THE PARIS ELECTRICAL EXHIBITION.

No. XI.

Mr. Ball's machine, constructed by the White House Mills Company, has attracted a considerable amount of attention because of its peculiar armature. Dr. Hopkinson builds up the core of his armature coils of thin iron rings slightly insulated the one from the other, so practically the core of his coil is solid iron. Messrs. Siemens simply have an open brass framework upon which to wind their armature coils; but Mr. Ball has neither open framework nor iron core—in the smaller machines having no core, in the larger a core of wood.

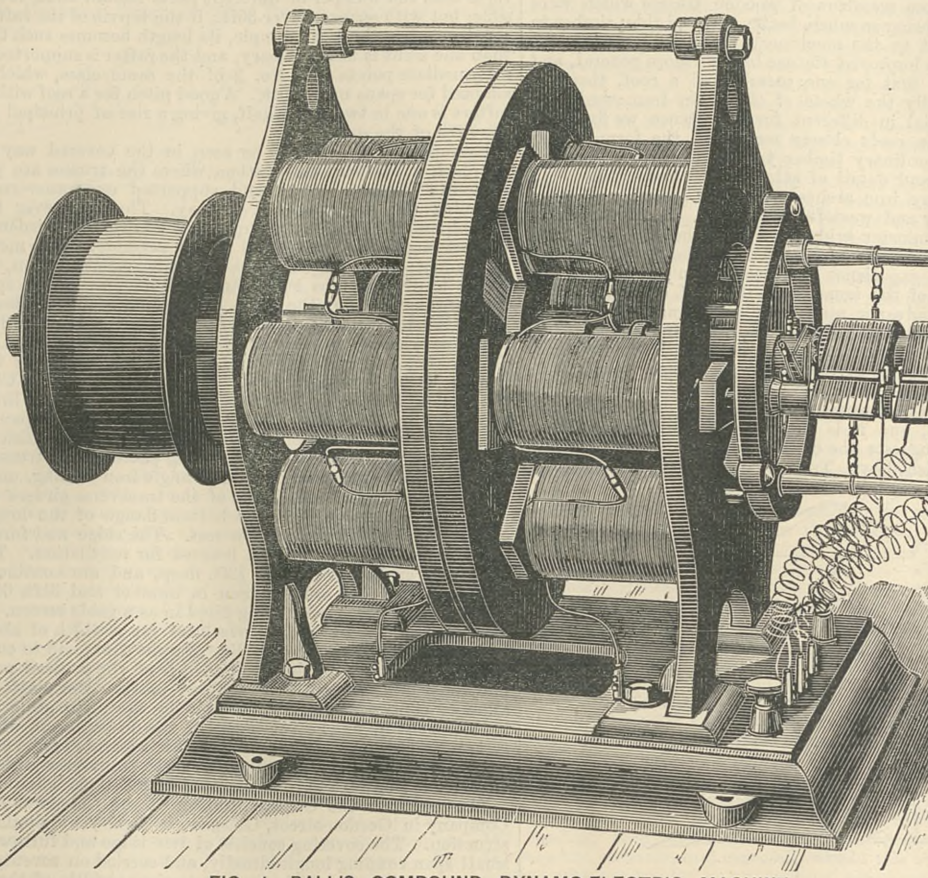


FIG. 1.—BALL'S COMPOUND DYNAMO-ELECTRIC MACHINE.

The compound machine—Fig. 1—has six opposite pairs of poles for the field magnets. The armature for a continuous current has eight series of coils, made up in two layers, one of which is connected to the commutator for the external circuit current; the other is used to magnetise the field magnets. It will be seen that this machine is somewhat the same in principle as that of Häfner-Alteneck, but the latter has less armature coils than field magnets, while Mr. Ball has chosen the opposite course. It is stated that at a speed of about 1000 revolutions a minute and an expenditure of 6-horse power, the machine has maintained in series ten arc lamps.

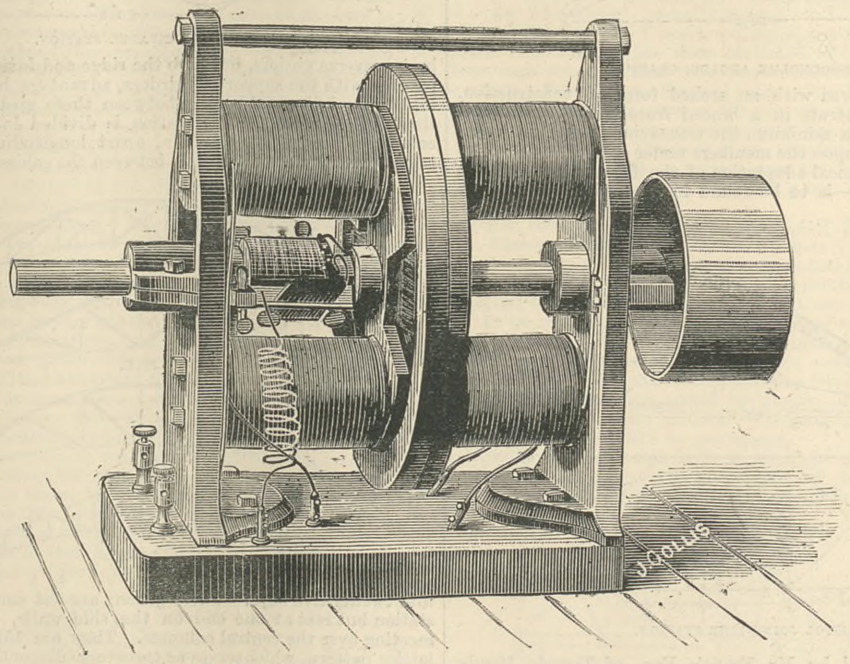


FIG. 2.—BALL'S SIMPLE DYNAMO-ELECTRIC MACHINE.

In the simple—Fig. 2—continuous current machine, designed by Mr. Ball, the armature is made up of six coils, wound in the shape of a horseshoe, with the broad face parallel to the poles of the field magnets, and connected together in a continuous circuit. The number of plates in the commutator is the same as the number of coils, each plate being in connection with the point of junction between two coils. The commutator plates are fixed at an angle of about 30 deg. with the axle. This is done to cut out opposite coils during a portion of the revolution, and so to decrease the internal resistance. This is following the lead of Brush, who considers it one of the most important features of his machine. The armature coils of Mr. Ball's machine are encircled by strong brass rings to give the armature the necessary rigidity. So little is known about these machines as yet that it is impossible to speak with certainty of their performance, which is said to be good. It seems to us that the method of winding the coils must be a tedious and delicate work in the course of manufacture.

The "Compagnie de Chemins de fer de l'Est" shows a very interesting dynamometer, designed by M. Napoli to explore a magnetic field. The production of electricity in dynamo and magneto-electric machines is due to the motion of a conductor through a magnetic field. In this case the electro-motive force is at each instant proportioned to the number of lines of force cut by the conductor during a unit of time. It is of interest, then, to concentrate as much as possible the lines of force, so that the whole be cut by the rotating conductor, and to arrange the armatures in the best manner. People as yet have a very vague idea of the influence of the form of the armature and the best arrangement of the masses of soft iron which form the polar extremities of the magnetic field. The dynamometer exhibited is to be used for investigating this problem. The whole of those parts of the apparatus which determine the magnetic field are mounted in a cubical box, which may be made to rest on either face upon a bronze slab, which can receive either (1) a vertical motion or (2) two horizontal motions at right angles to each other. A small piece of iron m, too small to act upon the magnetic field under investigation, is maintained at a fixed point—Fig. 3. This iron m is carried by a copper rod I fixed to the cross-piece $a\,b$ resting on the brackets $t\,t^1$, and the cross-piece being attached to the variable spring R S. The action of R S is limited by the binding screws K K^1. The end R of the spring is connected to a steel band fastened to the sector A B, which works under the action of the lever L and its connections M N as shown. During the movement of the sector the tension of the spring R S varies continuously. If the arrangement be properly made, at a particular movement the force exerted in one direction on $a\,b$ is greater than the attractive force exerted on m; $a\,b$ will thus be displaced and make contact with K K^1. Another sector A^1 B^1, which moves synchronously with A B, influences a runner C which in its movement traverses a cylinder T T^1, on which a band of paper is wound. When $a\,b$ comes into contact with K and K^1, an electric current passes and causes a pencil carried by C to be withdrawn from the paper. Thus the number of displacements of C are proportional to the tension of the spring R S. And it therefore follows that the length of the line traced on the cylinder T T^1 by the pencil attached to C will be proportional to the resultant forces of R S and m. To render the chance of error very small, the screws K K^1 can be so regulated as to make the play of $a\,b$ infinitely minute. In order to avoid one line being written over another on the cylinder T T^1, a slight angular movement is given to it after each operation.

To explore a given magnetic field it is necessary to divide, in our mind's eye, the box which contains the said

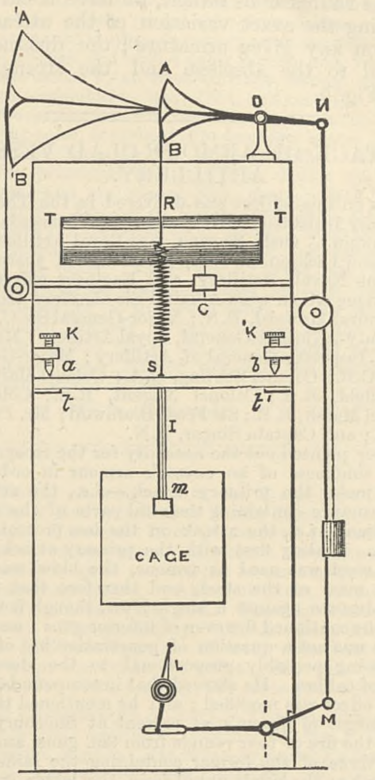


FIG. 3.—NAPOLI'S DYNAMOMETER.

field into a large number of small cubes, and to consider the tops of all these cubes. If we can ascertain the amount and direction of the force which is developed at each of these points the problem will be solved. By taking advantage of the three rectangular movements which can be given to the slab carrying the box, we can bring the small piece of soft iron m under the influence of each of these points successively. We shall moreover be able to measure the resultant of the force exercised on each of these in the fixed direction R S. Give

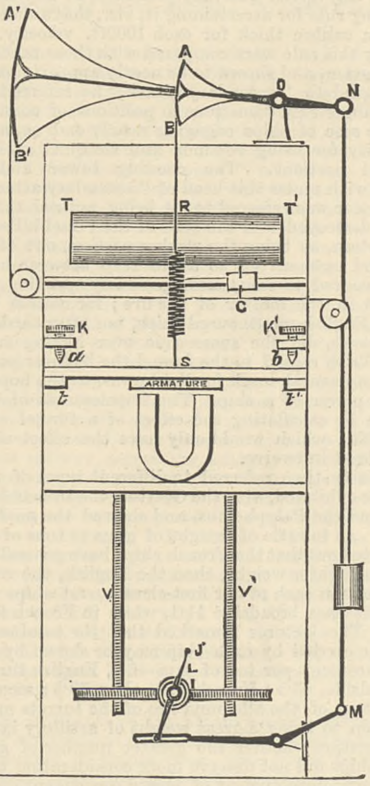


FIG. 4.—NAPOLI'S DYNAMOMETER.

the box a quarter turn and repeat the same operations, and we shall have the resultants in a direction perpendicular to the first. Lastly, begin again by resting the box on another face, not parallel to the two first, and we shall have the resultant in a direction perpendicular to the two first. We shall thus know the resultant of the force which is exercised on each point in three rectangular directions; and we shall know the

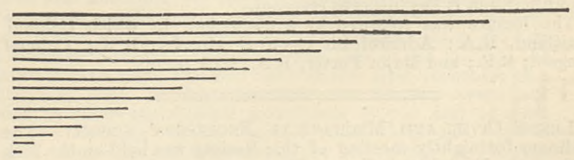


FIG. 5.

amount and direction of this force. This apparatus gives at once the law of variation of the attractive force exerted by a magnet, or an electro-magnet, on its armature. This is a very useful law, both for horology and telegraphy, for fixing the forms to be given to relays

A very simple modification of the apparatus exhibited permits continuous diagrams to be obtained—Fig. 4. The lever L, which influences the movements of the spring, acts, by means of an endless screw, on two screws V and V^1, which are advanced or withdrawn one-tenth of a millimetre at each turn of the lever, and carry the magnet with them. At the same time the cylinder T T' receives an angular movement proportional to the recoil of the spring. If, then, the lever L is turned continually, and at the same time the paper band of the cylinder T T' is unwound, a diagram will be produced similar to the one shown. If the extremities of the lines traced by the pencil of the runner C be united, we have a curve graphically showing the exact variation of the attractive force developed on any given armature; the distance will be proportional to the abscissæ and the strength of the ordinates, Fig. 5.

THE ATTACK OF ARMOUR-CLAD VESSELS BY ARTILLERY.

A LECTURE on this subject was delivered in the Theatre of the Royal Artillery Institution, Woolwich, on Wednesday, the 19th inst., by Captain C. Orde Browne, late Royal Artillery. General Sir Collingwood Dickson, K.C.B., presided, and there was a large attendance of Naval, Artillery, and Engineer officers and civil engineers, among whom were Admiral Sir Geoffrey Hornby, R.N., K.C.B.; Admiral Howard, R.N.; Major-General Sir C. Arbuthnot, K.C.B., Deputy-Adjutant-General, Royal Artillery; Major-General R. Radcliffe, Inspector-General of Artillery; Major-General Hon. E. T. Gage, C.B.; Colonel Stirling, R.A.; Colonel Maitland, R.A.; Colonel Oldfield, R.A.; Colonel Nugent, R.E.; Colonel Noble, R.E.; Colonel Marsh, R.E.; Sir Fred. Bramwell; Mr. Peter Barlow, C.E., F.R.S.; and Captain Singer, R.N.

The lecturer pointed out the necessity for the recognition of the nature and thickness of an enemy's armour in order to decide whether to make the primary attack—*i.e.*, the attack on the armoured structure containing the vital parts of the ship—or the secondary attack—*i.e.*, the attack on the less protected or unprotected parts. Dealing first with the primary attack, he showed that, where steel was used as armour, the blow was distributed through the mass of the steel, and therefore that it had great power of resistance against a single blow, though it was liable to succumb to the continued fire even of inferior guns; and he pointed out that this was not a question of penetration but of shattering, the effect being probably proportional to the stored-up work, irrespective of calibre. He showed that in compound or steel-faced armour the effect was modified; and he mentioned the case of a compound target of Brown's, at present at Shoeburyness, which had resisted the fire of four rounds from 9in. guns, and one from a 38-ton gun, three of the former containing the same amount of stored-up work as the single round from the latter gun, so that a sort of comparison became possible between the effects of a given quantity of work delivered in one heavy or three light projectiles. He said that, while in the case of steel the blow was distributed through the mass, in the case of iron armour the iron suffered locally only, and hence it was either penetrated completely, or was practically uninjured, and did not suffer seriously from the continued fire of guns unable to perforate it. Hence the great significance of the development of new-type guns, steel shells, and gun-cotton charges. From the instance of the Krupp 9·45in. 18-ton gun at Meppen, which perforated 20in. of iron without injury to the projectiles, the lecturer deduced that fire might be carried into the most strongly armed portion of any English armour-clad, except the Inflexible, by a new type 18-ton gun. He showed how important it was to ascertain the limit of thickness of iron which any given gun may penetrate at any range, and gave the following rule for ascertaining it, viz., that a shot will penetrate armour one calibre thick for each 1000ft. velocity. The results obtained by this rule were compared with those taken from Colonel Inglis's diagram, and shown to be nearly approximate.

With regard to "secondary attack," he referred to the case of the deck being struck from guns in positions of command, particularly in the case of ships engaging nearly end on, and pointed to the necessity for using common and shrapnel shell in attacking unprotected portions. The conning tower and the funnel were dealt with under this head of "secondary attack." The case of the Huascar was referred to, it being noticed that her conning tower was destroyed, and the staff of the vessel killed. The vessel kept her stern, as being the weaker portion, out of fire as far as possible, and manœuvred so as to keep between her adversaries. She endeavoured to ram, and, generally speaking, showed great skill except in the matter of her fire; for neither in her engagement with English unarmoured ships, nor afterwards with the two Chilian vessels, did she succeed in ever hitting anything to any purpose. With regard to the funnel the lecturer pointed out that it afforded a natural mark for light guns, in the hope of reducing the steam power of a ship. The hopelessness of this endeavour was shown by calculating the effect of a funnel cut down from 50ft. to 30ft., which would only have the effect of reducing the speed one knot in twelve.

The lecturer then referred to different types of vessels, models of which he exhibited, viz., the Glatton, the Inflexible, the Admiral Duperrè, and the Polyphemus, and showed the mode of attack in each case. As to ratio of weight of guns to tons of displacement, it was pointed out that the French ships have generally more pieces, and these of lighter weight, than the English, the average number of heavy guns in each of our first-class turret ships being 5·1, and in each first-class broadside 11·1, while in French first-class ships it is 15·3. The lecturer remarked that the total weight of metal in ordnance carried by each ship may be shown by the number of tons displacement per ton of gun—*i.e.*, English turret, first-class, 56·1; broadside, 43·5; French, first-class, 39·5; second-class, 52·3. The advantage of the all-round fire of the turrets might enable an English ship to bring a great weight of artillery into action; but it was a question whether the greater number of guns carried by broadside ships did not deserve more consideration than formerly, since the great development of power consequent on the introduction of new-type guns. Very heavy guns had special power against chilled armour, which they might wreck in a way that would not be possible with the same power distributed among a number of lighter guns. This question concerned our Navy more than our land artillery, seeing that the French, the Germans, the Russians, the Danes, the Dutch, the Spanish, and the Portuguese had forts of chilled iron on their coasts—a species of armour which England had not adopted, or even tried. To lead to discussion the lecturer suggested two questions: First, whether we do not need medium new-type guns introduced, as far as possible, into the armaments of our ships and forts; and, secondly, whether the secondary attack of the weaker parts of armour-clad ships did not deserve more attention than it has hitherto received.

The lecture was followed by a discussion, in which Colonel Maitland, R.A.; Admiral Sir Geoffrey Hornby, R.N.; Colonel Nugent, R.E.; and Major Porter, R.A., took part.

LEEDS CIVIL AND MECHANICAL ENGINEERS' SOCIETY.—The ordinary fortnightly meeting of this Society was held on the 25th inst. at the Yorkshire College. There was a moderate attendance of members to hear an excellent paper on "Belt Gearing," read by Mr. Rhys Jenkins. A discussion followed; and on the motion of Mr. T. H. Brocklebank, seconded by Mr. A. Beard, a cordial vote of thanks was accorded to the author of the paper.

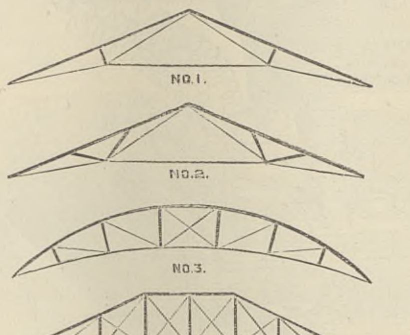
VILLE DE BOUGIE.—This small coasting steamer, built by Forrestt, of London, to the order of Mr. A. Rickard, ran a satisfactory trial trip on the Thames, attaining the speed of 8¾ knots. She is built entirely of steel, having hold for cargo forward of the machinery, which consists of a pair of 8in. by 10in. surface condensing engines, return tube boiler, &c. Passenger accommodation is fitted aft, and there is the usual forecastle arrangement, &c. The vessel is rigged as a yawl, and sails for Algiers this week.

IRON ROOFS.*

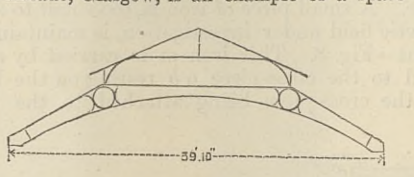
By Mr. A. T. WALMISLEY, C.E.

THE subject is a very extensive one, but much less has been written about the design of iron roofs than of iron bridges, and the author having examined and collected together drawings of some of the details of various roofs for the purposes of his own study, thought a discussion profitable to the meeting might be raised in comparing the merits and objections of various systems of roof construction which have been adopted in different situations. His object is not to propound new theories, but to elicit valuable information from gentlemen who have had experience in the design and erection of iron roofs, and to point out examples to be found in practice, without attempting to describe minutely any particular covering, designed to meet special cases, or to state in detail the dimensions of the framework supporting the same.

When iron was first used in the construction of a roof it was only employed for those members of wooden trusses which were subject to tension, it being so much better adapted than timber to resist such strain; but as the machinery for manufacturing different sections of iron improved its use became more general, and iron was substituted first for one member of a roof, then for another, until gradually the whole of the main framework was formed of this material in different forms. Hence we find that many of the early iron roofs closely resembled the form of construction adopted for ordinary timber trusses, the only alteration being in their section and detail of attachment at the joints. In a similar manner many iron arches of bridges resemble masonry designs, and are heavy and wasteful imitations. A comparison of Southwark and Westminster bridges at once shows the improvement made in our knowledge of ironwork at the time the latter was erected over the experience possessed when the former was built. The principle of the trussing of the roof over the House of Lords was a great advance upon the old systems that had been adopted, but would probably be much modified if constructed in the present day. The general use of iron in works of construction renders it desirable to arrive at the best form to adopt in different cases consistent with efficiency and economy. The primary characteristic or feature in the design of a roof is the main rib or principal, and it is the form of principal, whether truss or arch, which suggests the class or type that any particular roof may be distinguished by. Trusses may be best examined by



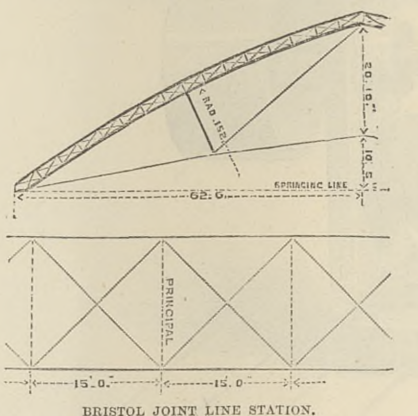
comparing the bracing. No. 1 (see diagram), which was introduced during the early days of railway construction, is still within certain limits one of the simplest and best forms. The central strut supporting each rafter is held in position by the tie rods which connect the head with the extremities of the rafter, and the horizontal thrust upon the supports is taken up by the tie rod which connects the two struts, and holds the trussed rafters together. A roof of this description may be seen in the side span of the Agricultural Hall, 36ft. wide. The roof over the Blythwoodholme Arcade, Glasgow, is an example of a space of about



BLYTHWOODHOLME ARCADE, GLASGOW.

the same width, covered with an arched form of construction. The introduction of struts in a braced framework is with the object of reducing to a minimum the transverse stress that would otherwise be induced upon the members under strain.

A useful and economical adaptation of the type of truss shown in No. 1—see diagram—is to be found in the Bristol Joint Line



BRISTOL JOINT LINE STATION.

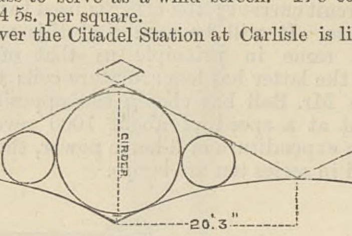
Station roof, designed by Mr. Francis Fox, of Temple Meads, Bristol, where the rafters are of a semi-elliptical form meeting at an apex in the centre, forming a rigid arch of 125ft. span, with a rise from springing level of 31ft. 3in., or one-fourth of the span. Owing to the form of the roof and its considerable rise the side walls could be kept low, and some saving in masonry was thus effected. They are carried up 24ft. above the platform at the springing level, or less than one-fifth of the span. The circumstances of the site did not admit of any design which would exert an outward thrust upon exterior buttresses, hence tie rods at the springing were indispensable. The tie rod rises in the centre 10ft. 5in. above the springing level. There are twenty-six principals, including two gables of ornamental design dividing the roof into twenty-five spaces at an average distance of 18ft. 9in. apart. The purlins are of wrought iron lattice arch construction, with horizontal bearing on top for the glazing which follows the slope of the roof, and is raised at intervals on standards for ventilation. The roof is curved in plan, having a radius of 1000ft. along the outer wall, and a length of 500ft. measured along the platform wall. No special provision was considered necessary with this form of construction for any play in the shoes into which the feet of the principals are secured. The principals if loaded equally are without transverse strain, but in order to provide against the effect of wind on one side or of unequal loading, as well as for the sake of appearance and the support of the heavy tie rod, some light bracing is added. The pointed form of principal was adopted chiefly because it harmonised with the general architectural character of the station buildings, and because some kind of curve in the principal appeared almost necessary for satisfactory effect in the case of a roof on a somewhat sharp curve. The price of iron was high at the time of the letting of the contract, and the roof cost £37 16s. per square of 100ft. measured on plan, including glazing and slates on boarding with all extras. The roof could, no doubt, be constructed for a less sum now.

The member which has the greatest influence upon the strains in a roof is the tie rod. The result of raising it in the centre above the level of the points of support is to reduce the strength of the truss due to its diminished depth, or practically to throw more strain upon the compound members of the roof, but additional headway is gained and a better general appearance presented. It is an essential feature in connection with the economy of all structures that the number of different parts should be as few as possible, but with spans of over 30ft., if the top rib of the rafter be not constructed, as the last example, its length becomes such that more than one strut is not necessary, and the rafter is supported at two intermediate points as in No. 2 of the same class, which may be adopted for spans up to 40ft. A good pitch for a roof with straight rafters is one in two and a-half, giving a rise of principal equal to one-fifth of the span.

Examples of No. 2 may be seen in the covered way over the approach to the Victoria Station, where the trusses are placed at moderate distances apart, and supported on transverse girders spanning the width of the railway. The roof over the great Exhibition of 1851 also was supported on overhead girders of convenient length, with ridge and furrow covering. This method has been adopted on a large scale in the Bridge-street Station, Glasgow, which is divided into two spans of 114ft. and 49ft. respectively. The large span covers the joint line terminus of the Glasgow and South-Western Railway and of the Wemyss Bay Railway, the latter of which is worked by the Caledonian Railway Company. The smaller side span is over the main line station of the Caledonian Railway, which is continued across the river Clyde into the Central Station or Northern Terminus. The joint line station is covered by eight ridge and furrow roofs of small span running longitudinally, carried on parallel lattice girders, which are supported on transverse girders of zig-zag pattern, and trussed longitudinally with three sets of vertical angle iron bracing, uniting the upper side of the bottom flange of the transverse girders with the underside of the centre of the bottom flange of the longitudinal girders upon which the gutters rest. The ridge and furrow roofs are crowned by lanterns with louvres for ventilation. The main transverse girders are about 12ft. deep, and are continuous over both stations; they are nineteen in number and 31ft. 6in. apart, the end transverse girder being filled in as a gable screen. The roof over the side span is open overhead for a width of about 21ft. transversely over the double line of rails from end to end of the station, the uncovered being divided from the covered portion by flat longitudinal vertical screens to protect the platforms. To allow of contraction and expansion on the main girders, oblong holes are cut in joint cover plates of the lower boom, where they rest on the columns. The two spans are separated from each other by a row of columns supporting the main transverse girders. The cost of the ironwork only in this roof was £16 per square.

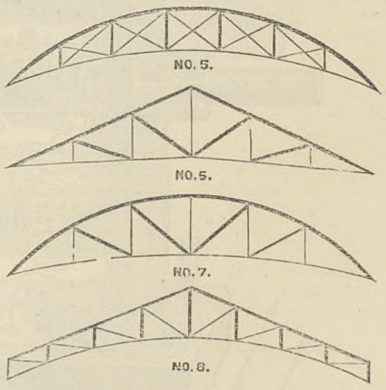
The roof over the Central Station of the Caledonian Railway Company in Gordon-street, Glasgow, is somewhat similar in construction. The covering consists of ten ridge and furrow roofs of small span running longitudinally, and carried on seventeen main transverse girders, which span the whole width of the station. The total length of this roof is 560ft., and the distance from centre to centre of supporting walls 213ft. 6in.; the main girders are 20ft. deep of zig-zag lattice work, braced longitudinally with four sets of vertical diagonals in each bay, and horizontal lattice girders carrying the gutters. The end transverse girder is filled in with wood and glass to serve as a wind screen. The cost of the ironwork was £14 5s. per square.

The roof over the Citadel Station at Carlisle is likewise carried



CARLISLE CITADEL STATION.

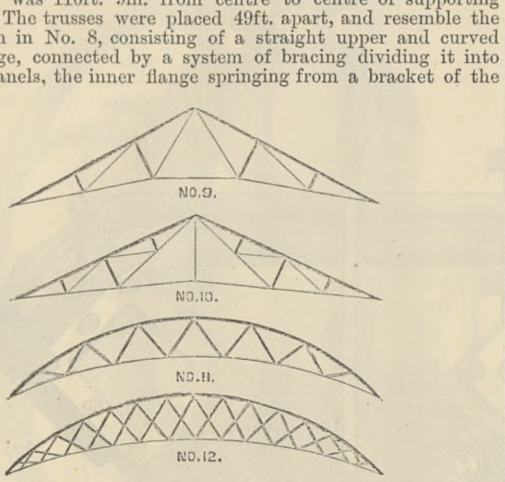
by transverse girders, but here the ridge and furrow covering runs parallel with the supporting girders, advantage being taken of the longitudinal diagonal bracing between these girders to carry the slopes of the roofing. The station is divided into two spans by columns placed about 40ft. 6in. apart longitudinally. There are twenty-four transverse girders between the gables dividing the roof



into twenty-five bays. These girders are not continuous over the station but rest at one end on the side walls, their other ends meeting over the central columns. They are 15ft. deep, of single lattice pattern, which serves as transverse diagonal bracing between the roof trusses. These trusses are formed of light ornamental open cantilevers placed 15ft. apart and united in the centre between two girders supporting the gutters which run in a transverse direction across the station at a level of about 9ft. below the top flange of the main girders, the glazing being carried down to meet the gutters, while the ridge is supported on the top flange of these girders and raised to provide open side spaces for ventilation. Owing to the irregular width of the station the main transverse girders are of varying length, their maximum lengths being 128ft. 3in. and 154ft. 6in. respectively. The cost of the ironwork, including columns, was about £12 per square. The roof over the retort house of the Tunbridge Wells Gasworks, designed by Mr. R. P. Spice, consists of eight ranges or spans supported on transverse wrought iron lattice girders of 65ft. span and 5ft. deep. They are placed 25ft. apart from centre to centre longitudinally. Each span between the supporting longitudinal side walls of the building is divided into ten spaces, and the roof is carried by six main principals and five intermediate principals placed alternately and connected by purlins and wind ties. The main principals consist of straight inclined top flanges with a curved lower flange struck to a radius of 14ft. having a rise of 7ft. above the springing. The main principals are 2ft. 8in. deep in the centre and 3ft. deep at the springing, where they are attached to verticals in the girders connecting the columns. The main principals are of lattice construction and the intermediate principals are formed of T. I.

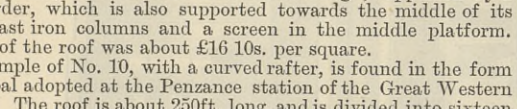
* Read before the Society of Engineers, October 3rd, 1881.

The details of the ironwork in the Paris Exhibition of 1878 were well worked out, and were designed by the late M. de Dion, President of the Société des Ingenieurs Civils. The sites selected were that of the Champ de Mars and the Trocadero. The roofs over the industrial halls were each of the class shown in No. 10, with principals 82ft. span, placed 16ft. 4in. apart. This form of truss is peculiar to iron roofs as distinguished from timber trusses, and represents the type almost universally adopted in France. The chief stations in Paris—the Gare du Nord, de l'Est, and d'Orleans—have principals of this type; the effect of the latter roof being very good. The system is light and comparatively inexpensive. The span of the roof over each of the machinery halls in the Paris Exhibition was 116ft. 9in. from centre to centre of supporting columns. The trusses were placed 49ft. apart, and resemble the class shown in No. 8, consisting of a straight upper and curved lower flange, connected by a system of bracing dividing it into eighteen panels, the inner flange springing from a bracket of the



supporting column vertically for a distance of about 7ft., whence it was curved towards the centre with the following radii: 24ft., 49ft. 2in., and 119ft. 9in.; the total rise from springing of the truss to the centre being 30ft. In the connection of the purlins to the roof principals allowance for expansion was provided for by making the bolt holes at one end, attached to the bracket on the roof principals, oval instead of circular. The grand vestibule in the Champ de Mars building was formed by a semicircular arch, enclosing a flat screen, above which rested a central dome, forming the chief architectural feature of the construction. The roof over St. David's Station, Exeter, erected about twenty years ago, is composed of trussed principals of the class of roof shown in No. 10. The details were designed by Mr. Francis Fox. The length of the passenger shed at Exeter is 360ft., with principals 15ft. apart—centres—of 132ft. span, having a total rise of 22ft., equal to one-sixth of the span. The principals are formed of rolled iron beams, fished with double-fish plates at their junctions, which occur at the place of the three tube struts in each half principal. The tie rod is raised 5ft. above the springing level, giving a depth of truss 17ft. This mode of construction is simple, but as rolled beams are deficient in lateral stiffness, some parts of the roof, especially the glazed part, were stiffened by the addition of ¼in. plates rivetted to the top flange of the principal. The principals of the two outside bays at each end of the roof were also firmly tied together by angle iron bracing. The purlins are of timber trussed, with light iron rods, and placed about 4ft. apart. The roof was covered with diagonal boarding, upon which was laid Croggon's asphalte felt and slated. This kind of roof was somewhat difficult of erection, owing to the considerable span and the absence of lateral stiffness in the section, but when once erected it was perfectly stiff. There are wind ties throughout the roof, which, with the help of the diagonal boarding from purlin to purlin, keeps the roof rigid. The ends of the roof are formed of wrought ironwork of ornamental design, supported by a trellis girder, which is also supported towards the middle of its span by cast iron columns and a screen in the middle platform. The cost of the roof was about £16 10s. per square.

An example of No. 10, with a curved rafter, is found in the form of principal adopted at the Penzance station of the Great Western Railway. The roof is about 250ft. long, and is divided into sixteen spaces by principals placed 15ft. 7½in. apart. The radius of the top flange of the principals is 68ft. 8in. The span of the roof is 77ft., with a depth of truss equal to 10ft. 6in. (centres), and rise of centre of tie bar, 2ft. above the springing level. The principals are connected by lattice purlins. There is no roller bearing, but a cast iron bed plate, having the surfaces in contact planed, is adopted, as the calculated expansion would be roughly only ⅜in. in length, which it is assumed the roof would be able to draw into itself in the case of contraction and *vice versâ*. The form of roof was adopted as the best to resist the strong winds which sometimes do considerable damage in the district, and the members forming the truss are attached together with rivetted joints, which were preferred to bolt connections. The cost of the ironwork was about £9 per square. No. 6 shows a type of truss with inclined struts and vertical ties deduced from the queen post truss, and is known as a queen rod roof, the term "queen rod" being usually applied to the suspending rods analogous to princesses in wooden roofs. The roofs over the Euston Station of the London and North-Western Railway are of this form, and the same type has been adopted in the roof over their station at Bletchley, in spans of about 40ft. The old Tithebarn-street roof of the Lancashire and Yorkshire Railway at Liverpool was constructed of this type in one span of 132ft. The roof over the retort house of the Dublin Gas Works, to which Mr. Jabez Church is consulting engineer, is carried by principals of this type—No. 6, see diagram. The principals are 64ft. 3in. span, placed about 6ft. 6in. apart, and the feet of each rafter abut into cast iron shoes, to which the tie rod is fastened. The depth of the truss is 28ft., and the rise of the tie bar 5ft. above the springing. The oblique struts and vertical ties or suspending pieces have jaws or forks at their upper ends, where they are hung from the rafters by means of pins and screws at their lower ends,



ROOF AT INDIA-OFFICE.

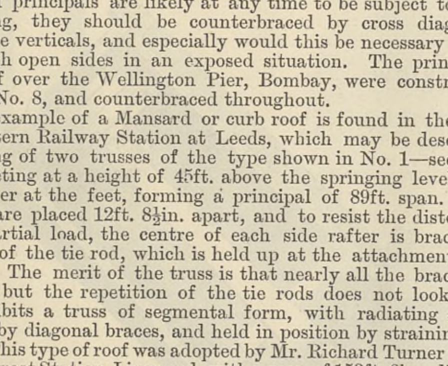
where they are connected with the struts and with the tie bar by means of pinching nuts. The length of the roof is 296ft. 1in. between end walls. Another example of No. 6 is to be found in the Swansea Station of the London and North-Western Railway, where the total width of 70ft. is divided into two spans, one of 64ft. 6in., and a side span of 5ft. 6in., the roof over the main span being composed of 23 principals 15ft. deep in the centre with the tie rod raised 1ft. above the springing, and placed 20ft. apart. The purlins connecting the rafters are formed of wood with flitch plate on each side, and about 6ft. apart. The roof was designed by Mr. H. M. Bradford. The roofs over the east and west courts of the Alexandra Palace, Muswell Hill, are of this type—No. 6—with principals 53ft. 6in. span placed 17ft. apart, it being found cheaper to truss the purlins than to place the principals nearer. The roof cost £10 per square, including fixing and columns without covering. The ornamental roof over the courtyard of the India Office is carried by a compound truss. The span is about 66ft. 3in., and the rise of the ridge above the springing 16ft. 4in., which depth is divided into two—see diagram—the upper portion being composed of a truss 7ft. 6in. deep, of the type shown at No. 6, but strutted at the base, below which is connected a trapezoidal truss about 8ft. 10in. deep, with ends inclined in continuation of the pitch of the upper truss, and braced in a similar way, while the central portion is in the shape of a rectangle divided into three bays, and braced with inclined struts, connected by tension bars.

The roof over the Volunteer Drill Hall in Port Elizabeth is an example of No. 7. The principals are 70ft. span divided into eight bays, the angle irons and bars being connected by rivets at the attachments. The total rise of the top rib in the centre is 15ft. 1in., and that of the tie forming the bottom rib 5ft. 9in. above the springing, giving a depth of truss of 9ft. 4in. The roof is covered with galvanised corrugated iron, No. 20 B.W.G., laid on felt over ⅞in. boarding fastened to the timber purlins, which are secured to the main ribs by angle iron cleats. The ironwork cost £6 10s. per square. In designing a roof for a foreign country, where skilled labour is scarce and expensive, it is advisable to offer every facility for erecting the different parts and to make them as similar and interchangeable as possible. Connections formed by pins or bolts are more easily fitted than those which require to be rivetted together, and may be advantageously employed in a trussed roof. No. 9 is a modification of the queen rod roof, and forms a very good type of truss. It has been adopted in the roof of the Victoria Station over the London, Brighton, and South Coast Railway, designed by Mr. Jacomb Hood. The trusses are of 50ft. span, supported on trussed girders 10ft. 9in. deep, which run transversely and form two spans of 124ft. 7in. and 117ft. 5in. respectively, meeting over the centre of cast iron columns 1ft. 6in. in diameter. Cast iron gutters are fixed on the top wrought iron plate of the girders and constructed to take a part of the strain in the top flange. The ironwork cost about £20 per square. The form of principal adopted in the Dover Harbour Station of the London, Chatham, and Dover Railway, also resembles No. 9. The span is about 44ft. with principals placed 6ft. 6in. apart and about 7ft. 6in. deep, the rise of the top of the rafter being 9ft. and the rise of tie rod 1ft. 6in. above the springing. No. 6 is to be preferred to No. 9 for those roofs where it may be advisable to introduce longitudinal bracing between the principals in a vertical plane, and its vertical members are better adapted for roofs with hipped ends than No. 9, but No. 9 possesses the advantage of struts at right angles to the rafter, and, therefore, of minimum lengths, while in No. 6 the inclination of the struts is generally different in each bay, and the last strut nearest the support is usually at a very unfavourable angle for resisting compression. At the same time it must be borne in mind that hipped rafters are a considerable support to a roof, and resist the wind pressure better than a gable. A combination of No. 6 with No. 9 is found in some constructions in which both the struts and ties are inclined, the struts being placed as nearly at right angles to the rafter as the design will permit, and thus their length is shortened, as compared with No. 6, and the strain upon them reduced. No. 8 combines the advantage of a straight rafter roof with the pleasing effect of a graceful curve to the inner member of the rib, the necessity of tie rods being done away with. A roof, 162ft. 6in. in length and 50ft. wide, was constructed upon this type—No. 8—for the Nitheroy Gasworks, Brazil, in 1868. The principals are 6ft. deep in the centre, and are supported on columns placed 12ft. 6in. apart. The roof overhangs 5ft. on each side at the eaves, which are supported by cast iron brackets. Great rigidity is given to the structure by the attachment of the brackets to the ends of the rafters and to the columns. In every roof where the trussed principals are likely at any time to be subject to partial loading, they should be counterbraced by cross diagonals between the verticals, and especially would this be necessary when erected with open sides in an exposed situation. The principals of the roof over the Wellington Pier, Bombay, were constructed similar to No. 8, and counterbraced throughout.

A good example of a Mansard or curb roof is found in the new North-Eastern Railway Station at Leeds, which may be described as consisting of two trusses of the type shown in No. 1—see diagram—meeting at a height of 45ft. above the springing level, and tied together at the feet, forming a principal of 89ft. span. The principals are placed 12ft. 8½in. apart, and to resist the distortion due to a partial load, the centre of each side rafter is braced to the centre of the tie rod, which is held up at the attachment by a king bolt. The merit of the truss is that nearly all the bracing is in tension, but the repetition of the tie rods does not look well. No. 3 exhibits a truss of segmental form, with radiating struts connected by diagonal braces, and held in position by straining the tie rods. This type of roof was adopted by Mr. Richard Turner in the old Lime-street Station, Liverpool, with a span of 153ft. 6in., divided into seven bays. The distance between principals was 21ft. 6in., which space was trussed laterally at each strut by purlins formed of 3 T-irons, the centre T-iron running direct from principal to principal, while those at the sides branched off right and left at 5ft. from each other, so that they were attached to the girder in three points. In addition, diagonal braces were fixed between two corresponding struts connected at the top with the purlins, and at the bottom in the adjoining principal with linking plates by bars of their own scantling. The ends of the principals were each fixed in a cast iron chair resting on rollers over the supporting wall on one side, and fixed on the other side upon a cast iron column. The cost was about £20 per square.

A similar form of truss has been adopted in the Snow Hill Station, Birmingham, designed by Mr. Thomas Vernon. This roof is divided into two spans, meeting over a central row of columns—one roof is 506ft. long, carried by twenty-four principals of 92ft. span, having a rise of 27ft. 6in., with a depth of truss equal to 9ft., the rise of the tie rod being 18ft. 6in. above the springing. The other roof is 176ft. long, carried by nine principals of 58ft. 3in. span, having a rise of 17ft., with a depth of truss equal to 7ft., the rise of the tie rod being 10ft. above the springing level. The principals are placed 22ft. apart, connected by purlins of two kinds, viz., trussed T-irons and lattice girders. The cost, including covering for the roof proper, was £13 4s. per square.

The circular or segmental form is the best adapted for wide spans, but in any very exposed situation both the last described roofs, as shown in No. 3—see diagram—would prove defective, as



ROOF AT MILLWALL DOCKS.

the counter-bracing applied to the centre bay is not extended to the side bays, so that when uniformly loaded some of the ties are called upon to sustain compressive strain. In the Fenchurch-street Station roof of 105ft. span, designed by Mr. G. Berkeley, in 1851, this contingency is provided for by counter-bracing every bay, as in No. 5—see diagram—where the struts are vertical. The roof over the new grain depôt at the Millwall Docks, designed by Mr. F. E. Duckham and now being erected, consists of twenty-one spans of 44ft. each by 211ft., supported on columns 15ft. high placed at distances apart of 15ft., and connected by trussed angle iron purlins. The main ribs are similar to No. 3—see diagram—with radial struts, but properly counter-braced as in No. 5. Each rib is divided into six bays, and is 8ft. 9in. deep, the tie being nearly horizontal. No. 5 represents a truss on the bowstring principle, in which the verticlas are constructed to act in compression while the inclined braces are considered to act in tension only. This form of roof was adopted in the Joint-line Station, at New-street, Birmingham, which comprises one of the largest areas in any single span. Its length is 840ft. divided into thirty-five spaces by principals placed 24ft. apart, and varying in span from 212ft. to 190ft. 9in. with a rise of about one-fifth of the span. Each truss is divided into thirteen bays, and the depth of the widest is about 23ft. with the tie rod raised about 17ft. 6in. above the springing level. The main ribs are connected longitudinally by trussed timber purlins 8ft. apart, resting on the back of the principals and butting against one another, thus forming continuous lines from end to end of the roof, which are maintained by wind ties springing from the foot of every alternate arch, and running diagonally across the roof to the foot of the fourteenth arch on the opposite side. The trusses are fixed on one side over brick pilasters, and on the other they rest on rollers placed over iron columns 2ft. in diameter, which act as drain pipes to convey away the water. The roof is terminated at each end with a gable screen and ventilated at the top along the centre by an elevated ridge resting on louvre standards. It was completed in May, 1854, and cost £17 15s. per square. The roof over the west-end terminus of the South-Eastern Railway, at Charing-cross, is divided into fourteen spaces by fourteen principals, in addition to the gable principal. The clear span is 166ft. The principals are trussed in similar manner to No. 5—see diagram—and are placed 35ft. apart. Each truss is divided into nine bays. The rise of the tie bar is 25ft., and of the curved rib 45ft. above the springing level, giving a truss 20ft. deep at the centre. The trusses are fixed at one end and hinged to a saddle bearing at the other. There are no wind ties, but two intermediate trussed frames are introduced in each bay with lattice girder purlins resting on the lower flange of the rib of the principal, and attached securely to the principal at the top and bottom flanges with slotted holes, the purlins being all bound together by the intermediate framed ribs and the rivetted sash bars. The roof cost £40 per square.

(*To be continued.*

The City of Rome.—A telegram to the *Times* says that the Inman steamer City of Rome arrived at Sandy Hook at 8 o'clock on Monday evening. The voyage from Queenstown to Sandy Hook took nine days and seventeen hours. She had a most tempestuous voyage. Heavy westerly gales stopped her at various times on the voyage, the stoppage, aggregating twenty-four hours, caused by the derangement of the steam reversing gear. The ship behaved well, and is a fine sea boat. The machinery, with the above exception, worked well. The 1415 passengers are all well. The best mileage was on Saturday, when she made 387 miles. She will return to Liverpool next Saturday with, possibly, 200 cabin passengers.

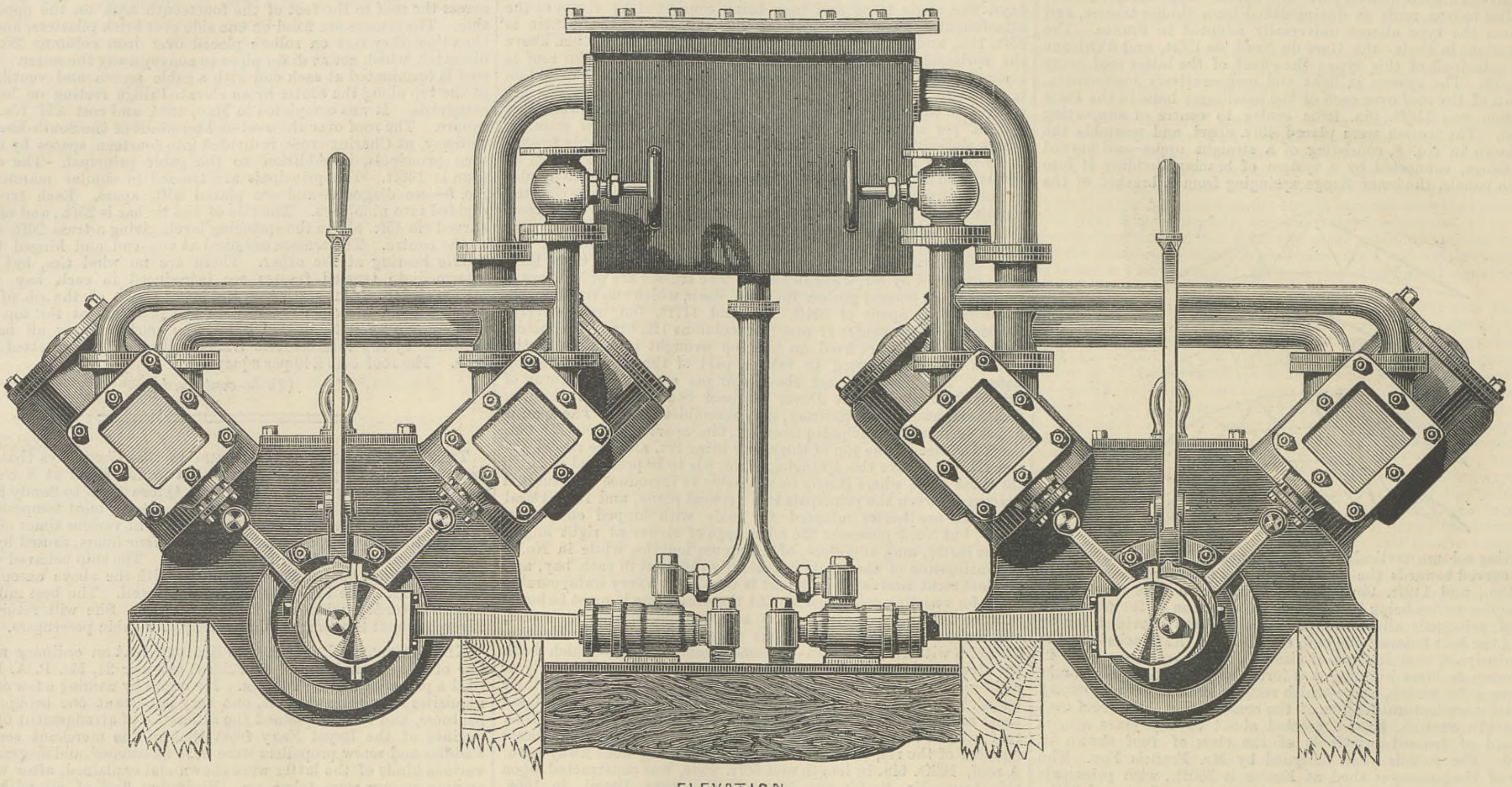
King's College Engineering Society.—At an ordinary meeting of this Society held on Friday, October 21, Mr. P. A. Low, read a paper on marine engines. He began by naming a few of the requisites of marine engines, one very important one being compactness, and then explained the difference of arrangement of the engines of the Royal Navy from that of the merchant service. Paddles and screw propellers were next mentioned, and diagrams of various kinds of the latter were shown and explained, after which engines proper were taken up. Beginning first of all with the cylinders, the arrangement, working, and advantages of the high and low-pressure system were shown by drawings and explanation. Some time was then occupied in describing condensers, expansion valves and gearing, link motion and the mode of reversing by means of an auxiliary engine, in showing forms of connecting rods and in explaining Kingston valves and their uses, &c. A description of the engines of the Arizona fully illustrated by diagrams, followed, and after showing diagrams of the stern tube and thrust block, Mr. Low concluded with an explanation of the practical working of marine engines aided by a sketch of the interior of the engine-room of the Sardinian. A short discussion followed the paper.

The Panama Canal.—An important letter sent by the American Secretary of State to Mr. Lowell, the American Minister in this country, has been published here relating to the Panama Canal. It is to the effect that the United States Government will not in any way interfere with the canal, but that it will feel bound to watch over such a highway between its two coasts. It refers to the 1846 treaty and says, "While thus observing the strictest neutrality with respect to complications abroad, it is a long-settled conviction of this Government that any extension to our shores of the political system by which the Great Powers have controlled and determined events in Europe would be attended with dangers to the peace and welfare of this country." Writing to the *Times* on this part of the question, Mr. H. Drummond Wolff says:—"Will you allow me to point out to you that by Article VIII. of the Clayton-Bulwer Treaty provision is actually made for a Panama canal? The following is the text of the article:—'The Governments of Great Britain and the United States having not only desired, in entering into this convention, to accomplish a particular object, but also to establish a general principle, they hereby agree to extend their protection by treaty stipulations to any other practicable communication, whether by canal or railway, across the isthmus which connects North and South America, and especially to the interoceanic communications, should the same prove to be practicable, whether by canal or railway, which are now proposed to be established by the way of Tehuantepec or Panama.' By Article VI. of the same treaty the contracting parties engage to invite every State with which both or either have friendly intercourse to enter into stipulations of a similar character. It must also be recollected that this treaty was signed in 1850, four years after the conclusion of the treaty of 1846 between the United States and New Grenada, now invoked by the United States Government. No change of any kind has taken place since 1850 in the conditions under which the Clayton-Bulwer Treaty was signed.

Canadian Storm Signals. — The storm signals issued by Toronto Observatory are founded on telegrams received three times a day from a large number of points from Nova Scotia to Battleford, and from the Gulf of Mexico to the St. Lawrence. The first telegrams are received about eight o'clock in the morning, and give the data of the thermometer and barometer, the direction and velocity of the wind, the appearance of the sky, and the amount of rainfall since the previous observation. These particulars are marked on a map of the continent, and the points at which the barometer is the same, or nearly so, are connected in curving lines, which generally form a complete oval. The map then shows a series of circles, one within the other, until the point is reached at which the barometer is marked lowest. An interval of one-tenth of an inch is allowed generally for each space between these circles. About the middle of the afternoon another lot of telegrams are received, and a similar map is made. The third map is similarly prepared near midnight, but storm warnings can then be given to but few points, as the telegraph offices are closed, except in large towns. These maps, and the differences between them, show in what direction a storm is travelling, the rate of its motion, the possibilities of its being diverted more or less from its course by a neighbouring area of high barometer, or hurried forward or retarded by other atmospheric movements to the east or west. Where the lines are drawn together most, there the wind is strongest. But while the observers at the Meteorological Observatory are enabled by these maps to tell with a great measure of accuracy the condition and peculiarities of a storm, and generally to know of its approach long before seamen would suspect that a storm was approaching, there are many indications which are noticeable by mariners, and can be turned to practical account sometimes a day or two before the storm breaks, or even before the storm drum is hoisted. To enter into these indications and explain their cause and signification would fill columns; they are generally known, however, to intelligent lakemen. Storms travel almost invariably from a westerly point to an easterly, and have well-marked characteristics common to all of them. Whether they are waves of an atmospheric sea is a question open to dispute. At any rate, the movements of the atmosphere in every storm bear a striking resemblance to that of the water in a warm and shallow sea.

FOUR-CYLINDER ENGINES—TWIN-SCREW YACHT, WATER LILY.

MESSRS. VOSPER AND CO., PORTSMOUTH, ENGINEERS.



ELEVATION

FIG. 1.
SECTIONAL END VIEW

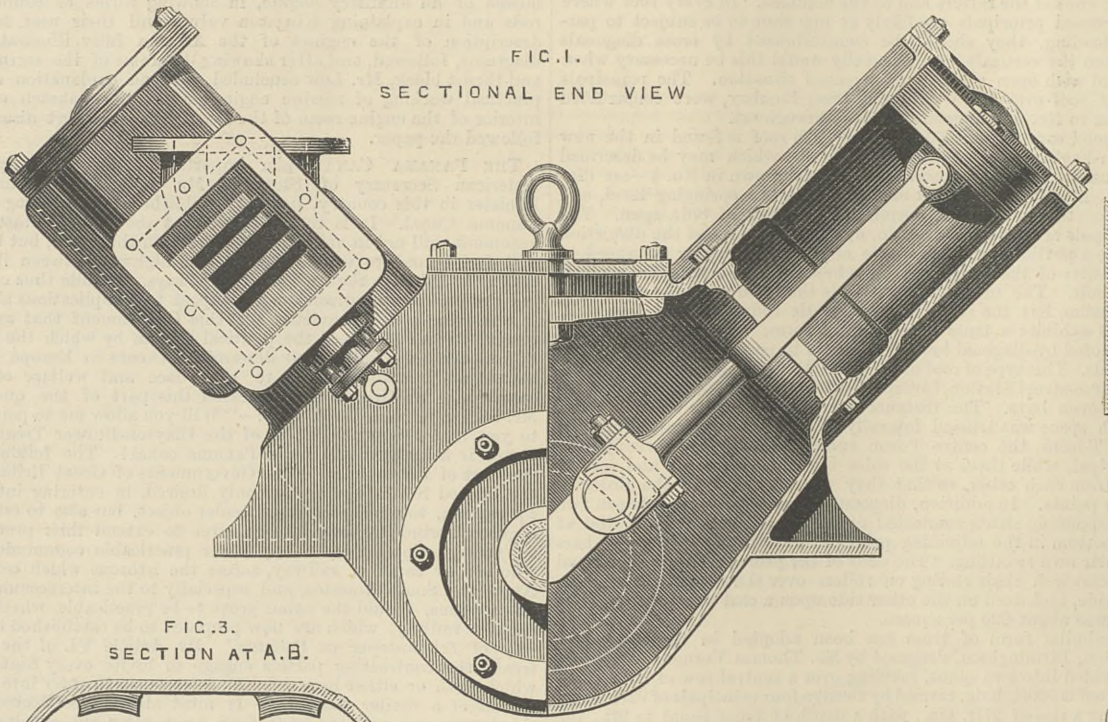


FIG. 2.
LONGITUDINAL SECTION

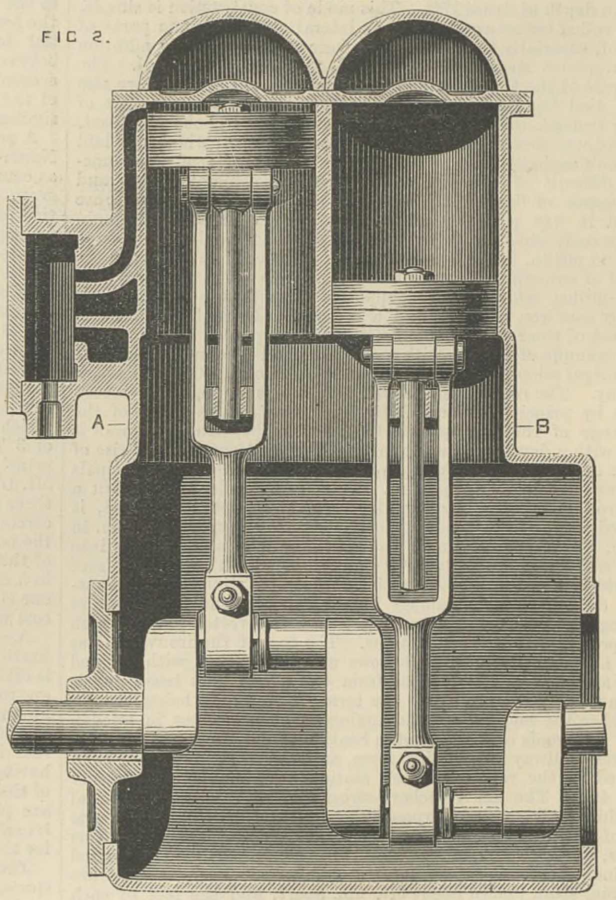


FIG. 3.
SECTION AT A.B.

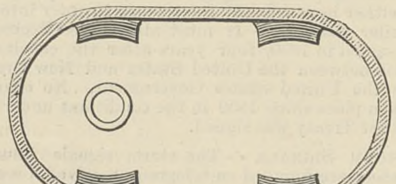
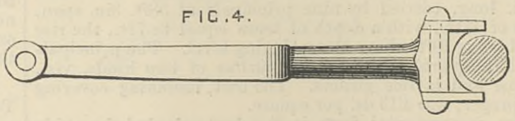


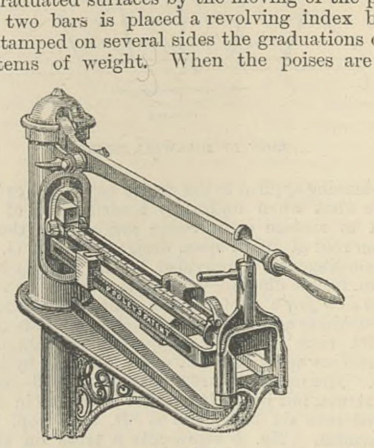
FIG. 4.



We illustrate above a set of four-cylinder engines fitted to the twin-screw yacht Water Lily, the property of Mr. Arthur Kavanagh, M.P. Our drawings show the construction of the engines very clearly. They are patented by Mr. Vosper, of Broad-street, Portsmouth. The Water Lily is 80ft. long and 14ft. beam. The engines are 16-H.P. nominal collectively, and are, we understand, giving the greatest satisfaction. The levers of the engines are led right up on to the deck, so that the owner or captain has full command of them. These engines have replaced two single engines, 9in. diameter, 9in. stroke, and drive the yacht faster without noise or vibration. The tank between the engines serves as a silent exhaust tank, and also as a feed-water heater. A boat belonging to Mr. Croft, of Fleetwood, has been fitted with a similar pair of engines, and after several months experience with them, that gentleman has expressed himself highly pleased with them.

POOLEY'S ENGLISH AND FOREIGN SCALES STEELYARD WEIGHING MACHINE

The illustration in the next column represents a newly-patented steelyard for weighing machines, by Messrs. Henry Pooley and Son, which exhibits at a glance any weight placed upon the platform from the smallest measurable fraction to the full load in two or more denominations, without changing the counterpoises or using any loose weights whatever. The steelyard has two arms, on one of which slides a poise adjusted to balance the heavier weights, as cwts. or tons, and on the other arm a smaller poise is fitted, which balances the finer subdivisions of weight, say from ¼ lb. to ¼ cwt. These bars are not graduated, so that there is no wear of expensively graduated surfaces by the moving of the poises; but between the two bars is placed a revolving index bar, having engraved or stamped on several sides the graduations of as many different systems of weight. When the poises are moved to

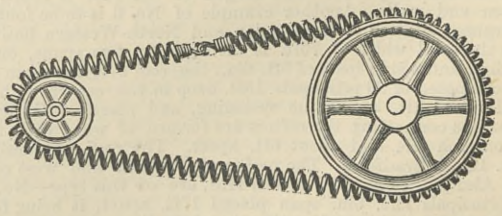


balance the load on the machine, the weight will be indicated by the poises upon that graduated surface of the revolving bar which may be presented to view, and by turning the bar on its axis any other graduated surface may at pleasure be brought to view, and the weight of the load read off upon it without re-weighing or touching the counterpoises.

The machine is invaluable in positions where goods are bought or delivered according to their weight by one national system, and sold or re-shipped according to their weight by another standard, as by its use all calculations are avoided, and the reading of the weight in several denominations does not involve more than one operation of weighing.

A NOVEL DRIVING BELT.

The accompanying engraving illustrates a new driving band, now being brought out in the United States by the Perpetual Tension Propelling Belt Company, Seventh Avenue, New York. It is made, as will be seen, of spiral wire, and the material may



be either brass or steel, as desired. While at work the belt is continuously changing its exterior position, or, in other words, is rotating at right angles to its line of motion, while passing round the pulleys, thus wearing the surface of the coil uniformly. The ends of the belt are fastened together by screwing flexible plugs into the ends of the coil, one being formed with a hook and the other with an eye.

SODA-WATER MACHINERY AT THE BREWING EXHIBITION

FIG. 1

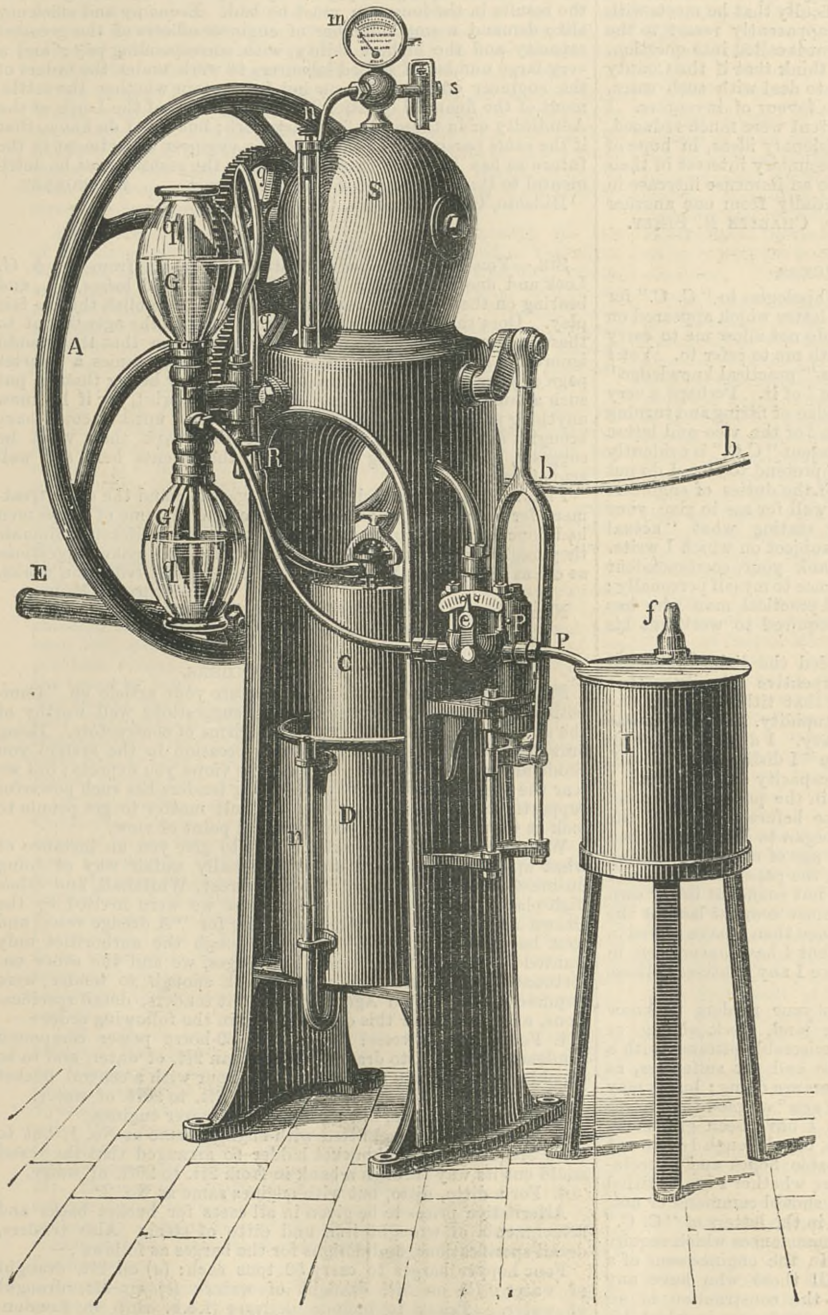
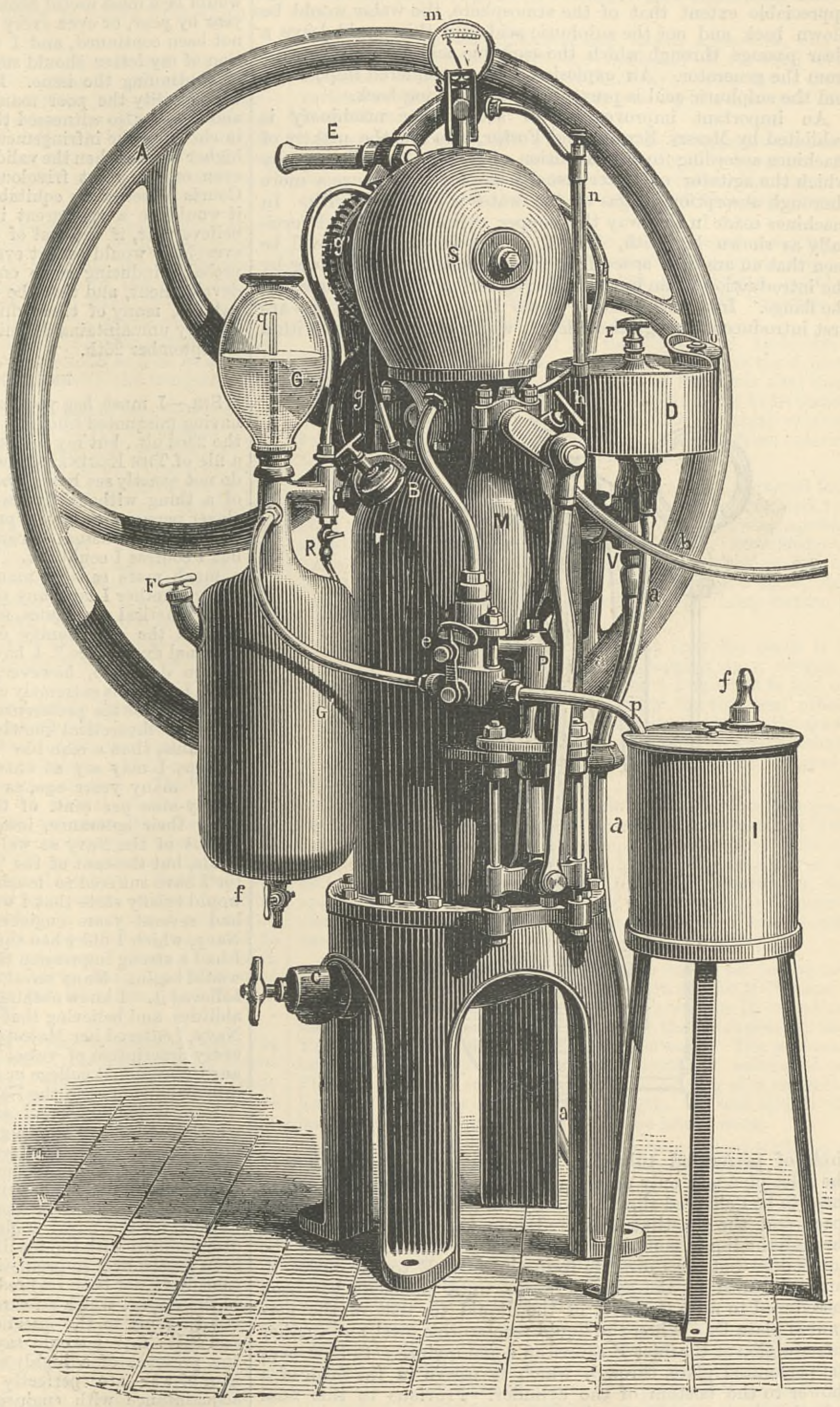


FIG. 3

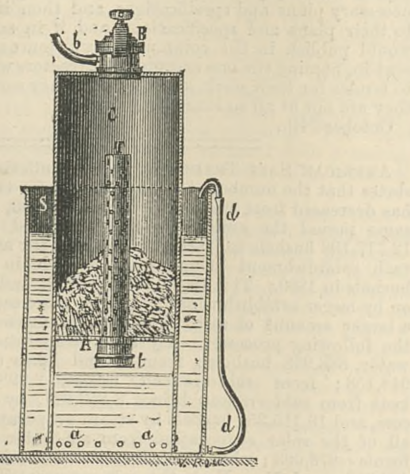


THE BREWING EXHIBITION.

In the report on this exhibition published in our last impression we mentioned some soda-water machinery of good design made on the Mondollot system by Messrs. H. Favarger and Co. This machinery we now illustrate. The construction of machinery of this class is of a wider range of interest than formerly, inasmuch as the continued growth in the consumption of aërated liquids has caused the proprietors of breweries to look upon aërated water-making machinery as a necessary adjunct to their plant. Brewers have often considerable facilities for this addition to their manufactures, amongst which are the possession of steam power and generally an ample and good water supply.

The smallest Mondollot machines are constructed so as to use bicarbonate of soda and dilute sulphuric acid, and are intended for use on board ship, and for small manufacturers. Fig. 1 is a perspective view of this machine. Fig. 2 is a sectional illustration of the gas generator or producer. S is a cylindrical

FIG. 2.



vessel open at the top, for containing dilute sulphuric acid. Within this vessel is fixed a second cylinder C of smaller diameter but greater length. A false bottom divides the interior of this cylinder into two compartments, the upper of which is for receiving the bi-carbonate of soda. t is an open tube pierced with holes for nearly the whole of its length, and it is fixed in the centre of the false bottom. B is a tubular opening for charging the cylinder C with the bi-carbonate. b is a portion of the tube connecting the apparatus with the condensing and pumping machine, and $d\,d$ is a flexible tube for discharging the acid and water.

Fig. 1 shows the machine complete. D is the outer and C the inner cylinder of the generator previously described. G G′ are glass purifiers into which the gas passes from the generator. S the condenser in which the water is impregnated with the carbonic acid gas, is of two gallons capacity. I is the water tank fitted with glass ballcock, affording a constant supply for aëration. P is a pump for forcing the filtered water from the tank, and the gas from the purifiers, into the condenser. A is a fly-wheel. with handle E, for working the machine by hand. $g\,g'$ are cog-wheels, the upper one of which is fixed to the spindle of an agitator in the condenser, which, by its rapid motion, facilitates the complete saturation of water with the gas. $n\,n'$ are water gauges, the one indicating the height of water in the condenser, and that of the acid solution in the cylinder D. m is a pressure gauge for denoting the pressure in the condenser. e is a distributing tap for regulating or varying the relative proportions of gas and water forced by the pump into the condenser. s is a safety valve attached to the condenser, and so constructed as to be easily adjusted to any pressure required. The operation of the machine is as follows:—A given weight of granulated bi-carbonate of soda is introduced into the cylinder C, through the feed-tube B, which is then securely closed. The outer cylinder D is filled nearly to the top with water, to which is added a given volume of sulphuric acid. The solution flows by its own gravity through the holes $a\,a$ into the cylinder C, but is prevented by the pressure of air therein from rising to the level of the soda. The machine having been set in motion, the air or gas in cylinder C is drawn off through the pipe b, and, the back pressure being thus removed, the acid solution rises up to the tube t, and, passing through the holes pierced in its circumference, comes in contact with the bi-carbonate of soda, upon which a rapid generation of carbonic acid gas immediately takes place. This restores for a moment the back pressure, forces down the solution from contact with the soda, and, for that instant, stops the generation of gas. But as at each stroke of the pump the gas is withdrawn from the cylinder, the fluid again rises to contact with the soda and a further generation of gas takes place. The pressure of the gas is thus made to regulate with the greatest nicety the rate of its own production. The gas passes from the cylinder, through the tube b, into the purifiers G G′—Fig. 1—where it is divested of all impurities. It is drawn thence by the action of the pump and forced into the condenser, together with the water to be aërated, which is drawn from the tank I. The combination of the two is effected by the high pressure maintained in the condenser, assisted by the motion of the agitator. The carbonated water then passes through the tube $b\,b$ to the bottling machine. It will be noticed that the production of gas is regulated automatically and at a uniform rate. The process continues while the machine is in motion until the materials are exhausted.

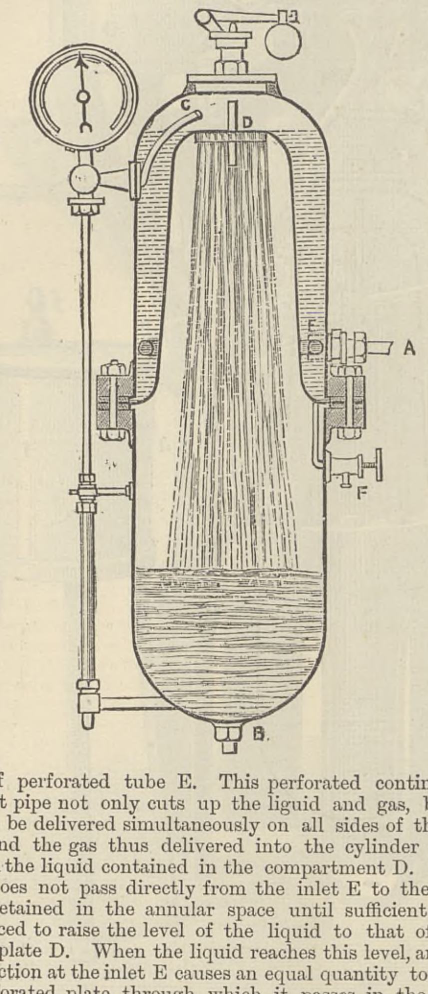
The larger machines differ from the machine shown at Fig. 1, principally in the generator, which is a closed vessel adapted for the generation of gas from sulphuric acid, and whiting or marble or other carbonate of lime. This generator is made of pure lead. The saturator and pipes are of thick copper, heavily lined with tin, so as to prevent contamination. It will be seen that the machine is very compact, and the advantages of the continuous automatically controlled generation of the gas are manifest. Fig. 3 shows one of these machines.

In this illustration M is the generator, which is made of cast iron thickly lined with lead, and serves as a base to support the other apparatus. B is a tubular opening for charging the generator with the whiting or other carbonate employed. D is a cylindrical leaden vessel for containing the sulphuric acid. r is a screw valve or tap which admits, or stops, the flow of sulphuric acid from the box D to the generator as may be required. G G′ are purifiers, the lower of which is of tinned copper and the upper of glass, through which the gas passes from the generator to the pump by which it is forced into the condenser. F and N are openings for charging the purifiers with water; and f is a tap for discharging the water when required to be renewed. S is the condenser for mixing the gas with the water to be aërated. I is the tank for the water supply. P is the force pump. $g\,g'$ are cog-wheels, the upper of which g' works the agitator in the condenser S. n is a water gauge for indicating the height of the water in the saturator, and m is a pressure gauge showing the pressure of the gas in the condenser. b is the tube for conveying the aërated water to the bottling machine. e is the distributing tap, with graduated quadrant, for regulating the relative proportions of gas and water pumped into the condenser. V is a safety vase, consisting of a U-shaped tube and filled with water. It puts the generator in direct communication with the outer air, and prevents any accumulation of gas in the generator.

The action of these machines is precisely similar in *principle* to that of Fig. 1, although the machines differ to some extent in their working details. The generator having been charged with whiting and water in given proportions, and the acid box D filled with sulphuric acid, the machine is set in motion. The sulphuric acid then flows down one of the tubes of the syphon $a\,a$, and up the other one into the generator M, and acting chemically on the whiting or other carbonate contained therein, causes an immediate generation of gas. This generation continues until the pressure of the carbonic gas in the producer exceeds that of the atmosphere; when this occurs, the gas seeking to escape finds no other channel but down the arm of the syphon tube, through which the sulphuric acid is ascending towards the generator. There it presses on the rising column of sulphuric acid and prevents its flowing into the generator until the pump, drawing the gas away, diminishes again the slight pressure. As soon as this occurs, the flow of acid immediately recommences and continues until the generation of gas is again sufficient to prevent the acid flowing into the generator. An agitator geared into and worked off the cog-wheel g keeps the whiting in constant agitation, so that no sulphuric acid can fall into the generator without being brought into contact with the whiting, and generating carbonic acid gas. The gas after being generated is drawn by the pump through purifiers, which free it from all impurity, and is forced with the water into the condenser, whence it is drawn off in the usual way into bottles or syphons. A safety vase, just seen at V, is an open vase, into which a U-shaped tube filled with water dips; this places the inside of the generator in direct communication with the outer air. As the weight of water is about one-half of that of sulphuric acid, should the pressure in the generator exceed to any appreciable extent that of the atmosphere, the water would be blown back and not the sulphuric acid, and this would leave a clear passage through which the carbonic acid gas could escape from the generator. An explosion is thus rendered impossible, and the sulphuric acid is prevented from blowing back.

An important improvement in soda water machinery is exhibited by Messrs. Barnett and Foster, who are the makers of machines according to the invention of Mr. H. Moy Thomas, by which the agitator or mixer usually employed to cause a more thorough absorption of gas by the water is dispensed with. In machines made in this way the copper cylinder is placed vertically as shown herewith, Fig. 4. From this section it will be seen that an annular space D is formed within the cylinder by the introduction of an inner half-cylinder hermetically sealed at the flange. Into this annular space D the liquid and gas are first introduced through the inlet A, which communicates with a

FIG. 4.



circle of perforated tube E. This perforated continuation of the inlet pipe not only cuts up the liquid and gas, but causes these to be delivered simultaneously on all sides of the annular space, and the gas thus delivered into the cylinder percolates through the liquid contained in the compartment D. Thus the liquid does not pass directly from the inlet E to the outlet B, but is detained in the annular space until sufficient has been introduced to raise the level of the liquid to that of the perforated plate D. When the liquid reaches this level, any further introduction at the inlet E causes an equal quantity to flow over the perforated plate, through which it passes in the form of a shower to the bottom of the cylinder. Previous to this final agitation, however, the liquid will have absorbed a great quantity of the gas which passed through it during its passage by stages from the lower part of the annular space to the level of the perforated plate H. The tube through the perforated plate D retards the fall of the liquid through the cylinder, as by its means a continual communication is established above and below the perforated plate, so that the rate at which the liquid passes through the perforations is not increased by the action of the pump, but takes place at a uniform rate under varying pressures. The water gauge indicates the accumulation of aërated liquid in the bottom of the cylinder, and by the introduction within the cylinder of the tube C communicating with the water gauge, the highest level which the liquid should be allowed to attain above the perforated plate is defined.

LETTERS TO THE EDITOR.

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

WIND PRESSURE.

Sir,—In "Ency. Brit.," Vol. XII., article "Hydro-mechanics," p. 517, new edition, Professor Unwin gives a formula which nearly accords with that in Mr. Hawksley's paper. Your correspondent "A.M.I.C.E." will there find the experiments, how made, with their results, and reasons for discrepancies. The formula is—"Resistance of a plane moving through a fluid, or pressure of a current on a plane. When a thin plate moves through the air, or through an indefinitely large mass of still water, in a direction normal to its surface, there is an excess of pressure on the anterior face and a diminution of pressure on the posterior face.

"Let V be the relative velocity of plate and fluid;
Ω be the area of plate;
G be the density of fluid;
h be the height due to velocity. Then

The total resistance $R = f G \Omega \dfrac{V^2}{2g}$ pounds $= f G \Omega h$, where f is a coefficient having the value of about 1·3 for a plate moving in a still fluid, and 1·8 for a current impinging on a fixed plane, whether the fluid be air or water." W. S.

Liverpool, Oct. 25th.

PATENT LAW REFORM.

Sir,—Referring to the frequent recent discussions regarding the patent laws as they now stand, and the question as to whether the cost of taking out a patent debars a poor inventor from availing himself of their protection, I would like to suggest that the cost of the patent itself is extremely insignificant as compared with the usually very heavy outlay in making the machine, experimenting with it, and in introducing it successfully to the public. In order to do this an inventor has generally to seek the assistance of a moneyed partner, who, unless the invention appeared likely to bring a good return, would not, I think, be inclined to incur the greater expense, however much the cost of obtaining the patent may be reduced. If the inventor takes out his patent rashly, there is very great probability of his finding out that some one had patented the same thing before—as I found, to my cost, many years ago. If he prudently makes a search in previous specifications, he must be prepared for what may be a heavy outlay. The Patent-office has published abridgments of specifications relating to various subjects. Those relating to my speciality—the steering of ships by steam power—have not been extended beyond the year 1866, although it is six years since the volume was published. It would be a most useful book to inventors for reference, if completed year by year, or even every three years. I do not know why it has not been continued, and I will be very glad indeed if the publication of my letter should suggest to the authorities the advisability of continuing the issue. During my experience I have seen with what facility the poor man's invention may be pirated from him, and I have also witnessed the extreme difficulty that he meets with in checking the infringement, as he must apparently resort to the higher courts when the validity of his patent is called into question, even on the most frivolous grounds. I think that if the County Courts possessed an equitable jurisdiction to deal with such cases, it would be a very great improvement in favour of inventors. I believe that, if the cost of obtaining a patent were much reduced, everybody would patent even the most visionary ideas, in hope of probably inducing some one to take a pecuniary interest in their development, and that the result would be an immense increase in patents, many of them differing substantially from one another only by unmaintainable imitations. Charles R. Simey.

September 26th.

ENGINE-ROOM ARTIFICERS.

Sir,—I must beg you to permit me to apologise to "C. C." for having misquoted him, if I did so, in the letter which appeared on the 23rd ult., but my present movements do not allow me to carry a file of The Engineer always about with me to refer to. Yet I do not exactly see how a person can have a "practical knowledge" of a thing without "personal experience" of it. Perhaps a very clever person may have a practical knowledge of fitting and turning without any "actual personal experience" of the vice and lathe, but I confess I could not. Your correspondent "C.C." is evidently a much more capable man than I dare pretend to be. I do not know whether I have any right to speak of the duties of engineers or of practical mechanics, so it may be as well for me to give your readers the opportunity of judging, by stating what "actual personal experience" I have had of the subject on which I write. Before doing so, however, I beg to thank your correspondent "W. L." for his extremely courteous reference to myself personally; especially for his preference "for a good practical man who has no more theoretical knowledge than is required to work out his diagrams, than a man like 'Experience.'"

Now, I may say at once that I discarded the title "practical man" many years ago, as I found by expensive experience that ninety-nine per cent. of those who used that title did so only to cover their ignorance, incapacity, and stupidity. I found it was so out of the Navy as well as in the Navy. I dislike cant of all kinds, but the cant of the "practical man" I dislike most of all, for I have suffered so much from the incapacity of that class. I would briefly state that I was brought up in the private trade, and had several years engineering experience before I entered the Navy, which I did when the ironclad era began to dawn, and when I had a strong impression that the golden age of naval engineering would begin. Many naval officers said it, the papers said it, and I believed it. I knew nothing of the Navy, but confident in my own abilities and believing that a good time must come at last for the Navy, I entered her Majesty's service. Since then I have served in every description of vessel in the Navy, but I have never been in any Government college or school, nor have I any relatives in those establishments or in the Navy.

Now it cannot be of any interest to your readers to know whether I am now engaged in farming land, stock-jobbing, or dragging out a wretched existence on a miserable pittance with a ruined constitution, waiting for death to end my sufferings, as many of my naval engineering acquaintances are doing; but it may interest them to know that the "golden age" or good time never dawned for the naval engineer, and that I have been grievously disappointed with the result of my service, for although I have not been passed over in promotion, my reasonable hopes and expectations have not been realised. I do not care whether I am entitled to the respect which an experienced man should command or not, but in reply to the questions contained in the letters of "C. C." and "W. L.," I would say that the circumstances which require the presence of a highly scientific man in the engine-room of a man-of-war are perfectly obvious to all those who have any acquaintance with engineering or with the construction of an ironclad, and that I cannot state any circumstances in which his presence is not required. For the scientific engineer is he who can see what is wanted instantly, one who can design the best, the cheapest, and most speedy means to attain a given end; one who can design a machine or engine, calculate the strain, and superintend its construction from beginning to end. The scientific naval engineer is he who has studied the strength and properties of metals and their alloys, who has a sound and extensive knowledge of chemistry, of electricity, theoretical mechanics, and especially of thermodynamics, and who has the capacity and knowledge to enable him to understand the science of gunnery and torpedo management. This is the man who is of use on board a war vessel—a man whose word the captain can implicitly rely on in moments of the greatest peril, and whose moral character will confer upon him a status which no amount of nominal rank or ability as a workman could possibly give. Of this stamp are the large majority of engineer officers now in the Navy, and of this stamp all the future engineer officers will be if the present system be liberally carried out.

As for the scientific man who would "make an elaborate calculation as to whether the explosion 'of a shell' had increased or lowered his vacuum," I have only to say that such a person never existed in the Navy, nor anywhere else, except in the mind of "W. L.," or possibly in a lunatic asylum; but certainly I have never heard of such persons before. Nor do I know anything of a class of persons "whose whole time has been spent at school and college." I cannot help remarking on "W. L.'s" opinion of the insignificance of the responsibilities of a naval engineer, as shown by his comparing the "winding up a watch" with the duties of an engineer on board a ship in action. This corresponds well with the views of my old acquaintances of former years, Admiral Holystone and Captain Tarbucket, who used to declare that anybody was good enough to have charge of the machinery of the fleet, and who used to treat engineer officers as something below the level of an ordinary seaman. But those gentlemen of the old school did not believe in steam or science; they had faith only in sails, wooden ships, and smooth bore guns of cast iron.

As for "C. C.'s" suggestion of making all the artificers junior engineers, and that all the labouring work should be done by skilful junior engineers, to whom great inducements should be held out to get them to enter into the Navy, I have only to say that it would cost about twice as much as the present system and three times as much as the system I advocate; whilst it would not give either efficiency to the Navy or satisfaction to the individual concerned. As well may "C. C." propose to offer inducements to the captains and mates in the mercantile marine to enter as able seamen on board men-of-war so as to get good practical seamanship! I have been anxious to preserve the title "Engineer" for those who know the science of engineering and the practice of all the trades connected with it; but as it appears that members of some of the different trades wish to assume the title, let us be liberal and logical, and include the stokers, and call them engineers also. Let the term "Royal Naval Engineers" include the engineer-in-chief of the Navy and the present "stoker second-class." The different grades could be distinguished as they are in the Royal Engineers—formerly Sappers and Miners, and by this means probably many decent young mechanics would be induced to enter the Navy to do duty as stokers first, and subsequently to rise after practical training in the engine-room to the warrant rank of artificer. This is the way to make the department popular throughout the country, and to open the door wide enough.

But the engineer officers would still have to be trained as they are now, for by this system the Admiralty get the cream of the intellect of the youth of Great Britain and Ireland, and then it is trained most perfectly in science and in practice in strictly naval engineering duties. I cannot but express my conviction that the highest credit is due to the men who proposed and those who authorised the present system. Nevertheless, to complete this system it is not only necessary to get the best talent of the country, and to educate it perfectly, but it must be well treated afterwards, faith must be kept, good pay and good position must be given, or the results in the long run must be bad. Economy and efficiency alike demand a small number of engineer officers of the greatest capacity and the highest ability, with corresponding pay; and a very large number of skilled labourers to work under the orders of the engineer officers. I know not for certain whether the settlement of the financial question lies in the hands of the Lords of the Admiralty or in those of a Treasury clerk; but this I do know, that if the same parsimony be shown to the engineer department in the future as has been the case in the past, the results must be detrimental to the efficiency of the service. Experience.

Hidcote, Gloucestershire, October 12th.

GOLD MINING.

Sir,—You have published two letters lately, one from Mr. A. G. Lock and one from a Mr. G. T. Evans, on gold losses, &c., and bearing on the Indian Mines, and I ask you to publish this in fair play. Does the former gentleman imagine that the agents sent to these mines are so ignorant of their profession that they would ignore the miserable little detail with which he occupies a quarter page of your paper? The second should know better than to put such a lame system of dressing gold ores into print, for if he knew anything of the business he would have waited until he could have brought out something much nearer the mark than what he suggests, yet something with which the agents here are well acquainted.

I am sorry for a man who would suggest one and the same treatment for ore varying so much in nature, and if some of these men had done practical work on different kinds of auriferous minerals they might be less ready to rush into print and make suggestions as old as the hills to those in charge of mining and reduction works. Henry J. Moritz.

Nundydroog Gold Mining Company, Limited,
Kolar Road, September 18th.

COMPETITIVE TENDERS.

Sir,—We have read with much pleasure your article on "Competitive Tenders," and consider your suggestions well worthy of the serious attention of all respectable firms of contractors. Being ourselves victims on more than one occasion to the system you condemn, we most cordially support the views you express; but we fear the present unfair way of soliciting tenders has such powerful supporters that it will be found a difficult matter to get people to look at the question from your practical point of view.

With your permission we should like to give you an instance of what appears to us to be an exceptionally unfair way of doing business much in vogue in Downing-street, Whitehall, and other high places. In September of last year we were invited by the Crown Agents for the Colonies to tender for "A dredge vessel and four hopper mud barges." Now, although the authorities only wanted one dredge vessel and four barges, we and the other unfortunate contractors who were foolish enough to tender were required by the Crown Agents to submit tenders, detail specifications, and designs for this dredge vessel in the following order:—

1. For a dredge vessel fitted with 30-horse power compound condensing engines, to draw not more than 2ft. of water, and to be capable of raising 200 tons of spoil per hour with a central bucket ladder working in the usual way in from 2ft. to 20ft. of water.
2. For a ditto, ditto, but with 20-horse power engines.
3. For a dredge vessel fitted with engines same as No. 1, but to draw 5ft. of water, and bucket ladder so arranged that the vessel could cut its way through a bank in from 2ft. to 20ft. of water.
4. For a ditto, ditto, but with engines same as No. 2.

Alternative prices to be given in all cases for bucket backs and attachments of wrought iron and ditto of steel. Also tenders, detail specifications, and designs for the barges as follows:—

Four hopper barges to carry 50 tons each: (*a*) on 2ft. draught of water; (*b*) on 3ft. draught of water; (*c*) on 5ft. draught of water. Prices to include delivery f.o.b. ship in London, and also at any other port named by contractor. In addition to the foregoing, the contractors were required to give a vast amount of other information, such as speeds of various parts of the machinery, calculations of horse-power, calculations of displacement, weights of hulls and machinery, &c., in all cases. Those who are acquainted with this class of work will know the immense amount of trouble we were put to in order to furnish the Crown Agents for the Colonies with the mass of information required to enable them to place this order for "A Dredger Vessel and Four Hopper Mud Barges." After waiting months for an acknowledgment of our labours, we were at last favoured with a slip of paper informing us that our tender was declined; no word of thanks for the trouble we had taken; no explanation why our tender was not accepted, and our elaborate plans and specifications, which had cost us so much labour and thought and considerable expense, have never been returned to us to this day.

Now, Sir, what we complain of is this—here we have a body of Government Commissioners drawing large salaries, with consulting engineers at their service receiving handsome remuneration, requiring contractors to do their work without any pay. Surely before sending out such a "Requisition" as that to which we are now calling attention, the Crown Agents for the Colonies should decide what they want, instruct their engineers to prepare the necessary plans and specifications, and then invite firms to tender to their plans and specifications, and if in addition to this they would publish in the columns of your journal the list of tenders sent in, naming the one accepted, contractors would be more willing to tender for their work, knowing that they would then have, what they are not at all so sure about now, Fair Play.

October 24th.

American Salt Trade.—A census bulletin upon this subject states that the number of establishments for the production of salt has decreased from 399 in 1860 to 264 in 1880, but that during the same period the amount of salt produced has increased from 12,717,198 bushels to 29,800,298 bushels, the average production of each establishment being 31,373 bushels in 1860, and 112,872 bushels in 1880. This shows that the salt industry is now carried on by larger establishments, requiring more capital, and producing a larger amount of salt. The total production was derived from the following processes:—By solar evaporation from sea or bay water, 888,968 bushels; from inland lakes or natural deposits, 944,158; from subterranean brines, 2,998,000; by artificial heat from subterranean brines 8,853,821, by kettle or pan process, and 16,115,351 bushels by steam evaporation process. Nearly all of the solar evaporation from sea-water takes place in California—878,093; while Utah furnishes the inland lake deposits—482,300; and New York the salt evaporated by solar heat from subterranean brines—2,777,000—as also that produced by kettle process—5,971,203. Michigan is the great source of the salt obtained by steam evaporation—10,177,505. The greatest number of salt manufacturers exist in the two latter States, being sixty-nine and eighty-six respectively. There are altogether 539 salt wells in the United States, the greatest average depth being found in West Virginia, 1043ft.; Ohio, 902ft.; Pennsylvania, 884ft.; and Michigan, 881ft., in which State is found the strongest brine, averaging 91¼ deg. of the salometer. There are 47,446 vats employed in solar evaporation, having an aggregate area of 78,173,114 square feet. The average number of hands employed is about 4000, though it fluctuates according to the time of year and the amount of business.

RAILWAY MATTERS.

The Shepparton and Memurkah Railway, in Victoria, was opened on the 5th ult.

The South Brisbane line, the Highfields, Brisbane Valley, and the Warwick and Killarney branches of the Queensland Central Railway Bills and estimates, have all been passed by the Assembly.

The Australian *Star* says that the Free State Executive have extertained proposals for the construction of the Colesberg-Bloemfontein Railway on behalf of Mr. Ralph Firbank, who, if the contract for the construction of that line is given to him, will be prepared, immediately surveys are completed, to push on with the earthworks. Mr. M. Unger is thus not alone in this project.

The demand for increased railway accommodation in New South Wales continues. The Minister of Works recently promised a deputation that a trial survey should be made for a railway from South Gundagai to Tumut, *viâ* Adelong, a distance of thirty-three miles. He has also been urged to construct a branch tramway from the proposed Illawarra Railway station, along West Botany-street, to Scarborough and Sandringham.

A scheme has been set on foot for a tramway crossing the Isle of Axholme and the adjacent district of Marshland in Yorkshire. The idea has sprung out of the application of the tramway system, encouraged by the Great Eastern Railway Company, to districts similarly situated in Norfolk and Cambridgeshire. Avoiding Goole, a terminus of the Lancashire and Yorkshire Railway, the proposed tramway will commence at Swinefleet, passing through Eastoft and Crowle, across the Isle of Axholme to a point on the Manchester, Sheffield, and Lincolnshire system.

The triple granite vaulting of the windy stretch of the St. Gothard Tunnel, the part under Andermatt, which has broken in so often, and which has been a source of so much trouble and expense, is at length completed, and bids fair to stand. There is consequently little doubt that the tunnel will be opened for traffic, as announced, on the first day of 1882. It is thought that traffic may commence before that date. Wagons and carriages are being got together at Airolo, and the company are advertising for guards and stationmasters able to speak two or three languages.

Two severe fatal accidents have happened since our last publication. In the one case a Midland express ran into a mineral train standing on a branch near Leicester, the facing points to which had been left open by the signalman, who had, since the gale of the previous Friday, which blew down the signal-post, been working the trains by hand. Four people were killed, and a lot injured. The second was a collision of two locomotives at Pannal Junction, near Harrogate, on the North-Eastern Railway. A goods train was standing with the front of the engine a foot or two over the main line, so that a Leeds express engine struck it, and was twisted round, thrown over, and a lot of people injured.

On September 1st, in reply to questions, the Premier of the Queensland Assembly stated that several proposals had been received by the Government to construct railways under the Railway Companies' Preliminary Act—under which large grants of land are to be make in lieu of money payment, as described in our impression of the 2nd ult. An English company had, according to *India and the Colonies*, proposed to build a line to the Gulf of Carpentaria, and a Victorian company had offered to form one from Charleville to the borders of New South Wales. These proposals are to be embodied in Bills, but the Premier would not pledge the Government to bring them forward during the present session.

The efforts to obtain additional railway communication between Manchester and Southport, are being continued, and on Tuesday a deputation representing the Southport Town Council and the local boards of Swinton and Pendlebury, Tyldesley, Atherton and West Houghton had an interview with the directors of the Lancashire and Yorkshire Railway in Manchester, when the desirability and importance of the proposed new railway were strongly urged upon the company. Mr. Barnes, the chairman of the directors, promised that the scheme should be seriously considered, and intimated that in all probability a committee of the directors would be appointed to confer with the clerks to the several authorities before taking any further steps.

The international express train from Turin to Rome, timed to arrive at Pisa at 4.42 a.m., went off the rails between Sarzana and Avonza a little before three on the morning of the 22nd inst. It is reported that sixteen carriages left the rails. Two passengers were killed, and from fifteen to twenty were injured. The *Times* Leghorn correspondent writes since :—"The brakesman states that the speed was thirty-seven miles an hour when the two axles of a saloon carriage, containing the Ministers Depretis and Berti, broke. The carriages following left the rails, rolling down the embankment right and left, where they lie crushed and broken; one being completely in fragments. It is a perfect marvel that only one person was killed, namely, Captain Count Perrone di San Martino. Fifteen persons are reported to be more or less contused.

A new tramway locomotive, made under Matthews' patent at the Kingsbury Ironworks, Ball's-pond, has just been sent to Liverpool for trial on the tramways of that town. This locomotive is constructed with the whole of the driving machinery arranged on the outside of the frame plates, and enclosed with a close casing so as to thoroughly exclude dust and dirt, thus avoiding the destructive action and removing the worst evil with which locomotives have to contend. The water is carried in side tanks on each side of the boiler, in one of which is a condenser for the exhaust steam, the tanks being connected by a pipe. By this arrangement of the condensing tanks, the water absorbs and condenses the steam until a considerable temperature is reached. The boiler is of the locomotive form, is very roomy, and works at a pressure of 150 lb. per inch. Smoke is to be avoided by the use of smokeless fuel. The regulator and reversing levers are placed at each end of the engine, and convenient to the hands of the driver, who is enabled to keep his attention constantly on the road. A powerful brake is provided, to be operated by the driver's foot; a steam brake is also provided. The engine is covered by a roof, and the boiler is enclosed with a casing, the upper part of which is fitted with glass panels. The whole of the working parts are of steel.

During the six months ending 30th June last, there were reported in the United Kingdom, 29 collisions between passenger trains or parts of passenger trains, by which one passenger was killed, and 168 passengers and seven servants were injured; 38 collisions between passenger trains and goods or mineral trains, engines, &c., by which 1 servant was killed, and 93 passengers and 26 servants were injured; 13 collisions between goods trains or parts of goods trains, by which 23 servants were injured; 2 cases of trains coming in contact with projections from other trains travelling on parallel lines, by which 2 passengers and 1 servant were injured; 37 cases of passenger trains or parts of passenger trains leaving the rails, by which 1 passenger was killed, and 42 passengers and 1 servant were injured; 10 cases of goods trains or parts of goods trains, engines, &c., leaving the rails, by which 4 servants were injured; 9 cases of trains or engines travelling in the wrong direction through points, by which 2 servants were killed, and 2 passengers and 6 servants were injured; 8 cases of trains running into stations or sidings at too high a speed, by which 15 passengers and 1 servant were injured; 73 cases of trains running over cattle—during the six months 22 horses, 16 beasts and cows, 46 sheep, 1 deer, and 2 donkeys, were run over and killed—or other obstructions on the line, by which 3 passengers were injured; 4 cases of the bursting of boilers or tubes, &c., of engines, by which 3 servants were injured; the failure of 291 axles, by which 1 servant was injured; the failure of 5 couplings, by which 14 passengers and 2 servants were injured; and 3 fires at stations, bridges, or viaducts, by which 1 servant was fatally injured.

NOTES AND MEMORANDA.

M. Pinsot, the forester of the Bois de Boulogne, finds that dynamite can be used with advantage for uprooting and dividing stumps of trees, but it is not applicable to felling trees which are to be used as timber.

According to the *Journal de St. Pétersbourg* the population of Siberia, including the nomadic tribes and the colonists—if they can be called so under the compulsory *régime*—is 1,385,000, divided among the provinces as follows :—Tobolsk, 463,000; Tomsk, 324,000; Irkoutsk, 165,000; Yenissei, 164,000; Transbaikal Territory, 141,000; Amoor, 3000; Maritime Provinces, 13,000; Yakoutsk, 112,000. The Siberian territory has an area of 10,709,000 square versts.

Prof. Exner, of Vienna, has lately proved that galvanic elements formed of three elementary substances, one of which is bromine or iodine, give perfectly constant action, and that the electro-motive forces exactly correspond to the heat values of the chemical processes. According to *Nature* there is no trace of polarisation. Bromine and iodine are also shown to be the worst conductors of electricity at present known. Both bromine and iodine conduct entirely without polarisation—the later in solid as well as in liquid condition. The conductivity rises rapidly with the temperature.

The United States Commissioner of Patents has forwarded to the Secretary of the Interior his report of the operations of the Patent-office for the past fiscal year, and his estimate of the amount necessary during the next fiscal year. The number of original patents issued during the first nine months of the present year was 13,084, an increase of 2261 over last year. The receipts of the office for the same period were 65,447 dols. in excess of those for the corresponding nine months of 1880. The report recommends a considerable increase in the examining corps and the clerical force of the office, and the following appropriation: 50,000 dols. to carry out the abridgment of patents and the publication of 10,000 volumes of the same; 15,000 dols. for producing burned and exhausted drawings; 10,000 dols. for photo-lithographing drawings; and 9000 dols. to complete the *Official Gazette* for the present year.

Prof. Lovering, of Harvard, has lately unearthed from the memoirs of the American Academy a paper by Dr. Nathaniel Bowditch, of Salem, Mass., communicated in 1815, in which he investigates the figures made by a double pendulum which compounded two vibrations at right angles to one another. This research, which *Nature* says was illustrated by several plates of figures, therefore antedates that of Lissajous, to whom the discovery of these figures is usually accredited, which was published in 1857. Bowditch investigated the cases of the ratios representing unison, the octave, the twelfth, and the double octave. Bowditch was himself inspired to this investigation by a paper written by Prof. Dean, of Burlington, Vermont, in which a compound pendulum, identical with that known as Blackburn's pendulum, was used to illustrate the motions of the earth as viewed from the moon. Blackburn's pendulum dates from 1844. Sang, in 1832, used vibrating wires to compound rectangular vibrations; and Wheatstone's kaleidophone dates from 1827.

Some experiments on the influence of varying pressures upon the duration of pendulum oscillation formed the subject of a recent communication to the Paris Academy of Sciences by M. Saint-Loup. As a first result of his experiments, he finds an increase of about $\frac{1}{13}$ of a second per day for a fall of 10 mm. in the barometer. He does not attach much importance to this figure, but it seems to show the importance of a correction for pressure in all calculations of exact time. M. Tresca stated that when the conference was held, under the direction of Le Verrier, for the construction of three Parisian regulators of precision, one of the constructors, M. Redier, had fitted to the pendulum a metallic barometer, with an arm which was displaced so as to compensate the variations of retarding influence in the atmospheric pressure.

From a recent comparative statement of the carrying trade of the world, it appears that, omitting vessels of less than 50 tons measurement, Europe possesses 42 tons to every 1000 inhabitants, America, 40; and Australia, 79; while Asia and Africa have only 2 tons per 1000. Liverpool ranks as the most important port in the world, with a tonnage of 2,647,373; this is succeeded by London, with 2,330,688, and Glasgow, with 1,432,364; New York comes next, with 1,153,676 tons. The nine leading ports of Great Britain have a tonnage of 8,724,123, while the first four ports of the United States have only 1,976,940. St. John, New Brunswick, is in this respect as important as Boston or Charleston, and more so than Philadelphia. Great Britain and Ireland possess a gross tonnage of nearly 12,000,000 sailing-vessel tons, and with the tonnage of her colonies the British flag covers 14,000,000 tonnage, out of the total existing world's tonnage of 27,000,000. The United States twenty years ago carried 66 per cent. of their foreign trade in their own vessels, whereas now they carry something less than 18 per cent.

Telegraph wires in considerable number might be laid through the large gas mains without abstracting very much of their capacity. Mr. A. Angus Croll, writing to the *Times* on this subject, in reference to a letter addressed by the Gas Light and Coke Company to the Commissioners of Sewers, "calling attention to statements which had recently been made as to the probability of accidents arising from the wires used by the Electric Lighting Company for the conveyance of electricity," says :—"Before charging the mains of the Great Central Gas Company for the first time—now more than thirty years ago—I placed the works and office in telegraphic communication. For that purpose a man went into one of the large mains from the works to the City, laying down the wires as he went along. This communication remained perfect some years, so long as the outer covering remained good, and, I need scarcely add, without any accident having taken place. Then, as now, it was suggested by an influential member of the Commission of Sewers that the laying down of the wire in the gas main would be attended with great danger to the City. Wiser counsel, however prevailed, and I was not interfered with."

According to the *American* census summaries the modification of the United States iron industries by the Bessemer steel manufacture has produced some great variations in local product, ores differing so greatly in their fitness for it. This has also made marked fluctuations in the price per ton of ore. Taking the five great iron States the price has fallen 15 per cent. in Michigan since the previous census, in New York 29 per cent., in Pennsylvania 34 per cent., while in New Jersey it has risen 30 per cent., and in Missouri 300 per cent. The same peculiar fitness of some ores for Bessemer steel has stimulated local production. The price of Iron Mountain ore, Missouri, is remarkable, being about seven dollars a ton, against a usual value of from two to four dollars a ton. There are twenty-three States ranking as iron-producing, beginning with Pensylvania—2,173,415 tons—followed in order by Michigan, New York, New Jersey, Ohio, Missouri, Alabama, Virginia, Maryland, Tennessee, Georgia, Kentucky, Massachusetts, West Virginia, Wisconsin, Connecticut, Oregon, Maine, Texas, North Carolina, Delaware, Vermont, and Indiana, twenty-three, of which the last furnished 513 tons of ore. In 1870 but sixteen States were thus listed. Alabama—now taking a prominent rank—Georgia, West Virginia, Connecticut, Oregon, Maine and Texas are new in the list. The value of the total product is put at 22,975,345 dols.; the total value of materials used at 2,810,744 dols.; the wages at 9,429,055 dols., with 31,412 men and boys. The working capital is put at 4,823,413 dols.; the value of plant at 8,649,275 dols.; real estate, 48,106,249 dols., with 909,058 paid as royalty. The largest iron-producing county is Marquette, on the Lake Superior shore of Michigan—1,374,812 tons. The largest single mine is Cornwall Ore Bank, Lebanon County, Pennsylvania—280,000 tons, at a value of 500,000 dols, and employing 135 persons.

MISCELLANEA.

The Paris Electrical Exhibition closes on the 17th of November.

Tin has been found in New South Wales, about sixty miles from Grafton.

By means of the life-boats, the rocket apparatus, and other agencies, in conjunction with the successful efforts used on board distressed vessels, as many as 2923 lives were saved from the various wrecks on our coasts last year by the National Life-boat Institution.

Messrs. Jackson, Rodwell, and Co., of Manchester, have just completed an extensive new plant which they have been laying down to enable them to turn out exceptionally heavy wheel castings in steel, and they got to work with their new process last week.

Mr. Charles Burns, J.P., who has managed the Clay Cross Coal and Ironworks from their commencement by the late George Stevenson, over forty years ago, has retired from active work, owing to ill-health. Mr. Burns is very highly respected in the Clay Cross and adjoining districts.

The Commission entrusted by the Minister of Agriculture and Commerce to inquire into the spread of infection in the department of the Seine by the discharge of sewage of Paris into that river has sent in its report, which advocates the purification by irrigation and downward filtration at St. Germain, the principal excremental solid constituents of the sewage to be prevented from entering the sewage, or mechanically separated therefrom.

Messrs. Charles Burrell and Sons have obtained for their traction engines all the medals that have been awarded for this class of engine, during the year 1881, at the following agricultural shows :—Worcestershire Agricultural Society, Stourbridge show, July, 1881; Wirral and Birkenhead agricultural show, September, 1881; Staffordshire Agricultural Society, Stafford show, September, 1881; Long Sutton Agricultural Society, Long Sutton show, September, 1881.

The *Quarterly Review* has found out that the earth is a vast secondary battery, which only needs tapping in a certain way, which is left for the Society of Telegraph Engineers to find out, to get an unlimited supply of electricity for lighting and other purposes. To tap it in some way would do good, for the *Quarterly* refers to this stored-up electricity for the cause of all earthquakes, Mallet, De Beaumont, Scropes, Lyell, Hopkins, Hilgard, and others notwithstanding.

On Wednesday morning the new screw steamer Ganges, built for the Peninsular and Oriental Company, was successfully launched from the yard of the Barrow Shipbuilding Company. The dimensions of the Ganges are—390ft. long, 42ft. breadth of beam, 32ft. 6in. depth of hold. She is a three-masted schooner, and has accommodation for 124 first-class, 48 second-class, and a number of steerage passengers. The engines are of the ordinary compound surface condensing type, of 390 nominal horse-power.

A good deal of difference of opinion exists as to the relative merits of two schemes for the extension of the Melbourne water supply. It appears, however, that there will be no withdrawal of the Yan Yean scheme, as the survey for the extension of the Yan Yean supply is being pushed rapidly forward. The proposal is to bring the Wallaby Creek into the southern watershed of the Plenty, and this scheme involves the cutting of a channel of no less than six miles and a-half in length. It will take a year at least to complete, and some of it will be heavy work.

A few days ago, our Birmingham correspondent writes, a party of gentlemen interested in limestone mining assembled at the Earl of Dudley's Conygre limestone pits, near Dudley Port, to witness some experiments with Nobel's blasting gelatine. Mr. E. F. Smith, the principal mining agent of Lord Dudley, was amongst those present. The limestone is of the hardest kind, and holes had been bored in on the previous day. The experiments, however, were unusually successful, the stone being brought away in great masses, and in good commercial condition.

Mr. Ponton, the surveyor, of Poole, has submitted to the authorities of that town an estimate of the power derivable from the rise and fall of the tides in Poole Harbour. He gives it as 30,000-horse power per 24 hours. He proposes to use a portion of this power to generate electricity for lighting the town of Poole, which, like Chesterfield, is unable to agree with its gas company, or to appreciate fully the light from oil lamps. We do not know, however, how Mr. Ponton is going to get 208 horse power per minute from a rise and fall of about 6ft. of tide, although there is twice as many tides at Poole as at most other places in the world.

The Silvertown Company has bought from Messrs. Hooper the s.s. Hooper, built some years ago specially for cable work. This is the largest cable ship afloat. Her measurements are :—Length over all, 350ft.; beam, 55ft.; moulded depth, 36ft.; gross tonnage, 4935 tons; net register. 3724 tons. She has three cable tanks, each 30ft. deep, and having respectively the diameters 41ft., 53ft., and 51ft., with the usual cable gear. The present owners intend renaming the ship the Silvertown. She leaves England in March to assist in laying the 3000 miles of cable now being manufactured by the company for the west coast of South America.

The electric light has now been adopted in the Cyclops Works (Messrs. Charles Cammell and Co., Limited). The Brush machine erected there is capable of running 16 or 17 lights, and operations have first been commenced in the west planing shop, where 6 2000-candle power arc lights have been put up. Messrs. Hammond and Co., who hold the patent rights of the Brush light for Yorkshire and Derbyshire, attribute the success partly to the care which Messrs. Charles Cammell and Co. have given to the driving engine, which in this case is a Parson's patent, made by Messrs. Kitson and Co., of Leeds. The engine is described as of a peculiar type. It works the dynamo machine direct without any belting at all, being able to run up to the high speed required. It has already been described in our pages.

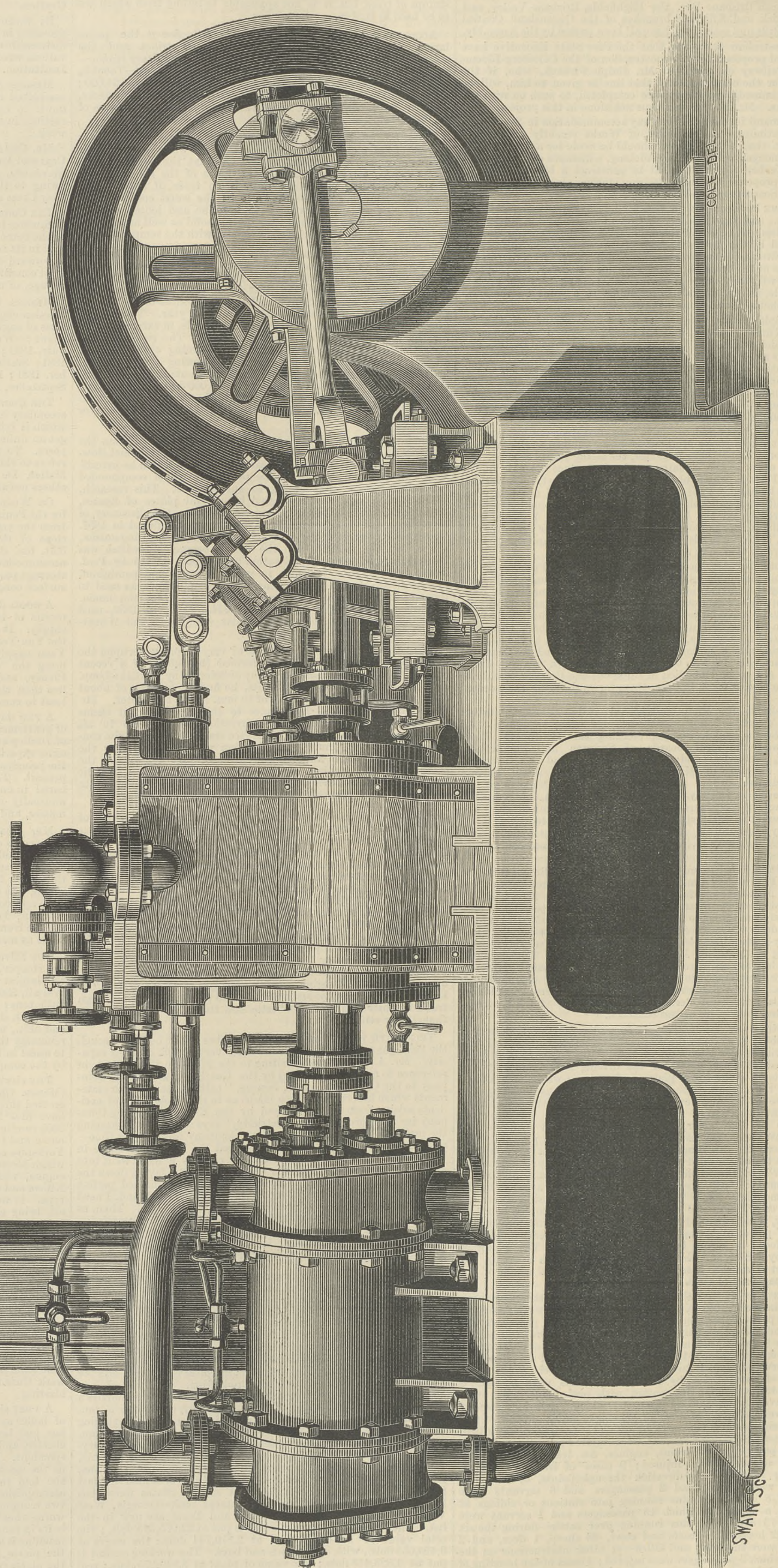
The annual meeting of the Manchester Geological Society was held on Tuesday, and Mr. Geo. Gilroy, M. Inst. C.E., of Wigan, a well-known Lancashire mining engineer, was elected president for the ensuing year. In order to facilitate the attendance of mining engineers and colliery proprietors at the meetings of the Society, it was decided to alter the date to the first Tuesday in the month, which is the date on which the Lancashire and Cheshire Coalowners' Association also holds its meetings in Manchester. Mr. Gilroy, in taking the chair, strongly urged that during the ensuing session special attention should be given to the important question of the use of explosives in mines, and expressed the hope that some means might be devised whereby they would be able to work their mines without the danger at present attendant upon blasting

A very simple method of planing at any required angle the edges of boiler and other plates where this is needed to facilitate calking has just been devised by Messrs. Wm. Collier and Co., of Manchester, and is thus briefly described by our Manchester correspondent. In the place of packing the plates at the required angle on the machine, which has been the method ordinarily adopted, the tool itself is made to work at any angle desired. This is accomplished by the introduction of a swivel head working upon two trunnions and moved backwards and forwards by a worm and worm-wheel, and which is locked fast in any position by means of bolts in radius slots on a radial plate attached to the slide. The machine itself consists of a long bed with a raised part for carrying the plates, and above this a girder with cramp screws for holding the plates in position. The tool is carried on a slide actuated by a screw with reversing motion, and is so arranged as to cut both ways, a pair of stops which actuate a small rack and pinion turning over the tool at the end of every stroke. The machine is constructed to take in and plane simultaneously at any angle a set of plates up to 12in. in thickness and 20ft. in length,

REFRIGERATING MACHINE FOR COOLING SHIPS' PROVISIONS.

THE BELL-COLEMAN REFRIGERATION COMPANY, GLASGOW, ENGINEERS.

(For description see page 318.)



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.*

W. D. (Crewe).—*Stoney "On Strains," Cargill "On Strains in Bridge Girders and Roof Trusses."*

J. J. B.—*We have not the address of the gentleman you name. We fancy that you will find the constant* ·0000238 *will answer your purpose. In order to find the power of an engine multiply the square of the diameter of the cylinder in inches by the average pressure, and by the piston speed in feet per minute, and by* ·0000238. *The result is the horse-power.*

C. P. (Preston-lane).—*There is no work on the application of water power to hoists and cranes complete enough to suit your purpose. You will, however, find a great deal of information on the subject in the "Transactions" of the Institution of Mechanical Engineers, and the "Transactions" of the Institution of Civil Engineers. It is more than probable that you can consult these volumes at the nearest free library.*

J. W. (Etruria).—*The tensile strengths of the three brands of iron you name are probably not very dissimilar, ranging between* 19 *tons or thereabouts, for the worst, and* 21 *tons for the best. But the worst iron is brittle and will snap short, while the best brand will stretch and prove very tough. Again, the worst brand will be found to work badly in the smith's hands, while he can do what he pleases with the best. Mere tensile strength is not a good criterion of the quality of a given brand of iron or steel.*

CONDENSED MILK.

(*To the Editor of The Engineer.*)

Sir,—Can any reader give me information about machinery used in the manufacture of condensed milk, or about makers of the same?

Ellesmere, October 26th. W. W.

RAILWAY GRADIENTS.

(*To the Editor of The Engineer.*)

Sir,—Will any reader tell me what is the maximum altitude attained, in a distance of seven miles, on any passenger railway in the United Kingdom? T. J. J., M.E.

Merthyr Tydfil, October 26th.

RAMSBOTTOM'S SAFETY VALVES.

(*To the Editor of The Engineer.*)

Sir,—Will any reader kindly tell me how much Ramsbottom's valves allow the pressure in a locomotive to rise over that at which they begin to blow? Crux.

October 26th.

CUPOLA PRACTICE.

(*To the Editor of The Engineer.*)

Sir,—I beg to inform "Ironfounder" that I find the belt or air chamber round the cupola the best thing I have yet tried, and I admit the blast in four places at right angles, having lids or doors opposite each hole so as to be able to get the bar inside to clean the tuyere holes, and he ought to have a blower—Root's is a very good one. It takes so much less power to drive a blower, and you get your metal very hot with less quantity of coke than you could with the fan. A No. 3 Root's blower running 380 revolutions per minute will melt 4 tons of iron per hour; too much coke is useless. I am much interested in "Foundryman's" queries, and would be glad to see them answered; also giving mixtures for brass bearings.

Ashford, Kent, October 24th. Foundry Manager.

(*To the Editor of The Engineer.*)

Sir,—In reply to "Ironfounder" in your last week's issue, I have recently erected two new cupolas. The casing of the lesser one is 3ft. 6in. in diameter and 22in. in diameter inside at the bottom; the larger one is 3ft. 9in. outside and 27in. inside in diameter. The charging holes are 12ft. 3in. above the tapping holes, and the total height is 24ft. The inside varies in diameter, being smallest above the tuyeres, and gradually wider up to the charging hole. I can get my metal hot with only a moderate quantity of coke. I have a 30in. Schiele's blast fan running about 1860 revolutions per minute, driven from a counter shaft by a 9in. cylinder vertical engine. The pipes from the fan are 12in. diameter, and the two tuyeres to each cupola are 7in. diameter, and made so that I can regulate or cut off the blast. Joshua Horne.

Providence Ironworks, Castleford, October 26th.

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Remittance by Bill in London.—Austria, Buenos Ayres, and Algeria, Greece, Ionian Islands, Norway, Panama, Peru, Russia, Spain, Sweden, Chili, £1 16s. Borneo, Ceylon, Java, and Singapore, £2 0s. 6d. Manilla, Mauritius, £2 5s.

MEETING NEXT WEEK.

Chemical Society.—Thursday, Nov. 3rd, at 8 p.m.: I. "On Citraconic and Mesaconic Ethers and Malic and Fumaric Acids," by W. H. Perkin. II. (1) "On the Action of Potassium Cyanide on Bismuthous Nitrate." (2) "On the Atomic Weight of Bismuth"—preliminary. (3) "Note on the Action of Sulphuric Acid on Zinc and Tin." (4) "Note on the Influence of Water on the Reaction between Potassium Iodide and Chlorine." (5) "The Volumetric Determination of Bismuth in the form of Oxalate." (6) "Additional Observation on the Halogen Salts of Bismuth." (7) "Laboratory Notes"—(*a*) A Lecture Experiment; (*b*) Dissolution of Manganic Dioxide and Manganese Ores in Hydrochloric Acid; (*c*) A New Method of Detecting Tin in presence of Antimony; (*d*) Detection of the Haloid Acids in presence of Nitrous and Nitric Acid, by M. M. Pattison Muir.

DEATH.

On the 8th inst., at 41a, Malvern-road, Kilburn, London, Frederick Pulker, C.E., aged 39, of consumption and phthisis.

THE ENGINEER.

OCTOBER 28, 1881.

PUMPS AT SEA.

Within the last few days the world has been startled by the announcement of the loss of two ships and a great many lives. The circumstances were very similar in both cases up to a certain point. The first was a great Dutch steamer, which sank because her propeller shaft broke in the stern tube. Water rushed in, the fires were put out, and the ship sank. Full details have not yet reached this country, but enough is known to make it certain that there was a great loss of life. The second case to which we would call attention is that of the steamship Clan-Macduff, 1496 tons, bound for Bombay from Liverpool. She was deserted on Thursday, the 20th inst., under circumstances which have been fully reported in the columns of the daily press, and foundered the following day. She encountered a heavy sea on Wednesday, and began to take in water. After a time the bilge pumps became choked, and could not be cleared. Then the water rose rapidly and drowned out the fires. Attempts were made to get her clear by baling, but in vain. The crew and passengers took to the boats, save nineteen who remained on board and were rescued on Friday morning by the steamship Upupa. Some of the boats were upset, one was broken, and there was great loss of life. As far as can be gathered, in neither this case nor in that of the Dutch steamer would any lives have been lost if there had been some good steam pump on board to keep the ship clear of water.

We have written before on this subject, and we do not intend now to go over old ground, or prove that nothing is more easily done by a steamer than carrying a steam pump which will bid defiance to almost any leak which she is likely to spring. A comparatively small pump will keep a ship afloat for days, which would otherwise have sunk in a couple of hours. No one has ever yet attempted to show that such pumps would not do the work required of them, or will assert for a moment that they would prove useless. All the same, not one steamer in a hundred has sufficient pumping power on board. Reliance is in the first place put on the ordinary bilge pumps, which as a rule are much too small to deal with a good strong leak. Failing this the sea injection can be used, but this also is an inadequate provision. What is wanted is a pump which will not choke, and which will raise an enormous body of water through a small height; 20ft. may be taken as about the maximum lift that would be required. The centrifugal pump is just the thing for this work, but there are other pumps in the market which will do as well. The Clan-Macduff's bilge pumps were rendered useless, it would appear, by being choked. This is a very common occurrence with bilge pumps, and all sorts of schemes have been devised to prevent choking. If the pumps are only used to empty the bilges, then a man can stand by to keep the strums or strainers clear, and to open the valve boxes as often as the valves get gagged; but this plan will not answer when it is a matter of life and death to keep the pumps going without a moment's hesitation. We do not think that any ordinary bilge pump can be made which will be trustworthy. The third provision for clearing a ship of water is the donkey or donkeys. It is enough to say of these that if the bilge pumps fail the donkey pumps are likely to prove useless. The fact that pumps drawing from the bilge of a ship have to deal with coal, corn, chips, shavings, waste, oakum, grease in balls, grease in sludge, mud, rust, and so on, should be accepted as proved, and handled accordingly. The right way to handle the fact is to provide at least one pump on board every steamer which will lift coal, corn, chips, shavings, waste, oakum, and grease in all its forms. There are pumps made with valves which will pass a workman's jacket through them. We have seen a live duck passed through a pump and come out none the worse—not a large pump either. The late Mr. Roberts worked a steam fire engine at the Crystal Palace competition with about half a square yard of canvas in the barrel. It had been taken up through the suction and could not get out. This canvas did not choke the pump. Our readers may rest assured that a satisfactory ship's pump can be made. We insist on this truth, because so much is heard about the choking of bilge pumps, that the uneducated might fancy that an unchokeable ship's pump is not to be had. There is really no room for doubt on the subject. We shall not argue the point in any way. We assert a well-known fact, namely, that it is quite possible to provide every steamship with a pump or pumps which will render her practically safe from foundering. We shall be asked, If this be so, why it is that steam pumps of the kind are not fitted? and we answer that the reason must be sought at Lloyd's and the Board of Trade. If Lloyd's and the Board of Trade insisted that adequate pumping power should be provided, it would be provided, and great loss of life and property would be avoided. Why the Board of Trade does not act in this matter it would be hard to say. Its marine department, with the best intentions in the world, is always doing what it ought not. Mr. Trail and Mr. Gray vex the souls of shipowners with trumpery water-closet fittings, and they will let a ship go to sea with pumping power inadequate to deal with a leak so small that it will not sink a ship for days. It is too much to expect anything from the Marine Department of the Board of Trade. It is not difficult to see why Lloyd's will do nothing in the matter. The body is an association of underwriters; that is to say, of gentlemen who insure ships. They divide their losses among them in a way well understood. It is well known that if a sufficiently large business is done in any kind of insurance, the average losses and gains can be calculated with the greatest accuracy. Now the use of good pumps on board ship would no doubt augment the profits of the underwriters by reducing their losses, but it would not augment them very materially, because the premiums paid for insurance depend to a large extent on the quality of the ship insured. The moment a ship was made safer by putting a good steam pump on board, the premium paid for insurance would be reduced. Lloyd's have next to no stimulus to induce them to act energetically in this matter. But it may be urged that shipowners will act in this matter. If each ship belonged to one owner, or to a few, they might do something; but steamers as a rule belong to a great many persons, who have no more to do with their management, and take no more thought for it, than the average shareholder does for the traffic arrangements of the railway, whose part owner he is. The loss of a ship is no loss to him. It is the underwriter's affair, not his. Thus it is nobody's business to see that steamships are provided with a great additional means of safety.

It is very probable that some persons will say that we write very hard things of Lloyd's, and the Board of Trade, and shipowners. Now this is just what we want to do If we knew that writing hard things would bring about a change for the better, and would promote the safety of passengers and of ships' crews, we should write very hard things indeed. The question stands thus—no one denies that if good steam pumps were fitted to ships they would be rendered thereby much less likely to founder than they are now. It is patent that if the Board of Trade or Lloyd's say that certain things must be done with a ship they will be done. If the Board of Trade and Lloyd's lay down a rule, the British shipowner does not live who would wittingly break it. This being the case, it is obvious that whenever a ship is lost in the same way that the Clan-Macduff—and a score of other steamers every year—was lost, the responsibility for her loss lies at the doors of the Board of Trade and Lloyd's. It will not do to assert that this is pure sentiment. It is nothing of the kind—it is indisputable fact. These two bodies are autocratic. They are all powerful. If Lloyd's will consult their own officers, we have not the least doubt that they will be told that an enormous advantage would be gained by providing steamships with adequate pumping power. If Mr. Trail will make inquiries he will arrive at the same truth. This being so, they have nothing to do but insist that adequate pumping power shall be provided, and it will be provided. It is no one's business to provide it now, because all responsibility is supposed to devolve on Lloyd's and the Board of Trade. We now urge these public bodies to do their duty. If the voice of public opinion be once raised up against them on this point, they will not find it easy to obtain silence. We have spoken plainly—dare we hope we have spoken to some purpose?

LONG SPAN RAILWAY BRIDGES.

When the span of a bridge is moderate, the engineer can adopt almost any design he pleases. If he be a man of taste he can make the structure charming. If not, he has full latitude to make it hideous. Dozens of examples of the latter truth may be found in London on the south side of the Thames. When the engineer has to make a single span bridge across a stream some three or four hundred feet wide, the conditions are somewhat altered. He must be at once very audacious and very well supplied with money if he is to get over certain well understood restrictions which limit his powers, and prevent him from giving freedom to his æsthetic fancies. Thus, for example, it is not at all probable that if a river 300ft. wide had to be crossed at one jump, pairs of arched girders with the roadway running above them would be adopted. The choice of the engineer would be practically limited to two forms of bridge, namely, the straight lattice girder and the bowstring, the load in the latter case being carried on the bottom chord. Web girders of this span would not be used for obvious reasons; and the same thing may be said of the Britannia girder. The structural qualities of the material with which we have to do would step in and powerfully control the shape to be given to the bridge.

When bridges of very great spans have to be designed, it is not improbable that the engineer will find himself still more restricted, and it is open to question whether or not æsthetic considerations will not have to be abandoned altogether. That section of the public possessed of some sense of structural beauty will probably cry out and denounce a given design because all its lines and proportions are ugly; and yet these lines and proportions may be those which it is alone possible to adopt under the given conditions. In the case of the Forth Bridge, for example, as designed by the late Sir Thomas Bouch, there were two spans of about 1600ft. each. It is open to question if any design can be prepared for girders of such a span which would be at the same time pleasing to the eye and able to do their duty. No parallel girder could be made which would serve the intended purpose. It would have to be at least 100ft. deep in the middle, and the mere stiffening of such a structure would involve the employment of a tremendous weight of metal. The ties would be simple enough, but a strut of 120ft. long cannot easily be made very stiff. An arch is equally out of the question. Its versed-sine could not well be less than 300ft.; and even if an arch were provided and the roadway were hung from it, struts must be introduced to stiffen the road. These need not be nearly so heavy as in the case of the parallel girder; but, on the other hand, the idea of an arched girder with a rise of 300ft. and a span of 1600ft. is enough to appal the stoutest heart. It is clear that in such structures the use of struts, that is to say, members in compression, must be, in the first place, avoided as much as possible, because they constitute the principal weight of the whole; in the second place, when used they should be as short as possible. Now, if we bear these things in mind, it will soon be seen that another question arises, namely, what is the best way to dispose the compression members which must be used? On the answer given to this question will depend the mechanical design of the bridge within certain limits; and it will also settle what its appearance will be, and its claims to be regarded as more or less a work of art. It is quite possible that it will be new to many of our readers to be told that on the disposition of the compression members in a wide span bridge it will mainly depend for its ultimate form, but it is none the less true. Anything may be done with ties. They need no stiffening; they are wholly self-sufficing; they can be put in anywhere; they are always very light compared with the work they have to do, unless they are of great length, and even then the longer they are the better will they compare with a strut of equal length. The engineer is allowed immense latitude in dealing with bars in tension, but it is not so with bars in compression. Paraphrasing an old proverb, we may say "Take care of the struts and the ties will take care of themselves." It may be accepted as proved that the struts settle the characteristics of a large span bridge.

Different minds will deal with the questions involved in different ways. Sir Thomas Bouch, for example, concentrated the whole of his compression strains—as far as the main strains were concerned—in gigantic towers 600ft. high; nearly all the rest of the bridge was in tension. The few compression strains which remained to be dealt with outside those in the towers were easily passed through comparatively short struts. It is a defect of all bridges in which tension alone is employed, that they must lack vertical stiffness under rolling loads. This truth is clearly exemplified by suspension bridges. Sir Thomas Bouch's bridge would no doubt have lacked vertical stiffness, had it been constructed, as far as the roadway carrying the trains was concerned. In some cases the whole of the strut work is divided between vertical piers and a single horizontal boom, which keeps the piers apart. An example is supplied by Chepstow Bridge. Such a system of construction cannot be adopted for large spans, because the tube acting as a strut must be comparatively short, or it will break across in the middle. It is certain that struts of some kind must be used in every bridge; and after what we have said it will be seen how important it is to put them in their proper place in a design. They admit of being arranged in not too many ways; but on the way in which they are disposed will depend the claims of the bridge to be admitted as a thing of beauty, or the right of the public to denounce it as a hideous structure. It would be possible to construct a bridge with a span of 1500ft. or 1600ft. in which the whole of the struts would be arranged like so many crane jibs radiating from the tops of the piers, and united by ties, coupling their extremities to each other at opposite sides of the pier, and to the roadway by vertical or inclined rods. Such an arrangement would be, as we have said, symmetrical and practicable, but we cannot say much for its beauty.

It must not be forgotten that in dealing with bridges of such enormous spans as that intended to cross the Forth, the provision for wind pressure must largely influence the design; for example, a high narrow structure would be certain to be overturned, and hence considerable breadth of base must be introduced. There is more than this, however, to be thought of. We have a long girder or its equivalent held at both ends; the pressure of the wind will tend to bend this girder horizontally. Let us, to be moderate, suppose that the maximum wind pressure upon a girder 1500ft. long will not exceed 30 lb. per square foot; the least average depth such a girder would have would be 200ft., assuming that it was a plate girder. Its superficial area would be $200 \times 1500 = 300{,}000$ square feet, and $30 \times 300{,}000 = 9{,}000{,}000$ lb. If we assume that the lattice work is so open that, taken with top and bottom booms and roadway, the net area is only one-fifth of that of the solid plate girder, we would have a gross wind pressure of 1,800,000 lb., or, in round numbers, 800 tons to provide for. This would act as a distributed load, and it will be seen that it is no trifle to be carried between supports 1500ft. apart. A lattice girder would not be used under the circumstances, but whatever is substituted for it must present a surface to the wind greater or less, and side strains will be set up. The bridge must have lateral stiffness to resist them, and it is a question which will materially modify the design how this stiffness can be best imparted. If there is to be a double roadway, half the difficulty is got over, but when there is but a single road it may be found necessary to make the piers and abutments considerably longer, measured up and down stream, than the bridge is wide; to spread the struts, and to make the ties pass through planes at an angle with a vertical plane passing through the roadway. Thus the bridge will be considerably wider at the piers than it will be in the middle. This may or may not be a beauty, according to the nature of the horizontal curves which the bridge outline will follow when seen in plan. If a pair of huge girders were used alone, then it would for economy be found necessary to make the bridge wider in the middle than at each end, for the same reason that a girder carrying a load is deeper in the middle than at either end. It is not necessary, however, to speculate on this supposition, because no engineer in his senses would think of using a lattice girder alone to cross a span of 1500ft.

It is clear, we think, that bridges of great span must not be judged by the ordinary rules of criticism, and yet we are by no means disposed to admit that it is quite impossible to render such structures handsome. Should the Forth Bridge scheme be carried out—and of this there is now every probability—several audacious enterprises both in Great Britain and abroad may be expected to follow. With the aid of stirred steel, the engineer may perhaps do things now held to be impossible; but try what he will, the main features of his design will still be found to depend on what he does with his struts or compression members. Their arrangement will influence everything else, and they will determine ultimately whether the structure is or is not to be pleasing to the eye.

COMMITTEE TRIALS OF THE 80 AND 100-TON GUNS.

On Wednesday, the 26th inst., the Committee on Ordnance fired both the 80 and the 100-ton gun at the proof butts in the Royal Arsenal. We gave a full description with woodcuts of the system of mounting and working the latter gun on its first trials about a year ago. It has remained longer in position than was originally contemplated. The trial we now speak of was intended to be a final one before despatching the four guns to their places of destination at Gibraltar and Malta. The alterations in the arrangements are few, consisting chiefly in the additions of fittings which have been completed from time to time. The gun, it may be remarked, is mounted to fire *en barbette*, and is intended to be loaded from either of two "cages" or loading chambers, constructed in the parapet on either flank of the gun. When the gun is in the firing position its centre of gravity is nearly over the pivot on which the platform traverses, so that there is little labour in bringing the gun round and dipping the muzzle, so as to be sponged and to receive its charge from either loading chamber. Sponging and ramming are performed by hydraulic power, as described in the article referred to. There has been a slight increase in power given by the enlargement of the hydraulic ram. The accumulator and engine are unaltered. In the gun factory has been designed and made an admirable reflecting sight, by which the gun was laid on the mark on the firing butt. This consisted of two looking-glasses, one fixed on the slide and the other immediately behind the rear sight on the gun, whose centres are in the same vertical plane parallel to the axis of the gun. The face of that on the slide is fixed at 40 deg. with the horizontal, and that on the gun has a steel curved guide which is connected with a horizontal axis on which the glass pivots, and is of such a shape that the upper glass is kept at 40 deg. with the horizon—in fact, parallel with the lower one. In the firing position one glass is in the proper position over the other to cause a ray of light falling on the upper glass from the point aimed at to be thrown on to the lower glass, and so to the eye of the man ranging the gun when standing on the ground or a step close to the rear end of the traversing platform. The man so placed sees an erect image of the point aimed at and the two sights directly in front of him, these being simply carried down to his level by means of the double reflection of the two glasses. There is a simple graduated head by which deflection is given, and a hand wheel for giving elevation. Speaking tubes are now fitted to enable the man firing to communicate orders to the loading points, and the place from which the traversing handles are worked. The number who lays also fires at any moment required by an electric apparatus. There were one or two missfires, but we cannot suppose that the fault was a serious one. The system is very complete. It would be possible for a man to fire the instant he saw his sights covering an object, which is a great matter at sea. The gun was fired five rounds, with a firing charge of 450 lb. of prismatic powder. For the first and third round Westphalian powder was employed, for the second, fourth, and fifth powder somewhat resembling it, made at Waltham Abbey. The object was not only to test the action of the gun carriages, &c., but also to try the comparative effects of the two kinds of powders. The Westphalian powder gave an average pressure of $14\frac{1}{2}$ tons per square inch, with a velocity of about 1540ft., and the Waltham Abbey powder about 12 tons, giving a velocity of 1545. The latter, therefore, gave the best results as far as the trial extended. The pressure is so remarkably low, however, that it has been suggested an attempt might be made to get more work out of the gun before dismounting it, but we have no authority to support this idea. One round was fired from the 80-ton gun with a charge of 450 lb., giving a velocity of 1575ft. It is intended to compare the effect of German and English made powders in this gun, as in the 100-ton. A gun factory 6in.-gun is mounted, awaiting its trial with recoil checked sharply.

TEES SHIPBUILDERS AND ARBITRATION.

Shipbuilding on the Tees and at West Hartlepool has been exceedingly brisk during the whole of the present year. In the first ten months the launches amounted to over forty-six—twenty-five at West Hartlepool, and the remainder at Stockton, South Stockton, and Middlesbrough. The tonnage has ranged from 841 up to 2900 gross register, and the total for the present year will, it is evident, be far above that for the past. It is not a secret that the prospects of the shipyards continue good so far as fulness of work is concerned. But there have been in the past months several annoying and injurious strikes, and the labour question in minor forms has continuously cropped up. The suggestion has been made that, under these circumstances, the province of arbitration might be fittingly and usefully extended into the shipbuilding industry. In the allied iron industry it is suggested that there is not sufficient diversity between the circumstances of the two industries to debar the adoption. It is urged that the variation between the prices of vessels is so great that the value of the labour could not be deduced approximately therefrom, even if shipbuilders were willing to disclose the prices obtained to accountants. This, it may be pointed out, is one of what may be called the essentials of arbitration, as it has been conducted in the North of England. The prices got for coal or for iron are obtained at periods defined, and these unquestionably exert much influence on the award of the arbitrator, or entirely influence the wages by the operations of the sliding scale principle. The fluctuations in value of manufactured iron are large—from common bars to boiler-plates; but in the North of England the fluctuations are less because ship-plates form the bulk of the production now, just as iron rails formed the bulk a few years ago. But owing to the fact that thousands of tons of manufactured iron are included in the return, one quality is balanced by another, and a fair average price is obtained. This could scarcely be the case in the shipbuilding industry, for two or three score of vessels only are built in a year, and they fluctuate in price say from £10 to £15 per ton. This is unquestionably one of the difficulties of the position, but it may not be, and ought not to be, an insuperable obstacle. In other respects there is some similarity between the condition of the two industries. In both the iron manufacture and in shipbuilding there is a variety of employment, of modes of payment, and of wages; and in both the contract system that prevails at times raises difficulties between employers, operatives, and contractors. But the need of some better method of regulating wages than that "higgling of the market" that now leads to strikes, is very great and growing. It will be found, we fear, difficult to introduce the system of arbitration into the shipyards, because of the great employment of unskilled labour therein, and of unskilled labour that is not directly employed and paid by the shipbuilders; but it is worth the attempt, for the loss that has accrued in consequence of the strikes of late has been great.

COLLIERS' WAGES.

The colliery population have pretty much abandoned arbitration as a means of obtaining what in their estimation are just wages. Sliding scales are now most in favour. But sliding scales do not give them complete satisfaction. Mr. Alexander Macdonald, M.P., president of the Miners' National Union, had a notion that he could frame out of all the scales in operation, one scale that should be capable of general adoption. Mainly to receive the result of his labours, a conference of miners' delegates was last week held in Birmingham; and it was attended by the representatives of 326,000 men. Their chief could not attend for he was unwell; but he sent them a communication wherein he explained that repeated attempts to carry out his wish had only resulted in the conviction that fifty different circumstances in as many different districts had to be considered; and that though there were a few matters that would apply to nearly all, yet that matters of detail must be left to the individual districts. Under the direction of their union vice-president—Mr. B. Pickard—the conference set to work to discuss the reports upon the working of the sliding scales in the several districts respectively. At the close of the week a series of resolutions was determined upon, of which the most business-like was that where a scale did not contain a minimum, an effort should be made to have one introduced; and it was determined to meet again in December to consider the advisability of moving the employers to again put up the price of coal. These miners' parliaments are a vast improvement upon riotous assemblages in pit fields; and, passing by the late violence in a portion of the Lancashire basin, it is satisfactory that the current of opinion has set in against any proceeding likely to bring the employers and workmen into collision.

LITERATURE.

Diamant et Pierres Précieuses, Bijoux, Joyaux, et Orfevreries, Par Ed. Jennettaz, E. Fontenay, Em. Vanderheym, et A. Coutance. Second edition. Rothschild: Paris. 1881.

This is an octavo of 580 pages, containing 350 woodcuts, and a frontispiece printed in colours. The four gentlemen who have written it are all men of eminence in their particular callings. Thus, M. Jennetaz and Coutance are both men of science, while M. Vanderheym is president of the Syndical Chamber of Diamonds and Precious Stones, and M. Fontenay is an eminent jeweller. We need hardly add that M. Rothschild has done his part admirably, the engraving, printing, and paper being excellent. The work deserves to be taken out of its present paper covers and re-bound for the drawing-room table. It will probably charm those for whom alone jewellery may be said to exist. But the work possesses besides no small interest for the mineralogist, the antiquary, and the lover of fine art.

All mankind, civilised and uncivilised, loves ornament, and precious stones have at all times played an important part in the world, because they may be regarded as representing the most costly, rare, and magnificent type of ornament that can be produced. The literature of precious stones is not insignificant. Up to the present period, however, we venture to say that no very complete single book has been produced in which all that is known concerning the history, physical properties, and trade relations—if we may use the words—of precious stones, has been set forth. Those who wish to know all about one particular stone—as, for example, the diamond—can find what they want only by examining a good many books. The same statement holds true of the ruby, the emerald, and so on. In fact, nearly all that need be known concerning precious stones is here set forth.

The first portion of the book is that which possesses most scientific interest. In it our authors deal with the whole theory of crystallography; next they consider the phenomena of cleavage, and go on to treat of the optical properties of precious stones. Their thermic and electric properties are dealt with in a distinct chapter. Next we have sixteen chapters devoted to descriptions of all the precious stones known. Then come seven chapters on stones of more moderate value, such as malachite and jade. Next is a treatise on goldsmiths' and jewellers' work, as illustrated at the Paris Exhibition of 1878; and finally come two chapters, one on pearls and the other on coral.

In dealing with such a book there are only two courses open to us. The first is to review it exhaustively, to which is the objection that such a review would occupy a great deal of space about a subject of small engineering interest; and the second course is to express an opinion about the merits or demerits of the book, which our readers must take for what it is worth; and to indicate a few of the points most likely to interest them. For example, we may cite the chapter on cutting and polishing precious stones. The chapter contains a wood engraving of the system of cutting agates employed in the little village of Oberstein, near Oldenburg. The workman lies on his chest on a kind of hollowed block, his feet rest against two pegs driven into the ground to prevent him from slipping, and in this position he forces the stone to be cut, secured at the end of a handle, against the edge of a vertical revolving grindstone of large size, and driven by water power. The position of the lapidary is, perhaps, one of the most remarkable known in the arts.

The chapter devoted to the employment of gems in the arts is too short. More might have been said with advantage, but to have said it would perhaps have been a little outside the purpose of the book. The use of jewels in watches and clocks did not begin until about the year 1700, and the art of drilling them for this purpose is said to have been discovered or devised by a Genevese named Flatio. The diamond is the best stone for the purpose, but it is too costly, and is never used save for the balance staff, small roses of little value serving well for this purpose. Years ago the cylinders of horizontal watches were made of rubies, but the difficulty of producing them was so great that none are made now. M. Ingold made pinions of rubies, but we need hardly say that his example has not been followed. The great advantage of using jewels for rubbing surfaces in watches and clocks is that the use of oil may be dispensed with, a point of great importance to accurate time keeping. Only rough diamonds can be used for cutting glass. They must have well-defined angles. The cutting edge should be slightly rounded. It cannot be produced artificially. Thus a diamond ring will scratch glass but will not cut it. Good glazier's diamonds are very scarce. In 1817 M. Brokedo patented in England the use of precious stones in wire drawing; diamonds are by preference used where price is not an object. They are used in drawing the very fine wire employed in embroidery and last indefinitely. The wire is only passed once through and gets a fine polish.

The chapter on the diamond mines at the Cape will be found interesting. Large quantities of machinery are being sent there daily from this country, and it may reassure some of our readers to learn that just as good diamonds come from the Cape as from any other part of the world. The first diamond was found as recently as 1867 by the daughter of a Dutch farmer. It was a beautiful stone of over 21 carats. The child used it as a plaything until its value was recognised by Dr. Atherstone. A search was made in the beds of the Vaal, the Haart, and the Orange, and twenty beautiful stones were soon found. Mining on a large scale soon commenced, the diamondiferous "stuff" being quarried out, and washed through various sized sieves. The diamonds are at last found in a copper vessel. It is estimated that during the years 1872-3 and 4 the value of the diamonds discovered reached 50,000,000 of francs; from 1875 to 1879 the value was 25,000,000 of francs, but we have reason to think that these figures are far below the truth.

Very minute information is given as to the characteristics of different stones, and the opinions held concerning them among the ancients are as far as possible stated. The analyses of stones is also given, and instructions for making blow-pipe analyses have not been forgotten. In a word, the book is as complete, perhaps, as it is possible to make a work of the kind. A chapter is devoted to the history of attempts at the production by artificial means of precious stones, and notably of the diamond, but we are surprised to find no allusion to the recent discoveries of Mr. MacTear. It would have been worth while to have said something about what has been done in this direction since the first edition was published.

The section of the book which treats of goldsmiths' work begins at the very beginning, going back to the days of the Pharaohs. Many well-executed engravings are used to illustrate the progress of the development of design in jewellery down to the present day.

The two final chapters deal at length with the natural history of pearls and corals, and give particulars of the trade in them.

We can recommend the book with confidence to our readers. It is very full and complete, and, on the whole, very accurate, the few defects which it contains being sins of omission rather than of commission.

THE LIMITS TO SPEED.

By Professor Osborne Reynolds.

No. I.

Among the facts which are so familiar to us as not to command our attention are the limits to the rates at which we can move over the surface of this earth, or, to put it more generally, the limits to the rate at which terrestrial objects can move. Everyone is now familiar with the fact that railway trains do not exceed sixty or seventy miles an hour; that steamboats do not exceed twenty-five miles an hour; carriages on ordinary roads, ten or twelve. The fastest running animals rarely exceed a mile in two minutes, or the fastest bird a mile a minute. That there are circumstances on which these limits depend must be generally recognised; but, while speed is the highest of our mechanical ambitions, how many of those who find themselves confined for nine hours between London and Edinburgh have ever asked themselves, why should there be a limit to speed at all?

In the early days of railroads the question as to the possibility of exceeding the speed of animals was very prominent; and many of the immediate circumstances on which possible speed depends—such as the strength and elasticity of the machine, and the smoothness of the road—have since received due attention. This was a matter of necessity, just as, in attempting to gain a higher standpoint on the side of a hill, account must be taken of the difficulties of the ground immediately above one. But such notice is a very different thing from a general survey of the limit imposed by the height of the hill itself. While we were still in the valley, and the immediate difficulties of ascent were great, our aspirations might well fall short of the top of the hill, which would not then become an object of attention. But having toiled up a great way, and having apparently reached a flat, or nearly flat, plane on which we are wandering without making any considerable ascent, it cannot but be a matter of interest and importance to make a more general exploration, and endeavour to ascertain what is the nature of the country behind and above the clouds which surround us.

The greatest speeds attained have not increased now for many years. It is probable that the run from Holyhead to London is still the fastest journey ever accomplished over so long a distance, although the number of instances in which this speed is approximately reached are now numerous, and continually increasing. With animals there is no great alteration—why should there be? And with machines, locomotives or steamboats, the improvement is that the average speed more nearly reaches the maximum, rather than any extension of the maximum. Noticing this, we cannot avoid the surmise that the obstruction to further advance arises from something more fundamental than mere economy or imperfection of mechanical contrivance. The question as to how far this is the case must admit of an answer if the circumstances can be subjected to a complete theoretical examination. The problem is very complicated, and it may well be doubted whether our knowledge of the circumstances and possibilities of art is sufficient to enable us to arrive at a definite conclusion. But what we may do is to look, in the first instance, for any circumstance which imposes a definite limit to possible speeds, and having investigated the law of this limit, look for other limits, and having examined each separately, endeavour to arrive at the result when they are taken in conjunction.

To begin with, it will be well to try and catch sight of the top of the hill from a distance. Going far away from the complexity of our immediate problem, we may ask whence there can be any limit to possible speeds? Any limitations in the circumstances on which speed depends would cause a limit to speed and although perhaps not very obvious, consideration will show that speed depends on certain physical and mechanical properties of material, and that these are essentially limited. Thus the strength of material is limited. Some materials are stronger than others, but the strength of the strongest is easily reached, and although improvement in art brings the stronger and more appropriate materials within reach, still by no tittle have we been able to extend the strength of the strongest beyond what it has been, so to speak, fined by nature. When compared by heaviness, natural tissues are the strongest materials. A silk cord will sustain more than a steel wire of the same weight, and such a wire is the strongest form of any manufactured material. To the limited strength, as compared with the weight of material, then, we may look for a limit to possible speeds; and this is not all. There are other limits—for instance, the limited temperature at which material retains its strength; in fact, the properties and powers of material are essentially limited in all directions, and, inasmuch as speed depends on these properties, it must be limited. If we take a somewhat closer view, the immediate conclusion is that there are at least two distinct sources of a limit to speed. The first and most obvious of these is that the resistance to motion requires that the moving object should be continually urged forward by a force, and the maintenance of this force requires additions to the weight of the moving object, which additions increase the resistance; so that at a certain speed there will be a balance between the resistance and the force, any increase in the force causing a still greater increase in the resistance.

This may be illustrated by reference to a railway. The resistance of the engine is the addition necessary to maintain the motion. Taking the best results, the resistance of an engine at high speeds is about 45 lb. per ton of its weight. If, then, the locomotive weighs 20 tons it would require a steady pull of 900 lb. to balance its resistance. To maintain this force a certain pressure of steam must act on the pistons. To keep up this pressure the cylinders must be filled and emptied every revolution of the driving wheels—say, every 26·4ft., or 200 times per mile. To maintain the speed then the boiler must supply steam enough to fill the cylinders 200 times per mile, *i.e.*, in whatever time the mile is run. Now the power of supplying steam by the boiler is limited. A boiler of a certain weight cannot be made to supply more than a certain amount of steam, and if we know the shortest time in which the boiler will produce 200 cylinders full of steam at the pressure required to move the engine, we know the shortest time in which it could run a mile, or the limit of speed arising from this source. To increase the size of the boilers would be to increase the weight and consequent resistance of the engine, so that the only chance of extending the limit is to increase the steam-producing power of the same weight of boiler; and the question whether this actual limit has been reached is a question as to whether there still remains, after all these years, room for improvement in the best boilers—whether, in fact, the steam-producing power of boilers has reached the limit imposed by the limit to the strength and other properties of material of which they may be constructed.

The case of the locomotive has been introduced here merely for the sake of illustrating the fact that, however distant, there is a limit to possible speeds arising from this source. As a matter of fact this limit is not actually reached, for, as will be subsequently shown, there are other and inferior limits which come in; that is when the engine is running without a train, but when the train is added, as it must be from an economical point of view, then the steam-producing power of the boiler does impose an economical limit on the speed of the train.

The case of steamboats is somewhat different. With these the resistance increases in a high ratio with the speed, as the square of the speed, so that not only have the cylinders to be filled at a rate proportional to the speed of the boat, but to maintain the requisite force the size of the pistons or the pressure of the steam must increase as the square of the speed; so that instead of being, as with the locomotive, nearly in the simple ratio to the speed, the quantity of steam required in a given time varies as the cube of the speed. Thus, in the case of steamboats, the steam-producing capacity of a certain weight of boiler is the source of the actual as well as the economical limit to the speed. This limit has been reached with the modern steam launch and torpedo boat, in which as much as two-thirds of the whole weight of the ship are given up to the engines and boilers; the highest speeds so attained being about twenty-five miles an hour. The action of this, which may be called the physical limit to speed, may be traced in animals, but the requisite data for its discussion are wanting. The second fundamental source of limits to speeds is the strength of the parts, and the forces holding these parts, necessary to withstand the forces to which the motion gives rise. This may be called the dynamical limit to speed.

This source of limit has received less general notice than the preceding. That the motion of machines and animals necessarily gives rise to forces in and between their parts is not perhaps very obvious, on account of its being so well known that motion itself does not give rise to force between the parts of a moving object. But this is only when the motion is rectilinear and uniform. To stop and start a body or to change its direction requires force proportional to the weight of the body and the rate at which the change is made. In order to realise how all possible motions on the earth are limited, it must be noticed that uniform rectilinear motion is impossible. Objects on the earth have to maintain their motion against such resistances as they encounter by the relative and limited motions of their parts; with animals by the motion of their legs, wings, or fins; in machines by the motions of their pistons, cranks, and wheels; and, even apart from this, uniform motion is impossible owing to the impossibility of maintaining a direct course—for instance, a perfectly even road.

The limit to the speed of any complex body, such as an animal, an engine, or even a revolving wheel, will depend primarily on the manner in which the general motion depends on or involves change in the speed or direction of motion of any or all of the parts. For example, in the case of all carriages the limit to the strength of the tires of the wheels would limit the speed if there were no inferior limit. That what is called centrifugal force tends to burst the tires must be universally known; but there is a simplicity about the law of this limit which marks it out as the best illustration of the class of limits which arise from acceleration.

The bursting tension of the tire caused by the revolution of the wheel is the result of the centrifugal force acting on each elementary portion of the tire, and is the same as if the tire were subject to an outward pressure equal to the centrifugal force all over its inner surface. The dynamical problem of estimating the centrifugal tension from the weight, diameter, and speed of revolution of the tire is not difficult, but it will be sufficient here to state the result. The tension per square inch of section of the tire is ·36 multiplied by the weight of a cubic inch of the material and the square of the velocity in feet per second. The limit of speed is that which causes a centrifugal tension equal to the greatest stress the material will safely bear. With iron this is about 15,000 lb. per square inch. A cubic inch of iron weighs 24 lb., so that the velocity squared is equal to 11 × 15,000 or 165,000 lb., or, roughly, the velocity equals 400ft. per second. This, which is 270 miles an hour, is the limit arising from centrifugal force to the safe velocity; for steel tires, the strength of which is about double that of iron, the limit becomes 380 miles an hour. It should be noticed that neither the diameter of the wheel nor the thickness of the tire makes any difference to this limit, which depends solely on the ratio between the strength and heaviness of the material. If we could get a stronger material then we might extend the limit, but as natural fibres are the only materials stronger than steel, and these do not possess the hardness necessary for tires, there is absolutely no prospect of any extension in this direction.

The velocity of the train is the same as the velocity of the tire, so that the figures given above show the limit to the velocity of the train arising from the centrifugal force on the tire—that is, supposing the tire subject to no forces but those considered. Looked at in this way, the limit appears well away from any speeds already realised. But as the tire is subject to forces arising from its contact with the rail and from the load on the wheel, the margin left for centrifugal force is much less than what has been stated, so that the actual limit, which involves complex considerations, is really much lower.

Wheels have been here considered as affording the simplest example of how changes in the direction, or speed of motion in the parts, of a moving object must cause a limit to the speed at which the object can move, and not because the wheels are the parts which would give way first were the speed to be increased. In the locomotive, as at present constructed, there are parts—the coupling and connecting rods, for instance—which would give way under these accelerations before the tires; and it will be the object in a subsequent article to discuss somewhat fully the limit to speed imposed by these, as well as by other parts of the machinery.

In the case of animals there are no wheels, but the problem does not differ greatly; for the forces required to stop and start the limbs tax the strength of these in much the same way as the strength of the tires is taxed by centrifugal force. So that the conclusion is the same, that the strength, as compared with the heaviness, of the material of the bones and tissues of animals determines a limit to the possible speed; which conclusion is borne out by the fact that the strength, as compared with the heaviness of these materials, is as high, or higher, than that of any other materials—the strength being that required to resist the particular forces which the parts are generally called upon to sustain, *i.e.*, bone to resist crushing, and sinews to resist tension.

Before closing this article, which is intended as an introduction to the more definite discussion of certain particular cases where these limits come in, it should be pointed out that besides the two sources of limits to speed which have been particularly noticed, viz., those which arise from the strength of the material, and those from the limited capacity of producing energy, there are other sources of limits. One of these, of a physical kind, is the inability to get rid of the heat produced at the joints by friction. The heating of bearings, which is a very common source of the actual limit to speed, although it has not apparently received much attention except in a practical way, admits of theoretical consideration as being subject to definite laws.

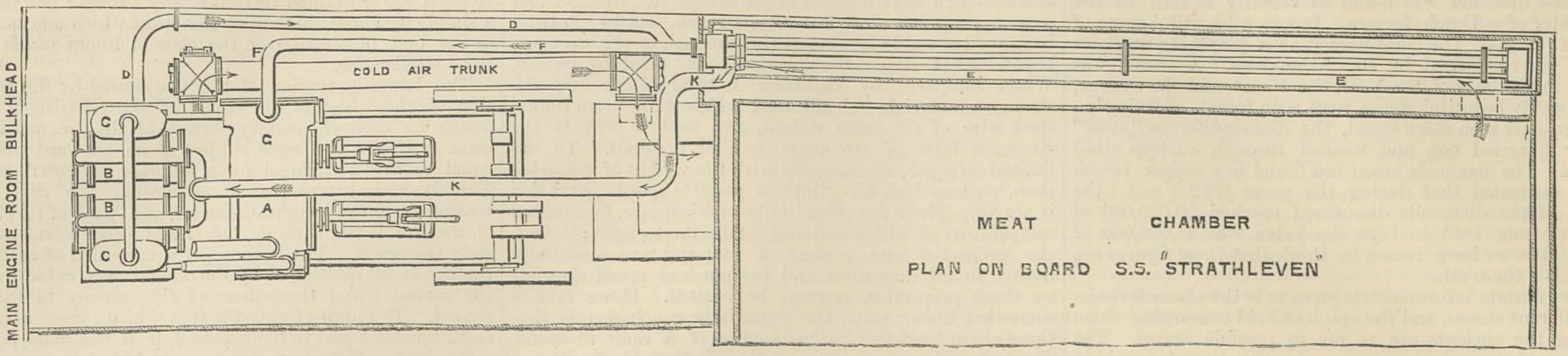
Another source of the limit to speed of the greatest practical importance, although more complex than the preceding, is the effect of the moving pieces and the forces between these to cause unsteadiness to the motion of the whole structure. The difficulty of keeping a railway train steady has perhaps as much to do with the actual speed attained as any other cause. In so far as this unsteadiness arises from the unevenness of the road, and the mere disturbing forces caused on the frame by the moving pieces, it belongs to the class of dynamical limits, but it depends on a particular property of matter not involved in other cases of this class of limits. The rocking of a structure depends on the character of its elasticity, and on the period as well as the magnitude of the disturbing forces; and, as a matter of fact, the tendency to vibrate would impose a limit on the speed of most machines, so that it is entitled to a place amongst the sources of limit, and may be called the elastic limit.

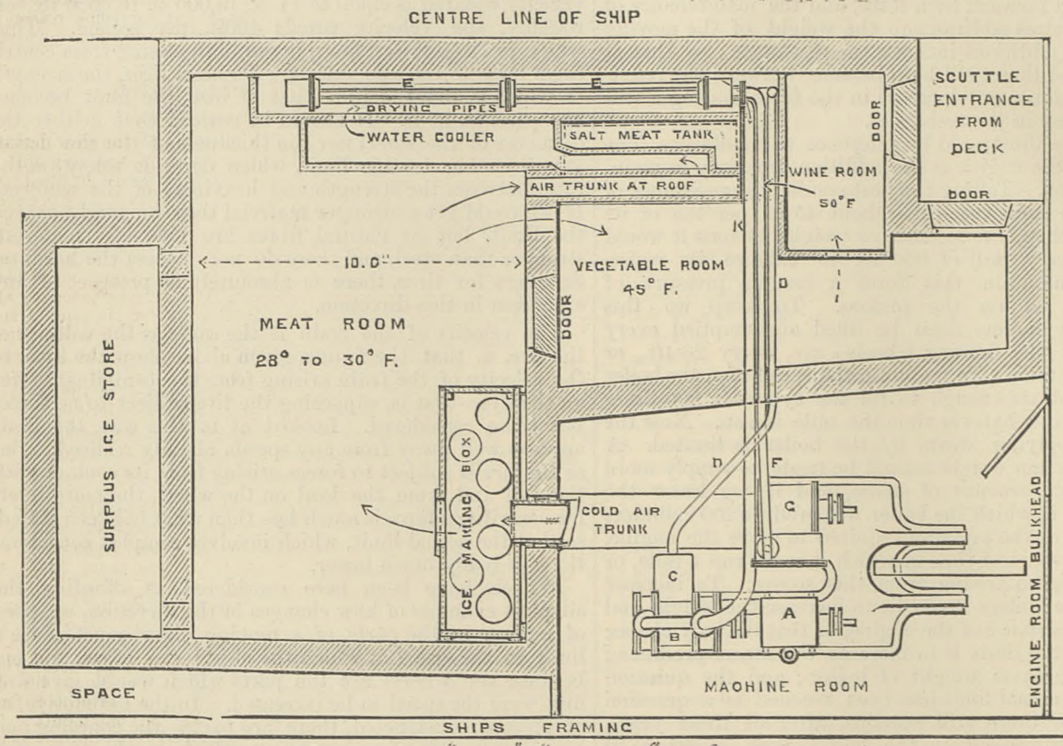
So far, then, we see that there are four distinct sources of limits to speed. The limited capacity of producing energy, the limited strength of the material, the limited power of discharging the heat produced by friction, and the elastic limit. In pointing out the general nature of these limits, attention has been directed to objects with powers of locomotion as being more familiar; there, however, are the same sources of limits to the speed of stationary machinery, such as steam engines and tools.

Owens College, October 18th, 1881.

REFRIGERATING APPARATUS, S.S. STRATHLEVEN AND DUNEDIN.

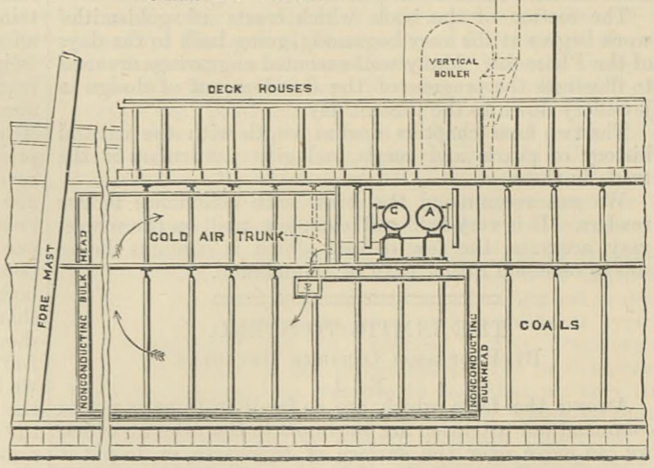
THE BELL-COLEMAN REFRIGERATION COMPANY, GLASGOW, ENGINEERS.





PLAN ON BOARD S.S. "ROME", "CARTHAGE" AND "KAISER-I-HIND"

SECTION SHEWING REFRIGERATOR COLD CHAMBER &c. SAILING SHIP "DUNEDIN"



We illustrate above the machinery which was fitted on board the steamship Strathleven in September, 1879, by the Bell-Coleman Mechanical Refrigeration Company, Nile-street, Glasgow, under the personal superintendence of the managing partner, Mr. J. J. Coleman, and which brought the first cargo of frozen meat which arrived in this country from the antipodes. This meat arrived in February, 1880, in excellent condition, the quantity being 33 tons, and it sold in Smithfield at good prices.

It has proved the pioneer of an important trade. This machine had a pair of air compressors B B of 16in. diameter and 2ft. stroke, in which the air was compressed by the steam cylinder A. The great heat which would be generated by the dry compression of the air, and would greatly increase the power required to drive the machine, was in this case avoided by vigorous injection of water during the act of compression, and the tepid compressed air passed to the water tower C, where it was brought into intimate contact with the water spray and reduced almost to the temperature of the spray. The compressed air then passed by the pipe D to the system of drying pipes E E, which were simply a set of tubes placed in the waste air current on its road from the chamber back to the machine, and thus the compressed air inside the tubes was cooled to a lower temperature than that attained by the use of the sea water, and consequently deposited aqueous vapour which was removed by automatic traps not shown in the drawing. The compressed air thus deprived of moisture passed by the pipes E to the expansion cylinder G, where in contributing to the motive power required to drive the machine it was expanded, and thereby reduced in temperature 140 deg. or 150 deg. below the initial temperature, registering in some portions of the voyage as low as 100 deg. below zero.

This identical machine has since been used with much larger meat chambers than were connected to it during the first voyage, and has brought regularly every month from America, more than 150 tons of meat each voyage. The first machine employed in the American trade was also of a similar type and size, and crossed the Atlantic in March, 1879, also under the personal superintendence of Mr. Coleman. Indeed fifteen machines of exactly the same size as the original Strathleven machine have been constructed, but the total number of machines made under the superintendence of the Bell-Coleman Company is forty-three, their aggregate cooling power being equal to freezing 200,000 tons of flesh annually, and we understand they have run 200 voyages consecutively without any serious mishap. The Bell-Coleman Company attributes much of its success and immunity from mishaps to the drying pipes, which are a peculiarity of their system, and which prevent accumulations of snow in cylinder ports and passages, which even if no water is injected into compressors is always formed in large quantities by the liquefaction and freezing of the aqueous vapour existing in ordinary atmospheric air.

The largest meat cargo machines afloat at the present time are those on board the Orient Liner Cuzco and the ship Dunedin. Each of these machines has a pair of air compressors 21in. diameter and 2ft. stroke, and both were fitted up by the Bell-Coleman Mechanical Refrigerating Company; as also a very powerful land freezing machine supplied to the Government of New South Wales for the Sydney public abattoirs, this machine having two air compressors of 23in. diameter and 3ft. stroke.

The arrangements made on board the Dunedin by the Bell-Coleman Company, which also supplied the boilers, is shown by the profile plan of the ship above, the machinery occupying less than 10 per cent. of the space to be cooled, which is estimated to carry 300 tons dead weight of meat.

We also illustrate on page 314, a new type of machine of small dimensions for the cooling of ships' provisions, two of which have been recently put, and are now working on the Peninsular and Oriental steamships Rome and Carthage, which are the largest vessels of the fleet; one of these machines is about to be fitted on board the Kaiser-i-Hind in place of the experimental machine which the Bell-Coleman Company first tried in Indian waters. These machines have air compressors of 14in. diameter and 12in. stroke, and steam cylinders of 13in. diameter and 12in. stroke. They are connected with meat storage chambers of about 900 cubic feet capacity, water coolers, vegetable rooms, &c., as shown on the plan.

These machines were carefully tried in the shops before being put on board in presence of the inspectors of the P. and O. Company, and with cooling water of 90 deg. gave temperatures of 40 deg. below zero when the air pressure was 55 lb.; and 53 deg. below zero when the air was 65 lb. pressure, an adjustable cut-off attached to the expansion cylinder slide enabling the pressure to be regulated at will. These machines are constructed with unusually large bearing surface, and run equally well at any speed between 30 and 200 revolutions, and it is claimed by the makers that their performance has not been exceeded by machines of same size, larger machines giving always lower temperatures—reaching to 80 deg. or 100 deg. below zero.

The lettering applying to the Strathleven plan applies also to the Peninsular and Oriental arrangements; and the Peninsular and Oriental machinery has been designed sufficiently large to admit of working a portion of a day, instead of keeping going the full twenty-four hours.

A Bell-Coleman machine for cooling the ship Inverness has been fitted and set to work on board the Cunard steamer Servia, which leaves the Clyde this week.

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

(*From our own Correspondent.*)

Upon 'Change in Wolverhampton yesterday, as in Birmingham this afternoon, there was a lull in the consuming market. But no great significance was attached to it, since vendors of most commodities were as strong in their quotations as a fortnight and a week ago.

The opinion held by many traders three weeks and a fortnight ago that with the 1st November the Earl of Dudley's coal was likely to be declared up another 1s. per ton, when pigs would consequently advance again between 2s. 6d. and 5s. per ton, and marked finished iron a further 10s. per ton, had yesterday and to-day very few supporters. The markets were therefore this week devoid of the excitement which some people had looked to characterise the close of October. But it was regarded as pretty certain that the advance in coal was only postponed.

Sheet makers this afternoon headed the market in their reports of activity. Producers of galvanising qualities are unable to execute orders with the needed promptitude; and not only are the galvanisers important customers, but merchants, too, are buying well for export. Singles were £8 to £8 10s. according to state of makers' order books, doubles a further 20s. or 30s. per ton, and trebles a still further 30s.

Makers of boiler-plates announced that orders were more numerous than some time back, but that they still continued to be of a hand-to-mouth character. Prices varied from £9 to £10 and £11, according to quality.

The marked bar makers do not find any falling off in the better demand which has of late fallen to their lot. Indeed, the demand is rather increasing, chiefly on export account. The Earl of Dudley's bars—rounds—were quoted at: Ordinary, £8 2s. 6d.; single B., £9 10s.; B.B., £11; and B.B.B., £13 per ton. His lordship's rivet and T-iron was: Single best, £10 10s.; B.B., £12; and B.B.B., £14. As to T-iron however, there was a minimum quotation of £9 2s. 6d., which did not apply to rivet iron. His lordship's angle iron of the four several qualities was 10s. per ton below rivet iron.

The marked bars of the other houses remain at £7 10s., with sheets and plates between 30s. and 40s. per ton additional. Medium and common bar makers are actively engaged in part on colonial and South American account. The minimum quotation this afternoon was £6 10s. to £6 15s. per ton. Hoops are brisk at £6 17s. 6d. to £7 5s. and £7 10s.

The Australian mail delivered this week has been fairly good, though there is not a readiness to buy eagerly in anticipation of further advances. According to last advices galvanised iron was going off quietly in Melbourne, ordinary brands of 26 w.g. fetching £20, and best brands, £21 10s. to £22 per ton. Drawn fencing wire was selling steadily at £12 10s. to £13 10s., and £14 for Nos. 6, 7, and 8 respectively. Bar and rod iron was moving off at £8 10s. to £11. Black sheets were selling quietly. Assortments of Nos. 8 to 18 were quoted at £11, while for No. 20 £13 was obtained. Plates were slow at £11. Hoop iron for trade purposes was £9 to £9 10s. Pig iron was in better demand, with trade quotations ranging from £4 10s. to £4 12s. 6d.

The finished ironworks at Oldbury formerly carried on by the late Mr. Thomas Whitehouse are being restarted by a firm of London merchants under the style of the Oldbury Iron and Steel Company.

The manufactured ironworks belonging to Messrs. Bissell and Son, of the Birchills, Walsall, are about to change hands. The new proprietors are Messrs. Thomas Bros., pig makers, Walsall.

The engineers' yards are active, and the prospects are favourble. The same may be said of the heavy founders.

Pig iron this—Thursday—afternoon in Birmingham was tame, whether reference be had to native or foreign sorts. But producers have some good contracts on their books, and they did not therefore complain at all. Staffordshire all-mine pigs easily fetched 2s. 6d. per ton in advance of Shropshire ditto, and in some cases they brought 5s. per ton more. Thus they were £3 7s. 6d. to £3 10s.—hot blast sorts. Native best part-mines were 57s. 6d. to 55s., and cinder sorts, 47s. 6d. to 45s. The Spring Vale Furnaces Company quoted the advanced figures of £3 5s. for their mine pigs, £2 17s. 6d. for their hydrates, and £2 7s. 6d. for their common sorts.

Hematites participated in the general quietude. But agents were not prepared to give way in their former quotations of 75s. to 72s. 6d.—figures, however, which it was impossible to obtain. Some agents announced that they could not get their principals this week to quote a price at all. Derbyshire pigs were quoted 54s. to 55s., but the price could not be obtained.

Mr. Alfred Hickman, of the Spring Vale furnaces, Bilston, who for some time past has been the largest pig maker in South Staffordshire, since he has been blowing four furnaces, which mean a total output of about 1100 or 1200 tons a week, has now purchased the Capponfold furnaces and estate at Bilston. The estate was the property of Messrs. John Bagnall and Sons, Limited, and the furnaces are now being carried on by Messrs. Bradley Bros., under a lease which has yet four years to run. Mr. Hickman has now joined the Board of Directors of Messrs. Bagnall.

The arbitrators under the South Staffordshire Mines Drainage Acts intend to make a draft mines' drainage award for the Old Hill district. They estimate that the rate required will be 3d. per ton on fire-clay and limestone, and 6d. per ton on ironstone, coal, and slack. By the provisions of the original Act of Parliament, the mines on the south side of the river Stour will be exempt from this rating.

Messrs. John Yates and Co., Birmingham, have received a first award for their collection of edge tools, hammers, forks, spades, and shovels at the Adelaide Exhibition.

The nut and bolt manufacturers at Darlaston not connected with the General Masters' Association have intimated that they are not prepared to be bound by the new scale of sizes and prices agreed upon at the conference in Birmingham recently. They state that they have prepared another list, which they say will be more to the interest of the workpeople.

The operative spade makers employed at Stourbridge and in the surrounding localities, such as the Lye, Halesowen, and Cradley, have resolved to ask for an advance in wages of 3d. per dozen. The prospects of the agitation are not bright, as the profits which are resulting to manufacturers of cultivating tools at the present time are very meagre.

The colliers at Silverdale, North Staffordshire, numbering over 1500, have refused the offer of their employers of an advance of 5 per cent. in wages, and have resolved to bring their tools up the pit unless their demand for a 10 per cent. increase, of which notice has been given, is conceded.

The Council of the Federation of Potters in North Staffordshire, at a recent meeting at Burslem, unanimously decided to adhere to a demand served upon the employers for a return to the old scale of wages, and to a change of hiring time from Martinmas to midsummer. It was also decided to call mass meetings of the potters in the various towns of the district to secure as much unity of action as possible.

Negotiations which have lately been pending between the local authorities of Sedgley, the centre of the nail-making district in South Staffordshire, and the District Gas-light Company, have terminated in an agreement to purchase the company's gasworks at Lower Gornal.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester, Thursday.—In the iron trade of this district business during the past week has been exceedingly quiet so far as pig iron is concerned, no transactions of any importance being reported, and there was a very dull market at Manchester on Tuesday. The downward tendency in the speculative markets of Glasgow and Middlesbrough has no doubt, to some extent, had its effect upon business here. Iron users are naturally induced to believe that the market is turning in their favour, and prefer to wait or only to partially cover at present any new requirements. Although speculative dealers in this market show some disposition to give way and there has been a little underselling during the week, producers who are mostly well sold for the remainder of the year show no anxiety to press sales, and makers' iron is generally firm at full rates.

Lancashire makers of pig iron have been selling little or nothing at their present prices, but they are very firm at their full rates of 48s. for No. 4 forge, and 49s. for No. 3 foundry, less 2½ per cent. delivered equal to Manchester, and they still decline to book any iron for delivery into next year.

In some outside brands there has been a slightly easier tone. Lincolnshire forge iron, delivered equal to Manchester, is being quoted at 48s. 6d. to 49s., and foundry at about 50s. per ton, with ordinary Derbyshire brands a trifle above these figures; whilst in G.M.B. Middlesbrough there have been sellers during the week at 49s. 4d. per ton net cash, for delivery equal to Manchester.

The finished iron trade continues firm throughout. Apart from the export demand there is an increasing quantity of manufactured iron going into consumption locally amongst engineers and others, and makers generally report a good inquiry, whilst in most cases they have already orders on hand to keep them going for some time to come. Bars are firm at £6 12s. to £7 per ton, delivered equal to Manchester; hoops are quoted at £7 to £7 5s.; and boiler plates at £8 10s. to £9 per ton.

Light rail makers are very busy, both with orders for home use and export, and Messrs. Barningham and Co., of Pendleton, Salford, have, amongst other work in hand, the construction of a portable tramway for use on Lord Norreys' farm and brick and tile works at Oxford.

Amongst boiler makers more work is also reported to be stirring, and in view of the improved prospects of trade the Phœnix Boiler and Engineering Works, at Bolton, which have been closed for a considerable time, have been re-started during the last few weeks, under the management of Mr. R. Pollett, the former proprietor.

Wagon builders are getting busier, the increased activity in the coal trade having recently brought more work into their hands.

Machinists in this district are also reported to be receiving tolerably good orders, but these for the most part are for abroad, the new work giving out in this district being still comparatively very limited in extent.

Messrs. W. Collier and Co., Manchester, have in hand a new machine or bending copper pipes by hydraulic pressure on a set of blocks. The pipes, which are first filled with lead, are put into the machine across two blocks, which can be fixed in any position, each block swivelling on a strong stud, and a third block worked from an hydraulic cylinder is pressed forward until the pipe is bent to the required form. The chief feature of the machine is the construction of the hydraulic cylinder and the ram, which works backwards and forwards much like a piston. This is effected by forcing water into and out of the cylinder at the back and front alternately. For this purpose the machine is provided with a pair of pumps driven by a strap. At the back of the machine is a plate carrying four weighted valves so arranged that one pair of valves lets the water into the back of the cylinder whilst making an outlet for it at the front, and the second pair lets the water in at the front whilst opening an escape at the back. The whole of the valves are actuated by four cams upon a shaft carrying a handle, one quarter turn of which by acting upon one pair of valves forces the ram forward, and an additional quarter turn which brings the second pair of valves into action forces it backward. By this arrangement it is impossible for a man to force water in at both ends of the cylinder at once, whilst at the end of the cylinder an escape of the water is provided, should the ram be forced too far forward.

In the coal trade a good steady demand is maintained for all descriptions of round coal, and the pits are kept going full time. The month is closing with a further upward movement in prices, and in the Manchester district the leading firms are advancing their pit and delivery rates on all descriptions of coal 10d. per ton, which will put the November pit prices up to an average of about 10s. for best coal, 9s. 2d. for seconds, 8s. for furnace coal, and 6s. 4d. per ton for burgy. In the West Lancashire districts advances of from 6d. to 1s. per ton are talked of, but nothing actually definite has yet been generally decided upon. The only description of fuel which colliery proprietors at present have any difficulty in moving off is slack, which, owing to the recently largely increased production, is at some collieries going into stock, and any general material advance in this class of fuel is scarcely probable, although in the Manchester district an advance of 5d. per ton is even being made on slack.

There has been a fair shipping demand for steam coal, which is firm at 7s. 3d. to 7s. 6d. per ton delivered at the high-level, Liverpool.

With regard to the wages question in the coal trade, the men are assuming a determined attitude. In the West Lancashire districts the employers seem divided in opinion, but no doubt a great deal will depend upon the action taken in the Manchester district during the next few days.

Barrow.—The position of the hematite pig iron trade is in every way as good as last noted, and indeed the orders received during the week show a very appreciable increase. The demand all round is good and fully maintained, placing makers in the position of not being able to effect delivery this year. American demands go to show that the wants of that part of the world are yet considerable, and a good inquiry will continue for some time. Price for No. 1 Bessemer are 62s. 6d. per ton, and No. 3 forge 60s. per ton. The steel trade is brisk; good orders are held, and inquiries coming to hand give indication of a very brisk trade being done. At the Barrow Steel Works the weight of metal turned out last week was 4630 tons. The demand for steel and merchant qualities is good.

Iron shipbuilders are fairly busy, though orders are being rapidly worked out, three launches having taken place this week. Railway rolling stock works engineers and others fairly employed. Iron ore in good demand at 15s. per ton at the mines. Raisers, however, are unable to contract for anything like an early delivery. Shipping moderately active.

On Tuesday there was launched at the yard of Messrs. Caird and Purdie, Barrow, the screw steamer Stafanie, which is 245ft. in length, 34ft. breadth of beam, and 17ft. depth of hold. Her engines, which were constructed by Messrs. Westray, Copeland, and Co., are of 150 nominal horse-power. The new boat is built highest class at Lloyd's, with double bottom fore and aft, to the order of Messrs. Burrell and Son, of Glasgow, for the Adria Steamship Company. The steamer was named by Miss Elizabeth Burrell, eldest daughter of the managing owner.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

At nearly all the collieries in the South Yorkshire coal district there is great activity, and advances ranging from 5d. to 1s. per ton. There is an exceptionally brisk business done with London—Silkstone and Barnsley coal having been largely consigned by rail.

Though the demand for ordinary iron has been pretty well met, and the market has consequently been less animated, the call for hematite continues as brisk as ever, and additional furnaces are being lighted. Advances made lately have been fully maintained. Makers are reluctant to book forward, anticipating that further rise in values will follow in the winter. more particularly if another 1s. or 2s. a ton is secured for coal. In the West Riding there are twenty-five out of forty-nine furnaces in blast, being the same as at the end of the June quarter.

Messrs. Newton, Chambers, and Co., of the Thorncliffe Ironworks and Collieries, have a very heavy business at present in gas coal, their contracts including many of the leading gas companies of England—London, Sheffield, Nottingham, Barnsley, Lincoln, Mansfield, Peterborough, Barnet, Northampton, Wellingborough, Bedford, Reading, Shrewsbury, Gloucester, Bristol, Cheltenham, and Bournemouth. The firm are also shipping large quantities of these coals for the Narva, Bombay, and Mauritius Gasworks. In the London metropolitan district alone, the firm had an average sale for the last three years of 167,752 tons per annum, of which 140,000 tons were house coal.

Engineers continue to be very actively employed, and Sheffield is not alone in reporting improvement in this important branch. Very important contracts for Bessemer and other plant have been already noted, but in addition to these I hear of many good orders being received from nearly all the heavy branches, as well as from the lighter departments.

In cutlery and general hardware there is nothing to complain of. In a leading cutlery establishment this week, I was struck by the quantity of solid silver and gold-mounted penknives. Instead of being special articles for presents, they appear to be getting articles of regular trade.

Bessemer billets have improved rapidly this week. On Tuesday morning rates were quoted for billets £6 5s. In the afternoon they rose 5s. a ton on these rates, and on Wednesday makers were refusing to book for deliveries at six months even at £6 10s. In "webs" an advance of 3s. per ton was secured on Tuesday, and a further 1s. 6d. on Wednesday.

The most interesting item of trade news for a long time in this district is the application of the principle of limited liability to the business of Messrs. Newton, Chambers, and Co., Limited, of the Thorncliffe and Chapeltown Ironworks and Collieries, near Sheffield. The capital is £650,000 in 32,500 shares of £20 each, of which it is expected that £14 per share will be called up; 6000 shares are to be taken by the vendors, and 26,500 shares are offered for subscription. The chairman is Mr. Thomas Chambers Newton, and the managing directors Mr. George Dawson and Mr. A. Chambers, the former looking after the ironworks, and the latter the collieries. The business was formed in 1793, and the change now made has been necessitated by the death of the last surviving partner in 1869, some of the executors having no power to continue the business, which has now grown to a greater magnitude than can well be covered by private enterprise. The collieries are the Thorncliffe, the Tankersley, and the Rockingham, and the quantity of coal under lease is estimated to exceed 23,000,000 tons, with 3,000,000 tons closely adjoining. The average annual output for the last three years has been 612,000 tons, which was increased to 620,000 tons in 1880, and during the first nine months of the present year it has amounted to less than 553,000 tons. There are 311 coke ovens, producing over 2400 tons per week of the best quality for Bessemer, steel-melting, and blast furnace purposes. The ironworks—Thorncliffe and Chapeltown—yield annually 31,000 tons of pig iron. 13,000 tons of which is converted into castings in the foundries; and there is also a complete engineering plant. The ironworks sales for 1879 amounted to £198,000, and for 1880 to £210,000. There are twelve miles of railway, with four locomotives, and over 1200 railway wagons, with freehold estates, farms, &c. The proprietors have agreed to take £448,963 for the whole concern, being the amount at which they stand, after due depreciation, in the books of the firm at the 31st December last. In this nothing is included for goodwill. The formation of the company is exciting great interest in iron and coal circles, there having been no more profitable business in South Yorkshire, and the shares will no doubt be promptly taken up.

The death is announced of Mr. Henry Currer Briggs, senior member of the firm of H. Briggs, Sons, and Co., Whitwood Collieries, and for many years the chairman of the board of directors. Mr. Briggs was only fifty-five years of age.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The general tone of the market held at Middlesbrough on Tuesday last might be characterised as quiet. The fall in the price of pig iron at Glasgow to 50s. or thereabouts had its usual effect. So also had the delay in shipments, and the consequent temporary accumulation of stocks, caused by the recent heavy gales. No. 3 g.m.b. iron changed hands at about 41s. per ton f.o.b. No. 4 forge might be had at a shilling less, and warrants at about 3d. less than makers' iron. In the manufactured iron trade there is still considerable steadiness, notwithstanding that buyers are holding back their orders in view of the weakness of the pig iron market. Plate and angle makers are booking a larger quantity of orders than they are running off. The price of ship-plates in quantities is from £6 7s. 6d. to £6 10s., f.o.t. Middlesbrough, less 2½. Angles are about £5 17s. 6d., and bars £6 2s. 6d. The price of bars has evidently increased considerably during the last few months, which is generally attributed to the stoppage of the Imperial Works at Eston—late Jackson, Gill and Co.—thereby diminishing the competition.

In platemaking fresh competition seems likely to ensue. The West Hartlepool Works, which have been bought by Mr. M. Gray and others, will be put into operation shortly. At present they have only one plate mill which is not of the most modern type, and the quantity they make is not likely to exceed 200 to 250 tons per week unless and until new machinery is put down. The proprietors, however, are about to sell a quantity of old plant belonging to the rail mills, and it is possible they may use the part of their site which will thus be cleared for new plate or angle mills. Mr. Gibson, who was at the outset engaged as manager by this firm, is understood now to have left their service, and his successor has not yet been appointed.

The rolling mills at Walker-upon-Tyne have been bought by a syndicate, who are endeavouring to get up a company, and it is expected that these works will be started some time next year. They are suitable for rolling plates, but their former proprietors, Messrs. Bells, Ridley, and Bell, found it impossible to compete with Cleveland for shipplates, and also limited themselves to the manufacture of boiler plates.

Mr. C. E. Muller's Erimus Works are now in steady operation. Their output in steel rails, which alone are manufactured, is from 600 to 700 tons per week. A paper on some of the machinery connected with them will be read by Mr. Copeland, of Barrow, at the next meeting of Mechanical Engineers, to be held at Manchester on Friday next.

At the Eston Steelworks very large quantities of steel rails are being made, the total amount in some weeks reaching to as much as 4000 tons. This is the produce of eight converters and two railmills. There is another rail mill which is kept in reserve in case of accident to either of those at work. Mr. Richards, the general manager, is on a tour in the United States, but is expected to return about the 9th of next month. Mr. S. Godfrey, the engineer, will then leave for a lengthened voyage for the benefit of his health. The Eston Steelworks are now lighted up regularly by means of electricity. The lamps in use are of several different kinds, and supplied by several rival manufacturers. They are all under probation, and when it is clear which kind is most successful, that kind will be adopted throughout. The electric light has also been applied to the works of Messrs. Johnson and Reay, of Stockton-on-Tees. The Brush light was for some weeks in operation at Messrs. B. Samuelson and Co.'s Newport Ironworks, but for some reason or other they did not appear to work satisfactorily and were removed.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

As a result of the small shipping returns and the slow demand for future export, the Glasgow warrant market was very dull at the close of the past week, and quotations steadily declined. It has been no easy matter to carry over on the market, as 5 per cent. has been paid from day to day for that purpose. Holders have consequently been desirous of selling, and hence it is no wonder that prices should recede. It is now more than ever apparent that the advance in prices which followed upon the damping out of blast furnaces was purely speculative, and not at all warranted by any improvement in the actual demand for pig iron on the part of consumers. This being now clearly apparent there is less disposition to speculate. The continued increase of stocks has also a depressing effect upon the market. In the course of the past week upward of 4000 tons of pigs have been added to the stock in Messrs. Connal and Co.'s stores, which have received close upon 20,000 tons of an addition since sixteen furnaces were extinguished a month ago. No doubt there are special causes at work in producing this large increase, but still the fact remains and tells adversely upon the condition of the market. The past week's exports have been larger, and a better tone was observable on 'Change on Tuesday. The foreign trade, however, will now gradually become contracted, and the principal dependence will be placed upon the requirements of home consumers, which are fortunately on an extended scale.

Business was done in the warrant market on Friday forenoon at from 50s. 7d. to 50s. cash, and 50s. 9d. to 50s. 3d. one month, the afternoon quotations being 50s. to 49s. 10d. cash, and 50s. 3d. to 50s. 1d. one month. The market was very dull on Monday, when transactions were effected in the forenoon at 49s. 9d. to 49s. 3d. cash, and 50s. to 49s. 6d. one month; and in the afternoon from 49s. 8d. to 50s. cash, and 49s. 10d. to 50s. 3d. one month. On Tuesday a decidedly better feeling prevailed, the market being strong, with business at 49s. 9½d. to 50s. 3d. cash, and 50s. to 50s. 5d. one month. The market was steady on Wednesday, with a slight upward tendency in prices. To-day—Thursday—the market was flat, with business from 50s. 8d. to 50s. 3d. cash, and 50s. 10d. to 50s. 6d. one month.

Since last report makers' prices have been reduced all round, the following being now the market quotations:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 59s. 6d.; No. 3, 51s. 6d.; Coltness, 60s. 6d. and 52s. 6d.; Langloan, 61s. and 53s.; Summerlee, 59s. 6d. and 51s.; Calder, 59s. 6d. and 53s.; Carnbroe, 53s. and 50s. 6d.; Clyde, 50s. 6d. and 48s.; Monkland, 50s. and 47s. 6d.; Quarter, 50s. and 47s. 6d.; Govan, at Broomielaw, 50s. and 47s. 6d.; Shotts, at Leith, 60s. 6d. and 53s.; Carron, at Grangemouth, 53s. 6d. and 52s. 6d.; Kinneil, at Bo'ness, 50s. 6d. and 48s.; Glengarnock, at Ardrossan, 53s. and 50s. 6d.; Eglinton, 50s. and 47s.; Dalmellington, 50s. 6d. and 47s. 6d.

The malleable trade continues active in almost all its departments.

It may be of interest to note that the pig iron merchants and brokers of Glasgow this week formed themselves into a society, to be known as the Scotch Pig Iron Trade Association, and adopted a constitution and rules for the regulation of the body. All present brokers are admitted free, but future numbers will be required to deposit a heavy fee.

The coal trade is quite as active as ever in the home department, but the shipping trade does not appear to be so good as it was a few weeks ago. This is due partly to the stormy weather at sea, and partly to the advanced period of the season at which we have now arrived. The recent rise in prices has upon the whole been maintained, and it is now almost taken for granted that the miners' wages will be advanced 6d. per day on the 1st November. By a number of firms the advance has already been conceded.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The rules against blasting in mines continue to form the staple subject of discussion, both amongst colliers and coalowners, and neither approve of it. If carried out it is very clear that nothing like the output now shown could be produced. The coalowners have already freely discussed them in meeting, and I see that the workmen's committee propose to do so at the end of week. At the same time they will receive the accountant's report for the four months ending August 31st, and the report of the deputation who went to the Birmingham conference.

It is openly expressed by members of the workmen's committee that if the order respecting blasting in mines be enforced, several collieries would have to be abandoned.

There has been a wages dispute at the Glamorgan Colliery between some of the men and the manager respecting yardage. It is still unsettled, and will form the subject of judicial inquiry next week.

The staple trades continue in a prosperous condition, and the firmness which has so long characterised the coal trade is, if anything, hardening. Some good mail contracts have been secured even at advanced rates, and the indication is in all quarters an upward one.

In Cardiff the tone of trade is particularly good.

The Powell Duffryn Co. is prosecuting several of their colliers for absenting themselves from work. It appears they objected to do ripping work, and pleaded that they were only engaged to hew coal at the face. No decision has been given, but it is looked forward to with interest.

The iron trade is still unchanged, and a fair winter trade seems certain. There is a good deal of activity shown at various works to meet the new order of things. Bessemer pig is quoted at 62s. 6d., steel rails at £6 5s., iron at £5 15s.

I have just been favoured with a view of the report submitted by H.M. Commission on Mines. It is an important document, and will lead to a great deal of discussion. In the matter of blasting in mines the opinion given is calculated to allay any anxiety about the regulation being enforced.

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.

18th October, 1881.

4530. Attaching Valances, M. A. Dearden, Dalby.
4531. Colouring Matters, J. A. Dixon.—(*C. Kœnig, Germany.*)
4532. Confiture Preserves, H. A. Bonneville.—(*D. Cornilliac, Paris.*)
4533. Electric Lamps, R. R. Gibbs, Liverpool.
4534. Rinsing Bottles, J. Dolheiser, Cologne.
4535. Distilling Apparatus, C. Paulmann, London.
4536. Hot-blast Apparatus, H. Lake.—(*J. Long, U.S.*)
4537. Supplying Water, S. Hallam and J. W. Shepherd, Manchester.
4538. Decorticating Ramie, J. C. Mewburn.—(*J. B. Sauvadon, Paris.*)
4539. Tyres, W. H. Carmont, Manchester.
4540. Filter Presses, H. Newton.—(*A. Dehne, Germany.*)
4541. Generating Currents, R. Kennedy, Paisley.
4542. Velocipedes, F. W. Eicke, Beulah Hill.
4543. Boots and Shoes, H. Ovans, Dublin.
4544. Hyponitric Anhydride, E. Turpin, Paris.
4545. Steam Boilers, G. Hill, Liverpool.
4546. Boilers, E. Crompton & J. Cochran, Birkenhead.
4547. Water-tight Sliding Doors, E. Crompton and J. T. Cochran, Birkenhead.
4548. Velocipedes, S. Hall, London.
4549. Filing Metals, T. H. Whitehouse, Walsall.
4550. Steam Generators, R. Mills, London.
4551. Water-closets, G. E. Waring, jun., London.
4552. Dynamo Machines, P. Jensen.—(*T. Edison, U.S.*)
4553. Charging Batteries, P. Jensen.—(*T. Edison, U.S.*)
4554. Sewing Machines, M. H. Pearson, Leeds.
4555. Ozonised Oxygen, E. Hagen.—(*L. Q. and A. Brin, Paris.*)
4556. Self-lubricating Bearings, P. M. Justice.—(*L. Bastet, U.S.*)

19th October, 1881.

4557. Water-closets, J. A. Hornby, Menai Bridge.
4558. Registering Dynamometers, W. P. Thompson.—(*Transmitting Dynamometer Company, U.S.*)
4559. Generating Electricity, F. Newton, Taunton.
4560. Steam Boilers, S. Fox, Leeds.
4561. Destroying Putrescible Matter of House Sewage, J. B. Kinnear, London.
4562. Sawing Rails, J. H. Kitson, Leeds.
4563. Holders, H. J. Haddan.—(*W. Miles, jun., U.S.*)
4564. Sawing Machinery, H. Haddan.—(*C. Mürer, Metz.*)
4565. Supplying Water, W. Farley & J. Bond, Torquay.
4566. Open Fire-grates, W. A. Martin, London.
4367. Drilling Rocks, J. McCulloch and J. H. and J. M. Holman, Camborne.
4568. Combining Door Chains with Locks, H. Skerrett, Birmingham.
4569. Filtering Sugar, J. Roper, London.
4570. Hat Helmets, A. Wilkinson, Marylebone.
4571. Measurement of Electricity, E. G. Brewer.—(*T. A. Edison, U.S.*)
4572. Guards for Threshing Machines, R. Moore, Fulbourn, and J. W. Lee, Cambridge.
4573. Life-boats, W. R. Lake.—(*A. Holmes, U.S.*)
4574. Heating Tubes, S. Fox, Leeds.
4575. Testing Boiler Tubes, S. Fox, Leeds.
4576. Meters, E. G. Brewer.—(*T. A. Edison, U.S.*)
4577. Treatment of Iron, P. Jensen.—(*Ch. de Montblanc and L. Gaulard, Paris.*)
4578. Ventilating Stoves, W. A. Barlow.—(*F. Lonholdt, Germany.*)
4579. Breech-loading Fire-arms, H. E. Newton.—(*Colt's Patent Fire-arms Manufacturing Company, Incorporated, U.S.*)
4580. Sounding Apparatus, J. Schwartz, London.
4581. Belt-fasteners, W. H. Steil, Battersea.
4582. Supplying Electricity, A. M. Clark.—(*J. de Changy, Paris.*)
4583. Distribution of Disinfectants, T. F. Scott and A. J. Campion, London.

20th October, 1881.

4584. Boxes, W. H. Bennett, London.
4585. Double-barrel Fowling Pieces, L. Gye, London.
4586. Stop-valves, J. A. and J. Hopkinson, York.
4587. Plaiting Machines, J. Dowling, London.
4588. Fleece-dividers, C. Pieper.—(*G. Erben, Austria.*)
4589. Gas Engines, L. Bénier and A. Lamart, France.
4590. Chimney Flues, F. Wirth.—(*Gesellschaft des Emser Blei-and Silberworks, Germany.*)
4591. Generating Electricity, H. J. Haddan.—(*G. Dessaigne, Paris.*)
4592. Generating Electricity, A. Millar, Glasgow.
4593. Cleaning Grits, A. Besser, Vienna.
4594. Buffer Brake, W. Beck.—(*J. Canet, Paris.*)
4595. Sash Fasteners, J. Shillingworth, London.
4596. Washing Bottles, J. J. Harvey, Kidderminster.
4597. Safety Envelopes, W. W. de la Rue, London.
4598. Water-closets, G. Pitt.—(*J. Finck, Germany.*)
4599. Food for Horses, &c., J. H. Cox, Matlock.
4600. Velocipedes, G. Singer, Coventry.
4601. Ornamenting Glass, J. W. Savage, London.
4602. Breech-loading Fire-arms, H. E. Newton.—(*Colt's Patent Fire-arms Manufacturing Company, Incorporated, U.S.*)
4603. Fire-grates, T. E. Clark, Minehead.

21st October, 1881.

4604. Finishing Corn, E. Foden, Sandbach.
4605. Steam Boilers, J. and G. Tinker, and J. and R. Shenton, Hyde.
4606. Manufacturing Tea, J. Marrillier, London.
4607. Magneto-electric Machinery, H. Joel, Dalston.
4608. Gas-engines, W. Watson, Leeds.
4609. Ventilating, &c., J. Court, London.
4610. Door Locks, J. Mathisen, Christiania, Norway.
4611. Steam-presses, L. M. Schmiers.—(*Schmiers, Werner, and Stein, Saxony.*)
4612. Steam-presses, L. M. Schmiers.—(*Schmiers Werner, and Stein, Saxony.*)
4613. Looms, W. Hanson, Bradford.
4614. Treating Peat, J. A. London, London.
4615. Fastener for Straps, &c., L. Dee, London.
4616. Drying Agricultural Produce, M. E. G. Finch-Hatton and R. Thorpe, Lincoln.
4617. Electric Lamps, A. Clark.—(*H. Sheridan, U.S.*)
4618. Preventing Purloining of Letters, G. Nobes, London.
4619. Filter-presses, E. A. Pontifex and R. Gunning, London.
4620. Cistern Valves, H. T. Dawson, Chiswick.
4621. Reel, F. Wirth.—(*J. and E. Adt, Germany.*)
4622. Handles for Canes, E. Edwards.—(*W. Rösseler, Germany.*)

22nd October, 1881.

4623. Billiard Marking Boards, G. W. W. Edwards, Wolverhampton.
4624. Screw-presses, C. S. Mair, Glasgow.
4625. Steam-boiler Furnaces, G. Clarke, U.S.
4626. Crushing Ores, C. J. Appleby, London.
4627. Shoes for Horses, F. Bidder & M. Rowley, London.
4628. Treating Peat, A. Wilkinson, London.
4629. Gland Stuffing-boxes, J. Stidder, London.
4630. Wire Fences, F. C. Guilleaume, Germany.
4631. Vans, H. Mousell, Gloucester. and O. Lythgoe, Manchester.
4632. Secondary Batteries, J. S. Sellon, London.
4633. Ships' Davits, R. B. U. H. J. Duncan, Leicester.
4634. Fire-proofing, A. M. Clark.—(*O. Gilman, U.S.*)
4635. Treating Ores, F. M. Lyte, London.
4636. Paste-board Match-box, A. M. Clark.—(*La Société Anonyme de l'Imprimerie Marseillaise, France.*)
4637. Rotary Apparatus, A. J. Boult.—(*L. B. Villebonnet, France.*)
4638. Ventilating, F. H. Smith, Winchmore Hill.
4639. Sewing Machines, T. Giffen & J. Dodd, Glasgow.
4640. Roasting Coffee, J. Parnall, Bristol.
4641. Targets, W. R. Lake.—(*A. Boivin, Paris.*)

24th October, 1881.

4642. Vacuum Brake Apparatus, J. Gresham, Salford.
4643. Storing Boots, S. Goodwin & W. Barsby, Leicester
4644. Cleaning Brushes, E. Norcombe, Birmingham.
4645. Cutting Profiles, T. Morgan.—(*E. Bahn, Berlin.*)
4646. Bottles, C. M. Warner, London.
4647. Twin Screw Ships, T. R. Oswald, Southampton.
4648. Tiles, H. J. Haddan.—(*A. Vaillaumé, France.*)
4649. Advertising, H. Haddan.—(*H. Jousseaume, Paris.*)
4650. Shirts, J. W. Frost, London.
4651. Suspension for Beds, F. Lebacq, Belgium.
4652. Ships' Berths, W. R. Lake.—(*D. Parks, U.S.*)
4653. Wire Fencing, H. P. Deane, Bath.
4654. Electric Lamps, G. A. Andre, Dorking.
4655. Stoves, J. Hartley, Barrow-in-Furness.

Inventions Protected for Six Months on deposit of Complete Specifications.

4532. Confiture Preserves, H. A. Bonneville, Cannon-street, London.—A communication from D. Cornilliac, Paris.—*18th October*, 1881.
4544. Hyponitric Anhydride, E. Turpin, Paris.—*18th October*, 1881.
4563. Holders or Receptacles, H. J. Haddan, Kensington, London.—A communication from W. H. Miles, jun., New York, U.S.—*19th October*, 1881.
4573. Lifeboats, W. R. Lake, Southampton-buildings, London.—A communication from A. Holmes, Petaluma, U.S.—*19th October*, 1881.
4611. Steam-presses, L. M. Schmiers, Leipzig.—A communication from Schmiers, Werner, and Stein, Leipzig.—*21st October*, 1881.
4612. Steam-presses, L. M. Schmiers, Leipzig.—A communication from Schmiers, Werner, and Stein, Leipzig.—*21st October*, 1881.
4617. Electric Lamps, A. M. Clark, Chancery-lane, London.—A communication from H. B. Sheridan, Cleveland, U.S.—*21st October*, 1881.

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

4157. Ventilators, T. H. Blair, Turnskey.—*18th October*, 1878.
4166. Stoves, J. Stordy and F. Hampson, Manchester.—*19th October*, 1878.
4176. Washing Fabrics, J. W. Ashton, Hyde, and W. Mather, Salford.—*19th October*, 1878.
4178. Rotary Printing Machines, W. L. Wise, London.—*19th October*, 1878.
4255. Compound Steam-engines, A. B. Brown, Edinburgh.—*24th October*, 1878.
4667. Applying Tensile Strain, D. Lewis, Netherton.—*16th November*, 1878.
4155. Binding Corn, W. Woolnough and C. Kingsford, Kingston.—*18th October*, 1878.
4252. Lamps, A. E. Ragg, Bebington.—*24th November*, 1881.
4508. Lithographic Printing Machine, G. Mann and C. Pollard, Leeds.—*7th November*, 1878.
4172. Vacuum Brakes, F. W. Eames, Leeds.—*19th October*, 1878.
4179. Cultivating Land, T. Perkins, Hitchin, and T. Burrall, Peterborough.—*19th October*, 1878.
4188. Alkalies, E. W. Parnell, Liverpool—*21st October*, 1878.
4208. Electric Illumination, C. W. Siemens, London.—*22nd October*, 1878.
4201. Frictional Screw Gearing, J. Robertson, Glasgow.—*22nd October*, 1878.
4216. Boot and Shoe Heels, F. Richardson, U.S.—*22nd October*, 1878.
4206. Steam-pressure Engines, C. A. Parsons, London.—*23rd October*, 1878.
4265. Bicycles, &c., G. Singer, Coventry.—*24th October*, 1878.
4349. Pumps, G. V. Fosberry, London.—*29th October*, 1878.
4416. Combing Machines, C. D. Abel, London.—*1st November*, 1878.
4441. Fastenings for Pictures, G. Bookham, Birmingham.—*2nd November*, 1878.
4221. Steering Apparatus, M. S. Hassfeld, London.—*22nd October*, 1878.
4318. Fleshing, &c., Hides, W. R. Lake, London—*26th October*, 1878.

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

3443. Ships' Sleeping Berths, J. Johnson, Poplar.—*8th October*, 1874.
3601. Spinning Mules, J. Chisholm, Oldham.—*20th October*, 1874.
3641. Fire-resisting Material, R. R. Horne, Glasgow.—*22nd October*, 1874.
3657. Gas, S. Holman, London.—*26th October*, 1874.
4016. Preparing Flax, T. S. Kennedy, Leeds.—*23rd November*, 1874.
3808. Washing Clothes, T. Hawksworth and J. Chaffer, Thornecliffe.—*4th November*, 1874.
3632. Dyeing Threads, &c., A. M. Clark, London.—*21st October*, 1874.
3663. Electric Telegraphs, J. Muirhead, jun., Wimbledon.—*23rd October*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 11th November, 1881.

2461. Performing Finger Exercises, F. H. F. Engel. London.—A com. from F. Moller.—*4th June*, 1881.
2602. Copying Presses, J. Mitchell, Sheffield.—*15th June*, 1881.
2604. Cooking Eggs, W. H. Beck, London.—A communication from P. L. Labarbe.—*15th June*, 1881.
2610. Securing Metal Boxes, W. Downie, Wood Green, and W. F. Lotz, London.—*15th June*, 1881.
2611. Distribution of Fluid, W. L. Wise, London.—A communication from C. Roux.—*15th June*, 1881.
2613. Velocipedes, A. L. Bricknell, Brixton.—*16th June*, 1881.
2616. Chimney Pieces, &c., G. Hodson, Loughborough.—*16th June*, 1881.
2633. Window Blinds, S. Hodgkinson, Manchester.—*16th June*, 1881.
2642. Corkscrews, F. A. Whelan, London.—*17th June*, 1881.
2643. Garden Syringes, F. Cooper, Handsworth.—*17th June*, 1881.
2667. Agricultural Harrows, E. Walker, Newark-upon-Trent.—*18th June*, 1881.
2668. Safety Pins, L. A. Groth, London.—A communication from J. Levi.—*18th June*, 1881.
2673. Extracting Silver, W. J. Fuller, London.—*18th June*, 1881.
2677. Folding Seat, J. Rettie, London.—*18th June*, 1881.
2708. Watch Escapement, A. Browne, London.—A communication from E. Wensch.—*20th June*, 1881.
2711. Electric Danger Alarms, T. A. B. Putnam, U.S.—*21st June*, 1881.
2745. Treatment of Animal Matter, E. Davies, Liverpool, and E. Massey, Dewsbury.—*23rd June*, 1881.
2746. Boots and Shoes, D. W. Cuthbert, Glasgow.—*23rd June*, 1881.
2752. Packing, F. des Vœux, London.—A communication from G. V. Wagenen.—*23rd June*, 1881.
2762. Adjusting Action, T. Barnby, Birmingham.—*24th June*, 1881.
2778. Steam Generators, W. Cooke and D. Mylchreest, Liverpool.—*25th June*, 1881.
2788. Obtaining Light by Electricity, B. J. B. Mills, London.—A com. from F. Million.—*25th June*, 1881.
2797. Treating Gaseous Fuel, S. Lloyd, Birmingham.—*25th June*, 1881.
2801. Circulating Water Boilers, F. Hocking, Liverpool.—*27th June*, 1881.
2817. Lamps, W. R. Lake, London.—A communication from E. P. Follett and A. Bixby.—*27th June*, 1881.
3009. Tills for Preventing Fraud, B. W. Webb, London.—*8th July*, 1881.
3076. Purification of Alcohol, W. R. Lake, London.—A communication from L. Salzer.—*14th July*, 1881.
3178. Securing Rubber Threads, T. Taylor, Derby.—*21st July*, 1881.
3190. Electric Lamps, R. H. Hughes, London.—*21st July*, 1881.
3482. Lamps, W. Spence, London.—A communication from A. Rinklake and C. Bolm.—*11th August*, 1881.
3484. Bottles and Jars, C. M. Taylor, Snaresbrook.—*11th August*, 1881.
3496. Umbrellas, A. McMillan, London.—*12th August*, 1881.
3630. Facing Bricks, C. Drake, Battersea.—*20th August*, 1881.
3714. Furnaces, &c., T. Barrow, Rock Ferry.—*25th August*, 1881.
3951. Regenerative Furnaces, S. Pope, Newburn.—*13th September*, 1881.
4135. Shoes for Warming Feet, G. H. Ellis, London.—*26th September*, 1881.
4163. Treatment of Brewers' Waste, A. G. Salamon, Clapham.—*27th September*, 1881.
4215. Knitting Machinery, W. H. McNary, Berlin.—*29th September*, 1881.
4532. Confiture Preserves, H. A. Bonneville, London.—Com. from D. Cornilliac.—*18th October*, 1881.

Last day for filing opposition, 15th November, 1881.

2688. Boss Holders, W. A. Hudgell, Hendon.—*20th June*, 1881.
2692. Printing Machines, F. Engel, Germany.—A com. from F. Schlotke & L. Hesse.—*20th June*, 1881.
2696. Combined Box, J. F. Walters, London.—*20th June*, 1881.
2698. Diving Apparatus, G. H. Heinke, London.—*20th June*, 1881.
2704. School Slates, J. F. Walters and W. Pickering, London.—*20th June*, 1881.
2707. Treating Liquids, W. R. Lake, London.—A com. from C. W. Ramsay.—*20th June*, 1881.
2710. Air-compressing Engines, E. Holt, Radcliffe.—*21st June*, 1881.
2720. Washing Wool, J. Petrie, jun., Rochdale.—*21st June*, 1881.
2723. Raising Screw-propellers of Ships, G. Leslie, Fairfield.—*21st June*, 1881.
2736. Combing Wool, J. and W. Baldwin, R. Haddon, and J. C. Dyson, Halifax.—*22nd June*, 1881.
2753. Heating Furnaces, T. Adams, Brierly Hill.—*23rd June*, 1881.
2754. Reservoir Pens, W. R. Lake, London.—A communication from F. X. Poznánski.—*23rd June*, 1881.
2764. Adjustable Partitions, W. S. Hunter, Canada.—*24th June*, 1881.
2765. Motive-power Engine, J. Levassor, Paris.—*24th June*, 1881.
2796. Lozenges, W. Sharp, Birmingham.—*25th June*, 1881.
2798. Raising Ale, J. Bennett, Worcester, J. Herd and B. P. Walker, Birmingham.—*25th June*, 1881.
2806. Sheep Shears, W. E. Gedge, London.—A communication from J. J. Bogard.—*27th June*, 1881.
2832. Laundry Irons, F. A. K. Cook, Londonderry.—*28th June*, 1881.
2878. Wagon Axles, S. Bradley, Kidderminster.—*1st July*, 1881.
2915. Breech-loading Fire-arms, C. D. Abel, London—A com. from F. Mannlicher.—*4th July*, 1881.
2929. Elastic Bulb Syringes, J. A. Grant, Canada.—*5th July*, 1881.
3169. Dynamo-electric Machines, A. M. Clark, London.—A com. from W. Laing.—*20th July*, 1881.
3214. Electric Lamps, A. M. Clark, London.—A com. from L. Bouteilloux & W. Laing.—*22nd July*, 1881.
3276. Adjusting Looking-glasses, C. E. Bulling, London.—*26th July*, 1881.
3292. Fastening Doors, A. Schlanders, London.—A communication from J. P. Black.—*27th July*, 1881.
3314. Treating Maize, T. Muir, Glasgow.—*29th July*, 1881.
3696. Electro-magnetic Clocks, C. Shepherd, London.—*24th August*, 1881.
3717. Cotton Cloths, J. Winter and T. Ivers, Farnworth.—*25th August*, 1881.
3726. Combing Machines, L. de Pass, London.—A communication from J. Imbs.—*26th August*, 1881.
3740. Tanning Hides, G. L. Loversidge, Rochdale.—*27th August*, 1881.
3760. Sewing Machines, H. Bland, Luton.—*29th August*, 1881.
3776. Horseshoe Forging-machines, S. Pitt, Sutton.—A com. from C. W. Woodford.—*30th August*, 1881.
3782. Velocipedes, J. White, Earlsdon, and J. Asbury, Coventry.—*30th August*, 1881.
3790. Covering Cables, W. R. Lake, London.—A communication from S. D. Strohm.—*31st August*, 1881.
3792. Steel, C. W. Siemens, London.—*31st August*, 1881.
3798. Heating Water, L. Dove, London.—*31st August*, 1881.
3812. Transmitting Messages, W. R. Lake, London.—A com. from A. & F. Johnson.—*2nd September*, 1881.
3845. Moulding Bottles, A. M. Clark, London.—A com. from Aupècle and Co.—*3rd September*, 1881.
4133. Purifying Gas, L. T. Wright, Beckton.—*26th September*, 1881.
4147. Roasting Coffee, W. R. Lake, London.—A communication from D. Strang.—*26th September*, 1881.
4259. Registering Fares, H. H. M. Smith, London.—*1st October*, 1881.
4303. Paper-folding Machines, R. Cundall, Thornton.—*4th October*, 1881.
4445. Screws, &c., W. R. Lake, London.—A communication from Harvey Screw Company, Incorporated.—*12th October*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 21st October*, 1881.)

1764. Coating Lead with Tin, A. Gutensohn, London.—*23rd April*, 1881.
1765. Motive Power Engines, E. Edwards, London.—*23rd April*, 1881.
1772. Bobbins, J. H. and L. Wilson, Cornholme.—*25th April*, 1881.
1790. Diving Costumes, S. J. Woodhouse, Leeds.—*26th April*, 1881.
1798. Steam Generators, B. Brazelle, St. Louis, U.S.—*26th April*, 1881.
1810. Combination Garment, W. R. Lake, London.—*26th April*, 1881.
1814. Button-hole Sewing Machine, W. Morgan-Brown, London.—*27th April*, 1881.
1823. Printing Machines, E. F. Kelly, London.—*27th April*, 1881.
1825. Padding Colours, G. W. Clayton, Manchester.—*27th April*, 1881.
1845. Necktie Fastening, J. Hinks, T. Hooper, and F. R. Baker, Birmingham.—*28th April*, 1881.
1848. Extinguishing Fire, J. K. J. Foster, Bolton.—*28th April*, 1881.
1849. Treatment of Coffee Berry, A. Gough, Buckingham.—*29th April*, 1881.
1850. Impregnating Water, J. K. J. Foster, Bolton,—*28th April*, 1881.
1885. Electric Telephones, W. Main, Brooklyn, U.S.—*2nd May*, 1881.
1888. Music Stools, A. W. L. Reddie, London.—*2nd May*, 1881.
1903. Fireplaces, M. Ingram, Manchester.—*3rd May*, 1881.
1923. Separating Iron from Charcoal, D. MacEachran, Greenock.—*4th May*, 1881.
1982. Smoothing Irons, T. M. Cracken, Ardmore.—*7th May*, 1881.
1989. Fastenings for Albums, S. Posen, London—*7th May*, 8181.
2463. Disintegrating Machines, C. E. Hall, Sheffield.—*4th June*, 1881.
2540. Crushing Machinery, C. E. Hall, Sheffield.—*10th June*, 1881.
2648. Working Targets, W. B. Blaikie, Edinburgh.—*17th June*, 1881.
3274. Lamp Casings, D. Graham, Glasgow.—*26th July*, 1881.
3461. Low-water Alarm, C. H. Smith, Whalley.—*10th August*, 1881.
3474. Self-inking Pad, S. Reid, Newcastle-on-Tyne—*11th August*, 1881.
3549. Rolls, T. Brown, Walsall.—*16th August*, 1881.

(*List of Letters Patent which passed the Great Seal on the 25th October*, 1881.)

1794. Bottle-stoppers, H. A. Bonneville, London.—*26th April*, 1881.
1816. Valves for Hot Water, T. G. Messenger, Loughborough.—*27th April*, 1881.
1818. Regulating Flow of Gases, F. W. Clark, London.—*27th April*, 1881.
1821. Looms for Weaving, F. S. Witham, Nelson.—*27th April*, 1881.
1826. Galvanic Soles for Shoes, G. W. von Nawrocki, Berlin.—*27th April*, 1881.
1827. Sowing Seeds, W. L. Wise, London.—*27th April*, 1881.
1828. Gunpowder, E. A. Brydges, Upton.—*27th April*, 1881.
1829. Nails, J. L. Heward, Newport.—*27th April*, 1881.
1838. Cattle Food, E. J. T. Digby, London.—*28th April*, 1881.
1840. Sweetmeats, S. P. Wilding, London.—*28th April*, 1881.
1842. Extracting Soluble Matters, E. B. Hart, Lisnacree.—*28th April*, 1881.
1851. Carving Forks, W. B. Hatfield, Sheffield.—*29th April*, 1881.
1855. Preparing Wool, &c., R. Cleg and J. Taylor, Oldham.—*29th April*, 1881.
1865. Lime-kilns, E. Crossland, Arnside.—*29th April*, 1881.
1870. Separating Grain, S. Handscombe and C. Dellar, Melbourne.—*30th April*, 1881.
1872. Breech-loading Small-arms, H. Walker, Birmingham.—*30th April*, 1881.
1929. Alarm Signals, P. A. de Sparre, Paris.—*4th May*, 1881.
1932. Weaving Fancy Fabrics, T. Stevens, Coventry.—*4th May*, 1881.
1939. Getting Coal, C. S. Smith, Leicester, and T. Moore, Shipley.—*4th May*, 1881.
1945. Separating Solid Particles, L. Fiechter, Liverpool.—*4th May*, 1881.
1950. Valve-gear, R. H. Robinson, Derby.—*5th May*, 1881.
1976. Stoves, J. Carrick, Glasgow.—*6th May*, 1881.
1998. Speculum Tubes, J. H. Aveling and J. Hicks, London.—*7th May*, 1881.
2050. Tram Rails, W. Sterling, Rusholme.—*11th May*, 1881.
2055. Looms for Weaving, E. Wilson, Lancaster.—*11th May*, 1881.
2106. Rock Tunnelling, H. N. Penrice, Hatfield.—*13th May*, 1881.
2110. Vacuum Brakes, A. Watt, Liverpool.—*14th May*, 1881.
2156. Torpedo Boats, J. H. Johnson, London.—*17 h May*, 1881.
2172. Fire-escape Ladders, A. M. Clark, London.—*18th May*, 1881.
2190. Paper Bags, E. P. Alexander, London.—*19th May*, 1881.
2210. Paper, T. Wilson, Hollingbourne.—*14th May*, 1881.
2378. Fire-arms, W. Nokes, Birmingham—*31st May*, 1881.
2399. Reducing Grain, W. P. Thompson, London.—*31st May*, 1881.
2488. Explosive Compounds, C. D. Abel, London.—*3th June*, 1881.
2620. Tools for Drawing out Tubes, W. C. Dixon, Basingstoke.—*16th June*, 1881.
2828. Ventilating Ships, J. Colling, Sunderland.—*28th June*, 1881.
3472. Dynamo-electric Machines, E. J. Harling and E. Hartmann, London.—*11th August*, 1881.
3473. Electric Lamps, E. J. Harling and E. Hartmann, London.—*11th August*, 1881.
3522. Knitting Machinery, A. Paget, Loughborough.—*13th August*, 1881.
3565. Glove Fasteners, W. R. Lake, London.—*16th August*, 1881.

List of Specifications published during the week ending October 22nd, 1881.

855, 6d.; 923, 6d.; 994, 6d.; 1017, 8d.; 1023, 6d.; 1029, 6d.; 1042, 6d.; 1060, 8d.; 1064, 4d.; 1078, 1s.; 1101, 4d.; 1111, 6d.; 1117, 1s.; 1120, 6d.; 1030, 8d.; 1136, 8d.; 1140, 6d.; 1147, 6d.; 1115, 6d.; 1154, 6d.; 1163, 6d.; 1164, 8d.; 1168, 6d.; 1184, 8d.; 1185, 6d.; 1188, 6d., 1190, 8d.; 1205, 2d.; 1206, 6d.; 1208, 2d.; 1210, 6d.; 1211, 6d.; 1213, 2d.; 1216, 6d.; 1217, 2d.; 1219, 2d.; 1220, 2d.; 1221, 4d.; 1223, 6d.; 1224, 8d.; 1226, 6d.; 1227, 6d.; 1228, 6d.; 1329, 2d.; 1230, 2d.; 1232, 2d.; 1234, 2d.; 1235, 6d.; 1236, 8d.; 1237, 2d.; 1238, 1s.; 1240, 6d.; 1242, 6d.; 1243, 4d.; 1244, 6d.; 1245, 2d.; 1246, 2d.; 1247, 6d.; 1248, 6d.; 1249, 6d.; 1250, 6d.; 1251, 6d.; 1252, 6d.; 1253, 2d.; 1254, 2d.; 1255, 6d.; 1257, 6d.; 1258, 6d.; 1259, 2d.; 1261, 10d.; 1262, 2d.; 1264, 2d.; 1266, 2d.; 1267, 4d.; 1268, 6d.; 1262, 2d.; 1270, 2d.; 1271, 2d.; 1272, 8d.; 1273, 6d.; 1276, 6d.; 1277, 4d.; 1278, 2d.; 1279, 8d.; 1280, 6d.; 1281, 2d.; 1282, 6d.; 1283, 4d.; 1284, 8d.; 1225, 2d.; 1287, 2d.; 1288, 2d.; 1289, 4d.; 1290, 2d.; 1291, 4d.; 1292, 2d.; 1293, 2d.; 1296, 8d.; 1297, 4d.; 1300, 6d.; 1301, 4d.; 1303, 6d.; 1305, 6d.; 1306, 2d.; 1307, 2d.; 1309, 6d.; 1311, 6d.; 1312, 6d.; 1313, 2d.; 1314, 2d.; 1316, 2d.; 1317, 2d.; 1318, 6d.; 1320, 2d.; 1322, 2d.; 1323, 4d.; 1324, 6d.; 1326, 2d., 1333, 2d.; 1335, 2d.; 1336, 6d.; 1338, 2d.; 1339, 2d.; 1340, 2d.; 1341, 2d.; 1344, 2d.; 1349, 6d.; 1354, 6d.; 1362, 4d.; 1380, 2d.; 1389, 8d.; 1410, 8d.; 1411, 6d.; 1437, 6d.; 1439, 6d.; 1441, 2d.; 1453, 8d.; 1502, 6d.; 1519, 6d.; 1535, 6d.; 1604, 6d.; 1610, 6d.; 3142, 6d.; 3157, 4d.; 3278, 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.

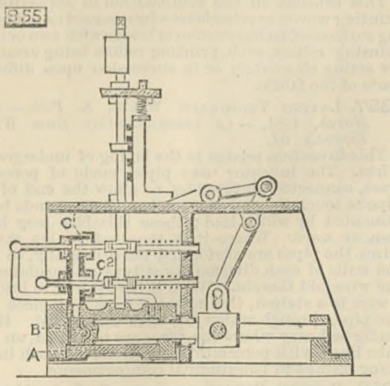
Prepared by ourselves expressly for THE ENGINEER *at the office of Her Majesty's Commissioners of Patents.*

923. Apparatus for Heating and Cooling Fluids, *G. C. Gibbs.*—*3rd March*, 1881. *6d.*

This consists of a lengthened chamber in the form of a spiral coil, and the section of the said chamber is shallow in the direction of its length, but of considerable depth across it. The walls of this chamber are either plain or corrugated. The chamber has apertures at the extremity of the outermost curve, and at the extremity of the innermost curve of the coil.

855. Working and Locking Railway Signals and Points, *J. C. Brush.*—*1st March*, 1881. *6d.*

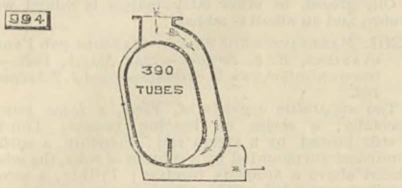
The hydraulic power is employed for actuating the main levers, to which the signals and points are connected in the usual way. By this means greater force is furnished for working the points and signals than can readily be commanded by manual power, and consequently signals and points at greater distances from the operator may be worked, notwithstanding the increased friction involved in such cases. Each lever is furnished with a hydraulic cylinder A having a piston B, the rod of which is suitably connected with



the said lever. The two ends of the cylinder are furnished with proper connections, and valves G^1 and G^2 so as to permit of the pressure being applied on either side of the piston.

994. Condensing Apparatus of Steam Engines, *J. Spence.—8th March, 1881.—(A communication from J. C. Spence.)* 6d.

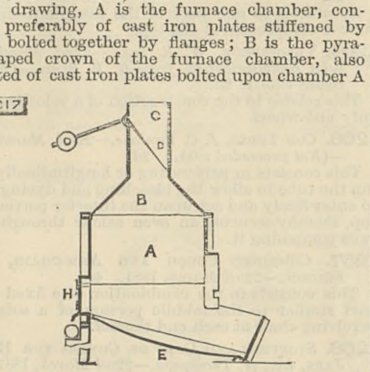
This consists essentially in the introduction of the exhaust steam into the lower portion at or near the



bottom, and the cold water through the tubes in the portion furthest from the condensed feed water.

1017. Furnaces for Burning Cane Trash, &c., *A. M. Clark.—9th March, 1881.—(A communication from M. J. L. Marie.)* 8d.

In the drawing, A is the furnace chamber, constructed preferably of cast iron plates stiffened by ribs, and bolted together by flanges; B is the pyramidal-shaped crown of the furnace chamber, also constructed of cast iron plates bolted upon chamber A



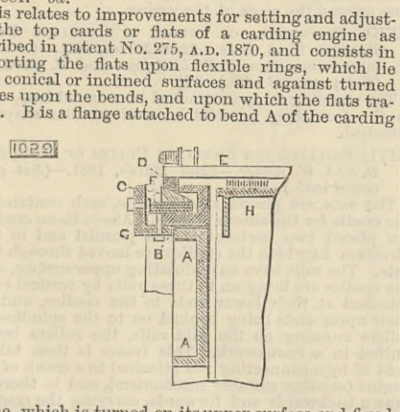
and surmounted by the hopper C in which the bagasse is dried, and through which it is fed to the furnace; D is the self-acting balance door or valve placed within the hopper in an inclined position; E are the fire bars at the lower part of the furnace; H are doors just above the fire bars for giving access to the furnace.

1023. American Organs, Harmoniums, Pianofortes, &c., *G. Green and C. Savage.—10th March, 1881.* 6d.

This consists in the employment of a grooved and tongued or dovetailed notch piece in the hammer butt.

1029. Carding Cotton, &c., *F. Mills.—10th March, 1881.* 6d.

This relates to improvements for setting and adjusting the top cards or flats of a carding engine as described in patent No. 275, A.D. 1870, and consists in supporting the flats upon flexible rings, which lie upon conical or inclined surfaces and against turned flanges upon the bends, and upon which the flats traverse. B is a flange attached to bend A of the carding



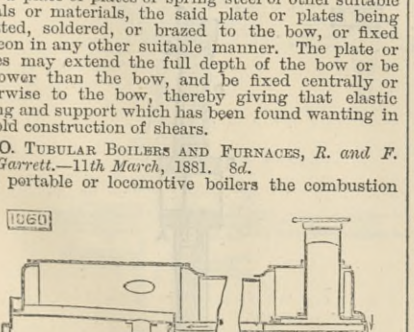
engine, which is turned on its upper surface and fixed concentric with and having its upper surface parallel to the axis of cylinder H. On the flange slides the segment of a frustrum of a cone C operated by screws F held in brackets G. On the inclined surface of the cone is placed a segment of a flexible ring D, also lying against a second turned flange forming part of flange B, so that it is prevented lateral motion, but can slide in a radial direction up and down the cone and against the flange when the flats E which lie upon it are set or adjusted.

1042. Sheep-shears, &c., *T. A. and R. H. Sorby.—11th March, 1881.* 6d.

This consists principally in fitting or fixing to the bow either inside or outside, or both inside and outside, a plate or plates of spring steel or other suitable metals or materials, the said plate or plates being rivetted, soldered, or brazed to the bow, or fixed thereon in any other suitable manner. The plate or plates may extend the full depth of the bow or be narrower than the bow, and be fixed centrally or otherwise to the bow, thereby giving that elastic spring and support which has been found wanting in the old construction of shears.

1060. Tubular Boilers and Furnaces, *R. and F. Garrett.—11th March, 1881.* 8d.

In portable or locomotive boilers the combustion



chamber C is cut off from the furnace A by extending the bridge B, or a screen which serves the purpose of a bridge, to a height approaching near to the crown of the furnace, and into this chamber at or about the level with this bridge heated air is admitted, which meets the gases of combustion as they pass over the bridge, and mingles with them to impart the requisite amount of oxygen thereto for ensuring their conversion into flame. Extending through the boiler at a slightly lower level than the crown of the furnace is a horizontal row of air tubes, which reach from the tube plate of the combustion chamber to and through the smoke-box.

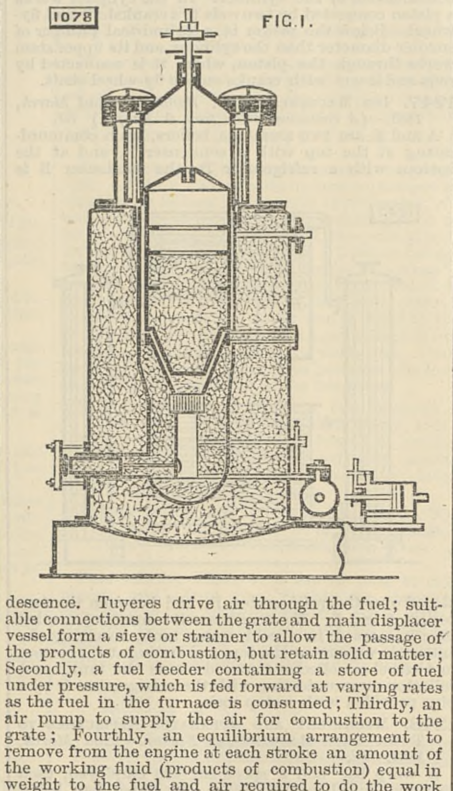
1064. Table, *A. Lloyd.—11th March, 1881.—(Not proceeded with.)* 4d.

The table when closed has the appearance of an ordinary table, the top working on hinges attached to the back frame, and when open forms a dressing table.

1078. Caloric Motor Engines, &c., *H. C. F. Jenkin and A. C. Jameson.—12th March, 1881.* 1s.

This consists in combining with a Stirling engine, First, a furnace or grate surrounded by non-conducting and refractory material, in which coke or other solid fuel burns under pressure in a state of vivid incan-

FIG. 1.



descence. Tuyeres drive air through the fuel; suitable connections between the grate and main displacer vessel form a sieve or strainer to allow the passage of the products of combustion, but retain solid matter; Secondly, a fuel feeder containing a store of fuel under pressure, which is fed forward at varying rates as the fuel in the furnace is consumed; Thirdly, an air pump to supply the air for combustion to the grate; Fourthly, an equilibrium arrangement to remove from the engine at each stroke an amount of the working fluid (products of combustion) equal in weight to the fuel and air required to do the work during each stroke, and by which the working fluid is expanded down to about one atmosphere before being ejected. These four parts are combined with the main displacer vessel, regenerator, refrigerator, working cylinder, and other parts of a Stirling engine. Further details consist, First, in an arrangement to allow fire-brick to be used to line or form the hot end of the main displacer chamber; Secondly, the air dis-

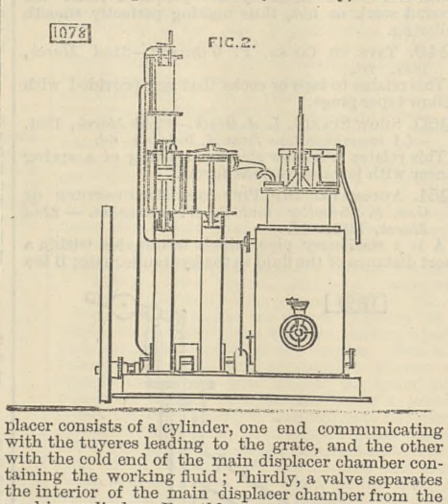


FIG. 2.

placer consists of a cylinder, one end communicating with the tuyeres leading to the grate, and the other with the cold end of the main displacer chamber containing the working fluid; Thirdly, a valve separates the interior of the main displacer chamber from the working cylinder; Fourthly, a cut-off valve connected with the engine governor is placed between the displacer vessel and the working cylinder; Fifthly, a fresh air reservoir contains air at a pressure to enable it to flow into the grate when the engine is stopped for any considerable period; Sixthly, a reservoir is provided, into which the products of combustion may be taken from the cold end of the displacer vessel; Seventhly, strainers are placed near the cold end of the regenerator to prevent grit or ashes being carried into the working cylinder, the equilibrator, or the air displacer. Fig. 1 shows the construction of the main displacer vessel and its adjuncts, and Fig. 2 shows the complete form of engine.

1101. Bricks, &c., *M. E. Dearnaly.—14th March, 1881.* 4d.

This consists in the employment of T-headed binders fitting into recesses formed in bricks.

1111. Expanding Rollers or Apparatus for Stretching Fabrics, *J. B. Liddell and P. Hawthorn.—15th March, 1881.* 6d.

This consists in wheels, sections, or parts of a combination roller arranged to revolve on axes which are inclined with respect to a common straight line, the inclination of the axes of the wheels increasing in proportion as they are more remote from the centre of the series.

1117. Safety Fittings for Saddles, *H. S. Wilton and B. S. Weston.—15th March, 1881.* 1s.

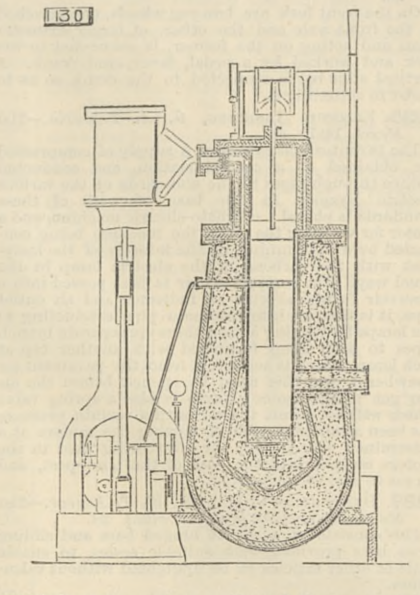
This relates partly to the means of attaching stirrups to the stirrup leathers, and to attaching the stirrup leathers to the saddle.

1120. Lamps, *S. Pitt.—15th March, 1881.—(A communication from W. B. Robbins.)* 6d.

This comprises, First, a flat wick of great breadth and of peculiar conformation; Secondly, a removable wickway section, which is thermally insulated at its lower edge from that portion of the wickway that communicates with the front, and whose upper edge is provided with removable burner plates, of which one plate is adjustable towards and from the other so as to enable the narrowing or widening of wickway at will of the user; Thirdly, a peculiarly constructed and arranged wick elevating device.

1130. Caloric Motor Engine Using Gas as Fuel, *H. C. F. Jenkin and A. C. Jameson.—16th March, 1881.* 8d.

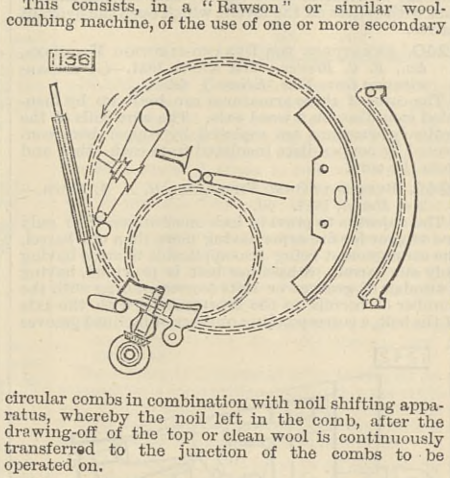
This relates to the class of engine described in patent No. 1078, A.D. 1881, and consists in using as the working fluid the products of combustion or oxidation of inflammable or combustible or oxidisable gas instead of air, and the heat is originally supplied to the working fluid by connection from gas and air or oxygen caused to combine in or on a "gas grate" before entering the displacer chamber. This gas grate consists of a small chamber lined with a refractory and non-conducting material capable of retaining and resisting a great continuous heat and of allowing continuous combustion of fuel to be carried on therein. The grate may be filled with or its bars formed of platinum gauze and pipe-clay, fire-clay, and asbestos, which, when heated, have the power of glowing without exciting explosion, or to any great extent flame, when a mixture of air and gas is blown or carried in a



current along the surface or through the mass. A is the grate or furnace surrounded by refractory non-conducting material, and filled with the platinum or other substance to facilitate the combustion of the gases. The engine is otherwise substantially the same as that described in above-mentioned patent.

1136. Combing Wool, &c., *W. R. Lake.—16th March, 1881.—(A communication from F. G. Lange.)* 8d.

This consists, in a "Rawson" or similar wool-combing machine, of the use of one or more secondary



circular combs in combination with noil shifting apparatus, whereby the noil left in the comb, after the drawing-off of the top or clean wool is continuously transferred to the junction of the combs to be operated on.

1140. Handles for Shovels, &c., *A. M. Clark.—16th March, 1881.—(A communication from W. H. Johnson.)* 6d.

This consists in providing the round or hand grip at its ends with knobs below its axis, and in providing the ends of the curved pieces with mortices to correspond, and in rivetting or bolting the round or hand grip between the curved pieces by a bolt or rivet which passes through near the centre of the round or hand grip and above the tenons and mortices, and in providing the rivet with oval headed washers; also in providing an intermediate brace of wood or metal, or both, rivetted to the curved pieces in such manner as to prevent the curved pieces from straightening.

1147. Production of Transparent Ice, *H. J. West.—16th March, 1881.* 6d.

This consists essentially in connection with moulds or cans for the formation of blocks or slabs of ice of the use of open-ended chambers formed of insulating or non-conducting material, in which chambers agitators are reciprocated or rotated horizontally for the purpose of producing motion of the water to be frozen over the surfaces of the ice as it forms in the parts of the moulds or cans external to such chambers.

1151. Firemen's Dresses, &c., *C. Wraa.—16th March, 1881.* 6d.

This consists essentially in a fireman's dress having an outer part which is soaked in water and an inner waterproof part, and provided with a reservoir for compressed oxygen or air, or with a smoke filter which will enable the firemen to enter and remain a short time in fire and smoke without the water and air supply hose.

1154. Holding or Packing Bottles, *J. Packham and J. Pelton.—16th March, 1881.* 6d.

The apparatus consists of laths or strips connected together by their ends so as to form the sides or walls of a number of angular compartments.

1163. Desiccating Eggs, &c., *E. P. Alexander.—17th March, 1881.—(A communication from L. J. Cadwell.)* 6d.

The substance to be treated is spread out on an endless travelling or other evaporating surface, subjected to the action of a current of hot or cold air, and when dry is broken up or disintegrated by the pressure of an adjustable suspended roller, and is then removed by a scraper, which directs it into drying pans where the operation is completed.

1164. Lock-stitch Sewing Machines, *B. Hunt.—17th March, 1881.—(A communication from J. Bond, jun., and C. M. Swain.)* 8d.

This consists essentially of a sewing machine in which the following elements are combined, viz., First, a fixed shuttle or spool case; Secondly, a uniformly rotating hook for carrying the needle thread round the spool case; Thirdly, a reciprocating needle; Fourthly, mechanism whereby the hook is turned to the extent of one revolution, while the needle makes one complete up-and-down movement; and Fifthly, a device for taking up the needle thread, tightening the stitch, and releasing the said thread during one revolution of the hook.

1168. Indicating Apparatus to be Placed at the Corners of Streets for Advertising, &c., *W. R. Lake.—17th March, 1881.—(A communication from P. J. Pointe and C. P. Porcher.)* 6d.

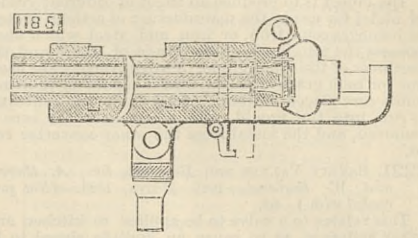
The apparatus comprises a sheet of paper or textile fabric of considerable length placed within a box or case and provided with addresses and other information, and having its ends wound upon rollers, which may be rotated from the exterior of the said box or case in one or the other direction according to the motion desired to be imparted to the said sheet.

1184. Pipe Joints, *J. A. Berly.—18th March, 1881.—(A communication from L. Langlois.)* 8d.

This consists in the general use of a ring made of an elastic or compressible material, as india-rubber, lead, &c., of a hollowed shape for the fixing together of mechanical organs which have to be assembled in air or water-tight joints.

1185. Machine Guns, *F. Löbel.—18th March, 1881.* 6d.

This consists, First, in the method of loading the machine gun by means of separate cartridge-boxes filled with cartridges and dropped in succession into position behind the breeches of the barrels; Secondly, in the method of tightening such cartridge-boxes in position by means of one or more screws or cams acting upon a movable block behind the cartridge-box; Thirdly, in the method of adjusting the cartridge-boxes in position by means of conical studs and



recesses; Fourthly, in the firing pins carried by one or more movable bars actuated by springs behind the movable plate which tightens up the cartridge-boxes; Fifthly, in the methods of drawing back and releasing the movable bar or bars carrying the firing pins; Sixthly, in movable supports carrying the empty cartridge-box when the latter is released and actuated by an excentric or cam at intervals. The drawing is a longitudinal section through the barrels.

1188. Manufacture of Alkali, *J. Mactear.—18th March, 1881.* 6d.

This consists, First, in the combination with the black-ash furnace employed in the alkali manufacture of one or more travelling beds for receiving the black-ash when discharged from the furnace; Secondly, in the employment in connection with the black-ash furnace used in the alkali manufacture of a rotating table, alone or combined with one or more travelling beds.

1190. Cutting and Finishing the Teeth of Combs, &c., *F. H. F. Engel.—18th March, 1881.—(A communication from the New York Hamburger Gummiwaaren Cie.)* 6d.

This consists principally in the combination of a rotary arbor or mandril carrying a saw or polishing disc, a yoke or frame comprising bearings for said arbor or mandril, and a shaft to which said yoke or frame is rigidly attached, and having an oscillating motion imparted to it.

1205. Supports or Feet for Pianos, &c., *H. J. Haddan.—19th March, 1881.—(A communication from J. Goetgeluck.)—(Not proceeded with.)* 2d.

This consists in attaching to the foot or base a plate having a spherical projection in the centre, and fitting into a correspondingly shaped recess formed at the top of a movable plate which carries at its under side the roller.

1206. Electrical Apparatus for Automatically Recording Time Signals, &c., *R. R. Harper.—19th March, 1881.* 6d.

The inventor uses a paper dial in connection with and driven by an ordinary clock, this dial being marked off into days, hours, minutes, &c., according as the clock is an eight-day, or only a daily one. At a particular point in the dial is fixed an electro-magnet, and at this point the time marked on the dial by a pointer provided is always the same as that indicated by the clock, that is, the dial is driven in unison with the clock, but the pointer is fixed. The effect of a current being sent into the electro-magnet, by completing the circuit through a contact piece, is to cause the magnet to act on its armature, which is a centred lever, one end forming the armature, and the other being free to press against a spring push furnished with a sharp point, which, when the one end of the lever is attracted, is pushed by the other through a slot in the dial so as to puncture the paper. On the current ceasing the lever returns to its normal position, the spring push doing the same. The apparatus can be used as a watchman's detector, registering the exact times he has been at given points of his round and given the required signals. The signal is given by simply pressing down ordinary contact keys placed at the required points, and so completing the circuit. Some slight alteration in the mechanism of the push point is, however, necessary to adapt the apparatus for this purpose, owing to the different points from which the signals are sent.

1208. Presses, *E. Hunt.—19th March, 1881.—(Not proceeded with.)* 2d.

This relates to the combination of a screwed shaft with toggle links and other parts of the press. The platen is connected to the head of the press by two pairs of toggle links, and the screwed shaft is carried in stationary bearings, the nuts being connected to the toggle links either by long links, or the lower toggle links are extended beyond the middle toggle joints.

1210. Baths, &c., *J. Bernard.—19th March, 1881.* 6d.

The bath consists of an inner and outer shell united by a flange, and between which the heating medium circulates. The bath may be surrounded by a space through which air circulates and is heated before entering the bath.

1211. Button-hole Sewing Machines, *H. Mills.—19th March, 1881.—(A communication from D. Mills.)* 6d.

This relates to machines for sewing or stitching button holes of the class which are finished and strengthened at each end by a bar formed of a series of long stitches extending transversely to the length of the button-hole. The invention is especially designed for application to machines having a cloth clamp arranged in combination with a vertically reciprocating needle, and it consists, First, in the detaining device in combination with the let-off device provided with a regulating screw to vary the length of the stitches; Secondly, in improvements in the detaining device, so as to be able to increase or diminish the extent of the projection or high surface of the cam, and thereby vary the proportion of the number of stitches in the sides to that of the stitches in the ends or bars; Thirdly, the combination with the primary slide of the cloth clamp of devices for regulating the length of the stitches and the proportion of the number of stitches in the sides and bars.

1213. Copying Presses, *G. W. von Nawrocki.—19th March, 1881.—(A communication from O. Michaelis.)—(Not proceeded with.)* 2d.

Two "bellied" pieces are fixed together at their ends at a distance apart, and to a staple on one end plate are hung two pressing boards. The books are placed between the pressing boards, and the bellied pieces pushed, so that the larger portions force the boards together.

1216. Lamps, *J. D. Rippingille.—19th March, 1881.—(A communication from Schwintzer and Gräff.)* 6d.

This relates to the use of a glass oil basin for suspension, slide, and other lamps, provided with one or more long necks carrying the burners and enclosed by a metal case capable of being readily put together and taken to pieces.

1217. Measuring and Registering the Flow of Liquids, *W. L. Hunt.—19th March, 1881.—(Not proceeded with.)* 2d.

One arrangement consists in the use of a tap the plug of which is of a given capacity, and the stem which carries mechanism for actuating suitable counting apparatus.

1219. LAMPS FOR BICYCLES, &c., *T. Tongue and T. E. Bladon.—19th March*, 1881.—(*Not proceeded with.*) 2d.

The object is to form the lamp so that it can readily be passed between the spokes and fastened to the hub of the wheel. The front containing the lens is made separate from the lamp body, to which it can be connected by sliding it vertically into grooves. The front carries the hinged barrel or clip, by which the lamp is suspended, and the two parts are secured together by a spring bolt.

1220. CASTING INGOTS, &c., *J. H. Johnson.—19th March*, 1881.—(*A communication from E. Wheeler.*) —(*Not proceeded with.*) 2d.

The object is to produce an ingot of different grades of metal for use in the manufacture of articles of steel or homogeneous iron, or iron and steel which shall possess the toughness of one grade of metal and the hardness of the other grade. Two converters are used, one for each grade of metal, and a mould is prepared and a core placed therein. Metal from one converter is run into the mould, and when hard the core is removed, and the metal from the other converter run in.

1221. SAFETY VALVES FOR BOILERS, &c., *A. Harvey and W. Borland.—19th March*, 1881.—(*Not proceeded with.*) 4d.

This relates to a valve to be applied to kitchen and other boilers so as to cause an audible signal to be sounded when the pressure of steam exceeds a certain limit, the steam issuing when the valve is opened, causing a bell to sound.

1223. PUMPS FOR RAISING WATER, &c., *A. Rigg.—21st March*, 1881. 6d.

This consists, First, in the application of an air vessel A, placed over the working barrel L of a pump so that the delivery takes place directly into it before the fluid enters the delivery pipe O; Secondly, in the

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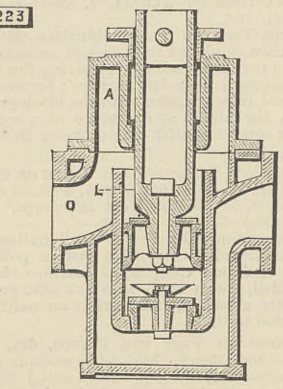


combination of an air vessel A placed over the working barrel L of a pump so that delivery takes place directly into it, with a vacuum vessel fixed immediately below and wholly or partially surrounding the working barrel of a pump, so that suction takes place immediately out of it.

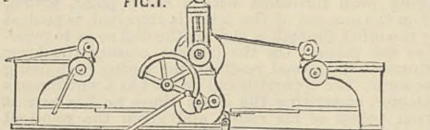
1224. ORNAMENTAL GLASS, *J. Couper, jun., and J. Elcock.—21st March*, 1881. 8d.

This relates to the formation of globes and other articles with corrugations or indentations both on its inner and outer surfaces. The article is placed in a hot state on a block having the finished form of the interior of such article, and a series of blocks are then brought down and pressed on to the outer surface.

1226. PRINTING MACHINES, *W. Evans, M. Smith and D. Braithwaite.—21st March*, 1881. 6d.

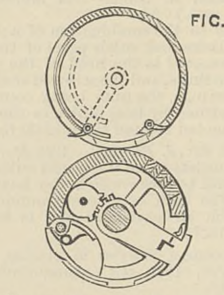
The impression cylinder is arranged so that one pair of its grippers are stationary and the other pair are adjustable to suit the size of sheet to be printed upon

1226 FIG. 1.



by mounting one jaw of the adjustable grippers on two arms which have their axis on the axis at each end of the impression cylinders. Fig. 1 is a side ele-

1226 FIG. 2.



vation of part of a printing machine, and Fig. 2 is a detached view partly in section of the impression and taking off-cylinders.

1227. CLEANING AND SEPARATING SEEDS, ORES, &c., *E. Davies.—21st March*, 1881. 6d.

This consists essentially in making the weight and descent of the materials operated upon produce the motive power that works the machine and cleans the material. The material falls on to a bucket or other wheel which it causes to turn, and then on to a series of inclined sieves, where it is acted upon by brushes caused to revolve by gearing with the bucket wheel.

1228. CONDENSATION OF STEAM, &c., *T. Elcoate.—21st March*, 1881. 6d.

This relates to combining in one instrument a condenser, cold water pump, and air pump, and it consists of a centrifugal pump with the shaft and vanes made hollow, the steam passing from the shaft through the vanes, the interior of which gradually narrow towards the outer end. Between the vanes the water is admitted, preferably from the opposite end of the shaft, and traversing outside the vanes, makes its exit into the outer peripheral exhaust along with the water of condensation.

1229. SHOES FOR VELOCIPEDISTS, *W. H. Halliwell.—21st March*, 1881.—(*Not proceeded with.*) 2d.

A flexible shoe is formed by making the waist of the shoe of shoulder leather instead of thicker leather, and a thin inner sole passes the full length of the shoe, forming the waist, and projecting for the purpose of fixing thereto a light sole and heel. The shoe is cut very low and laces down to the toe-cap.

1230. UNBREAKABLE COMPOSITION FOR MANUFACTURE OF DOLLS, &c., *A. C. Henderson.—21st March*, 1881. —(*A communication from J. W. Platonoff.*) 2d.

The composition consists of animal glue mixed with gelatine, animal or vegetable wax, and glycerine. To render the substance hard and tough 30 to 35 per cent. of zinc white is added, and the whole coloured as desired.

1232. ELECTRIC LAMPS, *H. E. M. D. C. Upton.—21st March*, 1881.—(*Not proceeded with.*) 2d.

This invention relates to regulating the carbons of a lamp. For this purpose the inventor rests the end of a vertical carbon upon two studs, which are the terminals of the conducting wires, the carbon bearing on these studs by its own weight, and sinking downwards as its lower portion is consumed.

1234. DRIVING AND INCREASING SPEED OF BICYCLES, TRICYCLES, &c., *J. Southgate, W. Smith, and R. Liddell.—21st March*, 1881.—(*Not proceeded with.*) 2d.

On the front fork are two cog wheels, one attached to the front axle and the other, of larger diameter than and acting on the former, is connected to the fork and worked by a pedal, lever, and crank. A vertical slide bar is connected to the crank so as to assist in actuating it.

1235. ELECTRIC LIGHTING, *G. A. Tabourin.—21st March*, 1881. 6d.

The inventor makes use of a supply of compressed air, obtained at a central station, and conducted thence through pipes to the standards of the various electric lamps. In the base of each of these standards is placed a magneto-electric machine, and a motor for working the same, the machine being connected by wires running up the interior of the lamp-post with the carbons of the electric lamp in the usual way. The compressed air is first passed into a reservoir furnished with an indicator and an outlet pipe, it is then let into the main pipe conducting to the lamps by turning a tap; there are separate branch pipes to each lamp furnished with another tap at each lamp, which is accessible from the pavement (or elsewhere), and this must be opened before the air can get to the motor; there is also a spring valve which will not admit the air until a certain pressure has been attained capable of moving the motors at a determined speed. The air after being used in the motors escapes into the base of the lamp-post, and serves to cool the apparatus.

1237. DRAUGHTING COATS, &c., *W. T. Raynor.—21st March*, 1881.—(*Not proceeded with.*) 2d.

This consists of a set of hinged bars and sliding cross bars provided with suitable scales, to enable coats or other articles to be draughted without calculation.

1238. INCLINED TRAMWAYS AND LIFTS, *H. P. Holt.—21st March*, 1881. 1s.

This relates to tramways or lifts worked by water counterbalance tanks, and it consists in arranging hydrants of large bore fitted with gear, so that the water is quickly admitted automatically to the tanks on either car arriving at the proper position when required under control of the conductor. This may be effected by inclined cams on the cars coming in contact with rollers on the levers, which open the hydrant valves.

1240. ARMATURES FOR DYNAMO-ELECTRIC MACHINES, &c., *E. G. Brewer.—21st March*, 1881.—(*A communication from T. A. Edison.*) 6d.

The cores of these armatures are built up by insulated iron discs on a wood axis. The wire coils of the ordinary armature are replaced by copper bars connected by copper discs insulated from each other and from the core.

1242. BREECH-LOADING FIRE-ARMS, *H. A. A. Thorn.—21st March*, 1881. 6d.

The object is to provide lock mechanism with only one trigger for fire-arms having more than one barrel, the arrangement being also applicable to arms having only one barrel. A hammer bolt is provided, having a number of grooves or slots (corresponding with the number of barrels to the arm) parallel with the axis of the bolt, a corresponding number of inclined grooves

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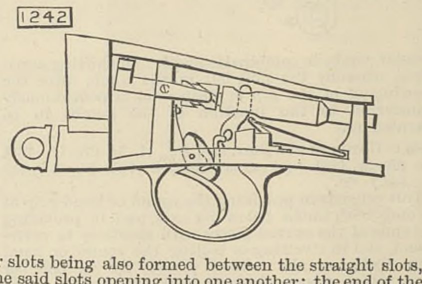

or slots being also formed between the straight slots, the said slots opening into one another; the end of the hammer bolt is formed with one or more inclined projections; the hammer bolt is also provided with a collar to allow of the bolt being withdrawn by the trigger a given distance to sufficiently compress the spring which operates the bolt, the trigger blade being formed with an inclined surface or slot, so that when the bolt has been withdrawn the required distance it is free to be driven forward by its spring. A spring is provided, having a stud which fits in the grooves or slots, the said spring being so placed as to always tend to rotate the hammer bolt.

1243. CUSHIONS FOR CARRIAGES, *S. Newington.—21st March*, 1881. 4d.

To prevent jarring and vibration under the ordinary cushion is placed a second cushion formed of two parallel boards with elastic hollow balls between them, the boards being linked together so as to be capable of approaching and receding from each other.

1244. COATING METAL PLATES, *R. and J. Lewis.—21st March*, 1881. 6d.

This consists in causing the plates or sheets to pass from a compartment or pot A containing the coating metal at the temperature required for coating through guides into an intermediate compartment or pot B

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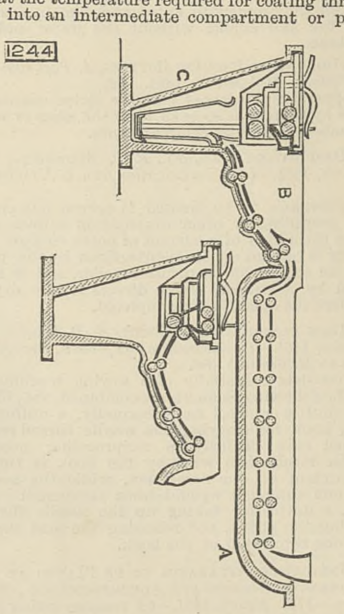

containing cooling grease, and thence into a third compartment or pot C containing grease, and in which the sheets or plates are finished by rollers.

1245. AXLES, SHAFTING, METAL PLATES, AND WHEELS FOR RAILWAY AND OTHER CARRIAGES, *W. M. Riddell.—21st March*, 1881.—(*Not proceeded with.*) 2d.

This relates to the combined use of various qualities of iron, or iron combined with other metals welded or joined together to form axles, and other parts requiring great strength and durability. It also consists in forming wheels of a series of plates of various qualities of iron and steel bolted or welded together, or of alternate plates of metal and paper boards bolted together.

1246. AERO-STEAM MOTOR, *G. W. von Nawrocki.—22nd March*, 1881.—(*A communication from P. Lochmann.*) —(*Not proceeded with.*) 2d.

This relates to a motor actuated by steam in combination with atmospheric pressure, the generation and utilisation of steam being effected in the same chamber, and its motive force obtained from the alternate expansion and condensation of the same quantity of water. The cylinder is surrounded by two annular chambers, one forming a condenser through which cold water circulates, and the other—lower—one is filled with a non-conductor of heat and forms an insulator between the upper chamber and the furnace secured to the underside of the lower chamber, and enclosing the boiler, which forms a continuation of the cylinder. In the cylinder works a piston connected by two rods to a crankshaft and fly-wheel. Below the piston is a cylindrical plunger of smaller diameter than the cylinder, and its upper stem works through the piston, where it is connected by rods and levers with cranks on the fly-wheel shaft.

1247. ICE MACHINES, *H. J. Haddan.—22nd March*, 1881.—(*A communication from O. Kropff.*) 6d.

A and E are two ammonia boilers, each communicating at the top with a condenser B, and at the bottom with a refrigerator D; the condenser B is

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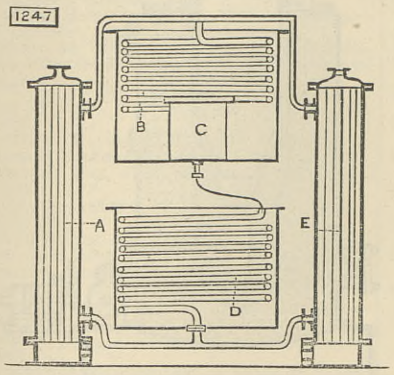

placed over the refrigerator D, and between the two boilers A and E. The condenser B consists of a coiled pipe immersed in a cold water tank, receiving the ammonia vapours at the top, and ending at the bottom in a vessel or collector C placed inside the tank, said collector communicating with the refrigerator D by a pipe provided with a stop cock.

1248. MACHINERY AND APPARATUS APPLICABLE TO TWIST LACE MACHINES, *J. Newton.—22nd March*, 1881. 6d.

A warp bar and a spool bar are employed, each carrying a full set of guides, the warp bar being operated by a cam cut to the required form, and the spool bar by a cam of the usual construction, the warp bar being at the front and the spool bar at the back, the threads of both bars being acted upon by jacks; these jacks when lifted clear out of the threads by a single hook jacquard make fining or cloth work, and when lifted out half the distance make pillaring, and when not acted upon by the jacquard make the ground work or not, thus making perfectly smooth pillaring.

1249. TAPS OR COCKS, *P. O'Connor.—22nd March*, 1881. 6d.

This relates to taps or cocks that are provided with hollow taper plugs.

1250. SHOW STANDS, *L. A. Groth.—22nd March*, 1881. —(*A communication from A. Dubois.*) 6d.

This relates to a show stand consisting of a spring pincer with jaws of various forms.

1251. AUTOMATIC DIP PIPE FOR MANUFACTURE OF GAS, *S. Chandler and G. W. Stevenson.—22nd March*, 1881. 6d.

A is a stationary pipe which terminates within a short distance of the fluid in the hydraulic main; B is a

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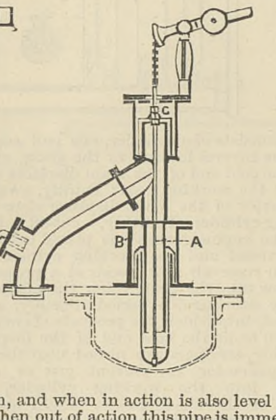

movable portion, and when in action is also level with the pipe, but when out of action this pipe is immersed in the fluid of the hydraulic main, and prevents any back flow of gas; C is a small valve which fits into a seating when the gas is being generated from the retort, which also prevents any escape should a back pressure occur.

1252. RAISING AND LOWERING WINDOW SASHES, *J. W. Lewis.—22nd March*, 1881. 6d.

On the outer side or face of each sash that is opposite the window frames, a rectangular groove is provided, and in the frame or casing corresponding grooves with rectangular worm threaded racks, adjusted and arranged so as to be capable of being moved laterally therein into the opposite grooves in the frame or casing. At the back of the grooves in the frame or casing are fixed in suitable bearings, and on both the right and left-hand side of the frame a pair of vertical shafts having each of them a worm and pinion together with a horizontal shaft and double bevel, wheel so arranged that this latter shaft with its wheel can be caused to gear into either of the pinions on the vertical shafts. To keep the horizontal shaft in gear with either of the vertical ones a forked pawl or catch is employed in combination therewith.

1253. SUBSTITUTE FOR COFFEE, *J. Challinor.—22nd March*, 1881. 2d.

This relates to the preparation of certain leguminous substances of the "leguminoso" or pulse order, and of the sub-order cæsalpineo as an article of food, either mixed with ordinary coffee instead of chicory, or used by itself as a substitute for coffee.

1254. STEAM ENGINE INDICATORS, *C. F. Schloesser.—22nd March*, 1881.—(*A communication from Messieurs Dreyer, Rosenkranz, and Droop.*)—(*Not proceeded with.*) 2d.

The whole of the enlarging apparatus is carried by a circular plate, which can be turned by hand upon the top of the cylinder cover to put a fresh paper on the revolving drum, and may be easily removed to apply a more or less powerful spring to the piston when required. Another part relates to an arrangement whereby the revolution of the paper drum can be arrested when at work, for removing and replacing the paper without unfixing the cord.

1255. PRINTING WOVEN FABRICS, &c., *R. Ritchie and J. Furguson.—22nd March*, 1881. 6d.

This consists in the combination in apparatus for printing woven or other fabrics by means of raised printing surfaces of an impression cylinder with two or more printing rollers, such printing rollers being arranged for acting alternately or in succession upon different parts of the fabric.

1257. LAYING TELEGRAPH WIRES, *S. Pitt.—22nd March*, 1881.—(*A communication from W. B. Espeut.*) 6d.

This invention relates to the laying of underground wires. The inventor uses pipes made of porcelain ware, connected by thimbles to allow the end of one pipe to touch the end of the other, the two ends being cemented by white lead; these thimbles may be of iron or ware. Where it is required to lay several wires the pipes are perforated longitudinally, so that the walls of each division constitute an insulator for the wire laid therein. When it is required to lead off a wire to a station, the inventor fixes a ⊥ piece into the pipe, through which the wire can be led. If the traffic be heavy where the wires are to be laid, an iron tube lined with porcelain is made use of, such lining being formed in longitudinal compartments.

1258. PACKING BOTTLES IN CASES, *S. C. Davidson.—22nd March*, 1881. 6d.

This consists in first folding the lower and cylindrical part of the bottle in a wrapper, consisting of strong pasteboard or very thin sawn wood like veneer sheeting, and then securing the same on the bottle by wrapping the whole bottle, including this wooden or pasteboard envelope, with thin paper.

1259. LUBRICANTS, &c., *J. Dickson and J. A. Mills.—22nd March*, 1881.—(*Not proceeded with.*) 2d.

Oil, grease, or other fatty matter is mixed with water, and an alkali is added.

1261. MANUFACTURE OF SULPHO-CYANIDES AND FERRO-CYANIDES, *H. E. Newton.—22nd March*, 1881.—(*A communication from U. de Günzburg and J. Tcherniac.*) 10d.

The apparatus consists of, First, a force pump; Secondly, a series of heating vessels; Thirdly, a still heated by a steam coil; Fourthly, a surface condenser surmounted by a column of coke, the whole placed above a spacious receiver; Fifthly, a second receiver, provided with a surface condenser and a column of coke; Sixthly, a gas-holder, which acts as a regulator.

1262. LAMPS FOR BURNING BENZOLINE, &c., *C. G. Crawford.—22nd March*, 1881.—(*Not proceeded with.*) 2d.

According to one part of the invention the wick tube is compressed at the top.

1264. VELOCIPEDE, *W. R. Lake.—22nd March*, 1881. —(*A communication from G. B. Scuri.*—(*Not proceeded with.*) 2d.

This relates to the construction of a velocipede with only one wheel.

1266. COP TUBES, *J. C. Vanlohe.—22nd March*, 1881 —(*Not proceeded with.*) 2d.

This consists in perforating or longitudinally grooving the tube to allow the bleaching and dyeing liquors to enter freely and act upon the interior portion of the cop, thereby securing an even colour throughout the yarn composing it.

1267. COMBINED COUCH AND ARM-CHAIR, *F. W. Sinnock.—22nd March*, 1881. 4d.

This consists in the combination of a fixed seat or part similar to the middle portion of a sofa and a revolving chair at each end thereof.

1268. STOPPERS AND CAPS OR COVERS FOR BOTTLES JARS, &c., *N. Thompson.—22nd March*, 1881. 6d.

This consists in combining with a cap, cover, or stopper, a lever handle pivotted thereto, and formed with levers to act against the end of the bottle neck or against a projecting ring or flange thereon.

1269. NECKTIES, SCARVES, AND GLOVES, *S. W. Robinson.—22nd March*, 1881. 2d.

Instead of forming the tie or scarf with a flexible strap or band to pass entirely around the neck of the wearer, and then to be tied or otherwise secured, or instead of forming the tie or scarf itself sufficiently long for that purpose, it is attached to a spring band or clip formed with a split or opening, and, preferably, to overlap at the back or other convenient position to enable the band or clip to be opened out sufficiently to pass around the neck of the wearer.

1270. FASTENING FOR STRAPS OF CARRIAGE DASH BOARDS, *W. R. Lake.—22nd March*, 1881.—(*A communication from C. F. Littlejohn and H. Ford.*)—(*Not proceeded with.*) 2d.

The standing strap is attached to a metal loop, and to the free strap a metal hook of peculiar shape is attached.

1271. PICKLING AND SWELLING PLATES OF IRON, &c., *D. and W. Rosser.—22nd March*, 1881.—(*Not proceeded with.*) 2d.

The vats are placed side by side, each containing the cradle for the sheets of iron. Above these cradles are placed two horizontal rails parallel and in the direction in which the cradles are moved through the vats. The rails have an undulating upper surface, and the cradles are hung on to these rails by vertical rods attached at their lower ends to the cradles, and at their upper ends being hooked on to the spindles or rollers running on the said rails, the rollers being united in a framework. This frame is then taken hold of by a connecting rod attached to a crank of an engine (or other suitable mechanism), and is thereby drawn backwards and forwards, carrying the cradles with it through the vats, the undulating surface of the rail under the rollers imparting at the same time a continuous up-and-down motion to the cradles.

1272. COTTON-COVERED WIRE, *W. R. Lake.—22nd March*, 1881.—(*A communication from H. Splitdorf.*) 8d.

This consists partly in winding spirally upon the wire the fibres of cotton in their natural but straightened condition.

1273. WHEELS FOR RAILWAYS AND TRAMWAYS, *A. C. Uljée and J. Cleminson.—22nd March*, 1881. 6d.

This consists in the combination in a railway or tramway wheel of a half-centre A, having formed with it shallow radial arms or spokes and a flanged

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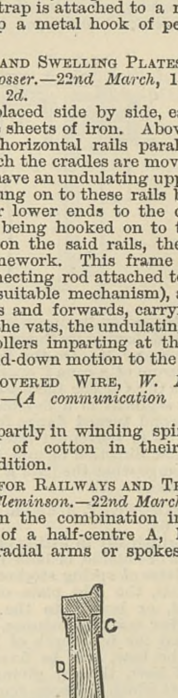

tire retaining ring; a half-centre B without radial arms or spokes; a tire retaining ring C, having formed with it a number of shallow arms or spokes converging towards a common centre (the wheel's axis), and connected together at their inner ends; and a disc or body D of compressed teak or other comparatively elastic substance.

1276. CUTTING PAPER INTO SHEETS, *J. H. Johnson.—23rd March*, 1881.—(*A communication from H. Schlatter.*) 6*d*.

This relates principally to the feeding apparatus, which is provided with rollers C D, connected by

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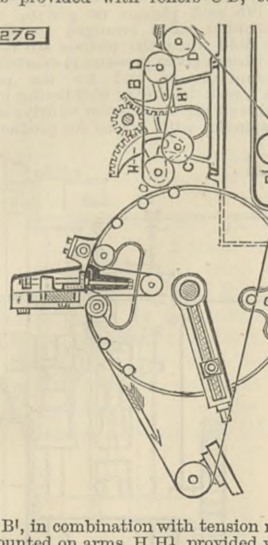


bands B B', in combination with tension rollers C' D', being mounted on arms H H', provided with toothed segments capable of being revolved about the said feeding rollers C D.

1277. FURNACES OR STOVES FOR BOILING PAINT, &c., *H. G. Grant.—23rd March*, 1881.—(*A communication from A. Prevot.*) 4*d*.

The furnace consists of an inner and an outer casing, the former having shelves to support the vessels containing the paint to be boiled, and between it and the outer casing the fuel is placed, a chimney communicating with the space between them. Air is admitted to such space to support combustion.

1278. TREATING THE FIBRE OF LALANG GRASS AND CITRONELLA GRASS, *J. Fisher.—23rd March*, 1881.—(*Not proceeded with.*) 2*d*.

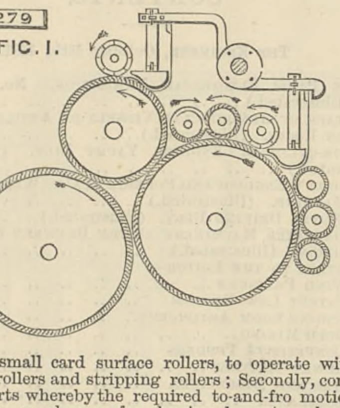
The leaves of the plants are treated with hot water under pressure, and containing in solution a sufficient quantity of alkaline material, so as to dissolve and remove the gummy and glutinous matters and woody covering from the fibres, which can then be made into pulp in the usual way.

1279. PREPARING WOOL AND OTHER FIBRES FOR SPINNING, *I. Holden.—23rd March*, 1881.—(*Partly a communication from W. C. Bramwell.*) 8*d*.

This relates, First, to the application to card cylinders used as "licker-in" or "opening" card

1279

FIG. I.



rollers of small card surface rollers, to operate with working rollers and stripping rollers; Secondly, combining parts whereby the required to-and-fro motion to brushes or clearers for clearing burr troughs of burrs is obtained by the continuous motion of a screw in one direction; Thirdly, combining parts whereby

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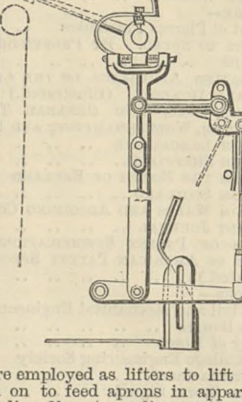

forks or grids are employed as lifters to lift the fibre under operation on to feed aprons in apparatus for mechanically feeding fibres to carding engines, and the simultaneous regulating of the vibrating comb operating with such feed apron.

1280. VARIABLE VALVE GEAR FOR ENGINES, *W. Johnson.—23rd March*, 1881. 6*d*.

The objects of this invention are to give the slide

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FIG. 1.

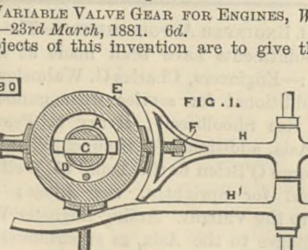
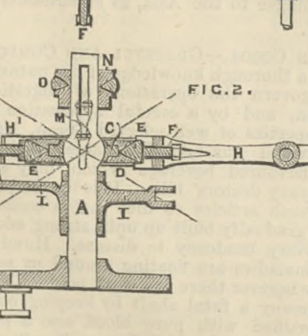


FIG. 2.



valves a more uniform motion than can be produced by the link motion; to do away with the angular motion caused by the use of excentric rods; to give an independent lead, that is, one which can be regulated independently of the cut-off and reversing gear; and to allow the valves perfect repose when the cut-off reaches its maximum. The drawings show the invention as applied to a double-action marine engine. A is the crank shaft, through which projects the pin C carrying ring D placed round crank shaft. Sliding in a groove of ring D is a second ring E carrying pins F and G, the latter working into the lead motion, and each of them into a slot of a link forming one arm of a bell-crank lever H H', each working the valve rod of one of the coupled engines. Sometimes three separate pins are used, as shown in Fig. 1. The lead mechanism is a lever I linked or working on one of the ring pins G and a fulcrum, and so arranged that by turning the lever or a screw the outer ring E is caused to slide on ring D, and the position of the inner and outer rings relatively to each other is changed. The ring D preferably consists of two rings bolted side by side, and grasping the shaft pins between them. The inner ring has a link M on one side equidistant from the ends of pin C, and connected to the reversing or cut-off lever by mechanism that will permit the inner ring revolving with the shaft, and consisting of a ring N sliding on crank shaft, and having a strap O round it linked to the reversing lever.

1281. WATCHES, *H. Aspinall.—23rd March*, 1881.—(*Not proceeded with.*) 2*d*.

The object is to avoid unnecessary friction when winding up the watch by pivotting the shaft of the wheel that is driven by the wheel on the pendant shaft, so that it shall fit into holes in the watch-plate.

1282. STEAM BOILERS, &c., *C. W. King.—23rd March*, 1881. 6*d*.

This relates partly to improvements on patent No. 3293, A.D. 1879, and consists in forming the combustion chamber as follows: The grate is preferably circular, and the part of the furnace surrounding it is formed by a casing lined with firebrick, the plan of such part having the outline of the grate. Upright boilers have the outer shell and top plate similar to donkey boilers, but the inside consists of a taper tube, widest at bottom, where it is connected to the lower portion of the shell barrel, while the upper end is fixed to the top. In this tube fire tubes are arranged and reach from the lower part up to just below the water line. A partition is placed inside the taper tube between the lower inlet and the upper outlet of the fire tubes.

1283. COMPOUND OR MIXTURE FOR CHOLERA, DIARRHŒA, &c., *W. Williams.—23rd March*, 1881. 4*d*.,

The mixture consists of 1 lb. flour, 1 lb. ground rice, 2 oz. ground cinnamon, 2 oz. carraway seeds, 2 oz. ground ginger, 8 oz. raw sugar, 1 oz. ground cloves, ½ oz. Cayenne pepper, and 4 oz. chalk.

1284. MULTICHARGE GUNS AND GAS CHECK WADS TO BE USED THEREWITH, *F. J. Cheesbrough.—23rd March*, 1881.—(*A communication from J. R. Haskell.*) 8*d*.

This relates, First, to a cap or plug to close the breech, and afford great facility for charging and cleaning the gun, and consists of a cap A with a hole B in the bottom. The flanges of the cap screw on to the breech. To close the breech a plug C is fitted in the bottom of the cap and secured by an arm D. When

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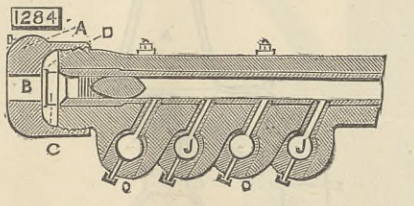

the cap is screwed back the plug drops down into a recess in the side of the cap, and when screwed home the plug is raised by the arm D, and covers the hole in the bottom of the cap. Supplemental charge chambers J made of separate pieces of steel are screwed into enlargements on the underside of the guns, and to load these chambers the priming hole is made large and fitted with a bronze priming plug locked in position by a key fitted with a suitable gas check. A pin O is provided to facilitate cleaning out of the supplemental charge chambers. The bore of the gun has a bushing or lining of steel or twist wrought iron. A gas check wad is used to extinguish "windage," and prevent the flame cutting around the wad and firing the charges ahead of the shot, and will also resist the destructive effect of the burning powder during its passage over the supplemental chambers.

1285. GOVERNORS FOR MARINE STEAM ENGINES, *M. Benson.—23rd March*, 1881.—(*A communication from P. Jordan.*)—(*Not proceeded with.*) 2*d*.

Two parallel shafts are geared together by three wheels on each shaft, the front one having a pulley to keep complete control of the engine. This shaft is formed with right and left-handed screws, which operate two of the gear wheels, the inner sides of which are conical, to raise and lower a lever that passes between them, and so regulate the supply of steam to the engine, such wheels being channelled out to suit the screws on the driving shaft. The other gear wheel on this shaft has a collar and screw to fasten it to the shaft. The wheel on the other shaft, which is the fly-wheel shaft, is hollow, and receives a spring secured at one end in a notch on the inner rim of the wheel, and the other end has a seat on the fly-wheel shaft.

1287. DEPILATORY PROCESS FOR HIDES AND SKINS, *A. M. Clark.—23rd March*, 1881.—(*A communication from C. J. P. Desnos.*) 2*d*.

The depilatory solution or bath is composed of 500 grammes limestone and 100 grammes orpiment made into a paste in the following manner:—The lime is placed in a copper with water at a high temperature. The lime is slaked immediately it begins to split, and the arsenic is then added, and also more water, the whole being well stirred for about five minutes, so as to form a paste. A kilogramme of American potash is added with sufficient water—10 litres—to render the mixture perfectly homogeneous. The mixture is exposed to a moderate heat, and raised to 10 deg. Beaumé, after which it is allowed to settle and the liquid decanted, such liquid forming the depilatory solution to be applied to the skins.

1288. ORNAMENTING FURS, *A. M. Clark.—23rd March*, 1881.—(*A communication from L. Havasy.*)—(*Not proceeded with.*) 2*d*.

This relates to a fur with feather tips attached to the pelt of the fur and projecting beyond the hairs of the fur.

1289. MANUFACTURE OF SOAP FROM ANIMAL AND VEGETABLE FATTY MATTERS, *P. Jensen.—23rd March*, 1881.—(*A communication from J. Weineck.*) 4*d*.

This consists in the saponification of fats of animal or vegetable origin without boiling them with alkaline lyes, by the rendering of them into the so-called globular state before the caustic lye is added, for the purpose of the manufacture of neutral hard soaps, as well as non-neutral washing soaps, while eventually at the same time obtaining spent lyes which do not contain chlor, and which are suitable for glycerine manufacture.

1290. BELLS, KNOCKERS, LETTER PLATES, &c., *W. R. Comings.—23rd March*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the combination of letter plates, knockers, and bell pulls, so as to fasten the whole in one and the same position on the door.

1291. TREATING HOMINY, *B. J. B. Mills.—23rd March*, 1881.—(*A communication from W. S. and M. Boon and R. H. Hall.*) 4*d*.

This relates to preserving hominy by taking the hulled, raw, dry kernels of corn as they come from the mill, and saturating or wetting them with an alkaline solution, and then drying without washing or cooking the same.

1292. MANUFACTURE OF CASTINGS FROM IRON, &c., *J. Watson.—23rd March*, 1881.—(*Not proceeded with.*) 2*d*.

This relates to the construction, arrangement, and method of supporting cores, chills, pins, or nuts to be used in the production of castings.

1293. KITCHEN RANGES, *J. Watson.—23rd March*, 1881.—(*Not proceeded with.*) 2*d*.

The side and back plates are secured together by casting near their edges hooks or catch-plates which interlock. The oven consists of one piece of sheet iron or steel forming the two sides and top and bottom, by being first bent into a tubular form and the ends secured by one row of rivets, after which it is acted upon by removable dies or pressing bolts, which give it the required form.

1296. SPRING SAFETY VALVES, *T. Adams.—23rd March*, 1881. 8*d*.

To provide for a free escape of steam from marine and other large boilers, four valves ranged in a square and each opening upwards into one chamber above them are employed. A is the valve box containing the four valves, divided from each other by plates B; C are the seatings, above which are the valves, each formed

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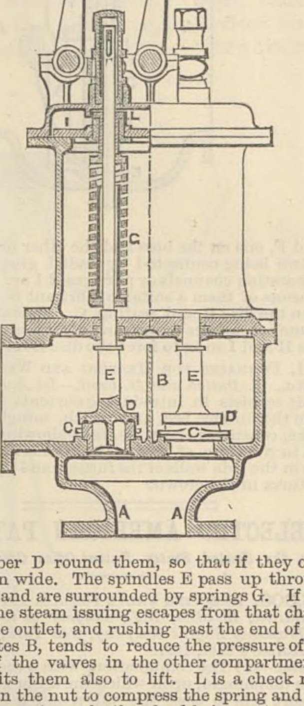

with a chamber D round them, so that if they once lift, they open wide. The spindles E pass up through the chamber and are surrounded by springs G. If one valve lifts, the steam issuing escapes from that chamber to the side outlet, and rushing past the end of the partition plates B, tends to reduce the pressure of air on the top of the valves in the other compartments, and so permits them also to lift. L is a check ring fitted between the nut to compress the spring and the plate I to prevent any further load being put on the valve after it has been adjusted, such ring being made in two or more pieces, which can be slipped under the head of the bolt, and then be embraced by a split ring, and so be clamped round the bolt.

1297. COATING OR COVERING THE SURFACES OF IRON OR STEEL SHIPS, &c., *W. Welch.—23rd March*, 1881. 4*d*.

The surface is first coated with the liquid or plastic cementitious composition described in patent No. 2168, A.D. 1866, to the depth of $\frac{1}{16}$in., and over this is placed a layer of granulated cork, sufficiently thick to obtain an insulating and non-condensing surface.

1300. METALLIC APPLIANCES TO BE AFFIXED TO HEELS AND SOLES OF BOOTS AND SHOES, *A. Sumner.—23rd March*, 1881. 6*d*.

This relates to tips and plates to be secured in position on the heels or soles of boots, at the parts which have worn away.

1301. TOBACCO POUCHES, *H. A. Fleuss.—23rd March*, 1881. 4*d*.

The object is to produce a compact, secure, and air-tight pouch, and it consists of two circular pieces of plastic rubber compound, joined at their edges by means of a solution, and between which a wood or other core is inserted before joining. A flap piece is also cut from a sheet of rubber compound and secured by solution. The article is placed in a mould and subjected to the vulcanising process, so as to secure the parts firmly together, and cause the pouch to retain externally the form of the mould. The flap is afterwards turned back, and the pocket opened by a knife along a portion of the join so as to remove the core.

1303. WINDING UP WATCHES, &c., *H. H. Lake.—23rd March*, 1881.—(*A communication from K. Vogel.*) 6*d*.

This relates to means for the periodic or constant restoration of the tension or strain upon a spring, or the re-winding of a weight used to actuate the clock movement, and it consists in the combination with the actuating spring or weight of a major spring or weight, so arranged and connected to the former that as it is being unwound or run down, such major spring or weight shall, so long as its force exceeds that of the actuating spring or weight, either intermittently or continuously restore such actuating spring or weight.

1305. SAWING MACHINES FOR SHORT STOCKS, *O. C. P. and R. A. E. Fleck.—24th March*, 1881. 6*d*.

The feed mechanism consists of two brackets A, one before and the other behind the saws, and each carrying two rollers C, such feeding rollers being grooved and worked by ratchet mechanism, one roller

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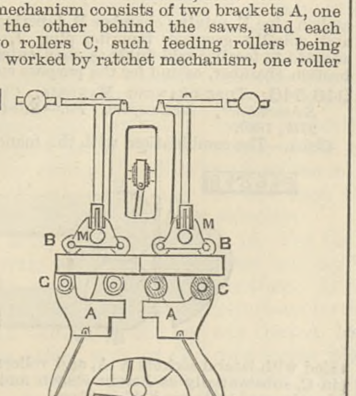


being driven directly and imparting its motion by chain gear to the other. Above these feeding rollers are four rollers B mounted in pairs in brackets M capable of turning on pivots and secured in weighted forks.

1306. COMPOUND STEAM ENGINES, &c., *E. Davies.—24th March*, 1881.—(*Not proceeded with.*) 2*d*.

This relates, First, to compounding high-pressure engines by attaching to the rear end of the cylinder a larger cylinder having a steam chest and valve of corresponding travel to the high-pressure cylinder valve, and driven from the same or a second excentric with the same throw; Secondly, in new compound engines the high and low-pressure cylinders are secured with a metallic partition between them, so as to form an end for both; Thirdly, the two cylinders may be made of equal diameter, and one of them reduced by an internal trunk.

1307. WASHING CLOTHES, *T. Wilson.—24th March*, 1881.—(*Not proceeded with.*) 2*d*.

An outer vessel is fitted with a dished cover at the bottom so as to form a space, holes in the cover giving access for water, &c. Tubes rise from the cover to near the top, and terminate near a ring over the inner vessel, which is perforated, and stands on feet within the outer vessel. When the water is heated it rises in the tubes, and falling on to the clothes in the inner vessel, passes down through them and into the space below the cover, thus providing a continuous circulation.

1309. SAFETY WICKET AND GRATING FOR STREET DOORS, *A. C. Henderson.—24th March*, 1881.—(*A communication from J. M. A. Montclar.*) 6*d*.

The object is to prevent burglaries under the pretext of handing in parcels or letters so as to gain access to the house when the door is opened. A grating is let into the door from the inside, and is opened and closed by a second or movable grating secured by a bolt. Beneath the grating is a horizontal aperture for the reception of the parcel or letter, such aperture being closed with a plate, and the parcel or letter dropping into a box. For larger parcels the lower panel of the door is mounted on strong hinges, and when not required to be opened is secured by a metal bar.

1311. CASTING, LINING, AND CASING SHAFT BEARINGS, &c., *A. Howat.—24th March*, 1881. 6*d*.

This relates to casing or lining iron or brass shells with phosphor bronze, and it consists in placing the shell with a lining of the thickness of the phosphor bronze required in the mould, which is filled with sand and rammed. The lining is then removed, and the phosphor bronze run in. The shell of the bearing is formed with taper holes, or grooves, or recesses of suitable shape, so as to secure the shell and the lining together.

1312. HOT-BLAST STOVES, *H. Massicks and W. Crook.—24th March*, 1881. 6*d*.

A wrought iron vertical casing with a conical top has at the apex a manhole, with an air valve in the cover. The interior of the stove is of brickwork, and comprises a series of segmental passages, preferably concentric, and formed of any desired number of circular and radial divisions. The gases enter from below to the centre of the stove, and the walls forming the passages terminate a short distance from the top of the stove, and have arches in each alternate wall at the bottom, so that the gases and heat traverse the passages from the centre to the outermost passages before being carried off. The blast passes through the stove in the opposite direction.

1313. BICYCLES AND TRICYCLES, *J. Harrington.—24th March*, 1881.—(*Not proceeded with.*) 2*d*.

A groove is formed round the journals, and a corresponding groove in the bearing to receive a number of balls. On each side of the groove round the journal are a series of rings and recesses to fit corresponding rings and recesses in the bearing. The invention relates further to the mode of fitting and adjusting the neck of the spine in the head of a velocipede so as to obtain great rigidity and facility of adjustment; also to improvements for facilitating the steering of tricycles; and lastly, to the clutch apparatus for connecting and disconnecting the driving wheels with the driving shaft.

1314. VENTILATING APPARATUS, *G. L. Shorland.—24th March*, 1881.—(*Not proceeded with.*) 2*d*.

This relates, First, to the employment of ascending air columns or currents to induce the outflow of vitiated air from rooms or buildings, and consists of a passage extending from bottom to top of the building, to the bottom of which air is admitted and flows out at top. Branch pipes communicate with the passages on each floor. In the second place the vitiated air can be withdrawn through a passage in the ceiling, which passage is continued upwards within the mid-roof by a tube with exit openings provided with light closing valves, which open to allow the vitiated air to escape into the roof space and close self-actingly, when necessary, to prevent down draught.

1316. ROCKETS, *J. C. Pain.—24th March*, 1881.—(*Not proceeded with.*) 2*d*.

This consists in securing sticks to the cases of the rockets by means of a spring or other catch.

1317. BEARINGS FOR SCREW PROPELLER SHAFTS OF SCREW STEAMERS, *W. R. Oswald.—24th March*, 1881.—(*Not vroceeded with.*) 2*d*.

The wear of lignum vitæ or other bearings used to support propeller shafts in the stern tubes, pipes, or boxes of screw steamers is compensated by the use of inclines, whereby the bearings are caused to approach the shaft to the requisite extent.

1318. SEWING MACHINES, *C. T. Bastand.—24th March*, 1881. 6*d*.

This relates to lock-stitch machines, having a straight needle and a transversely reciprocating shuttle, and it consists in so combining the needle and shuttle that they receive a continuous movement, that is, they do not remain stationary during any period in the formation of the stitch.

1320. TUBES FOB FACILITATING THE DRAINAGE OF LAND, *W. Lavender.—24th March*, 1881.—(*Not proceeded with.*) 2*d*.

Short lengths of tubing, with a socket to receive another short tube with an enlarged head at one end, and protected by bars or a perforated disc, are interposed at intervals between the ordinary drain pipes, the head of the second short tube opening to the atmosphere.

1322. IRON, *J. H. Johnson.—24th March*, 1881.—(*A communication from W. E. Sendey.*) 2*d*.

Superior ore, such as Spanish hematite, is smelted in a blast furnace. The crude iron produced should contain from 1 to 2 per cent. silicon, and it is refined previous to puddling in a reverberatory furnace having the bottom and sides of its hearth lined with iron ore, such as hematite, the molten metal being run in and gently stirred. When removed it will be free from phosphorus, sulphur, silicon, and manganese.

1323. METALLIC CARTRIDGES, *W. R. Lake.—24th March*, 1881.—(*A communication from L. Létrange.*) 4*d*.

The cartridge shells are made of an alloy of copper and tin, or of copper and nickel, or of copper together with both these metals.

1324. BOILING AND DIGESTING PAPER STOCK, &c., *A. M. Clark.—24th March*, 1881.—(*A communication from H. Coker.*) 6*d*.

This consists in heating the mass in the digester by a steam heater, and obtaining a circulation of the lye by the variations in specific gravity.

1326. RAILWAY BRAKES, *A. M. Clark.—24th March*, 1881.—(*A communication from J. Meissner and H. Heschmann.*)—(*Not proceeded with.*) 2*d*.

A horizontal frame, with bowed end bars and side sockets for holding the brake shoes, is held in position against the bottom of the car by longitudinal movable clamps, so that it can adjust itself to the relative position of the bogie truck and the body of the carriage when running on curves, the clamps being connected with rods whereby the frame may be moved longitudinally for applying or throwing off the brake.

1333. CARRIAGE LOCKS AND HANDLES, *J. Edwards.—25th March*, 1881.—(*Not proceeded with.*) 2*d*.

The locks have two springs operated independently of each other, so that when the bolt to which a tail is formed is turned up, the tail is pressed against a lever and operates one spring as it is turned up. A hook on the bolt commences to engage the other spring, which acts as a means to pull the bolt partly out of the case of the lock, so that when the door is pushed it is secured. The handles are made of enamelled plates, toughened glass, vegetable ivory or other similar substance in place of metal.

1335. Fountain Penholders, *H. J. Haddan.—25th March*, 1881.—*(A communication from H. Burckas.)*—*(Not proceeded with.)* 2d.

The cylindrical main portion is formed with an inlet and a valve which is kept open, while the pen is used by the pressure of the finger on a lever connected with a spring which closes the inlet when released. An interchangeable ink distributor is provided.

1336. Finishing and Rounding Pills, *J. G. F. Richardson.—25th March*, 1881. 6d.

The pills are acted upon by two revolving discs moving in opposite directions at equal or different velocities and round a common or round two different centres.

1338. Working the Rollers of Blinds, Maps, &c., *S. Bee.—25th March*, 1881.—*(Not proceeded with.)* 2d.

A collar nut, preferably roughened or milled, is applied to the lower end of a tubular spindle, so that according to the direction in which the nut is rotated, so a rotary motion is imparted to the spindle, which at top carries a worm or mitre wheel gearing with the blind or other roller.

1339. Elastic Stamps or Printing Apparatus, *F. Van Den Wyngaert.—25th March*, 1881.—*(A communication from A. Weylandt.)*—*(Not proceeded with.)* 2d.

The characters or designs are formed on a vulcanised rubber in the form of a wheel or roller.

1340. Alarm Apparatus, *W. R. Lake.—25th March*, 1881.—*(A communication from C. Haas.)*—*(Not proceeded with.)* 2d.

This relates to a portable alarm apparatus that can be placed against a door or window, and when the latter is opened a bell or gong will be sounded.

1341. Apparatus or Means for Getting Coal, Blasting, &c., *J. MacNab and R. W. Jenkins.—25th March*, 1881.—*(Not proceeded with.)* 2d.

This relates to improvements on patent No. 3150, A.D. 1876, and consists in the manufacture of cartridges for blasting, of the addition to a locally strong quick-burning explosive, such as dynamite, gun cotton, &c., of a duly proportioned quantity of a locally weak or slow-burning and expansive or propelling explosive, such as gunpowder used for blasting purposes. The invention further relates to the mode of discharging the cartridges.

1344. Velocipedes, *E. R. Settle.—25th March*, 1881.—*(Not proceeded with.)* 2d.

This relates, First, to a ball bearing for pedals and wheels, and consists in the use of a division plate placed vertically in the chamber containing the balls, which are placed in holes in the plate, the recessed caps of the bearing screwing down on the screwed part of the spindle passing through the hub; Secondly, the felloe consists of a hollow tube of cylindrical, oval, or other section; and, Thirdly, the bearing for the lower centre of the steering fork is made of hardened steel with a conically turned hole, in which the centre turns, a projection preventing the socket moving.

1349. Rabbit and Vermin Trap, *T. Douglas.—26th March*, 1881. 6d.

The gripping jaws which snap on to the legs of the animal when it steps on the catch plate are replaced by a small arched metal bow or hoop attached to the lower bar or base of the trap, and a transverse bar or rod on the inner end of the top bar or usual bow spring released by the pressure of the animal on the tread plate.

1354. Casting Metals, *J. C. Mewburn.—26th March*, 1881.—*(A communication from J. Demogeot.)* 6d.

The process differs essentially from the ordinary process, inasmuch as the sand is rammed into the mould boxes by a machine, and instead of having at least two parts of the flask for each mould, there is only a single flask for each description of piece or casting.

1362. Automatic Regulation of Heat in Kilns, &c., *A. S. Tomkins, M. Courage, and F. A. Cracknall.—28th March*, 1881. 4d.

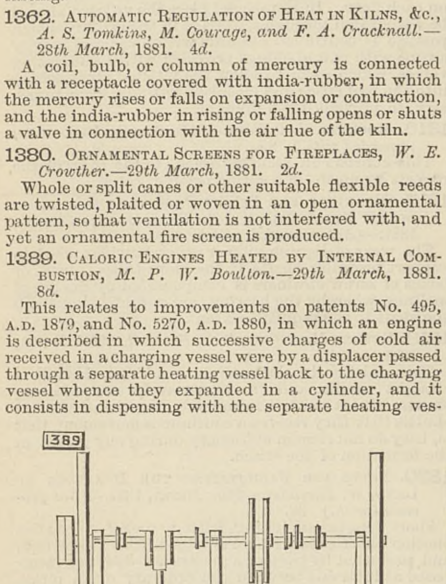
A coil, bulb, or column of mercury is connected with a receptacle covered with india-rubber, in which the mercury rises or falls on expansion or contraction, and the india-rubber in rising or falling opens or shuts a valve in connection with the air flue of the kiln.

1380. Ornamental Screens for Fireplaces, *W. E. Crowther.—29th March*, 1881. 2d.

Whole or split canes or other suitable flexible reeds are twisted, plaited or woven in an open ornamental pattern, so that ventilation is not interfered with, and yet an ornamental fire screen is produced.

1389. Caloric Engines Heated by Internal Combustion, *M. P. W. Boulton.—29th March*, 1881. 8d.

This relates to improvements on patents No. 495, A.D. 1879, and No. 5270, A.D. 1880, in which an engine is described in which successive charges of cold air received in a charging vessel were by a displacer passed through a separate heating vessel back to the charging vessel whence they expanded in a cylinder, and it consists in dispensing with the separate heating vessel by employing the internal combustion of gaseous or liquid fuel. A is the air charging vessel, the upper portion kept cool while the lower portion is hot; D is the displacer with a shield which works in this vessel; R is the regenerator through which air flows in passing from one side of D to the other; C is the working cylinder fitted with piston having a shield. A gas pump delivers gas into chamber E, when it is ignited by a gas jet.



1410. Steam Washing Machines, *G. Collier.—31st March*, 1881. 8d.

Within a box a cylindrical sieve is mounted on an axis and receives the articles to be washed. Steam is admitted to the box and the sieve is caused to revolve. Perforated tubes run longitudinally through the sieve, and through them the steam circulates and permeates the clothes. The bottom of the box contains water.

1411. Hydraulic Apparatus for Indicating at a Distance the Extent to which Reservoirs are Filled, *E. de Pass.—31st March*, 1881.—*(A communication from P. O. Oechelhäuser.)* 6d.

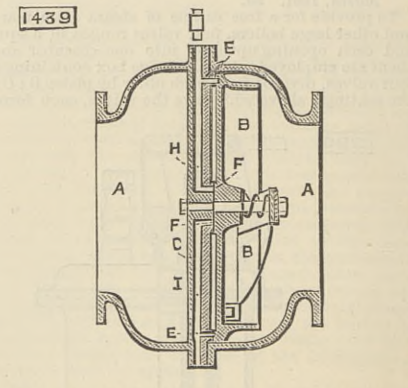
A pump for displacing liquids is employed, and its rod is provided with a rack, which through suitable gearing is connected to the bell of a gasometer, and is caused to rise and fall. A pipe is connected at one end to the pump and laid underground so as to remain unaffected by frost, and its other end is connected to a level indicator provided with a graduated scale.

1437. Knives and Forks, *W. H. Stokes.—1st April*, 1881. 6d.

The end of the handle to enter the bolster is reduced so that it will almost enter the hollow bolster formed on the fork or knife, and then pressure is applied so as to force the handle in, the edge of the bolster cutting away the reduced part as it enters, whereby a sure fit is secured. A special machine for forcing the two parts together, and another for forming the hollow bolsters by means of dies are described.

1439. Valves, *W. H. Westwood and E. T. Wright.—1st April*, 1881. 6d.

The objects are to facilitate lubrication, prevent the tendency of the moving parts to set or stick fast, and to effect the liberation of such parts when so set or stuck fast. As applied to a disc valve it consists of the case A, disc or moving part B bearing against the seat C. The valve is opened by partly rotating disc B by suitable gearing, the disc being pressed on its seat by a spring. In the face of B are concentric grooves



E and F, one on the boss and the other near the edge, the two being connected by radial grooves. In the valve seating channels or passages H I are formed, and by means of them a suitable lubricant is supplied between the disc B and seating C. Should the disc B become set, a force pump can be connected to the passages H and I so as to force the disc from its seat.

1441. Furnaces for Heating and Welding Tubes, &c., *W. Dutton and M. Croft.—1st April*, 1881. 2d.

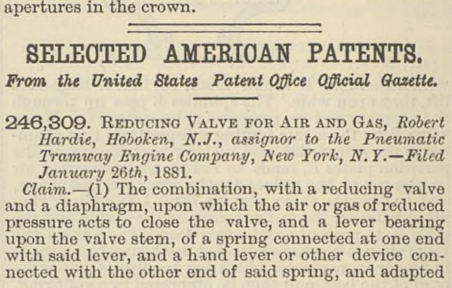
This consists in introducing currents of heated air above the furnace bed, and which, mingling with the smoke, consumes the same, thus allowing slack to be used in the place of coal. The air circulates through flues in the side walls of the furnace and issues through apertures in the crown.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

246,309. Reducing Valve for Air and Gas, *Robert Hardie, Hoboken, N.J., assignor to the Pneumatic Tramway Engine Company, New York, N.Y.—Filed January 26th*, 1881.

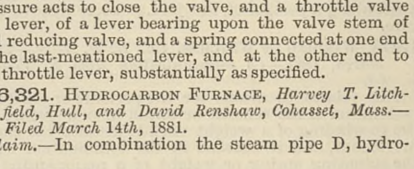
Claim.—(1) The combination, with a reducing valve and a diaphragm, upon which the air or gas of reduced pressure acts to close the valve, and a lever bearing upon the valve stem, of a spring connected at one end with said lever, and a hand lever or other device connected with the other end of said spring, and adapted



to be adjusted for increasing or diminishing the resistance offered by said spring to the closing of the said reducing valve, substantially as specified. (2) The combination, with a reducing valve and a diaphragm, upon which the air or gas of reduced pressure acts to close the valve, and a throttle valve and lever, of a lever bearing upon the valve stem of said reducing valve, and a spring connected at one end to the last-mentioned lever, and at the other end to the throttle lever, substantially as specified.

246,321. Hydrocarbon Furnace, *Harvey T. Litchfield, Hull, and David Renshaw, Cohasset, Mass.—Filed March 14th*, 1881.

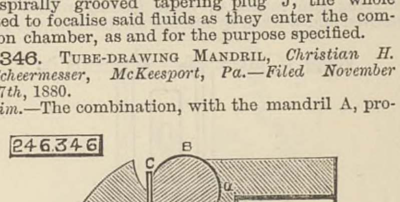
Claim.—In combination the steam pipe D, hydro-



carbon pipe E, mixing chamber B, tapering nozzle C, and spirally grooved tapering plug J, the whole adapted to focalise said fluids as they enter the combustion chamber, as and for the purpose specified.

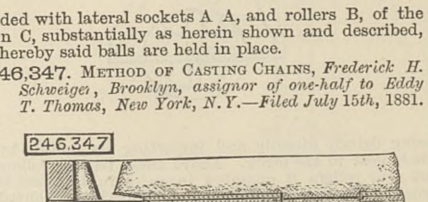
246,346. Tube-drawing Mandril, *Christian H. Scheermesser, McKeesport, Pa.—Filed November 27th*, 1880.

Claim.—The combination, with the mandril A, pro-



vided with lateral sockets A A, and rollers B, of the pin C, substantially as herein shown and described, whereby said balls are held in place.

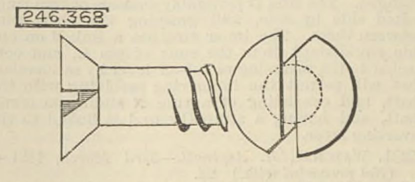
246,347. Method of Casting Chains, *Frederick H. Schweiger, Brooklyn, assignor of one-half to Eddy T. Thomas, New York, N.Y.—Filed July 15th*, 1881.



Claim.—That improvement in the art or method of producing cast metal chains which consists in the following steps, viz.: forming a part of the mould for each link of a series, embedding in the mould material a series of cast links, so that each link will surround a portion of two such mould portions, then moulding the remainder of the series of link moulds, removing the pattern, and finally pouring the metal, thus casting a series of links which inclose within them as one chain the previously made metal links, substantially as described.

246,368. Wood Screw, *Jas. W. Campbell, Brooklyn, N.Y.—Filed February 23rd*, 1881.

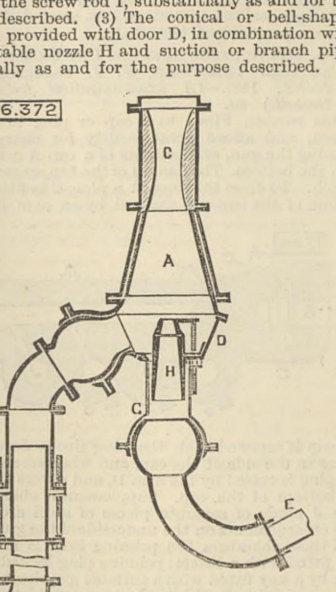
Claim.—A countersinking wood screw having a conical head with a nick the walls of which are mainly parallel, but of which walls each is divergent from the



other near one end to give clearance to the chips made by the cutting edge of the straight wall opposite, the planes of the several sections of wall being all parallel with the longitudinal axis of the screw, though not parallel with one another, substantially as specified.

246,372. Hydraulic Gravel Elevator, *George W. Cranston and Benjamin Willson, San Francisco, Cal.; said Cranston assignor to the Hydraulic Elevating Gravel Mining Company, same place.—Filed December 20th*, 1880.

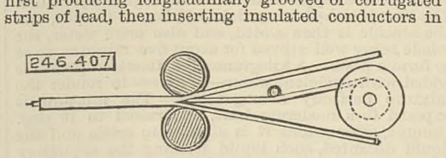
Brief.—A hydraulic gravel elevator in which the two lower sections of the upraise pipe have removable linings. The suction pipe is of short sections bolted together, and has a telescopic section also. The water and suction pipes are connected to the extension of the bell-shaped section by ball-and-socket joints. *Claim.*—(1) The conical or bell-shaped section A, provided with removable lining F, in combination with the detachable and vertical upraise pipe C, having lining E convex upon its interior, substantially as and for the purpose set forth. (2) The independent nozzle H, formed with a tapering bore or passage, and provided at its upper end with an arm, in combination with the screw rod I, substantially as and for the purpose described. (3) The conical or bell-shaped section A, provided with door D, in combination with the adjustable nozzle H and suction or branch pipe, substantially as and for the purpose described. (4)



The upraise or vertical pipe C, provided with a bell-shaped chamber at its lower end and an adjustable nozzle H, arranged below and in line with the centre of the chamber, said chamber being provided with two corresponding openings, one on each side of the nozzle, with one of which openings a suction pipe is connected, while the other is closed by a removable door, substantially as above specified. (5) In a hydraulic gravel elevator constructed with a bell-shaped chamber at the lower end of its vertical or upraise pipe, and provided with an adjustable nozzle H, arranged to slide in a stationary section G, below and in line with the centre of the bell-shaped chamber, the water pipe E, having its lower end bent upward and connected with the lower end of the stationary section G by a ball-and-socket joint. (6) The combination, with a hydraulic gravel elevator of a suction pipe made of short sections bolted together, one portion of which is arranged to slide telescopically in the other, substantially as and for the purpose described.

246,407. Manufacture of Electrical Conductors, *Thomas T. McTighe, Pittsburg, Pa.—Filed July 13th*, 1881.

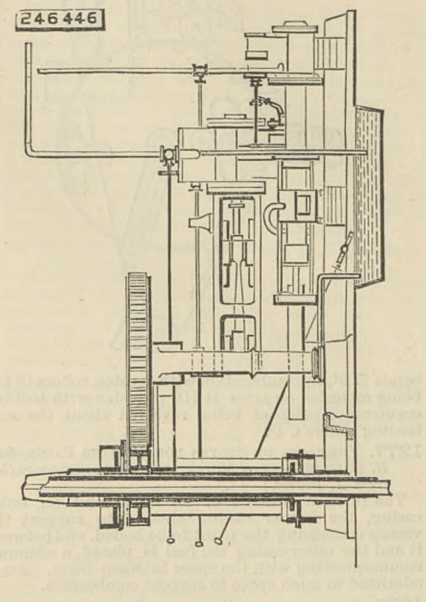
Claim.—The method of manufacturing insulated and protected electrical conductors, consisting in first producing longitudinally grooved or corrugated strips of lead, then inserting insulated conductors in



the grooves, and finally subjecting the whole to pressure, substantially as described. (2) The method of manufacturing insulated and protected electrical conductors, consisting in simultaneously drawing two separate longitudinally grooved lead strips and interposed insulated electrical conductors through a suitable compressor, substantially as described.

246,446. Well Boring and Rock Drilling Machine, *John Atkinson, New York, N.Y.—Filed February 19th*, 1881.

Claim.—(1) A rock-drilling or well-boring machine constructed with a rotary drilling spindle arranged in vertical position, in combination with a reciprocating engine arranged in horizontal position, with its driving shaft placed vertical and parallel with the drilling spindle and directly geared therewith, substantially as herein shown and described. (2) A rock-drilling machine having its drilling spindle supported on hydraulic pistons, in combination with a means of charging the inclosing cylinder thereof from beneath said pistons with water under pressure, tending to constantly support and lift said pistons, with a valve arranged to confine the water pressure thereon or allow its escape with more or less freedom, to effect the rise or fall of the said piston or pistons with any desired speed or pressure, substantially as herein set forth. (3) The combination, with a rock-drilling or well-boring machine having its drilling spindle supported on hydraulic pistons, of a hydraulic pump arranged to charge the cylinders of said pistons, a controllable valve to allow the regulated escape of the fluid from said cylinder and pump, and a tank arranged on the circuit of said pump, with the suction and discharge pipes thereof directed into said tank, substantially as and for the purposes set forth. (4) The combination, in a rock-drilling or well-boring machine having its drilling spindle supported on hydraulic pistons which control the rise and fall thereof, with means for charging said cylinder with water under pressure in a direction to lift said pistons or piston, and an adjustably weighted valve arranged to allow the escape of the fluid when the pistons are raised to their limit or when a given pressure is exerted on the pistons, substantially as and for the purposes specified. (5) A rock-drilling or well-boring machine constructed with an engine or motor to drive or rotate the drilling spindle, with means for producing the



vertical movement of the spindle, and a device to control said vertical movement, in combination with a series of distinct operating handles 1 2 3, controlling each movement, arranged in a group on the front of the machine, adjoining the drilling spindle, substantially as and for the purpose specified. (6) In a rock-drilling or well-boring machine, substantially such as described, the combination, with a vertically-sliding frame supporting the drill spindle, of the circle of balls or rollers resting in said frame, and the bearing rim fixed to said spindle and resting on said rollers, substantially as herein shown and described.

CONTENTS.

The Engineer, October 28th, 1881.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Engineers, Charles G. Walmsley to the Asia, additional for service with gunboats at Haslar, vice Shoolbread; Henry S. Pemberton to the Asia, additional for Staunch, vice Walmsley; George O'Brien to the Duke of Wellington, additional for Sprightly, vice Jones; George Aborn, to the Valiant. Acting-Engineer William J. Mullinger to the Asia, as supernumerary for disposal.