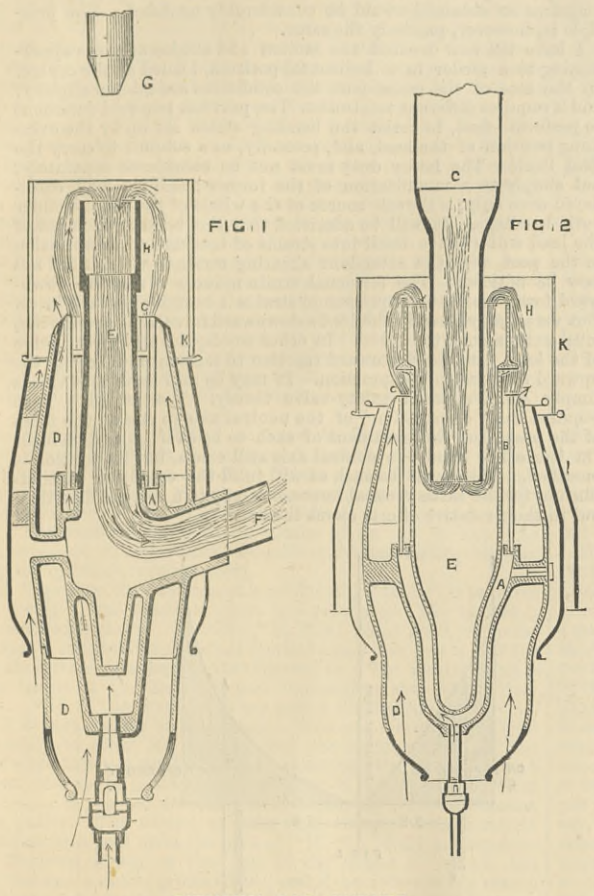
THE SMOKE PREVENTION EXHIBITION.

As many of our readers are no doubt aware, an exhibition of appliances for preventing smoke is now open at South Kensington. The exhibition is held in the arcades of the Horticultural Gardens, while the large conservatory is lighted with Dr. Siemens's new apparatus for burning gas. It is too complex to be called with propriety a gas burner, with which words very simple ideas are always associated. In a paper read by Mr. Siemens at Vienna, he described the principle of this burner as "heating to a high degree both the gas and air, and utilising for the purpose the heat still remaining in the waste products of combustion." The accompanying engraving illustrates it.



SIEMENS' GAS BURNER.

The gas in a cold state passes through the gas chamber A, and gas tubes B, to the point of ignition C. Cold air enters the air chamber D, and before arriving at C is equalised and distributed to the flame by means of a toothed circular collar. The flame burns around the porcelain H, and turning over the top of it descends into the interior of the burner or regenerative heating chamber E. This effect is produced by a continuous current occasioned by the main chimney, the end of which is seen at G and the branch chimney F. The waste heat and products of the flame being thus collected in the regenerative heating chamber E, the temperature of the latter is raised to 900 deg. Fah. The consequence is that the gas and air in the surrounding chambers, during the progress of their ascent from the bottom to the top of the burner, are raised to a similar temperature. Outside the burner is a coating of thin metal, I, between which and the burner a current of cooler air ascends to prevent the overheating of the burner, and also to add to the supply of the air to the flame. On the top of this outer casing rests a cylinder of glass, K, which protects the flame from the action of the wind. From a report by Mr. Keates we learn that this burner gives about 5·5 candles per cubic foot of gas per hour, a very high result.

The exhibits cover a wide range, anything from a paraffin lamp to a mechanical stoker being on view. The object for which the exhibition has been set on foot is very laudable. The metropolis, it is assumed, suffers greatly from smoke; and it is highly desirable that smoke should cease to issue from the chimneys of London houses and factories. To secure this end it is necessary to give a stimulus to manufacturers. Accordingly an exhibition has been got up, and prizes are to be awarded. There is besides the chance that very considerable sales will be effected. Manufacturers and inventors have taken the South Kensington authorities at their word, and the smoke prevention exhibition is a huge shop for the sale of house fire-grates, or "stoves," as they are called technically by builders. Considerable ingenuity has been displayed in the construction of many of these stoves, and much taste in the design of others. We have had no opportunity of ascertaining what the various grates and fireplaces exhibited would do when out of the hands of the exhibitors; but it is evident to any one who will take the trouble to visit the exhibition early in the day that there is not an open fireplace shown which will burn bituminous coal without the evolution of smoke. It is just as well, we think, that the public and inventors should clearly understand that what they propose to do is simply impossible, under the conditions. It is comparatively easy to prevent the discharge of smoke from a fire, provided the furnace temperature can be got high enough; but the heat of an ordinary house fire will not suffice. There is no want of air in question, as is too frequently the case with engine and other furnaces. The thing lacking is the high temperature which is absolutely necessary to secure the conversion of carbon and oxygen into CO_2. In the house fire it is nearly certain that CO_2 is never produced initially, but that in all cases CO is first evolved, and that the additional quantity of oxygen necessary to burn CO to CO_2 is got afterwards if it is got at all. It is well known that at moderate temperatures it is not easy to get carbonic acid, but without this a temperature high enough to burn suspended particles of carbon cannot be reached. The best grate, so far as we could see in the exhibition, as a smoke burner, was one in which fresh fuel is always put on below that already burned clear, because here there is a chance that the CO coming away from the fresh coal will be heated enough to combine with oxygen. But the fact that the exhibitor himself begged us "not to meddle with it, as the judges were just then examining the chimneys to see if smoke was coming from any of them," goes far, we think, to prove that even this grate is not satisfactory.

Many of the makers of house fire-grates have apparently given up the struggle with bituminous coal in despair, and gone in for anthracite. Now, in a sense, anthracite is an admirable fuel, but we much doubt that it will ever become popular. It is lighted with difficulty; it easily goes out; it gives a peculiarly penetrating heat, with nothing of the soft mellowness of good bituminous coal; and it plays havoc with the grates in which it is burned. On the other hand, it is extremely clean, makes little ash—when it is really good—endures a long time, and possesses great heating powers. But it must not for a moment be forgotten that by burning anthracite we do not secure any of the objects had in view by the promoters of the Kensington Exhibition save one, namely, the suppression of the evolution of soot. CO_2—carbonic acid gas, and C O—carbonic oxide, to use the popular names for these compounds, may be and are both freely evolved. They are invisible, it is true, but it is these gases and sulphurous acid gas, and not a few pounds of suspended carbon which lend horrors to a London fog. It has long ago been shown that the dense black trail which may now and then be seen hanging in the wake of a steamer for miles does not contain more than a very few pounds of soot, and the quantity of unconsumed carbon which a domestic fireplace sends into the air is altogether insignificant. Not so the carbonic acid. Every pound of coal requires for its combustion 12 lb. of air, containing 2·66 lb. of oxygen. The air will occupy a volume of about 158 cubic feet. The 2·66 lb. of oxygen will combine with 1 lb. of carbon and produce 3·66 lb. of carbonic acid gas, which will occupy 48 cubic feet. Thus an ordinary house fire burning 10 lb. of coal per hour discharges into the air 480 cubic feet of one of the most poisonous gases known. It is quite clear that this evolution of gas has nothing whatever to do with smoke. It cannot be prevented unless the products of combustion are passed through lime water, or boxes containing lime in some form. But a great deal of carbonic oxide is, as we have said, also produced by every house fire. 6 lb. of air and 1 lb. of carbon produce 2·33 lb. of carbonic oxide and 4·67 lb. nitrogen. The carbonic oxide will have a volume when cooled to the temperature of the outer air of about 31 cubic feet; and a consumption of 10 lb. of coal per hour would represent the discharge into the air of 310 cubic feet of a gas hardly less deleterious than carbonic acid. In practice neither gas is given off to the exclusion of the other; both are evolved, and so long as any fuel save hydrogen is consumed, so long must the air of great cities be contaminated. All the same, it is well to get rid of even the much smaller evil, namely, the "blacks" and "smuts" which render life a burthen at times in large cities; but, as we have said, it is simply impossible to do this with slow-combustion fires, unless anthracite be burned, and those who think they would like to try this coal cannot do better than go to South Kensington, where they will see it used to the best advantage. For ourselves, speaking after a four years' experience of it as a house-fire coal, we assert that we prefer bituminous coal, with all its dirt and dust.

It is a remarkable fact that not a single manufacturer of house fire-grates has yet turned his attention to the only way in which what is wanted can be attained. Soot is certain to be given off, that is to say suspended carbon, and this can only be got out of the smoke by causing its deposition. Now, so long as the velocity of the smoke is high the carbon will not be dropped; but if the velocity is small, the carbon will be thrown down just as mud is when a river becomes sluggish. Much more is done for us than is recognised by our chimneys; the quantity of soot collected in them is very large. When it is borne in mind that a most insignificant quantity of carbon will dye so to speak, a vast volume of air, it will be readily understood that if the soot now collected and taken away by the sweep were scattered broadcast over London the result would be disastrous. Is it not possible to go a step further and so construct our chimneys that they will pick up a little more soot in its flight to the outer air? Mr. Benjamin Goodfellow, of Hyde, exhibits a model of Johnson's smoke washer, which illustrates what we mean, although it is too large for domestic purposes. The apparatus consists of an enlarged flue, through which the smoke passes on its way to the chimney; it is usually made of strong timber, so put together as to be quite air-tight. The bottom of this flue is formed by a water tank also constructed of timber, and is divided into compartments, the number of which varies according to the amount of duty required. In each compartment is a dash wheel, upon each blade of which is fixed a number of spikes, which, as the wheels revolve, dip into the water in such a way as to cause a continual spray, or fine rain, through which the smoke has to pass, and is thereby washed. At the chimney end of the machine is fixed a fan, which keeps the draught at any required speed. A machine as described has been in use with two 30ft. by 7ft. boilers about six months, during which time chemical tests have been carried on under the supervision of Mr. Estcourt, the Manchester City Analyst, and it is found, we understand, that when using water alone, from 75 to 80 per cent. of the sulphurous acid is suspended, but by applying soda or lime in the water the whole of the acid can be suspended, and, as a matter of course, the "blacks" are arrested, as by passing through the water they are thrown down in the tank. Here is the true principle on which those who wish to purify the air of cities must work.

After the house fire-grates have been passed, the visitor comes to the section of the exhibition devoted to appliances for preventing the evolution of smoke from steam boiler furnaces. This part of the exhibition will be found well worth a visit by engineers. The defect of it is that no information concerning the efficiency of the apparatus shown is supplied by the exhibition. A number of furnace fronts and grates is all that is to be seen. Only one or two are in use burning coal. The principle involved in the construction of all is the same, namely, the supplying of the furnace with small quantities of fuel at a time, so as to render the evolution of gas and the admission of air to mix with it and burn it constant. Almost every conceivable mechanical device has been called in to aid the inventor in securing his end. Many of the plans shown have been already illustrated and described in our pages. They may be divided into two types: (1) that in which the grate bars are given a motion which carries the coal from the front to the back of the grate by degrees. (2) That in which the coal is thrown on the grate by mechanical means.

As an example of the first type we may cite McDougall's stoker, which was illustrated in THE ENGINEER for Aug. 20th 1880, and is manufactured by the Chadderton Iron Company. The coal is put into hoppers fixed on the furnace front, and is thence moved onward through the furnace by the slow rocking motion of the bars, not unlike that of the shakers of a thrashing machine. The fuel is forced into the grate by a horizontal ram. Its combustion is supposed to be completed by the time it reaches the bridge, over which tumble ashes and clinkers only. Mr. O'Neill, managing director of the Moorside Works of Messrs. Walker and Thomas, Bury, states that as the result of experience with this stoker, he has found that the weight of coal used from January 1st to March 10th, 1875, say 536 hours, by three boilers fired by hand, was 558 tons 8 cwt. The weight of coal used from January 1st to March 8th, 1876, say 532 working hours, one boiler being hand-fired and the other two having McDougall's mechanical stokers attached, was 492 tons 16 cwt. 2 qr., or a difference of 65 tons 11 cwt. 2 qr. in favour of the latter period, using the same quality of coal, the same pressure of steam in the boilers, and no alteration in the two engines these boilers drive. One of the engines had 4 per cent. more work on in the latter period than in the former, and having more regular turning the two engines have and are doing more work than they did in 1875, when there were no mechanical stokers fitted to the boilers. Knap's well-known stoker is another example of this type.

Newton's mechanical stoker and fuel economiser illustrates the second type of fuel feeder. This apparatus consists of an ordinary hopper bolted to the door frame of the furnace, above the door, in such a way as not to interfere with the opening or closing of the door. In the bottom part of the hopper are two horizontal-toothed rollers, about an inch apart, by means of which the coal is crushed sufficiently small, and made to fall into two grooves or shutes passing into the furnace. A blast of hot air is brought to the front end of these shutes by means of a sheet iron tube passing through the flue underneath the boiler, from a small fan at the back. This blast carries the coal forward through the shutes, and spreads it, it is claimed, over the surface of the furnace. The shape of the fires can be varied by means of a depressing plate at the end of the shutes, and the force of the blast can also be regulated by means of a neat little valve placed in the tube. This valve is worked from the lever which gives motion to the crushing rollers in the hopper, so that, instead of a constant blast of air passing into the furnace, its admission is also intermittent, like the supply of coal. It will be seen that this apparatus, to some extent, resembles Crampton's, for feeding furnaces with dust fuel. According to the chief engineer of the National Boiler Insurance Company, the following results were obtained from this apparatus during a trial made on the 27th and 28th of last June :—

	Machine firing. (No. 1 test.)	Hand firing. (No. 2 test.)	Machine firing. (No. 3 test.)
Duration of test..	3 hours.	3 hours.	3 hours.
Firegrate area ..	33 square feet.	33 square feet.	33 square feet.
Coal burnt (total)..	1594 lb.	1724 lb.	1568 lb.
Quality of coal ..	Small bright slack.	Nuts, bright and clean.	Unscreened nuts and slack, clean, but not new.
Percentage of ashes	4·67	5·9	6·66
Water evaporated.	1204 galls.	1200 galls.	1185 galls.
Temperature of feed	56°	56°	56°
Water evaporated per lb. of coal ..	7·55 lb.	6·97 lb.	7·55 lb.
Coal burnt per sq. ft. of firegrate..	16·1 lb.	17·4 lb.	15·84 lb.

The average boiler pressure was 98 lb. per square inch, and the boilers were fed with cold water. The result shows a saving of 12 per cent. by the use of the mechanical stoker.

The second type of feeder is also well illustrated by the apparatus—Proctor's patent—shown by Messrs. Butterworth and Dickinson, of Burnley. To the front of each furnace is fitted a box, and in this box works a flap on a hinge. The hinge is at the top, and the flap, which is about 12in. long and 6in. wide, hangs down. To the flap is fitted a spring, the whole device being exceedingly like the front of a well-known rat-trap. The flap is lifted up automatically by a cam against the action of the spring, and when raised a few lumps of coal are placed between it and the fire by a screw working in the bottom of a hopper. Then a kind of Corliss trip gear is brought into play. The rat-trap flap is suddenly released, and pulled by a spring it falls to a vertical position, jerking the lumps of coal before referred to over the fire. There are two of these flaps at work, fitted to a Lancashire boiler front, and jerking wood blocks over the grates all day long. The cost of the apparatus is £40 a boiler. There is no reason that we can see why it should not work very well, so long as no extraordinary demands are made on the boiler for steam. The fact that it is being used by no fewer than 160 firms is very good evidence that it gives satisfaction. The boiler can be fired by hand with the

stoker affixed. The wheel which actuates the rat-trap or "shovel," as the inventor calls it, has three different lifts, and so varies the tension of the spring that the coal is thrown alternately to the back end, middle, and front of the grate, thus securing equable distribution. Mr. Holden, director of the Globe Cotton Spinning and Manufacturing Company, of Burnley, who has five of the Proctor feeders at work, states that they save 7½ per cent. of fuel, and that smoke is quite prevented.

Messrs. Vicars', of Earlston, Lancashire, well-known stoker is shown with improvements. It belongs to the first type of stokers to which we referred—that is to say, those in which the grate bars impel the fuel forward. Very considerable changes have been made in the feeder since it was first brought out some sixteen years ago, during which time about 1600 have, we believe, been made. The whole mechanism is now actuated by one ratchet wheel and cross shaft, which makes it more accessible for working, and leaves a large door for firing by hand during any temporary stoppage of the driving power, or lighting the fires. A bar can be renewed at any time, in a few minutes, without stopping the boiler, and the bars being short, their weight, and therefore cost, is less than that of common fire-bars. Instead of the long bars and water-trough arrangement formerly used, bars of from 2ft. 6in. to 3ft. long are now employed, the back ends of which rest upon a grated plate, which does away with the pipe across the flue to protect it. The only holes required to fix the furnace are four ⅝in. diameter in each flue, and two the same diameter in the front plate. The action of the furnace is as follows:—A large hopper is filled with fuel, which is fed from thence by plungers in suitable quantities on to the bars, where it is coked, and, by their motion, carried backward on to a grated plate; the ends of the bars act as plungers and break up the large pieces of coked fuel into a size favourable to active combustion, at the same time forcing it forward into the flue, where the combustion is completed; the clinkers and other incombustible matter descend to bottom of flue over the bridge, from whence they can be easily removed at suitable intervals of time without opening the doors, as it is necessary to do in hand firing.

The system of firing with gas is exhibited by a model and drawing at Kensington. It is shown in only one form, namely, the Wilson gas producer. This consists of a species of tower or kiln, within which coal is roasted slowly, air and steam entering the fuel through a central tuyere communicating with steam jets outside. An application of the system to a Lancashire and an ordinary Cornish boiler is illustrated by large wall diagrams. The gas is brought from an underground culvert through a cast iron stand pipe to the furnace front. The producer has no cooling tubes, condensers, or underground chambers. Of its performance we possess no experience. It is stated that it can make gas for heating purposes for three farthings per 1000 cubic feet. A producer 8ft. in diameter will make 4 cwt. of fuel per hour into gas. More might be done in this direction—that is to say, in the way of firing boilers by gas—than has yet been done. In large establishments there is no reason why a central apparatus for producing gas should not be used, the gas to be led to the boilers in various directions. No regenerators would be needed, and the cost of the plant need not be great. We are not now referring to the Wilson gas producer, but to such a one as any intelligent engineer might put up for himself without infringing any patents.

It will be seen that we have made no attempt whatever to refer to all the exhibits at South Kensington. To do this forms no part of our purpose. No good end would be served. To say nothing of house fire-grates, we have left without mention many furnace-feeders, not because they are not good, but because we have not space to spare to notice them in detail. We have named a few because they are typical of systems, and because we have independent testimony that they can do good service. For ourselves, we are not particularly enamoured of any furnace-feeding device. They undoubtedly admit, however, of being used with great advantage in the case of mill boilers burning small coal and slack, and working well within their powers. Those exhibited are among the very best ever designed; and steam users who can spare the time will find that they can spend an hour among the furnace-feeders at South Kensington with profit.

THE INSTITUTION OF CIVIL ENGINEERS.

The sixty-third annual general meeting was held on Tuesday, the 20th of December, the president, Mr. Abernethy, F.R.S.E., being in the chair.

The notice convening the meeting having been read, and scrutineers of the ballot for the election of a Council for the ensuing year having been appointed, the secretary read the annual report of the Council upon the proceedings of the Institution during their period of office and upon its general conditions.

It had been pointed out by Thomas Tredgold, in 1828, when requested to define the nature and objects of civil engineering, that the domain of the civil engineer would extend with every discovery of science. A comparison of the papers contributed thirty years ago with those of the present day bore out this opinion, as it showed the great changes brought about in the interval in the practice of the profession by the new industrial applications of science. Having regard to the increasing number of subjects which occupied the attention of engineers, it was manifestly important that the papers read at the meetings of the Institution, and selected for publication, should be so varied as to be useful to its members in whatever branch of the profession they might be engaged. The tendency of modern manufacturing processes was to rely more and more upon machinery, the design and construction of which, as it became more elaborate, could no longer be the work of the mere handicraftsman, but called forth the highest powers of the skilled engineer. It thus happened that men were now to be found exercising engineering vocations widely different from those of the designers of roads, bridges, and similar public works, who, very erroneously, had often alone been recognised as civil engineers. As the Institution was largely composed of the former class, it was necessary that the range of subjects for papers should be widened, so that all interests might be consulted. The Council appealed to the four volumes of "Minutes of Proceedings" issued since the last annual meeting, as evidence of the success that had been attained in this direction.

A short synopsis was then given of the contents of the four volumes. It was stated that, besides Mr. Abernethy's address as president, which related mainly to the remarkable growth of dock and harbour accommodation for the commercial marine, fourteen papers had been read and discussed at the ordinary meetings, while thirty-seven other communications had been selected for printing, including six students' papers out of eighteen read at as many supplemental meetings. The combined articles ranged over most of the questions now occupying the attention of engineers. The foreign abstracts continued to be highly appreciated, especially by members resident in distant countries who were debarred from access to information respecting the progress of engineering on the Continent and in America.

The Council had had the pleasure to award George Stephenson medals and Telford premiums to T. F. Brown, G. F. Adams and B. Baker; a Watt medal and a Telford premium to J. I. Thornycroft; Telford medals and premiums to T. Seyrig, M. am Ende and Dr. J. Weyrauch; Telford premiums to R. H. Brunton, C. Colson, C. H. Meyer, B. Walker, J. R. Bell, J. L. F. Target, and W. T. H. Carrington; and the Manby premium to J. P. Maxwell. It was stated that the dies for the George Stephenson Medals, now for the first time presented, had been purchased during the year from Messrs. J. S. and A. B. Wyon. The medal had on the obverse a portrait of that illustrious engineer, and on the reverse a representation of one of the earliest locomotives built by him. Miller prizes had been bestowed upon the following students, viz.:—J. B. Hunter, M. B. Jamieson, T. Stewart, W. H. Edinger, D. Macalister, L. Burnet, E. W. N. Wood, A. S. Vowell, and W. Marriott.

The subject-matter index to the whole of the publications of the Institution, from 1837 to 1879 inclusive, which had been issued in the autumn, might be said to mark an epoch in engineering literature. The approval with which it had been received was evidence that the unobtrusive but painstaking labour of the compilers was fully appreciated. A name index, which would be a complement to the other, was in course of preparation.

During the past year there had been an increase of 52 Members, 119 Associate Members, and 49 Students, with a decrease of 16 Associates, while the Honorary Members remained the same. There were on the books on the 30th November last, 18 Honorary Members, 1261 Members, 1406 Associate Members, 552 Associates, and 662 Students; together, 3899. At the same date in 1860, the number of Members of all classes was exactly 1000. The Student class had only been created fourteen years. In the interval, 1462 candidates had been admitted, of whom 400 had since been elected into the Corporation, and 400 had ceased to belong to the Institution and in most instances to the profession. The deceases had been at the rate of nearly 19 per 1000, and had included several very old members, notably Mr. James Ashwell, the survivor of the five founders of the Institution.

The income last year was £12,398 11s. 5d., besides which the receipts had included £3076 14s. on account of admission fees and life compositions (which were rigidly treated as capital, and were not used for defraying ordinary expenses), and £431 5s. 6d. from dividends on trust funds. The general expenditure had amounted to £12,092 7s. 11d., including £6523 17s. 8d. for four volumes of "Minutes of Proceedings" and for the subject-matter index. A sum of £3000 had been invested, and £390 0s. 1d. had been expended for premiums and prizes under trust. The cash balance in hand was £771 12s. 1d., being £424 2s. 11d. above what it was at the same period in 1880. The income had been nearly 4 per cent., and the total receipts 6 per cent. in excess of the previous year.

The nominal or par value of the investments held under trust was £14,642 13s. 10d., and of those belonging absolutely to the Corporation £36,838 11s. 8d., the dividends on the latter having contributed £1433 17s. 6d. to the income. It was stated that on the 30th of November, 1867, the Institution investments—irrespective of trust moneys—were of the nominal value of £17,133 1s. 3d.; that in the next two years £18,120 2s. 4d. had been paid for rebuilding and furnishing the enlarged premises, without the necessity for calling upon individual members for special subscriptions; and that the present capital had been the growth of little more than twelve years.

The President then presented the premiums and prizes to the respective recipients, and, in doing so, expressed his high sense of the obligations the general body of members were under to the authors of papers.

The report having been adopted, cordial votes of thanks were passed to the President, Vice-presidents, and Members of Council, for their zeal on behalf of the Institution; to the auditors for the time and trouble they had bestowed in verifying the accounts; and to the secretaries for their services.

The scrutineers, to whom a vote of thanks was passed by acclamation, announced that the following gentlemen had been duly elected to serve on the Council for the ensuing year: Sir W. G. Armstrong, C.B., President; Mr. J. Brunlees, Sir J. W. Bazalgette, C.B., Sir Frederick Bramwell, and Mr. E. Woods, Vice-Presidents; Mr. B. Baker, Mr. G. Berkley, Mr. G. B. Bruce, Sir John Coode, Mr. E. A. Cowper, Mr. J. N. Douglass, Mr. A. Giles, Mr. H. Hayter, Dr. W. Pole, Mr. R. Rawlinson, C.B., Mr. A. M. Rendel, Dr. C. W. Siemens, Mr. D. Stevenson, Sir William Thomson, and Sir J. Whitworth, Bart., other Members of Council.

The Walker Rolling Mill.—Our North of England Correspondent stated last week in our pages that the attempt to resuscitate Walker Rolling Mills is not likely to be gone on with. It appears, however, that this statement is not strictly accurate. We are informed that the necessary share capital is being subscribed privately, and this is the reason that the matter has not come before the public.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—John Boswell, chief engineer, to the Nankin, additional, for the Majestic; J. Shirwell, engineer, to the Asia, additional, for the Canada; H. C. Stansmore, engineer, to the Magpie, vice Coope; C. Underhill, assistant engineer, to the Duke of Wellington, additional, for the Fire Queen, vice Shirwell; and Adam Shoolbread, engineer, to the Asia, as supernumerary and chief inspector of machinery, Joseph H. Ellis, to the Asia, additional, for steam reserve.

The Tay Bridge.—The North British Railway Company has decided not to apply to Parliament for suspension of standing orders as previously intended to enable the company to introduce a Bill in the coming session to get rid of the obligation in the present Act to take down the old bridge before the erection of the new one. In consequence of this decision no new Bill can be obtained within the next twelve months. The company is, however, promoting a line by Glenfarg, and it seems probable that the line will be carried over the Tay by a bridge at Newburgh, reaching Dundee through the Carse o'Gowrie. At Newburgh the river is narrow, and as it is divided by an island it was long ago argued that here could be constructed a cheaper and much more substantial bridge than at Dundee.

Society of Telegraph Engineers and of Electricians.—At the annual general meeting of the Society of Telegraph Engineers and of Electricians, held at the Institution of Civil Engineers, 25, Great George-street, on Thursday evening, the 15th inst., the following gentlemen were elected as the council of the society for the ensuing year:—President, Lieut.-Col. C. E. Webber, R.E.; vice-presidents: Willoughby Smith, Professor W. G. Adams, P.R.S., C. E. Spagnoletti, M. Inst. C.E., Professor D. E. Hughes, F.R.S.; honorary secretary, Lieut.-Col. Frank Bolton; honorary treasurer, E. Graves. Council: W. S. Andrews, William T. Ansell, Sir Charles Bright, M. Inst. C.E., E. B. Bright, the Earl of Crawford and Balcarres, F.R.S., H. G. Erichson, H. C. Forde, M. Inst. C.E., Matthew Gray, John Fletcher Moultor, F.R.S., Alexander Siemens, Augustus Stroh, C. F. Varley, F.R.S. Associate Members of Council: Capt. J. T. Bucknill, R.E., T. R. Crampton, M. Inst. C.E., C. H. B. Patey.

LETTERS TO THE EDITOR.

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

STRAINS ON CRANE POSTS.

Sir,—My last letter was running to a considerable length, and, closing it rather abruptly, I find I have omitted to fully explain a point which may be confusing. In considering the strains at the various layers of the supposed rectangular girder, all notice of the areas was left out; for every layer had the same area, and as the influence upon each ordinate would have been the same, we were justified in neglecting this factor. But in any section where the layers will have different areas, each ordinate—as obtained in the manner described in my last letter—must be multiplied by the corresponding area, and in most sections used in practice the diagrams so obtained would be considerably modified. The principle is, however, precisely the same.

I have till now treated the section and strains as those appertaining to a girder in a horizontal position, loaded at the centre. In the case of the crane post the conditions are altered slightly, and it requires different treatment. The post has two-fold functions to perform—first, to resist the bending strain set up by the overhung position of the load, and, secondly, as a column to carry the load itself. The latter duty must not be considered separately, but simply as a modification of the former; and the load, considered once only, is the sole source of the whole of the strains under both headings. It will be admitted that the bending moment of the load will resolve itself into strains of tension and compression in the post, with the attendant shearing strains—which need not now be noticed. The tensional strain induces a reactive downward force, and the compressional strains a reactive upward force. But we already have in the load a downward force, and equilibrium must exist among the three. In other words, the downward force of the load, plus the downward reaction to tension, must equal the upward reaction to compression. It may be said here that this is simply Mr. Pendred's safety-valve theory. Not at all. That requires the "elimination" of the neutral axis to one of the faces of the post, and the treatment of each to be as if quite detached. On the other hand the neutral axis still exists, but its position is modified. This must be such as will fulfil the condition of equilibrium for the three vertical forces, not only in a vertical direction but in their rotative efforts about the axis.

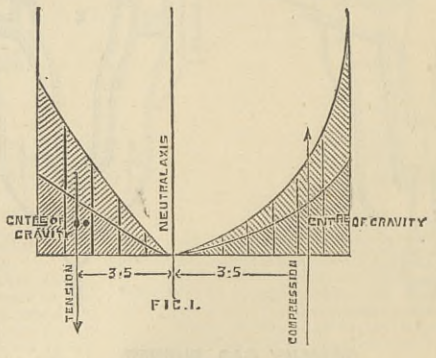


FIG. 1.

Fig. 1 is a diagram, as described in my last letter, with the upper curve joining the extremities of ordinates obtained by multiplying together the stress due to alteration of length, the area of the layers, and the distance from the neutral axis. The area contained is therefore, as before, proportionate to the moment of resistance, on one side to tension, on the other to compression. The lower curve, inclosing the darkly shaded area, follows the extremities of ordinates obtained by multiplying area of layer by stress due to alteration of length only; and the area enclosed is therefore proportionate to the stress exerted. This stress may be accurately considered as concentrating its effort at the centre of gravity of the darkly shaded area. The distance of such centre from the neutral axis will be the leverage of resistance, and the leverage multiplied by the stress, as shown by the diagram, will be the moment of resistance for either tension or compression. The alteration in length for any layer will still be proportionate to its distance from the neutral axis. The resisting stress will be dependent upon such deformation but not proportionate to it. To keep the three forces in equilibrium vertically, the stress area for compression must be greater than the area for tension by the amount of the load.

That the same forces may be in equilibrium about the neutral axis, the moment of resistance by compression plus the moment of resistance by tension, must be equal to the moment of the load, *i.e.*, its weight multiplied by its distance from the neutral axis. Assuming that the tensional stress in Fig. 1 is 242·2 tons, with a leverage of 3·5 units; that the compressional stress is 282·2 tons, with a leverage of 5·5 units; and that the load is 40 tons, distant 60 units from the neutral axis, Fig. 2, we then have vertical forces in each direction equal to 282·2 tons, and therefore equilibrium; the rotative moment of the load is 60 × 40 = 2400 unit tons, and is opposed by compression moment = 1552·2 unit tons plus tension moment = 847·7 unit tons, or 2400 unit tons; the forces thus considered are, therefore, also in equilibrium. In the case assumed the neutral axis is some distance from the central line.

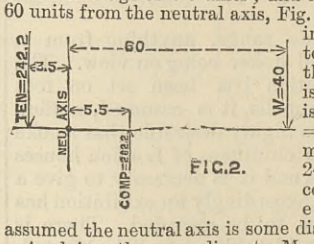


FIG. 2.

Applying the preceding to Mr. Pendred's question, his error arises solely from, and consists in, calculating his forces as acting about one or both of the faces of the post, instead of about the neutral axis. That gentleman, in a letter appearing in your issue of the 11th ult., appears to think that I have stated that a load, resting vertically above the post, produces the same strains as supported by the jib at any distance outside the post. I have never said so; on the contrary, I readily admit that the strains must be altered for both the back and front flanges, A and B in Mr. Pendred's sketch. This applies also to the illustration of the solid column. I must confess that I cannot see what Mr. Pendred is aiming at in this connection, or what he gains; neither do I understand his allusion to "rotation round a moment."

Mr. Pendred's reference to the webs and shearing strains indicates rather that he has bound himself up with rules, than that he has fully considered the theory. He is clearly aware that in designing box or H girders or posts, with webs relatively light, the flanges are "considered" as resisting all strains of tension and compression, and the webs all shearing strains. But this is only an assumption for convenience of calculation, and introduces an error of small value only; still, however, an error. As a fact the whole of the girders suffer shearing strains, and one portion also suffers tensional strain, while the whole of the remainder is affected by compression—*vide* "Rankine's Applied Mechanics," art. 309. At the end of the above-mentioned article Rankine says, "The shearing force is to be treated *as if it were* entirely borne by the vertical web." The italics are mine. Again on p. 367 of the same work, referring to this assumption, he says, "It is sufficiently accurate for practical purposes." We are now, however, endeavouring to extract truth, and it is desirable to keep approximate formulæ outside.

In a letter published on the 18th inst., a gentleman, whose very appropriate *nom de plume* is "Buster," states that the neutral axis passes through the centre of gravity of the crane, plus the load. I always thought previously that there might be an infinite number of neutral axes existing anywhere in a definite surface

passing from end to end of the structure; but "Buster" says there is but one. To illustrate his theory he gives a sketch of a very common arrangement of crane, where the load placidly rests upon the top of the end of the jib, like an apple on the tip of a juggler's nose. There are a few cranes made—I dare say "Buster" has seen them—where the load suspended from a chain is arranged to be raised or lowered in a vertical line below the jib. The centre of gravity in these cases is generally somewhere in mid-air between the load and the post, and this point, "Buster" says, is the neutral axis. He said he would pause for a reply. It is to be hoped he has utilised the pause for reflection.

On the same date "H. S." handles me rather severely—first on account of my style, and then upon my statements. As to the style, the manner in which "H. S." turns my phrases upon myself is a pleasing proof that he has a sort of fellow-feeling, though he considers it proper to decorously protest. I am, however, very glad that "H. S." led me to re-read Mr. Fyson's letter, and thus afforded me an opportunity of apologising to that gentleman for an attack, the severity of which was not justified. I understood Mr. Fyson to accept Mr. Pendred's safety valve theory as the basis of his calculations; instead of which he calculates all his moments about a neutral axis. This removes the inconsistency which I pointed out. Still, I think that to consider the load, first as producing strains which it does not produce—excess tension—and then to calculate another strain which is not produced—compression in the back plate—only for the purpose of cancelling each other, is both cumbrous and misleading. Further, the result obtained in the shape of stress values is one which I must protest against as being most improbable, if not impossible. The neutral axis is assumed to be at the centre of the section, and both back and front plates are to be the same sectional area. As they are each the same distance from the neutral axis, each will have the same alteration of length under stress; but the stress for one is 4·66 tons per square inch, and the other 5·24 tons per square inch. Certainly wrought iron will not meet these conditions, and I do not think Mr. Fyson knows of a material that will. Nothing like this proportion of stress could be obtained with a central neutral axis.

Turning to "H. S.," I had objected to Mr. Fyson trying to produce strains of tension and compression at the same time in the same portion of the same structure, by the application of a single concentrated load. "H. S." says I was wrong, and thereby implies that it is possible. The instances he adduces are, however, not in point. The vertical reactions he speaks of do not in any way cancel or oppose the horizontal tension and compression, but are simply the ultimate result thereof.

With respect to the question of equilibrium, "H. S." is in error in supposing I was confused upon the point; and the matter is fully dealt with above. To make "H. S.'s" point good, he must show that I contend for a central neutral axis; but this is just the thing that from the first I have objected to. The neutral axis is in the hands of the designer, and the position may be infinitely varied. "H. S." next refers to my pulley illustration, and treats it as if it were a reply to Mr. Fyson. This was not so. Its object was simply to show Mr. Seguin that the bending effort of the weight upon the post might be taken as acting at right-angles with the post, just as he could already see that it did for the jib. For this purpose it was not necessary to consider the vertical reaction of the pulley. The second mistake I am charged with is merely an error as to a fact upon the part of "H. S." I did not consider the "flexional strain on the post at the height C" at all, but rather the strain at the ground line; and if he refers to my sketch he will see that I make the weight V equal weight W, and leverage C equal jib A; and as A W is therefore = C V, the flexional strain is correctly stated.

With "H. S.'s" views upon the T-headed crane I quite agree, and am unaware that I have written anything to the contrary. I designed some ten years ago in conformity with the principle he lays down.

"Q. E. D.," in his letter appearing in yesterday's issue, dismisses the question in a very summary manner. Of course his statement that the strains in the front of the post are greater than those in the back is correct. But his reasoning is fallacious. He says Mr. Pendred's view of the safety valve theory is quite correct. Turning to that gentleman's first letter I find the following:—"I dealt with the strain . . . just as if it were a safety valve, with the back plate for the fulcrum." In my letter, Oct. 21st, I tell Mr. Pendred that he has taken both back and front plates as alternative axes or fulcra. This he promptly denied Nov. 11th, and reiterated his statement that the back is the fulcrum. But "Q. E. D." supporting the same theory, says that the toe or front plate is the fulcrum. These gentlemen may be left to settle this little difficulty to their mutual satisfaction. "Q. E. D." not only disagrees with his leader, but he does so with himself. He shows that there is a compressive strain all the way up the front, "and in like manner" a tensile strain up the back. Next he says, "It will tend to turn about its toe." Asked why it does not follow its inclination, "Q. E. D." must reply because the tensile strength of the back-plate prevents it. "And in like manner" "Q. E. D.'s" arguments equally lead up to the statement that it is tending to turn about the heel or back plate, but is prevented by the compressive resistance of the breast plate. Will this gentleman who so loves the practical, and so amusedly smiles at the abstract, consider the "practical" case of the post bending under an excessive load and tell us what will happen. Will not the breast plate with contiguous angle iron and portions of the web be compressed, absolutely and visibly, even to the "practical" eye? and will not the back plate, &c., be correspondingly stretched? and will there not be a point in the web plates between the two classes of deformation, which will not be affected by either? and will not such point be the one and only point about which the above movements will have taken place? and is not that point extended across the section, the neutral axis which "Q. E. D." says is imaginary? Let him paint his crane post first, or try a model in lead, and what is now to him only imaginary will become a visible reality.

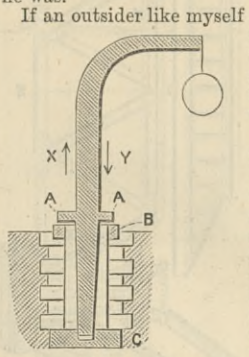
It is necessary to the safety valve theory to suppose, as Mr. Pendred does on November 11th, the back plate travelling upwards in a right line, and the front plate similarly travelling downwards. But these two are connected by a horizontal ligature—the web plates—and the moment they commence to move in opposite directions they must revolve; cut the ligature by shearing the web plates down the line of neutral surface, and the safety valve theory becomes correct; but the box crane post no longer exists; it has become simply an independent strut and tie.

34, Freke-road, Lavender Hill, S.W., November 26th. C. MAJOR.

SIR,—I am sorry that I did not make my meaning quite clear to some of your correspondents. When I wrote I had in mind certain small bent cranes which are familiar to me, though apparently not to your readers. In these the lower part of the crane post, which is round, drops into a hole in some masonry without touching it. The lower end is secured in a cup in a cast iron sole, but it does not touch the bottom of this cup. The whole weight of the crane is sustained by the collar A A resting on the ring B, and the tendency of the crane is to turn about the point B; that is to say, that point in the contact of ring and collar next the weight. I hope this will be quite clear. Now it is obvious that in this case there is no tendency to turn about a neutral axis of the crane, and that the breast of the crane, assuming it to rise in a vertical line directly over the point of contact B, will have to sustain just as much more than the backplate of the crane as the amount of the weight.

It is quite unnecessary I think that I should treat the subject mathematically. Two such correspondents as Mr. Major and Mr. Coventry are quite enough to imperil the reputation of mathematics as a means of solving such questions, without a third party rushing into the field. I may say, however, since an appeal has been made to mathematics, that Mr. Coventry is accurately right, and Mr. Major is wrong. At least, Mr. Coventry's views are those held by the best trained men of the day. I do not know whether Mr. Coventry was a Cooper's Hill man, but I suspect he was.

If an outsider like myself may venture to say so much, I would hint that neither gentleman quite understands the other, and that both are in a sense right. Mr. Coventry takes hold of the question all round, while Mr. Major grasps it by one side.



Mr. Major will not, I think, dispute that in the crane I have sketched, the arrow Y represents a greater force than does the arrow X. If so, the compressive strain on the breast of the crane must for some small distance above the point B be greater than the tensile strain at the other side. It is for Mr. Major to show, first, that this extra strain is ultimately diffused through the crane post; and secondly, that it is so diffused that, assuming the crane post to be symmetrical in cross section and homogeneous in material, the neutral axis will be found in the centre of gravity of the cross section. Q. E. D.

Cambridge, December 19th.

SIR,—With reference to a passage near the end of Mr. Coventry's letter in your issue of the 16th inst., permit me to state as a matter of fact, that the name of Mr. F. de Vasconcellos is not in the list of students of Cooper's Hill, either past or present. Also that Mr. Coventry's equation (8) and its proper applications have, from the first, been taught at that College. R.

Staines, December 20th.

THE FOUNDATIONS OF MECHANICS.

SIR,—In my first letter on this subject published in THE ENGINEER for November 18th, I mentioned that while it would be impossible for me to criticise at length the important series of papers by Mr. Browne, which you are now giving to the world, I would like to comment from time to time on Mr. Browne's statements. With your permission I shall now consider the force theory put forward by Mr. Browne in your last impression.

Mr. Browne assumes that matter consists of a series of "force centres" grouped or aggregated. The theory is not new. Bishop Berkeley has enunciated much the same thing, but with this we need not concern ourselves. The question is—is the theory true? I answer at once that it is not true, for the simple reason that there is no such thing as a pure force. I assert that what is conveniently and conventionally called force is and must be associated with matter. I will take Mr. Browne's own definition of force. The definition in question is surrounded by a mist of words, but it is easy enough to see that force, according to Mr. Browne, is that something or anything which can produce motion. If I understand him aright, a "force centre" is not a mode of motion, but it is a quality possessed by something—what, Mr. Browne does not say—which can produce motion—in what Mr. Browne does not say, but I assume he means in other force centres. It is almost impossible for the ordinary mind to extract sense from such a transcendental proposition. But if we take it for granted that he is right, we come to the old statement that force is something which produces motion.

Now, I reassert that nothing can produce motion but motion, and that if this be not true, then neither is the theory of the conservation of energy.

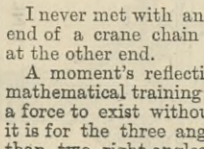
Before Mr. Brown can push his arguments or draw his deductions usefully another stage, he must make his ground good on this point. He must prove that motion can be caused by something which is not motion.

That Mr. Browne feels the difficulty with which he has to contend is quite clear from his last paper. He is face to face with the famous axiom that action and reaction are equal and opposite. That, in other words, a force cannot exist without another force which precisely equals it; and for the first time in the annals of really scientific literature we have a mathematician, if not actually disputing the truth of the axiom, asserting that it must be taken with limitations. Mr. Browne sees that the axiom means death to the theory of the existence of force. He dare not risk his reputation by wholly rejecting it; but he yields it a half-hearted allegiance, which is really as bad as total scepticism. Here is what he says on the subject:—"Most of the cases which are cited as illustrations of the law are so under special circumstances only. Thus Newton himself uses the illustration of a horse drawing a cart; but in that case the reaction and action, as represented by the pull at the two ends of the trace, are equal only when the horse and cart are alike moving with a uniform speed. If, for instance, it were true at the commencement of the horse's effort, so that the pull at one end of the trace was always counterbalanced exactly by a resistance at the other, *it is clear that the start could never be made at all.*" The italics are mine.

Now, as a matter of fact, by no possibility can the pull on one end of a trace be greater than the resistance at the other end, if we neglect the inertia of the trace.

Permit me to ask Mr. Browne a question which bears directly on this question. How is a railway train drawn? He will reply, by the pull of the engine on the tie bar. The pull will be, let us say, 5000 lb. But this pull could not exist unless the resistance of the train was also 5000 lb. To assert the contrary is to assume that there must be a greater pull at one end of the tie bar than the other. In old engravings of the celebrated Magdeburg experiment, we see two teams of horses harnessed, each team to one of the hemispheres of the exhausted vessel, which they are trying to pull apart. No doubt the philosophers of that day thought that they were doubling the pull by using two teams instead of one. Mr. Browne will admit that the same result could have been secured had one of the ropes been made fast to a tree. As I have said, under no possible circumstances can the pull on a rope be greater at one end than the other—assuming, of course, that the inertia of the rope is left out of consideration, and that it does not rest on the ground, and so encounter frictional resistance. But if the resistance offered by a train to an engine is precisely equal to the strain put on the tie-bar, we have two forces resisting each other which are equal and opposite, and so no motion in the train can take place. Why it is that motion does take place I leave Mr. Browne for the present to find out. If he fail, I will tell him.

To make my meaning quite clear, I will give the following illustration:—A and B are two pulleys which can revolve without friction; W W are two weights of 1 lb. each. The strain on the cord C is only 1 lb., although it carries 2 lb. I owe an apology to your readers for giving such illustrations, but I cannot help it when I find a mathematician gravely asserting that a trace can have a greater strain put on it at one end than the resistance at the other.



I never met with an engineer who asserted that the pull at one end of a crane chain lifting a weight was greater than the pull at the other end.

A moment's reflection on the part of anyone having a little mathematical training will show that it is simply as impossible for a force to exist without an equivalent equal and opposite force as it is for the three angles of a triangle to be equal to more or less than two right-angles. But the mathematician will see that it follows as a corollary that, if every force in nature is balanced by another opposing force, the forces must appear on both sides of every equation, and may therefore be eliminated.

It may appear that I am writing sheer nonsense, when I assert that there is no such thing as force, but anyone who will take the trouble to think will see that I do nothing of the kind; I have as powerful thinkers as Herbert Spencer and Professor Tait on my side; I think Dr. Oliver Lodge will go nearly as far. Of force we have no real idea apart from that imparted by our perceptions. When—to use Mr. Browne's own illustration—we lift a book, we feel what we call resistance, and the expenditure of nervous energy in producing muscular contraction we associate with "resistance" and call it "force." But nothing has really taken place but a transfer of motion from ourselves to the book. We call these attendant sensations the "exertion of force." We generalise from this premiss, and immediately force springs into existence. If we were so constituted that we did not feel the sensation in question, we should never have heard of force. As it is a weak man estimates resistances and forces on a different scale from a strong man; to an ordinary man, the lifting of a nut kernel represents no expenditure of force, to a pigmy the resulting idea would be entirely different.

We may, however, dismiss this species of illustrative argument as unnecessary. The salient point to which Mr. Browne must address himself is that every force in nature is balanced by another force equal and opposite. The pressure in a steam cylinder cannot exceed the resistance of the piston. The force—to use Mr. Browne's words—required to impel an electric current through a wire must be precisely equal to the resistance of that wire. *The resistance is in all cases the precise measure of the force.*

I think I hear Mr. Browne say that the resistance depends on the motion. If he concedes this, he must also concede that motion can be the equivalent of a force. If this be so, then motion may be force. I fear he will not grant this; it would concede too much to me—prove too ruinous to his own theory.

It would not seriously interrupt the general progress of his papers, if Mr. Browne would, to save misapprehension, digress for one moment, to prove that a force can exist without its precise equivalent in the form of a resistance.

London, December 19th. Φ. H.

THE DITTON ENGINES.

SIR,—Upon reading over the leading article last week in your influential journal on the Ditton pumping engines, your remarks would lead your readers to suppose that these engines were designed by Mr. E. A. Cowper. Such was not the case, as they were designed by Messrs. Simpson and Co., the manufacturers. Messrs. Simpson and Co. had on three previous trials found them so economical that they considered it advisable to have a perfectly independent trial made, therefore Mr. E. A. Cowper was called in. Messrs. Simpson and Co. have made many pumping engines and also mill engines almost similar in design, and have found them nearly as economical as those at Ditton; hence the results are not so "phenomenal" as at first sight appear.

The condensation from the jacket drains on Mr. Cowper's trial circulated by gravity back to the boilers, so it could not be measured; but on two previous trials the return drains were disconnected and the discharge measured, and the quantity was, as stated by you, found to be just over 2 lb. per indicated horse-power per hour. On Mr. Cowper's trial both pair of engines were running together, and as the rate of expansion was in each engine slightly different, it is impossible with absolute accuracy to ascertain the amount of steam accounted for by the indicator, and therefore the initial condensation; but on the other previous trials the engines were tried singly, and it was found to be about 30 per cent. of the amount supplied by the boilers through the cylinders, instead of 134 per cent. as given in your article.

Your statement about the boilers being very economical is correct, but by burning the proper proportion of coal as compared with the heating surface, as Messrs. Simpson and Company always do, similar results have always been obtained—in fact, more is often done, and on one of the trials where both of the Ditton engines were running together, and four boilers used instead of three, as on Mr. Cowper's day 11·08 lb. were evaporated from and at 212 deg. Fah. by 1 lb. of coal. For all kinds of manufacturing, pumping, or other purposes this type of engine has always been found very economical, and it is much to be wondered why it has not been more generally adopted. For electric lighting it is also most applicable, owing to the uniformity of rotative force exerted and consequently steadiness in running.

Engine Works, Grosvenor-road, Pimlico, London, S.W., Dec. 20th. JOHN G. MAIR, M.I.C.E.

[We stated that the steam actually used by the Ditton engines was a little more than 134 per cent. greater than that accounted for by the indicator, not 134 *times* as our correspondent seems to think. The meaning of the statement has been missed by our correspondent. It is intended to convey that the whole quantity of steam used being 234, the indicator accounts for 100 only. Thus, the figures he gives mean that the whole consumption of steam being 233, the indicator accounted for but 100, and the actual consumption was 133 per cent. in excess, or nearly what we have stated.—ED. E.]

BALANCING PORTABLE ENGINES.

SIR,—The interesting article on the "Limit of Speed," by Professor Reynolds (ENGINEER, 9th inst.), gives me the opportunity of making, through your valuable columns, a suggestion which, unless I am mistaken, would certainly make the ordinary portable engine more perfect. I have never yet heard of it being tried and proving useless, or worse; nor do I for a moment think that my humble suggestion carried into practice would stay all vibration; but would not a properly weighted fly-wheel largely assist in steadying a portable engine, which not unfrequently rocks itself into soft ground up to the bottom of the fire-box?

I have frequently seen, at shows and elsewhere, portable engines vibrating at every stroke of the piston, especially when running at about 100 revolutions per minute. I have also noticed that at greater or less speeds the same engine will run much steadier; this, of course, depends upon the total weight of the whole machine, which must regulate the time of "Free Vibration."

NOEL CHANDLER.

Cannock Chase Foundry and Engine Works, Hednesford, December 15th.

THE NEW TAY BRIDGE.

SIR,—In your notice of the new Tay Bridge of November 25th, you mention the test the iron has to stand is a tensile resistance of 22 tons per square inch, with 6¼ per cent. of elongation in a length of 8in.; and all rivet holes in girders are to be drilled. As Mr. Barlow does not contradict this in his letter to you, published in THE ENGINEER of last week, correcting your statement as the cost of the undertaking, I take it for granted that the tests, as published by you, are correct. I would like to know how Mr. Barlow reconciles this with his specification, issued to intending offerers, where it is stated that the elongation is be 15 per cent., and all the holes both in cylinders and girders are to be drilled.

I made out my tender in strict conformity with the conditions of the specification, and if Mr. Barlow has seen fit to make serious alterations and concessions in some of the most important of these conditions, it is easy to see how he arrives at the £40,000 less than the parliamentary estimate; but I leave your readers to judge of the fairness of such a proceeding.

Dundee, December 7th. W. B. THOMPSON.

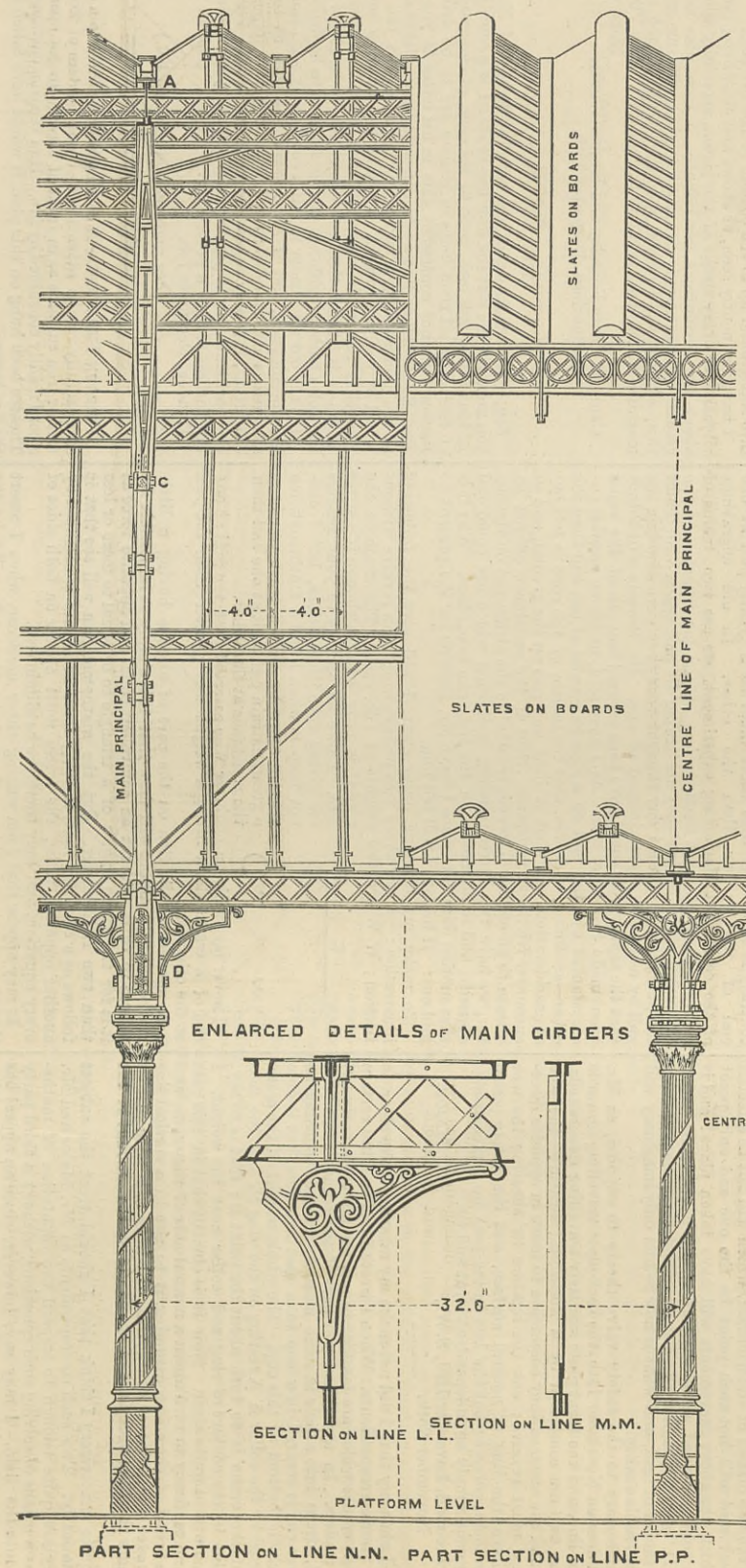
(*For continuation see page* 456.)

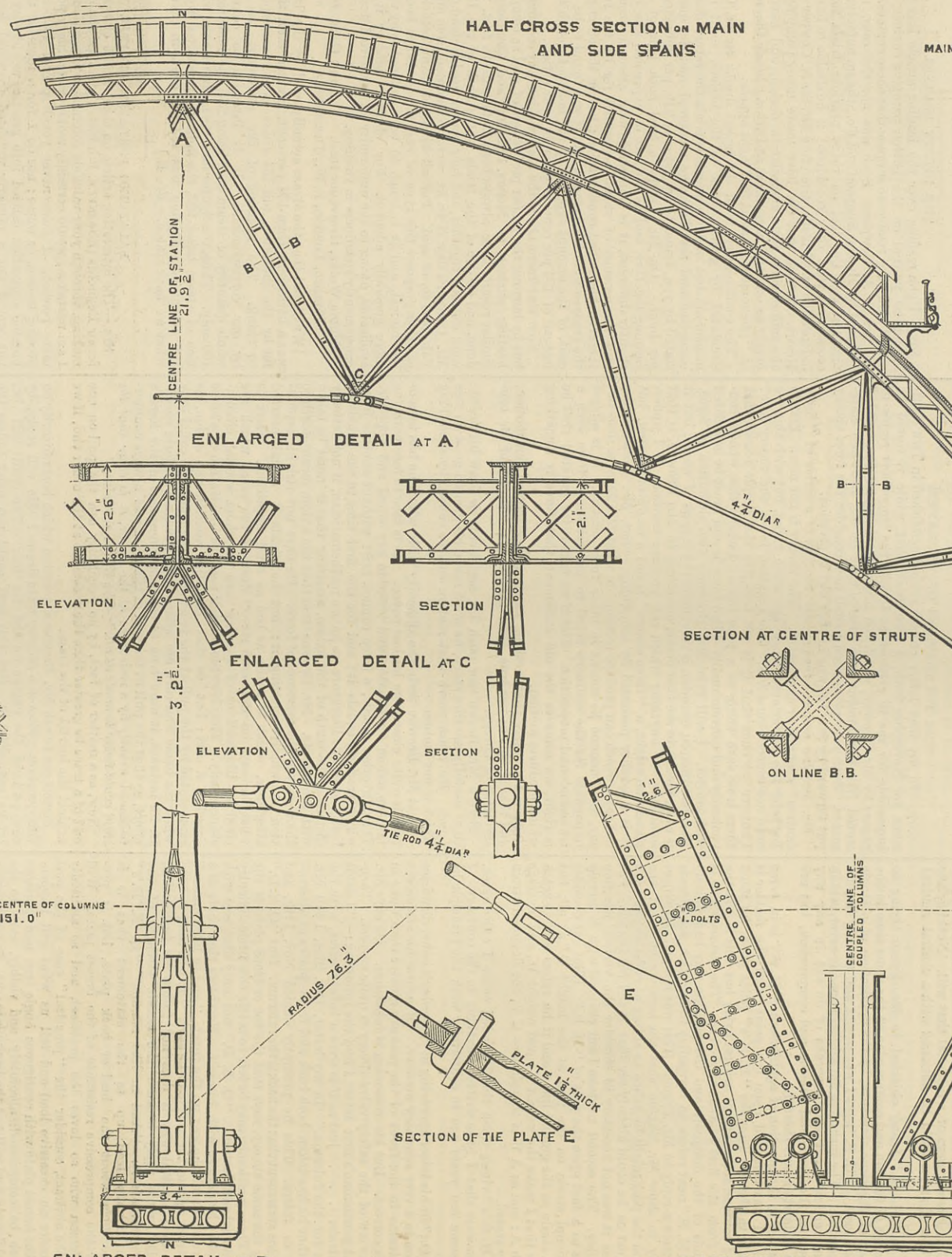
FIRES IN THEATRES.—A correspondent writes to a contemporary and usefully recalls attention to the old device of holding ventilators or iron curtains as in front of theatre stages open by means of a cord readily consumed by fire. Had the iron curtain at the Vienna Theatre been hung on this plan, it would have fallen by itself when the fire began

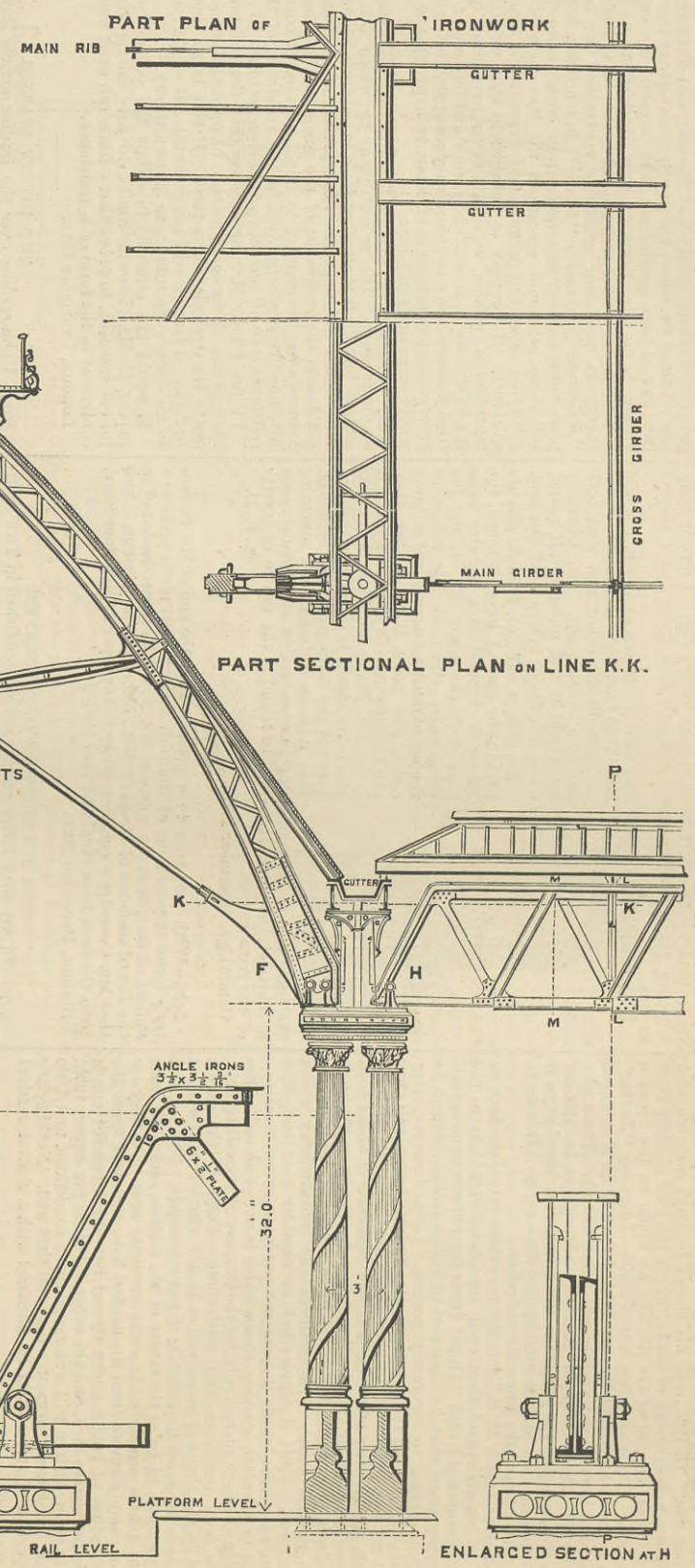
DESIGN FOR A NEW LANCASHIRE AND YORKSHIRE RAILWAY STATION IN LIVERPOOL.

MR. J. B EVERARD, LEICESTER, ENGINEER.

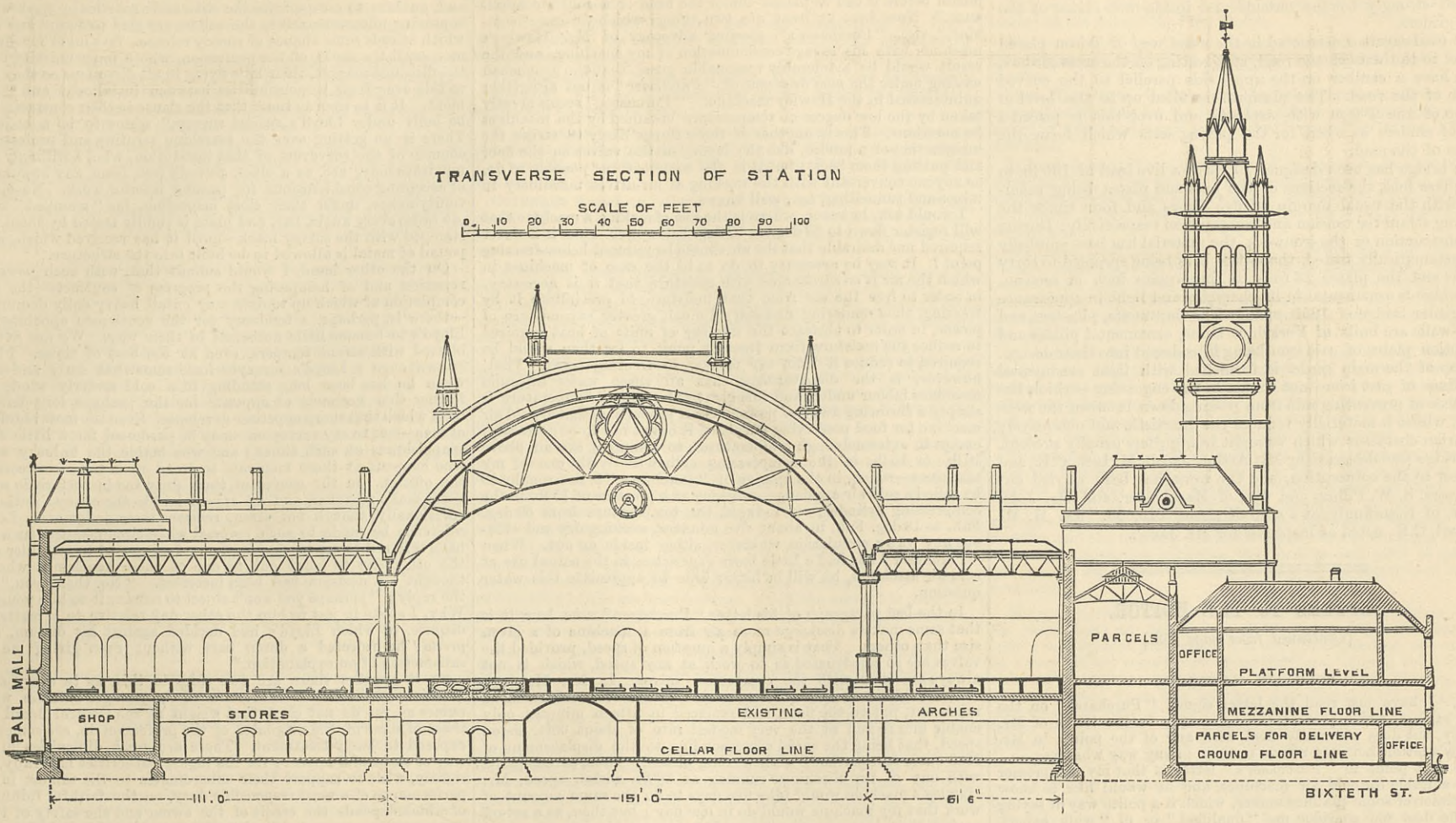
(*For description see page 445.*)







DESIGN FOR A NEW LANCASHIRE AND YORKSHIRE RAILWAY STATION IN LIVERPOOL.



Our illustrations above and on page 455 show the details of the large roof of the passenger shed submitted in the late competition for a new station at Liverpool for the Lancashire and Yorkshire Railway Company, as part of the design of Mr. J. B. Everard, C.E., and Messrs. Goddard and Paget, architects, both of Leicester.

The area to be covered has a length of 780ft., and a width between the side walls varying from 264ft. at the north end, to 316ft. at the south. The foregoing figures show that a roof in one span was almost out of the question, as not only was the span unprecedentedly great, but the varying width would have led to great complication in construction, and an unsightly appearance when completed. It would also have almost prevented the use of the old station for passenger traffic during the reconstruction. Divided into two spans, these difficulties would only have been partially met, and it was therefore decided to make the design for a roof in three parts; the central part a crescent-shaped roof of 151ft. span, and the two side portions carried on horizontal girders, that on the west having a span of about 57ft., and that on the east varying from 57ft. to 108ft. The advantages of this method appeared to be that the traffic could be carried on without interruption, and that the supporting columns could be kept on the platforms instead of being between the lines of rails. At the same time the light and lofty effect of an arched roof would be combined with economy of construction.

In working out the details, great care was bestowed upon the lighting and ventilation. The ridge-and-furrow system was adopted as being decidedly the best, not only for the central portion of the main span, but also for the side spans, ventilation being secured throughout the whole length of the ridges. The glazing was to be upon the north side and the east and west hips only, thus securing ample light, while the painful glare from the south, which is so unpleasant in most large stations in hot weather, would be effectually excluded.

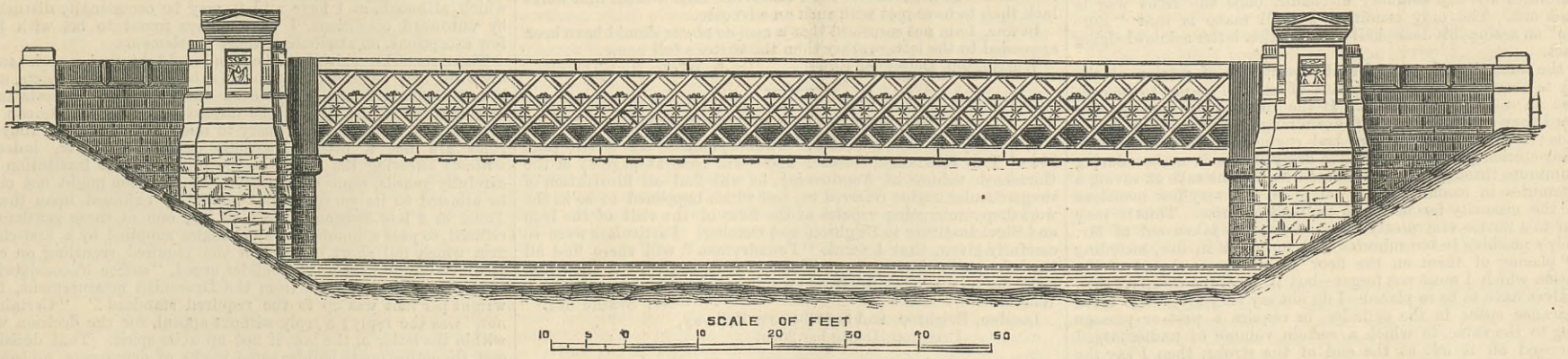
The construction of the ironwork will be readily understood from the illustration; it only therefore remains to add a few details as to the estimated cost. This for the large roof, including the wind screen at the north end, was as follows:—

Tons.	cwt.		£	s.	d.
1368	10	Wrought ironwork in main principals, girders, purlins, intermediate rafters, shoes, bracing wind ties, wind screen, and bolts, at £20	27,370	0	0
13	16	In steel pins to main principals, at £35	483	0	0
253	17	Cast ironwork in large brackets, shoes, and other heavy ironwork, at £9	2,284	13	0
553	14	Cast ironwork in gutters, ridges, and crestings, at £10	5,537	0	0
84	0	In galvanised iron covers to ventilators, at £22	1,848	0	0
72	15	Lead work in aprons, rolls, &c., at £27	1,964	5	0
		Feet super.			
4800		Cast iron front to wind screen, at 2s.	480	0	0
		Feet lineal.			
1536		Hand rail to gallery, at 5s.	384	0	0
		Feet cube.			
12,200		Woodwork in ridges, hips, plates, gallery, &c., at 4s.	2,440	0	0
		Feet lineal.			
82,200		Wood skylight bars, at 3½d.	1,198	15	0
		Squares.			
1892		Wrought boarding on roof, and snow boards, at £2	3,784	0	0
1918		Slating with Welsh slates, at 32s.	3,068	16	0
1254		Glazing with rolled glass, at £3 6s. 8d.	4,180	0	0
		Yds. super.			
103,800		Painting, at 6d.	2,595	0	0
			57,417	9	0
		Contingencies, 10 per cent.	5,761	11	0
			£63,379	0	0

The area of the space covered by the large roof—being the horizontal area between the walls — was 2228 squares of 100 superficial feet. It follows, therefore, that the estimated cost per square of the roof and the screen was £28 9s. If to this be added the columns, 475 tons at £8 10s., or £4037, we have as the total cost £67,416, which is equal to £30 5s. per square.

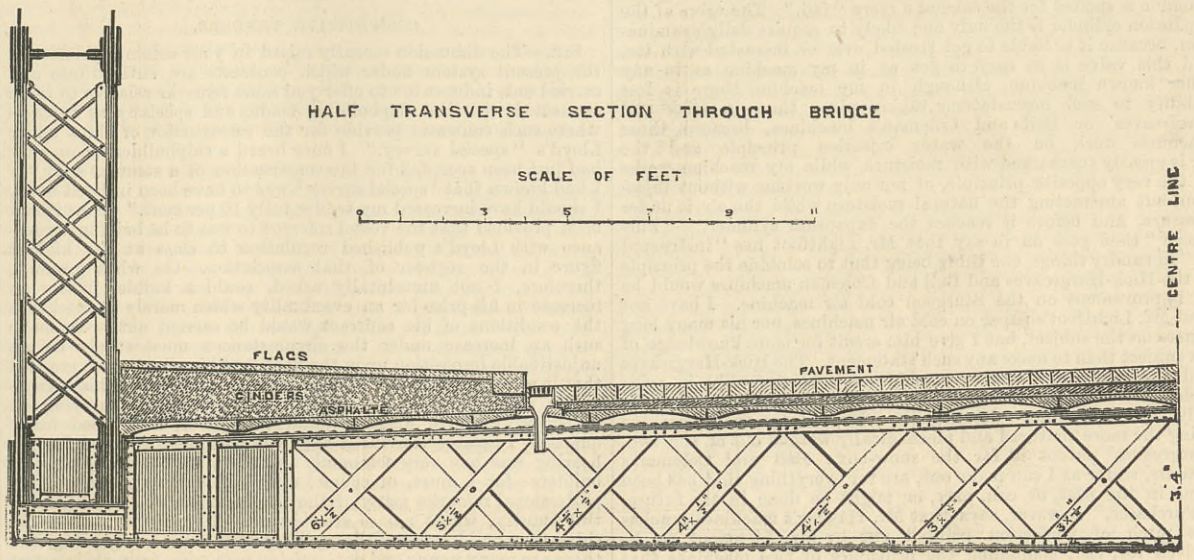
BRIDGE OVER THE IRWELL, SALFORD

MR. A. JACOB, M.I.C.E., ENGINEER]



The Corporation of Salford are just now completing the last of a series of bridges thrown across the River Irwell, in order to connect and complete the communication between the Salford Borough and the city of Manchester, as well as to unite more directly the three sub-districts of the Borough of Salford proper. It has been thought by some of the community, whose one idea of economy is the present saving of pounds, shillings, and pence, that at least one or two of these bridges were uncalled for, but those whose experience in municipal management has been more matured have, no doubt, exercised sound judgment in establishing direct and commodious means of communication for the public throughout a district covering an area of more than eight square miles. There can be no question that for purposes of registration, drainage, removal of refuse, economy of energy, and saving of wear and tear in wheel carriages, the construction of good and direct roads of easy gradient is a matter of the soundest economy.

The bridge which we illustrate serves to unite the Pendleton and Broughton districts of Salford, and the new road which forms the approach to it is the connecting link which completes an almost direct line of communication from Pendleton to the northern districts of Manchester. In the design for the ironwork the stereotyped form of lattice girder has been to some extent departed from. In the top and bottom booms of the main girders, the plates which take the compression and the tensile strain are arranged vertically, in order that the strains may pass as directly as possible from the diagonals through the metal which is provided to resist them. It has been found necessary to employ a certain amount of packing between the point where the lattice bars are rivetted to the web plates, but these packings have been made to serve the purpose of cover plates, and there is very little material in the girder work which is not usefully employed in resisting force of one kind or another.



The cross girders are attached to the main girders in such a manner that there can be no tendency to distort the main girder by bringing a greater strain to bear on the inside plates and bars than on those outside. A square gusset or knee-piece

of plate is rivetted between the web-plates of the main girder opposite to the end of each of the cross girders, as shown in the engraving, and the web of the cross girders is attached to this gusset by angle iron and rivets, besides which the end plates are rivetted strongly to the outside and inside web-plates of the main girders.

The roadway is constructed in the usual way of T-iron placed parallel to the axis of the road, and resting on the cross girders, which have a camber on the upper side parallel to the curved section of the road. The platform is filled up to the level of the top of the T-iron with asphalte, and over this is placed a layer of cinders as a bed for the paving setts which form the surface of the road.

The bridge has been designed to carry a live load of 100 lb. to the square foot, the sections of the bars and plates being calculated with the usual margin of five times and four times the breaking strain for tension and compression respectively. During the construction of the ironwork, the material has been carefully and systematically tested, the lattice bars being specified to carry 24 tons and the plates 23 tons to the square inch of section. The bridge is ornamental in its character and light in appearance for a girder bridge of 125ft. span. The abutments, pilasters, and tieing-walls are built of Yorkshire stone, ornamental pillars and inscription plates of cast iron being introduced into their design. The top of the main girder is furnished with light ornamental mouldings of cast iron—not shown in the engraving—which has the effect of preventing rain from passing down between the web-plates, whilst it materially reduces the inartistic and obtrusively utilitarian character which wrought iron girders usually present. The bridge was designed by Mr. Arthur Jacob, M. Inst. C.E., and engineer to the corporation, and the work has been carried out by Messrs. S. W. Pilling and Co., of Manchester, and Mr. John Butler, of Stanningly, at a cost of about £10,000. Mr. H. W. Pendred, C.E., acted as inspector for Mr. Jacob.

LETTERS TO THE EDITOR.

[*Continued from page* 453.]

COLD AIR MACHINES.

Sir,—I have just read the letter signed "Purchaser" on the above subject, which professes to be a reply to the letter of Mr. Galwey, but does not really deal with any of the points in Mr. Galwey's letter, nor even allude to them in any way whatever.

The first point in "Purchaser's" letter is that my compressor is not suitable for cold air machines, and he would like to know the opinion of some qualified maker, which is a polite way of saying that he does not consider me "qualified," or of "wide experience." I admit that my experience in air compressing machinery has been limited to fifteen years' constant practice with that class of machinery before Messrs. Bell and Coleman commenced their machine, during which time I have had to do with the designing, erecting, or working of some two hundred air compressors and with various pressures up to as much as 24,000 lb. to the square inch, and also the production of cold by the compression and expansion of air. I do not, however, consider a reference to past experience as an altogether satisfactory argument, so long as simple facts, figures, and diagrams can be given, upon which any engineer is competent to form his own judgment, without blindly following the lead of others. And, indeed, "Purchaser" abandons this position later on, when he recommends the machine of a Mr. Hawley, whose name has been hitherto unknown in connection with either air-compressing and cold-air machinery. I merely mention this to show the fallacy of "Purchaser's" argument, not that I myself imagine that Mr. Hawley's machine must necessarily be inferior merely because his name has not been kept prominently before the public in connection with that class of work. I never heard of the machine before, and therefore do not attempt to express an opinion merely upon the assumed experience or inexperience of the inventor.

"Purchaser" says he has examined one of my compressors, and that the valves are bad to get at and examine, and "it would take a skilled mechanic a considerable time to get at them." This remark only proves that "Purchaser" does not understand my machine. If he will give me his full name and address I shall be most happy to run down to Liverpool or Warrington to meet him, and explain to him how the valves can be got at and examined, and that what, at first sight, may appear difficult is really, when explained, a very simple and easy thing, and that there is no valve about the machine that cannot be taken out and replaced within ten minutes by any ordinary mechanic, once the right way is pointed out. The only condition I shall make is that "Purchaser" on seeing this done shall write another letter acknowledging the fact.

At the same time, I contend that this matter of getting at the valves is about the least important of all the points to be considered in a cold-air machine. If the valves are properly constructed they ought not to need examining more than once in six months; and it would be very bad engineering to sacrifice the working efficiency of the machine in every stroke it makes during every minute throughout, say, six months, for the sake of saving a few minutes in examining the valves on the very few occasions when the necessity for doing so is likely to arise. Thus it may appear to a novice very pretty to see the valves taken out of Mr. Hawley's machine in ten minutes and put back in five, including the "placing of them on the floor"—an important part of the operation which I must not forget—but if, in order to effect this, the valves have to be so placed—I do not say they are—as to leave a clearance space in the cylinder, or require a port or passage leading to the valve, in which a certain volume of undischarged compressed air is left at the end of the stroke, then I say the machine is spoiled for the sake of a mere "fad." The valve of the expansion cylinder is the only one likely to require daily examination, because it is liable to get frosted over or incrusted with ice, and this valve is as easy to get at in my machine as in any other known machine, although in my machine there is less liability to such incrustations taking place than in Hick and Hargreaves' or Bell and Coleman's machines, because those machines work on the water injection principle and the air is greatly surcharged with moisture, while my machine works on the very opposite principle, of not only working without injection, but abstracting the natural moisture while the air is under pressure, and before it reaches the expansion cylinder. "Purchaser" then goes on to say that Mr. Lightfoot has "instructed us" in sundry things, one thing being that to combine the principle of the Hick-Hargreaves and Bell and Coleman machines would be an improvement on the Sturgeon cold air machine. I have not read Mr. Lightfoot's paper on cold air machines, nor his many long letters on the subject, but I give him credit for more knowledge of his subject than to make any such statement. The Hick-Hargreaves and the Bell and Coleman machines are exactly alike in principle, following numerous precedents in this respect, and differ only in the minor details, the Hick-Hargreaves machine being the more matured and mechanically worked out of the two. Hargreaves' patent is for the snow-box; Bell and Coleman's patents, so far as I can make out, are for everything that has been done in the past, or can, may, or might be done in the future. "Purchaser," however, says that Mr. Hawley's machines reaches the pitch of perfection pointed out by Mr. Lightfoot to be striven for, viz., combining the principles of two machines that are exactly alike in principle, the result of which combination must be a curiosity. It is, however, unfortunately true that there are too many "inventions" made up in this way, *i.e.*, picking a bit here out of one specification, and a bit there out of another, and so on. He then, in a most unjustifiable manner, attacks my machine—without one tittle of argument or evidence adduced—by stating that it will "require extensive alterations and improvements before it can be placed under the head of a cold air appliance." Now here at least are two things which we can "combine," viz., "Purchaser's" glowing advocacy of Mr. Hawley's machine, with his savage condemnation of my machine, and the result would be a tolerably reasonable guess that the gentleman writing under the *nom de plume* of "Purchaser" is not altogether uninterested in the Hawley machine. "Purchaser" seems greatly taken by the low degree of temperature obtained by the machines he mentions. This is another of those things likely to strike the imagination of a novice, like the laying of the valves on the floor and putting them back; but it is the easiest thing possible to do, as anyone conversant with the working of air-driven machinery in mines and tunnelling, &c., well knows.

I would ask, however, where is the use of making a machine that will register down to 50 deg. or 60 deg. below zero when it is never required nor desirable that the air should be reduced below freezing point? It may be necessary to do so in the case of machines in which the air is so surcharged with moisture that it is necessary, in order to free the air from that moisture, to precipitate it by freezing, thus rendering necessary a much greater expenditure of power, in order to abstract the number of units of heat required to reduce the moisture from freezing point to ice than would be required to reduce it from say 60 deg. to freezing point. That, however, is the disadvantage that all these water injection machines labour under, and this great reduction of temperature is simply a throwing away of power. In a properly designed cold air machine for food preserving purposes, it ought not to be necessary, except in extremely high temperatures, to compress the air above 10 lb. or 15 lb. in the compressing cylinder. With one of my machines—which, in the opinion of "Purchaser," is not worthy to be called a cold air appliance—working at a pressure of 15 lb. in the compressing cylinder, we reduced the temperature from 60 deg. Fah. to 18 deg. Fah. in about five minutes, working dry and without any water circulation whatever, either inside or out. When "Purchaser" has had a little more experience in the actual use of cold air machines, he will be better able to appreciate this water question.

In the last paragraph of his letter "Purchaser" asks how it is that some makers discharge more air from a machine of a given size than others. That is simply a question of speed, provided the valves are so constructed as to work at any speed, which is not always the case with the compressor valves. In Mr. Hawley's model cold-air machine it seems that his valves, which can be taken out, put on the floor, and replaced in fifteen minutes, only enable him to run at the very modest rate of about 60ft. piston speed, that being the speed corresponding to the displacement of 2000 cubic feet per hour with a 10in. piston. Thus, as compared with one of my machines running at 300ft. piston speed, Mr. Hawley's machine would take five days to do the same amount of work that my machine would do in one day; but then, as a set-off against that, he may perhaps be able to change his valves in about five minutes less time than I could mine!

The 40,000 cubic feet delivered by a 10in. machine in one hour must be a mistake. It must mean 40,000 cubic feet space cooled through so many degrees by the discharge into it of so much air of lower temperature.

John Sturgeon.

3, Westminster-chambers, S.W.,
December 19th.

Sir,—In your issue of the 16th inst. there appears an attack upon myself, under the very flimsy cloak of a reply to a letter of mine. The writer—"Purchaser"—begins by what is intended to represent a shrewd guess at my being personally interested in the Sturgeon compressor, but in a very few sentenees he clumsily drops the mask and shows that he is perfectly well aware of the fact. In the first place, the cold air machine "Purchaser" professes to have examined, is not of my invention, as he insinuates, but a John Sturgeon's dry cold air machine, and the valves are not only easy of access, but are simplicity itself.

In face of his assertion to the contrary, courtesy compels me to assume that he knows nothing at all about them.

A little further on "Purchaser" informs me that the machine alluded to will require considerable alterations before it can be placed under the head of a cold air appliance, and in the same sentence he asks for information as to results obtained, thus again showing his complete ignorance of the machine he condemns.

"Purchaser's" idea of a cold air machine seems to be chiefly, nay, almost entirely, based on the accessibility of the valves, without reference to any other point of efficiency.

I am not acquainted with Mr. Hawley or his machine, and in spite of the very damning particulars given by "Purchaser," I will refrain from further remark, except to condole with Mr. Hawley, for had I been his bitterest foe I could not have wished him worse luck than to have met with such an advocate.

In fine, I am not surprised that a *nom de plume* should have been appended to the letter rather than the writer's full name.

Warrington, December 19th. J. Will. N. Galwey.

MR. STROUDLEY'S LOCOMOTIVES.

Sir,—If your correspondent, "Foundryman"—see letter, page 294 of The Engineer, October 21st—will look at page 91 of the thirteenth volume of *Engineering*, he will find an illustration of the particular engine referred to, and which happened to be in the workshop undergoing repairs at the time of the visit of the Iron and Steel Institute to Brighton last October. Particulars were so carefully given, that I think "Foundryman" will there find all the information he requires. If not, I shall be happy to show him anything he may wish to see, if he will make a call at the Brighton Works.

W. Stroudley.

London, Brighton, and South Coast Railway,
Brighton, December 20th.

COMPETITIVE TENDERS.

Sir,—The discussion recently raised in your columns relative to the present system under which contracts are entered into and carried out, induces me to offer you some remarks relative to those connected with the shipbuilding trade, and specially as to cases where such contracts provide for the construction of ships under Lloyd's "special survey." I once heard a shipbuilder whose offer had just been accepted for the construction of a steamer say, "If I had known that 'special survey' was to have been insisted upon, I should have increased my tender fully 10 per cent." Now it had been provided that the vessel referred to was to be built in accordance with Lloyd's published regulation to class at the highest figure in the register of that association. On what grounds, therefore, I not unnaturally asked, could a builder justify an increase in his price for an eventuality which merely assured that the conditions of his contract would be carried out? To make such an increase under the circumstances must surely be an unjustifiable imposition upon the pocket of his client; for, granted that it was the contractor's intention to honestly fulfil his engagements, no such supervision could affect in any way the carrying out of the work. On making inquiry, however, in a good many quarters, I became convinced that the sentiment expressed in my hearing was one very commonly shared in by a certain class of builders—for I must, of course, except from the stricture of my professional remarks many of the leading firms of shipbuilders in this country, whose names are "household words" wherever the ships they build sail to. Everything must have a beginning, and there are many young and enterprising men who, from their outset in shipbuilding, need no more to claim an extra percentage to insure their honest fulfilment of their contracts than do the older firms to whom I have alluded. But, on the other hand, there is a large class of men who commence a speculative career as shipbuilders as the result of all sorts of accidents. A temporary depression in the trade brings into the market many old-established yards. Men with capital ready to invest are scarce at such times, and, anxious to escape from the risks and anxieties of work which is proving unremunerative, the sellers are glad to accept any offer which affords some chance of speedy release. So a lot of mushroom men swell the ranks of the profession, whose impecuniosity floods the discount market, their bills flying in all directions as they seek to tide over their responsibilities between instalment and instalment. It is to such as these that the clause in their contracts, "to be built under Lloyd's special survey," seems to be a bugbear. There is no getting over the searching scrutiny and professional acumen of the surveyors of that institution, who, I willingly bear my testimony, are, as a class, entirely free from any imputation of accepting considerations for passing inferior work. No opportunity exists, under their close inspection, for "scamped" work. *Ab initio* every angle, bar, and plate is rigidly tested by them, and stamped with the survey mark—until it has received which, not a pound of metal is allowed to be built into the structure.

On the other hand, I would submit that, with such power of rejection and of hampering the progress of contracts—the non-completion of which up to date may entail heavy daily demurrage—there is, perhaps, a tendency for the gentlemen appointed by Lloyd's to become little autocrats in their way. We are not all blessed with serene tempers, even at the best of times. I have known even a Lloyd's surveyor look somewhat surly and cross when he has been long standing in a cold easterly wind, and feeling that keenness of appetite for the, perhaps, long-deferred meal which that sharp appetiser developes. Even the most indulgent of men—not to say surveyors—may be pardoned for a little extra snappishness at such times; and woe betide the unlucky wight who happens at those moments to tread upon the moral corns of the official. In the course of their duty the inspectors do sometimes make mistakes, and an appeal laid to the central authority occasionally, though not often, reverses their judgment. Let no reference be made to such reversal when circumstances such as I have referred to are in conjunction. I suggested to a builder only the other day to point out to one of these gentlemen where I thought his decision had been incorrect. "No, thank you," was the reply; "perhaps you won't object to naming it to him yourself. Why, I spoke in jest to him the other day relative to a matter in dispute, in which Lloyd's had decided against his dictum, and, *presto!* he rejected a dozen bars without even giving me the satisfaction of an explanation."

So it appears there are two sides to this, as to every other question, and it may be that some of the younger builders, whose names as yet do not carry that weight at the Central Board that those of some of the magnates of the profession do, are somewhat exposed to hasty treatment. There are great difficulties in the way of successful appeal; for the higher authorities naturally, and rightly, wish to support their subordinates to the utmost in the performance of a most responsible duty, on the faithful fulfilment of which depends the credit of the owner and the safety of those numerous lives entrusted to the efficiency of his ship. And so your new beginner, your aspirant for success in these days of keen competition, has to bite his nether lip and swallow down the rising objection, when a man of greater importance and more assured reputation would refuse to be finally bound by the decision of the subordinate. In such cases, therefore, it may be that Lloyd's special survey really constitutes an element almost demanding some insurance against the expense which the caprice or ill-temper of an official may bring about. But while admitting this possibility, and that there may exist grounds for complaints recently under my notice, as to undue interference and strictness, I still stick to my text, that the honest builder, as a rule, will rather rejoice in the closeness of the supervision which guarantees and witnesses the perfection of his work, than find in it a source of grumbling and complaint as to the extra expenditure that supervision—according to the ideas of a man whose principles are more lax—puts him to.

There can be no doubt but that on the whole this system of special survey works admirably. It assures to the merchant abroad, who, through his English agent, desires to purchase a vessel, the highest possible guarantee for thoroughly sound material and perfect workmanship. Let but the fee be paid, and the purchaser may sleep soundly in the consciousness that not a scrap of material, not a single rivet, is being put into his vessel which has not been scrutinised by the lynx-eye of a thoroughly trained and reliable expert, a man who would be ruined in his profession were it once even hinted of him that he had the "itching palm." It is not within my knowledge, after a good many years of connection with shipbuilding, that I have ever heard so unsavory a rumour attaching to any individual occupying the highly respectable position of a Lloyd's surveyor. The greatest care is exercised in their selection, and their prospects in life depend upon their exercising their functions, not only with strictness and fidelity, but with the utmost possible courtesy, a quality which, although, as I have said it may be occasionally disturbed by untoward conditions, I have always found to be, with but few exceptions, an attribute of those gentlemen.

These remarks, which have been induced by recent experience of my own, may be extended from the subordinate to the chiefs, and it has occurred to me lately—even while my own interests have been entirely on the side of the utmost strictness which can be practised by the former—to query to some extent whether Lloyds' rules are not a little too strictly defined; whether, indeed, without affecting the safety of the interests that institution so carefully guards, some more elasticity in decision might not only be allowed to its surveyors but absolutely enjoined upon them. Thus, in a late instance known to me, one of those gentlemen refused to pass a number of steel angles supplied by a first-class firm which fell short by $\frac{1}{16}$in. of the required scantling on one face. "Would it not," the builder urged, "suffice if, considering the very small divergence from the Draconian measurement, the weight per foot was up to the required standard?" "Certainly not," was the reply; a reply without appeal, for the decision was within the letter of the law if not up to its spirit. That decision cost the unfortunate builder some weeks of demurrage, probably, and yet there could be little doubt but that the rejected bars were quite up to the required strength of the fuller dimensions. Then, again, as to a testing case under my own observation. Lloyd's rules for tensile strain of steel plates, angles, and bulbs specify not less than 27 tons or more than 31 tons per square inch of section, and that there should be an elongation of 16 per cent. in every length of 8in. tested before fracture. I recently saw as fine a lot of steel as I could desire to work up rejected because the strain was 31¼ tons before fracture. Fortunately for the builder, the surveyor's conscience permitted of this slight excess; but—had that east wind, and that abnormal condition of the digestive powers prevailed—it might not have proved so elastic, although the elongation of the material was more than up to standard. I would submit that in these and similar cases a latitude of judgment might be permitted to men of the stamp of Lloyd's surveyors, without its exercise laying them open to a possible charge of laxity in the performance of their duty.

Permit me one further word before concluding these remarks on contracts under Lloyd's regulations, on a subject which the recent loss of the Teuton makes of importance. Weight of evidence demonstrates that that vessel sank from the bulkheads giving way. Now, Lloyd's rules provide ample strength for the pressure of a column of water equal to the depth of the ship, and far in excess of it in the case of the collision bulkhead; but how about the additional strain brought to bear, when to that pressure is added that caused by the attempt to steam full speed ahead, as did the Teuton in the hope of reaching a port of safety? In the case of that unfortunate vessel, it was evident such a margin was not provided, and it certainly seems to me that the incident calls for close examination into the sufficiency of present provisions against the recurrence of a similar contingency.

F. A.

London, December 21st.

RAILWAY MATTERS.

THERE are thirty-two miles of tramway in active and paying operation in Sydney, New South Wales.

AN electric head light has been fixed on a locomotive on the Northern of France Railway, the current being, it is said, generated by the engine.

ON the lines of the six great French railway companies there were, in the period from 1868 to 1877, 773 accidents, by which 218 persons were killed and 2158 injured. In 1871 there were no less than 155 accidents causing death or injury; in 1873 there was not one, at least according to published statistics.

THE Fontaine locomotive, with the driving wheels in the air, is being sat upon in America. The *Scientific American* says that Fontaine's arrangement secures "a reinforcement of power equal to nearly 80 per cent." The *Railroad Gazette* has very unfavourably criticised this monstrosity in locomotives, and the *Scientific American* thinks the *Gazette* is unkind in showing up the fallacy in the thing.

A LARGE portion of the new contract for the supply of locomotive coal for the North-Eastern Railway Company has been obtained by the owners of several of the leading thick-seam collieries in South Yorkshire. The contract, which is for twelve months from the 1st of January next, is said to have been given at 6d. per ton of 20 cwt. more than is paid for the present year's supply.

THE total capital embarked in railways in India at the close of last year was upwards of £129,000,000, The net receipts were £4 11s. per cent. upon the capital, as compared with £4 7s. in 1879. The guaranteed lines, including the East India, yielded 5·43 and the State lines 2 per cent. The gross receipts derived from the railways of all kinds amounted to £12,099,593, while the gross expenses were £6,192,171.

THE American papers are describing experiments on the Second Avenue Elevated Railroad with what is there known as the Hardie compressed air locomotive. The principal feature of the engine is said to be that the compressed air is heated to about 240 deg. Fah. previous to going to the two cylinders It would thus seem that its principal feature is one of the chief features of the Beaumont engine, but since it has gone across the prodigious dampness it has become Hardie.

THIS winter two new State lines are to be commenced in India, both as protective works against famine. The first is the metre gauge line, from Rewari—on the Rajpootana Railway—and extending to Hissar. It will be carried on ultimately to Ferozepore, and when finished will greatly shorten the communications between the Punjab and Bombay. The second line, also of the metre gauge, will connect Bellary with Goa and the Murmagao Railway, and will have a branch from Gadac to Sholapore, on the Great Indian Peninsula line.

SURVEYS are shortly to be commenced of the three alternative routes between Calcutta and Nandgaon, the present terminus of the Nagpore-Chatisgarh Railway, and the long-talked-of direct Calcutta and Bombay Railway may shortly become an accomplished fact. Another survey party will examine the country between Mymensing and Gowhatty, in Assam. The country north of the Ganges, from a point opposite Patna to Baraitch through Goruckpore, is also to be explored, and it is rumoured that if the Government decides on a railway there, its construction will be entrusted to private enterprise. There is also talk, says *The Colonies and India*, of surveying for a line to connect Bundelcund with the Central Provinces system.

A FEW days ago a narrow escape from death occurred at Thirsk Junction. The Hartlepool train, which is due at the junction about three in the afternoon, had just shut off steam after leaving the ticket platform at the north end of the junction, and was running into the station, when a porter ran out of the porter's room, and, crossing the lines, attempted to get on to the platform on the eastern side, the ascent from the four-foot on to the platform being about 4ft. high. He missed his step, and fell back on to the line on which the train was running. Metcalfe, the driver, observing him in danger whistled, but the young man again attempted a second time to leap on to the platform; the driver immediately applied his continuous Westinghouse brake, and succeeded in bringing his train to a standstill within about a yard of the porter as he was climbing on to the platform.

THE accident which occurred on the 16th ult. at the entrance of Liverpool-street station, when as a train from Enfield was passing over a set of facing points about 320 yards from the buffer-stops, the brake carriage next the engine left the rails, became separated from the engine, and after running about 110 yards turned partially over on its right side, and injured seven passengers, was caused by the want of proper packing under a new joint sleeper which had been put in to replace an old one which required renewal. Major-General Hutchinson in his report says it was a most injudicious thing to have attempted without imperative necessity to take out and replace an important sleeper during a busy part of the day in a station such as Liverpool-street, and to have done this without giving any warning to approaching trains was a very careless act on the part of the ganger. The guard applied Barker's hydraulic brake, and this, no doubt, was useful in preventing the front carriages from running into each other when the speed was suddenly checked by the brake carriage falling over on its side.

A NUMBER of measurements were recently taken by Herr Fischer on locomotives of the Hanover and Bremen Railway, with, the *Railroad Gazette* says, a view to ascertaining the efficiency of the combustion of the fuel. The gases were drawn off at different times from between the plate over the fire-tubes and the steam outlet above; they were conducted through a rubber tube to a gas apparatus in a wagon behind the tender. A graphite thermometer gave the temperature under the steam outlet. The fuel was coal. Putting aside those samples that were taken while the door was open on account of excessive steam, the smoke-gases during one journey are shown to contain about 12 per cent. carbonic acid, at a temperature of 300 deg. to 350 deg. When the locomotive was standing still, the CO_2 increased to 17·5 per cent., owing to less draught; the oxygen disappeared almost wholly, and there was some carbonic oxide, while the temperature fell to 250 deg. Similar figures were obtained on other trips. There was never more than 2·1 per cent. of unburnt gas. Considering the disadvantageous condition of working locomotives as compared with stationary boilers, the results are regarded as highly favourable. The table shows that on one journey only 15 to 20 per cent. of the entire heat was lost through the chimney, whereas, with stationary boilers, twice as much is often so lost.

THE dispute between the Taff Vale and Great Western Companies has been somewhat modified in character. The Great Western Company constructed a length of 400 yards between its line and that of the Taff Vale Company for the convenience of mineral traffic. This the Taff Vale Company wished to use also for passenger traffic, at a fair remuneration, but were denied, except on terms which the Taff Vale Company held to be excessive. The question was finally brought before the Railway Commissioners, who decided that the public convenience necessitated the use of the junction by the Taff Vale Company. The Great Western Company has in effect questioned the right of the Commissioners to force another line upon them contrary to their wishes, and a local train sent by the Taff Vale Company was stopped. Another hearing followed, when the decision was again insisted upon, and penalties enacted after a certain period. This week the Taff Vale Company sent another trial train from their line to that of the Great Western, and this was permitted to run into the Great Western station, but the through ticket from the Taff Vale to Newport was not recognised, and the names of the persons tendering were taken, in order that they might be summoned. The Taff Vale carriages now run three times a day into the Great Western, but the dispute can scarcely be said to be ended.

NOTES AND MEMORANDA.

SOME French polish reviver is made of—pale linseed oil, 2 pints; strong distilled vinegar, ½ pint; spirit of turpentine, ¼ pint; muriatic acid, 1 oz.

A DYNAMO-ELECTRIC machine has been designed by Dr. Paget Higgs in which the armature is almost completely encircled by tubular ring magnets.

THE dome of the Palais de Justice, Brussels, now approaching completion, is to be constructed of *papier maché*, the weight of which will be about 16 tons.

A SATURATED solution of sulphate of copper in water is recommended as the cheapest and best thing for writing on zinc labels. The writing should be done either with a hard wood stile, or with a blunt quill pen.

ORDINARY American railway cars weigh as follows:—a sleeping car of the usual pattern, about 66,990lb.; a drawing room car, 63,900 lb.; a passenger car, 55ft. long, 42in. wheels, and four wheel trucks, weighs 45,310 lb.

OZOKERITE when refined is possessed of the same essential qualities as beeswax, it fuses at between 60 deg. and 70 deg. It will melt with any proportion of paraffine, stearine, beeswax, and vegetable wax, and under proper treatment it is suited for almost all articles usually made of wax.

IN a paper recently read before the Académie des Sciences on the variations of the resistance of electric machines with their velocity, by M. Lacoine, the author shows reason for thinking these variations are explained by those of contact between the movable commutator and the springs in friction.

THE following is said to make a good varnish for labels. It dries in a few seconds, and produces a colourless, smooth, and shining coat: Sandrac, 53 parts; mastic, 20 parts; camphor, 1 part; oil of lavender, 8 parts; Venice turpentine, 4 parts; ether, 6 parts; alcohol, 40 parts. The ingredients must be macerated for weeks, until everything is dissolved.

A PAPER has been printed in the *Comptes Rendus* on the combination of hydrogen with oxygen under the influence of electric currents, by MM. Deherain and Maquenne. The state of humidity of the surfaces between which the current is produced greatly affects the nature of the discharge, both as to external aspect and to its action on the gases.

DR. PHIPSON recently communicated to the Académie des Sciences, Paris, a note expressing his belief that commercial zinc generally contains some small proportion of another metallic element, for which the author proposes the term *actinium* to characterise its curious actinic phenomena. Precipitating the metal with sulphide of barium, washing, drying, and calcining, a white sulphide of zinc is obtained, which, under the influence of the direct solar rays, changes in about thirty minutes to a slate colour, but returns to the original white if kept again in darkness, but with free access of air. The phenomenon does not occur, the *Chemist and Druggist* says, however, if the solar rays pass through glass.

AT the last meeting of the South Staffordshire Mill and Forge Managers' Association, a paper on "Rolling-mill Speeds" was read by Mr. G. B. Wright, of Walsall. Experiments and calculations seemed to point to the best speed for forge rolls for billets being 315 per minute, by 20in. rolls running at 60 revolutions; bars up to 4in., 260ft. per minute, by 20in. rolls at 50 revolutions; bars up to 12in., 230ft. per minute, by 22in. rolls at 40 revolutions; bars up to 18in., 172ft., by 22in. rolls at 30 revolutions. All these speeds were for ordinary draughts. A discussion took place as to whether or not increased speed would not injure the quality of the famous Staffordshire bars, but the objection was met by a recommendation of the use of the light draught.

AN article recently appeared in a German paper on the effect of colour of green bottles on liquors, in which it was stated that liquors contained in colourless bottles, when exposed for some time to the light, acquire a disagreeable taste, notwithstanding the fact that they may have been of superior quality before being so treated; liquors contained in brown or green bottles, however, remain unchanged in quality, even if exposed to direct sunlight. This phenomenon has not received proper attention heretofore, and quality has often been sacrificed for the sake of outward appearance. Since the results of the above treatment are due to the chemical action of light, it is advisable to use red, orange, yellow, green, or opaque bottles for the preservation of liquors, while colourless, blue and violet ones should be entirely discarded.

THE phenomena of the bursting of bubbles has recently occupied the attention of M. Plateau. When a bubble bursts it disappears almost instantaneously, leaving behind it a multitude of small liquid drops. The order of the phenomena is described as follows: The bubble begins to burst at one point, the film rolling away in a circle around the opening, and its edge becoming a rapidly-enlarging liquid ring. This ring draws itself together into segmental portions, which ultimately become small spherules. At the same time the contraction of the rest of the bubble causes a rush of air through the aperture, and blows off the spherules into the air with a kind of small explosion. The phenomena are best observed by blowing a bubble of glyceric solution upon an iron-wire ring, and then bursting it at the top by touching it with a needle whose point has been dipped in oil.

AT the meeting of the Chemical Society on the 15th inst., Mr. V. H. Vetey read a paper "On Some Higher Oxides of Manganese and their Hydrates." The author prepared pure oxides of manganese containing less than 1 per 1000 of potassium and 1 per 6800 of calcium. He heated the higher oxides in currents of nitrogen and in pure hydrogen, estimating the water evolved and the loss of weight of the oxide. The temperatures used varied between 80 to 200; a few experiments were made at higher temperatures. At certain points in the thermometric scale the manganese compound remained unaltered on continued heating at that temperature. On this ground the author concludes that a definite oxide or hydrate was formed. On raising the temperature a further loss of water or oxygen takes place, until another point in the thermometric scale is reached, at which the manganese compound again remains unaltered on continued heating at that temperature. The author concludes that another definite oxide or hydrate is formed, and so on. The author determined the specific gravity of some of these oxides. He concludes with some theoretical discussion as to the probability of the metallic oxides having formulæ much more complicated than those usually assigned to them.

A REMARKABLE instance of injury from lightning, on an estate near Geneva, is recorded by M. Colladon. The lightning first struck a tall poplar standing near an iron-wire fence; thence the fluid passed to an elm standing close to the fence on the other side, damaged three main branches of this, and wounded the trunk on the fence side, down to a point opposite the top wire of the fence. The course was then along this wire, but only, it appears, in one direction, viz., towards an iron gate a little way off, under which passed the pipe which supplied gas to the house. The wire, a double one, was fused in some parts. After damaging the gate the current, *Nature* says, found its way to the gaspipe—making a hole in the ground—and passed along this to the house, injuring no part of the pipe system of that, but only a piece of ornamental rose work containing iron wire in the ceiling of the drawing-room over the lustre. Thence it passed to earth by the iron pipes and wires on a balcony outside the room. Several bushes near the poplar and fence were affected—coloured brown—and the plate on the collar of a dog which was attached to a wire between two shrubs, and had been heard to howl at the time, had disappeared. The extended character of the discharge and the influenee of wires seem to be salient points in this case. M. Colladon advises making the parts of telegraphic or telephonic wires that pass near a house double or triple the mean thickness, so as to diminish the chances of lateral discharge.

MISCELLANEA.

THE vicar of Dudley contemplates the use of the electric light in the parish church.

THE second 80-ton gun for the turret has been successfully landed at the Admiralty Pier, Dover.

THE business of the Ladies' Tracing Office will, on and after the 27th instant, be carried on at No. 8, Great Queen-street, Westminster.

MRS. HENRIETTA VANSITTART has taken honours at the three colonial exhibitions for the Lowe-Vansittart propeller, and a first award of merit and a gold medal were awarded her by the jury at Adelaide.

IT is announced that a new shipyard is about to be commenced upon the Tees. This has, no doubt, been prompted by the success which has attended the only shipyard existing at Middlesbrough, and where 25,000 tons of shipping have been made during the present year.

WE learn from New York that the performance of the new Cunard steamship Servia was eminently satisfactory; engines perfect, and ship never stopped during the entire voyage. Notwithstanding the gales which prevailed and terrific sea, she sustained no damage throughout the passage, and on one day ran 406 miles.

IT is stated that Messrs. B. Samuelson and Co., of Middlesbrough, have decided to institute the selling of pig iron by auction, instead of, as usual, in the market, either fortnightly or monthly, as circumstances may suit. The *Iron Trade Review* remarks that this is the method adopted with various staple industries in England, but would be quite a new step as to pig iron.

THE journal of the British Society of Mining Students, Chesterfield, for December 1881, and January, 1882, just published, contains an able and useful paper on "The Forest of Dean Coal Field," by H. R. Insole and C. E. Bunning. It describes the geological features and formations, ores, methods of working, production, and the number, description, and time of working of the engines at the various collieries, the number and kind of pumps and boilers, and concludes with a glossary of the terms used in the coal field.

WE are informed that Sir William Palliser is of opinion, from his many tests to destruction of his converted guns, that the injury to a Spanish gun reported in our last impression was caused by a very violent pressure set up in the bore, bulging the tube so much as to crack the casing above and below longitudinally, and thus, as usual when this happens, according to his experience, separating the body of the gun from the breech, the latter being blown to the rear. Sir William has written to the Spanish Minister in London to ask that full information may be afforded to him on the subject.

THE Trinity steamer Hercules has left Plymouth for London, having completed the work at Eddystone tower for the season. She will return in January to fix a temporary light in the new tower for use until the new light is ready, when it will be formally inaugurated by the Prince and Princess of Wales, and the Duke and Duchess of Edinburgh, the Duke being Master of Trinity House. Amongst lighthouses the new one has the distinction of being the most rapidly built. The fury of the recent gales was such that the old tower was repeatedly buried, and shook considerably under the strain. The waves rose perhaps 60ft. above the tower; even the top of the new tower was reached, and the lantern windows washed by the sea.

A VERY heavy fire caused considerable destruction last Friday in the works of Messrs. John Fowler and Co., of Leeds. About 400 men will be thrown out of work until the destroyed buildings are re-constructed. Messrs. Fowler and Co. telegraphed to Messrs. Hammond and Co., of London, to run their electric light wires over the ruins, so as to enable them to clear away the *débris* by night as well as by day. Within forty-eight hours of the fire the ruins were illuminated. A double gang of men is now at work clearing the ruins, and the light will be used until the whole of the workshops are rebuilt. Where a fire is causing serious inconvenience by stoppage of business or rent—items often not covered by insurance—the electric light is evidently likely to find additional employment.

A WRITTEN copy of *Progress*, an embossed magazine for the blind, has been sent us, with a sample of the embossed printing used. This magazine was started in April last, and has appeared monthly since then. It is published by the British and Foreign Blind Association for Promoting the Education and Employment of the Blind, 33, Cambridge-square, London, W., and is edited by Dr. T. R. Armitage, the hon. sec. of that association. It is in the Braille type, which is a character consisting of raised points, now used very largely by the blind in most civilised countries. The paper on which the magazine is printed is embossed on both sides from stereotype plates, prepared by the blind themselves; which method of printing has been for some time adopted in all the works, musical as well as literary, published by the Association.

THERE has lately been quite a famine in the Cleveland district in the matter of Bilbao hematite ore. Several furnaces have in consequence been put upon slack blast, and in some cases have been charged with Cleveland iron-stone instead. The reason for this scarcity is that many ore steamers were detained by the stormy weather which has recently prevailed, and when that difficulty was ended, the neap tides which had set in prevented their egress from Bilbao. The same succession of unfavourable conditions happened twice over, which was certainly extremely unfortunate. Subsequently two large steamers got upon the "Saltscar rocks" at Redcar, and it was only after a third of their cargoes had in either case been thrown overboard that they were got off.

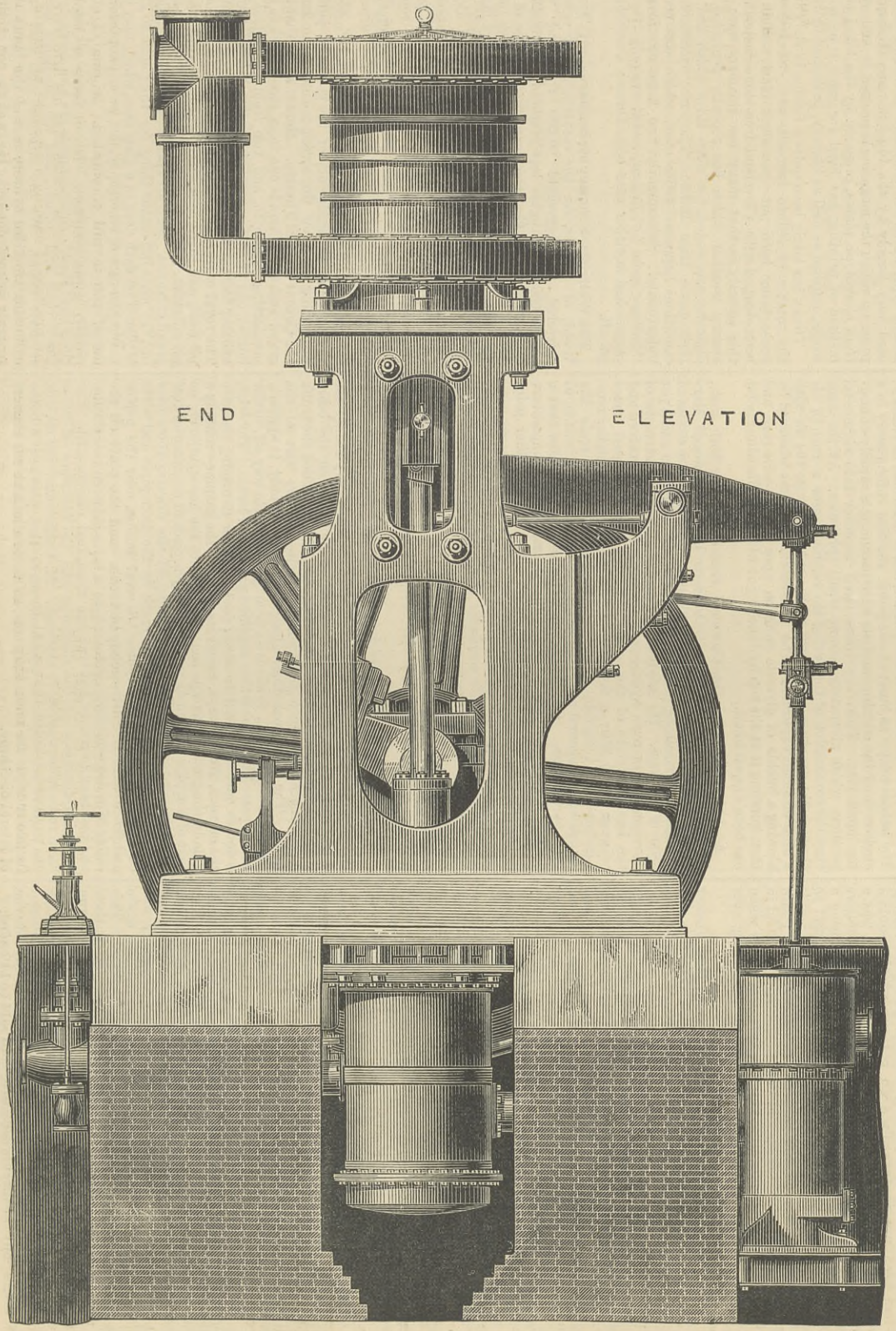
THE White Star Company has contracted with Messrs. Harland and Wolff, of Belfast, for the construction of vessels which, when delivered, will aggregate 60,000 tons and will cost nearly £2,500,000. In August last Harland and Wolff turned over to Ismay, Imrie and Co., the managing owners of the White Star Line, a new steel steamship, the Arabic, which has since arrived at this port, and the Coptic, which was delivered last month. Among the vessels contracted for is a sailing ship which, when completed, will be the largest sailing vessel in the world. Ismay, Imrie, and Co. have already expended £2,000,000 on steamships built in the yard of Harland and Wolff previous to the present year. An American paper says, somewhat regretfully, "some time ago these noted builders were looking for a shipbuilding site on the Delaware river." The American policy has probably since made them glad they did not find one.

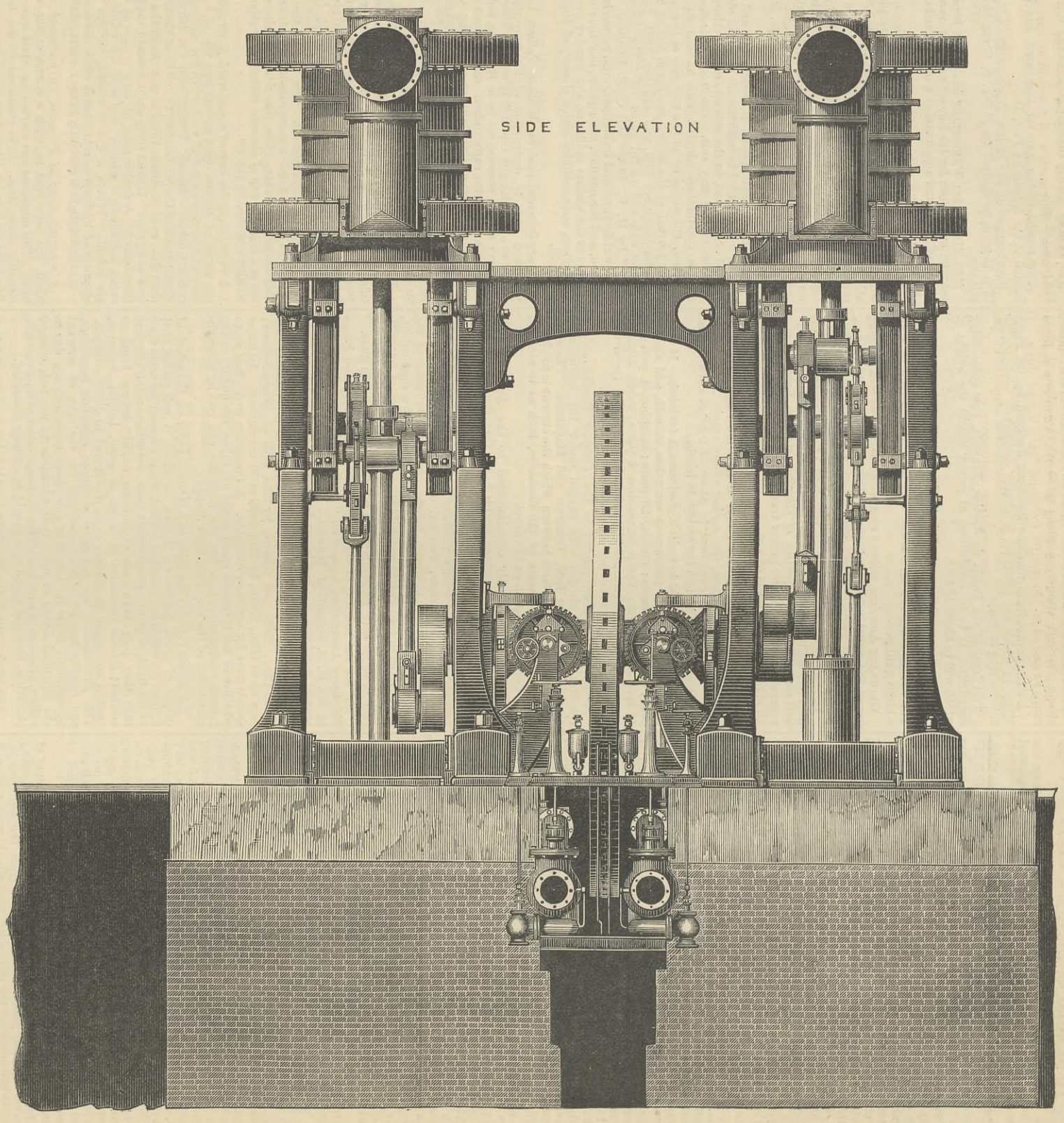
SINCE the Ring Theatre fire it has become necessary to reassure the public of the sufficiency of the means of public exit; and it is interesting to know the arrangements at so large a building as the Covent Garden Theatre. Here it seems that in addition to the grand staircase, there is one from street level to the first tier communicating therewith, and two from the grand tier to the upper boxes; one from Hart-street to the gallery, communicating with another from a second door in Hart-street to amphitheatre stalls. The royal entrance is available for quick exit from the grand and pit tiers, and there is a large door in Hart-street opening into the pit entrance, giving four large passages to Hart-street, besides the grand entrance. Men are stationed to unlock all doors, if necessary, but the most important thing for the public to know is that a key is placed on each door in a glass case, which may be smashed to get the key in case of emergency, but we are not informed whether the doors open inward or outward. In case of obstruction in the streets, arrangements are made to enable all the visitors to go into the Floral Hall. Arrangements are also made for the easy exit of the *artistes* and others, and the gas-lights are supplied from separate mains. We are informed also that fire mains for fire extinction are fitted to every part of the house supplied from two separate sources, one being tanks at the top of the house.

BESSEMER BLOWING ENGINES FOR MESSRS. STEEL, TOZER, AND HAMPTON.

MESSRS. W. AND J. GALLOWAY AND SONS, MANCHESTER, ENGINEERS.

(*For description see page* 461.)





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TO CORRESPONDENTS.

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

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

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

J. C. (Newcastle-on-Tyne.)—*There was no enclosure in your letter.*

MOULDER.—*Mr. Fletcher, of Warrington, can supply you with what you want.*

R. P. DE W.—*Your communication has been received, and an account of the work will be given early next year.*

ENQUIRER.—*The pump will discharge at each stroke something less than the contents of the working barrel. By working barrel we mean that portion of the pump traversed by the piston at each stroke. In your case the stroke is 6ft., the barrel 9in. diameter. The cross sectional area of a 9in. cylinder is 63·5 square inches; this multiplied by 72, the number of inches in 6ft., gives 4572 cubic inches of water, or 2·64 cubic feet; this multiplied by ·16 gives the gallons, viz., 42·24. Allowing for leakage past the piston and valves, your pump would probably throw 35 gallons per stroke.*

A. B. (Wexford).—*We believe that the wheel cracked at the rim because the arms prevented contraction. The wheel rim is light and cooled quickly. If the boss is parted as we described, the rim can contract without being put in tension, by forcing the halves of the boss together. Theoretically the cure is not complete, because it does not provide for an all round contraction, but in practice the plan will be found quite successful. We have met with rare cases in which heavy lumps of metal united the arm with the rim. Owing to a well understood cause, these lumps were unsound, and the unsoundness extending through the rim has led to fracture.*

J. D. (Plymouth).—*We have already given particulars of The Destroyer. We reproduce some of them for your benefit here. Her length over all is 130ft.; between perpendiculars, 126ft.; beam, 12ft., depth of hold from base line to underside of deck, 11·3ft.; depth to intermediate deck, 8·6ft.; space between decks, 2·9ft.; displacement at 9ft. 6in. draft, 228 tons; area of midship section, 107 square feet; buoyancy to the inch at load line, 5050 lb. The motive power consists of two 24in. cylinders by 20in. stroke; steam pressure, 120 lb. to the square inch; two boilers, 65ft. grate surface; heating surface, 3860 square feet. The gun is breech-loading, 30ft. long and 16in. bore; weight of gun, 8 tons; weight of projectile torpedo and propelling piston, 1620 lb.; charge, 12 lb. of prismatic powder, the air space surrounding the charge thirteen times the volume of powder. The powder charge is fired by an electric fuse, the charge in the projectile torpedo being 340 lb. of gun-cotton, which is exploded by concussion.*

CAPSULE MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers inform us where we might obtain the necessary machinery for making tin capsules of the smallest kind, to work by hand-power? MERCHANTS.

Birmingham, December 15th.

SLAUGHTERHOUSE FITTINGS.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give us any information respecting the following:—What are Wilson's patent dead meat trestles used in slaughterhouses, and the name and address of the manufacturers? Also who are manufacturers of wheelbarrows with fluid manure scoop at front, and wheelbarrows with runners and tools for same, both of which are also used in slaughterhouses? MERCHANTS.

Birmingham, December 20th.

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Advertisements cannot be Inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

*** *Letters relating to Advertisements and the Publishing Department of the paper are to be addressed to the Publisher, Mr. George Leopold Riche; all other letters to be addressed to the Editor of* THE ENGINEER, 163, *Strand.*

DEATH.

On the 18th inst., at 14, Cavendish-place, GEORGE EDMUND STREET, R.A., aged 57.

THE ENGINEER.

DECEMBER 23, 1881.

THE UNITED STATES NAVY.

THE United States Navy is now, and has been for a long time, the least powerful possessed by any important nation. It would not be far from the truth if we said that for warlike purposes North America has no navy at all, and even for police, transport, and scientific purposes she has a marine force quite inadequate to the performance of its duties. Congress has for many years manifested the utmost repugnance to voting any money for expenditure on ships of war; and, as a consequence, even the few comparatively strong vessels which the United States once possessed are now more or less in a condition of ruin. In spite of this, Brother Jonathan begins to talk about meddling in South American politics; but to do this effectually he must have sound ships. It became evident long since that "something must be done," and accordingly an Advisory Board was appointed last summer, and after investigating, deliberating, and taking evidence since the 11th of July, it reported on the 7th of November to the Hon. William Hunt, secretary of the navy. The report was not made public, however, until recently. We have a copy lying before us, and its recommendations are worth notice.

The committee, as we should call it in this country, was instructed to determine: (1) The number of vessels that should now be built; (2) their class, size, and displacement; (3) the material and form of their construction; (4) the nature and size of the engines and machinery required for each; (5) the ordnance and armament necessary for each; (6) the appropriate equipment and rigging for each; (7) the internal arrangements of each, and such other details as might seem to be necessary and proper; and lastly, the probable cost of the whole of each vessel when complete and ready for service. The committee very prudently began by ascertaining what ships the United States possessed before going further; and they state that after careful investigation they found that of 61 unarmoured cruising vessels now on the navy list—torpedo vessels, dispatch vessels, tugs, and sailing vessels excluded—but 32 either are available, or can be made so at a cost low enough to warrant the expenditure. Of these 32 vessels 24 are at present in commission in the squadrons, leaving a reserve of 8 for the relief of ships requiring repair, &c., or 25 per cent. of the whole number, "while throughout the world it is recognised that, in order to keep up the strength of a wooden fleet, a reserve of 50 per cent. is necessary."

To secure this end the total number of unarmoured ships must be 70 vessels, making allowance for the fact that several of those now serviceable will not very long remain so. It will be well here to explain that the committee were not called upon to say anything concerning ironclads; concerning such ships, however, they have expressed an opinion, which may be stated here. The committee hold that Congress would not vote money enough for the construction of even a moderately strong ironclad fleet; and that ironclads are not wanted by the United States in time of peace. They also point out that any ironclads which might be laid down now would probably become obsolete by the time they were completed, and that the greatest care would have to be taken in preparing a new design to prevent this result from ensuing. But the most suggestive and interesting of all the reasons given for the non-construction of ironclads is contained in the following passage:—"Finally, no type of ironclad vessel could be developed intelligently without knowing what weight and calibre of ordnance was to form her armament. A most serious obstacle to the establishment of this element, and one that is not generally known in this country, is the positive uncertainty that at present an efficient ironclad armament could be procured otherwise than by purchase in a foreign market, which it is considered that the country would not permit. It would be decidedly inadvisable to arm any ironclad that might be built with other than what is known as high powered, breech-loading ordnance, nor would calibre of less than 10in. be at all satisfactory for ironclad armament. It is a matter of great uncertainty whether the construction of an efficient, high-powered, steel, breech-loading gun of 10in. calibre could be successfully completed in this country. This is not due to any lack of skill in doing the work, but in the great hesitation of founders to accept the risk of attempting to furnish such large masses of steel of the necessary qualities, with no previous experience in the work to serve as a guide; also in the total absence of the proper appointments or plant in this country to produce the masses required. Such plants can readily be constructed, but only at such a great cost as to deter manufacturers from establishing them, since they could only be made remunerative by building heavy guns for this Government." Comment on these statements is needless. It is not often that a Government committee is so thoroughly outspoken.

The committee recommend the construction of thirty-eight unarmoured cruising vessels. These vessels are to be divided into classes according to their sea speed. The highest velocity to be attained is 15 knots in regular work, which probably means 17 knots on the measured mile. Of this type two are recommended to be built, with a displacement of 5873 tons; six should be 14-knot vessels of about 4560 tons displacement; ten should be 13-knot vessels of about 3043 tons displacement; 20 should be 10-knot vessels of about 793 tons displacement. Now it is by no means certain that the speed wanted can be got with the stated dimensions. The draught of water of all the ships is to be, for obvious reasons, comparatively small. The 10-knot boats are to draw but 9½ft.; single screws only are to be used; and the machinery is to consist of compound horizontal back-action engines of a type well known in our own Navy. The cylinders to be jacketted, the boilers to be of the English tubular type carrying 80 lb. or 90 lb. pressure. Some protection is to be secured by coals, the rest by placing the engine below the water-line. To drive a ship of nearly 6000 tons at fifteen knots in rough weather, will require at least 6000 indicated horse-power. It is necessary that a cruiser shall be able to keep the sea for a long time, but 6000 indicated horse-power cannot be had for less than 120 tons per day. It is not easy to see how a ship of the stated dimensions could carry more than 1000 tons of coal, or enough for a little over eight days' steaming. Of course the ship will not always steam at full speed, but the committee attach so much importance to speed—and the coast line of the United States is so vast, that it is prudent to provide for long high speed voyages—that we take them at their word and express a doubt that what they want can be obtained. To produce a 14-knot ship of 4500 tons is a much easier task. Less than 4000-horse power ought certainly suffice to give her the requisite speed, and her consumption would not exceed about 85 tons per day, or for eight days 680 tons. But such a ship would as easily carry 1000 tons as the bigger vessel, because the smaller speed would render it practicable to use engines and boilers of much less space and weight. It is, however, not to be forgotten that either of these types will give the United States cruisers as large as the largest of our great American liners, and very nearly as fast as all but a few of those most recently built. Eight vessels of the kind will constitute a powerful fleet, which would effectually demolish the ocean trade of such a nation as England, unless a stop was very quickly put to their proceedings. The smaller vessels are in every way of less importance, and would play but an insignificant part if a war broke out although they will no doubt prove very serviceable in time of peace. The ten knots boats are to be built of American timber, but the committee recommend that all the others shall be constructed of steel, and this notwithstanding "the greater cost of steel as a shipbuilding material, the lack of experience in the manufacture of steel frames in this country, and the experimental stage that steel shipbuilding is still passing through in Europe." Briefly stated, the reasons given for adopting steel are—(1) the great saving realised in weight of hull; (2) the increased strength of hull; (3) the rapidly increasing success that attends the construction of steel hulls in Europe; (4) the certainty that steel is in the very near future to almost entirely supplant iron in the construction of vessels; (5) the impetus that such a step, taken by the Government, would give to the general development of steel manufacture in the United States; (6) the necessity that, when the ships recommended are completed, they shall in all respects be equal to, if not better, than any of their class in foreign navies; and, finally, "that for the reputation and the material advantage of the United States, it is of prime necessity that in this country, where every other industry is developing with gigantic strides, a bold and decided step should be taken to win back from Europe our former prestige as the best shipbuilders of the world."

We have not space to enter at length on the consideration of the special features of the proposed ships. It must suffice to say that it is intended that they shall have a powerful fore and aft fire; and, in order fully to attain it, it is recommended that the fifteen, fourteen, and thirteen knot classes of vessels be provided with projecting half turrets forward and aft, and recessed bow-ports, capable of permitting both head and beam fire; that the necessary arrangements be made for permitting the installation of a stern pivot-gun that shall command stern, quarter, and beam fire; that channels shall be done away with, and the old style of standing cathead be replaced by a swinging davit. The committee is of opinion that solid metal rams should not be applied to the stems of vessels, but that their bows should be strengthened for ramming. The ships are to be armed with breech-loading guns of 8in. and 6in. calibre, and at least 26 diameters long in the bore. The fifteen-knot class of vessels will carry 359 tons of armament, the fourteen-knot class 280 tons, the thirteen-knot class 161 tons, and the ten-knot class 32 tons. The ships are all to be provided with full sail power, the amount of sail surface not to be less than twenty-five times the amount of mid ship section. It is true that as the proposed ships will carry no armour, the naval architect will have a fair chance of securing desirable qualities. Yet we very much doubt if the United States or any other country can produce a full-rigged ship of 6000 tons displacement able to steam 17 knots on the measured mile, and to keep at sea for a week at 15 knots, provided with an efficient armament and a full crew, stores, and provisions. We do not say that such a ship cannot be made, but we none the less think that the committee have not quite realised the difficulties to be encountered in getting what they want. These ships cannot be long and narrow like our passenger steamers. They must have good beam, in order that they may sail well, and, as is well proved by experience in this country, it is extremely difficult to combine fast steaming with good sailing powers. We cannot see that enough has been made of coal protection, and the introduction of an iron deck, shell-proof to horizontal fire, would prove of the utmost value. As the proposals of the Advisory Board stand, each ship is liable to be sent to the bottom by a single heavy shell.

COMPETITIVE TENDERS.

IN our issue of September 30th we drew attention to some of the defects of the system of competitive tenders, and the interest thereby aroused is a sufficient proof how real these evils are felt to be. The *Contract Journal*, besides reprinting the article, has several times returned to the subject, and various correspondents have dealt with it in our columns. We feel, therefore, that no apology is needed for inviting our readers to join us in considering the question again, in the additional light thus thrown upon it. In a former article we specially referred to two crying evils in the present arrangements of competitive tenders, the first being the appointment of the engineer as sole arbitrator of every dispute that may arise between the company and the contractor; and the second, the general practice of accepting the lowest tender, quite irrespective of whether the work can possibly be done at the price or not. With regard to the first, it was suggested that some well-known engineer, not in the employ of the company, should always be named in the specification as referee; and with regard to the second, that a tenderer, whose price was obviously below the fair value of the work to be done, should be given the option of simply withdrawing it.

We are glad to find that these proposals, which were not of course put forward as original, are already acted upon in some quarters. In our issue of October 21st a civil engineer of Glasgow states that his firm have long followed the practice of naming a separate arbitrator, but with the provision that no reference is to be permitted until the contract is completed. He points out that without this

provision the contractor may delay the work indefinitely by constant appeals to the arbitrator, and also that no engineer likes to submit his work to the scrutiny of another during its progress. This provision seems very fair, and to have a direct tendency both to ward off disputes and hasten the completion of the contract. The only objection we see is that the question may turn upon some part of the work—*e.g.*, the foundations of a lock—which cannot be examined when the job is complete. In such a case, however, there should usually be no difficulty in the engineer and contractor agreeing upon a statement of the bare facts of the case, which, being signed by both, may afterwards form the foundation of the reference. If this is impossible, then the arbitrator must be called in; but he may still be asked to withhold his award until the contract is finished. The reserves under the contract must be made sufficient to cover such contingencies, for if it turned out, on the award being given, that the contractor had been overpaid already, there would probably be some difficulty in recovering the amount. These, however, are points which do not affect the principle itself, whose excellence is sufficiently shown by our correspondent's statement that, after carrying out a large number of contracts on this system, they have never yet had to resort to arbitration.

On the other point raised by us—the mode of dealing with an abnormally low tender—our correspondent's practice is much more liberal towards the mistaken tenderer than ours would be. He returns the schedule and quantities, asking him to satisfy himself that he has made no mistake, and calling his attention specially to any particularly questionable items. We had only proposed to give him a general idea of how his tender stood, as compared with his competitors, and allow him the option of withdrawing it altogether. We cannot help fearing that, if our correspondent's system was accepted, unscrupulous tenderers, anxious for business, would purposely tender far below the mark, hoping thus to obtain a footing, and then, by a judicious discovery of errors, would raise their figures to just such an amount as would carry off the contract from their more honest competitors. We hold to the view that every man should feel the penalty of his mistakes; and all we wish is—and as much for the benefit of others as himself—that he should not be mulcted to the very serious amount often involved in the carrying out of a disastrous tender. The danger we have mentioned would far outweigh, in our opinion, any slight advantage which the company might sometimes obtain on our correspondent's system, in the actual rate at which the contract is finally placed. In fact the *Contract Journal*, in a recent number, appears to take exactly the opposite view. It states that in a recent competition for certain buildings at Hull, one tender was found to be £1000 less than any of the others. It is not stated what the total amounts were, but this difference seems to have been enough to startle the authorities; and they, with a liberality rarely found in a public body, followed our correspondent's system, and allowed the tender to be amended, to an extent, as is stated, of £700. Our contemporary considers that they should have held the unfortunate man to his bargain, being doubly careful to see that the work was strictly to specification, unless, by what is somewhat curiously styled a *lapsus pennæ*, some particular item should have been omitted, in which case he might have been allowed to supply it. We cannot coincide with either view. Knowing what is known by most people of the average English builder, he is about the last man we should wish to hold to a clearly disastrous contract, however close the inspection of the work might be. On the other hand, there is nothing which an average contractor so much loves as an opportunity to amend his tender; and for that very reason such opportunities should never be given. In point of fact, when once the envelopes containing the various tenders have been opened, it is practically impossible to prevent the knowledge of their contents from leaking out, and being used unfairly to the advantage of somebody. If the authorities had simply given the man the chance of choosing whether he would do the work at the price quoted, or not do it at all, we believe they would best have consulted at once his interests and their own, whatever the ratepayers might have had to say on the matter, which would be a good deal.

We will now pass on to consider other features of the question. More than one letter, in our own and other columns, has drawn attention to the unfair practice of making the tenderer supply gratis the designs of the work he is to tender for. One case mentioned is that of the tenders for a screw dredger and hopper barges, in which the competitors had to send in full designs and estimates for no less than four different descriptions of plant, nothing being given them beyond a few leading particulars in each case. Here it is evident that the engineer would not, or could not, take the trouble to ascertain what would really suit his requirements, and therefore induced several dredging engineers to do his work for him, without even the chance of being thanked for it—the real contractor probably having the order safe in his pocket the whole time. A still worse case is that of a gasworks, from which invitations to submit designs and tenders for scrubbers, purifiers, &c., were sent out to a few selected firms. They complied, but heard nothing more, until, some weeks afterwards, tenders were advertised for the supply of scrubbers, purifiers, &c., for the same gasworks; and on examining the designs and specifications they were found merely to be copies of those which these too confiding manufacturers had previously submitted. They tendered on the basis of these, but it is hardly needful to say that some other favoured individual carried off the order. The remedy for these and similar cases, which we trust are not numerous, can only lie with the contractors themselves. So long as an idle or incompetent engineer can readily induce manufacturers to do his work for him, he is not likely to neglect the opportunity. The practice can be stopped only by the manufacturers making a stand against it, and this they can only do if they are united. Here we see once more the need and scope for a Society of Contractors, towards which it is to be hoped that some move may eventually be made.

Another point on which much discussion has taken place is the relative value of the systems of open tender, of limited tender, and private contract. The Italian Railway Commission has lately reported on this subject, after examining witnesses on all sides. Whilst preferring public tenders in the abstract, they state that in practice they present many inconveniences, especially in the fact that middlemen are thus enabled to come forward and bid for jobs which they cannot themselves carry out. These they often take at a price below their real value, trusting to the chance of sub-letting them at a small profit to some needy manufacturer. There is no doubt that this is a source of serious trouble where it exists, and that it does exist to some extent; but it would seem easy to stop it by simply insisting that every tender shall specify the name of the firm and of the works where the contract will be carried out. A more serious difficulty with open tenders, in our opinion, is the opportunity it offers for weak and speculative firms to rush in and tender in the hope of business, without knowing anything of the real character of the work. Some such firm is nearly sure to quote the lowest price, often far the lowest. If this is accepted, there is endless trouble in overseeing the execution of the work, and it is certain to be, after all, but indifferently done. Often it becomes necessary to cancel the contract altogether, and have the job completed elsewhere, to the grievous waste of time, temper, and money. If the tender, on the other hand, is declined, the speculator can seriously annoy the company by imputing partiality to it or its engineer, and thus bring discredit on the whole system, while the delay which is probably occasioned before the contract is finally settled gives room for the amending of tenders and other evils which we have already referred to. Hence, if open tender is to exist, it seems most desirable that there should be some means of excluding firms who cannot show that they are really competent to undertake the job. But between such a modified system of open tender and a system of limited tender, in which the limits are made very wide, there is scarcely any difference, and it matters little in reality which name is applied. It is such a system of limited tender which the chief Italian railways seem to prefer, and which the report referred to apparently endorses, at least for important contracts. On this system, a railway company, say, would keep a list of firms to whom invitations were to be sent when any particular class of articles was required; but the list would be a long one, and additions could be freely made to it, whenever a fresh firm was able to show that it really possessed the facilities and plant necessary for that particular kind of work. This is practically the system adopted by many of the English railway companies, and we believe it works well. It differs essentially from the system of very limited tender adopted by some public bodies, where the orders, however large and however simple of execution, are divided over two or three firms alone. Wherever an engineer evinces a preference for such an arrangement, his employers may rest tolerably assured that he has very good private reasons for doing so. How easy it is to "work the oracle" may be seen from a recent very notorious instance. A colonial Government sent a requisition to England for a large order of steel rails, to a somewhat peculiar and very light section. Their representatives at home had, we will say, four names on their list, and four only, as makers of steel rails. Of these three were firms whose capacity and reputation nobody could doubt, and who were, or had been, actual rail makers; but by a strange fatality, they had all more or less declined the light rail trade, and they were not likely to throw themselves into it again by quoting a low price for a single order. The fourth name was a country firm of engineers, quite unknown to fame, and it afterwards transpired that they had never rolled a rail in their lives, though they had often "thought of doing so." At the same time it transpired also, or was rendered probable, that among those interested in this last firm were one or two of the official representatives of the Government in question. The result may be easily imagined. The last firm obtained the contract. Being totally unable to execute it themselves, they sought the assistance of certain large and eminent makers of steel rails, who, however, were not on the official list, and when, by some unexplained accident, an invoice from these makers to the contracting firm found its way to the Government office, it was found that the rails were being delivered to the contractors at £2 a ton less than the price which the unfortunate colonists had been deluded into paying for them. The consequences may be guessed—charges, countercharges, inquiries, commissions, resignations, and the casting of a flood of light upon the mysteries of colonial extravagance.

From such a danger as this a company will be wholly free, if it is known that any respectable firm, in a good way of business, can without difficulty obtain a place on the list of contractors for any articles which the company may require, and which they are fitted to supply. There is no fear lest manufacturers should be slow to avail themselves of such opportunities; and by such means the company will secure such an amount of competition as will ensure their buying their goods at the best price, and safe from jobbery, while they will at the same time be free from the devices of the mere adventurers of trade. It must be observed, however, that our remarks apply only to stores, tools, &c., in which there is no special difficulty of construction, and where the work will be easily supervised. In special cases, such as the performanceof tidal work in harbours, the constructing of appliances for new and special cases, &c., a company will do wisely to sanction its engineer's applying to some contractor of high standing, whose qualifications and experience mark him out specially for this particular employment, and to leave to him and to the engineer very wide discretion in settling the details both of the work and the payment. It is, of course, assumed that the company have confidence in their engineer. If they have not, the remedy is in their own hands; and the sooner they make use of it the better.

NORTHERN LEAD MINING.

Probably the experience in the lead mining industry in the North of England is different to that of almost every other mining and metallurgical industry in the district in the year that is now so near its close. Most of the mining industries have recovered from the depression that set in a few years ago, so far as the quantity of the production is concerned, but they do not as yet seem to have recovered entirely the value of the output. But in lead mining, not only is the value but the volume of the production also far below that of a few years ago, in several of the districts that were amongst the most productive in the North of England. Especially does this seem the case in the great lead mining district of Weardale. There are in that district unhappy local differences that affect the industry, but that need not be indicated in detail here. It may, however, be stated that the great "W. B." mines in Weardale have in the past been amongst the most productive in the world, the output having long been from 10,000 tons to 16,000 tons yearly. But since the dulness in trade set in, it has shown itself in the most marked form in that district, and during part of a recent year the mines were for a time entirely closed. It is rumoured that such a step is now again contemplated, though the statement has not yet been officially made. Still the fact that such a rumour has arisen, and the lesser output of the last few years, is enough to illustrate the great dulness of the trade in the district, and this at a time when there is in the south-west of the kingdom a very marked increase in activity in lead mining. The Weardale mines are the property of the Ecclesiastical Commissioners, and there have been once or twice statements made that it is the question of the "dues" payable to them that is responsible for the present condition of the industry. The question is worth the consideration of those interested in the trade. The North of England has long been the largest contributor to our production of lead, and the whole nation is interested in the conditions that affect its prosperity, and possibly prevent its further growth and development.

THE ST. GOTHARD TUNNEL.

We have several times spoken of the difficulties with which M. Favre had to contend when he became contractor against much opposition for the construction of this tunnel, and of the obstructiveness by which even some members of the St. Gothard Railway Company prevented his commencement and proper progress of the work. Since the tunnel has been drawing towards completion the company has several times commenced and threatened to commence proceedings against the executors of M. Favre on account of its non-completion to date. It is, however, completed long before the company's lines are ready to work it. The tunnel company has thus gained an unenviable notoriety; yet, according to the *Times* Geneva correspondent, the company is again commencing fresh proceedings against the executors of the late Louis Favre, the contractor, for the recovery of the penalties which it alleges he has incurred by exceeding the time originally fixed for the completion of the undertaking. "The company has even gone the length of confiscating some of the securities lodged with them as caution. Considering that, inasmuch as the lines of access are not yet finished, the company is in no way injured by the delay; that the delay is due rather to its *lâches* than any fault of Favre or his representatives; and that Favre lost the whole of his fortune by the contract, this proceeding is regarded as harsh and unfair in the extreme. The press is unanimous in denouncing the conduct of the company, and there is a general demand for the intervention of the Federal Council, who are empowered to settle all disputes arising out of the construction of the tunnel, to prevent the consummation of an injustice which would dishonour the whole country." According to official figures the cost of this tunnel from first to last has been 56,808,620f., or £2,272,344.

AMERICAN LOCOMOTIVES IN AUSTRALIA.

That American locomotives are not quite all that they are represented to be by their builders seems reasonably clear. The peculiarity about the American engine is, that so long as it is at work in the United States it never gets out of order, and can haul tremendous loads at high speeds; while out of the States it is hardly so good as a common English locomotive. From a recent number of the *Australian Engineering and Building News*, we learn that in New South Wales, American engines are not quite what they ought to be. The Baldwin Company of Philadelphia has, it seems, supplied thirteen locomotives, two being passenger engines of the same dimensions as those ordinarily in use, and eleven of the eight-wheel Consolidation pattern. The latter are designed for heavy goods traffic, and in point of power are the best in the possession of the Government. The cylinders are 20in. in diameter, with a stroke of 24in.; the driving wheels being 4ft. in diameter. "In the language," says our contemporary, "of perhaps the best authority on these matters in these colonies, these American locomotives are 'short livers.' Everything seems to be made of cast iron, from wheels to steam chest domes, and wrought iron and steel are only brought into requisition where copper and brass are used in the English locomotives. Starting at the frame, we find bar iron kneed and bolted together in the most clumsy fashion to make that which John Bull makes out of solid iron. The wheels are of cast iron with steel tires, and among those which had been taken from the "cripples," were two which had cracked right through the boss. Inside the boss of almost every wheel the metal is honeycombed, and upon looking at the axle-box, we find the same lamentable state of things." We believe that some time ago a return was made to Parliament of the performance of these engines, which was not satisfactory. In a little time it will be known whether English hands cannot turn out a better American locomotive than Americans themselves. The performance of Mr. Cleminson's engines referred to in our last impression will perhaps clear up the point.

LITERATURE.

The History of Salt: with Observations on its Geographical Distribution, Geological Formation, and Medicinal and Dietetic Properties. By E. M. Boddy, F.R.C.S. London: Balliere, Tindall, and Co. 1881.

This book has the following in its introduction:—"The present age is wonderfully productive of these eccentric ideas, while at the same time it is unhappily pregnant with the most unnatural and anti-healthful habits. The mystified authors take good care to run into the wildest extremes, so that their marvellous schemes and quaint devices—fortunately for their fellow-creatures—cause them

to be justly derided by the thoughtful, and disregarded by the sensible, though not a few are caught by the tinsel. The grotesque aberrations of thought which have so prolifically generated such an incongruous medley of medico-social phantasmagoria, though considered by their promoters as wonderful scientific projections, are rendered more ridiculous than they really are by their wild and unreasonable denunciations of those who do not happen to coincide with their farcical puerilities and whimsical crudities ; and their intolerent followers, with considerably more zeal than discretion, promulgate their doctrines with voluminous additions and preposterous assertions—*mentis gratissimus error*." After this expectation is tiptoe, and we are informed, as might be expected, that, "owing to the peculiar and incomprehensible prejudices of those who labour under the false impression that they are wiser and more discriminating than others, and who became proportionately obstinate in their notions, we shall endeavour to bring forward undeniable evidence in support of our arguments, though it is possible they may neither acknowledge that they are wrong, nor admit that their preconceived ideas prevent them from arriving at an unbiased conclusion." Mr. Boddy will therefore probably think that it is owing to the "incomprehensible prejudices of those who labour under the false impression that they are wiser and more discriminating than others," and their resulting obstinacy, that readers will say they cannot understand the annexed, which follows the remark of Sir C. Lyell, that sea-water finds access to volcanic foci, and Sir Humphrey Davy's observation, that salt was deposited from Vesuvian lava. Mr. Boddy says : "But for all that, it does not prove satisfactorily that salt is solely the result of volcanic agency and indirectly from the sea, because there is not the slightest trace of the remains of marine organisms, unless they are totally destroyed and obliterated when it is in a state of fusion. If so, it is more conclusive that salt, such as we find it, is solely due to volcanic force." Further on we are informed that rock salt appears to be the result of volcanic agency ; but that "salt is not subject to geological laws, by reason of its being confined to no particular strata, and by the absence of organic remains ; and that it is not derived from sea-water, because there are no marine organisms to be found in it. That though it may have a pristine source, it has—though it may appear paradoxical—a dual inchoation, by its being found as rock salt, and by its being present in sea-water, and, as I have stated, in a condition of immaturity." When he wrote this book, Dr. Boddy seems to have forgotten that he was not amusing his infant patients.

A New Method of Graphic Statics Applied in the Construction of Wrought Iron Girders. By E. OLANDER, A.M.I.C.E. Vol I. London : E. and F. N. Spon. 1880.

THIS book is a step in the right direction, the intention of the author being to show by drawings of real girders and diagrams, the practical application of the graphic method of determining stresses as assisted by the elementary formulæ for finding strains, such as those at the centre of the top and bottom flanges. The explanation belonging to each working drawing, and the diagrams relating thereto, is given on the sheet therewith. The explanation is not, however, sufficient or clear in many instances, and there is a too general assumption that graphic statics is completely understood by those who may want a book which proposes to show their application in a practical manner. The explanation is written in a way which suggests that the author is under the impression that he has previously given a general explanation to his readers, and herein only takes it up in a more detailed fashion. Thus it is necessary for anyone who studies the book with the intention of applying the author's methods to a girder, of which an example is given, to consider here and there what the author means, and this can only be found out by those having so much previous knowledge of the subject that the book would be almost unnecessary to them. There is, moreover, much too little information given on the preliminary steps by which a designer obtains the necessary sectional areas as affected by the weight of the girder itself. In practice usually, the load to be carried, the type, and leading dimensions are given ; the strains are then taken out as for a girder of no weight ; the sectional areas are then determined and the weight follows. Having now this permanent load, the strains have to be newly determined, and the sectional areas reapportioned. Where the girders are large this process must be repeated several times. To some extent this is obviated as respects girders of the types for which working drawings are given, but it is so seldom that a girder is wanted that is identical with these in relation of dimensions to loads, that the assistance is perhaps not as great as it at first appears. To be really useful to the student, as this book proposes, the author should take one of each of the several most used types of girders, and describe every step from beginning to end of the process of finding strains and determining sectional areas, just exactly as he would describe them to an intelligent pupil with practical knowledge standing by his side, and asking the why and wherefore for everything while he performed the whole operation, or, in fact, just as he would mentally describe it to himself as he proceeded step by step. Mr. Olander's book takes a place between pure graphic statics and descriptions of executed girders, but it does not do what we have above described, and for a book that will do it there is still room, but there are few who could write it. It requires two to do this—one who knows how to obtain all the strains, and the other who has just enough of this knowledge to know that he does not know.

Mr. Olander gives tables of the sectional area of rivet holes, or rather the amount by which the sectional area of plates of various thicknesses is reduced by rivet holes of different diameters. In these tables the holes are taken as $\frac{1}{8}$in. larger than the rivet, whether the latter be 1in. in diameter or only $\frac{7}{8}$in.; or, in other words, the reduction of area for rivets of the latter size is too high by nearly 15 per cent.

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Middlesbrough and its Jubilee. A History of the Iron and Steel Industries, with Biographies of Pioneers. Edited by H. G. Reid. London : The *Gazette* Office, 62, Ludgate-hill.

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Experiments with Pressure of Gas in Solid Coal. By Lindsay Wood. Newcastle-on-Tyne : Andrew Reid.

GEORGE EDMUND STREET.

IN recording the death of Mr. George Edmund Street, R.A., we chronicle the loss of one of our greatest architects, one who has designed some of our finest pieces of modern architectural work, and who has gone from among us, at fifty-seven years of age, while his greatest work is yet unfinished. Mr. Street was born at Woodford, Essex, in 1824, and educated at the Collegiate School, Camberwell. His architectural studies were begun under Mr. Owen Carter at Winchester, and completed under the late Sir George Gilbert Scott, with whom he remained five years. Like his master, Mr. Street adopted the Gothic style in the buildings he erected, and the numerous essays and lectures which he has written upon architecture have all been directed to illustrate the history and principles, and promote the progress of that style. His principal literary efforts are "The Brick and Marble Architecture of North Italy in the Middle Ages," 1855 ; and "Some Account of Gothic Architecture in Spain," 1865. Mr. Street has for many years been largely engaged in the work of erecting and restoring churches and other ecclesiastical buildings all over the country. As a restorer he showed remarkable ability as well as educated taste, and hence he was most successfully conservative in his work of this class. Among the most prominent of his buildings may be mentioned the Cuddesden Theological College, the chapel and schoolrooms of Uppingham College, and the new churches at Bournemouth, Garden-street, Westminster ; St. Philip and St. James, Oxford ; St. John, Torquay, All Saints' Clifton ; St. Saviour, Eastbourne ; St. Margaret, Liverpool ; and St. Mary Magdalen, Paddington. Among his restorations may be noticed the churches of Eccleshall, Wantage, Uffington, in Berks, and Stone, in Kent, and Jesus College Chapel, Oxford, and lastly, but by no means least, the South transept of York Minster. He was also the architect of Lord Crawford and Balcarres's house at Dunecht. Perhaps his most considerable work in church building was the erection of the nave of Bristol Cathedral in the Early English style. He was also engaged upon the restoration of the nave and building of a new choir in Christ Church Cathedral, Dublin, and on building a new synod-house in connection with the Cathedral for the Irish Church. But in London Mr. Street's reputation will mainly rest upon the Royal Courts of Justice in the Strand, now approaching completion. He was appointed architect of this great building in 1868, after a competition in which the most famous architects of the day, including Sir Gilbert Scott and Mr. E. M. Barry, took part. Although a great deal still requires to be done before the interior of the building is finished, the outer shell is fairly complete, and the public are able to judge of the imposing effect which the Royal Courts will present as they are approached from the Strand. The French form of Gothic which has been adopted by Mr. Street in these courts is unfamiliar in England, and gives them a character of their own. It is said that he made over 1400 drawings for this structure with his own hands. Mr. Street was appointed in 1850 diocesan architect to the diocese of Oxford, and he subsequently filled similar posts in the dioceses of York, Ripon, and Winchester. He was a Fellow of the Institute of Architects, of which he has been vice-president, and a Fellow of the Society of Antiquaries, and of other societies. In 1866 he was elected an Associate of the Royal Academy, and was advanced to be a Royal Academician on June 29, 1871. He was also a member of the Imperial and Royal Academy of the Fine Arts at Vienna and a Knight of the Legion of Honour.

We believe that his remains will be laid in Westminster Abbey on Thursday next.

LIVERPOOL ENGINEERING SOCIETY.

TIDES AND TIDAL SCOUR.

AT the thirteenth meeting of the session, the second part of the paper on "Tides and Tidal Scour," by Mr. Boult—an account of which has already been published—was read by the author. In the discussion which followed the paper, Mr. A. G. Lyster observed that the two chief instances of the formation of bars occur—first, in the case of rivers highly charged with detritus, which is held in suspension so long as the velocity of the river is maintained in its natural channel, but which becomes deposited when the force of the stream is dissipated by the waters of the ocean and the opposing action of its waves ; second, where the tendency of prevailing winds is to sand up the mouth of a river, which again works for itself a passage through the opposing barrier, and eventually brings about a balance of forces which developes a so-called bar at its mouth. The action and treatment of both these instances largely depends upon the fact that water, flowing at a certain velocity, produces considerable mechanical effect, so that, in the condition described, it is capable of abrading and holding in suspension solid matter in proportion to its velocity, and when fully charged its effective or abrading powers vanish, and any subsequent diminution in its velocity is attended by a corresponding deposition. The Mississippi is a river of this class, which has been deepened by the skill and energy of Mr. James Eads, whose advice was only recognised and carried into effect after a lengthened struggle, and the execution of which was attended by complete success. This river, highly charged with detritus, terminates in three mouths or passes, and the plan of operations consisted in selecting one pass and constructing jetties on each bank, the entrance of the other passes being secured from scouring action by sills across their beds. By this means the outflow in the one pass was confined within narrower limits ; a higher velocity resulted, and the deepening of the channel took place. The jetties were so arranged as to determine the course and action of the river current at an angle with the littoral currents, the effect of which was to largely reduce the bar, and cause the detritus to be deposited to seaward, instead of forming a fresh bar further out. On the correct determination of the external or counteracting forces depends, almost entirely, the success of such a scheme. The means adopted to carry out the work were specially suited to the circumstances and locality of the undertaking. No stone was handy, but in the neighbourhood of the pass there were large fields of rushes, which were plaited into wooden frames, so as to form mattrasses ; and these were subsequently floated out and sunk in position, in a sufficient number of layers to attain the required height. After a lapse of time they became silted up, and formed a very cheap and effective form of jetty. The result accomplished by these jetties may be described as follows :—A channel was scoured throughout their length, and into deep water, of 31ft. in depth, where before there existed in places only 10ft. of water, and a removal of 7,607,151 cubic yards of material was effected. When we look at the enormous tract of country—twenty-four times the size of England—which depends on the Mississippi as the natural outlet for its trade, we shall be able to form some idea of the magnitude and importance of the result obtained. Among other interesting instances of the improvement of rivers by artificial means may be mentioned the mouth of the Danube, by Sir Charles Hartley. An entirely novel theory in this direction is that advanced by Mr. Knapp, of New York, which is now being carried into effect for the removal of the bar at Sandy Hook. On the supposition that the bar is caused by the neutralisation of the river current by the wave action in the open sea, and the consequent deposit of the detritus held in suspension, he suggests the destruction of the wave force by building an artificial bar to a convenient height for the passage of vessels. The detritus, he argues, will thus be borne forward past the bar, and carried away by the littoral currents. Without the data to criticise in detail the theory advanced, it is probable there will be a tendency for the bar to reform outside the false bar ; in addition to which, a construction of this class in deep water, and in an exposed situation, must necessarily be attended with serious difficulty and expense. The interesting phenomena offered by our own river Mersey cannot now be discussed ; but this river may be considered to come under the second class of bar formation referred to.

A vote of thanks to Mr. Boult for his able and interesting paper, and to Mr. Lyster for his remarks, was carried unanimously.

BESSEMER BLOWING ENGINES FOR MESSRS. STEEL, TOZER, AND HAMPTON.

MESSRS. W. AND J. GALLOWAY AND SONS, of the Knott Mill Ironworks, Manchester, have just completed for Messrs. Steel, Tozer, and Hampton, of Sheffield, a pair of blowing engines, which are by far the largest of the kind yet constructed for Bessemer purposes. These engines, of which we give an illustration on page 458, have steam cylinders 54in. in diameter, while the blowing tubs are 72in., with a stroke of 6ft. Since their erection at Messrs. Steel, Tozer, and Hampton's works, these engines have been blowing against a pressure of 30 lb. to the square inch. It will be seen that they are on the condensing principle, and are fitted with expansion gear adjustable by hand. The valves of the blast cylinders, we may also add, are constructed and arranged on Messrs. Galloway's well-known patent system, which has already been very extensively adopted, and which we may state has given general satisfaction.

POCOCK'S WATER METER.

THE engravings on the next page illustrate a new form of water meter which possesses several novel features. It is a positive meter, and seems in every way calculated to give accurate measurement, and to consume little or no power to work it, and from the nature of its construction, it cannot stop if water is passing through it, even though the quantity may be only a few gallons in twenty-four hours. In our illustrations Figs. 1 2, and 3, are respectively a perspective and a plain view of the valve and its mechanism, and the other figures the construction of the meter, which is as follows :—Three single acting diaphragms A A^1 A^2, impervious to water, actuate a single crank P D E, thereby working a three-way single slide valve J by means of an excentric F. B B are thrust rods from the diaphragms to the crank. C C^1 C^2 are radius rods which are hinged at one end to the meter case, and at the other to the diaphragms to ensure the parallel working of the latter. W is the worm which is driven by a stud projecting upwards from the top of the valve, and K is the index or counter. Upon entering the meter the water passes directly into the inlet or valve chamber H, and thence through the ports in the valve seating, successively into the chambers formed between the diaphragms and the meter covers, and which are the measuring chambers. By its pressure upon the diaphragms the water pushes them towards the centre, one after another, thus causing the continual rotation of the crank, which in its turn works the valve, making thereby the proper communications between the inlet chamber and the measuring chambers, and between the latter and the outlet. In the sections the crank is at a dead point in relation to the diaphragm A^1, the chamber A^1 being full of water and momentarily disconnected with both the inlet and outlet, previously to its being opened to the outlet. The chamber A is in full connection with the inlet chamber, and consequently the inlet pressure of the water is acting upon its diaphragm A, thrusting it towards the centre of the meter, and causing the crank to revolve in the direction indicated by the arrow. The chamber of A^2 is in connection with the outlet chamber, which is the central portion of the meter, and the crank is pushing the diaphragm A^2 outwards from the centre, and thereby forcing the contained water into the outlet chamber, and thence away through the outlet.

It will thus be seen that the inlet pressure only acts upon the internal walls of the chambers, and consequently only upon the inner side of the diaphragms. The diaphragms are made up of a large number of segmental brass plates hinged to and

POCOCK'S WATER METER.

FIG. 1.

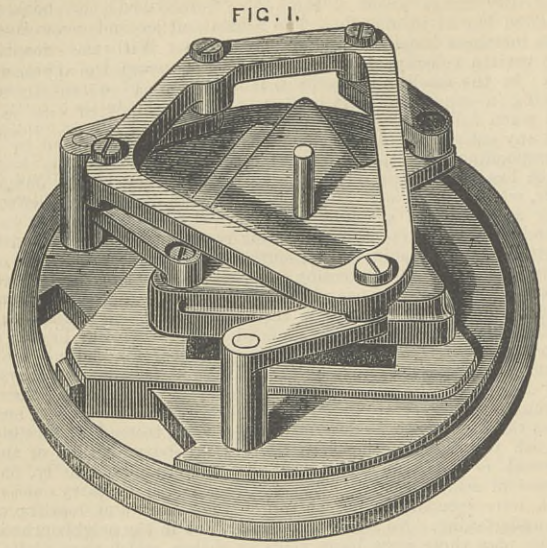


FIG. 2.

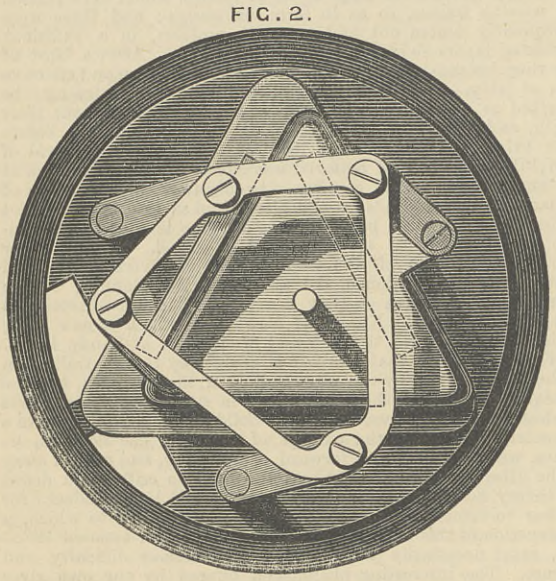
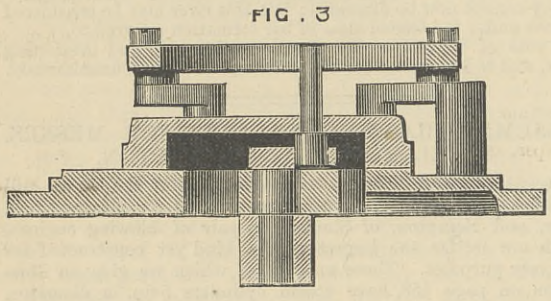
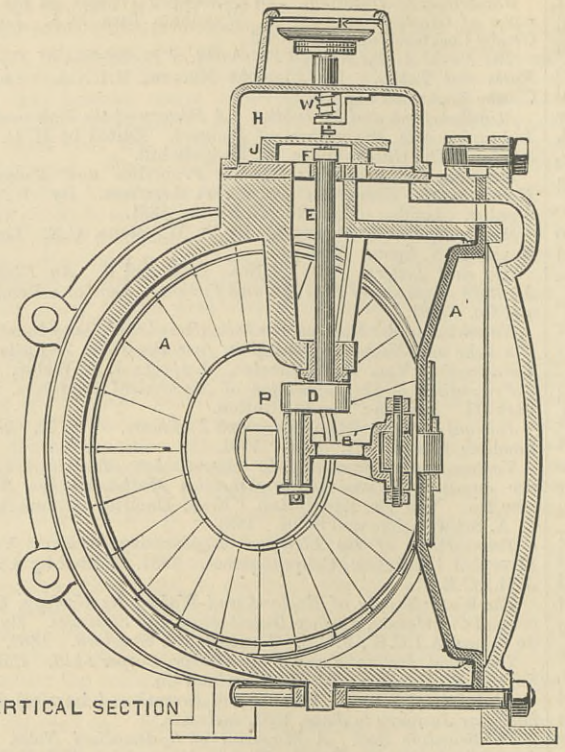
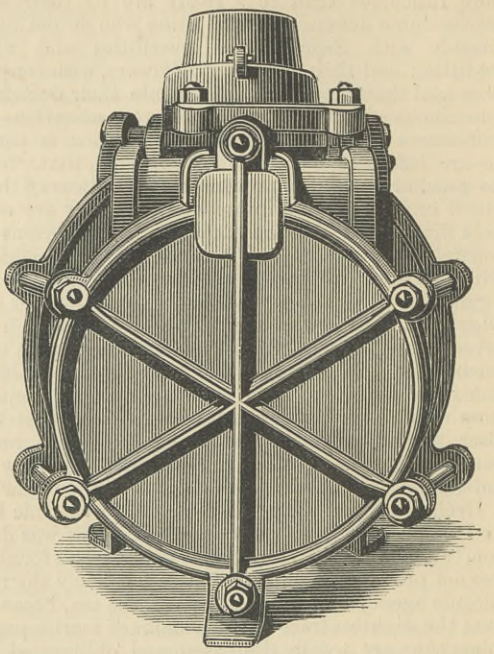


FIG. 3

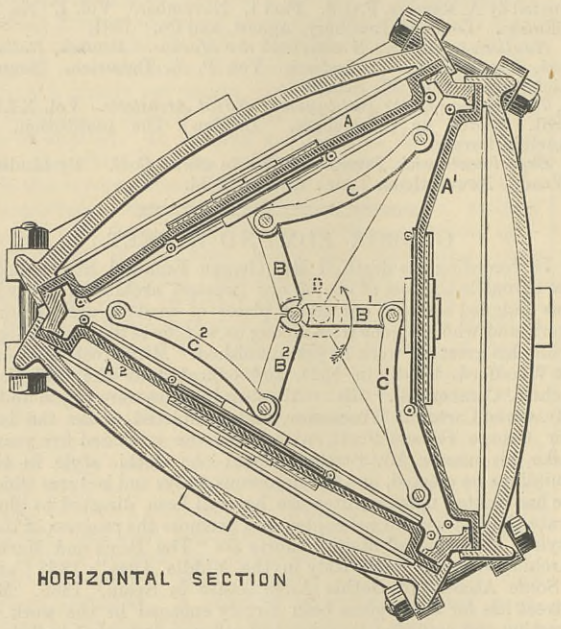




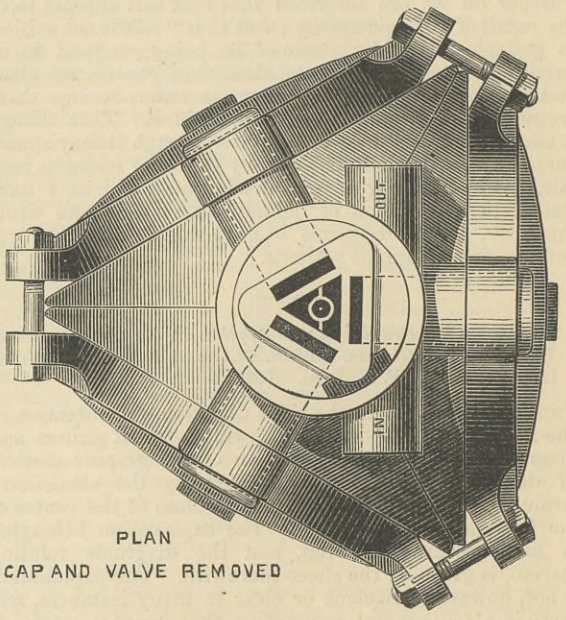
VERTICAL SECTION



ELEVATION



HORIZONTAL SECTION



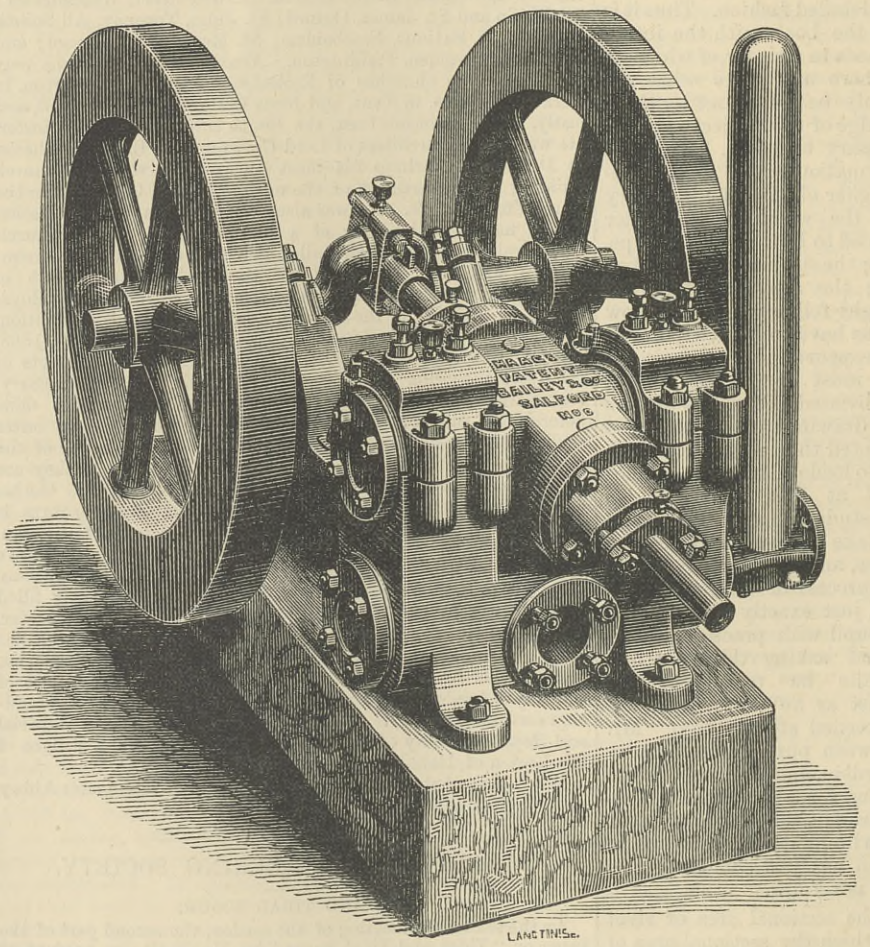
PLAN
CAP AND VALVE REMOVED

radiating from a central disc, and are lined with red vulcanised india-rubber to make them impervious to water. The whole of the working pressure, that is the difference between the inlet pressure and the outlet pressure, is thus borne by the metallic diaphragms and none whatever by the india-rubber. As the india-rubber is not subjected to strain, is protected from atmospheric deteriorating influences by being immersed in water, and as it moves but a very short distance to and fro it may be supposed to last a long time. The valve mechanism is exceedingly ingenious. Although actuated by a rotary moving part, it is a perfect three-way slide valve, the edges of the slide being kept parallel with the ports by the very simple parallel motion shown at Figs. 1, 2, and 3. The motion given to the valve tends to keep it flat, and not, as in the case of rotary valves, to wear it convex on the face on account of the greater motion at the periphery than at the centre. In the meter there are no springs, and only one stuffing-box, namely, that through which the spindle passes from the inlet chamber H to give motion to the index. This spindle, however, is ground into its socket, has a very long bearing, and only makes one revolution for the passage of sixty gallons of water. The diaphragms, though much thinner than shown, are made to withstand from 150 lb. to 200 lb. per square inch, or 350ft. to 450ft. head, though they seldom have to sustain more than a small proportion of the inlet pressure.

BAILEY'S HYDRAULIC PUMPING AND HAULING ENGINE FOR MINES.

Messrs. W. H. Bailey and Co., of the Albion Works, Salford, Manchester, have recently been successfully engaged in applying the Haag's patent water motor, of which they are the sole makers, for pumping, winding, and hauling up inclines in mines, quarries, &c. The water for driving these motors is obtained by tapping the rising main, and the exhaust water is run back to the sump, from which it is again forced back into the main by the pumping engine. Thus the pumping engine, which is generally capable of lifting considerably more water than is made by the mine under ordinary circumstances, is in reality the prime mover, the water is the transmitter, and the water motor is the converter of this surplus power into the rotary motion suitable for the above object. There can be no doubt that in mines where such surplus pumping force exists, water is the most economical medium for carrying power to the remotest parts in a mine, seeing that the duty of a pumping engine in converting fuel into power is the highest attainable by any motor, and in conjunction with Haag's motor much higher than can be obtained by compressed air; that is, with an additional ton of coal used in driving the pumping engine for the purpose of circulating the water below, as much power is obtained as with several tons expended in the compression, and the use of air as a motive power. Regarding first cost, such water power is likewise far more economical than air, the cost of the water motor averaging less than half that of an engine suitable for driving with air, whilst the outlay for an air compressor and engine to drive it is very considerably less.

Messrs. W. H. Bailey and Co. inform us that they have now supplied many of these motors, both in this country and abroad, which are giving the greatest satisfaction in every case, and range in size from 2 to 30-horse power. One of the largest size was made for Mr. Hussey Vivian for his celebrated nickel silver mines in Norway, and is used for winding and pumping; one of a similar power is used by Mr. G. N. Newdegate at his Nuneaton Colliery for hauling underground a load of 3½ tons up an incline of 400 yards, having a rise of one yard in six; another, but smaller one, has been at work for the last four years hauling coal in the Lever Edge Coal Company's mine at Bolton; whilst others are in similar uses in limestone and stone quarries. One is at the Penmaenwawr Slate Quarries, North Wales, belonging to Mr. A. Darbyshire; one at Messrs T. Dixon and Sons, of Whitehaven. These work at a water pressure ranging from less than 40 lb. to 200 lb. per square inch. The accompanying woodcut is from a photograph of a hauling engine very recently made by Messrs. W. H. Bailey and Co. for Messrs. Leonard, Boult, and Co., Easton Colliery, Bristol. This engine is for the purpose of underground hauling, and is made to work at a water pressure of about 460 lb. to the square inch. They have thus gained a varied experience, which has enabled them to still further considerably improve this motor for the above purposes. The accompanying woodcut so clearly shows the principle of this engine that further description is almost unnecessary, beyond remarking that the peculiarity mainly consists in the arrangements of the water ways, which is such as to enable these motors to run at a higher speed than any other of the type, and this, too, with an efficiency, Messrs. Bailey state of fully 86 per cent. of the theoretical power in the water. From the illustration it will be seen that the motor is in fact a horizontal oscillating engine. The cylinder oscillates on massive trunnions on an equally massive bed containing the waterway, whilst in the trunnions are formed the ports for regulating the flow of the water. There are no excentrics, rods, links, nor slides of any description; in fact, the engine has only three movable parts, viz., the piston rod, the cylinder, and the crank axle, and all these are adjustable in their bearings, and provided with means for continuous lubrication. Throughout it is a handsome and substantial design, and from its simplicity and compactness is eminently suitable for underground work.



THE VIENNA CIRCULAR RAILWAY.

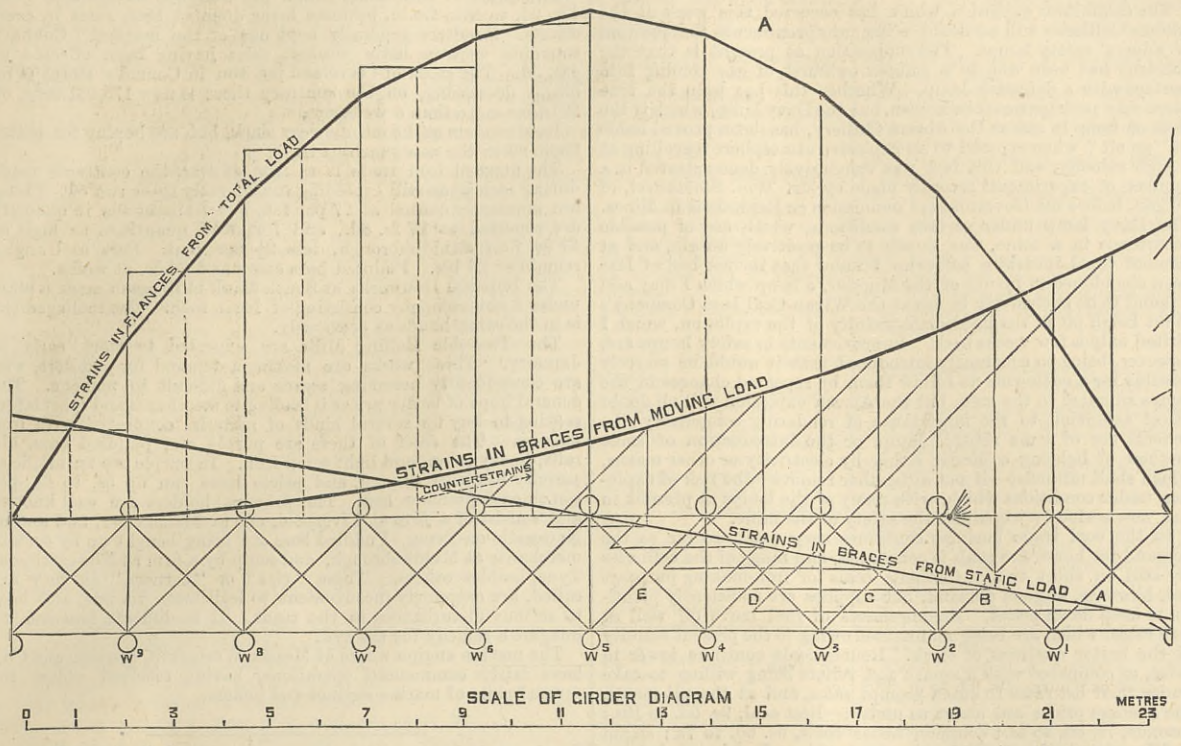
No. III.

IN our last impression, on page 436, we gave illustrations of two types of stations on the Vienna circular railroad. In a succeeding impression we shall give additional illustrations. This week we give diagrams and particulars of the girder strains. In our engravings of last week Fig. 20 is a large lateral section of the station on the Mariahilfer branch. Fig. 21 is a part sectional plan of the same. Fig. 22 is a cross section of the same. Fig. 23 is the Aspern Bridge station; and Fig. 24 is a cross section of the same.

Next to the Central Station on the Franz Josef's Quai, the Aspern Station, from its position in the city, and owing to its significance as an exchange station from the Nordbahn and Praterstrasse on one side, and from the Verbundungs Bahn, Wien Aspang Railway, Arsenal, States Railway, and Southern Railway on the other side, is the most important one on the whole line. Its juxtaposition to the Ringstrasse, Aspern Bridge, Radetzky Bridge, the Franz Josef Barracks, and the Museum of Art, require special architectural treatment, and on account of the varied traffic that will meet at this point, accommodation has been provided for its interchange without interfering with the continuous circuit of trains on the inner ring. As in the case of the ordinary elevated stations above described, the booking-offices are all on the ground floor, one at either end, respectively for the town and Leopoldstadt passengers. With the exception of the space occupied by the booking-offices, and the approaches to the staircase, the whole of the covered area underneath will be free to the public. The greater part of the structure occupies a piece of dead ground between the ordinary watercourse of the river Wien and the left bank. A quay wall will be built outside the line of the outer row of columns supporting the main girders over the river, and the space at the back filled up to the level of the Ringstrasse.

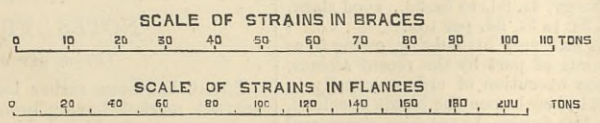
Fig. 23 shows the general elevation of the building, intended to be alike on both sides. The platforms are provided with the usual offices, and the continental indispensability, a refreshment room on either side. Arrangements have been made for station master's office and offices for porters, guards, and police. Hydraulic lifts are provided for passengers' luggage, postal arrangements, &c., as it is the intention of the Government to build the New Central Post-office in the immediate neighbourhood, and it is necessary to make provision for the intended improvements. Turntables and sidings have been provided for the emergencies of spasmodic traffic, such as is likely to occur on Sundays and holidays. Fig. 24 is a cross section of the building showing the relative position of platforms, the proposed Quay wall on the river Wien, and the style of roof intended to cover the whole station in one span.

We give in the diagrams A, B, and C, the strains on various standard girders, the particulars of which accompany the blocks.



Moments of Forces.

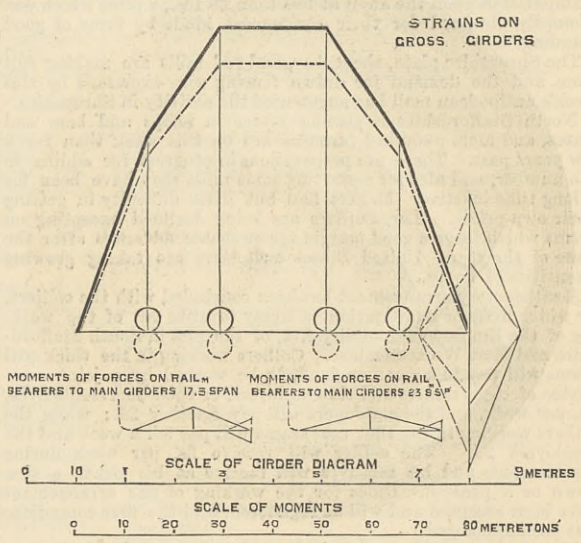
Weight.	Distance.	Moment.	Sum.
16	2·38	38·08	38·08
16	4·76	76·16	114·24
16	7·14	114·24	228·48
16	9·52	152·32	380·80
8	11·90	95·20	476·00



Moving load per metre, 4·96 × 23·8 (S) = 118 tons; static load = 42 tons; total load = 160 tons; concentrated at each apex = $\frac{160}{10}$ = 16 tons; length of girder (L) = 24·40 metres; span (S) between centres of pressure on piers = 23·80 metres; depth (D) between centres of gravity of flanges = 2·32 metres.

Strains.
= loads × secant 45° 40′.

Maxm. strain −	Maxm. strain +	Bars.
51·372	—	A
40·798	—	B
31·066	—	C
22·176	·556	D
14·127	6·920	E



The moments of forces on rail bearers are taken when one wheel of the heaviest axle is on the centre of the span of the rail bearer.

Strains on Cross Girders.

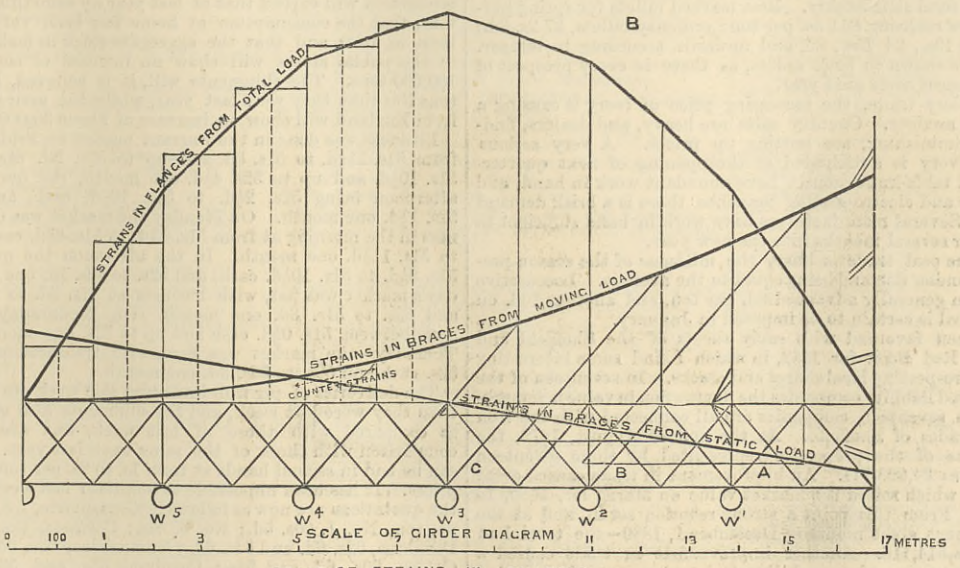
Main girders of 17·5m. span
- Loads on cross girders:
  - Load from two locomotives .. .. 50·00 tons.
  - Load from weight of structure .. .. 6·00 ,,
  - Total .. .. 56·00 ,,
  - Load concentrated at each point $\frac{5}{4}$ = 14·00 ,,
  - Length of cross girder .. .. 8·00 metres.
  - Depth of cross girder in centre .. 0·69 ,,
- Loads assumed for determining moments of forces:
  - The weights assumed for estimating the forces on the cross girders and rail bearers are those caused by a locomotive on three axles.
  - Load on first axle .. .. 12 tons.
  - Load on second axle .. .. 13 ,,
  - Load on third axle .. .. 12 ,,
  - Distance apart of centres of axles 1·4 metre.

Main girders of 23·8m. span.
- Loads on cross girders:
  - Load from two locomotives .. .. .. 44·80 tons
  - Load from weight of structure .. .. 5·00 ,,
  - Total .. .. 49·80 ,,
  - Load concentrated at each point $\frac{23·8}{4}$ = 12·45 ,,
  - Length of cross girder .. .. 8·00 metres
  - Depth of cross girder in centre .. .. 0·69 ,,

Braces in compression.

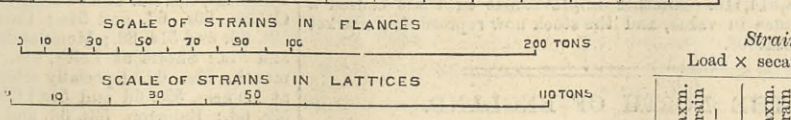
The strain on bars in compression is exactly the same in amount as that of corresponding bars in tension, but opposite in character. Therefore the table shows strains on all the inclined bars, both tensional and compressional, in one-half of the girder. The strains in the other half are obviously similar. The vertical bars receive only a strain due to half the concentrated weight ($\frac{16}{2}$ = 8 tons) passing through for distribution to the inclined braces whose apices are in top flanges.

		Tension (−). Loads on braces in tension.						Compression (+).			Maxm. load −	Max. load +	Sum when fully loaded.
Bars.	Weights.	W1.	W2.	W3.	W4.	W5.	W6.	W7.	W8.	W9.			
A	Moving ..	−5·31	−4·72	−4·13	−3·54	−2·95	−2·36	−1·77	−1·18	− ·59	−26·55	—	−36·00
	Static ..	−1·89	−1·68	−1·47	−1·26	−1·05	− ·84	− ·63	− ·42	− ·21	− 9·45	—	
B	Moving ..	+ ·59	−4·72	−4·13	−3·54	−2·95	−2·36	−1·77	−1·18	− ·59	−21·24	+ ·59	−28·00
	Static ..	+ ·21	−1·68	−1·47	−1·26	−1·05	− ·84	− ·63	− ·42	− ·21	− 7·35	—	
C	Moving ..	+ ·59	+1·18	−4·13	−3·54	−2·95	−2·36	−1·77	−1·18	− ·59	−16·52	+1·77	−20·00
	Static ..	+ ·21	+ ·42	−1·47	−1·26	−1·05	− ·84	− ·63	− ·42	− ·21	− 5·25	—	
D	Moving ..	+ ·59	+1·18	+1·77	−3·54	−2·95	−2·36	−1·77	−1·18	− ·59	−12·39	+3·54	−12·00
	Static ..	+ ·21	+ ·42	+ ·63	−1·26	−1·05	− ·84	− ·63	− ·42	− ·21	− 3·15	—	
E	Moving ..	+ ·59	+1·18	+1·77	+2·36	−2·95	−2·36	−1·77	−1·18	− ·59	− 8·85	+5·90	− 4·00
	Static ..	+ ·21	+ ·42	+ ·63	+ ·84	−1·05	− ·84	− ·63	− ·42	− ·21	− 1·05	—	



Moment of Forces.

Weight.	Distance.	Moment.	Sum.
20·50	2·917	59·798	59·798
20·50	5·834	119·596	179·394
10·25	8·750	89·687	269·081



Moving load per metre, 5·43 × 17·5 (S) = 95·0 tons; static load = 28·0 tons; total load = 123·0 tons; concentrated at each apex $\frac{123}{6}$ = 20·5 tons; length of girder (L) = 18·25 metres; span (S) between centres of pressure on piers = 17·50 metres; depth (D) between centres of gravity of flanges, = 1·70 metres.

Strains.
Load × secant 41° 20′.

Maxm. strain −	Maxm. strain +	Bars.
34·224	—	A
22·299	—	B
12·132	3·727	C

Braces in compression.

The strain on bars in compression is exactly the same in amount as that of corresponding bars in tension, but opposite in character. Therefore the table shows strains on all the inclined bars, both tensional and compressional, in one-half of the girder. The strains in the other half are obviously similar. The vertical bars receive only a strain due to half the concentrated weight passing through for distribution to the inclined braces whose apices are in top flange.

		Tension (−). Loads on braces in tension.					(+) Compression.	Maxm. load −	Maxm. load +	Sum when fully loaded.
Bars.	Weight.	W1.	W2.	W3.	W4.	W5.				
A	Moving	−6·595	−5·276	−3·957	−2·638	−1·319		−19·785	—	−25·620
	Static	−1·945	−1·556	−1·167	− ·778	− ·389		− 5·835	—	
B	Moving	+1·319	−5·276	−3·957	−2·638	−1·319		−13·190	+1·319	−15·372
	Static	+ ·389	−1·556	−1·167	− ·778	− ·389		− 3·501	—	
C	Moving	+1·319	+2·638	−3·957	−2·638	−1·319		− 7·914	+3·957	− 5·124
	Static	+ ·389	+ ·778	−1·167	− ·778	− ·389		− 1·167	—	

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

(From our own Correspondent.)

THE firmness of last week's markets in Birmingham and Wolverhampton had in no respect given way to-day and yesterday. A fair extent of business was again done at advanced rates for forward delivery, but there were only few sellers who would book forward. They were fewer than a week ago. Firms who have six weeks' work before them are content, and the majority are in that condition. The men this week are working with close application, and there are concerns whose mills have in the past four weeks turned out more iron than in any month in their history.

Perhaps the most satisfactory feature of the week is a revived demand for boiler plates of an excellent quality. Throughout most of the year the mills of this class have been very short of work. Now, however, instances might be cited in which they are full of work, and are likely to remain so. The plates are for home consumption mainly. They are needed for works' and mill extensions, in which this and the Manchester district are alike conspicuous.

The next most satisfactory indication is more spirited buying by United States consumers. From these cabled inquiries for quotations by cable have come, and the inquiries have been followed by orders upon makers' terms. Nor have such transactions been exceptional.

And this week's Australian mail has been of more value than the corresponding mail a month since. Customers buy with less reluctance, and they are prepared to give slightly better prices.

To-day—Thursday—large consumers of pigs were desirous to get their orders accepted, some of them for 1000 tons in a line. They were ready to give from 1s. 3d. to 2s. 6d. a ton more than they would have given three weeks and a month ago, yet were still holding back from giving the prices to which the iron has risen in the interval. The vendors of certain Derbyshire pigs refused orders to-day at, in a few cases, 52s. 6d. per ton. Generally the current quotations for less valuable brands of the same district's make were from 50s. to 52s. 6d., but business was not pushed. For Wellingbrough iron quotations were withheld. The Lilleshall Company still quoted £3 5s. for prompt delivery in small lots; but for forward delivery they required next quarter's quotations, which are as yet indefinite. Barrow and Tredegar hematite iron, sold, the latter for foundry use mainly at 75s. per ton. Less money would not be taken, and there was a renewal of the intimation that these quotations for delivery in this district are unlikely to prevail after this quarter has run out in respect either to Bessemer or to forge and foundry qualities. Wellingsworth iron was to be had at a little under 52s. 6d., though that was the open market quotation. The same has to be said of the Spring Vale pigs, which in the three qualities made at those furnaces were respectively quoted at 47s. 6d., 57s. 6d., and 65s. per ton.

Preparations are being pushed forward for the starting of more furnaces as early as possible in the New Year.

Coke was, therefore, in better demand. Furnace proprietors who had bought lots of 2000 tons were prepared to double the orders at the same figure, but it is doubtful if their offers will obtain acceptance. Rhondda Valley coke was quoted 17s. 6d., but other South Wales sorts were procurable at 15s.; for South Yorkshire coke 16s. 6d., and for Derbyshire 16s. was asked; while North Wales sorts were not hard to buy at 15s.

Prices of coke and crude iron are kept from rising with conspicuous rapidity by the expectation this week entertained that there will not be a rise in the price of coal with the opening of the year as was at one time feared, even if the colliery owners should have to pay upon the slightly augmented sliding scale offered to the men last week. But the colliers may yet force the hands of the colliery owners. At present forge coal is to be had at 7s. 6d., and furnace coal at from 9s. to 20s. per ton.

Makers' full prices were given to-day and yesterday for high-classboiler-plates. Nothing less would be accepted. "Monmoor" quality realised £9, and best Monmoor a further £1.

Sheets for deep stamping were not quoted, makers being full of work. Steel sheets are going off in growing numbers, and this week there is a revival in the inquiry for charcoal qualities, which have not been in conspicuous request.

Latens, doubles, and singles for galvanising cannot be made as fast as the consumers desire. Some ironmasters were requiring £11 10s. for latens, whilst others would have accepted £11; doubles were £10 and £9 15s., and singles £8 15s. and £8 10s.—all for galvanising. Common qualities of singles were procurable to-day at £8 5s.

Marked bars are experiencing a better demand at £8 2s. 6d. and £7 10s., and £7 is being readily got by the one firm from whom it is still possible to buy at that figure for immediate delivery. To-day it was difficult to purchase a bar of any quality suitable for manipulation upon the anvil at less than £6 15s., a price which was promptly obtained for their commonest kinds by firms of good standing.

The Shropshire plate, sheet, bar, and rod mills are making full time, and the demand for drawn fencing wire expressed by this week's antipodean mail has augmented the activity in Shropshire.

North Staffordshire is getting busier in hoops and bars and plates, and more puddling furnaces are on this week than for a few years past. There are preparations in progress for adding to the number, and also for restarting some mills that have been for a long time inactive. Makers find but little difficulty in getting their own prices. Large orders are being declined excepting on terms which leave a good margin for probable advances after the close of the year. United States customers are taking growing quantities of hoops.

A satisfactory arrangement has been concluded with the colliers, by which little or no litigation is likely to arise out of the working of the Employers' Liability Act, of the pits in South Staffordshire and East Worcestershire. Colliers working in the thick coal seams will pay to a common fund, to be worked by a joint committee of eight miners and six employers, or their representatives, 2d. per week, and the employers will pay another 2d.; while the colliers working in the thin coal seams will pay 3d. a week and the employers 2d. The collier will receive 8s. per week during disablement, and his relatives will receive at his death a sum down or a pension. Rules for the working of the arrangement have been accepted and will be registered, and the first committee has been appointed.

Manufactures of brass, of tin, and of spelter, or in which those metals are largely used, are all tending upwards in sympathy with the raw material; and the Association of Operative Brassworkers in Birmingham are hastening the declaration of higher prices by getting ready to make a demand for higher wages.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—In the iron market of this district there has not been quite so much activity during the past week. This, however, is by no means a sign of any actual depression in the trade, but is due rather to the season of the year, and the near approach of the holidays, when business is naturally controlled to the narrowest possible limits. The market here, notwithstanding the easier tone reported from speculative centres of the iron trade, is quite as strong as ever, and both the local makers of pig iron and the smelters in this immediate district are for the most part so fully sold for as far forward as they are disposed to go that they are not at all anxious for further orders at present.

Lancashire makers of pig iron still quote 51s. per ton less 2½ per cent. for both forge and foundry qualities delivered equal to Manchester, and although there is not much business being done at these figures they are exceedingly firm, whilst so far as forge iron is concerned they have practically none to offer in the market at present.

Any business doing in outside iron has been chiefly in Lincolnshire brands, sales of which are reported at about 50s. 6d. to 51s. less 2½ for No. 4 forge, and 52s. for No. 3 foundry delivered equal to Manchester. Derbyshire iron is only being offered here in very limited quantities, but where there are sellers in the market the prices quoted average a trifle above those for Lincolnshire brands. Although North-country makers have now a better chance of competing in this market, there is still but a small business being done here in Middlesbrough iron. For g.m.b's. delivered equal to Manchester the prices quoted range from 51s. and 51s. 3d. net cash for forge up to 52s. 10d. per ton for foundry qualities.

In the finished iron trade makers all continue full of work, and in many cases the orders they have already in hand will see them well over the first and second quarters of next year. Many of them are now very chary about quoting at all for further orders, deliveries upon which cannot commence for some time to come, as they prefer to take their chance of the market, which they feel sure will be still more in their favour. Where quotations are made they are firm at £7 for bars, £7 10s. for hoops, and £8 15s. to £9 per ton for sheets, delivered into the Manchester district.

Locomotive builders generally are busy, tolerably large orders having recently been secured in this district.

Founders both of engineers' castings and builders' materials are fairly employed, and prices, which so far have not followed to any material extent the advance in pig iron, now show an upward tendency.

For girder work, although some of the makers are not quite so pressed with orders as they were a short time back, there is still a good demand. With reference to an order which Messrs. De Bergue and Co. have in hand for the new *Guardian* newspaper offices, I may mention—not so much as a feature of any very special importance as an item which may be of interest with regard to constructive ironwork—that the firm have found that they can introduce rivetted girders in the place of the heavy rolled iron girders previously stipulated with great advantage both as to price and suitability for constructive purposes.

Reports from all branches of the engineering trades continue satisfactory, and the monthly returns issued by the Amalgamated Society of Engineers from the various districts throughout the country again show a steady improvement in all the important centres of industry. As compared with December, 1880, when there were 2297 members on the books of the society in receipt of out-of-work donation, there are now only 1080, and in this district the relative numbers are 120 at the present time, as compared with 250 in December last year. From all the Lancashire districts the reports are much the same in tone as those I last gave. All round Manchester trade is improving, and there has been a pretty general advance in the wages of the patternmakers to the extent of about 2s. per week. With the exception of one or two districts, such as Burnley, Blackburn, Rochdale, and Wigan, trade generally is reported as moderate, and in one or two cases as good.

The Italian Government has just given out an order in this district for torpedo boat fittings, and this has been placed in the hands of Messrs. W. H. Bailey and Co., of Salford, who have carried out similar contracts for the British and Russian Governments.

Several of the large firms in this district having business houses in both Manchester and Liverpool have just made arrangements with the Post-office authorities for laying down wires for telephonic communications between their establishments in above-named places.

The calamitous explosion which has occurred this week at the Abram Collieries will no doubt bring into prominence the question of miners' safety lamps. The supposition at present is that the accident has been due to a sudden outburst of gas coming into contact with a defective lamp. Whether this has been the true cause may perhaps never be known, but the Davy lamp, which is the class of lamp in use at the Abram Colliery, has been proved liable to "go off" when exposed to an explosive atmosphere travelling at a high velocity, and this fact was conclusively demonstrated in a number of experiments recently made by Mr. Wm. Smethurst, of Wigan, before the Government Commission on Explosions in Mines. The Davy lamp under certain conditions, which are of possible occurrence in a mine, was shown to be positively unsafe, and at some of the Lancashire collieries I know that its use has of late been abandoned in favour of the Mueslër, a lamp which I may add I found to be exclusively in use at the Wigan Coal Iron Company's West Leigh pit in the immediate vicinity of the explosion, which I visited only a few weeks back. Improvements in safety lamps are, however, being so constantly introduced that it would be scarcely possible for a coalowner to follow them by repeated changes in the lamps supplied to the men, but the Abram explosion will no doubt direct attention to the importance of rendering compulsory the general use of some reliable lamp, or the introduction of some method of lighting collieries either by electricity or other means, which shall minimise—if not altogether remove—the risk of explosion under conditions which, with many of the lamps at present in use, now seriously jeopardise the safety of the mine.

In the coal trade business continues very quiet, so far as the demand for house-fire coals is concerned, and many of the collieries are still on short time. Common coals for iron-making purposes are, however, in good demand, but supplies are sufficiently plentiful to keep down prices. Engine classes of fuel move off well at late rates, which are being maintained owing to the present scarcity of the better qualities of slack. Round coals continue lower in price, as compared with a month ago, sellers being willing to take under their list rates to effect prompt sales, and at the pit mouth the average prices are about as under:—Best coal, 9s. 6d. to 10s.; seconds, 7s. 6d. to 8s.; common house coals, 6s. 6d. to 7s.; steam and forge coals, 5s. 6d. to 6s.; burgy, 4s. 6d. to 5s. 3d.. good slack, 3s. 9d. to 4s. 3d.; and common, 3s. to 3s. 6d. per ton.

In the shipping trade there is still very little doing, owing to so many vessels having been kept out of port by the recent storms. This has not only prevented the execution of orders actually in hand, but has thrown a good deal of coal upon the hands of sellers, which is now being offered at low figures, Lancashire steam coal delivered at the Garston Docks or at the high level, Liverpool, being obtainable at as low as 7s. 6d. per ton.

Coke is is fair demand for iron-making purposes, the better sorts fetching from 12s. to 14s. per ton at the ovens.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

In the iron trade the improvement steadily continues. This week there has been a great pressure to get orders completed before Christmas. The weight of work in the hands of the Sheffield rollers has been unequalled for several years. The shipbuilding yards keep very busy, and orders for ship plates have come in so freely that the makers have been able to secure an advance in prices.

There is a movement among the ironworkers to resuscitate the Ironworkers' Union in this district. The effect will be to release the local men in a great measure from being ruled by the Staffordshire Union as at present. Our Sheffield ironworkers are not quite satisfied at recent reductions of wages to which they have had to submit, owing to the Lancashire reductions having been enforced all round. They say that if they had not been bound to Staffordshire they would not have agreed to these reductions.

Bessemer steel sells briskly. Best marked billets for spring purposes are now realising £11 5s. per ton; ordinary billets, £7 2s. 6d.; common, £4 10s., £4 15s., £5, and upwards, according to temper. No anxiety is shown to book orders, as there is every prospect of further advances early next year.

In the cutlery trade, the increasing price of ivory is causing a good deal of anxiety. Country sales are heavy, and dealers, finding stocks diminishing, are putting up prices. A very serious advance in ivory is anticipated at the opening of next quarter Shaving and table-knife houses have abundant work in hand, and in the silver and electro-plating branches there is a brisk demand all round. Several manufacturers have work in hand sufficient to last them for several months into the new year.

Though the coal trade is busy, the mildness of the season prevents the London demand being equal to the average. Locomotive coal has been generally advanced 6d. per ton, and another 10d. on household coal is certain to be imposed in January.

I have been favoured with early sheets of the Sheffield and Rotherham Red Book for 1882, in which I find some interesting information respecting local shares and stocks. In seventeen of the leading limited liability companies the fluctuation in value is remarkable. These seventeen companies are all connected with the iron and steel trades of Sheffield. At the end of August, 1879, the market value of the properties represented by these seventeen companies was £4,005,741. An improvement in trade caused great speculation, which raised the market value on March 1st, 1880, to £7,407,905. From this point a strong reaction set in, and at the end of the next eight months—December 1, 1880—the total had fallen to £6,514,116. Another improvement in trade caused a further advance in value, and the stock now represents a market value of £8,822,308.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

The attendance at the iron market held at Middlesbrough on Tuesday last was not very large, a circumstance probably owing to the proximity of Christmas. For the same reason the business actually done was comparatively insignificant. Prices showed no weakness, notwithstanding the slight fall which had taken place during the previous week at Glasgow. There are not wanting symptoms that the Middlesbrough iron market is destined in future to take the lead, rather than to continue to follow its northern rival; and being the focus of a district which is larger and more important than any other iron-making district in the country, it is only natural that this should come to be the case.

The novel announcement made by Messrs. B. Samuelson and Co., that they intend next year to make the experiment of selling their iron by auction, instead of by private contract, was much discussed; and various opinions were expressed as to the desirability or otherwise of such a change, and as to its probable effects upon the trade generally. It would seem to be only the natural sequence of the somewhat independent policy which the above wealthy firm have pursued for some time past. They were amongst the first to insist upon cash payments every Monday for iron supplied the previous week, whether to merchants or consumers. They soon found that this policy threw them almost entirely into the hands of a few of the wealthier merchants, and often compelled them to stock large quantities. These merchants naturally used their advantage for their own benefit. It is probably in order to get rid of thraldom of this kind that the plan of selling by auction has been devised. It is hoped that the publicity of the sales will attract a large number of buyers from all parts, and will prevent the possibility of any small clique exercising undue influence upon the market price. On the other hand, it is clear that not many consumers will find it to their interest to attend sales and pay prompt cash; therefore the need to the iron trade for middle men with capital will be more than ever established.

The price of Cleveland g.m.b. pig iron was on Tuesday from 42s. 9d. to 43s., f.o.b., business being done at both rates by merchants. Smelters generally kept out of the market. Connal's warrants were a little weaker, sales having been effected at 43s. 3d. The stock of Cleveland pig iron in Connal's stores is no longer decreasing, on the contrary there is now 175,931 tons, or 604 tons more than a week ago.

Ironfounders still continue very slack, but are hoping for better trade when the new year sets in.

The finished iron trade is as firm as ever, the contracts made during each week still exceeding considerably those run off. Plates are nominally quoted at £7 per ton, but transactions in quantity are reported at £7 2s. 6d., and for small quantities as high as £7 5s. f.o.t. Middlesbrough, less 2½ per cent. Bars and angles remain at £6 10s. Puddled bars command £4 5s. at works.

The Imperial Ironworks at South Bank have again made a start under a new company consisting of local men. The management is in the same hands as previously.

The Tees-side Rolling Mills are expected to start early in January. These works are making a demand for puddlers, who are consequently becoming scarce and difficult to manage. The general hope of better prices is leading to merchants and speculators seeking to buy up several kinds of material connected with iron making. The chief of these are purple ore, puddled bars, old rails, heavy scrap, and light scrap iron. In purple ore an artificial scarcity has been created, and prices have run up 5s. to 6s. per ton since September last. The principal holders are well known, and consist of a firm at Liverpool, one at Manchester, and one at Newcastle-on-Tyne. Puddled bars are being bought up by certain merchants at Middlesbrough, and scrap by a firm at Newcastle-on-Tyne, besides others. These "rigs" or "corners," as they are called, are extremely inconvenient to legitimate traders, and lead to serious disturbances in the trade. It is difficult, however, to imagine a remedy for the evil.

The marine engine works of Messrs. Westgarth, English, and Co., have fairly commenced operations, having received orders for several pairs of marine engines and boilers.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

There has been rather less doing on 'Change in Glasgow, the warrant market having been very heavy in consequence of the great extent of which holders have been realising. Towards the close of last week it became apparent that the legitimate demand for pig iron had considerably slackened, and the quotations immediately began to decline. Since then prices have been gradually drooping, the fall in warrants being from 1s. to 2s. per ton. It is right to explain that this reaction of the market is not due to any falling off in the iron trade, which is brisker than is usual at the present season. When prices began to advance some weeks ago consumers immediately entered into extensive contracts for the delivery of iron, and it is now evident that their wants are almost fully supplied for some time forward. This fact, together with the heavy stocks of iron on hand, has had a depressing effect upon the speculative department of the trade, and holders have been showing much anxiety to get rid of the iron, in case of a further decline in prices. No little anxiety is being felt in anticipation of the annual declaration of the statistics of the pig iron trade. The exports of pig iron are known every week, and the state of the stocks in Messrs. Connal and Co.'s stores can be ascertained daily, but it is only once a year, on Christmas Day, that the amount of iron in makers' hands, the exact production during the twelvemonth, the consumption in the manufactured ironworks in Scotland, and the consignments by rail to England are made known. The figures will, it is expected, be available on Tuesday next, the 27th instant. In the meantime there are not wanting estimates of what they will probably be. It is calculated that the production will exceed that of last year by something like 150,000 tons, that the consumption at home has been very much larger than in 1880, and that the aggregate stock in makers' yards and in the public stores will show an increase of considerably over 100,000 tons. The shipments will, it is believed, be fully 90,000 tons less than they were last year, while the arrivals of pig iron from England will show an increase of about 30,000 tons.

Business was done in the warrant market on Friday forenoon at from 51s. 11½d. to 51s. 8d. and up to 52s. 2d. cash, and 52s. to 51s. 10½d. and up to 52s. 4½d. one month, the quotations in the afternoon being 52s. 2½d. to 51s. 10½d. cash, and 52s. 5d. to 52s. 1½d. one month. On Monday the market was dull, with business in the morning at from 51s. 11d. to 51s. 8½d. cash, and 52s. 2d. to 51s. 11½d. one month. In the afternoon the quotations were 51s. 8½d. to 51s. 10½d. cash, and 52s. to 52s. 1d. one month. Tuesday's market was flat, with business at 51s. 9d. to 51s. 4¼d. cash, and 52s. to 51s. 8d. one month. On Wednesday business was done between 51s. 0½d. cash and up to 52s. one month. To-day—Thursday—the market was firm, with transactions at 51s. 9d. to 52s. cash and 52s. to 52s. 3d. one month.

The deliveries of pig iron into store this week are rather smaller than they were last week, and the shipments also show a decrease as compared with those of last week, but are favourable in comparison with those of the same week last year. Makers' iron can be had in second hands at from 1s. to 2s. per ton below circular prices. It has been impossible to maintain last week's figures, and the quotations are now as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1. 60s. 6d.; No. 3, 54s.; Coltness, 62s. and 54s. 6d.; Langloan, 62s. 6d. and 54s. 6d.; Summerlee, 60s. 6d. and 53s. 6d.; Calder, 60s. 6d. and 54s.; Carnbroe, 55s. and 53s. 6d.; Clyde, 52s. 6d. and 51s. 6d.; Monkland, Quarter, and Govan, each 52s. 6d. and 51s.; Shotts at Leith, 61s. 6d. and 55s.; Carron at Grangemouth, 53s. 6d. (specially selected, 56s.) and 52s. 6d.; Kinneil at Bo'ness, 52s. 6d and 51s.; Glengarnock at Ardrossan, 55s. and 53s. 6d.; Eglinton, 52s. 6d. and 50s. 6d.; Dalmellington, 52s. 6d. and 51s.

Although the quantity of manufactured goods despatched during the past week from Glasgow to foreign ports has not been quite so large as of late, the different branches of the manufactured iron and engineering trades are as active as ever. Iron merchants have very good orders from all parts of the world, particularly from the colonies. There is no alteration this week in prices. The steel works are all very active, and their number in the Glasgow district is being extended. The latest addition is at Govan, in the neighbourhood of Glasgow, where the Govan Forge and Steelwork's Company, Limited, are now constructing works which will enable them to turn out a large quantity of manufactured steel on the Siemens principle.

There has been rather more doing this week in the coal trade, and the shipments have been particularly good both at Glasgow and Ayrshire and Firth of Forth ports. This is partly accounted for by the improved weather at sea allowing shipments that were in arrear to be sent away. The domestic inquiry, however, is hardly yet perceptibly improved. Prices are still easier, although there has been no declared change.

The Cairntable Gas Coal Company held its annual meeting in Glasgow on Wednesday, when the directors recommended a dividend of 5 per cent. It was stated that the quantities of coals sold by the company during the year were 1376 tons Cairntable Boghead-Cannel, 18,566 tons gas coal, 4548 tons common coal, and 3144 tons dross.

A favourable report has been submitted to the first general meeting of the Burntisland Oil Company, Limited, which was held a few days ago in Edinburgh.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

IT is a good sign of the times, showing that the colliers have no legitimate cause of grumble, that at a large meeting at Mountain Ash this week greater part of the time was taken up with a discussion on the land question. The only other subject discussed was the sliding scale, which the meeting decided required modification, and a notice accordingly was framed to be submitted to the coalowners.

The coal trade maintains its buoyancy, and prices are unchanged. Prospects are fair of an advance of prices, and that there is scope is proved by the circumstance that a large railway buyer is still able to secure best screened at pit for 7s. per ton. This would be equivalent to a trifle less than 10s. f.o.b. General buyers possibly could not get coal at such terms, railways being large consumers and regular in cash payments, which count for a great deal more than acceptances. There is a falling off to be noted in the matter of clearances, Cardiff figuring for about 90,000 tons exports instead of 130,000, but this was attributable to purely local causes and the storms. The demand is well kept up. From Newport, on the other hand, 27,000 tons of coal were sent, being almost double that of the week before, and the export of Swansea, 17,000 tons, was up to the highest standard from that port.

Great caution is being exercised on the subject of ventilation. Once or twice of late the warning has been issued to colliery managers, and there is no doubt it has come opportunely and prevented the periodical outburst. It is almost strange that a Christmas should pass without an outburst, and this especially considering the great output of the present.

There is a reasonable certainty that the Taff Vale coal annual returns will show an increase of a million tons over the year 1880, and I have a strong impression that this will be the maximum.

The iron trade continues in its late hopeful condition, prices are very firm and inquiries good. There has also been a large number of orders placed.

During last week Rhymney turned out 2440 tons of bloom and steel rails. Good work is being done at the blast furnace at the same place.

At a meeting of the Swansea Harbour Trust this week it was decided to extend the eastern pier and purchase a new dredger.

Prices of steel rails remain the same, but with an upward tendency; tin-plate is also looking up.

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 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.

13th December, 1881.

5433. LOCKS, W. H. St. Aubin, Bloxwich.
5434. LIFE-PRESERVING MATTRESSES, G. G. de L. Byron, Brighton.
5435. CANNON, R. Brandon.—(*B. B. Hotchkiss, France.*)
5436. MACHINE GUNS, J. G. Accles, London.
5437. COUNTERS for MULES, D. & F. H. Orme, Oldham.
5438. SPINDLES, T. Watson, Paisley.
5439. BOILERS, W. E. Burder, Loughborough.
5440. WARPING, &c., MACHINES, J. C. Sewell, E. Hulton, and J. Bethel, Manchester.
5441. PUMPS, H. J. Haddan.—(*D. S. Chapin, U.S.*)
5442. ROWLOCKS for BOATS, E. C. Martin, Ipswich.
5443. STEAMING, &c., FABRICS, H. Webster and J. Clegg, Dewsbury.
5444. BOOTS, &c., W. R. Lake.—(*W. Comey, U.S.*)
5445. GALVANIC BATTERIES, O. C. D. Ross, London.
5446. GAS FITTINGS, J. J. Boyle, Manchester.
5447. GLOVE FASTENINGS, J. Hinks, T. Hooper, and F. R. Baker, Birmingham.
5448. SENSITIVE PAPER, W. T. Morgan, Greenwich.
5449. SPINNING SILK, H. Lake.—(*A. Bertholon, France.*)
5450. GARMENTS, G. Cardew.—(*M. D. du Mont, Paris.*)
5451. SECONDARY BATTERIES, J. Pitkin, London.
5452. ELECTRICAL BATTERIES, W. R. Lake.—(*J. F. Aymonnet, France.*)

14th December, 1881.

5453. PRESERVING MILK, H. W. von Roden, Germany.
5454. REPAIRING BOOTS, J. Lewis, Birmingham.
5455. SCREW-PROPELLERS, J. Taylor, Birkenhead.
5456. ENGINES, H. Williams, Liverpool.
5457. SEPARATING DUST, R. Howarth, Rochdale.
5458. LOOMS, J. Kenyon and E. Deakin, Lancaster.
5459. KNIFE-CLEANING, E. M. Knight, Manchester.
5460. FENCES, &c., D. Rowell, London.
5461. DIVIDING, &c., DOUGH, J. W. Drysdale, Glasgow.
5462. ARTIFICIAL LIGHT, E. T. de Banzie, Glasgow.
5463. HORSESHOES, W. R. Lake.—(*G. Dunning, U.S.*)
5464. DISTILLING ALCOHOL, K. Trobach and A. Cords, Berlin.
5465. RAILS, &c., W. Seaton, London.
5466. LOCKS, W. & S. Bash, & N. Damsa, Manchester.
5467. BARRELS, J. Campbell & J. Swainston, London.
5468. TELEGRAPH CONDUCTORS, J. Imray.—(*J. M. Stearns, Brooklyn, U.S.*)
5469. GAS-MOTOR ENGINES, F. W. Crossley and H. P. Holt, Manchester.
5470. GALVANIC BATTERIES, C. Mauris.—(*A. Thomas, Nantes, France.*)
5471. COLLARS for HORSES, T. Loveday, Islip.
5472. BOTTLE STOPPERS, N. Fritzner, Berlin.
5473. OPENING, &c., TAPS, T. G. Sharpe, Huddersfield.
5474. WAGONS, H. Vickery, London.
5475. WHEELS, G. L. Scott, Manchester.
5476. FELTING, G. Atherton.—(*G. Yule, Newark, U.S.*)
5477. ELECTRIC LAMPS, W. R. Lake.—(*C. F. de la Roche, France.*)
5478. HAND-STAMPS, E. M. Richford, London.
5479. TRANSMITTING MOTIVE-POWER, A. Lafargue, London.
5480. SEWING MACHINES, W. Lake.—(*F. Chilton, U.S.*)
5481. SECONDARY BATTERIES, D. Fitz-Gerald, London.
5482. BLASTING CARTRIDGES, R. M. Gardner, London, and G. Trench, Faversham.

15th December, 1881.

. GAS-MOTOR ENGINES, S. Griffin, Bath.
84. VELOCIPEDES, A. Lafargue, London.
485. MATCH-BOXES, M. Wilson, London.
486. PRODUCTION of COPIES of PICTURES, &c., A. A. Hely, London.
87. GAS ENGINES, W. Watson, Leeds.
5488. WORKING GRAPPLE-BUCKETS and FORKS, J. C. Thompson, Kingston-upon-Hull.
5489. BOTTLES, F. Wirth.—(*H. Lambrecht and G. Hirdes, Germany.*)
5490. ELECTRIC LAMPS, W. Lake.—(*J. Mondos, France.*)
5491. GRINDING WIRE CARDS, A. W. L. Reddie.—(*W. Decker, Saxony.*)
5492. RANGE-FINDING, T. Bolton, Calcutta.
5493. BUTTON-HOLES, A. Helwig and J. Dewdney, London.
5394. SECONDARY, VOLTAIC CELLS, J. W. Swan, Newcastle-on-Tyne.
5495. PRODUCING TRANSPARENT SHEETS, E. V. Emery, Canonbury, London.
5496. ROVING FRAMES, J. Cryer, Dukinfield.
5497. CARRYING BOXES, &c., C. Carus-Wilson, London.
5498. SPRING-PACKING, W. Lockwood, Sheffield.

16th December, 1881.

5499. RECORDING CURRENTS, J. Swan, Newcastle-on-Tyne.
5500. SPRING BALANCES, R. Lamont, Kilmarnock.
5501. RAILWAYS, T. W. Rammel, London.
5502. CARTRIDGE CASES, G. Kynoch, Witton.
5503. FIRE LIGHTER, J. Milne, Edinburgh.
5504. LOCKS of FIRE-ARMS, E. Bled and E. Richoux, Paris, and J. Warnant, Liege.
5505. SECURING ENDS of CANS, W. R. Lake, London.—(*J. M. Clark, Delaware, U.S.*)
5506. CARRIAGE DOORS, S. A. Say, London.
5507. SUBSTITUTE for COFFEE, H. Gardner, London.—(*E. A. Grote, Siegen, Germany.*)
5508. PREVENTING EXPLOSION, J. A. Fisher, London.
5509. BOTTLES, &c., F. S. Darby, Wandsworth.
5510. CASTORS, S. H. Barnett, Notting-hill.
5511. ASCERTAINING PITCH of SCREW PROPELLERS, D. B. Hutton, Poplar.
5512. SHIPS' COURSE, D. H. Hughes, Liverpool.
5513. COILED WIRE, J. Hodson, St. Helens.
5514. DRIVING TRICYCLES, W. P. Thompson, Liverpool.—(*N. Merrill, New York, U.S.*)
5515. TRAYS, J. Taylor, Halifax.—(*W. Taylor, U.S.*)
5516. APPARATUS for USE in TAKING PRISONERS, F. Macpherson, Manchester.
5517. CHAIN, J. Sothcott, Bayswater.
5518. TORPEDOES, C. A. M. Evoy, London.
5519. PENS, &c., J. H. Johnson, London.—(*J. Hanestrosa, Paris.*)
5520. LOCKS of FIRE-ARMS, E. Bled and E. Richoux, Paris, and J. Warnant, Liege.

17th December, 1881.

5521. SECONDARY POLARISATION BATTERIES, G. Grout and W. H. Jones, Hornsey.
5522. PHOTOGRAPHS, H. Bonneville.—(*M. Wolff, Paris.*)
5523. SEPARATING AMMONIA, G. Chapman, Glasgow.
5524. ELECTRIC LAMPS, R. Kennedy, Glasgow.
5525. DYNAMO ELECTRIC MACHINES, W. H. Akester, Glasgow.
5526. COMPOSITION, T. Fletcher, Warrington.
5527. COCKS and VALVES, J. C. Millard, London.
5528. GAS GLOBE GALLERIES, J. Challender, Manchester.
5529. RAISING SUNKEN VESSELS, R. Hodgson, London.
5530. STERN POSTS, E. Hayes, Stony Stratford.
5531. FLYERS, S. Ingham, Ludden.
5532. TREATING WOOD, D. Francke, Korndal, Mölndal.
5533. DRAINING WATER, J. Bothams, Wilts.
5534. GAS LOCOMOTOR, W. Beck.—(*J. Montclar, Paris.*)
5535. SPINNING FIBRES, B. Morley and H. Jagger, York.
5536. ELECTRIC LIGHTING, J. E. Gordon, Kensington.
5537. BREECH-LOADING GUNS, T. Nordenfelt, London.
5538. BREECH-LOADING ARMS, T. Nordenfelt, London.
5539. BREECH-LOADING ARMS, T. Nordenfelt, London.
5540. SLIDE RULES, J. H. Thomson. Shoeburyness.
5541. WAGONS, W. Bowen, Southwark.
5542. GALVANIC BATTERY, W. R. Lake.—(*La Société Universelle d'Electricité Tommasi, Paris.*)
5543. BRICK-MOULDING, C. F. Schlickeysen, Berlin.

18th December, 1881.

5544. TREATING MUD, J. Simpson, Liverpool, and E. W. Parnell, Widnes.
5545. SEWING MACHINE, J. Graham, Dundee.
5546. SOFTENING YARN, L. Groth.—(*J. Balster, Saxony.*)
5547. CUTTING LEAVES, L. A. Groth.—(*R. Söderström, Upsala, Sweden.*)
5548. VACUUM PUMPS, L. A. Groth.—(*H. Goebel and J. W. Kulenkamf, New York, U.S.*)
5549. DICE, &c., A. G. Labottière, London.
5550. ODOMETERS, W. Thompson.—(*P. McDonnell, U.S.*)
5551. ARMATURES, J. H. Johnson.—(*W. Griscom, U.S.*)
5552. HEEL, A. M. Clark.—(*P. Lemarchand, Paris.*)
5553. PACKING for STEAM-ENGINES, J. H. Chapman, Forest-gate, and R. H. Harper, London.
5554. FASTENING WINDOWS, B. C. Cross, Dewsbury.
5555. FILLING VESSELS, E. Rouse, Manchester.
5556. TRAMWAYS, R. S. Cunningham, C. A. Vinkeles-Houssart, and W. May, London.
5557. CHEQUES, A. Reddie.—(*M. Berry, U.S.*)
5558. CRANK SHAFTS, J. Dickinson.
5559. RENDERING FABRICS WATER REPELLENT, C. B. Warner.—(*L. P. Britt, New York.*)
5560. YEAST, E. A. Brock, Stratford.
5561. INCREASING HEAT, &c., E. Fair, San Francisco.
5562. CLEANSING GRAIN, W. Burley and J. H. Morgan. St. John's.

Inventions Protected for Six Months on deposit of Complete Specifications.

5428. BURNERS, R. H. Brandon, Paris.—A communication from L. Sepulchre, Belgium.—*12th December*, 1881.
5435. BREECH-LOADING CANNON, R. H. Brandon, Paris.—A communication from B. B. Hotchkiss, Paris.—*13th December*, 1881.
5463. DIES for HORSESHOES, W. R. Lake, Southampton-buildings, London.—A communication from G. Dunning, Chicago, U.S.—*14th December*, 1881.
5464. DISTILLING ALCOHOL, K. Troback and A. Cords, Berlin.—*14th December*, 1881.

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

5101. BOLTS, &c., H. B. Sears, Liverpool.—*12th December*, 1878.
5123. OBTAINING LIGHT, &c., G. E. Dering, Welwyn.—*13th December*, 1878.
5128. WIRE CARDS, G. and E. Ashworth, Manchester.—*14th December*, 1878.
5161. FLUES, W. J. Armstead, Sawston, and G. Pannell. Haverhill.—*16th December*, 1878.
96. PORTABLE FORGES, H. Eyre, South Norwood.—*9th January*, 1879.
251. FILTER PRESSES, H. E. Newton, London.—*21st January*, 1879.
5112. PLATES for ARTIFICIAL TEETH, J. H. Gartrell, Penzance.—*13th December*, 1878.
5247. TANNING, E. Wirth, Frankfort-on-the-Main.—*23rd December*, 1878.
5199. FILTERING, F. H. and W. G. Atkins, London.—*18th December*, 1878.
5225. BLEACHING COTTON, &c., J. B. Alliot, Radford, and C. Vanlohe, Manchester.—*20th December*, 1878.
5232. PEPTONISED MEAT, S. Darby, London.—*20th December*, 1878.
13. CONSTRUCTING HARROWS, R. Cichowski, Ozarow, Russian Poland.—*1st January*, 1879.
5159. PREPARING GAS, R. V. Tuson, London.—*16th December*, 1878.
5170. RELIEF-LINE PLATES, H. J. Haddan, Westminster.—*17th December*, 1878.
5175. VALVES, H. J. Haddan, Westminster.—*17th December*, 1878.
5184. TRAMWAY RAILS, &c., H. T. Grainger, London.—*18th December*, 1878.
5239. TREATING AIR, &c., H. J. and J. W. Wilson, Sheffield, and A. French, Lead Hills, Lanarkshire.—*21st December*, 1878.
182. LOCOMOTIVE ENGINES, R. E. Middleton, Westminster.—*15th January*, 1879.
5182. GATES, &c., A. L. Bricknell, London.—*17th December*, 1878.
5196. REGULATING the TREADING of HEALDS, J. Poole, Rradford.—*18th December*, 1878.
5211. TREATING WOOD, H. Hardman, London.—*19th December*, 1878.
5233. SETTING STAMPS, J. Leighton, London.—*20th December*, 1878.

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

4429. PIPES, &c., N. L. Tindell, London.—*23rd December*, 1874.
4371. JUJUBES, &c., E. Hawker, Lee, Kent.—*18th December*, 1874.
4439. STAMPING METALS, J. Vaughan, West Bromwich.—*24th December*, 1874.
4325. SAFETY VALVES, J. Jordan, Manchester.—*16th December*, 1874.
4352. STEAM-BOILERS, G. and J. Weir, Glasgow.—*17th December*, 1874.
4362. TREATING TWINES, G. Good, Lopen.—*18th December*, 1874.
4388. CYLINDERS, W. R. Lake, London.—*21st December*, 1874.
4476. ROTARY PUDDLING MACHINES, J. H. Johnson, London.—*30th December*, 1874.
4471. TRANSFERRING PATTERNS to FABRICS, J. Briggs, R. Hudson and H. Grimshaw, Manchester.—*30th December*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 6th January, 1882.

3468. SPRING SADDLE BARS, G. Curtis, London.—*10th August*, 1881.
3471. SPRING MATTRESSES, &c., E. Lloyd, Bracebridge, and H. J. Rust, Sheffield.—*11th August*, 1881.
3485. GENERATING ELECTRICITY, I. L. Pulvermacher, London.—*11th August*, 1881.
3486. MARKING, &c., CORKS, W. R. Lake, London.—A com. from G. E. Böethius.—*11th August*, 1881.
3489. AXLE-CAPS, J. Crowther, Manchester.—*12th August*, 1881.
3495. METALLIC SPRING MATTRESSES, S. Knowles, Manchester.—*12th August*, 1881.
3507. PLASTERING, &c., E. G. Brewer, London.—A communication from D. W. Stockstill, T. J. McGeary, and E. W. Anderson.—*12th August*, 1881.
3512. STOVES, &c., T. Redmayne, Sheffield.—*12th August*, 1881.
3523. VENETIAN BLINDS, W. Brierley, Halifax.—A communication from F. Rühr.—*13th August*, 1881.
3527. GAS ENGINES, T. H. Lucas, Birmingham.—*13th August*, 1881.
3529. FABRICS, W. Lake, London.—Com. from M. A. Hervy, G. Legé, and L. Goizet.—*13th August*; 1881.
3587. BICYCLES, &c., A. W. Robinson, Birmingham.—*17th August*, 1881.
3610. CIRCULAR RIBBED FABRICS, H. M. Mellor, Nottingham.—*19th August*, 1881.
3647. STEERING SHIPS, J. Walker, W. Thompson, jun., & T. Thompson, jun., Durham.—*22nd August*, 1881.
3677. REGISTERING FARES, J. N. Maskelyne, London.—*23rd August*, 1881.
3751. COATING SHIPS' BOTTOMS, A. B. Rodyk, London.—Com. from N. B. Dennys.—*29th August*, 1881.
3834. FAUCETS, &c., W. H. Thompson, Liverpool.—A com. from C. Whittaker.—*3rd September*, 1881.
3929. "TELERADIOPHONE," E. J. P. Mercadier, Paris.—*10th September*, 1881.
4144. CHECKING MONEY, J. N. Maskelyne, London.—*26th September*, 1881.
4369. TREATING NITROGENOUS SUBSTANCES, W. Marriott & H. Marriott, Huddersfield.—*7th October*, 1881.
4485. STEAM-BOILERS, G. Stevenson, Airdrie. — *14th October*, 1881.
4678. HEATING WATER, S. Leoni, London.—*26th October*, 1881.
4696. JOINTS of PIPES, J. A. Eaton, London. — *27th October*, 1881.
4704. CHANDELIERS, G. W. von Nawrocki, Berlin.—A com. from H. Raupp.—*27th October*, 1881.
4739. PEGS for VIOLINS, &c., J. Wallis, London.—A com. from E. Hamma.—*29th October*, 1881.
4961. NAILING BOXES, F. W. Blood, Liverpool.—*12th November*, 1881.
4968. TRUNKS, &c., W. B. Worger and E. M. Richford, London.—*12th November*, 1881.
5028. TELEPHONE RECEIVERS, R. and M. Theiler, London.—*16th November*, 1881.
5084. BOTTLES, &c., J. Pattison, Kennington.—*21st November*, 1881.
5154. STOPPERS for BOTTLES, H. Barrett, Westminster.—*25th November*, 1881.
5170. DRAWING FRAMES, R. Andrews, Bessbrook.—*26th November*, 1881.
5192. GUN BARRELS, W. C. Stiff, Birmingham.—*28th November*, 1881.
5223. ORNAMENTED FABRICS, G. Pitt, Sutton.—A com. from The Fabric Ornamenting and Manufacturing Company.—*29th November*, 1881.
5312. PURIFICATION of ALKALINE SOLUTIONS, H. Deacon and H. Gaskell, jun.—*5th December*, 1878.
5244. LUBRICANT, &c., J. G. Accles and J. D. Scott, South Shields.—*7th December*, 1881.

Last day for filing opposition 6th January, 1881.

3378. ARTIFICIAL MANURE, C. H. F. S. d'Esplaviz, Twickenham.—*4th August*, 1881.
3533. CRINOLINES, C. S. Schneider, Chelsea, London.—*15th August*, 1881.
3537. MOULDING, &c., FLASKS, J. S. Campbell, New York, U.S.—*15th August*, 1881.
3538. REGISTERING, J. Porritt, Milnsbridge, near Huddersfield.—*15th August*, 1881.
3542. COLOURLESS, &c., OIL, W. P. Thompson, London.—Com. from I. Gottlieb.—*16th August*, 1881.
3547. SEWING MACHINES, A. Francois, Douai, France.—*14th August*, 1881.
3555. TOBACCO PIPES, H. Woodward, Shepherd's Bush, London.—*16th August*, 1881.
3555. CONVEYING ARTICLES from SHIPS, H. Redknap, Twickenham.—*16th August*, 1881.
3559. ELECTRIC LIGHTING, C. W. Harrison, Southampton-buildings, London.—*16th August*, 1881.
3561. DIRECT PROPULSION of LAND, &c., ENGINES, A. H. V. de Kerkhove and T. Snyers, Brussels.—*16th August*, 1881.
3562. BALLS, A. J. Altman, St. Botolph's, London.—*16th August*, 1881.
3575. BLEACHING THREADS, C. D. Abel, London.—Com. from A. Delabove.—*17th August*, 1881.
3576. VELOCIPEDES, M. A. Weir, Gracechurch-street, London.—*17th August*, 1881.
3588. DAMPING, &c., LITHOGRAPHIC STONES, J. Meinschock, New Cross, London.—*17th August*, 1881.
3598. LOOMS, E. Smith, Houley, near Huddersfield.—*18th August*, 1881.
3601. SUPPORTING, &c., LOOKING-GLASSES, C. D. Martin, Brownlow-street, London.—*18th August*, 1881.
3606. METALLIC STRUCTURES, C. D. Abel, London.—A communication from the La Société Nouvelle de Constructions (Systéme Tollet).—*19th August*, 1881.
3609. STRETCHERS, J. Furley, South Park, Sevenoaks.—*19th August*, 1881.
3616. FORKS, SCREW-BOLTS, &c., G. R. Postlethwaite, Aston, near Birmingham.—*19th August*, 1881.
3618. CRICKET BATS, G. W. Frowd, Newington-causeway, London.—*19th August*, 1881.
3625. PICKERS and PICKER-SPINDLES, I. and A. Wallwork, Ashton-under-Lyne.—*20th August*, 1881.
3646. WET EXTRACTION of LEAD, &c., from ORES, H. J. Haddan, London.—A communication from A. Drouin.—*22nd August*, 1881.
3648. HEATING APPARATUS, W. H. Stephenson, Blackburn.—*22nd August*, 1881.
3655. REGULATING ELECTRIC CURRENTS, R. E. Dunston, Donhead, St. Mary, and G. Pfannkuche, Delahay-street, London.—*22nd August*, 1881.
3658. HARVESTING MACHINES, W. R. Lake, London.—Com. from N. Denizot.—*22nd August*, 1881.
3675. SORTING, &c., GRAIN, K. H. Sander, Zweinaundorf.—*23rd August*, 1881.
3693. FLUID METERS, H. C. V. de P. Ahrbecker and and H. E. J. Hamkens, London.—*24th August*, 1881.
3701. BENDING RAILS, J. H. Johnson, London.—Com. from L. Vojacek.—*25th August*, 1881.
3705. EXTRACTING, &c., PARAFFINE WAX, O. Herrlich, London.—Com. from H. Ujhely.—*25th August*, 1881.
3715. GAS ENGINES, H. Williams, Liverpool.—*25th August*, 1881.
3738. HEATING by GAS, E. Haskell and J. P. Bayly, London.—*27th August*, 1881.
3831. MILKING COWS, A. B. Crees, Ilminster.—*2nd September*, 1881.
3859. SELF-MASSAGE, C. A. Angström, Stockholm.—*5th September*, 1881.
4042. GAS and OIL STOVES, S. Clark, Upper-street, London.—*19th September*, 1881.
4101. CLEANING MARBLE, &c., G. J. C. M. B. de Liebhaber, France.—*23rd September*, 1881.
4272. SCOURING, &c., MATERIALS, J. McNaught and W McNaught, jun., Rochdale.—*3rd October*, 1881.
4335. HARBOURS, &c., W. R. Kinipple, London.—*5th October*, 1881.
4407. GAS ENGINES, J. A. Drake and R. Muirhead Maidstone.—*11th October*, 1881.
4707. WINDOW-SASHES, J. H. Mills, Southampton.—*27th October*, 1881.
4896. PREPARING PHOTOGRAPHIC EMULSIONS, J. Plener, Cockspur-street, London.—*8th November*, 1881.
4913. LAYING HOLD of SUNKEN VESSELS, J. Standfield and J. L. Clark, London.—*9th November*, 1881.
4953. VENTILATOR, H. W. Yates, Brighton.—*12th November*, 1881.
4964. COUPLING, W. J. Fraser, Adelaide-road, London—*12th November*, 1881.
5022. COLD AIR MACHINES, E. Hesketh, Dartford.—*16th November*, 1881.
5208. STOPPERING JARS, H. Mardon, Bristol.—*29th November*, 1881.
5231. MOTIVE-POWER ENGINES, J. Bell, Wishaw.—*30th November*, 1881.
5269. PURIFYING COAL GAS, J. Walker, Leeds.—*2nd December*, 1881.
5284. TRICYCLES, N. K. Husberg, London.—*3rd December*, 1881.
5302. DRYING COFFEE BEANS, F. des Vœux, London.—Com. from W. A. Dieseldorff.—*5th December*, 1881.
5342. TEMPLES for LOOMS, J. Hardaker, Leeds.—*7th December*, 1881.
5464. DISTILLING ALCOHOL, K. Trabach and A. Cords, Berlin.—*14th December*, 1881.

Patents Sealed.

(*List of Patent Letters which passed the Great Seal on the 16th December*, 1881.)

2474. GENERATING STEAM, A., J., and R. Anderton, Accrington.—*7th June*, 1881.
2582. TRICYCLES, H. J. Haddan, Westminster.—*14th June*, 1881.
2586. SHIPS' PENS for CATTLE, H. J. Haddan, Westminster.—*14th June*, 1881.
2642. CORKSCREWS, F. A. Whelan, London.—*17th June*, 1881.
2668. SAFETY PINS, L. A. Groth, London.—*18th June*, 1881.
2677. FOLDING SEAT, J. Rettie, London.—*18th June*, 1881.
2688. BOSS HOLDERS, W. A. Hudgell, Hendon.—*20th June*, 1881.
2692. PRINTING MACHINES. F. H. F. Engel, Hamburg.—*20th June*, 1881.
2698. DIVING APPARATUS, G. H. Heinke, London.—*20th June*, 1881.
2704. SCHOOL SLATES, J. F. Walters, Bayswater, and W. Pickering, Strand.—*20th June*, 1881.
2706. FINISHING PLAITED FABRICS, W. P. Thompson, Liverpool.—*20th June*, 1881.
2707. TREATING LIQUIDS, W. R. Lake, London.—*20th June*, 1881.
2708. ESCAPEMENT for WATCHES, A. Browne, London.—*20th June*, 1881.
2711. DANGER ALARMS, &c., T. A. B. Putnam, New York, U.S.—*21st June*, 1881.
2713. COMBING MACHINES, J. C. Walker and J. E. Stephenson, Shipley.—*21st June*, 1881.
2715. NECK-TIES, J. Thomas and B. White, London.—*21st June*, 1881.
2720. WASHING WOOL, J. Petrie jun., Rochdale.—*21st June*, 1881.
2727. HEALDS, W. E. Gedge, Strand, London.—*22nd June*, 1881.
2729. BUTTONS, &c., J. Harrington, Brixton.—*22nd June*, 1881.
2746. BOOTS and SHOES, D. W. Cuthbert, Glasgow.—*23rd June*, 1881.
2753. HEATING FURNACES, T. Adams, Brierley Hill.—*23rd June*, 1881.
2771. SCREW-CUTTING, &c., A. M. Clark, London.—*24th June*, 1881.
2796. LOZENGES, &c., W. Sharp, Birmingham.—*25th June*, 1881.
2812. SEWING MACHINES, T. J. Denne, Holmesdale Lodge, Red Hill.—*27th June*, 1881.
2848. TREATING CARBON, J. G. Lorrain, London.—*29th June*, 1881.
2863. DYE PRODUCTS, A. M. Clark, London.—*30th June*, 1881.
2932. WHITE METAL, &c., J. C. Mewburn, Fleet-street, London.—*5th July*, 1881.
2957. CAUSTIC HOLDERS or CASES, G. F. Redfern, London.—*6th July*, 1881.
3056. TREATING FLUID SLAG, A. M. Clark, London.—*12th July*, 1881.
3076. PURIFYING ALCOHOL, W. R. Lake, London.—*14th July*, 1881.
3132. DOUBLING and WINDING, J. and J. Horrocks, Manchester.—*19th July*, 1881.
3332. ROAD-MAKING ENGINES, A. Lamberton, Coatbridge.—*2nd August*, 1881.
3463. PROTECTING CABLES, F. R. Lucas, Old Broad-street, London.—*10th August*, 1881.
3914. PREPARING COTTON, W. and W. Lord, Todmorden.—*9th September*, 1881.
4020. SMOKE-CONSUMING APPARATUS, G. West, New Lenton.—*19th September*, 1881.
4573. LIFEBOATS, W. R. Lake, London.—*19th October*, 1881.
4611. STEAM PRESSES, L. M. Schmiers, Leipzig, Saxony.—*21st October*, 1881.
4617. ELECTRIC LAMPS, A. M. Clark, London.—*21st October*, 1881.
4705. JOURNAL BEARINGS, A. M. Clark, London.—*27th October*, 1881.

(*List of Letters Patent which passed the Great Seal on the 20th December*, 1881.)

2333. NAVIGABLE VESSELS, J. F. Jaquess, London.—*27th May*, 1881.
2629. BALL COCKS or VALVES, S. Owen, London.—*16th June*, 1881.
2710. AIR-COMPRESSING ENGINES, E. Holt, Radcliffe.—*21st June*, 1881.
2714. PREPARING CLAY, E. J. T. Digby, Hammersmith, London.—*21st June*, 1881.
2723. RAISING, &c., SCREW PROPELLERS, G. Leslie, Fairfield, Arbroath.—*21st June*, 1881.
2735. BUCKLES, J. Belicard, Manchester.—*22nd June*, 1881.
2736. COMBING WOOL, J. and W. Baldwin, R. Haddon, and J. C. Dyson, Halifax.—*22nd June*, 1881.
2741. TREATING VEGETABLE SUBSTANCES, A. Gough, Buckingham.—*22nd June*, 1881.
2748. FEEDING WOOL to SCRIBBLING, &c., MACHINERY, W. Cliffe and T. E. Ainley, Golcar, near Huddersfield.—*23rd June*, 1881.
2757. WINDING, &c., YARN, J. and T. A. Boyd, Shettleston.—*24th June*, 1881.
2794. LOOMS, W. H. Beck, Cannon-street, London.—*25th June*, 1881.
2798. RAISING BEER, J. A. B. Bennett, King's Heath, and J. Herd and B. P. Walker, Birmingham.—*25th June*, 1881.

2800. Engines, G. P. Renshaw, Nottingham.—27*th June*, 1881.
2816. Treating Spent Lyes, G. Payne, London.—27*th June*, 1881.
2818. Preventing the Escape of Sparks, W. R. Lake, London.—27*th June*, 1881.
2832. Laundry Irons, F. A. K. Cook, Londonderry.—28*th June*, 1881.
2920. Carrying Cement, W. W. Hewitt, Swanscombe.—4*th July*, 1881.
2930. Electric Lamps, E. P. Ward, London.—5*th July*, 1881.
3052. Winding Engines and Wagons, D. Greig and R. H. Shaw, Leeds.—12*th July*, 1881.
3218. Registering the Travel of Locomotives, R. H. Braddon, Paris.—23*rd July*, 1881.
3232. Carbonising, &c., Bones, W. L. Wise, London.—23*rd July*, 1881.
3362. Electric Lighting, K. W. Hedges, London.—3*rd August*, 1881.
3496. Umbrellas, A. MacMillan, London.—12*th August*, 1881.
3770. Recording the Number and Prices of Tickets, J. P. Power, London.—30*th August*, 1881.
3874. Looms, E. Smethurst, Manchester.—7*th September*, 1881.
3918. Case for Receiving Trimmings, E. J. V. Earle, London.—9*th September*, 1881.
4729. Raising Ships' Boats, A. M. Clark. London.—28*th October*, 1881.

List of Specifications published during the week ending December 17th, 1881.

593, 2d.; 1141, 2d.; 1159, 2d.; 1183, 2d.; 1207, 2d.; 1263, 2d.; 1515, 2d.; 1611, 2d.; 2078, 6d.; 2083, 6d.; 2102, 4d.; 2107, 2d.; 2108, 2d.; 2109, 6d.; 2110, 1s.; 2116, 2d.; 2117, 2d.; 2119, 2d.; 2121, 6d.; 2122, 6d.; 2123, 2d.; 2124, 4d.; 2125, 6d.; 2126, 2d.; 2127, 6d.; 2128, 2d.; 2130, 8d.; 2131, 6d.; 2132, 6d.; 2133, 8d.; 2135, 2d.; 2136, 4d.; 2137, 6d.; 2138, 2d.; 2139, 8d.; 2140, 2d.; 2141, 2d.; 2142, 2d.; 2144, 6d.; 2146, 6d.; 2147, 6d.; 2148, 6d.; 2149, 6d.; 2150, 6d.; 2151, 2d.; 2152, 2d., 2153, 2d.; 2154, 2d.; 2155, 4d.; 2156, 6d.; 2157, 6d.; 2158, 2d.; 2159, 8d.; 2160, 6d.; 2162, 2d.; 2163, 2d.; 2164, 2d.; 2166, 6d.; 2168, 2d.; 2169, 6d.; 2170, 2d.; 2172, 6d.; 2173, 6d.; 2174, 4d.; 2175, 4d.; 2176, 4d.; 2177, 4d.; 2178, 2d.; 2180, 4d.; 2181, 4d.; 2182, 6d.; 2184, 2d.; 2185, 6d.; 2187, 10d.; 2188, 2d.; 2189, 2d.; 2191, 2d.; 2192, 2d.; 2193, 2d.; 2194, 2d.; 2195, 4d.; 2196, 2d.; 2199, 2d.; 2200, 2d.; 2201, 2d.; 2202, 6d.; 2203, 6d.; 2205, 2d.; 2207, 6d.; 2208, 4d.; 2209, 6d.; 2210, 6d.; 2211, 6d.; 2212, 2d.; 2213, 2d.; 2214, 6d.; 2216, 6d; 2219, 4d.; 2220, 2d.; 2221, 6d.; 2222, 6d.; 2227, 6d.; 2229, 6d.; 2230, 6d.; 2231, 6d.; 2249, 6d.; 2276, 6d.; 2314, 2d.; 2337, 6d.; 2437, 6d.; 2455, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

593. Adaptation of Oil, Fat, and Butter to Culinary Uses, *W. White, London.*—10*th February*, 1881.—(*Provisional protection not allowed.*) 2*d.*

This relates to the employment of suet and also to the employment of dried bread or biscuit crumb saturated with edible oil, or with butter, lard, or fat.

1141. Aromatic Salt, *T. Morgan, London.*—16*th March*, 1881.—(*A communication from D. Viard, J. Espinasse, and L. Raismes, all of Paris.*)—(*Provisional protection not allowed.*) 2*d.*

This relates to the combination of white salt, pepper, cloves, basil, cinnamon, nutmeg, laurel leaves, thyme, coriander seed, and parsley.

1159. Beverage or Liquor, *W. P. Thompson, London.*—17*th March*, 1881.—(*A communication from C. Desnos, Paris.*)—(*Provisional protection not allowed.*) 2*d.*

The principal ingredients are beer, ale, porter, or stout, and sarsaparilla.

1183. Knife Handles, *M. Bauer, Paris.*—18*th March*, 1881.—(*A communication from G. Bourgade, Le Chene Roud, France.*)—(*Provisional protection not allowed.*) 2*d.*

This consists in the employment of porcelain, stoneware, clay, glass, and such like substances.

1207. Lubricating Dies or Moulds, *P. Wood, West Bromwich.*—19*th March*, 1881.—(*Provisional protection not allowed.*) 2*d.*

This consists in the introduction of a jet or jets of steam between the clay in the die and the sides of the die or mould.

1263. Advertising, *J. P. Bennet, London.*—22*nd March*, 1881.—(*Provisional protection not allowed.*) 2*d.*

Sheets of paper are saturated with chemical solutions, and upon one side of each sheet advertisements are printed.

1515. Wrapper or Envelope for Expressing Oil from Seeds, *C. H. Dibb, Hull.*—6*th April*, 1881.—(*Provisional protectional not allowed.*) 2*d.*

The wrappers are made of compressed tanned walrus hide.

1611. Compound of Cocoa, &c., *W. Barry, London.*—13*th April*, 1881.—(*Provisional protection not allowed.*) 2*d.*

The compound consists of pure cocoa, Peruvian bark, liquid homeopathic preparation of phosphorus, and sulphate of iron.

2013. Improvements in Apparatus for Generating and Conveying Electricity, *A. Masson, Bordeaux, France.*—7*th May*, 1881.—(*Not proceeded with.*) 2*d.*

The improvements consist in the application to dynamo-electric machines of an earth current to regulate the path of electricity generated, combined with the application of dualised wires, in the use of an insulating medium composed of cement and powdered iron mixed, and in the arrangement of the dynamo-electric machine, so that it can be revolved at the same speed as its motor.

2038. Improvements in Electric Lighting Apparatus, *H. J. Haddan, London.*—10*th May*, 1881.—(*A communication from R. J. Gülcher, of Bielitz-Biald, Austria.*) 6*d.*

This invention consists in a new method of regulating the arc in electric lamps by the motion of a single electro-magnet without any intermediate mechanism, the magnet turning on an axle, and being set in motion by the attraction of a fixed iron bar. It also relates to a means of producing several arc lights from a single source, the lamps being arranged in parallel circuits, and the current led to them by a large cable, from which wires branch off to the respective lights. The lamp, and the method of dividing the current, was described and illustrated in one of our recent articles on the Paris Exhibition.

2078. Meteorological Indicating and Air-testing Instruments, *F. H. F. Engel, Hamburg, Germany.*—12*th May*, 1881.—(*A communication from W. Klinkerfues, Gottingen, Germany.*) 6*d.*

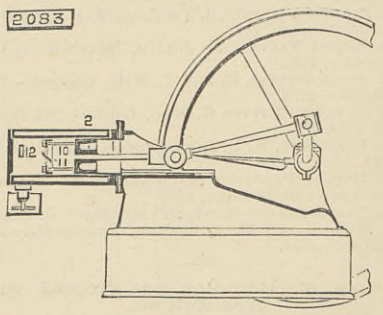
This relates to the construction of an instrument indicating the dew point, relative moisture, and air temperature, simultaneously by the combination of a hygrometric hair or hair-string, a thermometer, and scales.

2079. Improvements in the Construction of Electric Lamps, &c., *C. H. Gimingham, London.*—12*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This invention relates to a method for hermetically sealing the conductor of an incandescent lamp into the glass globe.

2083. Motive Power Engines, *J. Robson, Birmingham.*—12*th May*, 1881. 6*d.*

This relates to engines worked by internal combustion of gas or vapour and air, and principally to working the valves of and starting such engines in which a charge of gas and air is drawn into a cylinder by the outstroke and compressed by the instroke of the piston into a combustion chamber at back of cylinder, and then ignited on the next outstroke, and the productions of combustion expelled by the following instroke. 1 is a water-jacketted cylinder; 2, the



piston, on which is fixed by studs a plate piston 10 with an aperture in which a nearly balanced swinging valve 11 is placed. On the outstroke a charge of gas and air is drawn into the cylinder by port 12, but is prevented by valve 11 from mixing with the previously consumed gases. The instroke compresses the charge which passes between pistons 2 and 10, and on the next outstroke it is exploded, the products of combustion being expelled from between the two pistons on the next instroke.

2102. Tin and Terne Plates, *D. Leyshon, Penclawdd, Wales.*—13*th May*, 1881. 4*d.*

This consists in immersing the plates to be coated in a bath of hot palm oil or grease after removing them from the bath of water and before placing them in the bath of molten metal which is required when the plates are immersed in a bath of cold grease as usual.

2107. Chromographic Printing, &c., *H. J. Haddan, London.*—14*th May*, 1881.—(*A communication from W. H. Forbes, Boston, U.S.A.*)—(*Not proceeded with.*) 2*d.*

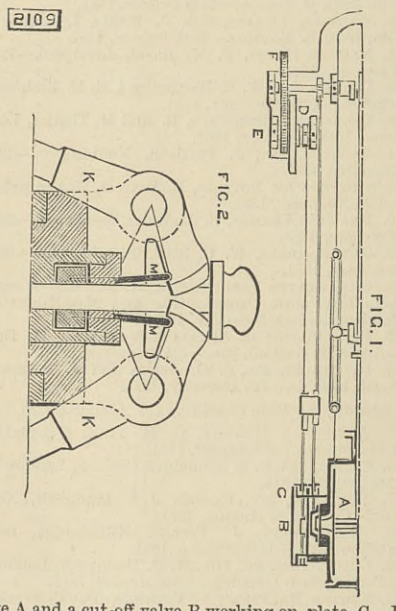
This consists in producing chromographic designs by printing on a single sheet, first from a lithographic stone, or its equivalent, one of the series of impressions which, with others, constitute the design, and immediately after or before the ink has dried, printing on said sheet from relief plates, or their equivalents, the other impression or impressions in continuous sequence.

2108. Cotton Pile Plushes, &c., *W. Irlam, Eccles.*—14*th May*, 1881. 2*d.*

This consists partly in treating cotton pile plushes woven with dyed cotton with a solution of Epsom salts, with or without glycerine.

2109. Mechanism Employed to Control the Speed of Steam Engines, *H. Lindley, Salford.*—14*th May*, 1881. 6*d.*

This relates to improvements on patent No. 325, A.D. 1868, in which weights upon levers were connected together, and moved to and fro radially in a plane at right angles to the axis of rotations, and their movements arising from the varying speeds of rotation were conveyed to mechanism to regulate the position of the excentric on the fly-wheel shaft, and it consists in adapting such governor to engines of low speed. Fig. 1 is a plan view showing this part of the invention. The valve chest of cylinder contains a main



valve A and a cut-off valve B working on plate C. D is the governor drum with weight levers drawn inwards by springs, and connected by links to the expansion excentric. The governor drum is mounted on shaft E, which is caused to rotate at twice the speed of the engine by the gearing F. The invention further relates to high-speed governors, and consists in causing the ends of the governor arms K to bear on the toggle links M, the lower ends of which rest on depressions formed in the button, the motion of which is transferred to the throttle valve.

2110. Regulating the Working of Vacuum Pans Applicable for Sugar Boiling, &c., *A. Watt, Liverpool.*—14*th May*, 1881. 1s.

Electro-magnetic valves are used for admitting the various fluids into the vacuum pans and condensers, these being all of a similar type, but each controlled partially according to its position or use by electrical thermometers or vacuum gauges, or both, the connection between these valves and the thermometers or gauges being so arranged that the alteration of the position of the mercury will either cause the flow or stop the flow of a current of electricity through the electro-magnet controlling the valve, and so cause the valve to open or shut as required, this current of electricity proceeding from a dynamo-electric machine or other sufficiently powerful generator of electricity.

2112. Flannel, &c., *W. Schofield.*—14*th May*, 1881. 2*d.*

The object is to prepare flannel so as to impart to it anti-rheumatic and disinfecting qualities, and it consists in placing the flannel into a solution consisting of about ½ lb. soft and 1 oz. common gum boiled in about 2 quarts of water, and, whilst boiling, about ½ pint of salad oil and about 1 quart of "sanitas" is added.

2114. Apparatus and Material for Filtering, *W. Spence.*—14*th May*, 1881.—(*A communication from Piefke.*) 6*d.*

This consists of a series of sieves arranged one above the other round a central tube with inlet, by means of which a filtering paste, with which the vessel containing the sieves is filled, can be drained and deposited on the sieves. The filtering paste consists of vegetable or animal fibre boiled with alkalies until converted into cellulose, and its specific gravity is increased so that it sinks in water, when it is put into a solution of argillaceous earth. By means of caustic alkalies the earth is precipitated and adheres to the fibre, which is afterwards washed and diluted lime added to it, which is afterwards made anti-soluble by means of alum or tannic acid, after which it is dried and reduced to powder.

2116. Travelling Cabinet, *W. M. Cochrane, London.*—14*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the arranging of various drawers or receptacles for wearing apparel and other articles, shelves and partitions for books, a sliding tray for holding paper and other writing appliances, an outside upper lid to serve as a writing desk, and an outside lower lid to form a table by fitting legs thereto.

2117. Producing a Number of Copies of any Writing or Design, *J. H. Noad, East Ham.*—14*th May*, 1881.—(*Not proceeded with.*) 2*d.*

The apparatus has a roller, on the circumferential surface of which is put a coating of gelatinous substance, and when this surface has received the impression of the aniline writing or design it is used for transferring such impression to a number of sheets of paper.

2119. Adjusting and Securing Door-knobs on their Spindles, *A. W. Pocock, London.*—14*th May*, 1881.—(*Not proceeded with.*) 2*d.*

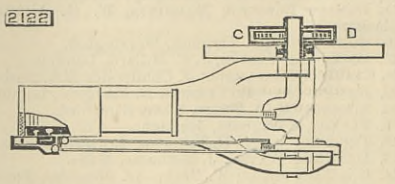
This consists in splitting or cutting some portion or portions of the socket into which the spindle takes, so that when the sides thus formed are drawn together by a screw or screws, they will close or grip firmly the spindle.

2121. Screw Propellers for Steamships, *W. R. Lake, London.*—14*th May*, 1881.—(*A communication from J. B. Root, Port Chester, U.S.A.*) 6*d.*

This consists in placing the screw shaft at an inclination or angle to the line of movement of the vessel, and diminishing the pitch of the screw, and increasing its diametric or propelling area according to the inclination or angle of the shaft, and relatively to the pitch and area which the screw would have were its shaft horizontal, and in the fore and aft line of the vessel.

2122. Gas Motor Engines, *J. Dougill, Manchester.*—16*th May*, 1881. 6*d.*

This relates, First, to the application of a spring and a clutch or brake to utilise and distribute the force derived from the explosion of the gas in a cylinder acting upon a piston; Secondly, to a valve to regulate the speed; and Thirdly, to another valve to admit the combustible charge, ignite it, and permit the escape of the products of combustion. The piston, instead of being connected rigidly to the fly-wheel through the crank, is connected through a spring D contained



within the driving pulley C, which is connected to the fly-wheel; one end of the spring being attached to the crank shaft and the other to the driving pulley. A clutch or brake acts on the periphery of the pulley to prevent a backward movement. A mushroom valve is placed at the end of the gas supply, and is acted upon by an arrangement at the back of the valve which admits the atmosphere, so that should the speed increase, the air valve will open wider, and so close the gas supply.

2123. Belts or Straps for Driving Purposes, *D. Williams, Portmadoc, N. Wales.*—16*th May*, 1881. 2*d.*

The belting is constructed of strips or folds of canvas stitched together by machinery, and passed through rollers, then steeped in a solution of boiled oil and resin, and afterwards coated on both sides with a composition composed of whitelead, varnish, boiled oil, and slate dust.

2124. Hydraulic Caps for Winding Shafts, *F. Wirth, Frankfort-on-the-Maine.*—16*th May*, 1881.—(*A communication from N. Frantz and F. Westmeyer, St. Johann-on-the-Saar, Germany.*) 4*d.*

This consists in the construction of double levers which have their fulcrums in the rams, and serve as supports for the carrying frame, said levers being placed in such a position by the weight of the descending stage that the stage is allowed to pass freely without previous lifting, and the levers return automatically into their former horizontal position by means of hydraulic pressure.

2125. Propelling and Steering Vessels, *A. Figge, London.*—16*th May*, 1881. 6*d.*

This consists partly in the combination and construction of flexible feathering fish-tail propellers worked by a rocking motion in movable framework, or attached in a suitable manner to the stern of the ships, and which can be moved by the steersman and turned to any desired angle.

2126. Compound for Renovating and Preserving the Polish of Wood Furniture, *C. D. Abel, London.*—16*th May*, 1881.—(*A communication from E. Schultz, Berlin.*)—(*Not proceeded with.*) 2*d.*

This consists in a mixture of fatty oils with gum mastic and other gums or resins dissolved in alcohol and with nitrobenzole.

2127. Life Preserving Garment, *F. W. Brewster, London.*—16*th May*, 1881. 6*d.*

This consists principally in making a flexible cape or similar garment to be put or worn on the shoulders of any suitable fabric or material, in the lining of which will be inserted and secured graduated or radiating columns or rows of corks.

2128. Apparatus for Steering Ships, *A. B. Brown and W. F. King, both of Edinburgh.*—16*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a combination of electrical appliances with a magnetic compass and with hydraulic or steam-steering apparatus, so as to provide for automatically maintaining a ship in a required course by suitably acting on the rudder when deviations from the course occur.

2130. Steering Apparatus for Ships, *W. Morgan-Brown, London.*—16*th May*, 1881.—(*A communication from H. Lindeman, Wilhelmshafen, Germany.*)—(*Not proceeded with.* 8*d.*

The standing parts, instead of being fastened to the sides, are fastened to the rudder head, or before or behind it, at a convenient point in the middle line.

2131. Petroleum or Hydrocarbon Cooking and Heating Stoves, *F. H. F. Engel, Hamburg, Germany.*—16*th May*, 1881.—(*A communication from H. Kock, Hamburg, Germany.*) 6*d.*

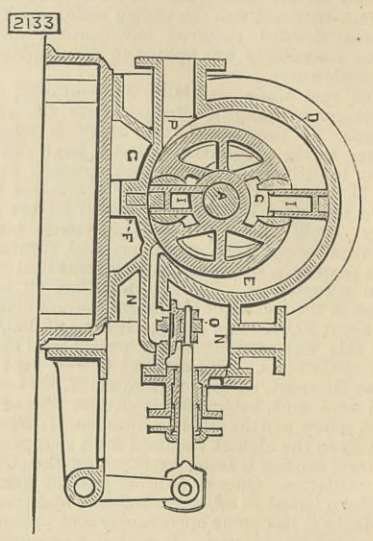
This consists, First, in the construction of the wick guide with feeding rollers furnished with longitudinal and circular grooves to form the surface of the rollers into a great number of sharp pointed pyramidical teeth; Secondly, in lining the wick holder with tin plate fastened by bending both ends; Thirdly, the construction of the crown or top part of the burner, sliding up and down for the purpose of altering the distance between the boiler and flame or flames; Fourthly, in the extinguishing caps of the burner, formed with a small opening at their upper side for the purpose of allowing of the burning of the flame.

2132. Portable Crane, *J. Hurst, Brighton.*—16*th May*, 1881. 6*d.*

The crane consists of a swinging jib pivotted between a pair of rings adapted to embrace the scaffold or other pole, the said rings being made in halves hinged together at one side, so that they may be opened to be applied to or removed from the poles, and are provided with clamping screws, by which they are firmly secured thereon.

2133. Rotary Engines, &c., *W. R. Lake, London.*—16*th May*, 1881.—(*A communication from W. H. and A. J. Jacobs, of Holland.*) 8*d.*

Upon the shaft A is secured piston wheel or drum E revolving excentrically within cylinder D, in which at the point of contact is a packing piece F pressed upwards by springs. In the drum are two opposite



cavities G to receive packing pieces capable of turning freely therein and serving to guide the pistons I, the ends of which have projections working in grooves in the cylinder ends. N is the inlet port controlled by valve O worked by an excentric, and P the exhaust port.

2135. Heating Apparatus, *R. H. Abrey, London.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

The boiler, instead of being placed outside the hot-house or other place to be heated, is arranged with the house or place to be heated. And instead of the products of combustion passing up the usual way, they are led away from the boiler in a pipe or pipes within the house or place to be heated. And the said flue pipe or pipes is or are surrounded with an exterior pipe along which the water from the boiler is caused to travel.

2136. Artificial Alizarine, *J. A. Dixon, Glasgow.*—17*th May*, 1881.—(*A communication from Dr. C. Kœnig, Höechst-am-Main, Germany.*) 4*d.*

Instead of following the ordinary practice of supersaturating with acids the aqueous solution of the alizarine smelt, and then precipitating the colouring matter, that aqueous solution is mixed with lime water and so precipitates from the same the calcium compounds of the alizarine, which are separated from the alkaline lyes by filtration or by other suitable means. The alkaline lyes thus obtained are evaporated, and from the same are removed on suitable concentration the above-mentioned alkali salts by crystallisation, and the organic substances remaining in the mother lye are destroyed by smelting with saltpetre or by blowing in air of a high temperature, and the caustic soda or caustic potash is recovered therefrom.

2137. Stands for Supporting Lasts in the Manufacture of Boots and Shoes, *J. Southwood, Leeds.*—17*th May*, 1881. 6*d.*

A stand is fixed to a table or bench. On it is provided a socket for the reception of a ball at the lower end of the pillar forming the rest or carriage for the last. A ball-and-socket joint is thus formed, which allows the last carriage or rest to be moved to any desired angle or position for the purpose of working at the boot or shoe placed thereon.

2138. Looms, *J. Holding, Manchester.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

An amount of elasticity is imparted to the strain which is put upon each picking band by partly transmitting the motion through a spring.

2139. Lamp Burners, *T. Rowatt, Kew.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a construction and arrangement of the deflecting cones and passages for the supply of air to the flame of a lamp in such a manner as to obtain increased completeness of combustion and consequent brilliancy of light.

2140. Ventilating Apparatus, *E. Hatton, Manchester.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

When applied to windows, a light frame is made and fitted in the window frame, so as to form a hopper ventilator, having two sides and a swing front of glass or other material. On the upper edge and sides of the swing frame are fixed strips of cloth, india-rubber, or any other flexible material so arranged as to form a weather-tight connection between the fixed and movable portion of the ventilator.

2141. Brooches, &c., *W. H. Taylor, Birmingham.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the fastenings of brooches, &c.

2142. Photographic Printing Frame, *W. H. Beck, London.*—17*th May*, 1881.—(*A communication from P. Piquepé, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists, First, in the manufacture and arrangement in rolls of sensitive paper; Secondly, in a special frame.

2144. Blasting Charges for Mining, &c., *W. E. Gedge, London.*—17*th May*, 1881.—(*A communication from C. Favre, St. Etienne, France.*) 6*d.*

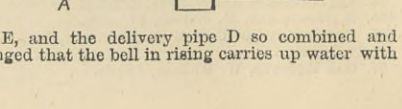
This consists essentially in the use of a spring apparatus with plug coated with incombustible paste (the fuse or match being also coated therewith) placed at the bottom of the cartridge.

2146. Wax-thread Sewing Machines, *W. R. Lake, London.*—17*th May*, 1881.—(*A communication from D. H. Campbell, Pawtucket, U.S.A.*)—(*Complete.*) 6*d.*

This consists, First, in the combination of a hook-needle, a centrally pointed shuttle, and a race compound of three or more bars or rails engaging in bearing contact with opposite portions of the periphery of the said shuttle; Secondly, the combination with a centrally pointed shuttle and hook-needle of a shuttle-driver provided with a downward projection at its rear to operate as a "cast-off" in enabling the needle to free itself from a loop. Other improvements are described.

2147. Water Waste Preventers, *W. Bartholomew, London.*—17*th May*, 1881. 6*d.*

This consists of the measuring cistern A, the lifting

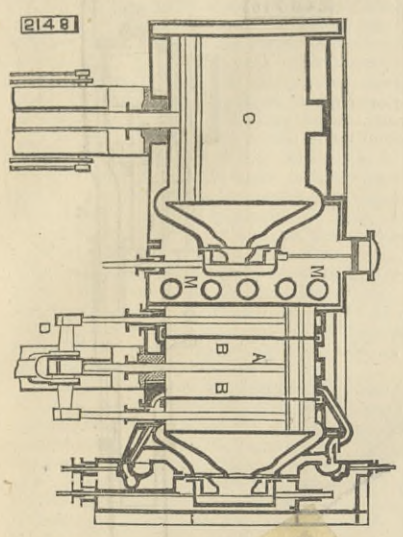


bell E, and the delivery pipe D so combined and arranged that the bell in rising carries up water with

it, and sets up a flow in the pipe D, thereby establishing a syphon-like action, and causing the discharge of the measured quantity of water.

2148. COMPOUND STEAM ENGINES, *H. H. Lake, London.*—17*th May*, 1881.—(*A communication from J. W. Chisholm, New York, U.S.A.*) 6*d.*

The object is to increase the efficiency of compound engines by more fully utilising the steam, and obviating loss of temperature from radiation of heat, and it consists in placing the high-pressure cylinder A centrally within the intermediate cylinder B, which



is in line with and on the same hori... plane as the low-pressure cylinder C. The p... inder A is connected to crosshead D, and ... inder B, while the piston of C is connec... ead, both crossheads sli... to the crank shaft in the ord... condenser communicates with cyli... air pump is worked from the cros... in cylinder C by levers. The chambe... between ... and C is provided with a series of pipes M, through which heat from the furnace passes.

2149. FIREPLACES, &c., *T. F. Shillington, Belfast.*—17*th May*. 1881. 6*d.*

This consists, First, in the combination with the grate or space in which the fuel is burned of a fuel receptacle or chamber provided with a door or doors and with an overhanging lip at the bottom; Secondly, in means for ensuring a continuous supply of air to the space immediately below the said curved overhanging lip in combination with means for heating the air; Thirdly, in the combination with the said grate and fuel chamber of a rocking shaft provided with a pusher at the bottom of the said fuel chamber, and with a lever at the front of the fireplace.

2150. TRUNKS OR BOXES FOR WEARING APPAREL, &c., *W. R. Lake, London.*—17*th May*, 1881.—(*A communication from F. H. Ransom, Buffalo, U.S.A.*) 6*d.*

This consists of a trunk in which the body and trays are provided with suitable means whereby the trays can be lifted out of the body of the trunk, and then moved out of the way without detaching them therefrom.

2151. SHEDDING APPARATUS IN LOOMS, *A. Flasher, Bradford.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the employment of one or more chains of tappets which work upon barrels fixed to the top rail of the loom.

2152. PUMPS, *B. J. B. Mills, London.*—17*th May*, 1881. —(*A communication from E. Hazelle, Paris.*)—(*Not proceeded with.*) 2*d.*

A ring of india-rubber is stretched upon the piston of the pump, thereby forming a rolling piston or packing, the friction of which is very trifling. When motion is imparted to the piston of the pump the packing rolls to and fro, forming a close packing.

2153. REGISTER STOVES, &c., *J. Sawyer, London.*—17*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the application of a combustion box or chamber fixed at the back of the stove, and provided with a slide door or valve at the bottom. The said combustion box or chamber is formed with openings leading to the chimney or flue.

2154. HORSE RAKES, *W. Brenton, St. Germans.*—17*th May*, 1881. 2*d.*

This relates to means for turning the rake, and for automatically fixing and holding it in position after it has been turned.

2155. PLOUGHS, &c., *W. H. Sleep, Sheviock.*—17*th May*, 1881.—(*Not proceeded with.*) 4*d.*

This relates partly to improvements on patent No. 2429, dated 12th June, 1876, and in constructing the ploughs, whether to take one or more furrows, it is optional whether a pair of stilts is attached to each set of ploughing tools, or whether by other suitable mechanical arrangement one pair is constructed for the manipulation of both sets.

2156. TORPEDO BOATS, *J. H. Johnson, London.*—17*th May*, 1881.—(*A communication from A. J. A. Lagane, Paris.*) 6*d.*

This consists in the combination with torpedo boats of a water-tight float, permanently connected to the upper deck of the vessel, for the purpose of maintaining the vessel entirely below the surface of the water out of the reach of projectiles.

2157. CALENDERING OR SMOOTHING PAPER, *A. J. Boult, London.*—17*th May*, 1881.—(*A communication from J. Eck and Sons, Düsseldorf, Prussia.*) 6*d.*

This consists, First, of an improved spreader which may rotate or be fixed for preventing folds or creases in the paper passing through the machine, and for stretching the same; Secondly, in combination with a prismatic projection for carrying the lubricant from one bearing to the next below, the roller bearing so constructed as to facilitate the correct parallel adjustment, the interchange and the screwing part of the separate rollers, the standards being divided. Other improvements are described.

2159. RAILWAY BRAKES, *C. D. Abel, London.*—18*th May*, 1881. —(*A communication from J. Hardy, Vienna.*) 8*d.*

This consists in the combination with the ordinary hand-screw brakes of a railway carriage or van of additional brake gear, wherein the brake shaft of the carriage is connected to a telescopic lever which can be coupled to the brake gear of the continuous brake carriage so as to enable either the brakes of both carriages to be operated simultaneously by means of the brake screw spindle of the one carriage, or each brake carriage to have its brakes operated separately.

2160. ATTACHING KNOBS TO DOOR LOCK AND OTHER SPINDLES, *E. S. Harvey, Tottenham, and J. Brodie, London.*—18*th May*, 1881. 6*d.*

Near one or both ends of the spindle numerous fine cuts or notches are formed across one or more of its faces. A short strip of thin steel plate is laid on to one of the notched faces, and one end of the steel plate is bent at right angles to form a short projection to enter one or other of the notches. Slits are cut in the central portion of the steel plate, so as to form out of it a tongue, and this tongue is bent, so that its end inclines outwards away from the spindles.

2162. PREPARATION OF WIRE FOR USE IN THE MANUFACTURE OF CATTLE FENCES, &c., *E. Fox, Millwall.*—13*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This refers to means of applying barbs or points or other projections at intervals on wire, wire rope, or rods or bars, to be used in the manufacture of cattle or sheep fences.

2163. FASTENINGS FOR BRACELETS, &c., *T. Champion, London.*—18*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a spring catch lever.

2164. ROLLER SKATES, *W. R. Lake, London.*—18*th May*, 1881.—(*A communication from C. M. Raymond, Boston, U.S.A.*)—(*Not proceeded with.*) 2*d.*

This consists, First, in combining the front and rear rollers for each foot with independent heel and toe plates; and Secondly, in so combining separate heel and toe plates, carrying respectively the front and rear rollers, that they may move or slide one upon the other, and thus permit an extension or contraction of the skate in length, the plates being adjusted to overlap over the rollers at either or both ends, even when the skate is extended to its utmost length.

2166. SPRING MATTRASSES, &c., *G. D. Peters, London.* —18*th May*, 1881. 6*d.*

This relates to a mattrass, seat, or cushion, consisting of frames and springs connected to the frames by metal strips and to each other by fasteners.

2168. PORTABLE EASELS, *E. J. Chatrel, Withington.* —18*th May*, 1881.—(*Not proceeded with.*) 2*d.*

The easel is provided with three folding legs, each with a joint in or about the centre, which can be stiffened by the insertion of a peg.

2169. DISTILLING SHALE, &c., *G. T. Beilby, Mid Calder, North Britain.*—18*th May*, 1881. 6*d.*

This consists in the system or mode of distilling shale or other oil-yielding mineral wherein the materials are passed through the retorts in a practically continuous manner, and wherein the distillation of the oil is effected in the upper parts of the retorts at a suitable moderate heat, wholly or to a great extent by the heat or actions of vapours or gases passing up from the lower parts of the retorts, in which lower parts the "spent" shale is being subjected to a comparatively high heat, for the purpose of increasing the yield of ammonia, and thereby enhancing the value of the aggregate products.

2170. SEPARATING LIQUIDS FROM SOLIDS OR LIQUIDS, &c., *H. J. Smith, Glasgow.*—18*th May*, 1881.—(*Not proceeded with.*) 2*d.*

A centrifugal machine is used, such machine resembling the centrifugal machines employed in the sugar manufacture, the shell of the basket or rotating vessel not being perforated however, but impermeable. The liquid mixture to be operated on is led into the vessel, and the vessel made to rotate at a suitable speed, the centrifugal force causing the solid particles or matters to collect at the outer parts against the inside of the cylindrical or other shell, whilst the central part becomes occupied by separate liquid, which may be withdrawn by means of a syphon or in any other convenient way.

2172. FIRE-ESCAPE LADDERS AND HOSE CONDUCTORS, *A. M. Clark, London.*—18*th May*, 1881.—(*A communication from J. R. Winters, Chambersburgh, and R. Vosburgh, Brooklyn, U.S.A.*) 6*d.*

This invention consists in the combination with the axle and the frame of swivelled screws, their nuts and guide uprights, whereby the frame can be kept level, however uneven or inclined the surface of the ground may be; also in the combination with the frame of stationary hooks and hinged hooks, whereby a side ladder can be conveniently and securely carried; also in combination with the frame of bent pipes and the hose, whereby the said hose will be raised and lowered by and with the said ladder; and also in the combination with the side bars of the ladder of tires and end blocks, whereby the ladder is strengthened.

2173. RIDING SADDLES, *R. Walters and J. Hewitt, both of London.*—18*th May*, 1881. 6*d.*

The springs are mounted in a protecting frame of the thickness or a little less than that of the bar of the "tree," and such spring frame is attached by webbing or other suitable means to the said "bar," so that the said spring frame shall, at its upper end, lie close to the edge of the bar, thereby adding nothing to the thickness of the saddle and lying in a similar manner to the bar between the panel and the flap.

2174. BRICKS, TILES, &c., *J. Walker, Leeds.*—13*th May*, 1881. 4*d.*

This refers to the manufacture of blue vitrified metallic bricks, tiles, terra-cotta, or other articles of ornamental or ordinary form, also to prevent fusion together while in the kiln.

2175. REGENERATING OR RESTORING THE ENERGY OF ELECTRIC BATTERIES, *W. R. Lake, London.*—18*th May*, 1881.—(*A communication from L. Marche.*) 4*d.*

The reconstitution is by passing through the battery an electric current in the direction opposite to its own current.

2176. EXTRACTION OF GLYCERINE FROM COMPOUNDS OR SUBSTANCES CONTAINING THE SAME, &c., *W. R. Lake, London.*—18*th May*, 1881.—(*A communication from P. J. B. Depoully and D. Droux, both of Paris.*) 4*d.*

This consists in the extraction of glycerine from manufacturers' refuse and other mixtures (especially the lyes obtained from soap works or from low wines, or the refuse of alcoholic fermentation) by the combination of the glycerine with fatty acids, properly so called, and with natural neutral fatty bodies, which combination permits the elimination by simple washing with water of the salts and other impurities from the ordinary glycerine of commerce, and which combination can be obtained either by heating in the open air, or in a retort without pressure, or in a suitable vessel under pressure.

2177. STOCKING AND SOCK SUSPENDERS CLASPS, *E. Blinkhorn and F. A. C. Grobert, both of London.*)—18*th May*, 1881.—(*A communication from H. Axman, Vienna.*) 4*d.*

A plate or strip is hinged to a back piece, or *vice versâ*, and slots are so arranged that a double-headed button can be slid along, and become fixed with the fabric nipped between it and the two plates or strips when moved in one direction, and the fabric be released, and also the button on a movement in the reverse direction; the button is so fitted that it is always in connection with one of the strips, one portion of the other strip being shaped that the head may pass through to permit the two plates to be unfolded or opened out.

2178. APPARATUS FOR OBTAINING OR APPLYING MOTIVE POWER, *B. J. B. Mills, London.*—18*th May*, 1881.—(*A communication from A. di Viana, Genoa, Italy.*)—(*Not proceeded with.*) 2*d.*

The apparatus consists of a motive lever working upon an axis carried by a suitable support or standard, and by its end transmitting by the aid of an arm or connecting rod threefold the power exerted upon it to a pair of discs, which work as a crank shaft, and give rotary motion to a balance lever provided at each end with any given weight, and thereby developing great power.

2180. DISTILLING APPARATUS FOR STEAMSHIPS, *A. L Normandy, London.*—18*th May*, 1881. 4*d.*

This consists partly in constructing distillery condensers, so that they may be worked with the impure steam from the main boilers in such manner as to produce partly good cold fresh water for drinking, and partly hot, and more or less impure or greasy fresh water, which is returned to the boilers, thereby replacing all the water abstracted from the boiler in the shape of steam for working the condensers, so as to obviate the necessity of feeding about twice as much sea water, and all the evil resulting therefrom.

2181. FIRE-ARMS, *W. W. Morton, London.*—19*th May*, 1881. 4*d.*

The trigger plate is solid with the body of the action of a drop barrel sporting gun or rifle on the so-called hammerless system. The stock is to have a solid head, *i.e.*, the locks are not let into it, but it bears against the back portion of the action as if there were no locks.

2182. TREATING ORES AND SUBSTANCES CONTAINING ANTIMONY, *J. Hargreaves and T. Robinson, both of Widnes.*—19*th May*, 1881. 6*d.*

This relates to treating antimonious ores and substances to obtain metallic antimony and other valuable products, such as gold, silver, mercury, bismuth, copper, lead, cadmium, and tin, when these metals or one or more of them are contained in the said ores or substances, and also sulphuretted hydrogen.

2184. APPARATUS FOR THE AMALGAMATION OF GOLD, *F. Campbell, London.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the construction and use of a washing tank or tanks supplied with water, revolvable copper or other stirrers and quicksilver trough, combined with one or more riffle boxes fitted with a series of copper troughs arranged step fashion for holding quicksilver, and precipitating corrugated amalgamated copper trays fitted with one or more copper troughs for quicksilver and baize covered tables.

2185. CHRONOGRAPHS OR STOP WATCHES, *L. A. Groth, London.*—19*th May*, 1881.—(*A communication from H. A. Lugrin and P. Nordmann, both of New York, U.S.A.*) 6*d.*

This consists essentially in the combination with the hollow arbor of the centre wheel, having a perforated end collar or seat, of the arbor of the quarter second hand which is supported on the collar of the hollow arbor by a shoulder or enlargement, so that the arbor of the quarter second hand is adapted to oscillate thereon.

2187. MARINE STEAM ENGINES, *W. Allan, Sunderland.* —19*th May*, 1881. 10*d.*

In constructing marine engines of the inverted direct-acting surface condensing type, the bed plate is formed with circular seats for the purpose of fitting therein the necessary suction and delivery valves for the circulating and air pumps, and also as seats for the pump chambers; the circulating water passages to and from the circulating pump valves are arranged in a portion of the bed plate, these passages leading to the surface condenser which is fitted to the bed plate. The surface condenser is formed so that the circulating water can be drawn or forced through its tubes, and it is also so arranged that when the engines are working as common jet engines the discharge water is permitted to escape through the discharge pipe for the circulating water. Other improvements are described.

2188. CONDENSING CARDING ENGINES OR MACHINES, *J. Ramage, Alva, N. Britain.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improvements in or connected with "carder condensers" or condensing carding engines machines, designed particularly to enable streaked, mottled, or spotted yarns or slobbing to be produced from the carded wool or other fibre, while also admitting of the production of ordinary plain yarns when desired.

2189. GOVERNORS OR BRAKES, *J. H. Hughes, Birkenhead.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in a governor and apparatus so arranged that the instant the carriage exceeds the speed to which the governor is set, the brake is applied automatically.

2190. BAGS OF PAPER, *E. P. Alexander.*—19*th May*, 1881.—(*A communication from L. G. Fisher, jun.*) 6*d.*

This relates to the manner of forming a square or oblong bag, the sides of which are of uniform thickness, and the bottom is closed by folding down the side portions so as to secure a bag that will open and assume its four-sided form by the act of filling.

2191. LOCK-BOLTS OR PINS, *H. F. Hailes, Hornsey, and A. S. Bishop, London.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to constructing bolts or pins which will be automatically locked ln their sookets when pushed home.

2192. MOTIVE-POWER ENGINES, *J. Cartwright, Idle.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in a combination of revolving movable plates or floats which are successively operated on by steam or compressed air, and which actuate the driving shaft of the engine, the plates or floats being pushed out in succession into a fixed cylinder to act as pistons for the steam or air to act against.

2193. ROUNDABOUTS OR "CAROUSSELS," *F. H. F. Engel, Hamburg, Germany.*—19*th May*, 1881.—(*A communication from W. Stuhr, Hamburg, Germany.*—(*Not proceeded with.*) 2*d.*

This relates, First, to the construction of the frame, allowing a double platform or story to be used for the reception of chairs, seats, or carriages; and, further, to the construction of the carriages or part of the carriages in such manner that a rocking up-and-down motion is or can be imparted to each chair or seat besides and independent from the roundabout motion of the machine.

2194. LOOMS, *J. Leeming and R. Wilkinson, both of Bradford.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to apparatus by means of which the whole of the heald shafts and warp threads may readily be brought into one plane, or levelled, for the purpose of affording greater facility for piecing up a broken end or warp thread, and to improved apparatus for operating rotary shuttle-boxes.

2195. FIGURED CLOTH, &c., *J. Warburton, Bolton.*— 19*th May*, 1881. 4*d.*

This consists in the manufacture of satin or twill cloth woven continuously from one warp, at the same time that a floated yarn figure is produced on the surface of the cloth from another warp, the latter being bound at the back when not making figure.

2196. MANUFACTURE OF FIGURED CLOTH, *T. Taylor and J. Warburton, both of Bolton.*—19*th May*, 1881. 6*d.*

This consists in the use of two separate ends of stitching yarn to one end of face yarn, and the shedding of the said yarns, in combination with the progressive order of the picks of coarse and fine wefts, whereby the drop box is dispensed with at one side of the loom.

2199. MANUFACTURE OF TIN AND TERNE PLATES, *G. Trubshaw, Llanelly, and G. Leyshon, Tipton.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a vessel divided into compartments containing the tin or terne metal and the grease.

2200. EXHIBITING ADVERTISEMENTS, *A. P. Judge, London.*—19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a revolving drum carrying the advertisements.

2201. RAILWAY LAMPS AND CHIMNEYLESS BURNERS FOR PETROLEUM LAMPS, &c., *J. Blake, Birmingham.* —19*th May*, 1881.—(*Not proceeded with.*) 2*d.*

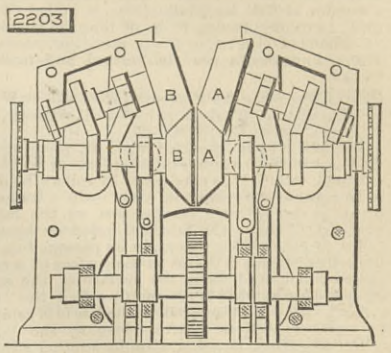
This relates, First, to the construction of parts of lamps to be used for lighting railway carriages from the roof; Secondly, to the construction of tricolour lamps; Thirdly, to the construction of chimneyless burners.

2202. BICYCLES, &c., *E. Marshall, Birmingham.*— 19*th May*, 1881. 6*d.*

This consists, First, in the method of constructing the anti-friction ball bearings; Secondly, in the application of gear wheels to velocipedes for varying the rate of motion communicated by the crank shaft to the principal or travelling wheel. Other improvements are described.

2203. BEVELLING ANGLE BARS, &c., *J. H. Johnson, London.*—19*th May*, 1881.—(*A communication from W. Highfield, Philadelphia, U.S.A.*) 6*d.*

is consists essentially in bevelling angle bars by



passing the bar between two pairs of rolls A A, B B, which confine the opposite flanges of the said bar, and gradually changing the angle of the pairs of rolls in respect to each other as the bar passes between them.

2205. HARPOONS, *H. J. Haddan, London.*—20*th May*, 1881.—(*A communication from O. C. Bjerke, Christiania, Norway.*)—(*Not proceeded with.*) 2*d.*

This consists in furnishing harpoons with specially-made wires or ropes in such manner that said harpoons can be readily placed in communication with one pole of a suitable source of electricity, while the other pole of the said source is connected with the water, and thereby allow of an electric current being sent through the harpoon, and into the fish or animal as soon as the harpoon strikes or penetrates the same.

2207. APPARATUS FOR WORKING BRAKES OF RAILWAY TRAINS, *J. Armstrong, Swindon.*—20*th May*, 1881. 6*d.*

This consists, First, in the combination of a reducing pressure valve and an ejector situated between the steam valve on the boiler and the ejector; Secondly, in the combination of a hand brake with a cylinder piston, sack, diaphragm, or their equivalent arrangement; Thirdly, in a double-beat valve situated on the pipes and cylinders of a train, so arranged that water or other foreign substance collected will escape.

2208. APPARATUS FOR IRONING, *W. H. Davey, Highgate, and H. Fabian, Erith.*—20*th May*, 1881. 4*d.*

To a revolving cylinder having a covering of soft fabric, is applied the fabric to be ironed. On this cylinder an iron, hollowed to suit the cylinder, and heated by steam or gas, is caused to move backwards and forwards in the direction of the length of the cylinder.

2209. GUNPOWDER FLASKS, &c., *F. W. Ticehurst, Birmingham.*—20*th May*, 1881. 6*d.*

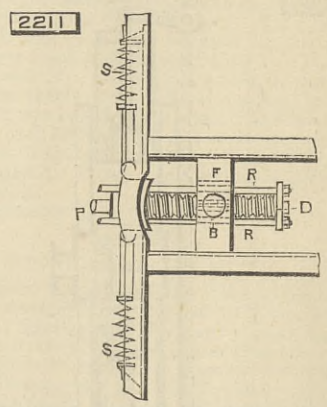
This consists in constructing the body of the flask or bottle so that it is filled and emptied at a screwed hole, at or near the bottom end of the bulging or convex side of the said body instead of at the neck end as usual, and closing the said screwed hole, by preference, by means of a hollow or tubular screw plug; also converting the empty flask or bottle into an oil lamp or candle holder.

2210. MANUFACTURE OF PAPER, *T. Wilson, Hollingbourne.*—20*th May*, 1881. 6*d.*

This consists, First, in bringing an endless felt or blanket into contact with the moist paper whilst this is still upon the endless wire cloth of the paper machine, and removing the paper from the wire cloth upon the surface of the said endless felt or blanket; Secondly, pressing the endless sheet of moist paper between two endless felts or blankets by means of rollers; Thirdly, transferring the endless sheet of moist paper from one endless felt or blanket to another, previous to receiving the pressure of the press rolls; Fourthly, air drying the endless sheet of moist paper in the state in which it leaves the press rolls as "water leaf," upon open work drums in place of upon steam heated rolls.

2211. BUFFER AND DRAW GEARING, *I. A. Timmis, London.* —20*th May*, 1881. 6*d.*

The drawing shows an arrangement in which B is a



central boss, F the framework, and through the former the draw rods R and plunger rod P work; D is the draw spring; S S are side check springs.

2212. DYNAMO-ELECTRIC MACHINES, *C. A. Barlow, London.*—20*th May*, 1881.—(*A communication from A. de Meritens.*)—(*Not proceeded with.*) 2*d.*

This relates to the use of straight magnets, provided with an armature at one set of poles, these to form horseshoe magnet.

2213. PRODUCTION OF HYDROGEN GAS AND MANUFACTURE OF AMMONIA, *E. S. Samuel, Liverpool.*—20*th May*, 1881. 2*d.*

This consists in passing steam through incandescent coke or other combustible, or through incandescent iron borings or scrap iron contained within a cupola, such incandescence being maintained by producing a rarefaction of the air within such cupola by means of a steam jet, and so inducing steam to pass through the incandescent material with great velocity, and whereby hydrogen gas is produced in large quantities.

2214. UMBRELLA AND PARASOL FURNITURE, *W. G. Denham and F. A. Ellis, both of London.*—20*th May*, 1881. 6*d.*

This consists, First, in making "stretches" of malleable cast iron; Secondly, in making "gets" or "middle bits" of malleable cast iron.

2216. SEWING MACHINES, *J. Imray, London.*—20*th May*, 1881.—(*A communication from H. Buckofzer.*) 6*d.*

This relates to the construction of sewing machines, whereby two rows of stitching are formed simultaneously by two needles, of which one is adjustable to or from the other, so as to produce the rows of stitching at any desired distance apart.

2219. MANUFACTURE OF STEEL, *J. Imray, London.*— 20*th May*, 1881.—(*A communication from P. E. Martin, Paris.*) 4*d.*

This consists, First, in the production of a spongy material resulting from reduction and cementation of metallic ores or metalloids effected by subjecting them to long-continued heat in admixture with reducing and cementing agents; Secondly, the production of alloys by fusion of iron and iron ore along with the spongy products; Thirdly, in the admixture of alloys with the fused metal.

2220. MANUFACTURE OF FUEL, *S. Baggeley, London.*—*20th May*, 1881.—(*Not proceeded with.*) 2*d*.

For fuel for ordinary purposes the following ingredients are combined :—To 1 ton of coke breeze or gas coke, broken in small pieces, is added 2½ cwt. of chalk, dry, in powder, 80 lb. of lime in powder, and 2½ gallons of oil of resin, or any other inflammable oil. These ingredients are well mixed and made into bricks.

2221. DRESSING AND FINISHING WOOLLEN OR WORSTED FABRICS, *J. W. Bannister and W. Bywater, both of Leeds.*—*21st May*, 1881. 6*d*.

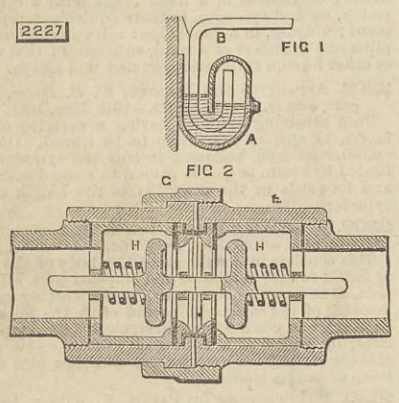
The fabric to be operated upon is, when required, first conducted over a steaming-box, or is otherwise steamed, thence it is conducted by rollers held so as to be capable of rocking in arms or in a frame acted upon so as to vary the tension on the fabric as required. Thence the fabric is acted on by another roller, or other guide rollers, in its passage to a brushing roller, thence it passes to the surface of a sand or emery roller, and from the surface of the sand or emery roller to what is commonly called the "inking roller." Between these rollers the fabric is acted upon by pressure rollers. After leaving the "inking roller" the fabric is acted upon by another adjustable pressure roller, and thence by a series of cylinders or rollers the fabric is conducted to the cuttle or cuttle arms for effecting the desired folding of it.

2222. APPLYING SPRINGS TO DOORS, *A. McMillan, Thornliebank, N. Britain.* *21st May*, 1881. 6*d*.

This consists in the mode of applying springs to doors, according to which a helical metal spring, placed in a groove or recess formed in the door, is connected by a chain or cord to a fixed point in the door frame the said chain or cord passing etween a pair of anti-friction rollers in the case of swinging doors, and in contact with at least one anti-friction roller in the case of other doors.

2227. SUPPLYING GAS TO MOVABLE GAS MOTOR ENGINES, *F. W. Crossley, Manchester.*—*21st May*, 1881. 6*d*.

To supply gas to a gas motor engine on a crane or traveller a trough A is fixed parallel to one of the rails, and is of a scroll form in section, and within it water is placed. From the engine a pipe B passes through the liquid, and is bent up into the gas space of the



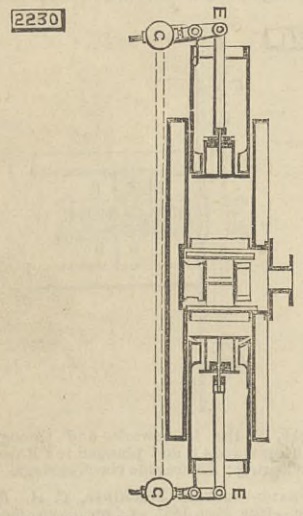
trough. To supply gas to locomotive gas engines holders are mounted on wheels and connected by a tubular pole E to a socket G on the locomotive, both the pole and the socket being closed by valves H, which are opened by the action of joining up.

2229. FIRE-GRATE SCREENS, *S. H. Ogden, Manchester.*—*21st May*, 1881. 6*d*.

This relates to the method of suspending fire screens.

2230. AIR COMPRESSORS AND APPARATUS FOR PUMPING OR FORCING FLUIDS, *H. Fletcher, Bolton-le-Moors.*—*21st May*, 1881. 6*d*.

This consists, First, in the employment of a balance weight G and lever E for counter-balancing the piston carried valves of air compressors; Secondly, in coupling together, where two pistons are used to com-



press alternately, the piston carried valves of one piston with the piston carried valves of the other piston by levers and one or more connecting rods, so that the connecting rods counterbalance the valves to the desired extent.

2231. APPARATUS FOR WASHING GLASSES, JARS, &c., *T. Wood, Newton Heath.*—*21st May*, 1881. 6*d*.

This relates to the combination of interior and exterior brushes revolving in opposite directions.

2239. SHAVING SKINS, *E. P. Alexander.*—*23rd May*, 1881.—(*A communication from H. A. House and S. D. Castle.*) 6*d*.

In a frame turns an inclined shaft carrying a band pulley, by which it is driven, and also an annular cutter consisting of a disc, to which is fitted an adjustable thin steel annular blade. On the frame is mounted a hood, cap, or fence, the inner edge of which coincides and extends nearly to the edge of the cutter, and is recessed to receive a curved plate, which can be moved in or out. The skin is drawn over the cap, and at the same time in contact with the cutter.

2249. HEATING DWELLING HOUSES, HOSPITALS, &c., *C. L. Friedlander, Jönköping, Sweden.*—*24th May*, 1881. 6*d*.

This has reference to an air chamber, vessel, or vault, in which is a furnace terminating in a box or receptacle connected with a tube box, from which the products of combustion are led through tubes to a second tube box, and thence through other tubes, and finally to the chimney. Cold air is admitted at the bottom of the air chamber, vessel, or vault, in which it is heated by contact with and radiation from the furnace and tubes. It traverses the apparatus and is emitted therefrom either directly or by a system of distributing pipes.

2255. RACKETS OR RACKET BATS FOR LAWN TENNIS, &c., *G. Hookham.*—*24th May*, 1881. 6*d*.

This consists in providing strings running across both sides of the frame, so as to form the sets of strings separated by the thickness of the frame,

2258. TRICYCLES, *H. J. Haddan.*—*24th May*, 1881.—(*A communication from J. A. McKenzie.*) 6*d*.

This consists in combining with two large front wheels, and a small rear steering wheel, treadles and devices connected to the inner ends of the front wheel hubs and adapted to be locked to or disengaged therefrom for propelling the vehicle. Also in mounting the front wheels on independent spindles, and connected to the ends of a rearwardly curved connecting piece.

2276. KITCHEN RANGES, *J. McI. Shaw, Glasgow.*—*24th May*, 1881. 6*d*.

This consists partly in the construction and arrangement in combined open and close fire ranges, of hinged or pivotted flaps or shutters, forming when opened out an expanding or trumpet mouth flue opening, fitted with a cover which when not in use is passed through a slot into the chimney flue, or canted up or suspended from the upper part of the range. Other improvements are described.

2314. PRESERVATION OF BUTTER, *G. M. Alexander, London.*—*26th May*, 1881. 2*d*.

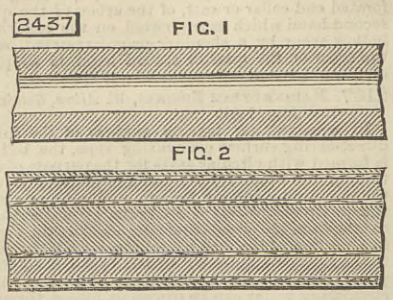
This consists in mixing, blending, and incorporating orthophosphoric acid with butter.

2337. GRATERS FOR GRATING SALT, BREAD, &c., *L. Field, Birmingham.*—*27th May*, 1881. 6*d*.

This relates to graters having rotating grating surfaces.

2437. METALLIC CIRCUITS FOR ELECTRICAL TRANSMISSION, *G. E. Edmonds, London.*—*2nd June*, 1881.—(*A communication from G. M. Mowbray.*) 6*d*.

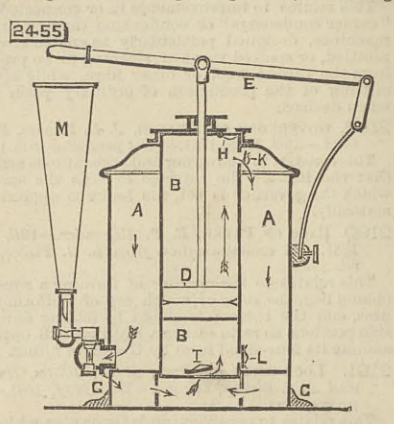
This is an arrangement for a return wire. Fig. 1



shows longitudinal and cross section of outward conductor, with groove for insulated conductor; Fig. 2 shows arrangement for multiple conductors.

2455. MECHANICAL FOG HORNS, *J. Sturge and J. Grubb, both of Birmingham.*—*3rd June*, 1881. 6*d*.

The pump B is placed within a cylinder A, and its piston D is worked by lever E and draws air in at C, and through valve I during the up stroke, and through



valve H during the down stroke, compressing each charge alternately and causing it to enter by valves K and L into cylinder A, from which it can pass to the fog horn M.

2730. MANUFACTURE OF HYGIENIC SWEETMEATS WITH OIL, *H. Bories and P. V. Tostain.*—*22nd June*, 1881. 2*d*.

This consists in mixing cod liver, castor, or other oil with sugar or chocolate, so as to form sweetmeats.

3007. BINDING BOOKS WITH WIRE STAPLES, *H. G. Thompson.*—*8th July*, 1881.—(*A communication from S. E. Mower.*)—(*Complete.*) 8*d*.

This consists, First, in the combination with the driving pulley having recesses of a clutch disc with a pawl and having a wing and bolt adopted to disengage such pawl; Secondly, in the combination with driving shaft of a double cam to operate the clincher presser and driver; Thirdly, in the combination with the clinching rod of a coiled spring and a cam adapted to compress cam and suddenly release the clincher so as to clinch the staple with a blow; Fourthly, in the combination on a power machine of an adjustable table; Fifthly, in the combination with the driver and segmental racks of a feed roll connected to the racks by pawl and ratchet mechanism constructed to feed the wire to the cutter plate; Sixthly, in a roller with adjustable screw pressure to regulate the pressure on wire; Seventhly, in combination with the feeding device and cutters of a disc with a channel at an angle to the feed channel, and adapted to straighten the wire. A hand machine is also described and shown.

3041. MAKING HOLLOW ARTICLES DIRECT FROM PUDDLED IRON, *A. L. Murphy.*—*11th July*, 1881.—(*Complete.*) 6*d*.

The puddled ball is manipulated under a hammer or other forging mechanism and formed into a cylinder, which is then punched or drilled with a central hole. The cylinder is then successively reduced and condensed over mandrils in a rolling mill.

3593. POTTERY, *H. J. Haddan.*—*18th August*, 1881.—(*A communication from G. Ligowsky.*)—(*Complete.*) 6*d*.

This consists essentially of a pottery apparatus, consisting of an elevated receptacle for containing slip, a hose for conducting said fluid to the moulds, a suction tube and hose for exhausting the superfluous slip therefrom, and a suitable device for producing a vacuum.

3775. SELF-LEVELLING BERTHS, *T. C. Dunn.*—*30th August*, 1881.—(*A communication from W. Miller.*)—(*Complete.*) 6*d*.

This consists mainly in a bail or bent bar, to which the ends of the berth are pivotted, said bar being pivotted to a bracket over the centre of the berth, so as to have a universal movement.

3777. HAND-PIECES FOR DENTAL ENGINES, &c., *S. Pitt.*—*30th August*, 1881.—(*A communication from E. T. Starr.*)—(*Complete.*) 6*d*.

This consists partly in the combination of a casing, a spindle chuck, tubular brushing, cone friction collars surrounding the chuck, and fitting in corresponding seats in the front and rear end of said bushing, and thrust and pull journals or shoulders of said chuck working against said cone collars.

3885. FIRE EXTINGUISHING APPARATUS, *W. R. Lake.*—*7th September*, 1881.—(*A communication from A. Burritt Hardware Company, Incorporated.*)—(*Complete.*) 6*d*.

This relates to fire extinguishers in which upon a fire occurring the waters in the apparatus will be caused to issue from a finely perforated nozzle and be distributed about the room in the form of spray, and consists in the application of a cup and a plug to the distributor in order to prevent the accumulation of foreign particles in the pipe, the plug being fixed to the nozzle so that the force of water will disconnect it, or it may be disconnected by the heat.

4973. BLENDING WORTS, *D. McG. Watson and A. C. Botterill.*—*29th November*, 1880.—(*Not proceeded with.*) 2*d*.

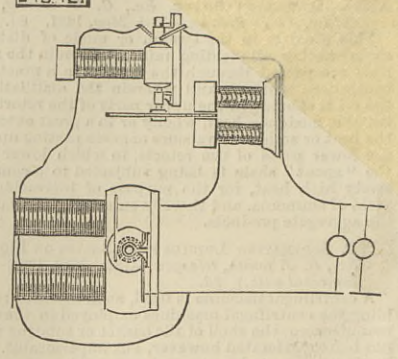
A branch pipe is attached to and depends from the wort pipe to a receptacle jointed to the extremity of the branch pipe, and which serves the purpose of a dispenser of the wort to several radial pipes standing out from the receptacle, and perforated to allow the wort to pass through and blend with the liquor in the fermenting vessel.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

248,421. CURRENT REGULATOR FOR DYNAMO-ELECTRIC MACHINES, *Thomas A. Edison, Menlo Park, N.J., assignor to the Edison Electric Light Company, New York, N.Y.*—*Filed March 5th*, 1881.

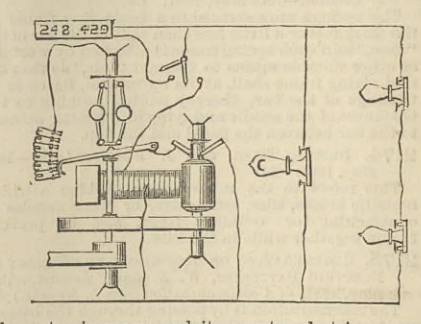
Brief.—The invention is clearly explained by the drawing and claims. *Claim.*—(1) The method of controlling or regulating the regenerative force of a dynamo or magneto-electric machine consisting in throwing into the field magnet circuit a variable and controllable counter electro-motive force, substantially as set forth. (2) The combination, with a generator, of an electro-motor included in the field-magnet circuit by its counter electro-motive force, substantially as set forth. (3) The combination of a generator, an electro-motor



included in the field-magnet circuit, and a magnet in the supply or consumption circuit controlling the rate of rotation of the motor, substantially as set forth. (4) The combination, with a motor, of a disc driven thereby, and a magnet, between whose poles or in whose field the disc rotates to vary and control the rate of rotation of the motor, substantially as set forth. (5) The combination of a generator, an electro-motor in the field-magnet circuit, carrying a disc upon its rotating shaft, and a magnet in the supply circuit in whose field the disc rotates, whereby the rate of the motor and the strength of the field circuit are varied and controlled, substantially as set forth.

248,429. ELECTRIC MOTOR, *Thomas E. Edison, Menlo Park, N.J., assignor to the Edison Electric Light Company, New York, N.Y.*—*Filed March 3rd*, 1881.

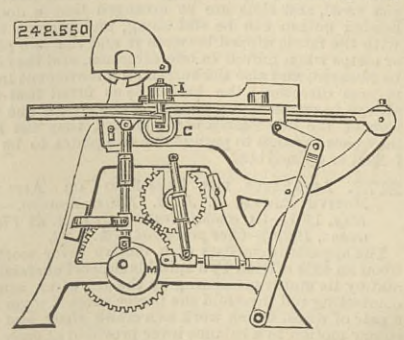
Brief.—The device is intended to prevent the disturbance of electric lights when a motor is thrown into the same circuit; and to this end it consists of a variable resistance included in the motor-circuit normally or when at rest, and a governor driven by the motor, and means controlled by the governor for cutting out the resistance gradually as the speed of



the motor increases and its counter electric current is sent to line. The resistance cut out should be the equivalent of the counter current at any given speed. *Claim.*—The combination, with an electro-motor, of a resistance included in its circuit normally or in a state of rest, and means operated by the motor and arranged to gradually cut out the resistance as the motor speeds up, and to entirely cut it out when the motor reaches a desired predetermined speed, substantially as set forth.

248,550. MACHINE FOR CUTTING OR DRESSING PLOUGH HANDLES, *George C. Avery, Louisville, Ky.*—*Filed June 13th*, 1881.

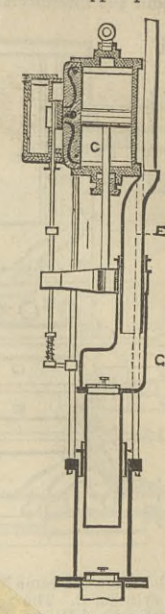
Brief.—The work carriage reciprocates upon a pivotted bar, which is oscillated, the two motions producing the required shape of the plough handle. A mechanism for returning the work backward after the forward is placed upon the arm. *Claim.*—(1) In a machine for cutting or dressing plough handles, a reciprocatory work carriage carrying mechanism for ejecting therefrom the finished work, substantially as described. (2) The combination of a rotary cutter mounted on a fixed axis of motion, a vibratory bar or arm, and a reciprocating work carriage sliding longi-



tudinally of said bar or arm, substantially as described. (3) In combination with the cams M and M², for imparting a vibratory motion to the carriage driving arm, one of said cams acting directly on said arm and the other acting on said arm indirectly, through the medium of its rock shaft, a compensating device composed of an arm flexibly connected to the rock shaft, an arm or clip rigidly secured thereto, and an interposed suitable cushion or yielding abutment, substantially as set forth. (4) In combination with a work carriage mounted to slide on an arm or support adapted to raise and lower a discharging mechanism composed of a friction wheel L, mounted in the carriage and adapted to be forced toward the inner side of the work, and an opposing yielding anti-friction wheel I, mounted in the carriage-supporting arm, and a continuously-revolving friction wheel G, combination being such as and operating substantially in the manner set forth.

248,718. STEAM PUMP, *Charles P. Deane, Springfield, Mass.*—*July 15th*, 1881.

Claim.—The combination, substantially as shown, of the piston rod C, having an outside connection with the pump, with the upper plunger E and its



the direct line between the plunger, and by the side of as and for the purpose

CONTENTS.

THE ENGINEER, December 23rd, 1881.

INCREASE IN STRENGTH OF DIFFERENT WOODS BY SEASONING.—White pine, 9 per cent.; elm, 12·3 per cent.; oak, 26·6 per cent.; ash, 44·7 per cent.; beech, 61·9 per cent.

FIREPROOFING FOR WOOD.—Take alum, 3 parts; green vitriol, 1 part; make a strong hot solution with water; make another weak solution with green vitriol in which pipe-clay has been mixed to the consistence of a paint. Apply two coats of the first, dry, and then finish with one coat of the last.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Dec. 17th, 1881 :—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 5754; mercantile marine, building materials, and other collections, 2722. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 2606. mercantile marine, building materials, and other collections, 136. Total, 11,218. Average of corresponding week in former years, 11,300. Total from the opening of the Museum, 20,554,046.