are cut to a long scarf, not, however, so long as the width of the belt. The cement is applied hot, the two parts are put carefully together and the joint is subjected to pressure from a weight or in a vice. The joint becomes set in twelve hours; but it is preferable not to use the belt before twenty-four hours have elapsed, when, it is said, the joint is the last place at which the belt will break. The practice is to suspend the belt, with a heavy weight on the joint, for the double purpose of testing the joint and of stretching the belt. We are assured that the joint will stand both heat and damp, and that one has never been known to give way.

SOME figures published in an account of a banquet given by the workmen of M. Decauville at Petit-Bourg show how enormous may be the results of steady adhesion to a special requirement. M. Emile Decauville has made a specialty of very light railways suitable for plantations, contractors' work, &c., and having occasion to visit Java to be present at the inauguration of 48 kilometres of this railway, he took this as part of a voyage round the world, and on his return was fêted by his workpeople. At the time it was stated by M. Marchand, of Creusot, that a larger quantity of iron and steel is now worked up per day at the Petit-Bourg Works than anywhere else in the world. Ten years ago Petit-Bourg was a small agricultural village, now it is the greatest ironworking centre of the Seine-et-Oise. One new series of workshops alone measures 14,000 metres, or nearly a hectare and a-half. So great is the quantity of this light railway work now turned out of these works that a Paris, Lyons, and Mediterranean locomotive which goes to the works each day hauls off from 18 to 20 loaded wagons, or half a goods train.

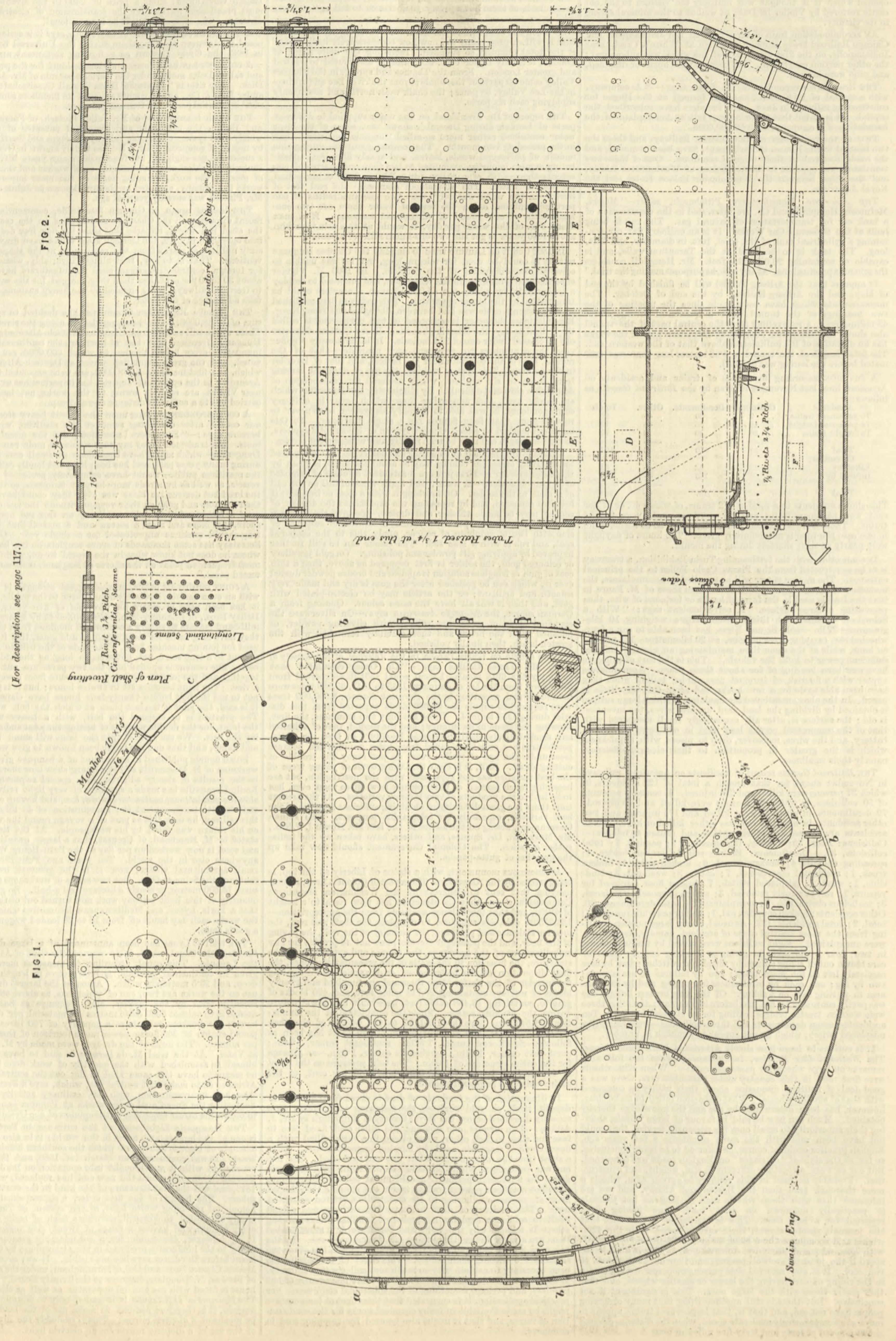
THE trial at Lyons has been announced of a large dredger for the Corinthe Canal, which is to connect the Gulf of Athens with the Lepanto. This canal, according to measures more recently given in continental journals, is 7600 metres in length, 8 metres deep, and 23·5 metres in width. Amongst the largest dredgers in use on the works are two, one of which has, as above stated, been recently tried by the makers, MM. Demange et Satre. Each dredge is to extract 5000 cubic metres of material per day of ten hours; the buckets each have a capacity of 750 litres. A compound engine of 300-horse power raises fourteen of these buckets per minute. The hulls of the dredger were made by M. Debianne at Vaise. At the trial M. de Lesseps is said to have expressed himself so astonished with the quantity of work done by it that he means to have the same kind to dig out the central parts of Africa so as to make that central sea, which, says a French paper, "he has in preparation with his ordinary activity—without neglecting the Suez Canal or the works at Panama—and which is to crown his career according to the opinion of the Grand France."

THE Macquarie Lighthouse, at the entrance to Port Jackson, is one of the largest and finest in the world; it is also the finest example of electric lighting of which the southern hemisphere can boast. It was commenced on March 1st, 1880, and the light in connection with it was brought into operation on 1st June, 1883. The old lighthouse, which the new one has replaced, was built in 1816, and was the first structure of the kind in the southern hemisphere. The light is of the first order, a sixteen-sided, dioptric, holophotal revolving white light, of the system of Teulére, commonly attributed to Fresnell, showing a flash of eight seconds in every minute, and having a range of twenty-five miles seaward. It is, however, discernible for a considerably greater distance, owing to the luminosity produced in the atmosphere by the electric beam before the direct rays become visible. It was constructed by Messrs. Chance Bros. and Co., of Birmingham, under the supervision of Sir Jas. N. Douglass, engineer to the Trinity Board. The lighthouse is fitted with gas and oil apparatus as well as electric light. The Macquarie Lighthouse is intended only to illumine half the horizon, it is therefore possible to make use of the landward rays by means of a dioptric mirror. This is probably the first instance of the use of a dioptric mirror for an electric light.

BOILERS OF H.M. IRONCLAD SHIP, COLOSSUS.

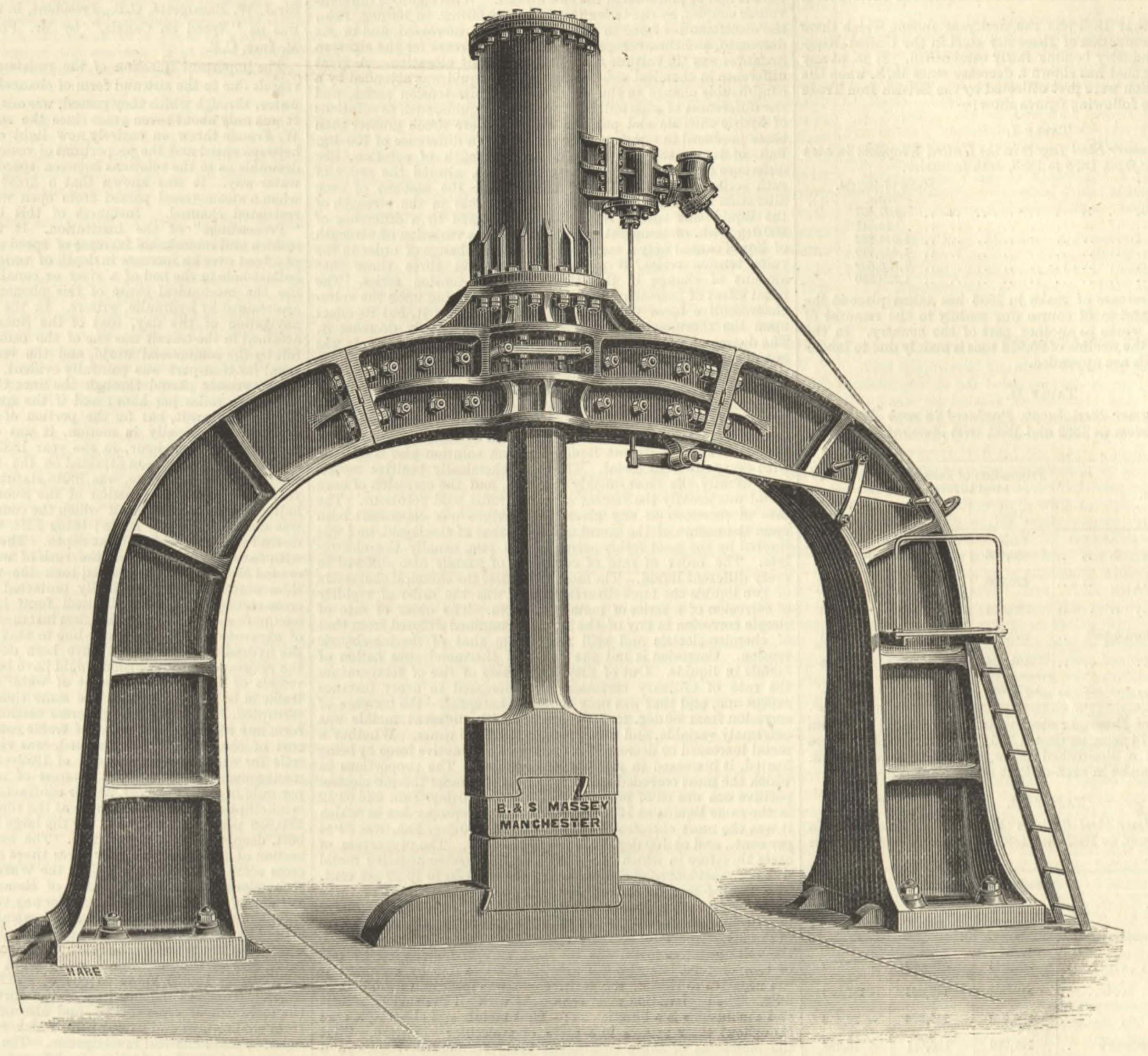
MESSRS. MAUDSLAY, SONS, AND FIELD, LAMBETH, ENGINEERS.

(For description see page 117.)



TEN-TON STEAM HAMMER.

MESSRS B. AND S. MASSEY, OPENSHAW, NEAR MANCHESTER, ENGINEERS.



ABOVE we give an illustration of a powerful steam hammer, recently constructed by Messrs. B. and S. Massey, Openshaw, near Manchester, for the Mersey Forge, Limited, Liverpool, and which was briefly referred to a short time ago by our Manchester correspondent in his "Notes from Lancashire." The hammer presents some important improvements as compared with those usually constructed of this form. Some of the large types of hammers, on account of the flat sides planed on the piston-rod, to prevent turning round, have commonly had the stuffing-boxes unmachined. That is, they have simply been put together as the castings have come out of the sand, with such fittings as could be done by hand, and the opening in the framing under the cylinder, through which the piston-rod passes below the gland, being larger than the piston-rod, of course does nothing to steady it; the result is that in such hammers the piston-rod is only guided by the fittings of the piston in the cylinder, with such aid as can be given by a gland stuffing-box, which consists only of castings dressed off by hand. In the steam hammer of which we give an illustration, the stuffing-box is accurately worked out by machine tools to the same section as the piston-rod, and the gland, which is of steel, is machined in every part to ensure an accurate fitting to the stuffing-box as well as to the piston-rod. In addition to this the opening in the framing below the gland is carefully machined to the precise dimensions and sections as the piston-rod, and this forms a deep guide. By these arrangements the piston and rod, when at the lowest working position, have a guide 5ft. 10in. deep; and if the work on the anvil is only 14in. high, the piston-rod has a minimum guide 7ft. deep, which, with a piston-rod 1ft. 6in. diameter, secures ample rigidity and accuracy in delivering the blow. The two halves of the framing are planed all over and secured by turned bolts fitted tightly into rimered bolt holes, and further secured by planed keys. The central web of the framing is made thicker in the lower panels than above, giving ample strength combined with moderate weight in the upper part. The valve gear allows the hammer to be worked either double or single action, the steam being either admitted to the top of the cylinder or shut off from it at the discretion of the attendant. The valve gear is so arranged as to be perfectly under command, so that although the design permits the use of stop blocks or a stop lever to prevent the piston rising too far, these are found unnecessary, and, in fact, the workmen prefer to be without them. The piston and piston-rod were forged solid from the special iron produced by the Mersey Forge. Nominally the hammer is ten tons, but the falling weight, exclusive of top steam, is nearer eleven tons. The stroke is 84in., and the width inside the arch 18ft.

CAVELL'S SMITHS' FORGE TUYERES.

THE object of this invention is, first, to simplify the construction and economise the cost of making tuyeres for smiths' forges in general; and secondly, to make a tuyere which is more durable and requires less attention and repair than the tuyeres at present in use. No water is used to keep the tuyere cool, and its construction is as follows:—

Fig. 1 is a section, Fig. 2 is a general view of the tuyere, and Fig. 3 a view showing part of a forge with the tuyere in use. On the upper and lower parts of the body of the tuyere are flanges, the upper flange carrying the nozzle A of the tuyere, held by bolts and nuts. This nozzle enters the hearth of the forge, and is placed in a vertical position, as shown in Fig. 3. On the lower flange is fixed a tube, which approaches the ash-

FIG. 1

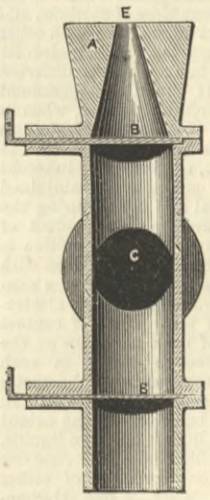
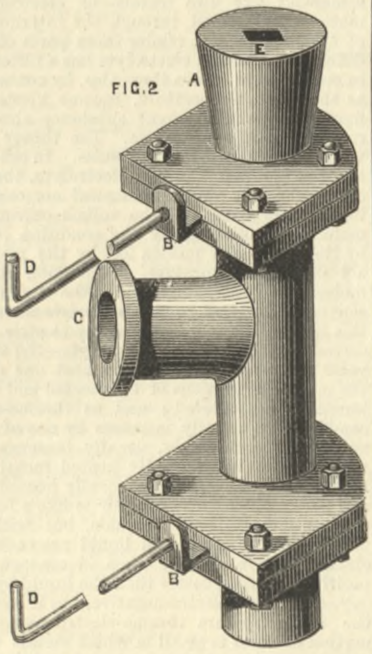
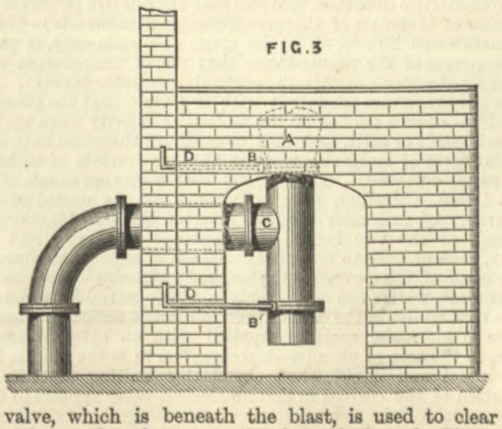


FIG. 2



hole. Between each of the flanges is inserted a draw valve P. When the upper draw valve is open it allows the air-blast to pass through the nozzle A to the hearth of the forge. The lower

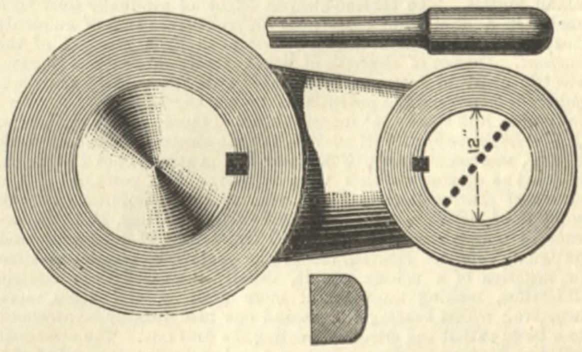
FIG. 3



slide valve, which is beneath the blast, is used to clear the tuyere of any ashes that may enter from the hearth. The centre part or trunk of the tuyere may be fixed permanently in the forge, and does not require to be removed, as in any case it is not burned by the fire. The nozzle, after lasting a long time, can be removed from the trunk by displacing a few bricks in the hearth and unscrewing the bolts which pass through the upper flange, when renewal is easily made. A saving is thus effected in the construction of forges by avoiding the necessity of taking the forge to pieces when any part of the tuyere requires repair or renewal. The tuyere is cheaper, and a forge takes much less room than those on the water-circulation system. It is made by Messrs. Cavell and Co., Orchard-road, Plumstead, S.E.

TIGHTENING A LOOSE CRANK PIN.

THE following description of a method of tightening a loose crank pin has been sent to the American *Mechanical Engineer* by Mr. Herman Winter, resident engineer of the Morgan Line S.S., N.Y.:—"You and your engineer readers everywhere will, perhaps, be amused and interested by an account of the manner in which I recently fastened loose pins in the steamships Glaucus, of the Metropolitan Line and the Morgan City, of the Morgan Line. These pins were shrunk in, but the shrinkage allowance was so great that instead of holding them it expanded the crank eyes, with the result stated. It was



impossible to make new pins, as the time at disposal did not permit of it. I therefore adopted the following expedient:—I drilled holes $\frac{3}{8}$in. in diameter the whole depth of the eye, as shown in the sketch herewith, and about $\frac{1}{8}$in. apart, merely so they would not run into each other, and also to have but little metal to cut apart after drilling. In these holes I put cartridges or plugs of Muntz's metal—see small figure in sketch—about $\frac{1}{2}$in. to $\frac{5}{8}$in. thick, having a pointed end. Of these a row was put in across the pin and driven home by a steel drift made for the purpose, as shown on the sketch. This also has a rounded end, and the cartridges are put in round end towards the driver, so that they would expand from the centre. You will readily see that the effect of this is to expand the split pin with great force against the crank eye, when all the holes are driven full of plugs. The operation was an entire success, and may be used to great advantage by others in similar straits, with a larger or smaller pin. I think it is a much better plan than drilling holes alongside the pin between it and the eye, and driving steel pins in as commonly done. This latter injures the crank eye irreparably for fitting a new pin to it any time."

THE BESSEMER STEEL INDUSTRY IN 1883.

ACCORDING to a report just issued by the British Iron Trade Association, the total production of Bessemer steel ingots in the United Kingdom in 1883 was 1,553,380 tons, against a total of 1,673,649 tons in 1882. This amounts to a decrease of 120,269 tons, or 8 per cent.

It is probable that 1883 was the first year during which there was a decreased production of Bessemer steel in the United Kingdom since that industry became fairly established. It is, at any rate, the first year that has shown a decrease since 1878, when the returns of production were first collected by the British Iron Trade Association, as the following figures show:—

TABLE I.

Production of Bessemer Steel Ingots in the United Kingdom in each year from 1878 to 1883, both inclusive.

Year.	Make of ingots. Tons.
1878	807,527
1879	834,511
1880	1,044,382
1881	1,441,719
1882	1,673,649
1883	1,553,380

The principal decrease of make in 1883 has taken place in the Sheffield district, and is of course due mainly to the removal of one of the largest works to another part of the country. In the Cleveland district the decline of 25,018 tons is mainly due to labour difficulties. Details are appended.

TABLE II.

Quantities of Bessemer Steel Ingots Produced in each District of the United Kingdom in 1882 and 1883, with Amount of Increase or Decrease.

District.	Production of Bessemer steel ingots.		Amount of increase or decrease in 1883.
	1882.	1883.	
	tons.	tons.	tons.
South Wales	483,086	504,966	+ 21,880
Sheffield	420,000	285,763	−134,237
Cleveland	326,924	304,606	− 25,018
Lancashire and Staffordshire*	252,313	247,440	− 4,873
West Cumberland	191,326	210,605	+ 19,279
Totals	1,673,649	1,553,380	

The production of Bessemer steel rails in the United Kingdom in 1883 was 1,097,174 tons, against 1,235,785 tons in 1882. There has therefore been a diminished make of 138,611 tons in 1883. Particulars of the make in each district are appended:—

TABLE III.

Production of Bessemer Steel Rails in the United Kingdom, and in each District thereof, in 1882 and 1883, with Increase or Decrease in the latter year.

District.	Production of Bessemer steel rails.		Increase or decrease in 1883.
	1882.	1883.	
	tons.	tons.	
South Wales	367,944	410,676	+ 42,732
Sheffield	310,000	142,665	−167,335
Cleveland	265,842	245,386	− 20,456
Lancashire and Staffordshire	141,306	125,011	− 16,295
West Cumberland	150,693	173,436	+ 22,743
Totals	1,235,785	1,097,174	

SOME RELATIONS OF HEAT TO VOLTAIC AND THERMO-ELECTRIC ACTIONS OF METAL IN ELECTROLYTES.†

By G. GORE, F.R.S., LL.D.

THE experiments described in this paper throw considerable light upon the real cause of the voltaic current. The results of them are contained in twenty tables; and by comparing them with each other, and also by means of additional experiments, the following general conclusions and chief facts were obtained. When metals in liquids are heated, they are more frequently rendered positive than negative in the proportion of about 2·8 to 1·0; and whilst the proportion in weak solutions was about 2·29 to 1·0, in strong ones it was about 3·27 to 1·0, and this accords with their thermo-electric behaviour as metals alone. The thermo-electric order of metals in liquids was, with nearly every solution, whether strong or weak, widely different from the thermo-electro order of the same metals alone. A conclusion previously arrived at was was also confirmed, viz., that the liquids in which the hot metal was thermo-electro-positive in the largest proportion of cases were those containing highly electro-positive bases, such as the alkali metals. The thermo-electric effect of gradually heating a metal in a liquid was sometimes different from that of suddenly heating it, and was occasionally attended by a reversal of the current. Degree of strength of liquid greatly affected the thermo-electric order of metals. Increase of strength usually and considerably increased the potential of metals thermo-electro-negative in liquids, and somewhat increased that of those positive in liquids. The electric potential of metals, thermo-electric-positive in weak liquids, was usually about 3·87 times, and in strong ones 1·87 times, as great as of those which were negative. The potential of the strongest thermo-electric couple, viz., that of aluminium in weak solution of sodic phosphate, was ·66 volt for 100 deg. Fah., difference of temperature, or about 100 times that of a bismuth and antimony couple. Heating one of the metals, either the positive or negative of a voltaic couple, usually increased their electric difference, making most metal more positive, and some more negative; whilst heating the second one also usually neutralised to a large extent the effect of heating the first one. The electrical effect of heating a voltaic couple is nearly wholly composed of the united effects of heating each of the two metals separately, but is not, however, exactly the same, because whilst in the former case the metals are dissimilar, and are heated to the same temperature in the latter they are similar, but heated to different temperatures. Also, when heating a voltaic pair, the heat is applied to two metals, both of which are previously electro-polar by contact with each other as well as by contact with the liquid; but when heating one junction of the metal and liquid couple, the metal has not been previously rendered electro-polar by contact with a different one, and is therefore in a somewhat different state. When a voltaic combination, in which the positive metal is thermo-negative and the negative one is thermo-positive, is heated, the electric potential of the couple diminishes, notwithstanding that the internal resistance is decreased. Magnesium in particular, also zinc and cadmium, were greatly depressed in electromotive force in electrolytes by elevation of temperature. Reversals of positions of two metals of a voltaic couple in the tension series by rise of temperature were chiefly due to one of the two metals increasing in electromotive force faster than the other, and in many cases to one metal increasing and the other decreasing in electromotive force, but only in a few cases was it a result of simultaneous but unequal diminution of potential of the two metals. With eighteen different voltaic couples, by rise of temperature from 60 deg. to 160 deg. Fah., the electromotive force in twelve cases was increased, and in six decreased, and the average proportions of increase for the eighteen instances was ·10 volt for the 100 deg. Fah. of elevation. A great difference in chemical composition of the liquid was attended by a considerable change in the order of the volta-tension series, and the differences of such order in two similar liquids, such as solutions of hydric chloride and potassic chloride, were much greater than those produced in either of those liquids by a difference of 100 deg. Fah. of temperature. Difference of strength of solution, like difference of composition or of temperature, altered the order of such series with nearly every liquid; and the amount of such alteration by an increase of four or five times in the strength of the liquid was rather less than that caused by a difference of 100 deg. Fah. of temperature. Whilst also a variation of strength of liquid caused only a moderate amount of change of order in the volta tension series, it produced more than three times that amount of change in the thermo-electric tension series. The usual effect of increasing the strength of the liquid upon the volta-electromotive force was to considerably increase it, but its effect upon the thermo-electromotive force was to largely decrease it. The degree of potential of a metal and liquid thermo-couple was not always exactly the same at the same temperature during a rise as during a fall of temperature; this is analogous to the variations of melting and solidifying points of bodies under such conditions, and also to that of supersaturation of a liquid by a salt, and is probably due to some hindrance to change of molecular movement. The rate of ordinary chemical corrosion of each metal varied in every different liquid; in each solution also it differed with every different metal. The most chemically positive metals were usually the most quickly corroded, and the corrosion of each metal was usually the fastest with the most acid solutions. The rate of corrosion at any given temperature was dependent both upon the nature of the metal and upon that of the liquid, and was limited by the most feebly active of the two, usually the electrolyte. The order of rate of corrosion of metals also differed in every different liquid. The more dissimilar the chemical characters of two liquids the more diverse usually was the order of rapidity of corrosion of a series of metals in them. The order of rate of simple corrosion in any of the liquids examined differed from that of chemico-electric and still more from that of thermo-electric tension. Corrosion is not the cause of thermo-electric action of metals in liquids. Out of fifty-eight cases of rise of temperature the rate of ordinary corrosion was increased in every instance except one, and that was only a feeble exception—the increase of corrosion from 60 deg. to 160 deg. Fah. with different metals was extremely variable, and was from 1·5 to 321·6 times. Whether a metal increased or decreased in thermo-electromotive force by being heated, it increased in rapidity of corrosion. The proportions in which the most corroded metal was also the most thermo-electro-positive one was 69·57 per cent. in liquids at 60 deg. Fah. and 69·12 in the same liquids at 160 deg. Fah.; and the proportion in which it was the most chemico-electro-positive at 60 deg. Fah. was 84·44 per cent., and at 160 deg. Fah. 80·77 per cent. The proportion of cases therefore in which the most chemico-electro-negative metal was the most corroded one increased from 15·56 to 19·23 per cent. by a rise of temperature of 100 deg. Fah. Comparison of these proportions shows that corrosion usually influenced in a greater degree chemico-electric rather than thermo-electric actions of metals in liquids. Not only was the relative number of cases in which the volta-negative metal was the most corroded increased by rise of temperature, but also the average relative loss by corrosion of the negative to that of the positive one was increased from 3·11 to 6·32. The explanation most consistent with all the various results and conclusions is a kinetic one:—That metals and electrolytes are thoughout their masses in a state of molecular vibration. That the molecules of those substances, being frictionless bodies in a frictionless medium, and their motion not being dissipated by conduction or radiation, continue incessantly in motion until some cause arises to prevent them. That each metal—or electrolyte—when unequally heated, has to a certain extent an unlike class of motions in its differently heated parts, and behaves in these parts somewhat like two metals—or electrolytes—and those unlike motions are enabled, through the intermediate conducting portion of the substance, to render those parts electro-polar. That every different metal and electrolyte has a different class of motions, and in consequence of this they also, by contact alone with each other at the same temperature, become electro-polar. The molecular motion of each different substance also increases at a different rate by rise of temperature. The theory is equally in agreement with the chemico-electric results. In accordance with it, when in the case of a metal and an electrolyte, the two classes of motions are sufficiently unlike, chemical corrosion of the metal by the liquid takes place, and the voltaic current, originated by inherent molecular motion under the condition of contact, is maintained by the portions of motion lost by the metal and liquid during the act of uniting together. Corrosion therefore is an effect of molecular motion, and is one of the modes by which that motion is converted into and produces electric current. In accordance with this theory, if we take a thermo-electric pair consisting of a non-corrodible metal and an electrolyte—the two being already electro-polar by mutual contact—and heat one of their points of contact the molecular motions of the heated end of each substance at the junctions are altered; and as thermo-electric energy in such combinations usually increases by rise of temperature, the metal and liquid, each singly, usually becomes more electro-polar. In such a case the unequally heated metal behaves to some extent like two metals, and the unequally heated liquids like two liquids, and so the thermo-electric pair is like a feeble chemico-electric one of two metals in two liquids, but without corrosion of either metal. If the metal and liquid are each, when, alone, thermo-electro-positive, and if, when in contact, the metal increases in positive condition faster than the liquid by being heated, the latter appears thermo-electro-negative, but if less rapidly than the liquid, the metal appears thermo-electric-negative. As also the proportion of cases is small in which metals that are positive in the ordinary thermo-electric series of metals only become negative in the metal and liquid ones—viz., only 73 out of 286 in weak solutions, and 48 out of the same number in strong ones—we may conclude that the metals, more frequently than the liquids, have the greatest thermo-electric influence, and also that the relative largeness of the number of instances of thermo-electro-positive metals in the series of metals and liquids, as in the series of metals only, is partly a consequence of the circumstance that rise of temperature usually makes substance—metals in particular—electro-positive. These statements are also consistent with the view that the elementary substances lose a portion of the molecular activity when they unite to form acids or salts, and that electrolytes therefore have usually a less degree of molecular motions than the metals of which they are partly composed. The current from a thermo-couple of metal and liquid, therefore, may be viewed as the united result of difference of molecular motion, first, of the two junctions, and second, of the two heated—or cooled—substances; and in all cases, both of thermo and chemico-electric action, the immediate true cause of the current is the original molecular vibrations of the substances, whilst contact is only a static permitting condition. Also that whilst in the case of thermo-electric action the sustaining cause is molecular motion, supplied with an external source of heat, in the case of chemico-electric action in is the motion lost by the metal and liquid when chemically uniting together. The direction of the current in thermo-electric cases appears to depend upon which of the two substances composing a junction increases in molecular activity the fastest by rise of temperature, or decreases the most rapidly by cooling.

* These two districts have been grouped together, because, as there is only one works in Staffordshire, to give the make of the county would be to furnish details of that particular works.

† Paper read before the Royal Society.

INSTITUTION OF CIVIL ENGINEERS.

SPEED ON CANALS.

AT the ordinary meeting on Tuesday, the 5th of February, Sir J. W. Bazalgette, C.B., President, in the chair, the paper read was on "Speed on Canals," by Mr. Francis Roubiliac Conder, M. Inst. C.E.

The important question of the resistance to the movement of vessels due to the size and form of channel, or to the depth of open water, through which they passed, was one as yet but little studied. It was only about seven years since the researches of the late Mr. W. Froude threw an entirely new light on the relations existing between speed and the proportions of vessels. A similar study was desirable as to the relations between speed, and area and form of water-way. It was known that a great loss of speed occurred when a steam-vessel passed from open water into a more or less restricted channel. Instances of this had been given in the "Proceedings" of the Institution. It was also known that a sudden and remarkable increase of speed accompanied the passage of a boat over an increase in depth of water, even if it were a mere ballast-hole in the bed of a river or canal. But neither the ratio nor the mechanical cause of this phenomenon had been clearly ascertained by hydraulic writers. In the most important inland navigation of the day, that of the Suez Canal, the low speed attained in the transit was one of the causes of the dissatisfaction felt by the commercial world, and the very small capacity of the canal for transport was painfully evident. The average speed at which vessels passed through the Suez Canal in 1882 was a little under two miles per hour; and if the speed were taken, not for the whole transit, but for the portion of time during which the vessels were actually in motion, it was only five and one-third statute miles per hour, in the year 1882. The greatest speed recorded, as having been attained on the canal by any vessel since the opening of the route, was 8·016 statute miles per hour in the year 1870. The cross-section of the Suez Canal was about one-half the area on promise of which the concession of the enterprise was sanctioned by the Porte; being 72ft. wide at a depth of 26ft., instead of 144ft. wide at that depth. The sides were constructed with flat shallow shoulders, the rush of water over which at once eroded the slopes, and dragged back the vessel under way. The sides were now being gradually protected by artificial stone. If a cross-section of a semi-elliptical form had been adopted, with adequate side walling, in the first instance, for an equal quantity of excavation below the water-line to that of the permanent canal the hydraulic radius would have been double what it now was; the resistance to propulsion would have been proportionately less; vessels of 4ft. greater draught of water could have passed, and traffic in both directions at the same time would have been uninterrupted. By giving a larger cross section of the same scientific form any conceivable amount of traffic could be carried on. The cost of the canal, as constructed, was returned at £143,585 per mile for execution—to the end of 1882—and £56,496 per mile for management, financing, and interest of money, making £200,081 per mile in all. The cost, at fair contractor's prices, of the walled semi-elliptical canal, 163ft. wide at the top and 30ft. deep, came to £80,682 per mile; and that for the large section, 240ft. wide and 30ft. deep, to £112,280 per mile. The area of the present cross section of the canal was only three times as large as the immersed cross section of such a vessel as the Warrior. It was impassable for modern vessels like the City of Rome or the Alaska—to say nothing of the Great Eastern—or for any vessel drawing more than 24ft. 9in. of water. A mathematical calculation of the retardation caused by back current in the canal showed that in the case of such a vessel as the Warrior, the retardation from this cause, due to the small size of the Suez Canal, was such as to reduce a speed in the open sea of 14·356 knots to one of 9·812 knots per hour in the canal. This was independent of the further retardation due to the bad form of cross section, and also of the direct retardation from shallowness and narrowness, which formed the subject of a separate mathematical investigation. The various speeds attained on river and canal navigations in different parts of the world had been collected, and were shown in a tabular form. The sizes of locks; the time consumed in passing through locks, hydraulic lifts, and hydraulic inclined planes; and the dates of the River and Canal Acts of Parliament authorising improvements in the inland navigation of the United Kingdom, were also tabulated. The loss of time at present experienced was reduced to a function of the changes of level overcome by a canal. The heights to be surmounted by different canal routes in crossing England were indicated, and the conclusion was arrived at that, by a scientific construction of canals and the application of steam power, a normal speed of five miles per hour, which was equal to the terminus to terminus speed of the mineral trains on certain English railways, might be readily attained on the inland water-ways of the country. For the cost of constructing and of working canals, reference was made to the thirty-seven pages of the Report of the Select Committee on Canals in 1883, contributed by the author of the paper, and to his reports on the comparative cost of transport by railway and by canal, which were reprinted by that committee. The cost, both of construction and of working, on the railways and canals of the United Kingdom, France, Belgium, and the United States; on the railways of New Sonth Wales, India and Pennsylvania; on the canals and lakes of America by steam-colliers and sea-going ships, was given in the appendix to the report of the select committee; and there was a statistical comparison between the capital cost and net earnings of the French and English railways; and of the mineral-carrying and non-mineral carrying trunk-lines among the latter. The cost of one-third of a penny per ton of cargo per mile was shown to pay working expenses, and 5 per cent. interest on capital for canal transport, being about one-third of the cost of corresponding transport by railway. The actual limit of the work done on a double line of railway in various countries was shown in a table, and might be compared with the almost unlimited capacity for traffic of a first-class canal.

RAILWAYS IN INDIA.—The Liverpool Chamber of Commerce, in concert with those of Bombay and Madras, have adopted resolutions and transmitted them to the Secretary of State for India to the effect that the sum of £2,500,000 annually expended on the extension of railways in India falls far short of the requirements of the country, that much larger sums should be raised for the purpose, and that the extension of railways in India should be pushed on as expeditiously as possible. They recommend that the railways should be constructed partly by the State and partly by private companies under Government control, both as regards construction and management, with a guarantee of, say, 4 per cent.; any surplus over 5 per cent. to be divided between the Government and the shareholders. That it is not desirable that the extension of Indian railways should be left entirely to the Government of India, as their Public Works Establishment would probably be unable to carry out with sufficient expedition the many large operations required. That all trunk lines should be made on the "broad gauge" system. That the present is a favourable time for these undertakings, as money is cheap, the price of iron is low, and rates of freight to India are very moderate. The Bombay Chamber add that the Government of India are quite alive to the great necessity which exists for rapidly developing the country by means of railway extensions, but that although these extensions would have the best effect on the commerce and people of India, they are delayed by the action of the home authorities; and the Bombay Chamber apprehend, unless this all-important question is taken up vigorously by the English Chambers and pressed upon the attention of the Government, the progress which will be made in railway construction in India will continue at the same slow rate at which it has hitherto done.

drainage department, the chairman—Mr. Walter Williams—intimates that there are instances in which costly channels for surface drainage are destroyed by mining operation of men of property and position, who, to say nothing of the infringement of bye-laws, could well afford in the interest of the district to leave intact the fuel whose mining causes the mischief. Again, trouble is experienced with the Birmingham Canal Company, with which there is a dispute as to a flood of water which is almost mastering one of the engines. But more serious is the considerable damage annually done to the Commissioners' complete system of surface drainage by the refuse of many towns and villages in the South Staffordshire district. As to this, considerable litigation may yet have to be undertaken. The excellent work of this very valuable commission is neither light nor easy. But its great importance to the district is distinctly recognised by the members, and it will be no fault of theirs if success does not attend the enterprise.

THE TELEGRAPH MONOPOLY IN THE UNITED STATES.

THE question of the practical monopoly of the telegraph service of the United States by the Western Union Telegraph Company has been much under consideration of late by the public in that country and by its Legislature, and in the latter a proposal has been made that the Government should there, as here, buy up the system. A Mr. Hill, of Colorado, has in the Senate given a mass of fact in regard to the great telegraphic system of the Far West. He traces it back to 1866, when it had 75,686 miles of wire, and down to the past year, when its wire mileage was 428,546. The messages had increased about eight-fold in that time—to 40,581,177 for the past year. The receipts had not risen in like ratio, but had been multiplied about threefold; and the profits of the working rose from 2,624,919 dollars in the year 1867—the first reported on by Senator Hill—to 7,660,349 in the year 1883. The market price of the company's stock, which was in 1860 about 58, and had fallen to as low as 30½, has since very greatly fluctuated. In describing the extent of the system of the Western Union, Senator Hill stated that the wires extend into thirty-seven States and nine territories in the United States, and into four of the British provinces. It seems that opinion in the United States is now gravitating either to Government purchase and control, or to the latter; but it is characteristic of the States to find that there is an influential objection to Government purchase, because a Government monopoly "might be no better than the present one;" and it is argued that there is "business enough for a Government line and many private ones, and each will serve to keep the other in order." It seems on the whole probable that opinion in the United States is fast drifting to the idea that there should be much more of the control of the Government over telegraphs and railways than there has been; and if that idea gains ground it is probable that with the vast resources of the States and with the need that they have to employ their great financial surplus year after year, some steps will then be taken towards a Government purchase.

RAIL-MAKING IN NEW SOUTH WALES.

VERY great interest has been aroused in Sheffield by the advertisement in THE ENGINEER from the Government of New South Wales. Mr. Charles A. Goodchap, the Commissioner for Railways, certainly presents a tempting inducement to firms and enterprising manufacturers. His Government has within a few years constructed over 1200 miles of railroad, and has now more than 500 miles in course of construction, all the materials for which, except the sleepers, have been imported at a heavy charge, in the form of freight, from England. Mr. Goodchap states that during ten years there were imported into New South Wales and Victoria no less than 1,250,000 tons of iron and steel, inclusive of the permanent-way material required for Government and other railways constructed during the period mentioned; and now the Government make the bold bid of offering 150,000 tons of steel rails as a starting order to any company enterprising enough to undertake their production in the colony, the avowed object being to encourage the development of the local iron mining and steel and iron manufacturing industries. There is so much competition and over-pressure at home, we shall not be surprised if some of our firms seriously contemplate planting an offshoot in the colony. Other Sheffield firms have established workshops in the United States, which are doing well; why not New South Wales, if coal and iron can be had in contiguity?

LITERATURE.

The Materials of Engineering. In Three Parts. Part I. Non-Metallic Materials, Stone, Timber, Fuels, Lubricants. By ROBERT H. THURSTON, A.M.C.E. London: Trübner and Co. 1883.

THE title which Mr. Thurston has given to this book may be admitted to be more satisfactory than the usual title given to books on the same subject, inasmuch as it contains much information which does not bear simply on the "strength of materials." Chapter 1 deals with stones and cement, and the first part of it describes various rocks or stones, chiefly of course as they are found in America. These descriptions are of the stones which are used in mechanical engineering work, as for machinery foundations, and are followed by information on their hardness, resistance to compression, transverse strength, and the effects of heat on them. In giving the expansion by heat, the author only states the coefficient for temperatures up to the boiling point of water; but inasmuch as in some mechanical engineering work stones are heated to higher temperatures than this, and as the coefficient is higher at the higher temperatures, we should have looked for experimental results bearing upon this. In speaking of "artificial sandstones," we are told that "these are made by several processes. Of these, béton and concrete will be referred to." Béton and concrete are not sandstones, and béton and concrete are usually thought to be the same thing; but Mr. Thurston confines the use of the term concrete to lime concrete, béton being, he says, that which is made with hydraulic lime or cement. Whether this distinction is always made in America or not we cannot say, but in any case the submarine work to which he alludes in speaking of béton is not of the kind usually spoken of, either here or in America, as mechanical engineering; so the limitation at the head of this chapter is erroneous. There are, however, plenty of facts and figures given in this chapter based on the experiments by well-known authorities, which makes it one of value. The different forms of dressing of stone are next described, and the kinds of masonry. These are not, perhaps, strictly relevant to the subject of the book, but they are not an objectionable addition; but to have been consistent the different forms of brick-laying bond should have also been given. In the chapters on timber the author deals concisely with the characteristics of different woods, seasoning, causes of rot, and sizes of timber of various kinds of trees. In nearly all cases the dimensions are given in English measures, followed by the equivalent metre measures. It is not quite clear why this has been done, unless it is to facilitate the translation of the book into continental languages, for neither England nor America wants these metric measures after the others. If Professor Thurston in his love for the metrical system had supplied all these, first and then the English equivalents, it could be understood; but the reason for that which he has done is not so easily to be seen. The order of the use of these two measures is not, however, preserved through the book, for in dealing with elastic flexure of wood one table has metric measures first and the other British, which is inconvenient. A good deal of what is said about timber relates to American woods; but as these are much used in this country, the information is valuable. In passing, it may be noted that we are told that a chestnut tree has been known to attain the age of 1000 years. We are not told anything more of this young tree, but probably the author is satisfied with the evidence on which he makes the statement. An illustration is given of the great gnarled old chestnut on Mount Etna. This cannot be taken as a typical example of chestnut tree growth, and is, perhaps, the 1000-year-old referred to.

In the third chapter we come upon a subject on which everyone will admit the author's authority—namely, the strength of timber. It is rather curious to note that so entirely is accurate information on the physical and mechanical properties of materials an outcome of the nineteenth century application of metals in structures, that as a means of explaining these properties, in different woods, Professor Thurston refers to the characteristics of metals under various stresses. Elasticity, flexure, and permanent set are thus exemplified. This is not mentioned as an objection, but merely as showing how truly comparative is our means of conveying ideas of a physical character, and that though timber has been used in structural work through ages, accurate ideas on its properties are conveyed by reference to our knowledge of the modern material—iron.

In dealing with the strength of timber used as pillars, the formulæ of Hodgkinson, Gordon, and Euler, are employed; and though the comparatively recent experiments of Laslett are used as well as the still more recent experiments by the author, resort is still had to the familiar formulæ of Tredgold, and the work done since the days of the writer of the much-quoted work on carpentry, verifies his experiments on the modulus of rupture, and fixes that as a mean between the tensile and compressive resistance of woods generally. Professor Thurston throughout his book gives full credit to those who have preceded him on this subject; but in some cases he seems to be too much afraid of hurting susceptibilities. His own experimental information, for instance, ought to make it unnecessary to speak in a decidedly uncertain manner of the work of others without being objectionably positive on doubtful points. He gives the results of his own experiments on rupture by torsion, and in speaking for a coefficient employed in an expression relating to this he says, "Cauchy makes C about four-fifths of the value of the coefficient of transverse rupture; but this relation must probably be variable." Now this coefficient bears a direct relation to that of rupture or it does not. The figures given in the book do not permit a direct comparison, but it is known that the relation does exist, and also that it is variable. Why then make a reader uncertain on the matter by saying, "must probably be variable," a phrase which removes responsibility instead of clearing up a doubt. Here it may be remarked that the author would have greatly added to the value of the book if he had applied after the manner of Mr. T. Box some of the formulæ given. This system affords a check for and by the author, and gives the reader confidence in a thing which he has not time otherwise to check for himself. This applies also to the useful information which is given on the strength of floor beams and on resilience.

In the chapter on fuels, the author's treatment of the heat and temperature obtained by combustion of different materials on different atmospheres and varying quantities of air is satisfactory; though as the book is presumably intended for engineers, the numerical treatment might have been with some advantage extended to the consideration of the heat and temperature developed, say, in a boiler furnace. This would have prevented the use of the quantity 4·265—which represents the ratio which the heat developed from the combustion of 1 lb. of hydrogen bears to that developed from 1 lb. of carbon—from being used without explanation.

In his chapter on lubricants it is noticeable that the general deductions as to pressures advisable on bearings for high and low speeds are much the same as those given by the Committee of the Institution of Mechanical Engineers, whose report we shall publish in an early impression. Professor Thurston has spent a good deal of time on this subject, and his machines for testing lubricants are largely used. The results of experiments, extending over a very wide field, are therefore given in, and make this chapter valuable. The sixth chapter of the book deals with miscellaneous materials, including different kinds of belting, rubber, and cordage, and the appendix with which the book is concluded consists of a number of conversion tables for British and metric quantities which occur in scientific calculations of all kinds.

The book is generally written in a clear and concise style, and presents the information conveyed in such a way as to make it readily found. It is a very useful book, and is well got up.

BOOKS RECEIVED.

The New Patent Law, being the Sections Relating to the Patents of the Patents, Designs, and Trade Marks Act of 1883, *with the Patents and Law Officer's Rules.* By James Johnson and J. Henry Johnson. London: Longmans, Green, and Co., and Stevens and Sons. 1884.

Almanach fuer die k. k. Kriegs Marine, 1884. Pola: Gerold and Co.

Handbook of Patent Law of all Countries. By W. P. Thompson. Sixth edition. London: Stevens and Sons. New York: D. Van Nostrand. 1884.

Iron and Steel Manufacturers of Great Britain, and Brand-book of British Iron and Steel. Compiled by H. W. Griffiths. London: The *Iron Trade Exchange* Office. 1883.

The History of the Year, a narrative of the chief events of interest from October 1st *to September* 30*th*, 1883. London: Cassell and Company. 1883.

A Digest of Patent Law and Patent Cases, incorporating the Provisions of the Patents Act, 1883, *for the use of inventors and the legal profession.* By H. A. A. Gridley, M.A. London: Marcus Ward and Co. 1884.

Painting and Painters' Materials: A Book of Facts for Painters and those who Use or Deal in Paint Materials. By C. L. Condit. New York: *Railroad Gazette* Office. London: E. and F. N. Spon. 1883.

The Art of Soap Making: A Practical Handbook of the Manufacture of Hard and Soft Soaps, Toilet Soaps, &c. By A. Watt. London: Crosby Lockwood and Co. 1884.

The Encyclopædic Dictionary. Part I. London: Cassell and Co. 1884.

MAREOGRAPHS.

THE adoption of the level of the sea as a basis for geographical measurements has been general in all European countries. Of late years automatic instruments have been in use at various parts of the European sea coasts by which the average level of the sea at any given period has been recorded with accuracy. In this respect Holland has taken a leading position, the placing of mareographs being undertaken by the Government.

The registration is effected by different methods, and the scale of measure is likewise a varying one. Some instruments are connected with a line, while others record a point every five minutes, the proportion of measurement ranging from one-twentieth up to natural size. For some instruments the daily renewal of the leaves is necessary, while others only require that operation every eight days. The mareographs constructed on the Reitz system only want this renewal once a month.

An interesting article on the subject recently appeared in the *Deutsche Bauzeitung*, according to which it would seem that the average level of the North Sea has not varied within the last 150 years. It is also known with certainty that the level of the Baltic is the same as it was at the time surveys were made in 1826 bearing upon the question of sea-level.

In connection with the facts thus arrived at regarding the sea-level, reference is made in this article to the general progress effected by the levelling commissions appointed by various European Governments. France inaugurated last spring a very important work of this nature, which in extent will surpass anything of the kind on record. In Belgium the work has been completed, records of height existing as to 8477 localities. In Holland the levelling now in progress is less extensive in its character, but is said to be remarkable for extreme accuracy. In Germany operations commenced in 1865, and will probably be completed in 1887. In Russia the work has been in progress since 1873. A feature of interest—the determination of which will soon take place—is said to be the defining of the variation between the levels of the Baltic and Black Sea. In Austria an extensive system of levelling has been in progress since 1872. Italy has been active in this direction since 1876, but the programme of future work is not yet quite decided. In Switzerland the work lasted from 1865 to 1881, the heights at which a great portion of the observations had to be made having increased the difficulties of the task. Spain and Portugal have both levelling works in progress. Amongst the results obtained in the former country is the establishment of the fact that the level of the Atlantic Ocean at Santander is 26·1in. above that of the Mediterranean at Alicante.

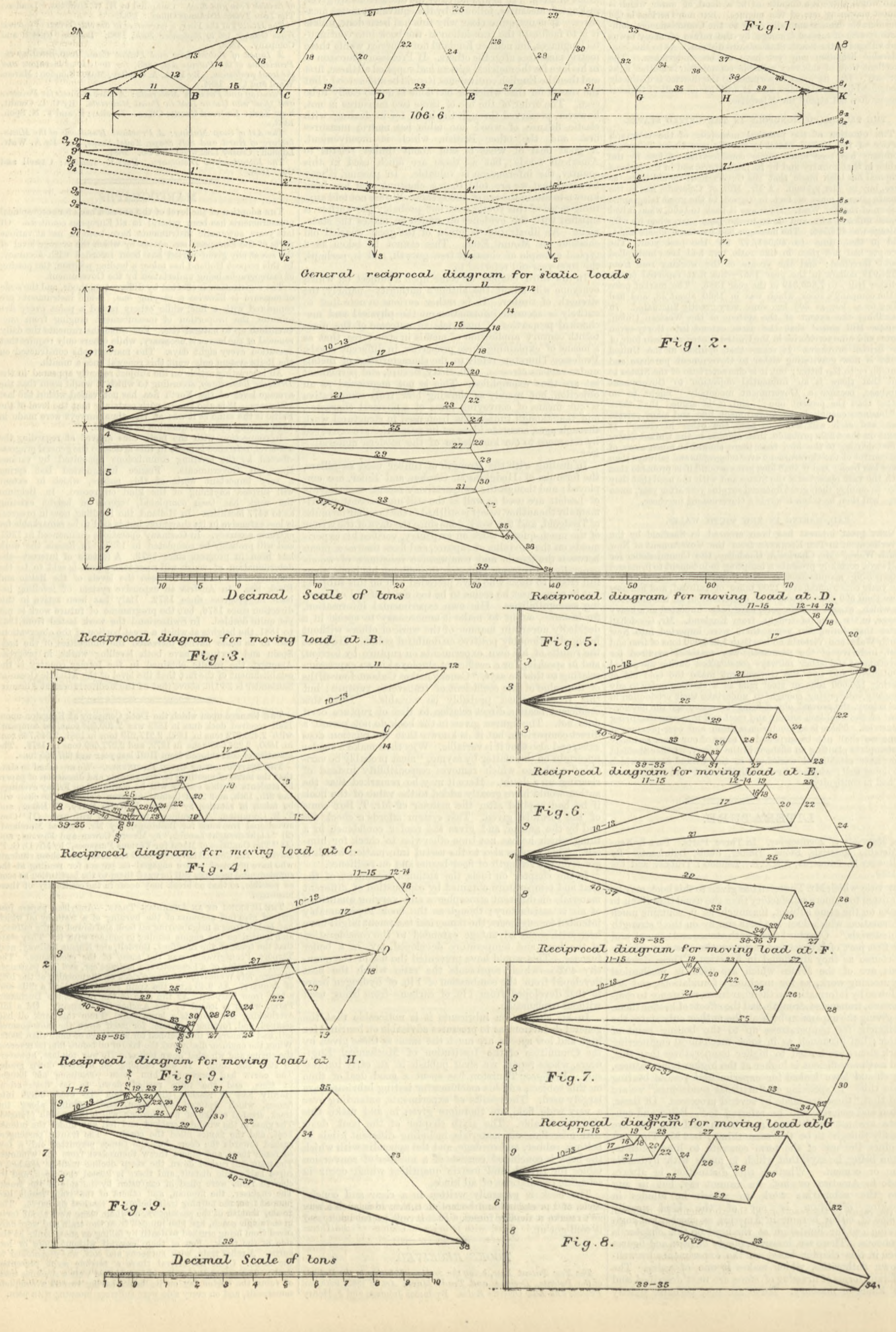
THE tonnage upon which the Dock Company at Kingston-upon-Hull received dock dues in 1883 was 2,460,564 tons, as compared with 2,425,372 tons in 1882, 2,217,219 tons in 1881, 2,346,788 tons in 1880, 2,224,658 tons in 1879, and 2,377,689 tons in 1878. The quantity of coal shipped from Hull last year was 637,955 tons.

THE INSTITUTION OF CIVIL ENGINEERS.—We are asked to state that the series of meetings for the reading and discussion of papers by students of this society will be continued on Friday evenings, the 8th, 15th, and 22nd instant, at seven o'clock. The chair will be taken in rotation by Messrs. J. Wolfe Barry, B. Baker, and T. R. Crampton. The subjects to be dealt with are:—(1) "Constructional Ironwork for Buildings," by Mr. Richard Moreland; (2) "Light-draught Launch," by Messrs. Cowan and Fawcus; and (3) "The Qualities of Metal for Various Purposes," by Mr. D. G. P. Davies. The Council have expressed the desire that those students who have promised or are engaged on papers for reading at the supplemental meetings will forward them to the Institution as soon as possible, so that no break may occur in the continuity of these meetings.

THE BURNING OF AN AMERICAN TRAIN.—American papers just arrived give full accounts of the burning of a train by oil which had leaked from a neighbouring oil tank and flowed on the railway, and ignited on the engine coming in contact with it. They state that the track of the Bradford, Bordell, and Kinzua Railway, near Tarport, Pennsylvania, was the scene of the occurrence. The train, consisting of a locomotive, a baggage car, and one passenger carriage, left Wellesville at nine o'clock on the morning of the 15th of January. At 9.46 a.m. the train rounded a bend a mile and a-half from Tarport. At the side of the road is the Buchanan Farm, which is leased by the Anchor Oil Company. On a hill overlooking the track is a large tank. From this tank oil had escaped, and, forming a channel for itself down the snow-covered hill, had submerged the road-bed for a distance of more than 300ft. When the engineer discovered the lake of oil before him he reversed the engine and whistled down brakes. He was too late, however, to stop the train. It was running on a steep down grade. The curve had prevented him from perceiving his danger in time, and the train rushed down to its destruction. Hardly had it reached the oil when the fluid burst into flames, which wrapped the train, and, running along the track, created a lake of fire, through which the engine plunged. The glass in the windows cracked and fell out under the intense heat, and the flames filled the coach. The frantic passengers rushed towards the doors, but the flames permitted only a few to reach them, and others threw themselves from the windows. The train still rushed down the steep decline until it reached a curve half-a-mile distant, and there it leaped the track, and its charred ruins were piled in confusion by the side of the track. The engineer, the fireman, and others of the train hands had jumped from the burning train before it reached the curve. The greater number of the passengers, of whom there were about forty in the single coach, had also jumped from the train and were only saved from being crushed to death by falling on snow banks at the side of the track. Few of them escaped without more or less burns. A relief train, with surgeons and cots, was despatched to the scene. Upon its arrival there a terrible sight presented itself. The passenger coach and baggage car were a smoking mass of ruins, the engine lay on its back, having turned a complete somersault, and on every side were sufferers moaning with pain.

BRIDGE OVER THE FEEDER, GREAT WESTERN RAILWAY.

(For description see page 117.)



EXAMPLES OF THE GRAPHIC TREATMENT OF STRESSES IN FRAMEWORKS.

By ROBERT HUDSON GRAHAM, C.E.

No. IV.

The Feeder bridge.—In this article I shall attempt to describe the graphic treatment of the stresses of one of the girders carrying the Great Western Railway over the Feeder near Bristol. The Feeder is a skew bridge of the semi-bowstring type, 106ft. 6in., span between centres of abutment bed-plates. On account of the skew the static and rolling loads are distributed unequally over the joints B, C, D, E, F, G, H, Fig. 1, of the lower boom of the girder. The reactions, corresponding to these loads, take place vertically through the centres of the abutment bed-plates; but, in order to meet the requirements of students, and to make this bridge serve the purpose of an example in closed polygonal figures, I have supposed the reactions to take place at the extremities, A and K, of the structure, instead of through the centres of the end supports. In consequence of this arrangement the direction of lines reciprocal of bars 10 and 40 are a little flattened and are brought into the same lines as the reciprocal of bars 13 and 37 respectively. In other respects the construction and character of the diagrams remain the same; but the values of some of the diagonal stresses vary both in nature and amount from what they would be if the reactions were taken to pass through the end supports. In addition the building up of the figures presents a little more difficulty, owing to the zero valves which occur in some of the diagrams for bars 12 and 14 36 and 38. It was to illustrate the graphic method under these exceptional conditions which led me to shift the reactions to the ends of the structure. It may be taken for granted that the behaviour of the flanges under strain would approximately assimilate itself to this assumed condition of things, the tendency being to increase the real stresses, owing to the arbitrary increase of the span at each end. A glance at Fig. 1 shows that the dimensions of this bridge are greater on the left than on the right of the section through E. On this account, and in virtue of the skew, the static load is distributed in the proportions of 4·67 tons at B, 9·20 tons at C, 13·30 tons at D, 16·48 tons at E, 20·42 tons at F, 21·61 tons at G, and 21·61 tons at H. The rolling load is similarly distributed in the proportions of 4·70 tons at C, 10·50 tons at D, 15 tons at E, 19·30 tons at F, 20·60 tons at G, and 20·60 tons at H, the first joint B being free of rolling load.

General reciprocal diagram.—The general reciprocal diagram of the Feeder bridge is given in Fig. 2, which for the sake of comparison, and to make it serve as a decimal standard or basis upon which to calculate the stresses corresponding to any distribution of load, is drawn on the supposition that the joints of the lower flange of the girder are each loaded uniformly with a weight of 10 tons. Moreover, in order to economise space, and to secure the benefit of a large scale, each load has been halved and made equal to 5 tons, so that in scaling off the stresses the quantities furnished by the diagrams must be doubled, in order to find the equivalent stresses under uniform loads of 10 tons.

The independent reciprocal diagrams.—Fig. 3 gives the diagram of stresses induced in the members of this bridge by a load of 5 tons instantaneously concentrated at joint B, the other apices being unloaded. As before mentioned, to find the stresses corresponding to a load of 10 tons at the same joint, the quantities read off the scale must be doubled. In like manner Fig. 4 represents the diagram of stresses corresponding to a load of 5 tons at C, Fig. 5 that for a similar isolated load at D, Fig. 6 that for an equal load at E, Fig. 7 that for a load at F, Fig. 8 that for a load at G, and Fig. 9 that for a load of 5 tons at H. In all these diagrams the divisions of the vertical line of loads in the ratios of the reactions at the abutments for different situations of the rolling load, are determined by the ordinary graphic method of drawing polar or funicular polygons, such as, for instance, 9, 1, 8, Fig. 1, which corresponds to the load at B, and is therefore drawn relatively to pole O, Fig. 3. All the polar polygons required are shown on Fig. 1.

Table of stresses.—The first seven columns of the annexed table of stresses contain the various stresses induced in the members of the Feeder bridge by uniform loads of 10 tons, separately and successively concentrated at the joints B, C, D, E, F, G, H, Fig. 1. Thus an isolated load of 10 tons at B would create a tensional stress of 13·2 tons in rod 14, and a compressive stress of only 1·4 ton in bar 24.

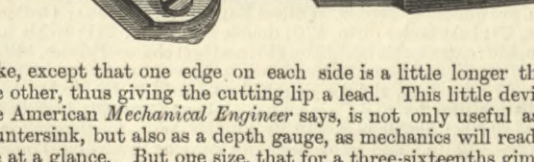
Column 8 gives the algebraic sum or resultant stress in each member of the bridge, supposing a static load of 10 tons to be simultaneously concentrated at each of the joints of the lower boom. Column 9 gives the same values, independently deduced from the general reciprocal diagram, Fig. 2. It will be seen by column 10 that the differences are very small, and therefore it may be said that the results of the two methods, given in columns 8 and 9, mutually corroborate each other. Columns 11 to 17, inclusive, furnish the stresses in the different members due to the actual static and rolling loads successively concentrated at the seven joints of the under flange. Where two quantities are given together in the same column, the first refers to the live, and the second to the static stress. Column 18 furnishes the maxima resultant stresses for each member corresponding to the most unfavourable condition of loading specified in column 19. Under uniform load all the diagonals are in tension, the maximum stress appertaining to bar 14, and the minimum to bar 16. Owing to the unsymmetrical form of the bridge, these stresses do not seem to follow any regular consistent law of increase or decrease. This becomes more evident when we consider the diagonal stresses in column 18, for the actual distribution of loads. The bridge being skew, both the static and rolling loads increase in the same direction, which completely destroys all symmetry, and brings the heaviest stress to bear in unexpected places. Hence, the absolute necessity of careful calculation in the case of skew bridges. In the present example the nearest approach to uniformity is in the stresses occurring in the upper and lower flanges, the stress along the upper flange being without exception positive and compressive, that along the lower flange negative and tensional. Moreover, for the actual distribution of load, the flange stresses may be looked upon as increasing, with very little variation, from the left extremity towards and beyond the centre of span.

Table of Stresses in the Feeder Bridge.

Diagonals.	Component stresses due to static loads; each of 10 tons. B.	C.	D.	E.	F.	G.	H.	Resultant static stresses, in tons. Algebraic sum.	General diagram.	Difference.	Component stresses due to varying loads of 4·67 tons. B.	13·9 tons. C.	23·8 tons. D.	31·48 tons. E.	39·72 tons. F.	42·21 tons. G.	42·21 tons. H.	Resultant stresses.	Distribution of loads.
12	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0		
14	13·2−	0	0	0	0	0	0	13·2 −	13·4 −	0·2	0+ 6·2 −		0	0	0	0	0	− 6·2	Rolling load at B; static loads at other joints.
16	6·4+	2 −	1·6−	1·2 −	1 −	0·8−	0·4−	0·6 −	1·0 −	0·4	0+ 2·99+	2·78−	3·87−	3·8 −	3·97−	3·38−	1·69−	−16·50	Rolling load from C to H; static loads at other joints.
18	5·8−	10·2 −	1·4+	1·16+	0·8+	0·6+	0·4+	10·64−	11·30−	0·66	0+ 2·7 −	4·7 −9·2 −	1·47+1·86+	1·74+1·91+	1·54+1·63+	1·23+1·29+	0·82+0·86+	− 9·05	Rolling load on B and C; static loads at other joints.
20	3·0+	5·2 +	4·2−	3·4 −	2·6−	1·8−	1·0−	4·8 −	4·50−	0·3	0+ 1·4 +	2·44+4·78+	9·99−	10·7 −	10·33−	7·60−	4·22−	−36·66	Rolling load from D to H; static loads at other joints.
22	2·8−	5·0 −	7·4−	3·2 +	2·4+	1·8+	1·0+	6·8 −	6·70−	0·1	0+ 1·31−	2·35−4·6 −	7·77−9·84−	4·8 +5·30+	4·63+4·89+	3·71+3·89+	2·06+2·16+	+15·69	Rolling load from E to H; static loads at other joints.
24	1·4+	2·8 +	4·2+	5·8 −	4·6−	3·2−	2·0−	7·2 −	7·0 −	0·2	0+ 0·65+	1·31+2·57+	4·41+5·58+	18·26−	18·27−	13·50−	8·44−	−49·67	Rolling load from E to H; static loads at other joints.
Flanges.																			
10	27·5+	23·6 +	19·8+	15·6 +	11·8+	8·0+	5·2+	111·5 +	113 +	1·5	12·84+	32·80+	47·12+	49·11+	46·87+	33·76+	21·94+	244·44+	
11	26·2−	22·4 −	18·8−	14·8 −	11·2−	7·7−	5·0−	106·1 −	107·5 −	1·4	12·26−	31·14−	44·74−	46·60−	44·50−	32·49−	21·10−	232·83−	
13	27·5+	23·6 +	19·8+	15·6 +	11·8+	8·0+	5·2+	111·5 +	113 +	1·5	12·84+	32·80+	47·12+	49·11+	46·87+	33·76+	21·94+	244·44+	
15	17·2−	22·4 −	18·8−	14·8 −	11·2−	7·7−	5·0−	97·1 −	98 −	0·9	8·03−	31·14−	44·74−	46·60−	44·50−	32·49−	21·10−	228·60−	
17	13·2+	24·4 +	20·4+	16·0 +	12·4+	8·4+	5·2+	100·0 +	101·5 +	1·5	6·16+	33·91+	48·55+	50·37+	49·25+	35·64+	21·94+	245·82+	Static and rolling loads at all joints.
19	9·8−	18·0 −	20·6−	16·2 −	12·6−	8·6−	5·4−	91·2 −	92·8 −	1·6	4·57−	25·02−	49·09−	51·0 −	50·05−	36·29−	22·79−	238·81−	
21	8·4+	15·6 +	22·8+	18·0 +	13·8+	9·6+	6·0+	94·2 +	95·5 +	1·3	3·92+	21·68+	54·26+	56·66+	54·81+	40·51+	25·32+	257·16+	
23	7·0−	13·0 −	19·4−	19·4 −	15·0−	10·6−	6·6−	91·0 −	92·4 −	1·4	3·27−	18·07−	46·17−	61·06−	59·58−	44·70−	29·85−	260·70−	
25	6·4+	11·64+	17·2+	22·4 +	17·2+	12·2+	7·4	94·4 +	95·5 +	1·1	2·99+	16·12+	40·93+	70·51+	69·32+	51·48+	31·29+	282·64+	

A UNIVERSAL COUNTERSINK.

THE Cleveland Twist Drill Company, of Cleveland, Ohio, has recently brought out the ingenious and useful appliance herewith illustrated, and we think all will agree that it is well named, for it can be used upon any boring tool employed by mechanics. Its construction is so simple as to require no explanation, and its advantages for adjustment or facility of sharpening are equally obvious. Both sides of the cutter are



alike, except that one edge on each side is a little longer than the other, thus giving the cutting lip a lead. This little device, the American *Mechanical Engineer* says, is not only useful as a countersink, but also as a depth gauge, as mechanics will readily see at a glance. But one size, that for a three-sixteenths gimlet or twist drill, is made at present, but all usual sizes will be put on the market in due course. It is sold for 25 cents.

ENGINES AND BOILERS OF H.M.S. COLOSSUS.

WE commence this week the publication of a set of illustrations of the engines and boilers of H.M.S. ironclad Colossus. We reserve a detailed description. It will be enough to say that the ship is fitted with twin-screw engines of the three-cylinder compound type. The boilers—one of which we illustrate on page 108—are oval, single-ended, and have each three furnaces. They are of an excellent type, which would not be passed for the mercantile marine by the Board of Trade because the sides are flat and stayed like the ends.

THE SOCIETY OF ENGINEERS.

PRESIDENT'S ADDRESS.

THE first ordinary meeting for the present year of the members of the Society of Engineers was held on Monday last, February 4th, at the Town Hall, Westminster.

The statement of accounts for 1883 was read, after which the president for the past year, Mr. Jabez Church, M. Inst. C.E., F.G.S., &c., presented the premiums of books awarded for papers read during that year. These were to Mr. George Bower, for his paper on "The Bower-Barff Process of Preserving and Ornamenting Iron and Steel Surfaces;" to Mr. Chris. Anderson, for his paper on "The Feasibility and Construction of Deep Sea Lighthouses;" and to Mr. Hamilton W. Pendred, for his paper on "Designs, Specifications, and Inspection of Ironwork."

Mr. Church announced that Lady Siemens had kindly presented to the Society seventy volumes on engineering subjects from the library of her late husband, Sir William Siemens, in remembrance of his long connection with the Society of Engineers. Mr. Arthur Rigg, the new president for 1884, then delivered his inaugural address, from which we give the following extracts :—

"Our colonies will doubtless in the future become more and more independent of the mother-country, and will, like America, educate their own engineers; but such a condition is not likely to prevail in India, at any rate for very many years to come. Hence there will be a constant, and, we will hope, an increasing demand for English engineers in that country, and all things concerning their progress and welfare must be matters of deep interest to us. Until within a comparatively recent period all civil, as well as all military, engineering was carried out by that distinguished body of men, the Royal Engineers; and even now their members occupy the highest administrative posts. From many schools, from engineers' offices, and from the great college at Cooper's Hill, numbers of young men have been drafted into India of late years to do work which was formerly required by Government from officers of the Royal Engineer Corps, whose studies had been more particularly directed to military and not civil engineering. The innovation does not always seem to have worked smoothly, for the new-comers consider it hard that while doing similar work, they should not be treated in regard to pay and position exactly as the Royal Engineers. But in many cases, much as one must sympathise with their feelings, the difference as to pay is simply one of contract; and when the employment of civil engineers has grown from an experiment into a permanent system, there is every reason to hope that future engineers will be able to make better terms with the Government employing them. All engineers are members of one service, and though it has two branches, military and civil, yet in a dependency like India none can dispute the advantage of military men having a competent knowledge of civil engineering, nor of civil engineers possessing some acquaintance with defensive works, &c., nor may we blame the responsible Government for moving slowly in changing any of its established systems. Quite until recent years the various services in India have been recruited from men who had the education of the old English school, men of cultivated tastes, and whose habit of mind and general ideas enabled them to mix at no disadvantage with the polite and ceremonious members of that ancient, aristocratic civilisation. None are keener-witted than the natives of India, in appreciating and respecting that "indescribable mixture of elevation of mind, correctness of taste, self-control, and decision of character" which constitutes the gentleman; but, by some people reports have been set on foot against the new civil engineers, that in too large a proportion this description is not sufficiently exact, and it would be most unfortunate if any such statements could be substantiated. Officers in the army and members of other professions are collected in schools or colleges, and being associated with their equals, never lose the tone of society in which they move; but engineers labour under a great disadvantage in this respect. Isolated during their training in practical work, they are brought into direct and intimate contact with a class of artisans into whose companionship their most injudicious friends would hardly send them to learn good manners. It is hardly a matter of surprise that some young men unlearn for awhile their earlier cultivation, and go abroad imbued with that offensive dogmatism which is a sure sign of ignorance and a narrowed mind. Competitive examination, too, has not yet proved an unqualified success, though it has opened a door of easy advancement into positions which formerly required higher qualifications than an overloaded brain. Hence it must not be supposed that any young man who gets on by making a good use of the abilities with which he is endowed can afford to ignore the feelings, or even offend the prejudices of those into whose society he may rise, or whom circumstances may bring under his control. It is a good thing to reflect upon a favourite maxim of the illustrious Smeaton—"that the abilities of the individual are a debt due to the common stock of public happiness and accommodation," and to remember, as he never failed to do, that the faithful discharge of so invaluable a trust will give to the engineer a position which none can ever take away. We should all rejoice to learn that the civil engineers in the Department of Public Works in India had induced the Government to improve the terms of their engagement, for it is monstrous that such a cause of jealousy should be allowed to exist between them and any branch of that gallant army through whose hold of India alone it is that opportunity is given for the employment of

English civil engineers there at all. Each department has its own peculiar duties; and officers of the Royal Engineer Corps, while supreme in military matters in times of peace, and supreme in all in times of war, yet have no claim to superior knowledge of the details of civil engineering. Nor have we any standing for adverse criticism of the well-considered conclusions of military officers—whether they object to a road or railway in a subject country, or point out the dangers arising from a Channel tunnel in our own. Modern engineering is the youngest of our sciences. Such works as the great roads and bridges of Telford, the harbours of Smeaton, and the constructive details of canals and railways belong more properly to that branch of civil engineering nearest akin to architecture, and they have been undertaken by civilised nations in all historic times. So long as the powers of wind and water alone were available for manufacturing purposes, the uncertainty and variability of the one, and generally local inconvenience in the other, rendered manufactures on an extensive scale impossible, and crippled any development of that branch of engineering which deals with motion and the application of power. Necessity led to the invention of tools in the earliest ages, and considerable practical skill must have been acquired in their use by rude tribes whose stone or bronze implements are their only history. Even now, if we travel among the fast disappearing races which inhabit those enchanting islands of the desolate Pacific, or if we become acquainted with an ancient civilised race, driven ages ago into the inhospitable north, we find implements and tools bearing a wonderful analogy to those portrayed in Egyptian tombs, or used by country millwrights of the present day. From rude axes of stone we can trace tools through various stages of development to the splendid machinery of modern times. The material used in their cutting edges have run through a series from stone to bronze, from iron to steel, and even to the diamond itself; while in the means for holding such tools, wood has given way to cast or wrought iron or steel. In this great chain of progress, lasting through uncounted centuries, there are gaps required to show how one tool may have gradually grown into another; but these gaps might, perhaps, be filled by diligent search. We even discover a tendency of recurrence to forgotten types, or details of construction, now as useless as the undeveloped leg bones of a whale; and in fact the great laws of development and natural selection are just as applicable to mechanical contrivances as to the growth of an animal or species. All we need to do in order that the analogy shall be identical and the comparisons complete is to doubt the credibility of men's interference, and to assume that tools chose for themselves higher organisations, and that their existing preference for steel over stone is simply the effect of inevitable law, and thus the whole chain of reasoning becomes nothing else than one more convincing proof that all things evolve themselves! Limits imposed by human or animal strength kept down the dimensions of ancient tools, and, as we all know, it was the invention and general use of steam power which has given an incalculable impetus to modern engineering. This has raised it from being a mere handicraft to an employment worthy of educated classes, and revealed its claims as a science worthy of the most enlightened intellects of our time. This new power has increased the dimensions of machines, and so enlarged the scope of mechanical engineering that a necessity has grown for better educational appliances for teaching the fundamental laws of matter and motion, and for instructing the engineer in those co-related sciences which must now be used for his advancement in life. There has thus arisen a strenuous, and in some cases a rather intemperate advocacy for an all-prevailing system of technical, apparently to the exclusion of every other kind of education. From the very dawn of authentic history we find accounts of workers in timber or stone; in the baser metals, or gold; but these artisans guarded the secrets of their crafts with a jealous care, imparting them only to a limited number of apprentices. Gradually the formation of guilds took place, apparently as much to prevent a general knowledge of their trade, as to ensure its continuance. In thus guarding against what they considered a too liberal extension of useful knowledge, they have been succeeded by trades unions, so dear to the working-men of our times; and it seems not a little remarkable that the City of London Guilds, the inheritors of traditions of more than oligarchal exclusiveness, should be as anxious now to make trade secrets generally known, as their predecessors were concerned to retain them in the possession of a few. And yet in reading history we do find scattered attempts to teach trades to outsiders, and one of the earliest seems to have been instituted by St. Basil the Great, Bishop of Cæsarea. This most remarkable man was born about A.D. 329; and during the reign of the Emperor Valens, he established a complete town in the suburbs of Cæsaræa, where there were workshops, in which "poor wayfarers," as they are quaintly called, might learn and practise various trades, under proper teachers.

Coming to later times, we find that in the midst of his experiments on the nature of heat, and numberless scientific researches, the celebrated Count Rumford found time to organise, and carry out successfully, a trade school for the very lowest classes. He describes an appalling condition of aggressive pauperism as prevailing in Bavaria; and it is most refreshing, in these days of so much sham philanthropy, to read the accounts of his arrangements for its removal. On the 1st of January, 1790, every beggar in Munich was arrested, and quartered in spacious buildings which had been prepared. Here they learnt various trades, and were kept clean and well fed. They made uniforms for the army, and such other work as was adapted to their powers; and the care of the distinguished engineer provided even for their amusements. Instead of pauperism, there prevailed contentment, and the indolent and vicious became, in some degree, industrious and reformed. Meanwhile, the poorer working classes were not overlooked; and the practical outcome of these most judicious arrangements of benevolent despotism was the extinction of pauperism where it had previously reigned supreme. Ancient workmen brought their handicrafts to great perfection; and the character of their masonry in Egypt, at Baalbec and throughout the East, and their productions in marble and bronze, attest their skill, and compel our admiration. The guilds carried on this work, without improving upon it; and during the middle ages intelligence came to the aid of manual skill, and Cistercian monks brought architecture to a state of high perfection, and scattered their splendid cathedrals in numbers and in matchless beauty over many lands. Meanwhile chemistry and other sciences were greatly advanced through encouragement given by enlightened Mahommedan caliphs at Bagdad and Cordova, and Arabian learning enriched Europe with an unequalled practical education. The restless spirit of investigation pursued throughout Western Europe in secret by the alchemists, or in fear by the philosophers, may claim credit for advancing the progress of science; while the experimental inquiries of Lord Bacon, Robert Bayle, the Marquis of Worcester, and a host of men of humbler name, not only cleared the path, but also prepared the way for the truer study of science and for the modern engineer. But of technical education as now understood, we find little trace until times within living memory. Those who, like Archimedes of Syracuse, were the engineers of ancient history, esteemed little the practical applications of their genius, and preferred to deal with problems of pure geometry or abstract mathematics; sometimes wrapping up their conclusions in enigmas, which only a later age has solved. So in modern times the mathematician and searcher into natural laws will too often disdain that kindly utilitarian spirit which would spend itself in doing most good to the greatest number. Fashion, too, and ignorance often combine in jealous sneers against that tithe of their own mercenary spirit, which would use superior knowledge for the advancement of its possessor, and the general effect tends to maintain a standard as lofty in seeming as it is false in fact, that genius is a gem too precious to wear, and that science becomes degraded the moment it is turned to practical account. This exalted standard has of late years happily yielded in some measure to common sense, but only after doing untold harm. It has not only impounded much of the richest treasure we possess, the inventive genius of our people, but has influenced many, who have all the pride of intellect and none of its power, to look with contempt on hard-working ignorance, whose name may indeed perish with his days, but whose works are of far more value than discussions upon life in four dimensions, and whose experience of natural laws teaches him more than all the philosophy of an Aristotle. In defence of a purely classical education it has been fairly urged that it forms an excellent training in preparing the mind for further developments in its culture, but surely, as the classical school admits, a mathematical education ranks on equal terms. Therefore they cannot deny to an intimate acquaintance with modern science the power of arriving at a similar end, with the additional advantage that it is usually of more interest and use through life than a cultivated talent for the composition of Latin verses.

"There is, however, one point of view which forms an essential difference between the two schools, which is the best defence of classical training against that exaggerated spirit of utilitarianism which even goes so far as to suggest the destruction of all the gardens and parks of England for growing vegetables, and can see no beauty in a waterfall, but thinks only of the mills it might drive. If the older system of education did not teach and did not profess to teach the abundance of undigested knowledge which the misleading standards of modern competitive examinations too often require, it did a better and a nobler thing, which the advocates of high - pressure education too often forget, or wilfully ignore. It never exhausted the immature undeveloped brain, but it taught the wisdom of ages past: it exercised the pupil in the application of such knowledge as he could easily acquire, and left considerable scope for his orginality. Moreover, it laid down the firm foundation of all the intellectual culture of our nation, and produced a race of men of rare sagacity and high administrative talents—men competent to build up the splendid empire we inherit, and of whom any country might well be proud to own among its sons. Even from the restricted point of view as to what should constitute the best education for an engineer, considering that it may fall to his lot to rule more men than the armies of many a famous kingdom, and all unaided and alone grapple with difficulties, material and political, innumerable, none can deny that a study of the qualities displayed in Xenophon's 'Retreat of the Ten Thousand' will be to him of more value than a very intimate acquaintance with the differential calculus. And time spent in learning modern languages, enabling him to read the invaluable works of French and German engineers, is much better employed than the cultivation of such an amount of mere mechanical skill as would beat a fitter at his own trade. Both the classical and the mechanical school of education have their good points; and no mere technical training can possibly place a man in such an exalted intellectual position as the classical system has done. There are men whose destiny it is to be mechanical workers, and they must make technical education paramount, and intellectual culture can only be to them a refining luxury, to which their leisure may well be devoted: and other men, whose natural gifts render them leaders rather than workers, can devote more time to brain-work and less to trade. In either case, technical knowledge is of great value, but its amount may well vary in their training. The great end and aim of education should never be, as too often found, the cramming with mere knowledge, but rather the cultivation of the power of applying knowledge. That is true wisdom indeed. These things are becoming better understood, and now that the cultivated classes have ceased to look upon the dirt and drudgery of mechanical toil as something deegrading, and that scientific attainments are becoming fashionable, it is to be hoped that the blending of the older and modern system which has been progressing in a tentative manner in our universities and great public schools, may grow and flourish, and that mechanical knowledge may more generally abound. It might be interesting to pursue this aspect of the subject further, but time would fail and your patience grow weary, and it will be more profitable to notice the course and progress of technical education during the past forty years, more particularly in its engineering aspect.

(*To be continued.*)

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

(*From our own Correspondent.*)

NEITHER merchants nor consumers are buying freely; the market is tame, and irregularity of operations marks the works. The orders now being received are unequally distributed. It is only in exceptional cases that they are of large extent, and in these instances the prices at which the contracts are accepted are low.

On 'Change this—Thursday—afternoon in Birmingham and yesterday in Wolverhampton, the makers of working-up and stamping sheets, and of tin-plates, again gave the best reports; but they are not over anxious to have it known that they are busy. Shipping orders are supplying the bulk of the work in hand. These makers quoted to-day £10 to £11 for working-up sheets (singles), and £13 to £13 10s., and on to £14 for stamping sheets (doubles). Prices of galvanising and merchant sheets again stood at an average of about £7 10s. to £7 15s. for singles, £8 to £8 5s. for doubles, and £9 to £9 5s. for trebles.

Over-production is still observable in numerous branches. Galvanised corrugated sheets offer a conspicuous example. Notwithstanding that the colonial and some other export markets are overstocked, consignments of galvanised sheets are still going out. The slightly better appearance of the Sydney market since last report is welcomed.

Galvanised corrugated sheets of the "Lion" brand are quoted this week, £12 10s. for 18 to 20 g.; £13 10s. for 24 g.; and £15 10s. for 26 g.; and the "Red Diamond" brand are £12 5s. for 18 g.; £13 5s. for 24 g.; and £15 5s. for 26 g. Galvanised close annealed flat sheets of the "Woodford Crown" brand in cases are quoted £15 for 18 g.; £16 for 24 g.; and £18 for 26 g. The "Anchor" brand annealed tinned sheets, also in cases, are £17 for 18 g.; £18 for 24 g.; and £20 for 26 g.; while the "Lion" brand of sheets are £20, £21, and £23 respectively.

The demand for boiler plates keeps slow, and tank plates are not selling quite up to the average. For bridge and girder plates there is, however, from some works, a fairly brisk call.

Boiler plates, not exceeding 15ft. long, nor 4ft. wide, nor 4 cwt. each, are quoted by Messrs. William Barrows and Sons at: Ordinary sorts, £9; best boiler ditto, £10; double best ditto, £11; treble best ditto, £12; extra treble best ditto, £15; and best charcoal plates, £19 5s. John Bagnall and Sons' boiler plates, to 5 cwt., are £9 for ordinary sorts, £10 for best, £11 for double best, and £12 for treble best. William Millington and Co.'s plates, to 4 cwt., are £9; best boiler sorts, £9 10s.; double best, £10 10s.; treble best—for flanging outwardly—£12 10s.; and treble best—for flanging inwardly—branded "L. M.," £15 10s. E. T. Wright and Sons' "Monmoor" best plates, to 5 cwt. each, are £9; double best, £10; treble best, to 4 cwt., £12; "Monmoor special"—for flanging, &c.—to 3 cwt., £15 10s.; and charcoal ditto, £17 10s. The firm's "Wright" qualities are 10s. per ton less, as usual.

Merchant iron is not selling with great activity, yet the bar mills are steadily engaged. Prices for best descriptions keep up.

Messrs. Hingley and Sons quoted their list to-day as: "Netherton" crown best bars, £7 10s. per ton at works; double best crown bars, £8 10s.; and treble best crown bars, £9 10s. These prices applied to rounds and squares ½in. to 3in., not exceeding 27ft. in length; and flat bars 1in. to 6in. wide, not exceeding 25ft. Angle iron up to 8in. united inches, and not exceeding 25ft., was quoted by Messrs. Hingley at £8 per ton nominal, and T-iron £8 10s. per ton.

Common bars could have been bought this afternoon in abundance at £6 2s. 6d. to £6. Common chain iron was £6 5s. upwards, and horseshoe bars, £6 15s. to £6 10s. as a minimum. Common angles were also £6 15s. to £6 10s., and ordinary tees £7 per ton. Hoops were £6 10s. at works, or £7 5s. delivered London; superior descriptions rising by 10s. per ton according to quality.

A rumour has obtained currency on the market that at the annual meeting of the Ironmasters' Association, which comes off in a week or two, a suggestion will be made in favour of an attempt to curtail the production in the finished iron branch. It would not seem, however, that the suggestion has emanated from official sources, nor that it has taken any definite form. Indeed, the market generally regard it as improbable that such a proposal would be adopted. The best informed think that it would be impracticable in a district like South Staffordshire, where the manufacture is in so many hands. It is borne in mind also that previous efforts in this direction in the sheet trade have not met with success. Yet it may happen that at the meeting of the Ironmasters' Association a discussion upon the matter may take place.

Mail advices from Melbourne delivered this week show that when the mail left bar and rod was in slow sale at £9. Black sheet iron had been quitted at £10 10s. to £11 10s. for Nos. 8 to 18, while hoop iron had changed hands at up to £10 10s. Some fair sales were taking place in fencing wire at quotations ranging from £11 10s. to £12 10s.

The local pig iron trade shows rather better sales this week, but the improvement is not conspicuous, and prices favour buyers on the basis of 62s. 6d. to 60s. for all-mine pigs, 50s. to 45s. for part-mines, and 40s. for cinder qualities.

The directors of the important extensive Sandwell Park Colliery Company on Tuesday declared an interim dividend at the rate of 5 per cent. per annum.

The secretary of the Iron and Steel Wire Manufacturers' Association has just issued a very useful table of sizes, weights, lengths, and breaking strains of iron wire under the wire standard gauge, which comes into operation on March 1st.

Most of the constructive ironwork manufacturers keep active.

The open market quotation at the present time for iron roofing work is £12 10s. per ton and upwards on trucks in Staffordshire, and iron rivetted girders £11 per ton and upwards. Galvanised shedding of improved design for agricultural erections is quoted at £35 per 40ft. length. Galvanised open cisterns 3ft. 10in. by 2ft. 7in. by 2ft. 6in. deep, to hold 150 gallons, are quoted on the open market by makers of repute at £12 12s. the half-dozen, delivered London or Liverpool, subject to a good discount. Similarly made cisterns to hold 125 gallons are quoted £11 14s. per half dozen, and 100 gallons £9 6s.

The Patent Shaft and Axle-tree Company, Limited, has given the workmen at the Monway Works, Wednesbury, fourteen days' notice to terminate the existing contracts. The men have hitherto worked by the "piece" system, and it is expected that in future they will have to perform "day" work. It is believed that the alteration will largely reduce wages.

A miniature iron house is about to be despatched by the Anglo-American Roofing Company, Wolverhampton, to be shown at the forthcoming building exhibition at Sydney. The house is 9ft. by 7ft., and 7ft. 6in. high to the eaves, and the roof is 7ft. 6in. high from the eaves to the ridge. Wooden ribs form the framework to the house, and to these calamined sheets 26in. by 32in. are nailed, thus forming the walls. Calamined and enamelled shingles 16in. by $8\frac{7}{16}$in., and pointed, are fastened to the roof and framework. Boards are nailed to the ribs on the inside, and the space between them and the metal is filled with sawdust. Two window sashes and a doorway complete the exhibit. It is claimed for the houses that they are more portable and cheaper than others. The Anglo-American Company hopes to open up a large trade with the Colony in calamined sheets for houses.

Notwithstanding the preference of builders and contractors for slates and tiles for roofing purposes, the iron shingles made by the Anglo-American Roofing Company are finding favour at home as well as abroad. The shingles have been utilised in the erection of residences at Reading, Ramsgate, and several other south-coast towns, while to Scotland, Australia, and China, some satisfactory orders have been despatched.

Constructive engineers, millwrights, and ironmasters in this district should be to some little extent served by an effort which is now being made by the Wolverhampton Exchange Company to obtain, for the information of local traders of the classes mentioned, particulars and plans of open contracts which are put upon the market from time to time for iron roofs, bridges, tanks, girders, fencing of all descriptions, boilers, corrugated ironwork, and the like.

Direct trading between hardware buyers in Australasia and the manufacturers in this part of the kingdom is increasing, and, notwithstanding the protests of the merchants, the establishment of "houses" in Melbourne, Sydney, and elsewhere by manufacturers is growing. This tendency is just now to the fore in the plumbers' brassfoundry and chandelier and gasfitting trades.

Lockmakers and some other hardware manufacturers find that customers are very nervous concerning the provisions of the new Patent Act, and they are insisting upon the erasure of the word "patent," except upon manufactures for which the patent still holds good.

Systematic efforts are being put forth to make the Industrial and Fine Arts Exhibition in Wolverl ampton next May a great success. The work has been divided over nine committees, and these have all begun operations. The mayors of numerous towns in the Midlands have been communicated with, asking for their co-operation. In some towns surrounding Wolverhampton local committees of manufacturers have been formed to arrange for the contributing of manufactures, and in other towns similar committees are contemplated. It seems likely that the directors of the London and North-Western Railway will consent to the carriage of heavy goods intended for the Industrial Exhibition at the same reduced rates as are charged in the case of the Royal and other agricultural shows.

On Wednesday the Council of the Wolverhampton Chamber of Commerce decided to memorialise the Board of Trade in favour of incorporated chambers and similar bodies having a *locus standi* before the Parliamentary Commissioners. On Tuesday the Birmingham Town Council consented to the application of the promoters of the North Birmingham Tramways and South Birmingham Tramways Companies for Provisional Orders, authorising the construction of such tramways. The council also consented to the use of steam-power on the central tramways within the borough for a period not exceeding three years. The Council will appoint inspectors to inspect the cars and engines along the lines, and will regulate their size and regulate travelling speed. The Public Works Committee have been to a great deal of trouble to ascertain the safest engine and the most powerful brake.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—A fairly steady tone is maintained in the iron market of this district, but not much actual business is being done. The tolerably large buying which took place recently seems to have covered in great measure the requirements of both makers and consumers for the present, so far as pig iron is concerned; and where there are any inquiries of weight in the market they are chiefly for long forward delivery, which makers hesitate to entertain. The market, however, can scarcely be considered as quite so strong as it was; not that makers are giving way, but merchants who bought pretty heavily at the late low prices, now that business is quieting down show some anxiety to realise if it is only at the very smallest margin of profit, and there is iron to be bought at prices lower than would have been taken a week or two back. This iron, however, is in second hands almost entirely, and buyers who have to deal with makers are not able to obtain concessions. In fact, so far as makers are concerned, the general tone is one of firmness, with very little inclination to entertain the offers which are in the market for long forward delivery—which practically mean deliveries extending over the second half of the year—at present rates.

There are, however, sellers prepared to book orders up to the end of the year, and where business is done the chief bulk of it is for long forward delivery. It seems, therefore, probable that as real requirements are for the present pretty well covered there may be a lull in the market until the contracts now running begin to work out, and both buyers and sellers are better able to judge on what terms future business can be done.

There was a good average attendance at the Manchester iron market on Tuesday, and moderately large inquiries for forward delivery were reported, but the actual business done was not of any great weight. For Lancashire pig iron makers' quotations were very firm at 45s. to 45s. 6d. less 2½ for forge and foundry qualities delivered equal to Manchester, and at these prices local makers were only open to sell for delivery up to the end of June. Fairly large sales could be made for more extended deliveries, but local makers decline to meet buyers, and the result is that the business offered to them has been taken by sellers from outside districts, and very few orders are at present being got for Lancashire brands. There is also only a moderate business being done in district brands of pig iron for pretty much the same reason. Offers for delivery up to the end of the year are reported, but makers hold back from committing themselves so far ahead. The average basis of prices is about 44s. 4d. to 44s. 10d. for forge, and 45s. 4d. to 45s. 10d. for foundry Lincolnshire, less 2½ delivered here, and at these figures makers are firm. Middlesbrough iron is still quoted at 45s. 4d. net cash for prompt delivery equal to Manchester, but for forward delivery 6d. per ton more is being asked.

One or two sales of hematites during the past week are reported at about 56s., less 2½ for good foundry brands delivered equal to Manchester, but there is still only a very limited business generally being done.

In the finished iron trade business continues very slow. One or two of the makers are well off for orders for the present, but generally they are only kept going from hand to mouth, and all through the market a weak tone prevails, although there is no actually quotable alteration so far as current prices are concerned. Good qualities of Lancashire and North Staffordshire bars delivered into the Manchester district do not average more than £6 per ton; hoops, £6 7s. 6d. to £6 10s.; and good qualities of sheets, £7 12s. 6d. to £7 15s. per ton delivered into the Manchester district.

The question has been recently raised as to what is really the present meaning of g.m.b. Scotch warrants, so far as it is any guarantee as to the quality of the iron in store, and as a considerable quantity of Scotch iron is used for engineers' castings in this district, it may be of interest if I state briefly the opinions I have heard expressed on this point by those who have a thorough knowledge of the facts. The brands which, many years ago, were known as "g.m.b.'s" have long since ceased to go into store, and their place has been taken by inferior makes, which in some cases are of so low a quality that they are practically made solely for the warrant market, as it would be difficult to find for them a legitimate outlet in any other way. Of course, this does not apply to the whole of the iron at present held in store, but there is so much obscurity surrounding the question as to what are the relative proportions of the inferior and better class brands that are classed as "g.m.b.," that it is suggested the Iron Rollers' Association, or what is known as the "Ring," should take some measures to place before the public the facts as to the actual brands which are held in store. In the meantime it would perhaps be as well if buyers of g.m.b. took the precaution of barring from their purchases of "warrants" all brands that are known to be of inferior quality.

Reports as to the condition of the engineering trades still show a decided falling off in, I may say, all branches. There are some classes of work in which there is still a good deal of activity, but even in these the orders in hand are running off much faster than new orders are coming in, and the outlook generally is anything but hopeful.

The question of safety lamps for coal mines has for some time past occupied considerable attention amongst mining engineers in this district, and the meeting of the Manchester Geological Society held on Tuesday last was devoted solely to the reading and discussion of papers on the above subject. Mr. Joseph Dickinson, H.M. Chief Inspector of Mines, contributed some further details with reference to the Marsant lamp, which has already been illustrated and described in THE ENGINEER. Since this description was given Mr. Dickinson has made further tests with this lamp, which, with the modifications he has suggested, has already been introduced with satisfactory results into a colliery where the Davy had been condemned as unsafe; and as the result of these tests Mr. Dickinson stated that they showed that great reliance might be placed upon the lamp, and as it gave more than double the light of the Davy, and did not go out so easily when tilted as the Muesler, it seemed likely to suit the requirements of many collieries. For those who objected to a lamp in which gas continued to burn under the gauze in an explosive atmosphere after the lamp itself had gone out, which is the case in M. Marsant's lamp, there was the lamp in a modified form with the smaller apertures, such as Mr. Dickinson has suggested. For those accustomed to test gas with the lamp in full flame there was still the Davy, which with the tin can, might under ordinary circumstances be safely used by firemen for testing. But with the Muesler and the Marsant to choose between, there seemed to be no longer any excuse for continuing to work with the Davy lamp where it might become exposed to an explosive current. Dr. C. Le Neve Foster, F.G.S., also read a paper on a safety lamp invented by Herr Pieler for indicating fire-damp when it existed in quantities so small that it would not be detected by an ordinary lamp, but might still be in sufficient volume in a dusty mine to be dangerous in its character. Experiments had shown that with an ordinary oil lamp it was practically impossible to detect the presence of fire-damp when it fell below 2 per cent., but with the Pieler lamp, which is a modification of the Davy constructed to burn spirits, fire-damp could be detected when it existed in so low a proportion as ¼ per cent. This lamp, Dr. Foster added, was already being used in numerous collieries in Westphalia and elsewhere with very good results.

The Lancashire coal trade continues in a depressed condition, with pits only in exceptional cases working more than about four days a week, and stocks accumulating. For all classes of round coal the demand is extremely dull, and with the commencement of the month there has been a pretty general reduction of 6d. per ton upon the prices previously quoted, but even this does not represent the full extent of the concessions which are being made by sellers, as stocks are being forced upon the market at prices which in many cases have no relation whatever to the quoted rates. The average quoted prices at the pit mouth are about 9s. 6d. to 10s. for best coals, 7s. 6d. to 8s. for seconds, 6s. 6d. for common house coal, and 6s. to 6s. 6d. for steam and forge coal. Engine fuel is in fair request, and the present small production of slack is keeping prices steady at 4s. 6d. to 5s. for burgy, 3s. 9d. to 4s. 3d. for best slack, and 3s. 3d. to 3s. 6d. for ordinary qualities at the pit mouth.

Shipping continues very quiet, with Lancashire steam coal offering freely at both Garston Docks and the high level, Liverpool, at about 7s. 6d. per ton.

For some time past efforts have been made to obtain a distribution of the surplus of the Hartley Colliery Relief Fund among the permanent relief funds which have since been formed in various colliery districts, and at a meeting of the committee of the North and East Lancashire Colliery District Surplus Hartley Fund, held in Manchester on Tuesday, a resolution to this effect was proposed but was not carried, the committee deciding that for the present no distribution of the fund, which amounts to over £2700, should be made, but that the money should be withdrawn from the bank and invested in some approved securities.

The annual meeting of the members of the Manchester Coal Exchange was held on Tuesday. The report submitted showed that the Exchange now incorporated continued to be successful, and Mr. T. Southworth, of Hindley, was elected president for the ensuing year.

Furness and Cumberland.—The hematite pig iron trade occupies a little better position than it has done for some weeks past, and on the whole the outlook is much more hopeful. The trade, however, is still in a very low condition, and is causing great anxiety to makers. The little change that has occurred will be welcomed by all. During the week the business transacted has been in excess of that for some months previous, and the sales have greatly increased. The orders coming to hand on home and even foreign account have improved and greater activity prevails. The stocks of metal now warehoused at makers, though continuing very heavy, have seen an appreciable reduction since the output was restricted to such an extent as it has been. Prices have improved owing to these few changes, but principally because of the increased activity on home and foreign account. No. 1 Bessemer samples may now be quoted at 48s. per ton net at works, prompt delivery; No. 2, at 47s.; and No. 3, 46s. per ton; while inferior samples are in demand at 45s. per ton and upwards. Steel is in quiet request, but there is also a tendency towards higher prices; the orders coming to hand are not extensive, but the merchant department is still fairly employed. The output from the rail department has not been very heavy, and they still continue at from £4 10s. per ton and upwards at works. Engineers, boilermakers, and the other minor departments of the iron and steel trades are still indifferently employed, and it is not expected they will experience much change for some time to come. Shipbuilders are remarkably quiet, and but few inquiries are coming to hand. Iron ore is languid, with large stocks and unchanged prices. Raisers are, however, firmer. Coal and coke steady, with easier prices. Shipping dull with freights low.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

IN spite of the restrictive policy which has been commenced in the North, the condition of the iron trade appears to go from bad to worse. A leading iron merchant who has abundant opportunities of watching the market, declares that prices have not yet reached their lowest level, though they are now unremunerative. The policy of restriction in the steel trade is now being vigorously attempted. I have already told you of the resolution to restrict the output by 20 per cent. at least; it has also been decided to advance prices by 10s. per ton. All the railmakers of this country have been invited to join in the movement, which will also have the co-operation, it is expected, of foreign manufacturers. In no branch of industry is restricted production so much needed as in steel rails, which have now dropped to £4 at works on the coast. There is something like a senseless competition to take orders at prices which do not admit of a profit, but this unremunerative production goes on in the hope that when values take an upward turn, the producing firms will be "in the swim," and ready equipped to make the best of it.

The chairman of the Lancashire and Yorkshire Railway, writing to a correspondent, states that his company has now arranged to experiment with the electric light, and expresses the hope that before long means will be found of improving the lighting of railway carriages. Electric lighting is becoming very freely used in this district for collieries, workshops, open spaces, and other purposes, the latest application of it being to enable contractors to carry on building operations by night as well as by day.

A very interesting gathering took place at the King's Head Hotel, Sheffield, on the 4th inst. The occasion was the eightieth birthday of Mr. Thomas Jessop, J.P., chairman of the great steel firm of William Jessop and Sons, Limited, Brightside Steel Works. The chair was occupied by Mr. E. Tozer, J.P.—Messrs. Steel, Peach, and Tozer, Phœnix Bessemer Works—and there were over fifty gentlemen present. Mr. Jessop is the president of a Birthday Club, which meets at the King's Head to celebrate the anniversary of the birthdays of its members, and it was this club which entertained him. Mr. Jessop, who looks as hale and hearty as ever, commenced active life in America as far back as 1829, and was travelling in the United States in 1832, where his tact and judgment made him a great favourite and helped to lay the foundation of what grew to be the largest crucible steel business in the world. He has filled every office of honour in the town—Master Cutler, Mayor, Town Trustee, magistrate for borough and county, and to crown all, established the Jessop Hospital for Women, a noble building, which is of great service to the town.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

NOTWITHSTANDING the announcement that a large increase in the stock of Cleveland pig iron had taken place during January, prices were steady at the market held at Middlesbrough on Tuesday last. But little business was done, however, as makers generally are well sold for this month, and do not care to commit themselves for a longer period. Next month the smelters' new restrictive compact will be in full operation, and the improved shipments usual in spring will no doubt assist in enabling sellers to obtain better prices. On Tuesday, No. 3 g.m.b., for prompt delivery, could not be had for less than 37s. per ton. Grey forge was offered at 35s. 6d., but in one or two cases sales were made at 6d. per ton less.

Buyers offer 37s. per ton for warrants, but holders want 37s. 6d., and no business results.

The stock of Cleveland pig iron in Messrs. Connal's store at Middlesbrough increased 62 tons during the week ending the 4th instant.

There is but little activity in the finished iron trade, some works being already idle for want of orders and specifications. The lower prices do not induce consumers to buy more than they want for immediate use. For prompt delivery quotations are as follows:—Ship plates, £5 5s. to £5 10s. per ton; angles, £5 to £5 5s.; and common bars, £5 5s. to £5 10s., all free on rails at manufacturers' works, cash 10th less 2½ per cent. discount. Puddled bars are £3 7s. 6d. per ton net at works.

The exports from the Tees last month were:—Manufactured iron and steel, 24,753 tons; and pig iron, 62,043 tons. Of the latter, 23,860 tons were sent to Scotland, 7760 tons to France, 7260 tons to Holland, 3090 tons to Belgium, 3010 to Italy, and only 630 tons to Germany.

The Cleveland ironmasters' returns for January were published on the 4th inst. They show that 118 furnaces are at work, 82 of which are producing Cleveland iron, and the remainder hematite, basic, and spiegel iron. The total quantity of iron of all kinds made amounted to 229,624 tons, against 232,666 tons in December. The total stock in the whole district amounted, on the 31st January, to 286,317 tons, being an increase of 33,212 tons since December 31st.

The failure is announced of Messrs. D. Baxter and Co., iron shipbuilders, of North Sands, Sunderland. It is said that the liabilities amount to about £25,000. The firm commenced business in 1881, and have turned out twelve vessels, three more being in course of construction. About 300 men have been thrown out of employment by the failure. Mr. J. A. Longden has been appointed official receiver.

In anticipation of the intended restriction of output of pig iron, about 100 men have received a fortnight's notice to terminate their engagements at the Craggs Hall and Loftus Mines.

A commencement was made with the dock extension at Middlesbrough on Friday last. Mr. John Jackson, of London, has entered into a contract with the North-Eastern Railway Company to do the work, which when completed will give double the water area and three times as much quay space as at present.

On Monday night about 200 puddlers at the West Stockton Ironworks struck work owing to the firm having stopped the level hand money of 1d. per heat. A similar partial strike has taken place at the Stockton Malleable Ironworks.

After five weeks duration the strike at the Bowesfield Ironworks has terminated. At the request of the workmen a deputation from the Iron Manufacturers' Association visited the works on Monday last to endeavour to settle the dispute. The workmen pleaded for the re-engagement of the discharged hands, and that every man should be allowed to return to his former place, and that no "animosity" should be shown to any of them. The employers' deputation informed them that the Bowesfield Company must be allowed to employ whom it pleased and discharge whom it pleased, in so far as it acted legally and according to the rules of the works. The three men about whom the strike had arisen would not be reinstated, and certain others whom the manager did not require would also be excluded. As for "animosity," notwithstanding the unfair action taken by the men, which might have justified retaliation, the company had decided not to sue them at law, and not to retain the balance of wages remaining in the office to the credit of some of them. After this interview the men held a meeting, and the result of a ballot then taken was that they resumed work next day.

The action of Murley *v.* Jackson and Stevenson, Jaques, and Co., has been going on at the Leeds Assizes for some days, and at the time of writing is not yet complete. It will be remembered that the defendant Jackson bought land at Boosbeck, in Cleveland. The surface he sold in building sites to Murley and others. The right to work the ironstone below he sold to Stevenson, Jaques, and Co., iron smelters, Middlesbrough, guaranteeing them from all claims for surface damage. Whereupon they worked all the stone out, leaving no pillars, and soon wrecked the whole village built above. Hence the action brought by the surface owners. The jury have found:—(1) That the stone was worked and gotten by both defendants. (2) That the stone was not worked and gotten in a good, orderly, and workmanlike manner. (3) It was not worked and gotten according to the best and most approved and customary manner of getting and working in mines of ironstone of like quality and description; and (4) That the ironstone as so worked and gotten was worked and gotten under, and in accordance with, the orders and directions of Jackson. The judge accepted the above finding, and said he would hear whenever convenient any argument on the question of who was entitled to judgment.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE Glasgow iron market has been comparatively quiet this week, but the changes in prices are not of much importance. The shipments of Scotch pig iron were larger than in the preceding week, but otherwise there was nothing in the condition of the market calling for special remark. The stocks of pig iron in Messrs. Connal and Co.'s warrant stores show an increase on the week of about 1800 tons.

Business was done in the warrant market on Friday at 43s. 3d. to 43s. 6½d. cash, and 43s. 5d. to 43s. 7½d. one month. On Monday forenoon the quotations were 43s. 5d. to 43s. 4d. cash, and 43s. 6½d. to 43s. 5½d. one month, the afternoon quotations being 43s. 4d. to 43s. 2½d. cash, and 43s. 5½d. to 43s. 4½d. one month. Tuesday's business was at 43s. 3d. to 43s. 4d. cash, and 43s. 5d. to 43s. 6d. one month. The market was flat on Wednesday at 43s. 2½d. to 43s. 0½d. cash. A large business was done to-day—Thursday—down to 42s. 8d. cash, the lowest figure touched for a series of years.

The values of makers' iron are without much alteration, as follows:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 54s.; No. 3, 51s. 6d.; Coltness, 58s. and 52s.; Langloan, 55s. and 51s. 6d.; Summerlee, 53s. and 48s. 6d.; Calder, 54s. 6d. and 48s.; Clyde, 48s. and 46s.; Monkland, 45s. 3d. and 43s.; Quarter, 44s. 6d. and 42s. 6d.; Govan, at Broomielaw, 45s. and 43s.; Shotts, at Leith, 54s. and 52s.; Carron, at Grangemouth, 49s.—specially selected, 56s. 6d.—and 47s. 6d.; Kinneil, at Bo'ness, 46s. 6d. and 46s.; Glengarnock, at Ardrossan, 52s. 6d. and 46s. 9d.; Eglinton, 47s. and 43s. 6d.; Dalmellington, 49s. 6d. and 47s. 6d.

The arrivals of Middlesbrough iron in Scotland are slightly larger than at the corresponding date last year.

In the malleable department there is considerable activity at a number of the works, while others are experiencing a lack of orders.

The past week's shipments of manufactured articles from Glasgow embraced £15,320 worth of machinery, £3875 sewing machines, £3070 steel manufactures, and £17,270 in goods. The engineering works of the Clyde district are, for the most part, busy, but although there are various important contracts in hand, the miscellaneous orders are not so numerous as they were some time ago.

The amount of the shipping business in the coal trade has been materially reduced by the recent stormy weather. From Glasgow, in the course of the week, 1700 were despatched to Bordeaux, 1200 to Valentia, 250 to Dunkirk, 580 to Rouen, 850 Demerara, 680 tons were taken for the use of steamers, and 3720 sent coastwise. Fairly good orders are now being executed. The prices, which have been slack for shipping coals since the beginning of the year, are now about 6d. less per ton than the figures then quoted, and there has also been a reduction, varying from 6d. to 1s., in the quotations of coals for household consumption. The week's shipments of coals at Ayr have been 3618 tons, 3051 at Troon, and 1065 tons at Grangemouth. In the Fife district the values of coals have also been reduced to some extent. At Burntisland the coal shipments for January have amounted to 32,462 tons, as compared with 37,791 tons in the first month of 1883.

The dulness in the coal trade and the necessary reductions in prices have been accompanied by a reduction in the wages of the miners. In the West the curtailment of pay is general, and it will also soon be so in the Eastern mining districts. In some places the men have come out on strike, but they are not expected to stand out for any length of time, as it is apparent that expenses must be very much curtailed if the collieries and ironworks are to be kept in operation.

The strike in the steel works of the West of Scotland is now at an end, and the men have gradually gone back to work at the reductions intimated at the close of the year.

The Pumpherston Oil Company has struck the shale at its No. 1 mine at the depth of only 30ft., and it is reported to be thicker and more valuable than was expected.

Mr. Henry Aitken has contributed a paper to the Mining Institute of Scotland on "How to Make the Most of our Coal in Coking it, and how Best to Treat it when Making Gas for Heating Boilers." He advocated the firing of the boilers of ocean steamers by means of oil, and the proposal led to an animated discussion.

The Clyde shipbuilding trade has been dull in the course of the past month, during which less than 7000 tons of new shipping have been placed in the water. We shall have to go back for many years to find such a very small output in any one month.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE Taff extension up to Ynysybwl is now complete, and awaits colliery enterprise, which, in part, has been delayed by litigation. I hear that Messrs. Cory will open out in this valley. A new taking has also been arranged there within the last few days. These, with the further development of the Taff Valley, will add considerably to the revenue of this line, though the necessary expenditure along the whole length from Pontypridd, in widening the line, &c., will be very large.

The Penygraig inquest promises to be a searching one. The colliers in committee have decided to be represented there, and have the case vigilantly watched. At the committee meeting a strong expression of confidence in the Fleuss life-saving apparatus was expressed, and it was recommended that stations should be formed in the Rhondda Valley, and men trained to the use of the apparatus.

A good deal of interest has been shown during the week at Cardiff by the arrival of the first ship that has been here which has adopted electric lighting. This is the screw steamer Minia, of London, owned by the Anglo-American Telegraph Company. There are fifty-six lamps on board, the electricity is generated by a Gramme machine, worked by a Caledonian horizontal engine of 8-horse power. The lights burned steadily, and seemed to give every satisfaction.

The Ferndale and Ocean scales not having warranted an advance of wages, it now only remains to see what the employers' scale will do. The examination of the books of the Coalowners' Association is now proceeding, conducted by Messrs. Kirk and Parsons, and the result will soon be known.

Prices are well retained, and as much as 11s. 6d. f.o.b. was obtainable last week for the best colliery screened. Work during the week has been very regular, and the total exports promise to be considerably in advance of those of last week, which were a good deal interfered with by the accident at Penygraig. A part of the ventilating fan broke during the week and interfered with operations, but the last body has been brought to bank.

The iron industry still flags, and nothing but spare orders are moving about at figures that give little encouragement. At Dowlais things have been very dull, but there is some degree of brightening up visible this week. Large consignments of ore from Bilbao have come into Dowlais and Ebbw Vale this week, and this is taken as a promising sign.

The Taff Vale Railway has just imported 500 tons of rails and nearly 1000 posts from Bridgwater.

The arbitrators in the Caerphilly dispute have no less than eight separate complaints to investigate. In the meanwhile the men are very wisely dropping in to work.

Two men were fined this week for gross negligence in one of the Rhondda collieries. They had left two doors open in the Ton pit, thereby interfering with the ventilation and positively endangering the lives of 500 men. No stronger illustration can be given of collier recklessness than this, and that, too, just after the disaster of Penygraig. Fines, however, cannot be regarded as sufficient punishment. Humane people advocate fines so that the wives and children should not suffer. But they do suffer, for in paying the fines they are stinted in food. The legal punishment in all such cases should be imprisonment with hard labour, the colliery owner supporting the wife and family, and the debt so incurred to be held as legal, and to be defrayed by the collier on resuming work.

Electric Lighting at Gunpowder Mills.—The gunpowder mills owned by Messrs. W. H. Wakefield and Co., Gatebeck, near Kendal, are now lighted by the electric light, these being the first works of the kind where this safe mode of illumination has been adopted. The works are very extensive—at least two miles in length. The dynamo is placed about the centre of the works. Very long mains were thus necessary, as each dangerous building is about about 200 yards from its neighbour. Overhead bare wires were found to be the best for conveying the current. These are carried on insulators on posts and trees along the route, branch wires being taken off to each building, four to eight lamps being necessary to each. The lamps used are the new pattern 12-candle power Swan lamps. The dynamo is a Crompton compound-wound, self-regulating Bürgin, which runs almost continuously day and night at this season of the year, the average work per day being at least 20 hours. In the dangerous powder-making sheds the lights are enclosed in specially-designed copper reflectors, enamelled white inside, with tight-fitting plate-glass fronts. These are then fitted on posts outside the hermetically-sealed windows of the building, the light being projected inside.

Additions to the Navy.—Official returns state that during the past twelve months fourteen vessels were launched for her Majesty's Navy, twelve vessels were ordered to be constructed, and in most cases were commenced, and that at the present time there are, in addition to the number just mentioned, seven others on the stocks, which were under construction prior to the commencement of last year. The vessels now being fitted for service include three double-screw second-class steam cruisers, each to carry ten guns, of 3750 tons each, with engines of 5000-horse power, named respectively the Amphion, Arethusa, and Leander; two single-screw composite corvettes, with twelve guns, and each of 1420 tons, and 950-horse power engines, named the Rapid and Royalist; two screw composite gun vessels, the Dolphin and Wanderer, each to carry three guns, of 925 tons and 750-horse power engines; three screw composite gunboats, each to carry four guns, of 560 tons, and fitted with engines of 650-horse power, named respectively the Albacore, Mistletoe, and Watchful; a sixteen-gun screw corvette, the Calypso, built of steel and iron, cased with wood, of 2770 tons, and 3000-horse power engines; a ten-gun steel twin-screw armour-plated barbette ship, the Impérieuse, of 7390 tons, and with engines of 8000-horse power; a double-screw steel armour-plated barbette ship, the Collingwood, designed to carry ten heavy guns, of 9150 tons, and 7000-horse power engines; and a seven-gun paddle composite vessel, named the Sphinx, of 1130 tons, and supplied with engines of 1140-horse power. The vessels now in progress, some of which are in a forward state for launching, include a sixteen-gun screw corvette, built of steel and iron, cased with wood, of 2770 tons, and 3000-horse power engines; a fourteen-gun screw composite corvette, of 1420 tons, with engines of 950-horse power; three twin-screw steel armour-plated barbette ships, each of 9600 tons, and engines of 7500-horse power, to carry ten guns each; a similar vessel, but of less tonnage—namely, 7390 tons, but with engines of greater horse power—namely, 8000; and a ten-ton double-screw steel second-class steam cruiser, of 3750 tons, with engines of 5000-horse power.

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.

29th January, 1884.

2289. Brakes, J. G. Rockhill, London.
2290. Trousers Button, J. Lee, Brighton.
2291. Weaving Carpets, &c., J. Templeton, Glasgow.
2292. Frame Corner, C. J. Price, West Molesey.
2293. Combined Spring and Weight Power, G. and H. A. Rumbelow, Herringswell.
2294. Spring Compensators, J. D. Hall, Newburn.
2295. Farm Cultivating, &c., Apparatus, W. P. Thompson.—(*R. Romaine, Ottawa.*)
2296. Tarpaulins, W. Hatchman, London.
2297. Velocipedes, F. Roberts, Lower Beeding.
2298. Self-acting Brakes, G. H. Staite and W. Hope, Liverpool.
2299. Aluminium, T. Griffiths, Oxton.
2300. Looms, C. Smith, Carlisle.
2301. Water-closets, J. Conlong, Blackburn.
2302. Revolving Cranes, H. J. Coles, London.
2303. Umbrellas, &c., J. Cross, Whitehaven.
2304. Covering Steam and Water Pipes, V. Brown, Denton, and J. Marshall, Haughton Denton.
2305. Covering Telegraph and other Wires with Gutta-percha, &c., W. Hancock, London.
2306. Covering Wire or Strand with Gutta-percha, &c., W. H. Wardale, D. Phillips, and W. Hancock, London.
2307. Metallising Wood, &c., L. A. White, Chorlton-on-Medlock.
2308. Locking Railway Carriage Doors while in Motion, T. A. Milo, London.
2309. Switch, E. C. Gee, Lewisham.
2310. Saddle-bars, J. A. Barnsby, Walsall.
2311. Horseshoes, A. Brinkman, Bow, and T. Dobson, Bromley.
2312. Preparing Surfaces for Printing, &c., A. G. Brookes.—(*E. Kunkler and J. Brunner, Switzerland.*)
2313. Button-hole Attachment for Sewing Machines, H. J. Allison.—(*The Schott Button-hole Attachment Company, New York, U.S.*)
2314. Tobacco Pipes, T. Thornton, Bury.
2315. Life and other Boats, I. A. Timmis, London.
2316. Paper, &c., A. Wilkinson, London.
2317. Tobacco Pipes, &c., J. Aikman, Glasgow.
2318. Steam-traps, J. Auld, Glasgow.
2319. Transmitting Motive Power, J. Morison and R. Armstrong, Dalkeith.
2320. Universal Pipe Joints, E. G. Brewer.—(*A. Robert, Gilly, Belgium.*)
2321. Preventing Rain Dripping from Waterproof Clothing, J. Neville, London.
2322. Ventilating Cricket Bat, &c., Handles, J. Neville, London.
2323. Artificial Stone, J. Hatfield, Kew-gardens.
2324. Tip Carts, &c., G. E. Tester, Tunbridge Wells.
2325. Cutting Machines, A. Lotz, London.
2326. Floats for Paddle-wheels, T. Bingham, London.
2327. Galvanic Batteries, J. Rapieff, Barnet.
2328. Indicating Apparatus, J. Wilshin and V. P. Healy, Anerley, and E. Hall, London.
2329. Ladies' Dress Extenders, J. Ridings, London.
2330. Alcohol, H. J. Haddan.—(*C. Coster, Bruxelles.*)
2331. Drawing Beer, &c., from Casks, E. Flint and J. Yardley, Birmingham.
2332. Automatically Stopping Steam, &c., Engines, M. B. Copland, Preston.
2333. Boots and Shoes, F. Laycock, Northampton.
2334. Treating the Residues of Soda Works, G. F. Redfern.—(*Dr. H. von Miller and C. Opl, Kruschau.*)
2335. Fitting Locks, &c., W. R. Comings.—(*H. Bassett, New Britain, U.S.*)
2336. Kilns, J. P. Cramp, Finedon.
2337. India-rubber Pumps, E. Edwards.—(*P. J. Ruffel, Paris.*)
2338. Window Blinds, &c., J. Sherrin, Ramsgate.
2339. Vegetable Fuel Motors, W. Quartermain, Fransham.
2340. Roping, A. W. L. Reddie.—(*W. F. Prosser and R. Wells, United States.*)
2341. Purifying Gas, A. W. L. Reddie.—(*The Smith and Sayre Manufacturing Company, New York, U.S.*)
2342. Direct-acting Duplex Engines, C. C. Worthington, New York, U.S.)
2343. Bridge and Water-way, F. Houghton, London.
2344. Mixing, &c., Sugar, J. H. Johnson.—(*The Compagnie de Fives-Lille, Paris.*)
2345. Packing, E. S. Hough, Brockley.
2346. Buttons, R. Elsdon, Brockley.
2347. Ventilating, &c., Apparatus, C. Tate, London.
2348. Filtering, &c., Air, C. M. Tate, London.
2349. Patterns for the Use of Tailors and others, B. J. B. Mills.—(*Moschcowitz Brothers, New York, U.S.*)
2350. Apparatus Used in Connection with Torpedoes, &c., C. A. M'Evoy, London.
2351. Securing Labels to Hampers, &c., C. F. Collom and A. Hill, Heavitree.
2352. Travelling Bags, &c., A. J. Alexander and H. Masters, Clifton.
2353. Drilling Apparatus, T. W. Asquith and R. E. Ornsby, Seaton Delaval.
2354. Artificial Manure, F. W. Martino, Sheffield.
2355. Converting Rotary Motion, W. R. Lake.—(*J. H. Palmer, Philadelphia, U.S.*)

30th January, 1884.

2356. Damp-proof Soles for Boots, T. and B. Hartley, Accrington.
2357. Tillotting Cloths, J. G. Tiller, Manchester.
2358. Music Stools, &c., E. Samson, London.
2359. Ship Construction, C. G. Clarke, Kingston-upon-Hull.
2360. Glue, J. F. Smith, Leicester.
2361. Reaping and Mowing Machines, R. H. C. Nevile, Wellinore, and E. Whitworth, Sleaford.
2362. Attaching Knobs to Spindles, G. Walker, Birmingham.
2363. Brace Buckles, G. Walker, Birmingham.
2364. Fusible Plugs, H. J. Harman, Manchester.
2365. Cupola, W. Glaze, Dudley.
2366. Disintegrating Hops, W. Barnett, Faversham.
2367. Pedal Horn, C. Henshaw, Manchester.
2368. Kilns, H. Hargreaves, Congleton, W. Beckett, Oulton, and W. Cliffe, Astbury.
2369. Fuses for Rifled Muzzle-loading Ordnance, W. P. Kelly, Mount Brandon, Ireland.
2370. Filing Bills, W. T. Symons, Winsford.
2371. Altering Ships' Helms, W. Laurillard, Hull.
2372. Dyeing Black Colour upon Cotton, J. K. Kaye, Moldgreen.
2373. Breaking Woollen Substances, G. Bamford, Milnsbridge.
2374. Zinc Roofing, J. and J. J. Mould, Birmingham.
2375. Knitting Machines, H. Leeming, Manchester.
2376. Preserving Grasses, T. Barrow, Rock Ferry.
2377. Chimney Pots, W. Beddows, Farnworth.
2378. Pressure Gauge, W. Dawes, Leeds.
2379. Window Fastener, S. Willett, Herne Hill.
2380. Tricycles, J. Jackson, Coventry.
2381. Separating Clay, C. Walton, London.
2382. Pin for Fastening Down Carpets, J. Hillyard, Oaklea, and W. K. Hillyard, Newcastle-upon-Tyne.
2383. Galvanic Batteries, F. H. Gossage, Widnes.
2384. Knitted Articles, J. Hoare, Loughborough.
2385. Knife-cleaning Machines, C. Spong, Brockley.
2386. Pipes for Smoking, W. P. Bruce, Kinleith.
2387. Slip Hook, J. C. Cole.—(*M. Mills, Fiji.*)
2388. Obtaining Hydrochloric Acid, J. G. Tatters, South Shields.
2389. Asbestos Packing, A. L. Normandy, London.
2390. Roller Mills, P. V. Gelder, Sowerby Bridge.
2391. Velocipede Frames, H. J. Pausey, London.
2392. Driving Wheels of Velocipedes, W. A. E. Sack, Bushey, and J. Gilfillan, West Brighton.
2393. Reproducing Coloured Pictures on Porcelain, &c., H. J. Haddan.—(*R. Beyermann and A. Kürth, Germany.*)
2394. Hanging Window Sashes, J. J. Barton, London.
2395. Wrought Metal Nails, E. A. Lee, Newport.
2396. Top Wicks, A. E. Webb, London.
2397. Bending, &c., Hooks, J. Finnie, Ayr.
2398. Horseshoes, A. Anderson, Edinburgh.
2399. Tea Pots, D. Lindo, London.
2400. Grinding Corn, &c., P. Gillen and J. W. Throop, London.
2401. Pencil Holders, E. H. Schmidt.—(*C. Conradty, Nuremberg.*)
2402. Finger Shield, J. Burgess, Birmingham.
2403. Stair Rod Eyes, W. H. Richards, Birmingham.
2404. Ventilation, G. F. Harrington, Ryde.
2405. Galvanic Battery, H. Fairfax, London.
2406. Shoes for Cycling, J. Penhale, London.
2407. Window Flower Guards, H. Copeland, London.
2408. Pruning of Bill Hooks, J. Room, Kingsweston.
2409. Envelope Machines, A. J. Boult.—(*L. P. Bouvier, Toronto.*)
2410. Pressing Cloth, A. Boult.—(*J. Shearer, Canada.*)
2411. Boots, G. Valiant, Toronto.
2412. Artificial Manure, T. Schecle and T. Kühn, Emmerich-on-the-Rhine.
2413. Roofs, D. Griffiths, Erdington.
2414. Washing Machines, A. Harmens, London.
2415. Purifying Coal Gas, W. T. Walker, Highgate.
2416. Drawing Boards, C. T. Atkinson, London.
2417. Letter Boxes, J. D. Steele, London.
2418. Treating Phosphates of Iron, &c., C. D. Abel.—(*P. Dietrich, Berlin.*)
2419. Coal Scuttles, J. H. Ramsay, Bamff.
2420. Pointing Pencils, T. Moore, London.

31st January, 1884.

2421. Lubricators, J. Baguley and W. Eastwood, Ashton-under-Lyne.
2422. Steam Traps, H. Hyde and W. Eastwood, Ashton-under-Lyne.
2423. Machine Belting, J. V. Taylor, Warrington.
2424. Doubling Winding Frames, T. Briggs and E. Webb, Salford.
2425. Twisting Yarn, T. Briggs and E. Webb, Salford.
2426. Twisting Yarn, T. Briggs and E. Webb, Salford.
2427. Kilns, J. Davies, Clifton.
2428. Electric Bells, &c., J. C. Bayley, Parkstone.
2429. Steam Gauges, G. C. Parini, Liverpool.
2430. Tube and Ball Toy Game, W. C. Owston, Pontefract.
2431. Self-locking Railway Chair Wedge, T. Williamson, Pollokshields.
2432. Fire-grates, F. H. White, Liverpool.
2433. Distillation of Solid Substances, B. P. Walker, Birmingham, and J. A. B. Bennett, King's Heath.
2434. Pressing Ensilage, G. Myers, Clifton.
2435. Sash Fastenings, W. Macvitie, Birmingham.
2436. Billiard Registers, H. Scott, Liverpool.
2437. Self-acting Steam Trap, F. A. Sharpe and W. Woollaston, Lincoln.
2438. Filter Press Taps, J. Newton, Longport.
2439. Adjustable Turret, I. Barnsley, Sheffield.
2440. Expanding Mandril, J. Timmins, Barrow-in-Furness.
2441. Adjusting Cords, W. Christie, Dundee.
2442. Magic-lantern Carriers, A. Watkins, Hereford.
2443. Adjustable Stride or Trivet, G. R. Pemberton, Birmingham.
2444. Vests, &c., S. Whitlow, Manchester.
2445. Portable Distilling Apparatus, W. Hood, Somerville.
2446. Window Ventilators, J. Badger, New York.
2447. Sockets for Balls, J. D. Sprague, London.
2448. Custard Paste, W. T. Symington and G. J. Thwaites, Market Harborough.
2449. Hydraulic Presses, W. Turner and G. Lewis, Salford.
2450. Fastening Corks, &c., P. H. Senior, Leeds.
2451. Ornamenting Handles, G. Timmins, Birmingham.
2452. Alarm Bells, B. R. Jackson, Birmingham.
2453. Operating the Doffer Combs of Carding Machines, J. Barker, Philadelphia, U.S.
2454. Tally Board, D. K. Horton, Boston, U.S.
2455. Springs for Velocipedes, A. Peddie, jun., Sunderland.
2456. Steam Boiler Furnaces, T. J. Barnard, London.
2457. Drilling Steel, &c., J. Varey and M. Holroyd, Bradford.
2458. Diving, W. D. Scott-Moncrieff, London.
2459. Furnace-bars, E. Newbold, Balham.
2460. Traps for Water-closets, &c., D. Page, Folkestone.
2461. Joiners' Plough, C. Crisford, Eastbourne.
2462. Glasses for Lamps, W. J. Forbes and A. Spyer, London.
2463. Cranes, J. Craven, Leeds.
2464. Waterproof, &c., Sock, J. S. and A. J. Woodington, St. George, Gloucester.
2465. Compressing Air, W. Rapson, Bigbury.
2466. Shells for Ordnance, M. Delmard, Plumstead Common.
2467. Treating Carbon Filaments, H. J. Haddan.—(*C. G. Perkins, New York.*)
2468. Malt, H. J. Haddan.—(*H. Hackmann, Bavaria.*)
2469. Navigable Balloons, H. J. Haddan.—(*O. Hartung, Germany.*)
2470. Manufacturing Food from Kernels, H. Freeth, London.
2471. Wood-working Machines, A. Dumanoir, Brussels.
2472. Gloves, S. H. Morley.—(*Messrs. E. S. Poncet and Co., Grenoble, France.*)
2473. Rearing Chickens, &c., C. E. Hearson, London.
2474. Painting the Laths of Venetian Blinds, A. Shepherd, Birmingham.
2475. Regulating, &c., the Flow of Gases, A. M. Clark.—(*F. L. Muratori and E. Cros, Paris.*)
2476. Cooling, &c., Liquids, B. Remmers, Glasgow.
2477. Filtering Medium, W. Fairweather.—(*F. Kleemann, Germany.*)
2478. Kitchen Ranges, A. Younie, Greenock.
2479. Winch Fittings for Fishing-rods, S. M. Patrick, Scarborough.
2480. Carrying Bottles, E. G. Brewer.—(*H. Raclot, Brussels.*)
2481. Galvanic Batteries, J. Pulvermacher, London.
2482. Hardening, &c., Thin Strips of Sheet Steel, W. T. Beesley, Sheffield.
2483. Hand-power Lifts, G. Andrews, London.
2484. Ventilating Tunnels, R. and G. H. Gregory, Leyton.
2485. Gas, B. Midgley, Milnsbridge, and W. Nunwick, Longwood.
2486. Fitted Dressing Bags, O. Seefels, London.
2487. Coupling for Shafting, R. C. Parsons, Leeds.
2488. Riding Saddles, S. Paget and E. N. Heney, Montreal.
2489. Rowlocks, E. H. Renton, London.
2490. Butter Worker, J. W. Barsham.—(*Messrs. P. Blanchard's Sons, Concord, U.S.*)
2491. Obtaining Ammonic Chloride, T. Heskin, Preston.
2492. Steam Pumping Apparatus, W. Anderson, Westminster.
2493. Pencil Cases, &c., J. Hilpert.—(*E. Mahla, Nürnberg, Germany.*)
2494. Galvanic Batteries, P. R. de F. d'Humy, Clapham Rise.
2495. Packing for Pistons, T. H. Taylor, Freemantle.
2496. Fire-grates, R. Crosthwaite, London.
2497. Signalling Apparatus, H. G. Ellery and J. T. Gent, Leicester.
2498. Opening, &c., Eggs, C. Guyard and L. Garnier France.
2499. Self-closing Doors, &c., W. Edwards, London

1st February, 1884.

2500. Bottles, W. Stott, Manchester.
2501. Softening, &c., Water, W. Wyatt, Ellesmere.
2502. Railway Carriage Coupling, G. Asher, Balsal Heath.
2503. Gas Motors, D. Clerk, Glasgow.
2504. Locks, &c., J. M. Matthews, Stratford.
2505. Locks, &c., J. M. Matthews, Stratford.
2506. Obtaining Motive Power, E. Schramm, B. Hewitt, and L. Schramm, Birmingham.
2507. Safe Guard and Rail Cleaner for Tramways, H. Conradi, London.
2508. Crimping, &c., the Tops of Glass Articles, J. Northwood, Kingswinford.
2509. Self-acting Buckets or Grabs, W. D. Priestman, Kingston-upon-Hull.
2510. Electric Logs, W. G. Rothwell, Liverpool.
2511. Clearing the Grooves of Tramway Rails, T. Shimmin, Liverpool.
2512. Feed-water Heater, O. T. Owen, Nantlle.
2513. Multitubular Steam Boilers, A. Smith, Westbourne, and A. Smith, Pollokshields.
2514. Pianofortes, H. W. Pohlmann, Halifax.
2515. Wood-sawing Machinery, T. H. Wharton and R. Smith, Bradford.
2516. Looms, W. H. Teague, Blackburn.
2517. Water Gauges, T. Crook, Preston.
2518. Looms, J. Almond, Blackburn.
2519. Oil Cans, A. Bradshaw, Accrington.
2520. Table Cutlery, J. F. Atkinson, Sheffield.
2521. Accumulator of Electricity, J. Mijers, Amsterdam.
2522. Bushings, &c., for Tapholes in Casks, H. A. Rueter, Boston, U.S.
2523. Casks, H. A. Rueter, Boston, U.S.
2524. Pipes for House Drains, G. C. Davies, Peckham.
2525. Opening Preserved Meat Tins, &c., R. Holbrook, South Norwood.
2526. Ventilating Houses, P. Butler, Turnham-green.
2527. Combined Knife or Fork and Spoon, A. Ashby and A. Borrett, Luton.
2528. Ventilators, J. M. Lamb, South Hampstead.
2529. Sewing Machines, W. Barsby, Worcester.
2530. Middlings Purifier, R. Howarth, Rochdale.
2531. Sharpening Razors, &c., T. Kendrick, Worcester.
2532. Brushes, T. Kendrick, Worcester.
2533. Whips, I. Chorlton and J. Holding, Manchester.
2534. Pumps, W. Hume, Port Glasgow.
2535. Telephone Holder, G. W. Errington, Newcastle-upon-Tyne, and F. Caws, Sunderland.
2536. Pumps, H. J. Allison.—(*H. M. de L. Babcox, U.S.*)
2537. Gas-making Lamps, T. Wood, Godstone.
2538. Preparing Clays, J. H. Key, Devon.
2539. Paints, F. Wirth.—(*O. Fischer, Germany.*)
2540. Slipping Apparatus, T. F. C. Morris, London.
2541. Nets, H. J. Haddan.—(*H. Heyerdhal, Norway.*)
2542. Horseshoes, W. Job and A. Galer, Torquay.
2543. Distilling Apparatus, E. G. Brewer.—(*D. Hainaut, Boitsfort, Belgium.*)
2544. Armatures of Dynamo-electric Machines, T. Parker and P. B. Elwell, Wolverhampton.
2545. Preparing Flax, &c., J. Barbour, A. Combe, and J. Gamble, Belfast.
2546. Preparing Manilla, Hemp, &c., J. Barbour and A. Combe, Belfast.
2547. Speed, &c., Gearing for Velocipedes, C. Linley, Stoke Newington, and G. G. Tandy, Clapham.
2548. Tightening Driving Chains of Velocipedes, J. White and J. Asbury, Coventry.
2549. Tandem Velocipedes, J. White and J. Asbury, Coventry.
2550. Table Forks, W. P. Winsor, London, and S. Worrall and G. B. Bingley, Sheffield.
2551. Paddle-wheels, T. Phillips, Aberdare.
2552. Metallic Tubes, S. Fox, Leeds.
2553. Tip-wagons, J. Woosey, Cardiff.
2554. Invalid Couches, W. Dickinson, Manchester.
2555. Fire-arms, J. Carter, Birmingham.
2556. Signals and Lamps, J. W. Hancock, Knighton.
2557. Harpoons, J. Evans, Dundee.
2558. Spectacle Frames, E. Nunan, London.
2559. Casting Nails, S. Williams, Aston.
2560. Securing Windows, &c., S. Coulson, Birmingham, and W. H. Edwards, Sutton.
2561. Drying Substances by Heated Air, C. D. Abel.—(*E. Langen, Cologne.*)
2562. India-rubber Tires, &c., J. Young, Low Moor.
2563. Horse-rakes, A. C. Bamlett, Thirsk.
2564. Drying Malt, &c., E. G. Colton.—(*H. Hermann. Brooklyn, U.S.*)
2565. Millstones, H. Lake.—(*W. Hartmann, Fulda.*)
2566. Pillar, &c., Box Protector, W. Booth, Hammersmith.
2567. Slide-valve Indicator, A. L. Whittell, London.
2568. Treating Excremental Matters, B. J. B. Mills.—(*J. M. Guénantin, Paris.*)
2569. Label, T. J. Findlay, Manor Park.
2570. Fishing Hook, &c., F. J. Williams, London.
2571. Valves, J. Pritchard, London.
2572. Engines, G. A. Barclay, London.
2573. Malleable Ferro-nickel, &c., A. M. Clark.—(*Société Anonyme dite Fonderie de Nickel et Metaux Blancs, Paris.*)

2nd February, 1884.

2574. Diamond Wire Trellis-work, J. R. Collier and D. S. Musgrave, Manchester.
2575. Pump, J. Atkinson, London.
2576. Smoke, &c., Flue, W. Crook, Salisbury.
2577. Bird Cages, F. Ostler, Yeovil.
2578. Ridge Tile, S. Turner, Barrow Haven.
2579. Rubbing Leather into a Round Section, &c., C. H. Averill, Balsall Heath.
2580. Ornamenting Plates of Tinned Iron, &c., S. Groves, Birmingham.
2581. Handles for Walking-sticks, &c., B. Acton, Brimscombe.
2582. Tubes used as Bobbins, S. Wilson, Athlone.
2583. Alarm Bells, W. F. Allcock, Birmingham.
2584. Lenses, R. Wilson, London.
2585. Door Bells and Knockers, D. Waude, London.
2586. Sluice Valves, G. Knott, Dukinfield.
2587. Steam Hammers, L. Roberts, Dudley Hill.
2588. Driving Dynamo Machines, T. Sutcliffe, Bradford.
2589. Flying Machines, W. Cornelius, Germany.
2590. Lead Piping, G. Ewing, Liverpool.
2591. Letter-boxes, C. L. H. Lammers, Gosforth.
2592. Controlling Signals, J. R. Dix, Corris.
2593. Converting Reciprocating into Rotary Motion, J. and J. Kirkwood, Leith.
2594. Rings for Pistons, &c., J. Binks, Bolton.
2595. Washing Machines, J. Howarth, Burnley.
2596. Starting Tram-cars, &c., A. Petty, Sheffield.
2597. Valves or Cocks, W. Housley, Ripley.
2598. Cleaning Boots, &c., W. Frost, Worcester.
2599. Releasing Single Harnessed Cattle from Vehicles, W. Corbould, London.
2600. Locking Hoops for Ordnance, E. Maitland, Woolwich.
2601. Ventilating Dwellings, H. Gruenbaum, London.
2602. Perambulators, J. Aylward, Coventry.
2603. Convertible Tandem Velocipedes, I. T. Townsend, Coventry.
2604. Water Service Valves, A. Sweet, London.
2605. Sewing Machines, E. S. B. Tombs, London.
2606. Bicycles, &c., F. W. Jones, Exeter.
2607. Warp Lace, J. C. Thornton, Nottingham.
2608. Roofing Tiles, S. Duprat, Paris.
2609. Type-writing Machines, H. A. Guhl, Hamburg.
2610. Frames for Velocipedes, R. E. Phillips, South Norwood.
2611. Sun Burners, C. Hunt, Birmingham.
2612. Gas Regulators, J. Kay, Ramsbottom.
2613. Locomotive Exhaust Apparatus, J. Armstrong, New Swindon.

2614. EARTH and WATER-CLOSETS, J. Donkin, Bournemouth.
2615. FAGOT BOXES, H. J. Haddan.—(*F. Perkins, U.S.*)
2616. SEWING MACHINE ATTACHMENT, J. C. Mewburn.—(*C. F. Norton and H. C. Mervin, Melbourne.*)
2617. DRILLS, R. Martin, Old Charlton.
2618. CANDLE MOULDING MACHINES, J. Claret, London.
2619. ORNAMENTAL EFFECTS, W. T. Bright, London, and F. J. Simmons, Wimbledon.
2620. AUTOMATIC RAILWAY BRAKES, J. H. Armstrong, Newcastle-upon-Tyne.
2621. OPERATING upon OILY RAGS, &c., E. S. Wilson and A. B. O'Connor, London.
2622. PEDESTAL for SHOEMAKERS, G. M. Brown, Lewisham, and W. G. Jones, London.
2623. SEALING the BOLT HOLES of FUEL ECONOMISER CAPS, E. Green, Wakefield.
2624. NAILS, W. Pitt, Kenilworth.
2625. PERAMBULATORS, L. L'Hollier, Birmingham.
2626. FLOATING DOCKS, S. B. Ballian, Paris.
2627. PROPELLING SHIPS, S. B. Ballian, Paris.
2628. AERIAL NAVIGATION, S. B. Ballian, Paris.
2629. PIANOFORTE ACTIONS, J. Herrburger, Paris.
2630. TREATING RESINS, A. Germot & L. Rivière, Paris.
2631. REGULATING ELECTRICITY, J. D. Gibbs, London.
2632. ELECTRO-MAGNETIC APPARATUS, J. B. Thistleton, London.
2633. APPLYING HEAT, J. Tate, Maryport.
2634. ROOFING, C. Fowler, Leeds.
2635. GAS ENGINES, F. Jenkin, Edinburgh.
2636. IMITATION SEALSKINS, J. Reixach, Manningham.
2637. COMPRESSING COTTON, &c., into BALES, A. E. Cummins, Dublin.
2638. UTILISING CERTAIN WASTE LIQUIDS, F. Wirth.—(*F. Graessler, Canstatt, Germany.*)
2639. SUPPORTING and INSULATING ELECTRICAL CONDUCTORS, W. R. Lake.—(*J. W. Tringham, Canada.*)
2640. MARBLE, A. Guttari.—(*M. Soderini, Florence.*)

4th February, 1884.

2641. BICYCLES, W. Andrews.—(*J. Truffault, Paris.*)
2642. BICYCLES, &c., W. Andrews, Aston.
2643. COMPENSATING RUDDER BAND, S. J. Browning, Portsmouth.
2644. STORING OFFALS, J. P. Milbourne, Cornbrook, and T. Humphreys, Salford.
2645. CLUTCHES, H. J. H. King, Newmarket.
2646. GAS ENGINES, J. Atkinson, London.
2647. LAMP, &c., BURNERS, W. Foxcroft and J. J. Perry, Birmingham.
2648. BEARINGS of SPINDLES, T. M. Gribbin.—(*J. Duffy, Paterson, U.S.*)
2649. VELOCIPEDES called TANDEMS, J. and H. J. Brookes, and J. Morris, Smethwick.
2650. APPARATUS for ENABLING MEN to WORK in DENSE SMOKE, &c., F. Byrnes, Liverpool.
2651. MEDICINAL PREPARATIONS, W. Ryding-Bennette, Liverpool.
2652. STEAM TRAPS, &c., T. Atkinson, Liverpool.
2653. CHIMNEY TOPS, C. H. Riley, Huddersfield.
2654. TABLE CUTLERY, J. F. Atkinson, Sheffield.
2655. MARKING CATTLE, J. Milne, King Edwards.
2656. LOCKS for RAILWAY, &c., CARRIAGES, W. H. S. Aubin, Bloxwich.
2657. SHOEING HORSES, J. Clarke, Northwich.
2658. DRYING WOOL, &c., G. Tolson, Earlsheaton.
2659. INJECTORS, H. Holden, R. G. Brooke, and T. H. White, Salford.
2660. HEELING, &c., BOOTS, O. Robinson, Kettering.
2661. TEMPLES and FIXINGS, J. Pickles, Leeds.
2662. PUTTING on MARKING INK, S. Musgrave, London.
2663. CANDLESTICK, W. Cracknell, London.
2664. PREPARING COTTON for SPINNING, W. Taylor, Oldham.
2665. OIL CANS, &c., T. F. Bladon, Birmingham.
2666. ALCOHOL, &c., J. H. Loder, Utrecht.
2667. CRUTCHES, &c., G. N. Thurn, Vienna.
2668. REGISTERING the FORCE of the HUMAN BLOW by ATMOSPHERIC PRESSURE, T. Welton, London.
2669. RAPID PRODUCTION of PILE UPRIGHT, &c., PLAITING, J. Dowling, London.
2670. ADVERTISING, E. Capitaine.—(*F. P. von Hertling, Berlin.*)
2671. TORPEDO BOATS, A. Mackie, London.
2672. SCROLL IRONS, W. and J. Darby, West Bromwich.
2673. ROTARY ENGINES, G. W. von Nawrocki.—(*C. Schwartz and J. Hoffman, Prussia.*)
2674. INSULATING WIRES, W. E. Heys, Manchester.
2675. UNSTOPPING BOTTLES, D. Griffiths, Erdington.
2676. CONVEYING the LIGHT EVOLVED from an INCANDESCENT ELECTRIC LAMP into parts of the HUMAN, &c., BODY, P. Ward, Greenwich.
2677. WOODEN SILOS, R. L. Tuffin, Redhouse.
2678. NOVEL VINOUS LIQUORS, &c., J. C. Mewburn.—(*H. Crot, Paris.*)
2679. SAFETY ALARM CLOCK, B. J. B. Mills.—(*G. Rua, Turin.*)
2680. TRANSMITTING MOTION, S. F. Pichler, London.
2681. INCANDESCENT ELECTRIC LAMPS, G. J. Lorrain, London.
2682. DETERMINING the CENTRE of GRAVITY of LOADED SHIPS, L. Benjamin, Glasgow.
2683. PLOUGHS, J. Howard and H. W. Gibbs, Bedford.
2684. TRACTION ENGINE, A. Sell, Nienborstel.
2685. COUPLINGS for PIPES, &c., N. Thompson, London.
2686. WINDOW SASH FASTENINGS, A. Johnson, London.
2687. JOINTS of METAL PIPES, N. Frere.—(*L. Kuypers and P. Denis, Brussels.*)
2688. POSTAL LETTER-BOXES, M. Lenzberg, London.
2689. PUNCHES, A. Pope, Birmingham.
2690. ROWING BOATS, A. J. Boult.—(*W. Rettig, Berlin.*)
2691. ENVELOPES, A. J. Boult.—(*L. Barthelemy, Paris.*)
2692. STAMPING APPARATUS, W. H. Beck.—(*E. Daguin, Paris.*)
2693. PREPARING SOLUBLE SALTS of CERIUM, J. B. Mackey, London.
2694. MILLS for HULLING GRAIN, D. Uhlhorn, jun., Grevenbroich, Germany.
2695. MACHINE for CARVING, &c., OPERATIONS, A. Guattari, London.
2696. LIGHTNING ARRESTER, A. M. Clark.—(*C. W. McDaniel, Carthage, U.S.*)
2697. RETAINER for NECKTIES, H. W. Aberlin and W. J. Geoghegan, London.
2698. BRACES, F. Tew, London.
2699. ENGINES, G. Found, London.
2700. BOXES for CONTAINING WATCH MOVEMENTS, H. H. Lake.—(*F. Fitt, Switzerland.*)
2701. OBTAINING CELLULOSE, &c., C. D. Abel.—(*C. F. Dahl, Germany.*)
2702. AUTOMATIC CYLINDER PIANOS, A. Capra and G. B. Rissone, London.
2703. ARC ELECTRIC LAMPS, J. H. Johnson.—(*La Compagnie des Fonderies et Forges de l'Horme, Chantiers de la Buire, Lyons.*)
2704. PRODUCING SPRAY, H. Brooks and R. Mestern, London.

ABSTRACTS OF SPECIFICATIONS.

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

2759. APPARATUS FOR ENABLING OBSERVERS TO READ THERMOMETERS, BAROMETERS, AND TO FIND HEIGHT OF LIQUIDS IN CISTERNS, BOILERS, VATS, &c., *J. Enright, London.—4th June,* 1883.—(*Not proceeded with.*) 4*d.*

Relates to the application of electrical apparatus.

2773. WEIGHING SCALES, *A. H. Emery, New York.—5th June,* 1883. 8*d.*

Relates principally to the combination of a main beam and an indicator beam suitably connected at or near the supporting fulcrum, and independent at the ends to relieve the indicator beam from the effect of the bending of the main beam by the weight or load.

2777. MACHINERY FOR TESTING THE STRENGTH OF MATERIALS, &c., *A. H. Emery, New York.—5th June,* 1883. 1*s.* 10*d.*

Relates to the construction of a machine adapted for producing and indicating strains of either tension, compression, or torsion, or transverse loads, on metallic bars, rods, plates, or other structures.

2776. PRESSURE AND VACUUM GAUGES, &c., *A. H. Emery, New York.—5th June,* 1883. 8*d.*

Relates to several improvements in the details of construction.

2786. ELECTRICAL APPARATUS FOR IGNITING GAS, &c., *J. A. Koerber, London.—5th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates to a portable apparatus for igniting gas.

2806. WEIGHING APPARATUS FOR LOOMS, *J. and A. Wallwork, Hurst, Ashton-under-Lyne.—6th June,* 1883.—(*Void.*) 2*d.*

The object is to shift the load upon the lever by self-acting means, so that it shall always be in correct position relative to the diameter of the coiled warp.

2822. APPARATUS FOR PUTTING INSTRUMENTS CONNECTED WITH A CENTRAL TELEPHONE STATION INTO COMMUNICATION WITH EACH OTHER, *W. R. Lake, London.—6th June,* 1883.—(*A communication from G. A. Cardwell, New York, U.S.*) 6*d.*

This relates to means whereby the individual subscribers may communicate with each other without the assistance of operators at a central office.

2828. ORNAMENTING OF TILES, BRICKS, AND OTHER FICTILE ARTICLES, *G., C. F., and L. Wedgwood and G. A. Marsden, Etruria.—7th June,* 1883.—(*Not proceeded with.*) 2*d.*

The object is to ornament the damp clay tiles and other fictile ware by means of slip and templates.

2834. ROTARY ENGINES, *T. Nordenfelt, London.—7th June,* 1883.—(*Partly a communication from G. W. Garrett, Stockholm.*) 6*d.*

In general the motor consists of a cylindrical drum, which, when acted on by pressure, revolves excentrically within cylinder.

2838. LATCHES FOR DOORS, CUPBOARDS, WINDOWS, &c., *F. G. Lynde, Melton Mowbray.—7th June,* 1883.—(*Not proceeded with.*) 2*d.*

The object is to dispense with the use of springs in latches, and instead to actuate the bolt by means of a weight or lever.

2846. MANUFACTURE OF FELT CARPETS, *J. Barcroft, Waterfoot.—7th June,* 1883. 4*d.*

The carpet is composed of four layers or folds of material, which are laid one above the other on the endless cloth or "batt frame," and are then felted together by the process and apparatus usually employed in the manufacture of felt carpets.

2848. OPERATING BICYCLES, TRICYCLES, &c., *E. Nunean, London.—7th June,* 1884.—(*Not proceeded with.*) 2*d.*

Relates to the general construction of the mechanism for propelling and steering bicycles, tricycles, &c.

2852. SHIPS' SLEEPING BERTHS, &c., *W. R. Lake, London.—7th June,* 1883.—(*A communication from C. A. Milligan, Somerville, and M. J. Killion, Boston, U.S.*) 6*d.*

Relates partly to the mechanism employed for swinging berths.

2855. ELECTRODES USED AS EARTH PLATES, *D. G. Fitz-Gerald, London.—7th June,* 1883. 4*d.*

When continuous currents of great magnitude are to be transmitted through earth, the inventor constructs the anode earth plate of a readily oxidisable metal, or of carbon surrounded by a mass of readily oxidisable material, or of a conductor surrounded by an oxide or salt capable of producing a metallic peroxide in presence of nascent oxygen. The cathode earth plate consists of a conductor surrounded by a mass of an oxidising material capable of absorbing nascent hydrogen.

2856. ELECTRICAL GENERATORS AND MOTORS, *W. R. Lake, London.—7th June,* 1883.—(*A communication from M. Bollmann, Vienna.*)—(*Not proceeded with.*) 4*d.*

The secondary currents produced in a generator are not commutated for the consumption circuit, but are used for exciting tertiary currents of the same direction as the main current which is thereby proportionately strengthened.

2857. SYSTEMS OF GENERATION AND DISTRIBUTION OF ELECTRICITY FOR LIGHT, HEAT, AND POWER, *T. J. Handford, London.—7th June,* 1883.—(*A communication from T. A. Edison, N.J., U.S.*) 10*d.*

This relates to a "compensating" system of distribution in which, when translating devices are thrown out of circuit in one part of the system, so that the numbers in the different parts become unequal, the excess current traverses the compensating conductor in one direction or the other. Means are provided for changing, when the numbers become unequal, the connections of a translating device from the greater side to the less, to maintain the balance of the system. Such means may be operated by hand, automatically by the variations of the current, by clockwork, or electrically from the central station. Various methods are described and illustrated. The invention further relates to the combination with a divided source of energy, of means for regulating the electro-motive force of each division of such source of energy, independently of the other divisions. Diagrams are given showing methods of applying the compensating principle to systems of general distribution employing feeding circuits and intersecting and connected positive and negative main conductors.

2858. TREATING CHICORY AND APPLIANCES THEREFOR, *E. Edwards, London.—7th June,* 1883.—(*A communication from L. Humbert, Ridez, Lille.*)—(*Not proceeded with.*) 2*d.*

The object is an improved process for treating roasted chicory for the purpose of extracting its juices by distillation or other means, and reducing such juices or extract by evaporation and the treatment in a vacuum or otherwise, with the addition of a sufficient quantity of sugar, to the state of a syrup or solid.

2860. LOOMS FOR WEAVING, *W. Irving and F. Howarth, Liversedge.—8th June,* 1883. 8*d.*

Relates, First, to the use in combination of certain appliances, whereby all motion or movement of the slag or "going part" is abolished, and a fixed and stationary reed and shuttle race are available; Secondly, improved apparatus for operating the healds.

2862. MAKING REFINED CAST STEEL FROM INFERIOR WROUGHT IRON, &c., *T. Sheehan, London.—8th June,* 1883. 4*d.*

Relates to the employment of muriate of soda, bicarbonate of soda, bisulphate of soda, sulphite of zinc, alumina (flux for the crucible not to be dissolved), hardwood charcoal, granular limestone, to be used raw, not burnt.

2864. REAPING AND MOWING MACHINES, *A. McGregor, Leigh.—8th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates to improvements in the general construction and arrangement of parts.

2865. APPARATUS FOR DRYING AND COOLING HATS IN THE PROCESS OF MANUFACTURE, *S. Wareham, Hyde, Chester.—8th June,* 1883.—(*Not proceeded with.*) 2*d.*

A current of cool air is caused to impinge upon the crown of the hat.

2866. ROADWAYS FOR TRAM-CARS, &c., *T. E. Knightley, London.—8th June,* 1883. 4*d.*

Consists in arranging parallel rails of iron or steel laid in close proximity and embedded in wooden blocks.

2869. TREATMENT OF MILK AND MATTERS TO BE MIXED THEREWITH, &c., *G. Lawrence, London.—8th June,* 1883. 4*d.*

This is a process of treating milk with fatty and other matters, by passing it and them, mingled with gases, through one or more steam ejectors, for separating and mixing the particles.

2874. TREATMENT OF TIN AND TERNE PLATES, *D. Grey, Maesteg.—8th June,* 1883. 4*d.*

Relates to the improvements in the fluxes.

2871. APPARATUS FOR BLEACHING, WASHING, CHLORING, SCOURING, SOAPING, DUNGING, AND DRYING WOVEN FABRICS, *J. Farmer, Salford.—8th June,* 1883.—(*Partly a communication from A. Lalance, Mulhouse.*) 6*d.*

This consists in a means of forcing the liquor to penetrate the fibres of the cloth by a mechanical process.

2880. MANUFACTURE OF GAS OR TUBE HOOKS AND HOLDFASTS, *T. Ashford, Birmingham.—9th June,* 1883. 6*d.*

Relates to the configuration and arrangement of four cutters or tools, two fixed and two movable, for the purpose of cutting blanks for gas or pipe hooks and holdfasts.

2882. SUPPLYING AIR TO THE INTERIOR OF TORPEDO BOATS AND SUBMARINE VESSELS, *A. H. Arnold, Portsmouth.—9th June,* 1883.—(*Void.*) 2*d.*

Relates partly to supplying air by means of a fan.

2884. APPARATUS FOR SPINNING, &c., *J. H. Clapham, T. R. Whitehead, and T. W. Wheelwright, Bradford.—9th June,* 1883.—(*Not proceeded with.*) 2*d.*

Consists in constructing the caps with projecting bottom rings or flanges having circular grooves, in which work travellers.

2885. CONSTRUCTION OF LEVER HORSE HOES, *W. J. Radford and C. H. Piff, Bisworth.—9th June,* 1883.—(*Not proceeded with.*) 2*d.*

The object is to so arrange the parts that while each lever carrying the cutting hoes retains its independent action and capability of self-adjustment to the inequality of the soil which is being treated, the attendant can steer the apparatus, and press into or raise out of the soil the hose by one and the same handle.

2886. STOVES OR AIR HEATING APPARATUS, *S. C. Davidson, Belfast.—9th June,* 1883. 8*d.*

Refers to improvements on patents No. 4773, dated 15th December, 1877, and No. 968, dated 5th March, 1880; and consists in certain modifications of same, in order to adapt them for the employment of gas as fuel instead of coal, coke, or wood.

2888. TREATMENT OF COMPOUNDS OF ALUMINIUM AND MEANS THEREFOR, *J. H. Johnson, London.—9th June,* 1883.—(*A communication from J. Varm, Paris.*)—(*Not proceeded with.*) 2*d.*

Relates to a process and means for the production of aluminium on a large scale with facility and economy, by the employment of electricity.

2889. INDICATORS FOR STEAM, AIR, GAS, AND OTHER ENGINES, *J., G., and J. T. S. Pimbley, Bolton.—9th June,* 1883. 6*d.*

The indicator consists of the usual drum which carries the paper upon its circumference, and one, two, or more cylinders, fitted with pistons, springs, and pencils, to register the pressures and vacuum.

2890. HOT WATER BOILERS AND STEAM GENERATORS, *J. Collier and M. H. Smith, Halifax.—9th June,* 1883. 6*d.*

One construction of boiler consists of a vertical cylindrical boiler with dome topped fire-box, having its sides forming the outer and inner shell or waterway connected by means of two concentric tubes, the space between the tubes being a waterway, the interior of the inner tube forming a fire flue.

2892. EXPANDING THE ENDS OF BOILER TUBES IN THEIR TUBE PLATES, *A. M. Clark, London.—9th June,* 1883.—(*A communication from D. H. Cunningham, Paris.*)—(*Not proceeded with.*) 2*d.*

The method consists in simultaneously expanding the tube on the inner or water side of the tube plate, and expanding or upsetting the end of the tube on the outer side of the plate, this double operation being performed with the aid of the tube expanding tool.

2893. EXTRACTING FROM THE BLOOD OF ANIMALS A PRODUCT FOR MEDICINAL PURPOSES, *M. Haeffner, Berlin.—9th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates to the general treatment of the blood.

2894. CONSTRUCTING STREET RAILWAYS, *F. Wirth, Frankfort.—9th June,* 1883.—(*A communication from C. Binder, Friedrichstal, Germany.*)—(*Not proceeded with.*) 2*d.*

Relates to the construction of the rails.

2895. PRODUCTION OF LIGHT BY ELECTRICITY AND APPARATUS THEREFOR, *W. P. Thompson, Liverpool.—9th June,* 1883.—(*A communication from R. J. S. Sheehy, New York, U.S.*) 6*d.*

This relates to a lamp in which the carbons are separated by a revolving clamping wheel, mounted in excentric bearings, the movement of the bearings permitting of the feed of the carbons; to a cut out, which automatically reintroduces the lamp into the circuit when the conditions necessary for its successful working are restored; and to an automatic device for reporting the failure of any lamp in the circuit.

2896. MACHINERY FOR PARING AND BURNISHING THE EDGES OF THE SOLES OF BOOTS AND SHOES, *F. Cutlan, Leicester.—9th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates to improvements in the general construction of the machine.

2899. DRAIN PIPES AND THEIR JUNCTIONS, *H. P. Boulnois and W. Hilder, Portsmouth.—11th June,* 1883.—(*Not proceeded with.*) 2*d.*

The pipes are made with a flat base piece on their undersides.

2901. MACHINE FOR DIVIDING BRISTLES, HAIR, OR OTHER FIBRES INTO BUNCHES OR TUFTS FOR THE MANUFACTURE OF BRUSHES, *J. C. Mewburn, London.—11th June,* 1883.—(*A communication from A. P. Dupont, Beauvais, France.*)—(*Not proceeded with.*) 2*d.*

Relates to the general construction of the machine and the arrangement of the parts.

2902. SAFES, *H. W. Chubb, London.—11th June,* 1883. 6*d.*

Consists in forming the main frame of a rolled bar of trough-like section, having a recess or rebate to receive the edge of the door or lid.

2905. PORTABLE RESTS OR SUPPORTS FOR THE HEAD, *H. H. Lake, London—11th June,* 1883.—(*A communication from E. F. Prescott, Boston.*)—(*Not proceeded with.*) 2*d.*

The object is to provide a portable head rest by means of a framework of metal rods bent into a curved shape.

2906. DYEING TEXTILE FABRICS, *H. H. Lake, London.—11th June,* 1883.—(*A communication from La Société Anonyme des Teintures et Apprêts de Tarare, France.*) 6*d.*

The process consists in conveying in a continuous manner to the fabric, which is caused to move continuously, the exact quantity of colouring liquid which can be absorbed by the said fabric.

2907. MACHINERY FOR MOULDING AND COMPRESSING CARBONACEOUS OR OTHER MATERIALS INTO BRICKS OR BLOCKS, *J. H. Johnson, London.—12th June,* 1883.—(*A communication from G. P. Couffinhall, St. Etienne.*) 6*d.*

Relates to improvements in the general arrangement of the plates.

2908. APPARATUS FOR REGULATING THE FEED IN ROLLER MILLS FOR GRINDING GRAIN, *T. Inglis and C. Herbert, Edinburgh.—12th June,* 1883. 6*d*

The inventors claim in roller mills for grinding grain, the front wheel or its mechanical equivalent operating differentially in relation to the back feed roll.

2909. DRYING OVENS AND APPLIANCES CONNECTED THEREWITH FOR DRYING LACE, &c., IN A STATE OF TENSION, *G. F. Edwards, London.—12th June,* 1883.—(*Void.*) 2*d.*

The object is to expedite and facilitate the removal of the frames from, as also their introduction into the oven, and to dispense with the raising and lowering apparatus.

2910. CONSTRUCTION OF APPARATUS FOR MILLING OR FULLING AND PLANKING FELT HAT BODIES AND OTHER MATERIALS, *J. Southworth and W. Hamnett, Stockport.—12th June,* 1883. 6*d.*

The apparatus consists principally of two or more milling or fulling blocks (by preference two) attached to levers, and rising and falling alternately in a chest or cistern in which the goods to be treated are placed.

2911. CONSTRUCTION AND PROPULSION OF SHIPS, *R. H. Brandon, Paris.—12th June,* 1883.—(*A communication from E. Lavarenne, Paris.*)—(*Not proceeded with.*) 2*d.*

Relates, First, to the construction or form of ships; Secondly, to means of propelling by compressed air.

2912. BARBED FENCING, *W. H. Johnson, Manchester.—12th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates to the means of fixing the barbs.

2913. APPARATUS FOR BURNING SMALL PYRITES AND CALCINING ORES AND OTHER MINERALS, *M. Finch, Silverton, and W., J., and S. Willoughby, Plymouth.—12th June,* 1883. 6*d.*

Consists in employing, for the purpose of calcining ores, such as pyrites, mundic, and other minerals containing sulphur, arsenic, or other foreign substances, a continuous flue, so constructed as to form a furnace.

2914. RAILWAY WHEELS, &c., *A. Longsdon, London.—12th June,* 1883.—(*A communication from A. Krupp, Essen.*) 6*d.*

Consists in manufacturing wheels of various constructions of iron or steel, with steel or iron rims or tires welded on.

2915. "DOBBIES" OR JACQUARDS EMPLOYED IN LOOMS, &c., *J. Garstang and A. and A. Harling, Burnley.—12th June,* 1883.—(*Not proceeded with.*) 2*d.*

The object of one part is to simplify the construction of "dobbies," and make them more certain of action, whereby friction and wear and tear of the parts is reduced.

2917. SADDLES FOR BICYCLES AND VELOCIPEDES, *S. Davis, Brighton.—12th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates to means for making the saddles adjustable.

2918. BUOYS OR FLOATS, *H. J. Haddan, Kensington.—12th June,* 1883.—(*A communication from V. Vidal, Pignans, France.*) 4*d.*

The object is to utilise cork-waste for constructing buoys or floats.

2919. FILES AND RASPS, *H. J. Haddan, London.—12th June,* 1883.—(*A communication from V. Vidal, Pignans, France.*)—(*Not proceeded with.*) 2*d.*

Consists in making the file or rasp cylindrical, annular, or disc-shaped, and causing it to turn on the axis of its cutting surface.

2921. ROOFING TILES, *C. Major, Bridgewater.—12th June,* 1883. 6*d.*

The tiles are made so that they can interlock.

2922. ELECTRIC METERS, *J. F. H. Gordon, London.—12th June,* 1883. 6*d.*

To obviate the friction caused by the portions of a meter, actuated by the current, having to drive the counter, the part actuated by the current is allowed to move freely, a motion actuated by clockwork being employed to move the counter at short intervals through a distance depending on the position of the part moved by the current. The whole or part of the current passes through a galvanometer, the axis carrying the pointer of which is horizontal, and has fixed on it a disc of thin brass, cut to a suitable curved shape, so that the vertical radius has its maximum length when there is no deflection of the galvanometer, and gets less as the deflection increases. A clock has on its hour axis a notched wheel, which allows an arm to drop at intervals, and which in its zero position is held just clear of the upper edge of the disc when there is no current, its fall being limited by the edge of the disc. Immediately after the fall, the clock rises the arm, which by a catch engages a ratchet wheel, and so moves a counter.

2923. CARRIAGES FOR HEAVY ORDNANCE, *W. Anderson, London.—12th June,* 1883. 6*d.*

This consists partly with guns so mounted as to be raised for firing by hydraulic lifting apparatus operated by air, which is compressed by the recoil of the gun; in the use in connection with such hydraulic lifting apparatus of a compensating cylinder for bringing the gun fully down to the loading position when the recoil is insufficient, the said compensating cylinder containing a piston which can be allowed to recede to permit water or liquid to flow out from the hydraulic lifting apparatus, and can be forced back to return the liquid into the hydraulic apparatus.

2925. OBTAINING MOTIVE POWER, *A. W. L. Reddie, London.—12th June,* 1883.—(*A communication from T. McM. Wilson, Bergen, Norway.*) 8*d.*

Relates to the obtaining of motive power from intermittent hydraulic pressure communicated to a liquid confined in a closed curved tube in connection with a crosshead, or its equivalent, from which a reciprocating motion may be taken.

2926. LAMP-BURNERS, *P. C. G. Klingberg, London.—12th June,* 1883.—(*A communication from A. F. Lundeberg, Stockholm.*)—(*Void.*) 2*d.*

Relates to the construction of burners in which three or more wicks are employed.

2927. GAS MOTOR ENGINES, *F. H. W. Livesey, London.—12th June,* 1883. 6*d.*

Relates to the construction and arrangement of engines worked by the combustion of inflammable gas or vapour, without explosive action, and without involving the waste of heat that results from the use of water or other cooling medium that is ordinarily employed to keep the working parts cool.

2929. WATER-CLOSETS, *F. Piercy, London.—12th June,* 1883. 6*d.*

Relates to means for ventilating water-closets and carrying off foul gases.

2930. CENTRIFUGAL PUMPS, BLOWERS, AND EXHAUSTERS, *W. R. Lake, London.—12th June,* 1883.—(*A communication from D. E. Farcot, Paris.*)—(*Not proceeded with.*) 2*d.*

Relates to centrifugal or turbine pumps, and has for its object to provide an improved pump applicable to both the forcing and drawing of liquids and gases.

2931. MACHINERY FOR BREAKING OR SCUTCHING FLAX, HEMP, &c., *W. R. Lake, London.—12th June,* 1883.—(*A communication from T. Burrows, Paris.*)—(*Not proceeded with.*) 2*d.*

The object is to mechanically strip the filaments from fragments of wood, straw, or other material, which adhere to them subsequent to the crushing operation.

2932. CONSTRUCTION AND ARRANGEMENT OF COWLS, EXHAUSTERS, OR VENTILATORS FOR CHIMNEYS, RAILWAY VEHICLES, SHIPS, &c., *J. W. Holland, Liverpool.* 8*d.*

Relates to the general construction and arrangement of the parts of cowls.

2933. METHOD OF AND APPARATUS FOR INDICATING AND SIGNALLING THE DEPTH OF WATER, FOR USE IN SHIPS, &c., *R. J. Barnes and H. S. Heath, London.—13th June,* 1883. 6*d.*

Relates to a method and apparatus for automatically giving a signal or an alarm by means of electricity when a ship approaches shoals, rocks, or earth at any fixed or predetermined depth of water.

2934. SEWING MACHINES, &c., *J. McHardy, Dollar, N.B.—13th June,* 1883.—(*Not proceeded with.*) 2*d.*

Relates partly to mechanism for enabling the bobbins or spools of sewing machines when empty to be rewound or refilled with thread without the necessity of removing the spools or bobbins from the shuttles. Other improvements are described.

2935. CONSTRUCTION OF LOOMS FOR WEAVING, *R. S. and R. Collinge, Oldham.—13th June,* 1883. 6*d.*

Relates to improvements in the shedding motion.

2936. Brakes and Apparatus connected therewith for Stopping or Arresting the Speed of Ships, &c., *R. Atkin, London.—13th June*, 1883.—(*Not proceeded with.*) 2d.

Relates to a framework covered with canvas which may be expanded or collapsed.

2937. Steam Tricycles, *J. Imray, London.—13th June*, 1883.—(*A communication from La Société Hemart et Cie, Paris.*) 6d.

Relates principally to the construction of the driving mechanism.

2938. Telephonic Apparatus, *J. M. Betts, London.—13th June*, 1883.—(*Not proceeded with.*) 2d.

Relates to the method of mounting the electro-magnet so that the vibrations of the disc shall cause it to move before its armature or a second electro-magnet.

2940. Gas Stoves, *H. J. Haddan, London.—13th June*, 1883.—(*A communication from R. Kutscher, Leipzic.*) 6d.

The inventor applies a series of horizontal pipes placed over the burner, and also some inclined pipes, which pipes are heated outside by the gases of combustion, and serve to heat the air which passes through the pipes.

2941. Buckets for Dredging and Digging Purposes, *C. Jarvis, Liverpool.—13th June*, 1883.—(*Not proceeded with.*) 2d.

Relates to improvements in that type of dredging and digging buckets which are constructed with loose or hinged bottoms, and provides a means for actuating such loose bottom so as to ensure the complete discharge of the contents of the bucket.

2942. Spinning Machinery, *F. Heslop, Leeds.—13th June*, 1883. 6d.

Relates to the nipper, and consists of a guide trough set in an inclined position, and a plate or cover sliding upon the machine upper edges of the trough.

2943. Fastening or Clamping Apparatus Applicable for Builders' Scaffolding, *W. P. Thompson, Liverpool.—13th June*, 1883.—(*A communication from C. Mansion, Paris.*) 6d.

Relates to a metallic attachment with automatic tightening to replace the ordinary ropes.

2944. Driving Centrifugal Machines, *A. Watt, Liverpool.—13th June*, 1883. 8d.

Relates to the arrangement for driving centrifugal machines, which consists in coupling a separate electro-motor to each separate centrifugal machine by means of a flexible universal or other joint admitting sufficient play in the basket at the bottom of the shaft, while the electro-motor shaft is steady in its bearings, by which it is possible to easily regulate (by means of a resistance coil) the speed or working of any of a series of centrifugal machines independently of the others.

2945. Treating Ores and Substances Containing Antimony, &c., *J. C. Butterfield, London.—13th June*, 1883.—(*Not proceeded with.*) 2d.

This relates to improvements in the general treatment of the ores.

2946. Apparatus for Consuming Smoke, *C. Mace and J. Brewster, Sunderland.—13th June*, 1883. 6d.

Relates to appliances by which an adequate supply of atmospheric air, variable in quantity and in point of application, can be admitted to the furnace by simple mechanism.

2947. Spirit Cooking Stoves or Lamps, *D. Poznainski, London.—13th June*, 1883. 4d.

Over the wire gauze through which the flame passes is applied a slide or slides, so arranged that it or they can by suitable means be moved over the wire gauze so as to increase or diminish as required the amount of surface through which the flame can pass, and thereby regulate the flame.

2948. Folding Packing Cases, Boxes, Crates, &c., *H. Greene, London.—13th June*, 1883. 6d.

Relates to the construction of the fittings of packing cases, &c., which can be folded up when empty.

2949. Insulating Wires or Electrical Conductors for Dynamo-electrical Machines, &c., *J. H. Johnson, London.—13th June*, 1883.—(*A communication from La Société A. Chertemps et Cie., Paris.*) 4d.

The wires have deposited on them a salt of silica, boric acid, alumina, or magnesia, preferably in a gelatinous condition. The water being then driven off by evaporation, leaves them covered with an insoluble refractory insulating covering.

2951. Furniture Castors, *W. R. Lake, London.—13th June*, 1883.—(*A communication from W. Valkenhuzen, Paris.*)—(*Not proceeded with.*) 2d.

Relates to improvements in the details of construction.

2953. Apparatus applicable to Steam, Hydraulic, and other Motors for Increasing the Efficiency thereof, *T. Morgan, London.—13th June*, 1883.—(*A communication from Messrs. Bonicard and Huet, Bordeaux.*) 6d.

Relates to the arrangement of cranks and levers.

2954. Lawn Tennis Bats, *A. J. Altman, London.—14th June*, 1883.—(*Not proceeded with.*) 2d.

The object is to impart additional strength to the bat, combined with increased lightness and resiliency.

2955. Regenerative Lamps and Gas Burners, *C. Pieper, Berlin.—14th June*, 1883.—(*A communication from H. Shider, Paris.*) 6d.

Relates to improvements in lamps and gas burners, in which the air serving to feed the flame is previously heated by the combustion gases from the latter.

2957. Tricycles and other Velocipedes, *R. C. Jay, London.—14th June*, 1883. 6d.

Consists of a mechanical arrangement whereby three different speeds may be obtained at the same time, enabling the feed to remain stationary when descending hills, and the machine to be driven backwards when required.

2959. Automatic "Registering" Apparatus, to be applied to Lithographic and other Printing Machines, *J. Mearns, Salford.—14th June*, 1883.—(*Not proceeded with.*) 2d.

Relates to the construction of feeding gauges and apparatus connected therewith.

2960. Looms for Weaving, *W. H. Kenyon, Huddersfield.—14th June*, 1883. 6d.

Relates to means for changing the order of succession in which the healds are actuated in weaving, by which means a positive steady action of the healds or heddles is given; also smoother and more regular working and simplicity of action, and at a considerable reduced cost of the apparatus.

2961. Bobbin Net and Twist Lace Machines, *A. C. Henderson, London.—14th June*, 1883.—(*A communication from L. R. Dufeutrelle, Paris.*)—*Not proceeded with.*) 2d.

Refers to working the fining and stump bars of bobbin net and twist lace machines.

2963. Metal Fencing, Hurdles, and Gates, *A. Whitgrove, Worcester.—14th June*, 1883. 6d.

Relates to the means of connecting the horizontal bars or rails to the standard or vertical bars.

2964. Enamelling Moulded Articles of Ceramic and other Refractory Materials, *C. D. Abel, London.—14th June*, 1883.—(*A communication from A. Schierholz, Germany.*) 2d.

Consists in first coating the burnt or baked article with ordinary enamel colours, and while these colours are still sticky, strewing over the same small solid glass beads, after which the article is subjected to heat in a muffle, until the said covering melts sufficiently to become combined in one with the surface of the article.

2969. Water-closet Basins, *R. McCombie and W. Leaman, London.—14th June*, 1883. 6d.

Relates to improvements in the mode of flushing.

2966. Apparatus for Marking and Telegraphing the "Score," &c., in Lawn Tennis, *J. M. Wilkinson and G. S. Rogers, Bristol.—14th June*, 1883. 6d.

Relates to a post provided with arms for marking the games.

2970. Disintegrating Rags, &c., and Machine to be used Therefor, *C. Pieper, Berlin.—14th June*, 1883.—(*A communication from H. Friederichs and C. Philippi, Hanover.*) 6d.

Consists substantially in compressing the material into a compact mass or body, and thereupon subjecting the same to the action of rapid rotating serrated cutters.

2971. Burners, *Sir J. N. Douglass, London.—14th June*, 1883. 4d.

Relates to the arrangement of deflectors.

2973. Manufacture of Barbed Fence-wire, *A. M. Clark, London.—15th June*, 1883.—(*A communication from A. Cary and E. A. Moen, New York.*) 6d.

Consists in the manufacture of wire of oval or flat section, with edgwise swellings on one or both edges, which swellings are then cut in a direction parallel with the wire and bent to form barbs.

2975. Ends of Braces, which may be Applied to other Articles, *G. Walker, Birmingham.—15th June*, 1883. 6d.

Relates to the formation of the clips.

2976. Manufacture of Buttons and other Fastenings, &c., *W. B. Fitch, London.—15th June*, 1883. 2d.

The buttons, &c., are coated with a glaze.

2977. Raising and Lowering the Chimneys of Portable and other Engines, *J. P. Coultas, Grantham.—15th June*, 1883. 6d.

Relates to raising and lowering the chimneys by means of a windlass.

2978. Creating a Vacuum in the Bulbs of Incandescent Electric Lamps, *C. H. Stearn, London.—15th June*, 1883. 4d.

The bulb is enclosed in a casing of asbestos, which retains the heat when during the final exhaustion a current is passed through the filament.

2979. Electric Hand Tool for the Use of Manufacturing Jewellers, &c., *T. H. S. Hawker and J. W. Salaman, Birmingham.—15th June*, 1883.—(*Not proceeded with.*) 2d.

Relates to the construction of a drill, the handle of which contains a small electric motor.

2981. Autotypographical Machine for Engraving Types for Printing, *L. A. Groth, London.—15th June*, 1883.—(*A communication from Don F. Berdugo y Ortiz, Madrid.*) 8d.

The inventor claims, First, the arrangement of a semicircular series of concentric keys and mallets with interchangeable letters so arranged that on being pressed they all strike the same spot; Secondly, the above arrangement in connection with a movable box, containing plastic matter in which the letters are impressed for forming a mould from which stereo plates can be taken; Thirdly, the arrangement of an india-rubber ring above the letters, and a guard so as to obtain the same depth of impression, independently of the pressure used.

2984. Manufacture of Electric Wire Conductors and Insulators, *J. Greenwood, Bacup, Lancashire.—15th June*, 1883. 4d.

The insulating compound is made of pulverised furnace slag and carbonate of lime subjected to an intense heat, and then mixed with tar, pitch, or bitumen and resin, with a small proportion of mineral oil. In making conductors the above paste is formed into slabs and the wires laid in V-shaped grooves, which are then filled with the conductors. The composition may be used in the construction of battery cells.

2994. Electric Incandescent Lamps, *A. M. Clark, London.—15th June*, 1883.—(*A communication from J. M. A. Gérard Lescuyer, Paris.*) 6d.

A pair of straight fine carbon pencils are inclined so as to cross one another, and is connected at the crossing point by passing through holes in a small carbon disc. The exhausted bulb is enclosed in an outer globe, which serves to prevent the cooling of the inner bulb.

3003. Construction of Arc Lamps, &c., *T. H. S. Hawker, Moseley, Worcester.—19th June*, 1883.—(*Not proceeded with.*) 2d.

This relates to a combination of a reversible electro-motor with a pole changer actuated by a differential solenoid; and to a dynamo-electric generator.

3026. Manufacture of Carbon Plates, *R. Applegarth, London.—19th June*, 1883. 2d.

The plates for galvanic batteries have their surfaces corrugated or fluted.

3167. Incandescent Electric Lamps, &c., *H. J. Haddan.—26th June*, 1883.—(*A communication from R. H. S. Thompson, Kentucky, U.S.*) 6d.

The lamp is so arranged as to permit of more or less of the filament being rendered incandescent as required. This is accomplished by contact makers, moved by a small motor, cutting out more or less of the filament according as an external switch is moved one way or the other.

3877. Treating Alcoholic Liquors with Electricity to Purify and Impart to them the Character of Age, *W. E. Gedge, London.—9th August*, 1883.—(*A communication from A. C. Zichenor, Alameda, Cal., U.S.*) 6d.

The liquor contained in suitable receptacles has an electric current passed through it.

4685. Machines for Manufacturing Cartridge Shells, *A. J. Boult, London.—2nd October*, 1883.—(*A communication from J. H. Ring, C. Cullahan, J. H. Pindar, and J. H. Morrison, Lowell, U.S.—(Complete.)* 6d.

Relates to the general construction of the machine for constructing cartridge shells from sheet metal by means of dies.

4740. Dampening Apparatus for Lithographic Presses, *L. Schmiers, Leipzig.—5th October*, 1883.—(*Complete.*) 6d.

This relates to a dampening apparatus, in which the moistening water is forced, by means of regulated pressure, through a hollow cylinder covered with layers of cloth.

4803. School Slates, *H. J. Haddan, London.—9th October*, 1883.—(*A communication from G. and R. Gray, G. W. Berrey, and G. O. Clarke, New York.*) —(*Complete.*) 4d.

Relates to the construction of a metal frame.

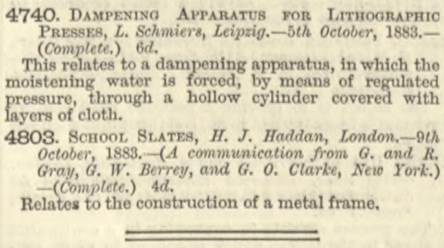
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

291,009. Spring for Piston Heads, *George W. Williams, Winona, Minn.—Filed March 29th*, 1883.

Claim.—In a piston packing expander, the combina-

291 009

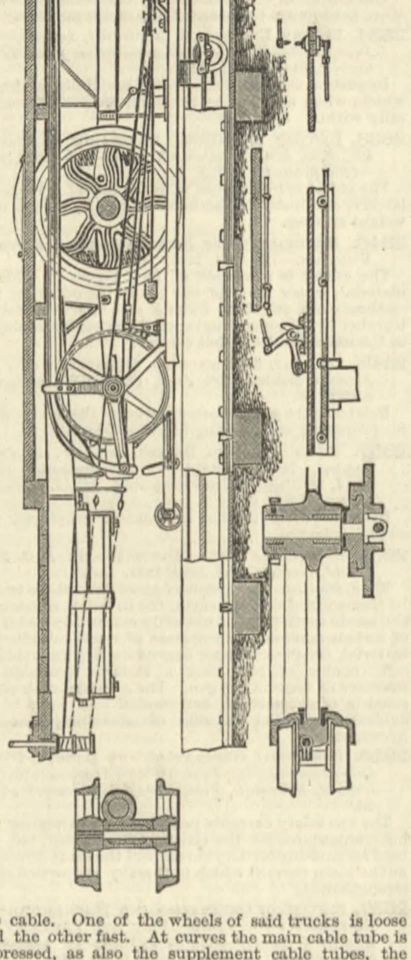


tion, with the spiral volute springs *s s*1, and the central bearing plate *b*, engaging directly with the bases of the same, of the central guide rod threaded nearly its entire length, the holding nut *h*, and setting-up nut *n*, both provided with guide bearings adapted to engage the outer or smaller ends of the said springs, substantially as and for the purposes specified.

290,708. Cable Railway Apparatus, *Charles W. Rasmusen, Chicago, Ill.—Filed March 21st*, 1883.

Brief.—A frame on car axles supports pulleys and guides, over and through which passes an endless chain having projecting arms which engage the propelling cable. To each end of the main frame is hinged a guide arm having a spring-held wheel which follows the tube slot, said arm carrying curved guides which direct the arms on the endless chain. The propelling arms are secured in their desired position by vertically-adjustable pins working in holes in the lower endless chain guide. Extending laterally from the endless chain, opposite to the projecting arms, are arms having rollers which traverse the guides, the drums on the carrying frame being grooved to receive said arms with the rollers. The projecting arms on the endless chain decrease in thickness toward their point. Flanged sleeves secure the cables to trucks, one flange having a bearing for the axle, and the other a flange at right angles thereto for embracing

290.708



the cable. One of the wheels of said trucks is loose and the other fast. At curves the main cable tube is depressed, as also the supplement cable tubes, the supplemental cable being driven from the main cable. The rails for the cable trucks at the beginning of curves at the depressed portions of the tubes are supported on springs to prevent injury to the arms of the endless chains on the cars, should they strike them. The tubes on curves have one set of rails on the bottom and one on top, and an extension or enlargement in the concave side to accommodate the cable. The cable-driving pulleys are out of line, the cable trucks being guided thereto by twisted guide-rails.

290,775. Combined Hay Tedder and Rake, *Will R. Johns, Rockford, Ill.—Filed February 12th*, 1883.

Claim.—(1) The herein-described tedder tooth hub, provided with radial ears fitted to receive the bent shank ends of the tedder teeth, and catch ears to engage and hold the teeth, in combination, with the teeth bent to enter the perforated ears and engage the catch ears, substantially as and for the purpose set forth. (2) The combination, with the rotary tedder teeth, of the slotted guards supported under the axial centre of the radial teeth, and having their rear ends

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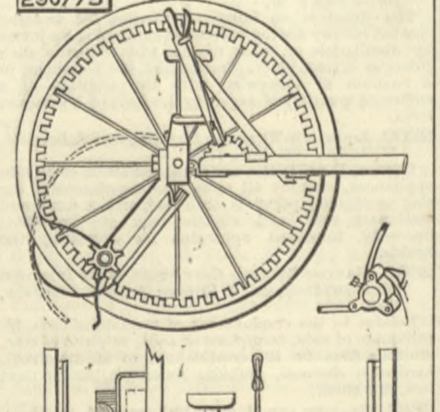
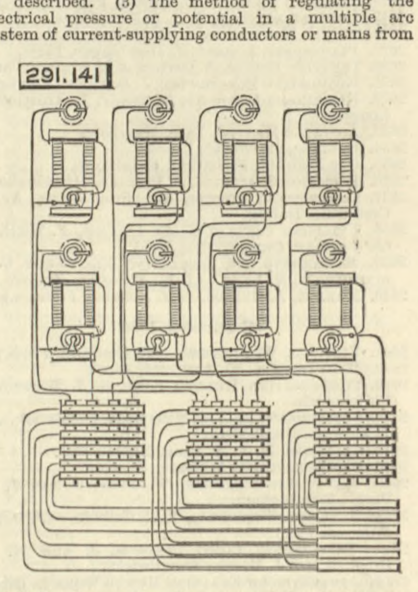


curving upward, substantially as and for the purpose set forth. (3) The combination, substantially as described, of the gear-toothed rim, a gear-toothed pinion loosely mounted on the shaft, of the tedder teeth in position to engage the teeth of the gear rim, a clutching mechanism of the shaft and pinion, and a pivotted lever spring detent to engage the opposite side of the pinion, as and for the purpose set forth.

291,141. System of Electrical Distribution, *Charles S. Bradley, New York, N.Y.—Filed August 18th*, 1883.

Claim.—(1) The method of regulating the electrical pressure or potential in an electrical supply system, which consists in feeding different points of the system from two or more independent sources of supply of electrical energy, and in separately regulating the electro-motive forces of these sources, according to the conditions of the load. (2) The method of regulating the electro-motive force or pressure in a multiple arc system of current-supplying conductors or mains, consisting in conveying the current to different points of the mains by means of feeders, supplying the feeders with electric currents by independent sources of electric energy, and separately regulating their electro-motive forces, so as to maintain different pressures in the various feeders, according to the conditions of the load, substantially as described. (3) The method of regulating the electrical pressure or potential in a multiple arc system of current-supplying conductors or mains from

291.141



which the lamps or other converting devices are directly supplied, consisting in conveying the current from a generating station to different points of the mains by means of independent feeding conductors, supplying these feeders with electric currents by independent dynamo machines, and separately regulating their electro-motive forces according to the conditions of the load, substantially as described. (4) The combination, with a multiple arc system of conductors or mains, and two or more conductors or feeders connecting it at different points with a central station, of two or more independent dynamo machines, each of which is provided with an independent regulating apparatus and a set of switching contrivances, whereby any of the dynamo machines may be separately connected to any of the feeders, substantially as and for the purpose described.

CONTENTS.

The Engineer, February 8th, 1884.

	PAGE
The United States Cruisers	103
Cocoa Powder	103
Hadfield's Manganese Steel	103
Fan for Mine Ventilation	103
The Metropolitan Sewage	104
Contracts Open—	
Narrow-gauge Bridge, Indian State Railway	104
The Physical Conditions of Iron and Steel. (Illustrated.)	106
Railway Matters	107
Notes and Memoranda	107
Miscellanea	107
Massey's Steam Hammers. (Illustrated.)	109
Cavell's Smith Forge Tuyeres. (Illustrated.)	109
Tightening a Loose Crank Pin. (Illustrated.)	109
Speed on Canals	110
Letters to the Editor—	
New Patent-office Rules	111
The Imperial Standard Wire Gauge	111
The Late Mr. W. Bird	111
Water Power	111
Designing Dynamo Machines	111
Crumlin Viaduct	111
Clothing Steam Pipes	111
Reversing Gear of Marine Engines	111
Old American Steamers	111
Leading Articles—	
The Education of Engineers	113
The Foreshore at Hastings	113
Sir E. Watkins on Continuous Brakes	114
Continuous Brakes and Engine-drivers	114
South Staffordshire Mines Drainage	114
The Telegraph Monopoly in the United States	115
Rail-making in New South Wales	115
Literature	115
Books Received	115
Mareographs	115
Examples of the Graphic Stresses in Framework. No. IV. (Illustrated.)	117
Engines of the Colossus. (Illustrated.)	117
The Society of Engineers	117
Universal Countersink. (Illustrated.)	117
The Iron, Coal, and General Trades of Birmingham, Wolverhampton, and District	118
Notes from Lancashire	118
Notes from Sheffield	119
Notes from the North of England	119
Notes from Scotland	119
Notes from Wales and Adjoining Counties	119
The Patent Journal	120
Abstracts of Patent Specifications. (Illus.)	121
Abstracts of Patent American Specifications.	122
Paragraphs—	
Speculators and the Electric Light	104
The Railways	106
Balloons for the War in Tonquin	106
Railways in India	110
Institution of Civil Engineers	115
Burning of an American Train	115
Additions to the Navy	120
Electric Lighting	120
Gunpowder Mills	120

Epps's Cocoa.—Grateful and Comforting.—"By a thorough knowledge of the natural laws which govern the operations of digestion and nutrition, and by a careful application of the fine properties of well-selected Cocoa, Mr. Epps has provided our breakfast tables with a delicately flavoured beverage which may save us many heavy doctors' bills. It is by the judicious use of such articles of diet that a constitution may be gradually built up until strong enough to resist every tendency to disease. Hundreds of subtle maladies are floating around us ready to attack wherever there is a weak point. We may escape many a fatal shaft by keeping ourselves well fortified with pure blood and a properly nourished frame."—*Civil Service Gazette.*—Made simply with boiling water or milk. Sold only in Packets, labelled—"James Epps and Co., Homœopathic Chemists, London."—[Advt.