INSTITUTION OF MECHANICAL ENGINEERS.

The annual general meeting of the Institution of Mechanical Engineers was held on Thursday and Friday, the 27th and 28th ult., in the hall of the Institution of Civil Engineers, 25, Great George-street, Westminster. The first meeting began at 7.30 p.m., and the second at 3 p.m. We published in our last impression the report of the Council read on the 27th ult., and from it it will be seen that the Institution is in a very prosperous condition, with a considerable sum in ready money available for any required purpose. Nevertheless, the Institution is, like many others, wholly dependent on the courtesy of the Institution of Civil Engineers for a place in which to meet; and we are disposed to ask what has become of Dr. Siemens' scheme for the erection of a building which should be available for the meetings of all scientific bodies without a London home.

The meetings were in no sense brilliant. The attendance was comparatively good, but the papers did not seem to be of the proper kind to evoke discussion, and very little took place. The first paper was read by Mr. Samuelson,

On Harvesting Machinery.

The author began by saying that in a paper read before the Manchester meeting of this Institution by Mr. W. R. Bousfield, the operations of agriculture were divided into four chief divisions, as follows:—(1) Preparation of the land; (2) sowing of the seed; (3) harvesting of the crops; (4) preparation of the crops for consumption. The writer took for his subject the third division, and without going into the history of the question, discussed some of those machines which are in practical use in the country at the present date. Harvesting machines may be divided into two main classes, as follows—(1) Those in use for cutting and gathering our hay crops, whether of natural or of artificial grasses; (2) those designed for the harvesting of corn crops. The first division may be subdivided into three classes—(*a*) Those machines used for cutting down the standing grass, or mowing machines; (*b*) those used for spreading the cut grass in order to expose it to the influence of the sun and wind, or haymakers; (*c*) those which are used for gathering the spread crop, or horse-rakes. As time would not permit of the latter two subdivisions being included in this paper, the writer confined himself on this occasion to mowing and reaping machines, and he proceeded to describe these at some length. It would be quite hopeless to make the paper intelligible without a large number of diagrams; and this refers particularly to that part of it dealing with self-binding reapers, and even though we published the diagrams, we believe that very few indeed of our readers are sufficiently interested in the subject to undergo the labour of endeavouring to understand them. It is not, perhaps, too much to say that the great body of Mr. Samuelson's hearers knew no more after he had read his paper than they did before about self-binding reapers; and this is hardly matter for regret, seeing that not one of the devices described by Mr. Samuelson has been proved to be calculated to meet the wants of the English agriculturist, however well they may suit the short, thin crops of the American farmer.

The discussion that ensued was exceedingly meagre. In spite of various efforts which had been made to insure the presence of agricultural engineers, and also of agriculturists, but few of them attended, and those who did attend were unwilling to open their lips. Of course, the recent severe weather may partly account for this. Implement makers and farmers are not collected to a large extent in London, like those interested in other branches of engineering, but, on the contrary, are scattered pretty uniformly all over the three kingdoms; and we cannot wonder that most of them hesitated to take a long journey to the metropolis in face of the late frost. We believe, however, that another cause was at work, and that one which we have before lamented in these columns, namely, disinclination of those who have studied special classes of machinery to give to the public the benefit of their experience. Makers of mowing and reaping machines were, no doubt, glad to hear what Mr. Samuelson had to say, or will be glad to read it when published; they are very willing to learn, but they are not so desirous to teach. We fear that so long as human nature continues what it is, this will be an abiding difficulty; and all the more honour is due to those who, like Mr. Samuelson, are found to step forward and explain so fully and frankly the processes and the mechanism they employ. We trust also that the Council of the Institution will not be deterred from their efforts to obtain papers of this kind, dealing with special classes of machinery, by finding that the discussions upon them are apt to be short and unsatisfactory. In this case practically only two questions were asked, one referring to the tractive force required for the various machines, and one to their adaptability for crops such as rice, which have to be cut about 1ft. from the ground. As to the first, Mr. Samuelson referred to the elaborate trials made by the Royal Agricultural Society, and recorded in their journals. As to the second, he stated that there was no difficulty in adapting a reaping machine to rice, &c., by mounting the wheels on adjustable bearings, and also providing a means of altering the level of the cutter-bar; it was also necessary to increase the size of all the wheels, otherwise the machine would stick fast in the deep irrigation channels of the rice-field, instead of passing over them.

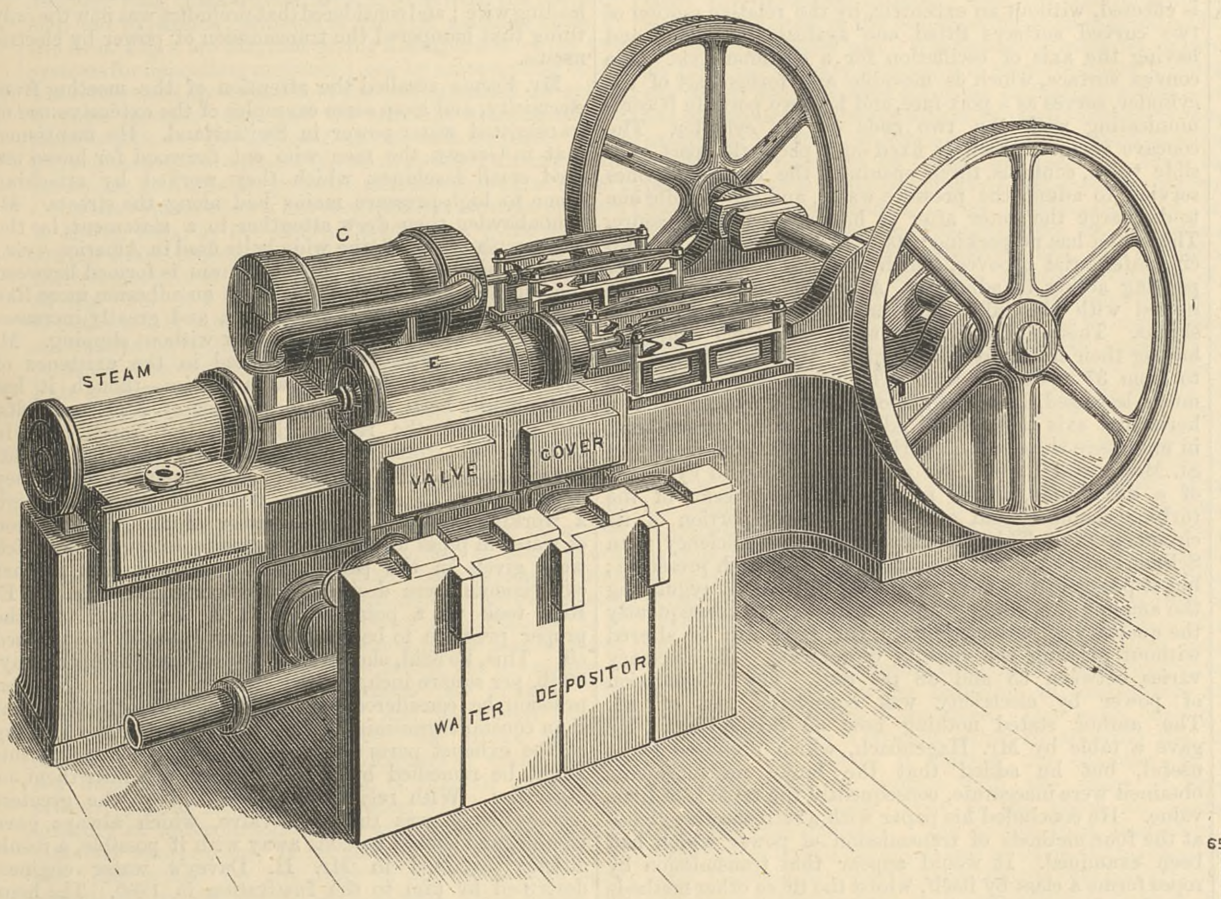
The next paper read was by M. A. Achard,

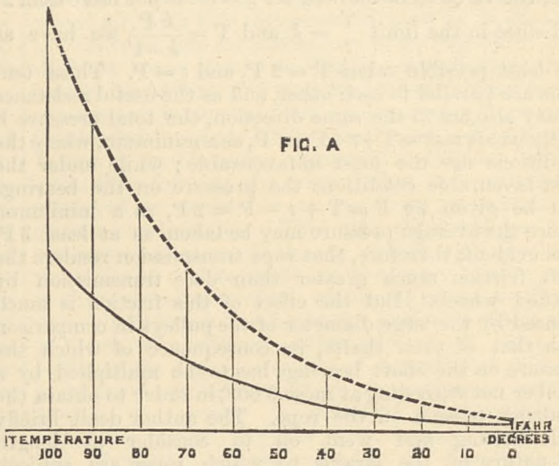
On the Various Modes of Transmission of Power to a Distance.

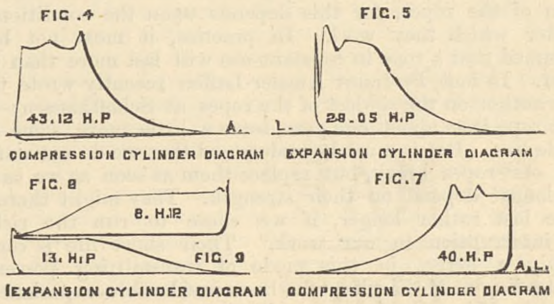
The author in this paper furnished a summary of the practical results obtained in the transmission of power to a distance. While the interest attaching to this subject is unquestionable, the author is, nevertheless, very doubtful whether a successful result can be attained in one particular application—namely, the establishment of large undertakings for distributing hydraulic power to a number of factories, either existing or contemplated, similar to the undertakings at Schaffhausen, Fribourg, and Bellegarde. At the first of these places, in spite of favourable circumstances, rapid extension of working, and good management, the profit has been very small on the capital outlay. The manufactories at the two other places, being much less favourably situated, have failed after a short and profitless existence. Their failure has shown very clearly that their founders laboured under a strange delusion in supposing that cheap motive power was in itself sufficient to create industries in localities where their essential elements were wanting. The author accordingly considers there is not much to be gained from this method of transmitting power to a distance, and that it can only succeed financially under exceptionally favourable conditions. Having premised so much, he next proceeded to examine the various methods used, or proposed, for transmitting power to a distance. He first considered transmission of power by wire ropes, which is merely an extension of the simple case of transmission by ordinary hemp ropes, and the same principles apply to both. Let A and B be the axes of two parallel shafts carrying two pulleys whose planes coincide. The driving power P acts on A, and the resistance Q on B. For simplicity, let it be assumed that those two forces act tangentially at the circumference of the pulleys. The motion is communicated from A to B by means of the rope passing round the two pulleys; of this the part which is passing towards the driving pulley is called the driving span, and the part which is passing from the driving pulley is called the trailing span. Let T be the tension of the driving span, and t that of the trailing span. Neglecting friction, &c., we should have $Q = P$; and the values of the tensions in the two spans are given by the equations $T - t = P$ and $\frac{T}{t} = k$; denoting by k the smallest practicable value of e^{fa} for the two pulleys, where e is the base of Napierian logarithms, f the coefficient of friction between the pulley and the rope, and a the ratio between the arc encircled by the rope and the radius of the pulley. Accordingly the values of T and t are given by the following equations:—

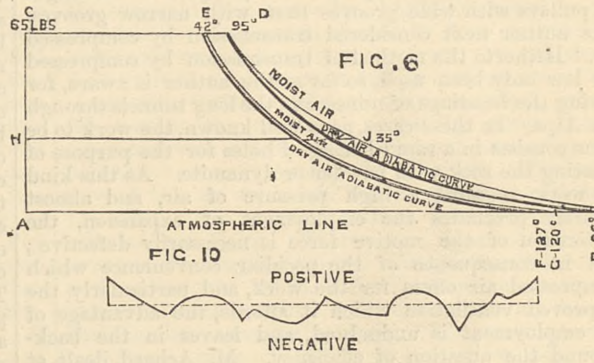
$$T = \frac{k\ P}{k-1};\quad t = \frac{P}{k-1}.$$

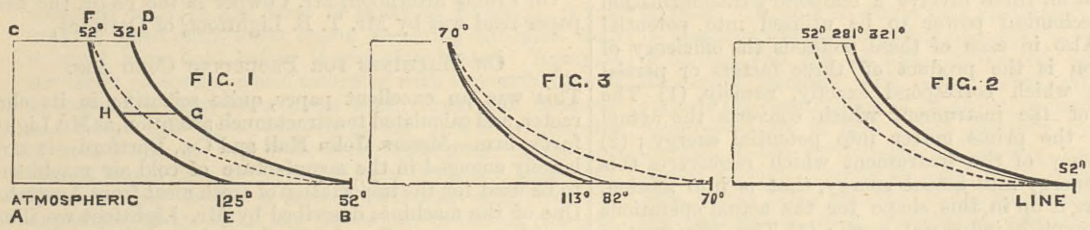
If the ratio $\frac{T}{t}$ be greater than k, the rope will slip on the driving pulley. The values of T and t, as above calculated, when k has its exact value, are only just sufficient to prevent slipping, which would occur on any accidental diminution of friction. For safety, therefore, it is necessary to assign to k a somewhat lower value than its real one; which practically amounts to increasing the tensions T and t a little beyond what is requisite in theory. The tension common to the whole rope when at rest is somewhere intermediate between the tensions T and t of its two spans while running; and by adjusting the rope while at rest to this intermediate tension, its two spans assume of their own accord the required tensions T and t as soon as it begins to run. The section w to be given to the rope, so that it may possess the requisite strength, is regulated by the driving tension T, and must be such that the quotient $\frac{T}{w}$ shall not exceed the











COLD AIR PRODUCING MACHINERY.

working strain which the material of the rope is suited to bear in practice. It is evident that, in transmitting a given amount of power, the driving tension, and consequently the section of the rope, may be diminished by increasing the speed; for if N denotes the power transmitted, and v the speed of the rope, then

$$P v = N, \text{ and } T = \frac{k P}{k-1} = \frac{k}{k-1} \frac{N}{v}.$$

In practice the rope elongates under the continuous pull, and requires shortening from time to time to keep the tension up to the proper amount. The author next took into account the useless resistances neglected for the sake of simplicity. The useful resistance Q is now necessarily less than the driving power P, and the ratio $\frac{Q}{P}$ represents the efficiency of the transmission. The useless resistances are two in number. The first is the rigidity or stiffness, due to the imperfect flexibility of the rope. This effect, however, is insignificant in the case of rope transmission, on account of the large size of the pulleys employed. The other useless resistance is the friction of the two shafts A and B in their bearings, which is measured by the resultant F of all the external forces acting on each shaft. It appears from the principles enunciated above that the employment of rope transmission renders this friction considerable. In fact, under average conditions of adhesion, the value to be allowed for $k = e^{fa}$ is not more than 2; and since in the limit $\frac{T}{t} = k$ and $T = \frac{k P}{k-1}$, we have as the least possible values $T = 2 P$, and $t = P$. These tensions are parallel to each other, and as the useful resistance Q may also act in the same direction, the total pressure F on the shaft may $= T + t + P = 4 P$, as a minimum, where the conditions are the most unfavourable; while under the most favourable conditions the pressure on the bearings will be given by $F = T + t - P = 2 P$, as a minimum. Hence the average pressure may be taken as at least 3 P. It is evident, therefore, that rope transmission renders the shaft friction much greater than does transmission by toothed wheels. But the effect of this friction is much reduced by the large diameter of the pulleys in comparison with that of their shafts, in consequence of which the pressure on the shaft bearings has to be multiplied by a number not exceeding at most 0·003, in order to obtain the resulting tension on the rope. The author dealt briefly with belting and went on to consider at length the nature of the strains to which ropes are subject. It is difficult to lay down any general rule as to the duration of the ropes, for this depends upon the conditions under which they work. In practice, it must not be assumed that a rope in constant use will last more than a year. In fact, Professor Amsler-Laffon recently wrote to the author on the subject of the ropes at Schaffhausen:—"A rope lasts about one year, some a little more, some a little less. But it must be understood that we do not wait till our ropes break, but replace them as soon as we can no longer depend on their strength. They might therefore last rather longer, if we chose to run the risk of interruption in our work." Their short life is certainly a defect in this mode of transmitting power. According to M. Ziegler, who has considerable experience on this subject, horizontal oscillations are very injurious to the duration of the ropes, and they appear to last longer on pulleys with wide grooves than with narrow grooves. The author next considered transmission by compressed air. Hitherto the method of transmission by compressed air has only been used, so far as the author is aware, for boring the headings of mines, and the long tunnels through the Alps. In these cases, as is well known, the work to be done consists in a rapid boring of holes for the purpose of blasting the rock with powder or dynamite. As this kind of work requires a high pressure of air, and almost entirely precludes the employment of expansion, the utilisation of the motive force is necessarily defective; but in consequence of the peculiar convenience which compressed air offers for the work, and particularly the improved ventilation which it affords, the advantage of its employment is undoubted, and leaves in the background the question of efficiency. M. Achard dealt at great length with the somewhat complex mathematics of the subject, but he did not supply much if any new data. Referring to the motors fed with the compressed air, the author held that this subject is still in its infancy from a practical point of view. In proportion as the air becomes hot by compression, so it cools by expansion, if the vessel containing it is impermeable to heat. Under these conditions, it gives out in expanding a power appreciably less than if it retained its original temperature, besides which the fall of temperature may impede the working of the machine, by freezing the vapour of water contained in the air. If it is desired to utilise to the utmost the force stored up in the compressed air, it is necessary to endeavour to supply heat to the air during expansion, so as to keep its temperature constant. It would be possible to attain this object by the same means which prevent heating from compression, namely, by the circulation and injection of water. It would, perhaps, be necessary to employ a little larger quantity of water for injection, as the water, instead of acting by virtue both of its heat of vaporisation and of its specific heat, can in this case act only by virtue of the latter. These methods might be employed without difficulty for air machines of some size. It would be more difficult to apply them to small household machines, in which simplicity is an essential element; and we must rest satisfied with imperfect methods, such as proximity to a stove, or the immersion of a cylinder in a tank of water. Consequently, loss of power by cooling and by incomplete expansion cannot be avoided. The only way to diminish the relative amount of this loss is to employ compressed air at a pressure not exceeding three or four atmospheres. The only real practical advance made in this matter is M. Mékarski's compressed air engine for tramways. In this engine the air is made to pass through a small boiler, containing water at a temperature of about 120 deg. Cent.—248 deg. Fah.—before entering the cylinder of the engine. It must be observed that in order to reduce the size of the reservoirs, which are carried on the locomotive, the air inside them must be very highly compressed, and that in going from the reservoir into the cylinder it passes through a reducing valve, or expander, which keeps the pressure of admission at a definite figure, so that the locomotive can continue working so long as the supply of air contained in the reservoir has not come down to this limiting pressure. The air does not pass the expander until after it has gone through the boiler already mentioned. Therefore, if the temperature which it assumes in the boiler is 100 deg. Cent.—212 deg. Fah.—and if the limiting pressure is five atmospheres, the gas which enters the engine will be a mixture of air and water-vapour at 100 deg. Cent.; and of its total pressure the vapour of water will contribute one atmosphere, and the air four atmospheres. Thus this contrivance, by a small expenditure of fuel, enables the air to act expansively without injurious cooling, and even reduces the consumption of compressed air to an extent which compensates for part of the loss of power arising from the preliminary expansion which the air experiences before its admission into the engine. This scheme was then mathematically investigated by the author. Next M. Achard dealt with the transmission of power by water pressure. Of machines worked by water pressure, the author referred only to two, which appear to him in every respect the most practical and advantageous. One is the well-known piston machine of M. Albert Schmid, engineer, Zurich. The cylinder is oscillating, and the distribution is effected, without an excentric, by the relative motion of two curved surfaces fitted one against the other, and having the axis of oscillation for a common axis. The convex surface, which is movable and forms part of the cylinder, serves as a port-face, and has two ports in it communicating with the two ends of the cylinder. The concave surface, which is fixed and plays the part of a slide valve, contains three openings, the two outer ones serving to admit the pressure water, and the middle one to discharge the water after it has exerted its pressure. The piston has no packing; its surface of contact has two circumferential grooves, which produce a sort of water packing acting by adhesion. A small air chamber is connected with the inlet pipe, and serves to deaden the shocks. This engine is often made with two cylinders, having their cranks at right angles. Its efficiency is equal to from 37 to 83 per cent. The other engine, which is much less used, is a turbine on Girard's system, with a horizontal axis and partial admission, exactly resembling in miniature those which work in the hydraulic factory of St. Maur, near Paris. The water is introduced by means of a distributor, which is fitted in the interior of the turbine chamber, and occupies a certain portion of its circumference. This turbine has a lower efficiency than Schmid's machine, and is less suitable for high pressures; but it possesses this advantage over it—that by regulating the amount of opening of the distributor, and consequently the quantity of water admitted, the force can be altered without altering the velocity of rotation. Its efficiency varies between 35 and 68 per cent. The transmission of power by electricity was considered last of all. The author stated nothing new on this subject. He gave a table by Mr. Hagenbach, which promised to be useful, but he added that the brake measurements obtained were inaccurate, consequently the table is of little value. He concluded his paper with a retrospective glance at the four methods of transmission of power which had been examined. It would appear that transmission by ropes forms a class by itself, whilst the three other methods combine into a natural group, because they possess a character in common of the greatest importance. It may be said that all three involve a temporary transformation of the mechanical power to be utilised into potential energy. Also in each of these methods the efficiency of transmission is the product of three factors or partial efficiencies which correspond exactly, namely, (1) The efficiency of the instrument which converts the actual energy of the prime mover into potential energy; (2) The efficiency of the instrument which reconverts this potential energy into actual energy, that is into motion, and delivers it up in this shape for the actual operations which accomplish industrial work; (3) The efficiency of the intermediate agency which serves for the conveyance of potential energy from the first instrument to the second. This last factor for transmission by electricity is the exact correlative of the efficiency of the pipe in the case of compressed air, or of water pressure. It is as useful in the case of electric transmission, as of any other method, to be able, in studying the system, to estimate beforehand what results it is able to furnish; and for this purpose it is necessary to calculate exactly the factors which compose the efficiency. In order to obtain this desirable knowledge, the author considers that the three following points should form the aim of experimentalists: (1) The determination of the efficiency K of the principal kinds of magneto-electric, or dynamo-electric, machines working as generators. (2) The determination of the efficiency K, of the same machines working as motors. (3) The determination of the law according to which the magnetism of the cores of these machines varies with the intensity of the current. The author added that he would gladly have concluded this paper with a comparison of the efficiencies of the four systems which have been examined, or, what amounts to the same thing, with a comparison of the losses of power which they occasion. Unfortunately such a comparison has never been made experimentally, because hitherto the opportunity of doing it in a demonstrative manner has been wanting; for the transmission of power to a distance belongs rather to the future than to the present time. The author believes that transmission by ropes furnishes the highest proportion of useful work; but that as regards a wide distribution of the transmitted power the other two methods, by air and water, might merit a preference.

The discussion which followed, the author being absent, was opened by Mr. J. N. Shoolbred, who gave facts and set forth certain experiments on the efficiency of electric generators, quoted in the paper, in a form more in accordance with English ideas. He observed that they confirmed the previous experiments of Dr. Hopkinson and others as to the very high efficiency of such generators, but this of course proved nothing as to the efficiency of transmission by electricity, where the electricity, after being generated, had to be reconverted into power at the other end. In this reconversion Dr. Siemens' experiments showed a loss of about 50 per cent. Recent experiments of his own, however, led to the hope that this loss might be largely reduced by adopting proper precautions between the two machines, the generator and the motor. Anyhow, there were many cases where efficiency was of the first importance, *e.g.*, where natural sources were utilised, or a large central steam engine could be drawn upon, &c., and here the greater compactness and economy of the electric transmission would give it important advantages. Mr. Alexander Siemens followed in the same strain, and thought far too much was made of the question of efficiency, which was often of little importance. He instanced Sir William Armstrong's arrangement at Rothbury, lately described by him in these columns, and that of Dr. Siemens at Tunbridge; and looked forward to the time when large steam engines would be established at central positions in towns, whence the power would be distributed by electricity as required. He held that a few experiments were necessary to settle the arrangements of such transmissions, because the conditions might always be preserved constant, by arranging the proper resistance in the leading wire; and considered that prejudice was now the only thing that hampered the transmission of power by electric means.

Mr. Fernie recalled the attention of the meeting from electricity, and gave some examples of the extensive use of transmitted water-power in Switzerland. He mentioned that in Geneva the men who cut firewood for house use used small machines, which they worked by attaching them to high-pressure mains laid along the streets. M. Schönheyder then drew attention to a statement in the paper with regard to the wide belts used in America—viz., that at high speeds a partial vacuum is formed between the belt and the pulley, which gives an adhesion more like that of an ordinary leather sucker, and greatly increases the tension which the belt will bear without slipping. M. Schönheyder altogether disbelieved in the existence of this action—and probably with justice—though it has undoubtedly been claimed in the case of American belts. He discussed the reason why the iron ropes used in transmission wore so rapidly, lasting, *e.g.*, at Schaffhausen only twelve months; and suggested that they must either be drawn too tight, or given too high a working strain. He also spoke of the great friction of water in pipes under heavy pressure, examples of which were given in the paper; and suggested that further experiments were desirable on this subject. Mr. W. E. Rich took up a point neglected in the paper, viz., the proper pressure to be used in transmission by compressed air. This, he held, should be as low as was convenient, say, 30 lb. per square inch, for dry air compressors. Air compression he considered was better suited to intermittent than constant transmission. In the latter case the freezing at the exhaust ports was a great inconvenience, but this might be remedied by placing a small fire near them, or otherwise. With regard to water engines, the greatest inconvenience was the slide valve, which always gave trouble, and should be done away with if possible, a result already attained in Mr. H. Davey's water engines, described by him to the Institution in 1880. The hour being late the meeting was then adjourned.

On Friday afternoon, Mr. Cowper in the chair, the first paper read was by Mr. T. B. Lightfoot, of Dartford,

ON MACHINES FOR PRODUCING COLD AIR.

This was an excellent paper, quite scientific in its character, and calculated to attract much attention, as Mr. Lightfoot's firm—Messrs. John Hall and Co., Dartford—is now largely engaged in the manufacture of cold air machinery to be used for the importation of fresh meat from Australia. One of the machines described by Mr. Lightfoot we illustrated on pages 248 and 249 of our last volume. An improved machine we illustrate herewith. Mr. Lightfoot prepared a great number of wall diagrams to render the construction of the machines he described clear. He began by pointing out that air is rapidly compressed under a piston, without either loss or gain of heat from without, it is raised in temperature, mechanical work expended on the piston being transferred to the air in the form of heat. If this compressed and heated air, at that pressure and temperature, be then introduced below another piston, and expanded without loss or gain of heat from without down to its original pressure, it will also resume its original temperature, and will have given back, while expanding, useful work precisely equal in amount to that absorbed during compression. If, however, after compression, the air is first cooled, by allowing some of its sensible heat to be absorbed by some cooler substance, and then expanded under a piston to atmospheric pressure, a less amount of useful work will be given back than in the first case, and the air, after expansion, will be found to occupy less than its original volume, and to be colder than its original temperature by a difference which is greater or less according as the quantity of heat taken away before expansion is large or small. The operation just described forms the basis upon which the cold air machines treated of in the paper are constructed, and the author proceeded to illustrate the proposition graphically. So much has recently appeared in our own pages on the subject, that we need not follow Mr. Lightfoot closely. The diagrams annexed are reduced from those prepared by Mr. Lightfoot to illustrate the theory of his machines, and to a large extent they explain themselves. Fig. 1 illustrates the theory of cold air machines graphically. A B represents a volume of atmospheric air—considered for the sake of convenience, as a perfect gas—at a temperature of 52 deg. Fah. This air is rapidly compressed under a piston to the volume C D. The pressure A C, above the atmospheric pressure, is then, in the present example, 50 lb. per square inch, and the temperature 321 deg. Fah., giving a rise of 269 deg. Fah. Now suppose that, instead of immediately expanding the volume C D of hot compressed air back to atmospheric pressure, we first abstract a portion of its sensible heat, and so reduce its temperature to 52 deg. Fah., it will be found that its volume will also be reduced to C F, where C F bears the same ratio to C D as the new absolute temperature bears to the old, or C F : C D : : 513 : 782. On now expanding the volume C F to its original atmospheric pressure, the piston will only be pushed out to the position E, and the final temperature of the air will be 125 deg. below zero Fah. The efficiency of the operation is represented by

$$\frac{\text{Volume swept through by expansion piston}}{\text{Volume swept through by compression piston}},$$

and the area B D F E gives the theoretic mechanical force required for driving the machine. Fig. 2 gives in thick black the adiabatic and in dotted the isothermal curve of compression of a perfect gas, from 14·7 lb. and 52 deg. to 65 lb. per inch. In Fig. 3 the adiabatic and isothermal lines are shown in thick black and dotted lines. The volume C D is as in Fig. 2 corrected; the intermediate lines show what is got in practice. In Fig. A the dotted line shows force of aqueous vapour at temperatures from 0 deg. to 100 deg. Fah. The black line shows the weight of aqueous vapour in one pound of saturated mixture of air and vapour at ordinary atmospheric pressure, and at temperatures from 0 deg. to 100 deg. Fah. Figs. 4 and 5 are diagrams from the compression and expansion cylinders of the first machine made by the firm. Fig. 6 is a diagram giving a comparison of the two systems for depositing moisture; one by extra cooling of the wet compressed air by means of the cold expanded air acting through metallic pipes, and the other by utilising the expansive action of the air itself, on the author's plan. Here C D represents the volume of the air at 95 deg. Fah. and 65 lb. per square inch absolute pressure, as it leaves the first cooler; C E is the volume when it has been cooled at constant pressure to 42 deg. Fah., by the external application of the cold air, during which process heat is given off sufficient to raise the temperature of an equal weight of the dry cold air by 84 deg. Fah.; E F is the adiabatic curve of expansion, and E G the actual curve, allowing for the effect of the moisture still remaining in the air at 42 deg. Fah. The final temperatures for these curves are 127 deg. and 120 deg. below zero Fah. respectively. On the other system D J is the curve of expansion down to a temperature of 35 deg. Fah.; the pressure is then reduced to 35 lb. per square inch absolute, and the moisture deposited is the same as in the first case, after cooling at constant pressure to 42 deg. Fah. The condensed vapour having been abstracted, and the dried air admitted to the second expansion cylinder, J K is the curve of expansion to atmospheric pressure, while D B is the line of adiabatic expansion from the point D. The final temperatures are 68 deg. below zero Fah. for J K, and 96 deg. below zero Fah. for D B. Figs. 7, 8, 9 show the first expansion in the new machine, and the final expansion under the piston, the horse-powers being calculated at 60 revolutions per minute. The diameters of the compression and expansion pistons are 27in. and 20in. respectively, the stroke in each case being 18in. Fig. 10 is a diagram of crank strains. An important fact to be noted, is that air at constant pressure, having free access to water, will hold a different quantity of water in solution as vapour or steam, at each different temperature; or conversely, the temperature of the "dew point" for any body of air varies with each quantity of water held in solution by it. The hotter the air, the more water can it hold without depositing. Thus if air is highly heated by compression, and water is then admitted to it, in the form of spray or injection, it will take up much more water before becoming saturated than it could have held before it was thus heated. Again, if air under compression and saturated with vapour is allowed to expand, a large quantity of such vapour will condense and freeze into snow, thereby giving up a large quantity of heat to the air, which air is in consequence cooled less than it would have been, had it been dry air to start with. This freezing is also a serious practical evil, from the deposition of ice about the valves and in the air passages, which necessitates frequent stoppages even in small machines. Various means have been devised for ridding the air more or less completely of its contained moisture, by employing some chemical material, such as chloride of calcium or sulphuric acid, which is a powerful absorbent of water. But in the author's opinion the use of such chemicals as are known to him is inadmissible, except perhaps for small machines, or for those working under special conditions, because of the trouble which would be experienced in changing the material, and evaporating off the water it has absorbed, so as to render it again fit for use. Mr. Lightfoot next proceeded to explain the nature of the isothermal and adiabatic curves, and he compared the theoretical curve with actual curves obtained in practice from machines made by his firm. In one case the initial temperature of the air entering the cylinder was 52 deg. Fah.; and it contained, as ascertained with a hygrometer, 0·007 lb. of aqueous vapour to the pound of mixture, this being about 88 per cent. of saturation for the observed temperature. By calculation from the volume, the temperature at the end of the stroke was 267 deg. Fah., whereas if the compression had been accomplished adiabatically, it would have been 321 deg. Fah. The air thus compressed is delivered to the cooling apparatus, consisting of an arrangement of small brass tubes, having cold water flowing through them. The air is thus reduced in temperature to within from 5 deg. to 10 deg. of the initial temperature of the cooling water, and with this abstraction of heat, its capacity to retain vapour being lessened, a portion of the moisture it contains is condensed, and may be collected and run off if suitable means be provided. In practice, with the machinery under the conditions mentioned above, the air, if cooled to 70 deg. Fah., may be made to part with about one-half of its contained moisture at this stage. Mr. Lightfoot then noticed shortly some of the machines previously devised for producing cold air Kirk's machine consists in principle of a single cylinder in which air is compressed at one end and expanded at the other. The heat caused by compression is partially carried off through the cylinder cover, which is water-jacketted, and the cold from expansion is used to abstract heat from a current of brine or other medium, circulating over the cover at the expansion end. Between the two ends is a regenerator, formed of several thicknesses of wire gauze. Through this both the hot compressed air and the cold expanded air pass, on their way from one end of the cylinder to the other; so that there is a continual alternate compression and expansion of the air, and a continual heating and cooling of the regenerator. The Giffard cold air machine consists of one single-acting water-jacketted compression cylinder, and one single-acting expansion cylinder, both worked from cranks on an overhead shaft. The compressed air is led from the cylinder into the cooler, which is merely a cluster of small tubes placed vertically in a case. The cooling water passes upwards outside the tubes, and thence goes to the compression cylinder jacket; the air is admitted into a casing below the ends of the tubes, passes up through them, and is taken off from the top to a wrought iron reservoir. A pipe from this reservoir supplies the air to the expansion cylinder; the admission and exhaust being controlled by two independent steel mitre valves in the cylinder bottom, worked by cams from the shaft. In this machine no attempt is made at drying the air; all the moisture taken into the compression cylinder is discharged in the form of snow from the expansion cylinder, with the exception of the portion deposited in the cooler owing to the partial cooling of the compressed air. Windhausen's machine expands air from its ordinary atmospheric pressure under a piston; the cooled and expanded air being discharged much below the atmospheric pressure, either through tubes surrounded externally by brine, or into a hermetically sealed chamber, where the objects to be frozen are placed. After this process the air is again compressed to atmospheric pressure, cooled, and re-expanded. The disadvantages of this machine are the large size of the cylinders, &c., necessitated by the very low pressure employed, and the fact of its entirely depending for its action on the production of a partial vacuum. The Bell-Coleman refrigerator consists of an ordinary machine for producing cold air by compression, cooling, and expansion, combined with an apparatus for depositing a portion of the moisture before the air is admitted to the expansion cylinder. In this system the air is partially cooled during compression by the actual injection of cooling water into the compressor, and by causing the current of compressed air flowing from the pumps to come in contact with a spray of water. From the pumps the mixed air and water is led by pipes into a chamber or chambers with perforated diaphragms, which catch a portion of the suspended moisture. The air, still in its compressed state, and cooled to within 5 or 10 degrees of the initial temperature of the cooling water, is then led to the expansion cylinder through a range of pipes, or other apparatus, with extended metallic surfaces, cooled externally to a lower temperature than that of the cooling water; so as to induce a further reduction in temperature and consequent deposition of moisture. This extra cooling of the compressed air is effected either by allowing the cold expanded air, before it reaches the chamber to be cooled, to come in contact with the range of pipes, or by exposing these pipes to the spent air passing from the cold chamber. The author then considered at considerable length the objections to which the machine was open. It should, however, be stated that he very frankly added that these machines have been successfully worked in cases where a large amount of cooling water of low temperature is available, as, for instance, on board an ordinary Atlantic steamer. There is no doubt that moderately dry air would be obtained wherever a sufficient supply of water at 46 deg. or 50 deg. Fah. can be had. Sturgeon's refrigerator is a horizontal machine with some novel arrangements as regards the construction of its air-valves and pistons. The compressed air is first cooled partially by being passed through tubes surrounded by cooling water, and then passed through charcoal or some other absorbent of moisture, before being admitted to the expansion cylinder. If the charcoal or other material is properly changed and renewed when necessary, this may form a dry air process; but, as already stated, the introduction of a chemical drier is in the author's opinion undesirable, except under special conditions. Messrs. Hick, Hargraves, and Co., of Bolton, manufacture cold air machines of horizontal form, in which the Corliss cut-off gear is applied to the admission valves of the expansion cylinder. The air is compressed in a double-acting cylinder, into which cooling water is injected at each stroke; it then passes through a series of receivers, in which the water mechanically carried over is deposited, and is finally admitted to the expansion cylinder, and expanded to atmospheric pressure. So far as the author knows, no attempt is made at drying the air, which passes to the expansion cylinder fully saturated for its temperature and pressure; but a large snow-box, consisting of a series of baffles, abstracts the bulk of the snow from the cooled air, after expansion and before its introduction to the chamber. In a machine of this description which the author has seen, the snow had to be cleared out from the exhaust valves every few hours. The author then proceeded to describe the cold-air machines manufactured by his firm, which have already been illustrated in our columns, as stated above. Neither of the machines so described were intended to produce dry air, and it is now necessary to explain the dry air process devised by the author. This process depends for its action on the varying vapour capacity of air at different temperatures; but instead of the transfer of heat being accomplished by contact with cold metallic surfaces, involving large apparatus and difficulties from the formation of ice, it is effected by the act of expansion itself. The partially-cooled compressed air, which, when the machine is taking its supply direct from the atmosphere, will always be fully saturated with vapour for its temperature and pressure, is introduced into a small primary expansion cylinder, and there expanded under a piston to such pressure as gives a final temperature of about 35 deg. Fah. The result is the condensation of almost the whole of the contained vapour, which is discharged, in the form of mist, with the air, into an apparatus having surfaces so arranged that the mist is deposited on them as water, falls to the bottom, and is drained off. The dried air, still at a high pressure, is then admitted to the second expansion cylinder, expanded down to atmospheric pressure, and discharged cold and free from moisture. As an illustration, assume that compressed air at 95 deg. Fah., and 65 lb. per square inch absolute pressure, fully saturated with vapour, is introduced to the primary expansion cylinder. Each pound of air will then contain 0·008 lb. of vapour. To bring this mixture of air and vapour to a temperature of 35 deg. Fah. will require a ratio of expansion of about 1·75, the pressure being reduced thereby to about 35 lb. per square inch absolute. The 0·008 lb. of vapour per lb. of air will now be reduced to 0·0016 lb., owing to the lessened vapour capacity, or lower dew point, of the air; the difference, or 0·0064 lb., being condensed into water, and collected in a suitable receiver. On admitting the dried air to the second expansion cylinder, it will expand to atmospheric pressure in almost exactly an adiabatic curve; and the pound of cooled air, as it is delivered from this second cylinder, will only contain about 0·001 lb. vapour in suspension. The difference between this amount and the 0·0016 lb. admitted from the water collector, is discharged as snow, and caught in a snow-box. Both these amounts together are, however, so small that the air is practically dry; in fact, on exhausting the cooled air, with this moisture and snow in it, direct from the machine into an atmosphere at 50 deg. Fah., only the slightest trace of mist is visible. A horizontal dry cold air machine for marine purposes, one of several now being constructed, is shown in the accompanying engraving. It is intended to supply 5000 cubic feet of cold air per hour. It has a double-acting compression cylinder, with gun-metal liner forming the water-jacket, this material being employed in preference to cast iron on account of its greater conductivity. This cylinder discharges the air, compressed to about 65 lb. per square inch absolute, into the series of coolers, made on the same tubular principle as those already described, whence it passes to the expansion cylinder with trunk piston. Each end of this cylinder is fitted with distinct adjustable cut-off valves. The baffles of the depositor consist of a number of grids, placed at an angle; an idea for which the author is indebted to Mr. E. A. Cowper. A jacketted steam cylinder with adjustable cut-off, supplies the necessary driving power. The disposition of the cylinders in this machine was arrived at and decided upon after very careful consideration of the turning moments about the shaft centre, a number of different combinations being taken. For larger machines the arrangement of cylinders would be somewhat modified, depending upon the number of each kind employed, and also upon whether the engine was simple or compound. The author concluded by dealing with the applications of cold-air machines.

The discussion which followed was very brief, and of small interest. Although Mr. Lightfoot had freely enough criticised the designs of other inventors, no one defended them or objected to Mr. Lightfoot's statements. Mr. Schonheyder said that it was an unfortunate thing that Mr. Lightfoot had used the words "rapidly compressed," because it might mislead. Whether air was compressed slowly or quickly the rise in temperature was the same. He supposed that what Mr. Lightfoot meant to convey was that the compression should be done so quickly that heat could not get time to escape from the cylinder. He then went on to say that he had carried out several experiments with Giffard's cold air machine which gave very fair results, the air being cooled by spray, snow was separated with a loss of efficiency, the water giving up its latent heat and keeping the air warm. The temperature of the air as it left the compression cylinder was 131 deg., while the temperature leaving the expansion cylinder was 8 deg. There was a tremendous waste of power in working the plunger through the ring of special packing designed by M. Giffard; rather more than one-half the power required to compress the air was given back in the expansion cylinder. The machine was not economical, inasmuch as 9 or 10 tons of ice may be made on other systems pe ton of coal. He thought that the whole of the heat given out in the compression cylinder should reappear in the water.

Mr. Gorman said that he had had twenty-two years' experience in ice-making, and that he was certain the reports concerning a certain ice machine at Hongkong must be wrong. With an ether machine from four to six tons of ice could be made per ton of coal, but with Kirk's machine not more than one ton of ice to half a ton of coal. The Hongkong machine had been superseded for this reason by an ether machine.

Mr. Crampton pointed out that all these statements concerning the relative quantity of fuel burned and ice produced were worthless and misleading unless the character of the engine employed was also stated. The amount of power required ought to be taken as a standard, not the coal burned.

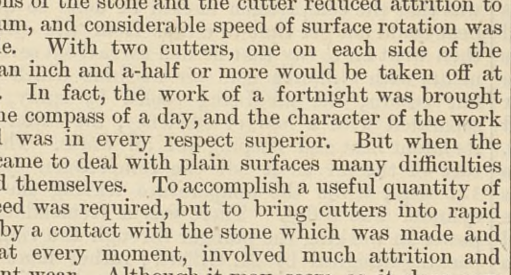
Mr. Joy warned the meeting against comparing cold-air machines with ice-making machines, which were totally different things. Mr. MacFarlane Gray then dealt at some length with the theory of the compression of air, and regretted that the author had not put the line of no pressure as well as the atmospheric line on his diagrams; and he then explained how it was possible graphically to calculate the precise dew-point under all circumstances. Mr. Price Williams said that it was impossible to over-estimate the importance of any combination of mechanism which would facilitate the importation of food, and he read a short extract from a letter which he had received from Sir William Armstrong bearing on this point, in which Sir William stated that it would be a fearful thing if anything happened to prevent the importation of food. As regarded economy, he thought that a small matter as compared with efficiency. Coal was of no importance as compared with meat.

In replying, Mr. Lightfoot said that he did not believe that speed had anything to do with the temperature of compressed air, and he had used the word "rapidly" to imply that the compression would take place adiabatically in a conducting cylinder, which would not be the case if the compression was slowly effected. As to economy of fuel, that was a question for the purchaser. If they were wanted, he would supply compound engines of the greatest economy to drive the cold air machines. He would have the zero line added to the diagrams before they appeared in the "Transactions."

The next paper read was by Mr. J. D. Brunton and Mr. Trier

ON STONE DRESSING MACHINERY.

The authors said that it had been for some time their desire to introduce to the notice of the members of that Institution their machines for dressing and turning stone; but they had delayed doing so until now, because they wished first to perfect the details; and especially to be able to say that they had practically mastered granite, that most difficult of stones to deal with. The machines now to be described had undergone the test of practical working, and had been pronounced to be good, serviceable, labour-saving machines by persons who have used them for some time past, and are using them still. Much ingenuity had been put forth, and numerous attempts been made to shape or dress stone by mechanical means, but no attempt would be made to describe the various machines that have been devised. Suffice it to say that, saws being excepted, they for the most part aim to do the work by means of chisels of some form or other, applied either to chip or scrape away the irregularities of the stone. It is at this point that the authors' machines diverge from the beaten path, and take hold of a new principle of action; the action, namely, of circular rotating cutters, operating by rolling to chip off from the stone the inequalities of its surface. This constitutes the elementary principle, and may be stated as a rolling pressure brought to bear at the base of a certain projecting portion of stone, with the intent to force it off. The great power of such a pressure to effect the desired object is due to the fact that its incidence at any given moment—or what may be called the tread of the cutter—extends over a very small space, and that upon this small space the whole force in exercise is concentrated. It remained to contrive such a mechanical arrangement as shall successfully apply this principle. We have in stone a material composed for the most part of particles hard enough to cut and wear away the hardest steel, but held together by a cohesion relatively far feebler than that which holds together the molecules of steel or chilled cast iron. Hence it will be evident that in attacking such a substance by a metal tool, it is of the first importance that attrition be avoided. If this enters in any considerable measure into the conditions of the contest, the metal will be worsted; but if it be a question of simple pressure, the stone will inevitably be overcome. The first application of the principle was to the turning of stone, especially granite. The simplicity of this application was due to the circumstance that the constantly revolving stone presented a continuous surface for attack, and the contact of the edge of the cutter with the surface was therefore unbroken. The cutter once set in motion by contact with the stone continued rolling, and being placed at an angle of about 25 deg. to the axis of the stone chipped the surface away incessantly in a spiral line, as the slide rest and tool holder moved along the bed of the lathe. Nothing more was needed. The concurrent revolutions of the stone and the cutter reduced attrition to a minimum, and considerable speed of surface rotation was attainable. With two cutters, one on each side of the column, an inch and a-half or more would be taken off at one time. In fact, the work of a fortnight was brought within the compass of a day, and the character of the work produced was in every respect superior. But when the authors came to deal with plain surfaces many difficulties presented themselves. To accomplish a useful quantity of work speed was required, but to bring cutters into rapid rotation by a contact with the stone which was made and broken at every moment, involved much attrition and consequent wear. Although it may seem, as it does now to the authors themselves, a very simple remedy for this difficulty, to drive the cutters, in other words, to give them a mechanical absolute rotation, such that their edges should roll on the stone; yet this simple remedy was not thought of till several years had been spent in efforts to dress plane surfaces by simple contact. The machine, as represented by the diagrams, was the offspring of this



slowly-attained perception of what, in the shape of mechanical arrangement, the nature of the case demanded. The diagram represents in section the chuck, or cutter carrier, and exhibits the way in which the cutters are given a determinate rotation on their own axis, at the same time that they are carried round in a circle by the revolution of their carrier; their outer edges thus describing a circular path, which may be called the track. The chuck A is a cast iron circular box, bolted to the flange F of the shaft C on which it revolves. Into it are fitted the cutter spindles *h*, in number three, six, nine, or twelve, according to the size of the chuck. The cutters *g* are fixed on their spindles by split nuts; a part of each of these nuts is a cone, which enters into the conical hole in the centre of the cutter. When screwed up the nut contracts and grips the thread of the spindle, so that nut, cutter, and spindle become as one piece. On each spindle is keyed a bevel pinion *e*, and all the pinions contained in the chuck gear into, and are driven by, the central bevel wheel *b*; this is keyed on the central shaft *k*, which passes through the centre of the shaft, and receives its motion by means of a pulley *f*. The rates of cutter rotation and of chuck rotation are so adjusted relatively one to the other that the cutter edge shall exactly roll in the track. For instance, in the case of a chuck having a track of 2ft. diameter and cutters of 8in. diameter, for every revolution of the chuck the cutters will make three revolutions. The ordinary speed of a chuck is 300 to 350 revolutions per minute, the cutters themselves making 900 to 1050 revolutions in the same time. With regard to the material of the cutters, it has been found that for all kinds of sandstones, grit stones, and free stones, as well as for the magnesian limestones and oolites, chilled cast iron cutters answer perfectly. A cutter will usually last for twenty such grindings before it is worn out. Its first cost is three shillings. For hard limestones, steel cutters are necessary on account of the resistance presented by these stones; but the wear is quite insignificant. A set of cutters will last several days without changing. For granite also steel cutters are required. In the lathe a cutter will run for about ten hours without sharpening, dressing once over 250 square feet of granite. In dressing plain surfaces the wear, in the case of granite, is greater than in turning, but still moderate. The construction of the machine was fully illustrated by diagrams.

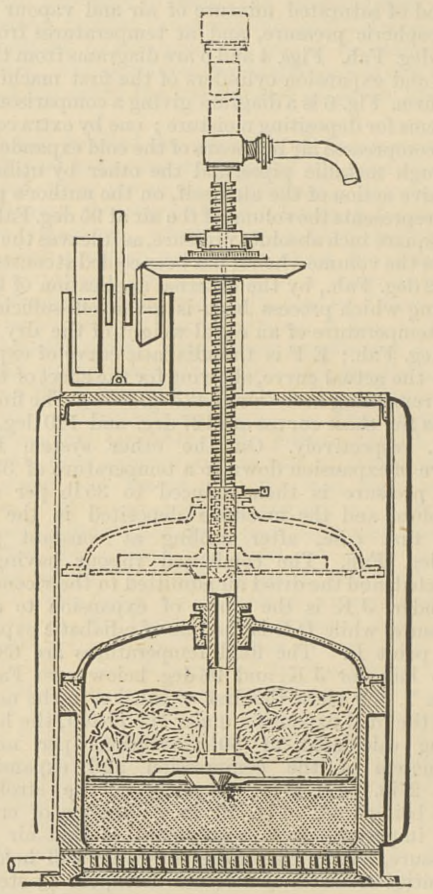
No discussion, properly so called, followed; but Mr. Trier carried on a conversation with Mr. Cowper, and explained certain matters more fully than the paper had done. Mr. Crampton asked for information on the relative cost of the machine work and hand labour, and was told that machine work was 2d. per square foot, against 6d. for hand labour; working on grit stone or granite the saving was much greater. In reply to Mr. Price Williams, it was stated that a machine was at work in Paris, and that nothing but plane surfaces could be machined.

Mr. Brunton said that all the large firms now making granite columns used lathes and his cutters. The great secret of success was to make the machinery very massive, not for strength, but to obviate tremour or jar. In Paris a machine was employed in dressing the large edge rollers used in chocolate factories. His machine would beautifully dress a 5ft. stone in thirty-five minutes, while it took a man five days to do the same work, or even more. Mr. Powis Bale wanted to know if a different cutting angle and speed was used with different stones, but Mr. Brunton said that this was not required; 45 deg. was a good working angle for all kinds of stone. As to speed, the faster the better; 400 revolutions per minute of the chuck he found the best, taking all things into consideration. In reply to Mr. Cole, he said that the machine would dress burr stone perfectly, but the great difficulty was that the blocks as they came from the quarry were so small that it was almost impossible to fix them in the machine. When the fixing could be done the machine would take off half an inch at one cut. The next paper read was by Mr. Henry Chapman,

ON THE FARQUHAR FILTERING APPARATUS.

The paper opened with the statement that sewage cannot be satisfactorily got rid of because of the difficulty of filtering such enormous volumes of water, and then went on to explain why mechanical filtering had failed. The principle of the Farquhar filter is that of the continuous removal of the solid or slimy matters as they become deposited on the surface of a filter-bed. The filter-bed—which is composed of sawdust, or sand, or powdered cinders, or other suitable granular material—is contained in the closed cylinder, and rests upon a coarse canvas or cloth, which is supported by a perforated plate resting on a strong grating. The liquid is forced into the filter, and passes through a hollow screw spindle direct to the underside of a cutter-plate, where it is distributed uniformly through the channels on to the surface of the filter-bed. The filtered liquid passes through the filter-bed, leaving all its solid impurities on the surface of the bed, and finally issues from a pipe. During the process of filtration, the cutter-plate is made to revolve by means of a pulley and bevel gearing, and, when desired, is caused to descend at any speed required, irrespective of its speed of revolution, by means of a feed-motion. In some cases the solid matters held in suspension in the liquid to be filtered are of a chalky nature, a thin deposit of which forms of itself a good filtering medium. In these cases it is only necessary to revolve the cutter-plate continually over the surface of the filter-bed in the cylinder, and not to cause it to descend. The accumulating deposit will then be continually scraped off, and forced up an inclined plane of the knife on to the top surface of the cutter-plate, the under surface of which will thus always be kept free, and the supply of liquid will be continually in direct contact with the surface of the filter-bed. In other cases the solid matters held in suspension in the liquid to be filtered are of a slimy nature, a thin deposit of which, if left on the surface of the filter-bed, would stop the filtration. In these cases it is necessary to cause the cutter to descend as well as to revolve, so that at each revolution of the cutter a very thin layer of the granular filter-bed will be cut up and scraped off, together with the slimy deposit adhering to it, thus producing at each revolution of the cutter a clean filtering surface on the filter-bed, and practically starting a new filter. When the cutter-plate has descended to within two or three inches from the bottom of the filter-bed, the descending motion of the cutter-plate stops automatically. The operation is then at an end, and the filter-bed, which at the commencement of the operation was underneath the cutter-plate, will now be at the top of the cutter-plate, and intimately mixed with the solid impurities which it has arrested. To remove the fouled filter-bed it is necessary first to unbolt the cover, and to raise it. Then, by means of reversing gear, the cutter-plate, which may have taken many hours, or several days, to descend to the bottom of the filter-bed, can be made to revolve in a contrary direction, when it will quickly ascend the full pitch of the screw at each revolution, and the fouled filter-bed will, in a few minutes only, be automatically discharged over the top of the cylinder. Both the cutter-plate and the cutter are then raised to a suitable height above the cylinder, so as to allow of the cylinder being cleansed, and a fresh filter-bed placed therein ready for another process. The whole of the above operation for a large machine should not exceed one hour. The engraving below is a section of the filter.

The paper went on to state that very satisfactory results had been obtained in Paris, especially at the sewage works where eaux-vannes were dealt with, MM. Duval and Durant-Claye stating that at the beginning of the operation the filtering bed was 25 centimetres deep, and the end only 75 mm., or 3in., and the liquid still passed out clear. At sugar works M. Pellet pronounced the filtration to be as perfect as though effected through blotting paper. Sawdust was the filtering material used. The author urged the value of the machine for waterworks, and pointed out that the average rate of filtration of our great water companies was at the rate of 2 gallons per square foot per hour, while the Farquhar machine could filter at the rate of 247½ gallons per square foot per hour, or a machine 10ft. in diameter would filter 466,560 gallons per day.



The discussion which followed was brief, and only important for the part Mr. Hawksley took in it. He said that the statements made were so remarkable that he would have to see the work done himself before he could believe it to be possible. M. Pellet must be mistaken. In preparing river water for town consumption it was imperatively necessary to filter it as slowly as possibly. The limit of speed was fifty gallons passed per square foot of surface of a bed of sand 2ft. or 2½ft. thick. The water would not be perfectly purified if it was passed any quicker. It was for a long time held that the process of filtration was purely mechanical in its nature, but it was now known that this was not the case. Mechanical action only removed the grosser impurities, and to render the water quite pure it must be kept a long time in contact with the sand. The facets of the sand appeared to exert a special power of attracting to themselves even the most minute impurities, but time was required to enable the sand to get the all but chemically dissolved particles to itself, the principle of aggregative attraction coming into play. Again, it was not impossible that during the time spent in the filter bed the organic matters might be broken up and rendered harmless by oxidation. But in the Farquhar filter the process was so rapid that only mechanical work could be done on the fluid to be purified, and he could hold out little hope that the machine would ever do for waterworks. He had no doubt that for the detention of thick matter it would prove very effective but costly. For sugar clarifying it might do. In order to retard the rate of filtration in waterworks, a pipe was so arranged in the filter bed that it was impossible there could be more than 2ft. of head to force the water through the bed. In the filter described the water would pass at twenty to fifty times the proper rate, and to believe that it would ever produce a potable water was a great mistake.

After Mr. Hawksley sat down, a desultory conversation ensued, in which Mr. Crampton, Mr. Newman, the President, and Mr. Hawksley took part. It was pointed out that, in dealing with sewage, much expense would be incurred in pumping it up to get the head required to drive it through the filter. Mr. Newman wanted to know if it would answer abroad, in a place where the river was made muddy by periodical rains. Mr. Hawksley said he had no doubt that the filter might be used for such a purpose, but it would leave the water tinged with colour, but not necessarily unfit or unpleasant to drink. In reply to Mr. Cowper, Mr. Farquhar said that a somewhat similar machine to that described had been tried at Messrs. Barclay and Perkins' Brewery, and had been removed. He then replied on the whole discussion, and pointed out that sawdust was quite different in its action from sand, and that even powdered glass would do better than sand.

The sawdust, under pressure, squeezed together, but sand would not. No doubt some of the statements made appeared incredible, but they were none the less true; and he relied on the accuracy of so careful a chemist as M. Pellet.

This terminated the proceedings, and after a vote of thanks to the members of the Institution of Civil Engineers for the use of their Hall, the meeting terminated. Several of the members dined together in the evening.

THE BLACKHEATH SUBSIDENCES.

DURING the night of Wednesday and the early morning of Thursday, April 11th and 12th, 1878, an extraordinary fall of rain visited the metropolis and its outskirts, causing an amount of distress from floods which appears scarcely ever to have been equalled in that part of the kingdom. The inundations were particularly severe in the valleys of the Ravensbourne and the Quaggy—a fact to which Sir Joseph Bazalgatte bore witness in a report which he made as the engineer of the Metropolitan Board of Works. On the morning of Thursday a singular phenomenon presented itself on the broad open *plateau* of Blackheath. At a spot near the ride known as "Rotten Row," the earth was found to have sunk in to a depth of about 20ft., leaving what was described at the time as "a dangerous hole eight or nine yards in circumference." The Metropolitan Board, who had jurisdiction over the Heath, first of all placed a fence round the mouth of the shaft, and subsequently filled it in. The fence was then removed, and there was apparently an end of the matter. But early in November last another hole of a similar character opened in the Heath at a spot considerably to the westward of the first subsidence, and on the 19th of that month a third aperture presented itself, not far from the first. Parties residing in the neighbourhood began to think that these earth-falls were looking serious, as it was impossible to say where they might ultimately show themselves. There were traditions of strange subsidences in Kent at remote times, one of which, near Eltham or Mottingham, was said to have been big enough to swallow up three full grown elms. Granting that there was some exaggeration in such stories, it was thought there was at least some modicum of truth about them, and curiosity was aroused as to the probable cause of such a departure from the ordinary rules of *terra firma*. The Astronomer-Royal, who, from his watch-tower in Greenwich Park, was accustomed to keep an attentive eye on the stellar regions, began to think it was time to consider the state of the earth beneath his feet, and accordingly proposed to the Metropolitan Board that they should explore these strange subsidences, with a view to ascertain the cause. The Board, having already had trouble enough with the Treasury auditor, replied that they had no money to expend for any such purpose, but that if he liked to explore the cavities on his own account, he had full leave and licence to do so, so far as they were concerned. At this stage of the proceedings, a newly-formed society, designated the Lewisham and Blackheath Scientific Association, came to the rescue, and appointed a committee to see what could be done. At the instance of Sir George Airey, the Metropolitan Board transferred to this Association the permission which they had previously given to him alone, and the Association took the further step of obtaining the consent of the Earl of Dartmouth, as Lord of the Manor, to the carrying out of the exploration.

The committee thus formed commenced operations a short time back, and through their courtesy, with that of the honorary secretaries, we are in a position to lay before our readers the full particulars of what has already been done, together with information as to the proceedings which are now contemplated. We are thus enabled to give a plan—Fig. 1—showing the position of the earth-falls on the Heath, together with a section—Fig. 2—of one of the subsidences which has been explored, and a rough sketch—Fig. 3—of a third. In addition to these, Fig. 4, drawn by Mr. T. V. Holmes, F.G.S., shows a section across the Heath in a direction leading from the Royal Naval College at Greenwich, to the railway between Blackheath village and the tunnel. It will be seen that the area affected lies to the south of Greenwich Park. The aperture A is that which first appeared. It is situated about 250 yards from the nearest point of the Park wall, close alongside of which runs the Charlton-road. Its position upon the Heath is very central, being about 370 yards E.S.E. from the large gates leading out of the Park. The second aperture B is situated rather more than 600 yards distant from A, in a direction S.W. by W., while the third, C, is only about 110 yards from A, in a south-easterly direction. The subsidence A, being filled up, is not available for examination; but the committee have examined the fall C, with very interesting results. The subsidence was found to consist in the first place of a shaft, almost circular in form, being 7ft. 8in. in the longest diameter, and 6ft. 9in. in the shortest. The sides went down vertically to a depth of 18ft., and had all the appearance of a well, or artificial shaft. At the bottom was a heap of fallen earth, and when this was removed the sides were found to recede, the hole increasing in its diameter to about 14ft. Whether on a deeper descent the diameter would increase still further, is of course uncertain; but there seems very little doubt that some enlargement would display itself. Further progress has been delayed through lack of funds, but steps have since been taken to raise a sum sufficient to continue the exploration. A conference on the subject has taken place between the officers of the Association and the West Kent Natural History Society, and the general committee now includes Sir G. B. Airey, Astronomer-Royal; Dr. H. E. Armstrong, F.R.S., President of the Association for 1881; Admiral Hamilton, R.N.; Rev. Brooke Lambert, vicar of Greenwich; Rev Thomas Wiltshire, Professor Cotterill, Dr. Prior Purvis, Mr. J. K. Laughton, R.N., F.R.G.S.; Mr. T. V. Holmes, F.G.S., Mr. J. C. Price, and Mr. E. W. Brabrook, F.S.A.; together with the honorary secretaries, Mr. Henry W. Jackson, F.R.A.S.; and Mr. John Yeo, R.N., and several of the leading inhabitants of the neighbourhood. From among the parties thus elected, an executive committee has been formed, who are taking steps to carry out the exploration. The estimates for the proposed operations range between £100 to £150; but in order to provide a margin, it is proposed to raise a fund of £250.

It will now be interesting to consider what is the probable cause of the strange phenomenon which the committee are about more fully to investigate. Already the explorers are overwhelmed with theories—geological, archæological, engineering, and nondescript. A *résumé* of the whole would be amusing, but we must limit our attention to those which possess a reasonable aspect. There are theories within the committee as well as theories from without. One of the former is from Admiral Hamilton, who refers to the fact that when the main drainage works were being executed, some very powerful springs were tapped in the Lower Woolwich-road, and he suggests that the escape of water which then took place may have depleted some natural reservoirs beneath the surface of the Heath, so as to leave a void into which the superincumbent strata have ultimately fallen. Whatever may be said as to the precise terms of this hypothesis, we think it must be allowed as highly probable that the underground waters are the cause, in some way, of the singular phenomenon for which an explanation is now sought. But when we remember that the first great subsidence was coincident with the extraordinary rainfall and flood of April, 1878, we are forced to the conclusion that an exhausted subterranean reservoir is not the exact cause of these strange subsidences. One member of the committee, an accomplished geologist, has ventured to conclude that the subsidence C is artificial. That its regularity of form suggests such a conclusion cannot be denied; but there is a striking and unmistakeable fact which is in a great measure adverse to the theory. We have stated that at the foot of the shaft in subsidence C there was a heap of fallen earth. With excellent judgment Mr. H. W. Jackson had this material carefully removed, layer after layer, in order that it might be compared with the bedding as seen at the mouth of the pit. The soil when taken out was placed in such a position that it could be easily examined, and it was found to correspond, layer by layer, with the virgin soil, as seen in section at the mouth of the cavity. One well-marked line of red sandy clay in about the middle of the earth which was removed, was very obviously identical with a thin streak of the same material in the unfallen portion. From this examination Mr. Jackson observed that it seemed clear it was the superficial beds of the Heath that had fallen in, and not, as had been suggested, a stopping of rubbish which had been thrown over some timbering for the purpose of making an artificial surface.

The fact thus brought to light at once settles the ques-

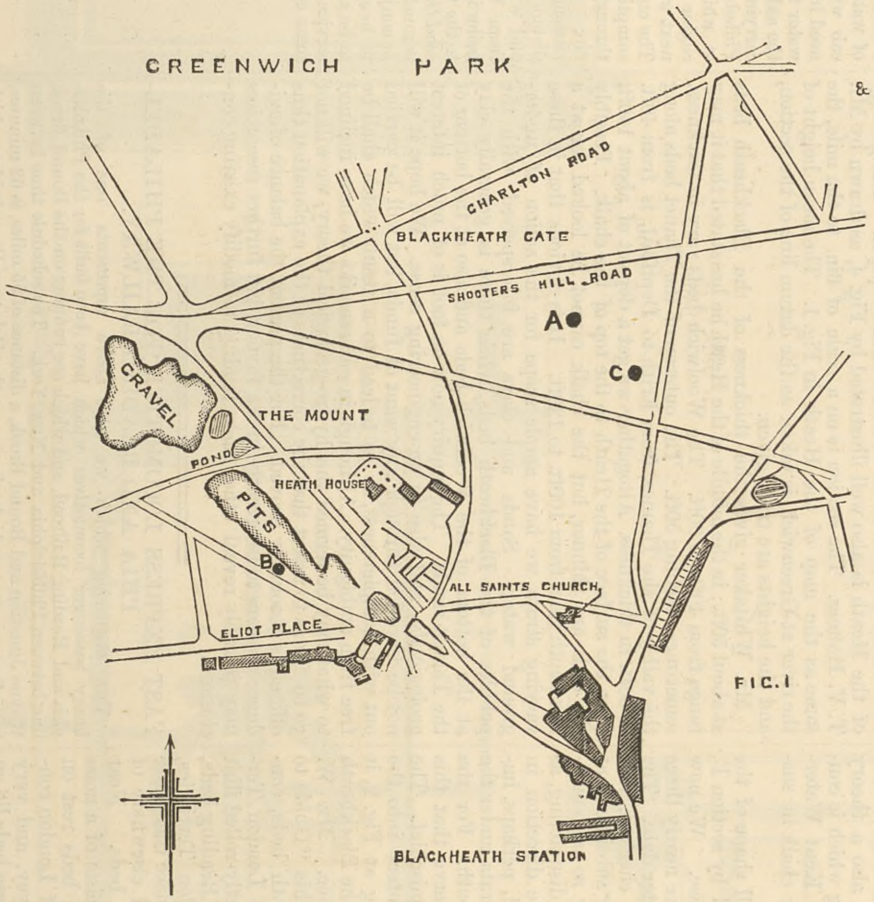


FIG. 1

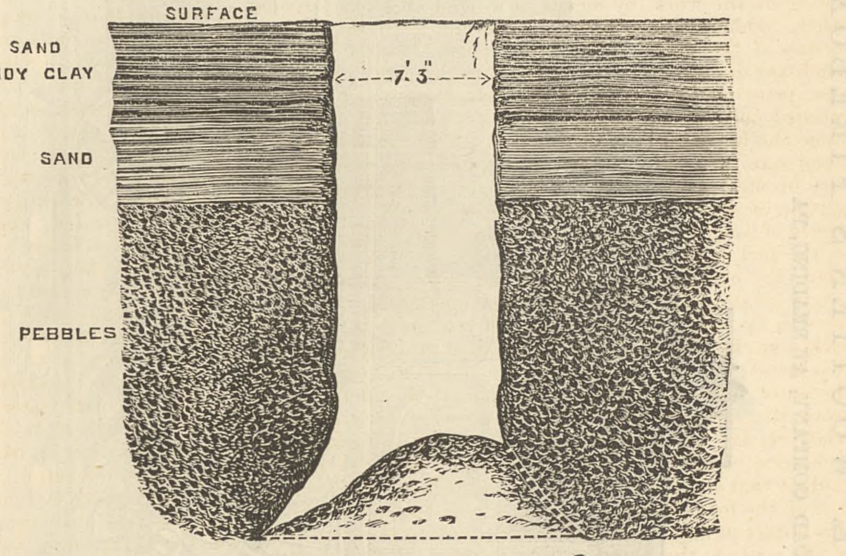


FIG. 2 SECTION OF HOLE C.

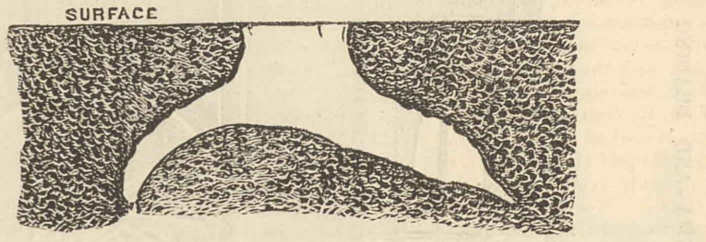
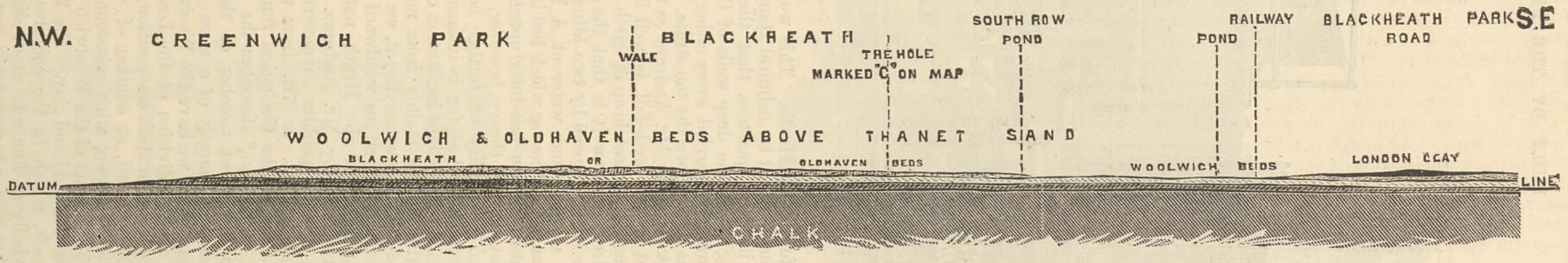


FIG. 3 SECTION OF HOLE B.

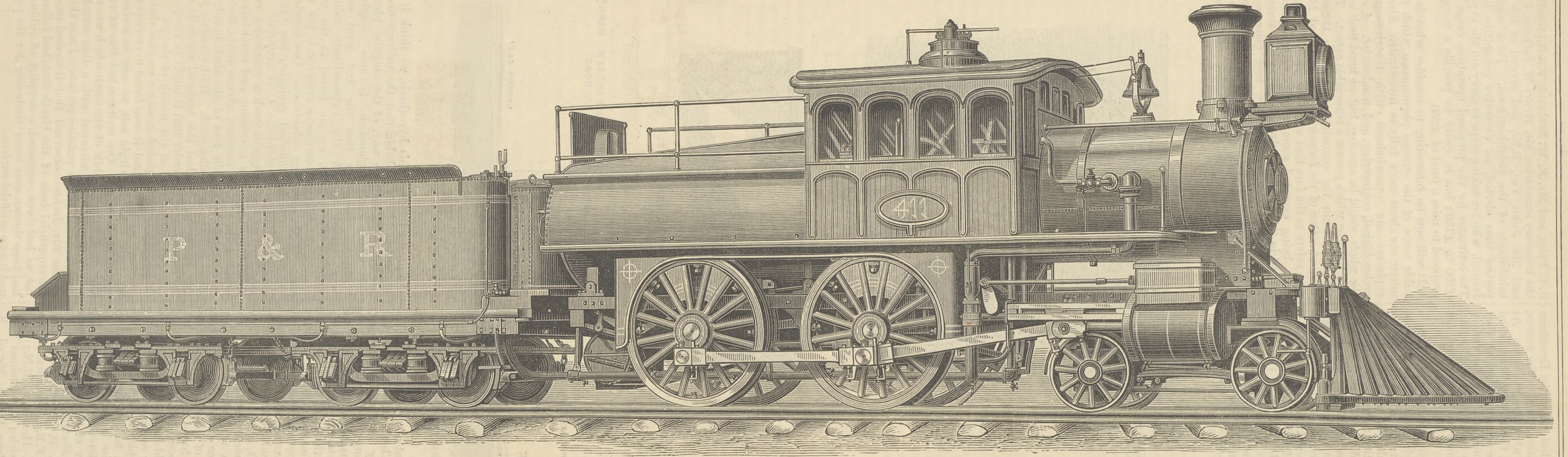
FIG. 4



MAP OF BLACKHEATH, AND SECTIONS OF HOLES.

EXPRESS LOCOMOTIVE, WITH MR. J. E. WOOTTEN'S FIREBOX.

BUILT BY THE PHILADELPHIA AND READING RAILROAD COMPANY, AT READING, PA



tion as to whether or not the subsidence was due to any operations commenced from above. It is clear that the top soil was never disturbed until it tumbled in, owing to the fall of the strata beneath. We have thus to account for the disappearance of the earth which originally filled up the entire shaft, 18ft. in depth. Unless we are to suppose that an artificial excavation was at some time effected without opening the top soil, we must infer that the fallen earth has gone to fill up a chasm created by some natural action. That a gallery was run in from one of the valleys in the side of the Heath, or even from one of the pits which are to be found there, appears extremely unlikely. We now arrive at another theory, which has something like experience for its guide, and which very closely agrees with the observed facts. It is contained in a letter addressed to the committee by Mr. Charles Andrews, C.E., of Westminster, who states that he has lately had experience of earth-falls of the Blackheath type, at the extension works of her Majesty's Dockyard at Halbowline, near Queenstown, in Cork Harbour. During the progress of these works, of which he was Superintending Civil Engineer for the Admiralty, he frequently found circular masses of the ground fall in very suddenly, the sides of the cylindrical hole thus formed being precipitated into the centre, so as to leave a cavity like a bell with a conical heap of rubbish in the middle. On one occasion a tramway, on which a horse was drawing a wagon, gave way, and the horse nearly fell into the cavity. Mr. Andrews says he clearly detected that these cavities were caused by subterranean streams of water flowing in the rock at about 25ft. deep. A stream would gradually cut out for itself a small drift-way, and where soft material occurred—as sand—the space would get continually enlarged at that point until the roof fell in. The drift would thus be blocked up, and the course of the stream diverted. The water would then find a new channel in the direction of the greatest fall or least resistance, until the same occurrence repeated itself. Mr. Andrews believes the geological formation at Blackheath consists of gravel overlying chalk, and he suggests that in wet seasons the water, whether from the surface or from land springs, flows beneath to some depression or pot-hole in the chalk, where it disappears. Mr. Andrews has also advanced the idea that there must have been some recent alteration, "caused by local works," in the drainage of the gravel bed which forms the Heath. This would so far favour the hypothesis put forward by Admiral Hamilton, as also a theory propounded in some quarters, that the pumping which is continually going on at the deep wells of the West Kent Waterworks has probably carried away either water or chalk in suspension, so as to let down the top strata.

The remark made by Mr. Andrews as to the bell shape of the cavity formed by the earth-fall, is well illustrated by section B, which also has the conical heap of earth at the base. We now seem to understand how it is that the subsidence nearly three years ago has been followed by two others at a later date. The flow of the underground water at A has been checked, and thereby driven into a course which has led to the subsidence at B, while that in its turn has interrupted the flow so as to occasion the fall at C. The theory, however, is rather disquieting, as indicating the probability of further falls. The direction in which these may be looked for is interesting, and, perhaps, important. There is a slight inclination of the strata under the Heath, and the slope is mainly from north to south. For the satisfaction of the Astronomer-Royal, we may observe that this puts the Observatory well to windward of the mischief. The geological formation of the Heath naturally enters into the question, as remarked by Mr. Andrews. Looking at Fig. 2, it will be seen that the pebbles characteristic of the Blackheath beds commence at 6ft. or 7ft. from the surface. Mr. W. Whitaker, F.G.S., of the Geological Survey, in his "Guide to the Geology of London," describes the Blackheath beds, constituting the uppermost member of the Lower London Tertiaries, as consisting mostly of a mass of perfectly-rolled flint pebbles. Next below we have the Woolwich and Reading beds, forming the middle division of the Lower London Tertiaries, and very inconstant in their composition, at one place consisting almost wholly of sand, at another of clay, and elsewhere of alternations of the two, with occasional pebble beds. Near Lewisham, the top part of the Woolwich beds consists of a mass of finely laminated sand and clay. The Woolwich beds rest on the Thanet beds, which in the neighbourhood of London consist almost wholly of fine soft sand, slightly clayey, and very compact, so that it stands upright in section. These beds lie on the chalk. Carbonated water from the Thanet beds have chemically dissolved away portions of the chalk, creating in some spots unevenness of surface and what are called "pipes." The geology of the Heath is also well illustrated by Fig. 4, as drawn by Mr. T. V. Holmes. The section is on a scale of 6in. to the mile, the same as the map of the Heath in Fig. 1. The mean height of the river at Greenwich is taken as the datum line of the section, and the heights are truly given.

Mr. Whitaker gives the thickness of the Blackheath beds at about 50ft.; in the middle of the Heath he has stated that it may range from 40ft. to 60ft. The Woolwich beds vary in thickness, sometimes reaching 50ft. The outcrop of the Thanet beds along the valley of the Thames, from Erith to Deptford, is from 40ft. to 50ft. in thickness. Altogether we get a deposit of about 140ft. from the surface of the Heath to the top of the chalk. Possibly the beds are thinner, but the chalk cannot be looked for at a less depth than from 100ft. to 120ft. It is obvious that in these varying strata we have ample scope for the action of underground water. Sands and clays are interspersed with the pebbles of the Blackheath beds, while there is generally clay at the bottom of the Woolwich beds and also at the bottom of the Thanet sands. The inquiry now on foot is of much interest geologically, and also in an engineering sense. We hope it will not be impeded through any want of funds, but will be carried out with completeness, so as to lead to a result which shall be free from ambiguity. Although in our remarks we have inclined to what may be termed the hydro-geological theory, we will not go so far as to assert that the correctness of the explanation thus offered is absolutely proved. For the present the balance of evidence appears to be greatly in its favour, but further researches may possibly reveal other facts tending to modify existing conclusions.

FAST EXPRESS LOCOMOTIVE FOR THE PHILADELPHIA AND READING RAILWAY.

THE engraving which we give above represents one of the heavy passenger locomotives which have been built for the Philadelphia and Reading Railroad, and which are running on the Bound Brook line, between Philadelphia and New York. The schedule time between Wayne Junction and Bound Brook, a distance of 55 miles, is 62 minutes, including one stop and slowing over the Delaware River bridge, which is one mile in length. This requires an average speed of a mile a minute for 55 miles. When doing full work it is said that the engine consumes 53 lb. of anthracite coal per minute and evaporates 55 gallons of water in the same time. It is provided with an oil reservoir in the cab with pipes leading therefrom to all bearings which are likely to need lubrication during the trip, and flexible tubes connecting with the water tank are so arranged as to deliver a stream of water to any of the axle bearings of the engine or tender. The tank has a capacity for carrying 4500 gallons of water, which is sufficient for the run from Philadelphia to Jersey city, a distance of 89·4 miles. The highest speed at which it has been found practicable to obtain a diagram from the engine was 65 miles per hour. A copy of this diagram will be published next week. The original is perhaps the fastest speed diagram ever taken The enlarged grate area admits, it is claimed, of very economical consumption of fuel, by reason of the exceptionally free passage for air through the bed of fuel, which is maintained at a depth of from 4in. to 6in. The highest speed of the engine was with a train of seven passenger cars, when a rate of 72 miles per hour was attained for a distance of 8 miles, which was traversed in 6 minutes and 40 seconds, and with a train of 15 fully-loaded passenger cars it has made the run from Wayne Junction to Bound Brook, 55 miles, in 76 minutes. The boiler is especially designed for anthracite coal, but is equally well adapted to the use of bituminous coal. "It will be noted," says the *American Railroad Gazette*, "that the distance between driving-wheel centres—78in.—is much less than usual in passenger engines of its class. This feature, in conjunction with the comparatively short stroke of piston, must prove to be an effectual preventive of the breakage of side rods which has grown to be a frequent occurrence since the advent of high-speed passenger service." Next week we will publish sectional views of this engine, with some comments on its design and operation .

General Dimensions.

Cylinders	21in. × 22in.
Diameter of driving wheels	68in.
" truck "	33in.
Wheel base	2ft. 1in.
Diameter of boiler	58¾in.
Number of tubes	184
Length of tubes	10ft. 2½in.
Diameter of tubes, outside	2in.
Length of fire-box, inside	9ft. 6in.
Width " "	8ft.
Grate area	76 sq. ft.
Heating surface of fire-box	135 "
" " tubes	982 "
Total heating surface	1117 "
Height of centre of boiler above rail	7ft. 8in.
Exhaust nozzle—variable	3¾in. to 5¾in.
Weight on driving wheels	64,250 lb.
Total weight of engine	96,200 lb.
Water-carrying capacity of tender	4500 galls.
Diameter of chimney	20½in.

WOOD PULP MAKING MACHINERY.

MM. THEODOR AND FRIEDRICH BELL, KRIENS, SWITZERLAND, ENGINEERS.

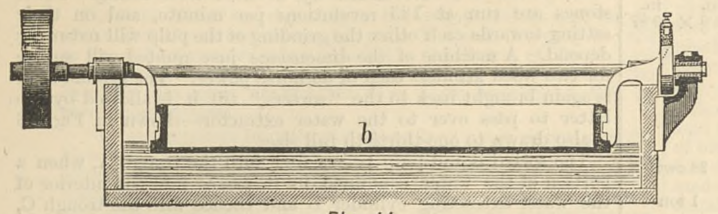


Fig. 11.

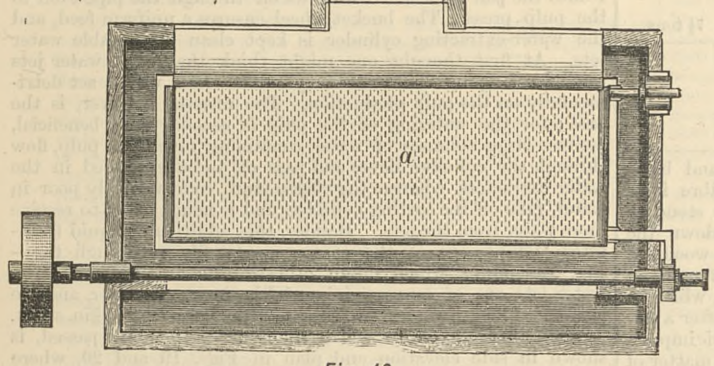


Fig. 12.

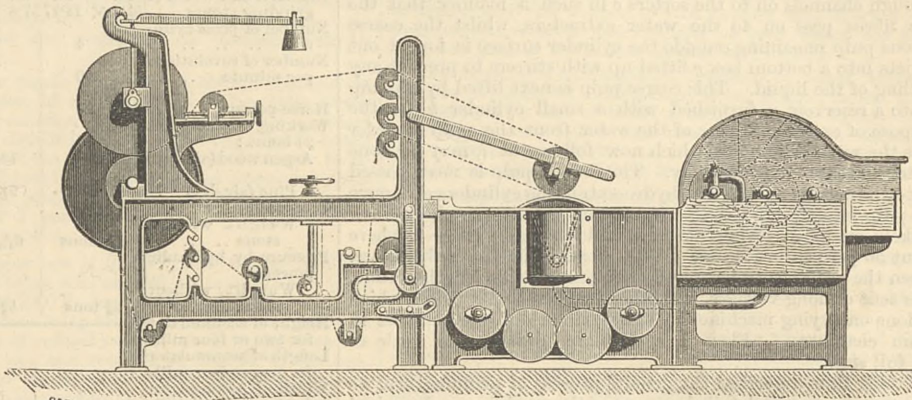


Fig. 22.

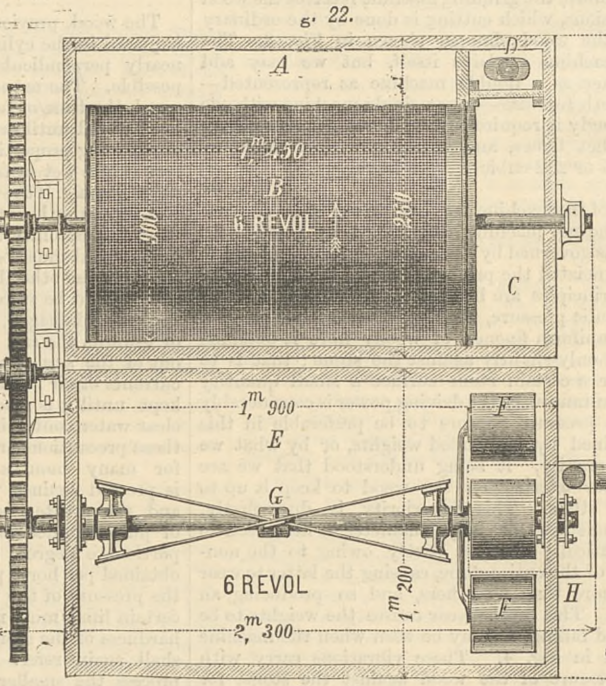


Fig. 18.

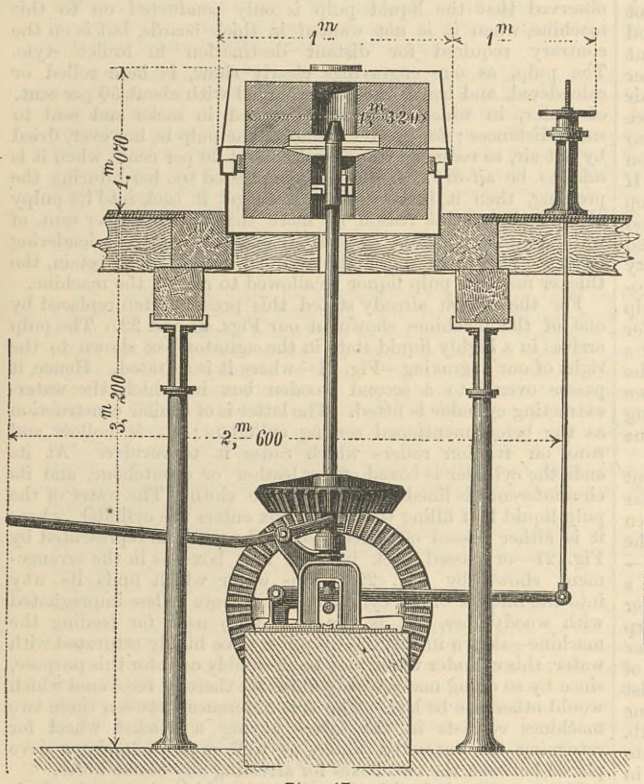


Fig. 17.

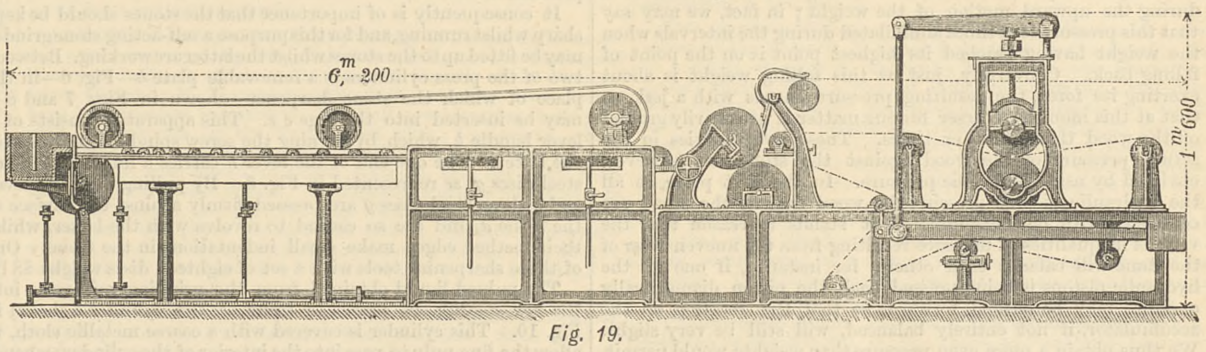


Fig. 19.

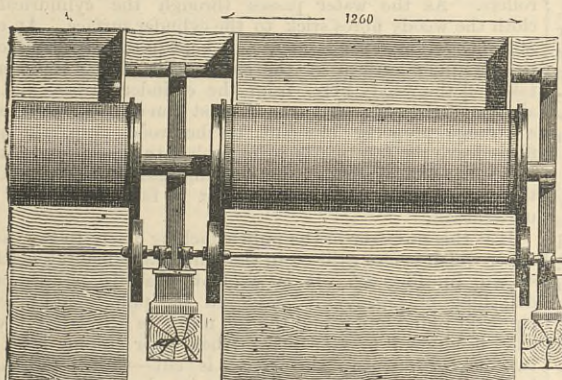


Fig. 14.

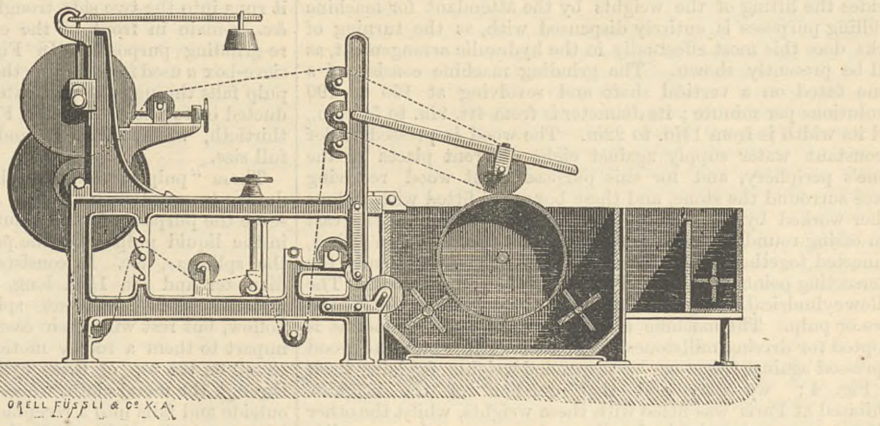


Fig. 21.

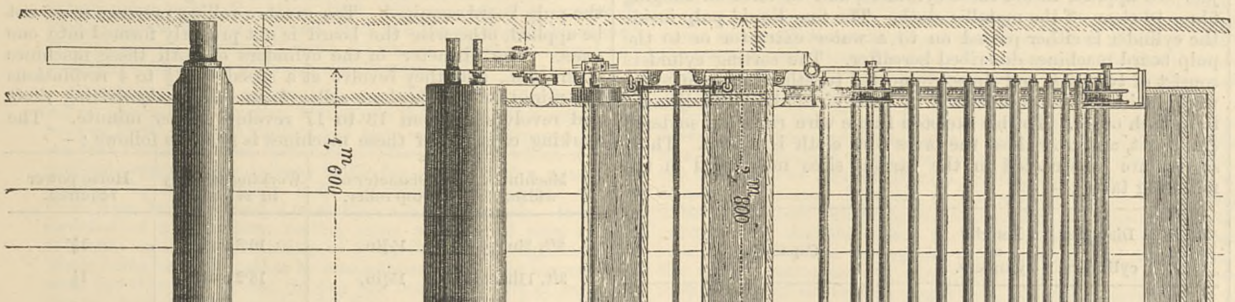


Fig. 20.

THE MANUFACTURE OF WOOD PULP.

IT has been asserted that the paper-making industry was best represented at the late Paris International Exhibition of 1878, for the reason that the various national sections were more or less represented by some speciality pertaining to this industry. Among the more important exhibitors of wood pulp-making plant were Messrs. Theodor and Friedrich Bell, of Kriens, Switzerland, and it is their patented system which we now propose to illustrate and describe. Briefly stated, the process consists in allowing peeled timber cut to certain dimensions to press against a revolving grinding stone under constant water supply, whence a pulpy liquid is obtained. This liquid is next subjected to certain mechanical operations, whereby the woody fibre is sorted according to its fineness, and made finer when required; besides which it is rendered down to a more or less water-free pulp, and useful in making paper or cardboard, or other ornamental paper fancy articles. The preparation of the wood by Bell's process is the same both for the vertical and horizontal machinery types; but it appears that of the two the vertical arrangement proves itself best in practice, so that we shall confine our attention to this system of manufacture. In Figs. 1 and 2, page 88, we show in sectional elevation and in plan the plant of a wood-pulp factory of

200-horse power producing about 2½ tons of air dry aspen pulp in twenty-four hours. The manufacturing process may be described as follows:—The liquid pulp passes from the grinding stones *a* on to a shaker *b* in which the coarse fibres are kept back and removed as occasion requires. The pulpy liquid runs through channels on to the sorters *c* in such a manner that the fine fibres pass on to the water extractors, whilst the coarse fibrous pulp remaining outside the cylinder surface is forced out by jets into a bottom box *e* fitted up with stirrers to prevent any settling of the liquid. This coarse pulp is next lifted by a pump *f* into a reservoir *g*, furnished with a small cylinder *h*, for the purpose of extracting some of the water from the pulp in order that the work of refining, which now follows at *i*, may be done better and more expeditiously. The refined pulp is next passed on to the sorters again. The hydro-extracting cylinders *d* remove the pulp into the stirrers R, whence the pulp is raised by small buckets on to a sieving machine and the pulp press *l*, where about 50 per cent. of water is extracted from the pulpy mass. When the pulp has to be stored for a considerable length of time, or is sent on long voyages, it further requires to be dried, which is done on drying machines by steam, or on endless blankets in steam chambers. Figs. 1 and 2 are drawn to a scale of $\frac{1}{250}$ full size.

Having thus described the general process of manufacture, we may now give a more detailed account of the machines we have just named. As we said before, the grinding machine receives the wood cut to certain dimensions, which cutting is done by the ordinary circular saw, or by the wood chopper shown in Fig. 3. The working of this machine explains itself, but we may add that it is built either as a double machine as represented—drawn to one-twentieth full size—or as a single machine with one hatchet; and accordingly it requires 3 or 2-horse power to drive it, giving off 75 hatchet blows, and working with a ten hours capacity of either 525 or 282 cubic feet of loosely-piled chopped wood.

As the dimensions of the machine are given on our engraving, we pass on to the grinding machine, illustrated as fitted with weights in Fig. 4, or as governed by hydraulic pressure as in Fig. 5. We have already enunciated the principle on which this machine works; but as two principles are here involved, namely, that of gravity and of hydraulic pressure, we may observe that practice shows that a more uniform fineness of woody fibre is obtained by pressing the wood only slightly against the stone; that is to say, by producing for a certain stone surface a small quantity of stuff, whereby simultaneously the driving power is considerably reduced. Hydraulic pressure appears to be preferable in this respect to that obtained by suspended weights, or by what we have just termed "gravity," it being understood that we are alluding to the power exerted on the wood to keep it up to the surface of the stone. This superiority is due, firstly, to the fact that grindstones of large diameter as here used do not remain mathematically circular, partly owing to the non-homogeneous nature of the entire stone, causing the latter to wear on certain points more than on others, and so producing an untrue surface circle. This undue wear causes the weights to be continually rising and falling, as may be seen when the machine is working, as shown in Fig. 4. These vibrations carry with them an uneven pressure of the wood against the stone, for naturally this pressure is smaller during the downward than during the upward motion of the weight; in fact, we may say that this pressure is at times annihilated during the intervals when the weight having reached its highest point is on the point of falling back. Conversely, just as this falling weight is about exerting its force, the resulting pressure ensues with a jerk, so that at this moment coarser fibrous matter is necessarily ground off the wood than at other times. These irregularities in the actual pressure of the wood against the stone are, however, obviated by using hydraulic pressure. In the first place, as all the hydraulic pistons pressing the wood against the stone are connected with one accumulator, it stands to reason that the various inequalities of pressure resulting from the uneven wear of the stone will balance each other; for instance, if one of the hydraulic pistons is being pressed back, the piston diametrically opposite may be pushed forward, so that the reaction on the accumulator, if not entirely balanced, will still be very slight. We thus obtain a more even pressure than weights would permit, besides the lifting of the weights by the attendant for machine re-filling purposes is entirely dispensed with, as the turning of cocks does this most effectually in the hydraulic arrangement, as will be presently shown. The grinding machine consists of a stone fitted on a vertical shaft and revolving at 150 to 190 revolutions per minute; its diameter is from 4ft. 9in. to 5ft. 7in., and its width is from 14in. to 22in. The wood is pressed under a constant water supply against eight different places of the stone's periphery, and for this purpose eight wood receiving boxes surround the stone, and these boxes are fitted with pistons either worked by weights or by hydraulic pressure. The cast iron casing round the stone is supported on four cast iron pillars, connected together in the form of a cross at their top ends, the intersecting point forming the bearing for the vertical shaft. The hollow cylindrical casing underneath the stones receives the ground fibre or pulp. The machine is driven in the same manner as is adopted for driving millstones. The manner in which the wood is pressed against the stone by suspended weights explains itself in Fig. 4; we may add that one-half of the machine exhibited at Paris was fitted with these weights, whilst the other half was arranged under hydraulic pressure, so as to exemplify the two systems. The press cylinders are not unlike common steam engine cylinders, and are fitted with four-way cocks under manual control; their diameter averages from 4in. to 6in., and the piston stroke ranges from 6in. to 10in. The water supply for all the cylinders is derived from one accumulator, keeping the pressure constant; it is fed by a small force pump. The latter is worked by belting, and keeps up a regular water supply. We show the accumulator in section in Fig. 5, and observe that the feed-water merely fills the lower part of the cylindrical vessel. A second cylinder cast in one piece with the cover dips with its open bottom end into the water, whilst inside the latter we have the usual plunger weighted according to the pressure required. The upper part between the two concentric cylinders serves as an air vessel. The feed-water at first compresses the air contained in the upper part of the vessel, whilst the air in the small cylinder escapes, when water takes its place. Any water excess is made to flow out of a safety valve. Gas piping connects the accumulator with the press cylinders, and it is evident that one uniform pressure corresponding to the pressure exerted by the plunger is maintained. The hind portions of the press cylinders have a flow-off passage, so that after the grinding down of the wood, when the piston requires reversing or putting back, a simple quarter turn of a four-way cock places the front end of the cylinder in communication with the accumulator, whilst its back end is open to the exhaust. A second quarter-turn of the four-way cock reverses the direction of pressure on the cylinder pistons, and so on. The ordinary working pressure on the last-named is about 0·1 atmosphere, that is to say, a mean pressure of 2·2 lb. per 1·5 square inch grinding surface is obtained. The press cylinders for a 50-horse power grinding mill are $14\frac{5}{32}$in. high by 6⅞in. wide. The following table shows that these machines are made in four sizes, viz.:—

	Size A.	Size B.	Size C.	Size D.
Diameter and width of grinding stones ..	in. in. 51·1 × 14·17	in. in. 57·8 × 14·17	in. in. 57·8 × 20·87	in. in. 66·9 × 20·87
Number of press cylinders	4	8	8	8
Number of revolutions per minute	190	170	170	150
Horse-power	25	40	60	90
Working capacity in 24 hours: Aspen wood (air dry)	7 cwt.	13 cwt.	18 cwt.	28 cwt.
Pine (air dry) ..	5 cwt.	9½ cwt.	14 cwt.	1 ton
Pressure by lever: Weight without stone	$3\frac{9}{10}$ tons	$6\frac{1}{10}$ tons	6½ tons	9¼ tons
Pressure by hydraulic power: Weight without stone	3¾ tons	5⅗ tons	$5\frac{3}{10}$ tons	7½ tons
Height of accumulator for two or four mills	11ft. 2in.			
Length of accumulator for two or four mills	35·43in.			
Width of accumulator for two or four mills	35·43in.			

The wood, previously cleared of its knots, splinters, and bark, is placed in the cylinder, in such a manner that its fibre is as nearly perpendicular to the running direction of the stone as possible. The nature of the water employed to grind down the wood, the time of felling, and the manner in which the wood has been stored until ground down, all have an important influence on the keeping properties of the manufactured wood pulp, which, if stored in a wet state, often becomes grey and mouldy after a few days' keeping. If the water is impregnated with many organic impurities, no matter how the wood pulp is treated, it becomes a matter of utter impossibility to store it long in a damp state; wood pulp of this kind must be used up quickly, or artificially dried by hot air. On the other hand, if it is imperatively required that wood pulp should be stored for many months in a humid state without becoming damaged, then the wood must be felled in the winter or towards the end of the autumn, and dried in the open air out of the sun's rays. It must be piled up loosely with free currents of air running through the whole pile, and must be so kept until it is ready for grinding down, during which operation clear water containing no organic impurities should be used. If these precautions are carried out, then the wood pulp will keep for many months in its damp state. The harder the wood is pressed against the stone the coarser is the pulp obtained and the greater is the driving power required; the quantity of pulp strained is also increased, though not in the same proportionate degree. Practice proves that the quantity of pulp obtained per horse power driving power is the greater the smaller the pressure of the wood is against the stone, though naturally a certain limit must not be surpassed. This limit depends on the hardness of the stone and the sharpness of the cut, to which we shall again refer. The more water is used in the grinding process the smaller is the driving power for one and the same production.

It consequently is of importance that the stones should be kept sharp whilst running, and for this purpose a self-acting stone grinder may be fitted up to the stones whilst the latter are working. Between two of the press cylinders is a removable plate *b*—Fig. 6—in the place of which the stone sharpener—shown in Figs. 7 and 8—may be inserted into the lugs *e e*. This apparatus consists of a lever handle *h*, which, by turning the screw spindle *d*, moves over the latter. The one end of the lever *h* carries a number of sharp steel discs *g*, as represented in Fig. 8. By pulling over the lever end *o* these steel discs *g* are pressed firmly against the surface of the stone *a*, and are so caused to revolve with the latter, whilst their teethed edges make small indentations in the stone. One of these sharpening tools with a set of eighteen discs weighs 88 lb.

The pulped liquid obtained from the grinding mill runs into the box *a*—Fig. 9—placed in front of the cylinder *b* shown in Fig. 10. This cylinder is covered with a coarse metallic cloth, to allow the fine pulp to pass into the interior of the cylinder, whence it runs into the two side troughs *c c*. The coarse pulp, splinters, &c., remain in front of the cylinder, to be thence removed for re-grinding purposes. In Figs. 11 and 12 we represent the sieve-box *a* used for retaining the splinters, shavings, &c., whilst the pulp falls through the perforated metal plate *b*, to be thence conducted on to the "sorters." Figs. 9 and 10 are drawn to one-thirtieth, whilst Figs. 11 and 12 are drawn to one-twentieth full size.

These "pulp sorters" are shown in end and front elevation, drawn to one-twentieth full size, in Figs. 13 and 14, and they serve the purpose of sorting out the fine fibres from the coarse in the liquid pulp after the preceding machine has eliminated the splinters, &c. It consists of four cylinders of 2ft. 3½in. diameter and 4ft. 1½in. long, which are merely covered with metallic cloth, without spindle or bottom. They are hollow, but rest with their cast iron ends on four rollers, which impart to them a rotary motion. The pulpy liquid is allowed to fall on the top of these cylinders, when the fine pulp passes through the metal cloth, whereas the coarse stuff remains on the outside and falls into a receptacle placed underneath. In order to promote the falling off of the coarse pulp, powerful water jets are applied inside these cylinders, and so force all hanging fibres to clear off the metallic cloth. The fine liquid pulp inside the cylinder is either passed on to a water extractor or to the pulp board machines described hereafter. The sorting cylinders consist of two cast, end rings, connected together by twenty-four wrought iron rods equidistant in their circumferential distance from each other. To this skeleton frame wire rings are soldered ½in. apart, and over these the brass wire cloth is drawn. These sorters are constructed in the various sizes mentioned in the following table:—

No. of cylinders.	Diameter of cylinders.	Length of cylinders.	Capacity.
2	2ft. 3½in.	4ft. 1½in.	Suited to a 25-H.P. grinding machine.
4	2ft. 3½in.	4ft. 1½in.	,, 40 ,, ,,
4	2ft. 3½in.	5ft. 3in.	,, 60 ,, ,,
8	2ft. 3½in.	4ft. 1½in.	,, 90-100 ,, ,,

As stated in our preceding remarks, the coarse pulp, requiring to be ground finer, is lifted by a pump, shown in Figs. 15 and 16, on to the refining mill represented by our Fig. 17. This pump, drawn to one-thirtieth full size, is worked at between 20 and 30 revolutions of the crank shaft per minute, or is constructed in four sizes, 4in., 6in., 8⅝in., and 10in. diameter, with working capacities of 9 to 66 gallons per minute, the pressure required being ½-H.P. to 2-H.P.

As we stated previously, the pulp—found too coarse—is ground down again in the refining mill, shown in Fig. 17, which in its external appearance resembles the ordinary flour grinding mill. It consists of two stones, 4ft. 4in. in diameter and 1ft. 5⅜in. wide, which are surrounded by a sheet iron casing. These stones are run at 135 revolutions per minute, and on their setting towards each other the grinding of the pulp will naturally depend. A machine of the dimensions just quoted will suffice for two wood grinders each of 50-horse power. The ground stuff is again brought back to the "sorters," till it is allowed by the latter to pass over to the water extractor—shown in Fig. 18—also drawn to one-thirtieth full size.

The sorted liquid pulp passes first into the trough A, when a portion of the water contained in it passes into the interior of the water extracting cylinder B and thence into the trough C, where it flows off through the pipe D. The pulp next enters the trough E, where it is kept in a constant agitated state by the agitator G. The liquid pulp is next lifted by the bucket wheel F into the pan H, whence it flows off through the pipe J on to the pulp press. The bucket wheel ensures a uniform feed, and the water-extracting cylinder is kept clean by suitable water jets. At first thought one might think that these water jets used for keeping the cylinder clean would act detrimentally on the pulp production. The reverse, however, is the case; for the watering of the pulp is necessary and beneficial, because large volumes of water, containing much fine pulp, flow through the cylinder sieves and pass off to be extracted in the water extractors, whereas the coarse stuff, comparatively poor in water, falls off the sorting cylinders and is hence ready to receive more water from the jets. Besides, this addition of liquid facilitates the passage of the coarse woody fibres through the—Fig. 19—pump, which might otherwise become choked. The water jets are of copper piping $1\frac{3}{16}$in. inside diameter, and are perforated lengthways in two rows by $\frac{1}{16}$in. holes drilled ⅝in. apart.

The pulp press, on to which the liquid pulp is now passed, is shown in side elevation and plan in Figs. 19 and 20, where it is drawn to one-fortieth the full size. It must, however, be observed that the liquid pulp is only conducted on to this machine, when it is not wanted in thick boards, but is on the contrary required for distant destination in leaflet style. The pulp, as our engravings clearly show, is here rolled or calendered, and leaves the press charged with about 50 per cent. of water, in which state it is packed in sacks and sent to small distances; for greater distances the pulp is, however, dried by hot air, so reducing its water to about 20 per cent., when it is said to be air-dry. If the pulp is pressed too hard during the pressing, then it is very difficult to get it back into its pulpy state, and for this reason no more than 70 to 80 per cent. of water contained should be pressed out between the calendering rollers. The more water the pulp is permitted to retain, the thicker may the pulp liquor be allowed to run on the machine.

For the reason already stated this press is often replaced by one of the machines shown in our Figs. 21 and 22. The pulp arrives in a highly liquid state in the agitator box shown to the right of our engraving—Fig. 21—where it is agitated. Hence, it passes over into a second wooden box in which the water-extracting cylinder is fitted. The latter is of similar construction as the before-mentioned sorting cylinders; it is hollow and runs on friction rollers which cause it to revolve. At its ends the cylinder is boxed off by leather or caoutchouc, and its circumference is lined with brass wire cloth. The water of the pulp liquid half filling the second box enters the cylinder, where it is either passed off direct—as in the machine represented by Fig. 21—or passed back into the first box—as in the arrangement shown by Fig. 22. This water which finds its way into the interior of the cylinder is still more or less impregnated with woody fibre, and as the wood pulp used for feeding the machine—shown in Fig. 22—requires to be highly saturated with water, this cylinder water may be profitably used for this purpose, since by so doing many woody fibres are thereby recovered which would otherwise be lost. The sole difference between these two machines consists in the latter having a bucket wheel for returning the extracted water, as well as in its having a sieve placed between the two boxes for arresting any coarse fibres.

Very peculiar indeed is the manner in which the wood pulp is caught off the extractor cylinder and passed on to the calendering rollers. As the water passes through the cylindrical wire cloth the woody fibres stick to the cylinder surface. An endless felt—shown in dotted lines, and kept in constant contact with this cylinder surface by the small roller clearly represented—takes off the woody fibres from the cylinder surface, and passes along with these fibres between the cast iron calendering rollers. By a strange property inherent to the wood pulp, the pressed fibres leave the felt to attach themselves to the surface of the top cast iron roller, when a scraper working against the latter detaches the pressed wood pulp and allows it to fall into a basket placed underneath.

It is this property of the pulp attaching itself to the cast iron roller which is also utilised in the pulp board making machine—shown in Fig. 22. It is evident that if no scraper for detaching purposes were employed the pulp would proceed to lap itself round and round the top roller as the latter revolved. This is allowed to take place, when after lapping itself round two or three times, the board is cut—whilst the machine is in motion—and the board is stripped off the roller, the circumference of which naturally corresponds to the length of the pulp board. This top roller is fitted with an indicator, showing the number of revolutions made, answering to the thickness of the pulp board required. Too great a rolling pressure must not be applied, otherwise the board is not properly formed into one mass. The diameter of the cylinders of both these machines is 2ft. 6in., and they revolve at a speed of 3½ to 4 revolutions per minute. The bottom roller forms the main driving shaft and revolves at from 13 to 17 revolutions per minute. The working capacity of these machines is given as follows:—

Machine width.	Diameter of top roller.	Working capacity in 24 hours.	Horse power required.
3ft. 3in.	15¾in.	10·8 cwt.	1⅓
3ft. 11in.	15¾in.	13·2 cwt.	1½
4ft. 5in.	15¾in.	15 cwt.	1¾
4ft. 11in.	15¾in.	16 cwt.	2

We have thus passed Bell's wood pulp-making machines under review, and propose, on a future occasion, to illustrate and describe the same firm's machinery for reducing straw into a paper-making pulp.

NAVAL APPOINTMENTS.—Frederick Skelton, chief engineer, to the Northampton, additional, for service in the Griffin; Charles Allsop, engineer, to the Pembroke, additional, for service in the Esk; Adam Shoolbred, engineer, to the Asia, additional, vice Kitts; Charles E. Stewart, engineer, to the Warrior; William H. Moore, engineer, to the Pembroke, additional, for service in the Tweed; and W. Brown, assistant engineer, to the Griffin.

RAILWAY MATTERS.

STEAM has been tried on the tram lines at Naples instead of horses. The first trial was made last week from the Porta Capuana to Poggio Reale, and with great success. Since then another trial trip has been made to Afragola.

COLONEL YOLLAND, reporting on the recent accident near Leeds, states that the alterations made by the Midland Company in 1872 in the station-yard were not reported to the Board of Trade, and were never inspected. He remarks that by this omission the company has made itself liable to a daily penalty of £20, or close upon £60,000.

"MEASUREMENTS for mile posts have been made recently on the New York, Pennsylvania, and Ohio Railroad over its whole line in a somewhat novel way,' says the *Railroad Gazette*. "A velocipede hand car with a 4ft. wheel was fitted with a revolution counter, and after determining carefully the number of revolutions per mile, the distances were rolled off by running it over the track. There was found to be a slight irregularity in the measurement, owing to the play and coning of the wheels, but the error was far within the limits of ordinary careful chaining."

THE directors of the Great Western Railway, having decided to considerably improve the communication between Uxbridge and Paddington, are laying additional rails from West Drayton to the first-named town. The directors also contemplate making Uxbridge the terminal station for their Victoria trains instead of stopping them at Southall Junction. The works for the new station at Slough will be commenced this spring. The construction of the auxiliary line to Taplow, whence it will be gradually extended to Reading, is in progress. These advantages are being tardily conferred on Uxbridge, because the Metropolitan District Railway Company propose to extend a line to Uxbridge.

IN accordance with the provisions of the Berlin Treaty, the Railway Commission appointed to deal with the new lines of the south-east of Europe will assemble in Vienna for the despatch of business in the second half of February. The Bosnia Valley Railway Bill has passed the Upper Chamber, Austria. This measure is very important, as it will bring Austria into direct communication with the port of Salonica. Herr von Schmerling remarked that he looked upon the Austrian occupation of Bosnia not as a temporary but as a permanent thing. This railway, he thought, would help to attach the natives of the province to Austrian rule by identifying their interests with those of the empire.

THE manufacture of bicycles and velocipedes has become one of the staple industries of the Midlands, and lately the railway charges for the carriage of these products have been considerably increased, in some cases up to 100 per cent. The manufacturers of Wolverhampton and Coventry have consequently interviewed the managers of the London and North-Western, the Great Western, and the Midland Railways, seeking a return to the rates that prevailed before 1881. The result has been that with this month the recently advanced rates have been lowered 50 per cent. on bicycles, and something like 75 per cent. on tricycles. The manufacturers in the Wolverhampton district have formed themselves into an association.

AN electric head-light for locomotives will soon be tried on the Cleveland and Pittsburg Railroad. The power will be furnished by a small engine placed behind the smoke-stack and furnished with steam from the main boiler. It seems to us that electric headlights are always going to be tried. It is about time that American locomotive superintendents—we beg pardon, master mechanics—began. The electric head-light is just the thing for unfenced railway. If properly managed, it would awaken sleeping cows; and if applied to some of the fast-time trains, of which we have heard so much, electric head-lights would produce streaks of light across the country which might be readily mistaken for dawn, and so wake up all creation.

DURING the early part of last year the total length of the Prussian railway system was 6197 kilometres, including 798 which had been added in the course of the year. By the end of the year the length had been increased to 6299 kilometres. The cost of the whole system had been 1,493,305,418 marks—£74,665,270—or at the rate of 244,312 marks per kilometre. The receipts for the year were 163,877,969 marks, as against 155,881,124 in the previous year. There was, however, a diminution of receipts per kilometre from 29,582 marks to 26,580, or at the rate of 9 per cent.; though, on the other hand, the expenditure also decreased from 18,042 to 16,326 marks per kilometre, or $9\frac{1}{2}$ per cent. The general result shows an excess of receipts over expenditure of 61,826,748 marks, against 57,990,555 in the year before.

"THIS continent," says the *American Manufacturer*, "seems destined to be the highway of the nations of the world, between the Atlantic and Pacific oceans. The Union and Central Pacific is completed; the Atchison, Topeka, and Santa Fe will in a few weeks connect with the Southern Pacific, of California; the completion of the North Pacific, the Texas Pacific, and the Mexican National roads is secured; the Canada Pacific is pushed with such backing that its completion may be looked upon as assured within ten years; while two schemes for ship canals and one for a ship railroad are in such shape that the completion of two of the three may be counted among the great engineering works to be completed in this generation." If a continent like America *will* get in the way what can it expect? People must cross it somehow, especially English people, who, when they take a fancy to go anywhere, generally go in spite of obstacles.

ADVICES from Vienna state that the preparatory operations having been finished, the work of boring the great tunnel through the Arlberg has now actually commenced. This tunnel will be one of the longest in the world, though not so long as that of St. Gothard. So far the operations on the eastern side of the Arlberg have progressed very favourably. The rock there found is a micaceous slate, through which the contractors find it possible to advance at the rate of from three to four metres a day. On the western side, on the other hand, the advance of the tunnel is retarded, and the operations frequently disturbed by the repeated inrush of large quantities of water. The contractors were warned before commencing the work that this was only to be expected. The geologists further advised that the tunnel should be carried through a lower stratum of rocks, which are of denser material and watertight, but their warnings were disregarded.

A SERIOUS accident occurred at an early hour on Sunday morning on the Solway Junction Railway to the iron viaduct across the Solway Firth, and the viaduct has been so much damaged by the sea that traffic has been suspended. The structure, which has been available regularly for railway traffic for about twelve years, was designed by Mr. Brunlees, C.E. It stretches across the Solway Firth from Bowness, and is more than a mile in length. It is constructed of iron girders, resting upon a series of piers of iron columns, each bay consisting of five pillars 40ft. high, and the whole being braced together by iron lattice-work. For several days since the thaw set in the Solway has been very full of ice. On Sunday morning there was a high tide, and when it began to ebb it travelled with such velocity that the blocks of ice were dashed against the bridge with great force. Four watchmen were on the bridge or near it, and so loud were the crashes they heard in the darkness that they felt sure that the bridge had been seriously injured. When day broke their fears were fully realised. It was then discovered that five of the bays or piers had been entirely swept away, twenty-five iron pillars having thus been destroyed, and that a few other pillars in other bays had been damaged. Fortunately the bays that were washed down altogether were at considerable distances from each other, though towards the middle of the bridge, and the iron girders were bolted so strongly together that they maintained their position, and so left the permanent way of the railway unbroken. On the next tide, however, came more ice, and the bridge is now impassable even on foot. We shall give further particulars in a succeeding impression.

NOTES AND MEMORANDA.

SOUTHERNERS have discovered, it is said, that smooth, strong, and pliable parchment can be manufactured from the palmetto of Florida and other Southern states. The parchment can be washed, rubbed and handled just like cloth, and the writing will not be effaced. It can be cheaply manufactured, and is likely to come into general use for conveyances, land office receipts, &c. As much as 60 per cent. of the weight of the palmetto can be utilised in paper making.

WATERPROOF paper is made by a new German method as follows: To a weak solution of ordinary glue add a little acetic acid; then make another solution by dissolving a small quantity of bicromate of potash in distilled water. These two liquids should be well mixed together, and the sheets of paper which have to be made waterproof drawn through the mixture, and suspended from suitable lines to dry. The proportions are not given, but 5 per cent. of acetic acid and 7 per cent. of a saturated solution of bicromate of potash will answer.

A SMELTER'S ton of copper ore is 21 cwt., and weighs 2352 lb., the manufactured copper being sold at 2240 lb. to the ton. Coke for a run-out fire is bought 2000 lb. to the ton. A ton of pig iron for a forge is 2268 lb.; blooms being sold at 2464 lb. to the ton, and 2700 lb. constituting a ton of refined metal. Coals in America are bought at 2240 lb, to the ton, and retailed at 2000 lb. to the ton. Here they are now always bought and sold at 2240 lb., except at Newcastle, where they are shipped by the chaldron of 30 cwt., of 3380 lb., and Newcastle coals are to-day so bought and sold in Quebec, Canada.

SOME one who has taken the trouble to count the United States patents issued to women finds that the number for the year ending July, 1880, was seventy, or ten more than the average. Most of the inventions of women have to do with household appliance. Among the past year's are a jar lifter, a bag holder, a pillow holder, a dress protector, two dust pans, a washing machine, a fluting iron, a dress chart, a fish boner, a sleeve adjuster, a lap table, a sewing machine treadle, a wash basin, an iron heater, sad irons, a garment stiffener, a folding chair, a wardrobe bed, a weather-strip, a churn, an invalid's bed, a strainer, a milk cooler, a sofa bed, a dipper, a paper dish, and a plaiting device.

A GOOD many curious calculations have been made in connection with the enormous crops of wheat produced by the Dalrymple farm in Dakota. This farm has fields of fabulous size. Last year 18,000 acres were under wheat. A correspondent of the Chicago *Inter-Ocean* has been indulging in some new calculations relative to the last harvest. From the speed of the harvester and the length of the cutting-bar he calculated that there would be 900 sheaves to the acre, or seventy-five shooks of twelve bundles each. As there were 18,000 acres in the field the shooks numbered 1,350,000, and the sheaves 16,200,000. Allowing 30in. of wire to the sheaf, over 7670 miles of wire were needed for binding the crop—almost enough to reach through the earth.

THE *American Manufacturer and Builder* gives the following rule for fixing the size of governor pulleys. "To find the diameter of the governor shaft pulley, multiply the number of revolutions of the engine by the diameter of the engine shaft pulley, and divide the product by the number of revolutions of the governor. To find the diameter of the engine shaft pulley, multiply the number of revolutions of the governor by the diameter of the governor shaft pulley, and divide the product by the number of revolutions of the engine." There is nothing recondite or abstruse in this; we have reason to believe, however, that everyone does not know how to calculate the size of such pulleys properly, perhaps because the calculation is so simple. Therefore we quote from our contemporary.

AT the last meeting of the Asiatic Society of Bengal an interesting paper was read by Mr. Valentine Ball, of the Geological Survey of India, in which he discussed the identity of the diamond mines visited by M. Tavernier in the 17th century. These mines have long been lost to memory. Mr. Ball now identifies Raolconda with Randukonda, on the Tungabudra river; Ganicolour, where the Koh-i-noor was found, with Kallur, on the Kisana, and Soumelpour, with Simah, in Chota Nagpore, and not with Sambalpur, as hitherto supposed. Burageesh, which is mentioned in the Ain-i-Akbari, is identified with Wairagurh, in the Central Provinces. The paper explains the various traditions connected with diamond mining as formerly practised in India, and throws much light on this attractive, but now almost extinct industry.

WE learn from Geneva that the celebrated Brunswick monument is showing ominous signs of giving way. It is built on land which not many years ago was reclaimed from the lake. Such land is notoriously treacherous, for often beneath it and only superficially covered, there are enormous holes hollowed out by the ice action when the Rhone glacier swept over the present site of Geneva. A few summers since a long lake wall at Vevey disappeared in the night and left not a trace behind. In the case of the Brunswick monument every precaution was taken to assure its integrity by placing it on an exceedingly thick and seemingly solid foundation of concrete, but it appears only too probable from present indications that the ground underneath is subsiding and that the structure is threatened with serious danger, if not with complete destruction.

THE *American Manufacturer* states that three or four years ago some of the mechanics in the Pennsylvania railroad shops were overhauling an engine, and they found a peculiar irregular rut worn, or rather eaten, $\frac{1}{2}$in. deep, several inches long, and from $\frac{1}{4}$in. to 1in. in width, into the steel of a steam chest. It was evidently the result of the action of some rapid and powerful corrosive, but its source was a mystery. For the oiling or lubricating of steam chests or cylinders a preparation of tallow is used. The company's chemist began a series of analyses to determine the cause of such rapid decomposition, and after considerable experimenting he discovered it. He found that where animal fat is allowed to lie a long while before rendering, the decomposition sets free in large quantities stearic, palmatic and oleic acids, and that the stearic acid, heated to the temperature of steam, acted very rapidly in decomposing iron. This at once yielded a clue to the corrosion found in the old steam chest, and now every barrel of tallow used by the company is subjected to analysis to determine whether it is made of new fresh fat, or whether it is charged with the various acids due to decomposition.

IN a note to the Vienna Academy—*Anz.* December 16th—Prof. Stefan describes experiments on the influence of terrestrial induction in development of an electric current, and the excitement of the telephone by currents from a rotating coil. The coil used was 56 mm. in external diameter, and 11 mm. in width. The earth's influence is best shown by so connecting the apparatus with a galvanometer that the circuit is closed during one half of the coil's rotation, and broken during the other half; if the completion of the circuit correspond to the positive maximum of the electromotive force of the earth's magnetism, and the interruption to the negative, the galvanometer is positively deflected. The deflection may be reduced to zero by displacing the contact, and from the displacement and the number of rotations the potential may be inferred in absolute measure. Next the telephone was so connected with the coil that the full alternately opposite currents went uninterruptedly through the circuit. This gave a simple tone. With 100 rotations per second the horizontal component of the earth's magnetism did not suffice to excite an ordinary telephone, but it excited one having a horse-shoe magnet. When the intensity of the field was doubled the ordinary telephone was also excited. The tone corresponds to the number of rotations. When the coil was rotated 220 times in a second the ordinary telephone sounded. The telephone was shown to be less sensitive to currents whose intensity periodically changes than to interrupted currents—an ordinary telephone sounded with 100 rotations or fewer, when the circuit was closed only during a short time of each rotation.

MISCELLANEA.

MESSRS. RICHARD GARRETT AND SONS, Leiston Works, Suffolk, have got a first prize for their portable engines at Melbourne.

THE Hotchkiss cannon has been officially adopted in the German Navy. The ships, according to their classification, shall in general be armed with this weapon in such manner that every point surrounding the vessel in question may be kept under the fire of at least two guns at 200 metres distance and further.

AT a meeting of the Sanitary Institute of Great Britain, held January 27th, B. W. Richardson, M.D., F.R.S., in the chair, the secretary read a list of books presented to the library since last meeting and one fellow and two members were elected. The institution apparently does not rapidly increase in numbers. Perhaps the conditions of fitness for election are very stringent.

THE shipbuilding yards on the banks of the Mersey are well supplied with work, and the activity in this branch of trade has enabled the ironworkers in the different departments to obtain an advance of wages, the employers within the last few days having consented to restore wages to the point at which they stood at the close of 1878, which represents an advance of about 2s. per week.

IN the year 1870, the Pratt and Witney Company, of Hartford, Connecticut, built for the Tilton and McFarland Safe Company, of New York, a milling machine, for shaping safe doors. This machine weighed 17 tons, would mill work up to 3in. wide and 9ft. long, and was capable of making a cut 6in. wide, 1ft. deep, on a combination of iron and steel. This machine is now in use by the Continental Ironworks, of Greenpoint, L.I. No machine of anything like these dimensions has been built in this country. Can any of our readers say who invented the milling machine?

THE miners in the Manchester district who have been working for about a fortnight are again becoming unsettled upon the wages question, and a demand has been made for a further advance of about 12 per cent. Deputations from the men are this week waiting upon the employers with reference to this demand, but so far the masters have declined to concede any further advance at present, on the ground that the state of trade does not warrant it, and that in other districts with which they have to compete no advance at all has yet been made. What action the men will take remains to be seen.

A NEW hopper dredger, named "Ely," built and engined by Messrs. W. Simon and Co., was on Saturday launched complete from their works at Renfrew. It is the property of the Taff Vale Railway Company, and has been built under the direction of Mr. Riches, its engineer. This vessel is to dredge to 30ft. depth, and cut its own flotation in shoals; it carries its own dredgings and also loads side barges and tows them when required. This is the ninth hopper dredger this firm have constructed, and they have another in progress to carry 1400 tons of its own spoil; it is to steam to New Zealand, and will be the largest dredger in the world.

THE Phosphor-Bronze Company held its seventh annual general meeting on the 1st inst. The directors declared a dividend of 10 per cent. per annum, less the interim dividend—$2\frac{1}{2}$ per cent.—already paid. The directors have devoted, they say, considerable attention to several novel applications of phosphor-bronze—amongst others, to its adaptability in the form of sheet, angle bars, and rivets, to the construction of steam launches and torpedo boats; and having thought it desirable to make a practical trial in this direction, they have ordered a small steam launch to be built entirely of phosphor-bronze, to test its greater durability by reason of its resistance to the oxidising effect of sea water. Should the venture prove a success, there is every likelihood of a considerable business developing in this branch.

THE *American Manufacturer* is lost in admiration of a casting shown at the Brussels National Exhibition by the Seraing works. It consists of what is practically the whole cast ironwork of a marine engine, with a pair of cylinders about 20in. diameter by 20in. stroke, cast in one piece—bed-plate, condenser, air, and feed, and bilge pumps, standards, cylinders and exhaust pipe. Our contemporary forgets that Messrs. Winans many years since are reported to have done much more. They took contracts from the Russian Government for locomotives. These engines were paid for by the pound, and, weight being no objection, are said to have been cast whole, and to have been such triumphs of the founder's art, that when lifted out of the mould, fettled up a bit, and lubricated, steam could be got up in them and the engines put to work at once. The United States need fear no rivalry while her sons can accomplish such feats as that.

THE celebrated yacht, America, which was once described in our columns by the late Mr. W. B. Adams, as "one flat board for a deck, and another flat board set on edge for a hull," is still in existence, but she is undergoing such radical changes in construction, that she will be the America no more. She is nearly thirty years old, was designed by George Sellers, was built in the States, and crossed the Atlantic to beat English yachts, which she did for the time being with a vengeance. She got the reputation of being able to sail straight in the wind's eye, which nautical exaggeration conveyed the fact that she was one of the most weatherly craft ever built. After going through many vicissitudes she is now being rebuilt; she was a most uncomfortable boat, anything rather than a "family yacht." Modern accommodations afloat demand more capacity than her model afforded, and the lack of height in the major portion of her cabin was always her bane. With a view to increase her head-room her forward deck has been raised flush with her quarter-deck. Her stern, too, has been lengthened above water—for what reason, will be a pertinent query sometime in the future. She has been fitted with a new stem, apron, and knightheads, and outside planking down to the water line. She will be planksheered flush with the deck over a new set of locust stanchions, and the gunwale sheer will be raised at the stem some 5in., making her 108ft. long over all. Her new stern finishes out fairly with her old lines, terminating in a very small V. If report be true, her mainmast is shorter than the old-time stick, being only 78ft. long. The main boom will be 70ft. It is intended, it is said, to race her during the coming season.

A CORRESPONDENT of the Hartford *Times* describes as follows the factory of the Georgia Ice Company at Atlanta:—On the ground floor is a boiler 50ft. long and $4\frac{1}{2}$ft. in diameter containing 150ft. of $3\frac{1}{2}$in. pipe. The boiler is kept filled with aqua ammonia, which is separated by the steam heat into ammonia gas and water. The gas, leaving the water in the boiler, forces its way through a 6in. pipe outside the building to the roof, three stories up, where it passes into 15,000ft. of coiled pipes, in which it is converted into liquid by cold water thrown over it in fountain jets. This liquid passes into 15,000ft. of $\frac{3}{4}$in. pipe, arranged in vertical sections 30ft. high and 3ft. apart, and its sudden liberation into these pipes turns the liquid pure ammonia into vapour, and the sudden expansion makes the pipes intensely cold. Now, above these hundreds of vertical pipes are innumerable little fountain jets throwing spray all over the pipes, the spray freezing gradually, forming an immense icicle of pure ice around each pipe. The gas next goes into 15,000ft. of absorbing pipe, and, being cooled by water running on the pipes, it is met by water forced into the pipes, and thus converted back into aqua ammonia, which goes into the big boiler, and is used over again. There is no waste, the same ammonia being used and reabsorbed any number of times. The water used for the spray is drawn from a well 75ft. deep, on the premises, and the large blocks of ice—which are loosened from the pipes by a little hot steam—come out pure and clear, and entirely free from any odour or objectionable taste. After the pipes have been stripped, about five weeks are required for a new lot of the requisite thickness to form. But, of course, the pipes are never all stripped at the same time, the ice towers being in all stages of formation. The factory has a capacity of 35 tons per day, but 20 tons keep pace with the demand, and it is not stored, but cut every day as it is delivered, and it sells at from 10 dols. to 12 dols. per ton.

WOOD PULP MAKING MACHINERY.

MM. THEODOR AND FRIEDRICH BELL, KRIENS, SWITZERLAND, ENGINEERS

(*For description see page 85.*)

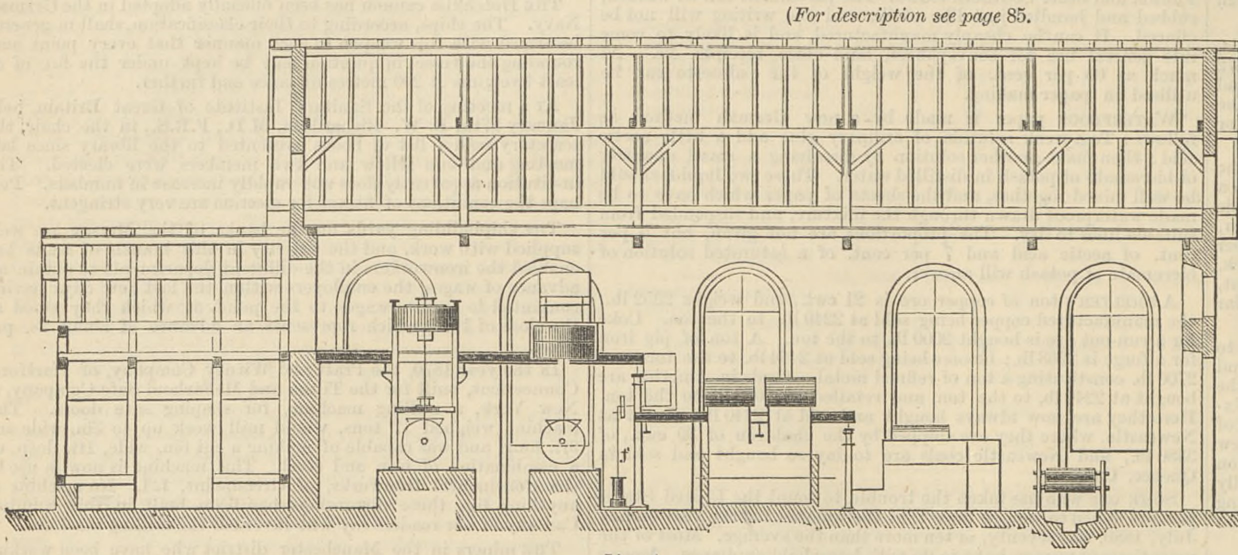
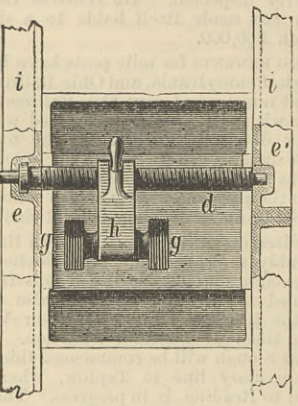


Fig. 1.



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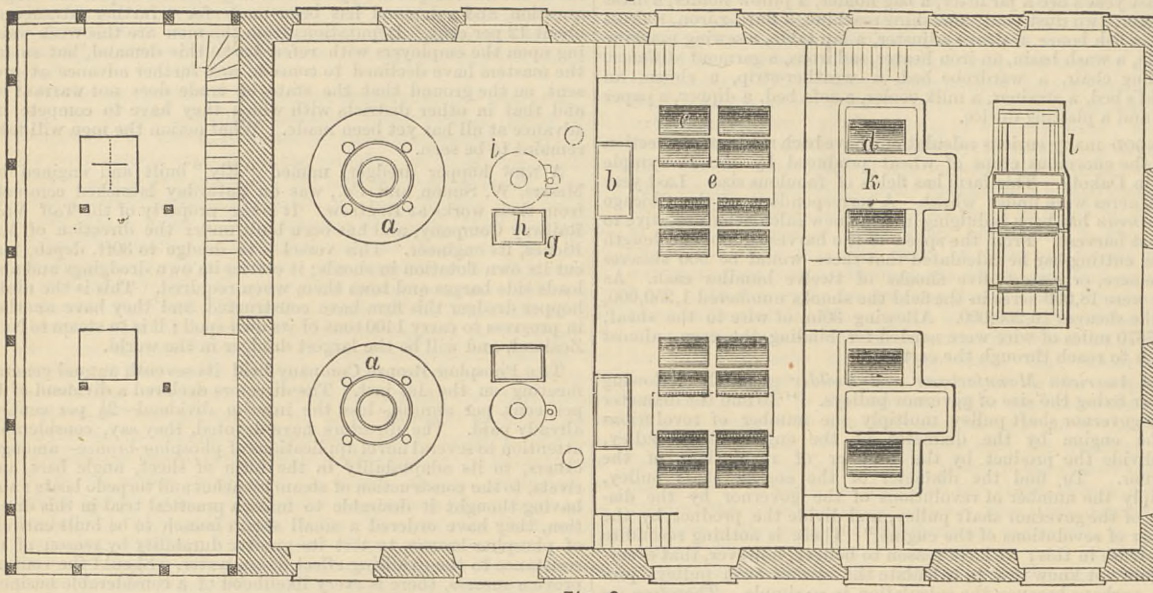
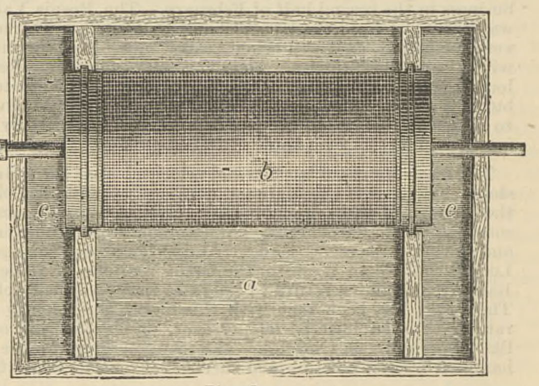


Fig. 2.



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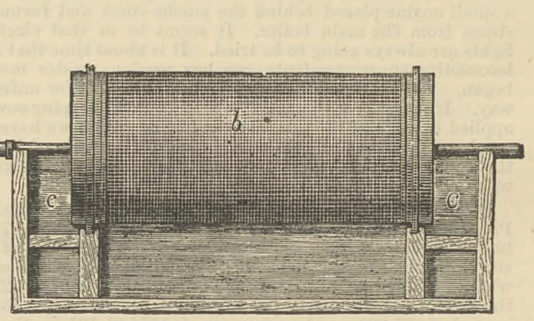


Fig. 10.

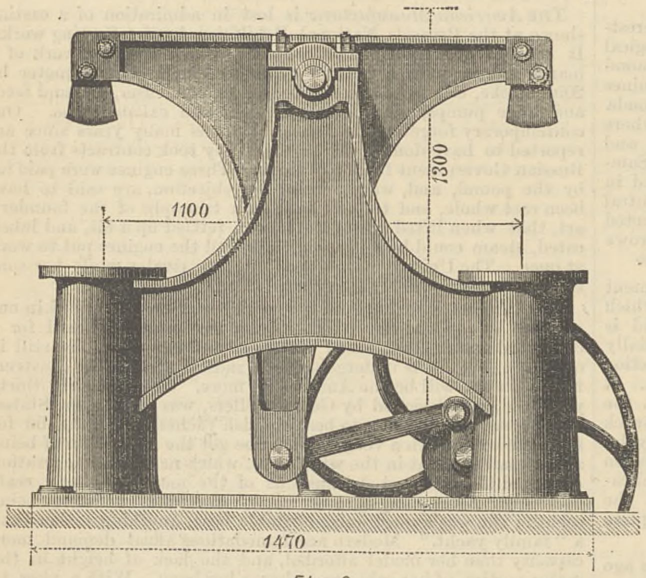


Fig. 3.

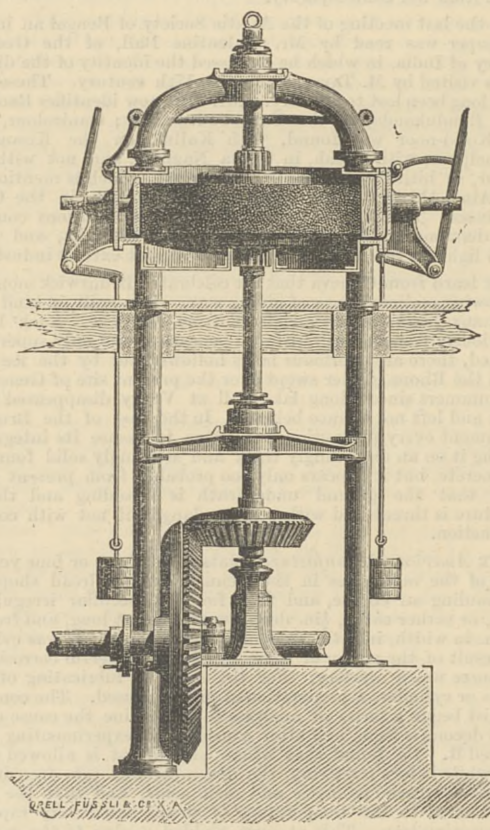


Fig. 4.

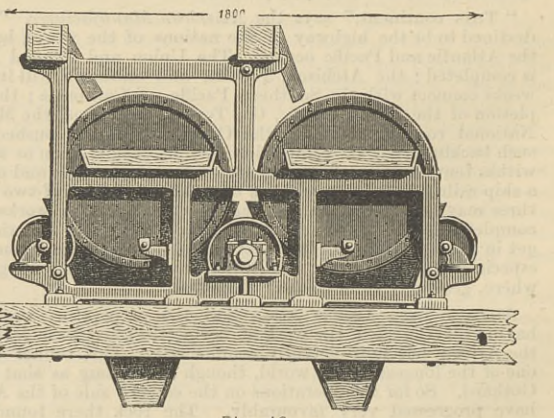


Fig. 13.

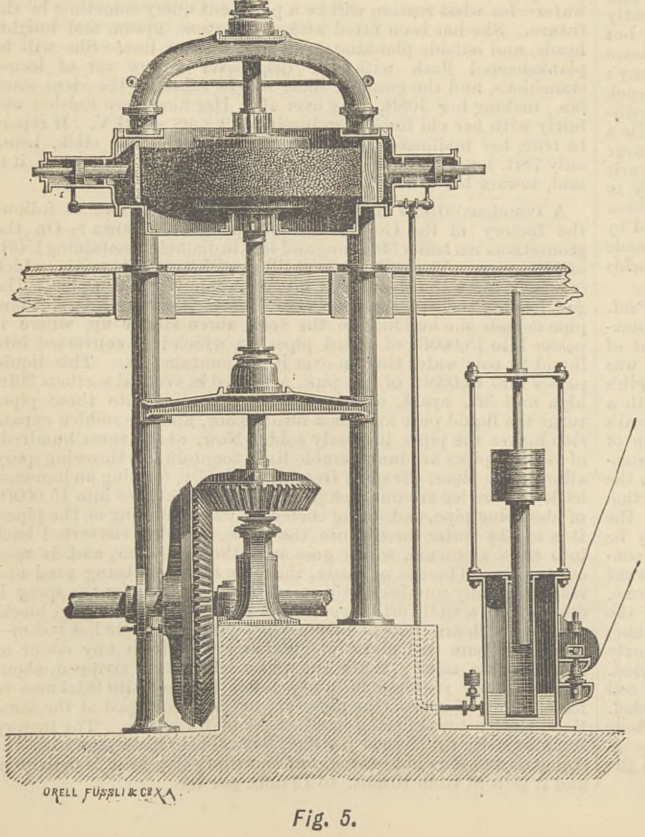
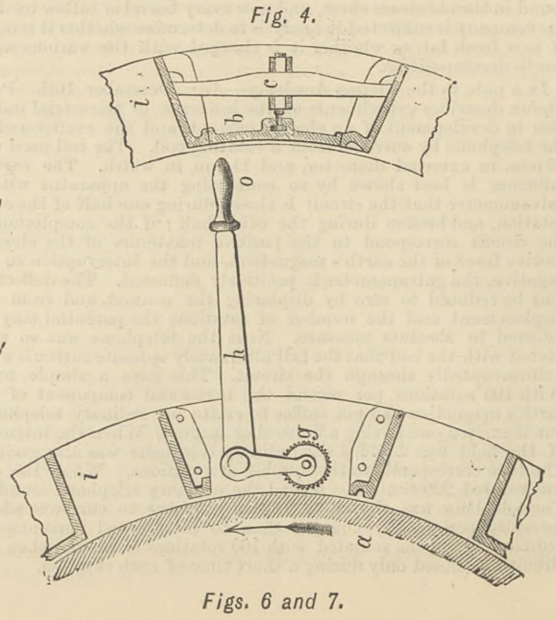
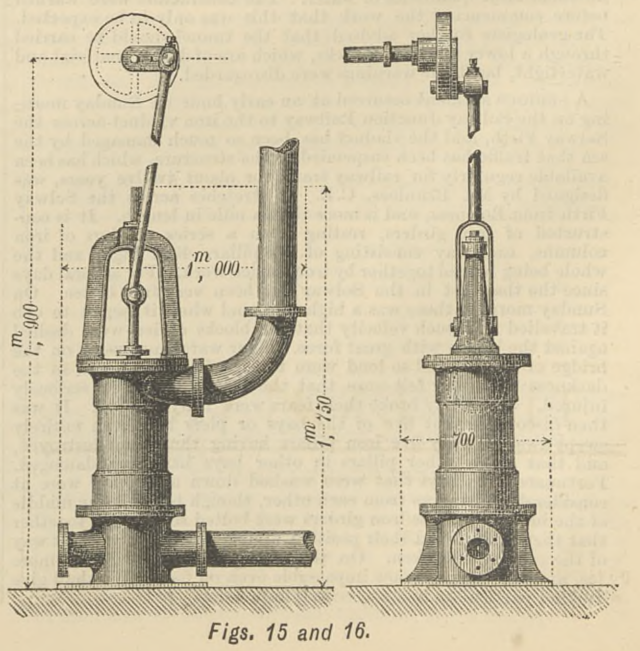


Fig. 5.



Figs. 6 and 7.



Figs. 15 and 16.

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TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

P. W. D.—*There will be an exhibition of electrical apparatus held in Paris this year.*

B. (Lancashire).—*There is no treatise on sheet rolling mills in existence. What do you want to know?*

A CONSTANT READER.—*You will find what you want in* THE ENGINEER *for December 28th,* 1878, *and in many other numbers.*

H. SYLVESTER (Bristol).—*A letter lies at our office for you, which will be forwarded when you send us your full address. It has been returned through the post as insufficiently directed.*

P. M.—*There are many books on the subject you speak of, all professing to be excellent. You cannot, perhaps, do better than obtain those published in Collins's Science Series, which you can obtain through any bookseller.*

W. K.—(1) *There is next to nothing to be done by English civil engineers in the States.* (2) *Stoney "On Strains"—you can get the work through any bookseller—or Cargill "On the Strains on Bridges and Roof Trusses," published by Messrs. Spon, Charing-cross.*

LEIGH (Lancashire).—*Whether you make a patented invention for your own use or for sale, without the consent of the inventor, you infringe the patent, and must take the consequences. It would scarcely be deemed a good excuse if a man who stole a watch urged that he did not take the watch to sell it, but for his own use.*

J. O. (Halifax).—*Such a machine cannot be made. Power cannot be got out of nothing by any combination of wheels, springs, or levers; and if you use a falling weight to drive the machine, even though there were no waste of power in overcoming friction, yet all the machine could do would be to lift the weight up again to the place where it was before.*

A. C. L. (South Ashford).—*Absolute zero, or the point of no heat, is in round numbers* 461 *deg. below zero Fah. As we have already explained, the boiling point is* 212 *deg. Fah,* 100 *deg. Centigrade, and* 80 *deg. Reaumur.* 0 *deg., or zero Fah., is* —17·7 *deg. Centigrade and* —14·2 *Reaumur, while* 32 *deg. Fah. is zero for both Centigrade and Reaumur.*

COUNTRY BLACKSMITH.—*We believe Bessemer steel has been used for horse-shoes; get a bar and try it for yourself. You will have a difficulty in welding it for cart wheel tires, but it can be done. Great care must be taken to work at as low a heat as possible; use a little powdered borax as a flux. Only trained hands can grind curved surfaces such as you speak of.*

AN OLD SUBSCRIBER.—*We do not know any work which is quite likely to suit your purpose. Truran's treatise "On the Manufacture of Iron" is now rather out of date. There is a treatise on the same subject by Kohn, published, we believe, by Spon, which is excellent of its kind. "Iron and Steel," by Charles Hoare, is a pocket-book of tables and memoranda, published by Crosby Lockwood and Co.,* 1876, *and its price is* 6s. *It may give you all the information you want.*

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Feb. 8th, at 8 p.m.: (1) "The Portsmouth Dockyard Extension Works," Part II., by C. Colson, Assoc. M. Inst. C.E. (2) "The Plant and Temporary Works used on the Portsmouth Dockyard Extension," by C. H. Meyer., Assoc. M. Inst. C.E.

SOCIETY OF ENGINEERS.—Monday, Feb. 7th, the statement of accounts for 1880 will be read, the president for 1880, Mr. Joseph Bernays, will present the premiums awarded for papers read during that year, and the president for 1881, Mr. Charles Horsley, will deliver his inaugural address.

SOCIETY OF TELEGRAPH ENGINEERS AND ELECTRICIANS.—Thursday, Feb. 10th: Council meeting at 7 p.m., ordinary general meeting at 8 p.m. "Earth Currents—Electric Tides," by Alex. J. S. Adams, Associate.

SANITARY INSTITUTE OF GREAT BRITAIN.—Wednesday, Feb. 9th, at 8 p.m.: "The Law in Relation to Sanitary Progress," by W. H. Michael, Q.C.

SOCIETY OF ARTS.—Monday, Feb. 7th, at 8 p.m.: Cantor Lectures, "Watchmaking," by Mr. Edward Rigg, M.A. Lecture I.: Introduction—Units of time—Historical sketch—Description of usual forms of watch—Escapements—Conditions of accurate timekeeping, and arrangements necessary for their maintenance in the higher class of watch. Wednesday, Feb. 9th, at 8 p.m.: Ordinary meeting, "The Present Condition of the Art of Wood-carving in England," by Mr. J. Hungerford Pollen. Friday, Feb. 11th, at 8 p'm.: Indian Section, "The Gold-fields of India," by Mr. Hyde Clarke.

THE ENGINEER.

FEBRUARY 4, 1881.

THE EMPLOYERS' LIABILITY ACT.

THE Act "to extend and regulate the liability of employers to make compensation for personal injuries suffered by workmen in their service," has now been in force about four weeks. We have not yet heard of a single case where action at law has been taken under its provisions, and we are satisfied that no legal decision has been given. Common sense would naturally prompt us to wait patiently for results before saying or doing anything further. While as yet before Parliament the measure was amply discussed. Now it has been passed, and has become the law of the land, surely peace might be allowed to reign until experience affords fresh data. Those, however, who are most immediately affected, viz., employers and workmen, do not seem content to do this. Even before the law came into operation employers in some districts took fright, and apparently came to the conclusion that the Act must not be allowed to take effect. There are not many cases, in modern times, where men of position in this law-abiding land have combined for the purpose of trying to render any law inoperative. Nevertheless, it has been sought to do so in this instance, notably in Lancashire; though from want of success the attempt appears now to have been abandoned. We do not contend that in so doing employers have acted illegally; on the contrary, they were strictly within their legal rights. They said in effect to their workpeople, "We have had a new liability cast upon us as regards yourselves. This liability may be expressed in pecuniary terms. A certain sum per workman per annum, varying according to the riskiness of his employment, would maintain a fund sufficient to meet all claims under the Act. We are willing to contribute one-half if you will give the other half of such necessary contributions, and provided you will undertake never to put the Act in force against us." This is what the employers who sought to contract themselves out of the Act are understood to have offered to their workmen.

With very few exceptions such offers have been declined, and the full influence of the trades union officials has been generally and strenuously used in the same direction. So far, dissatisfaction with the untried Act would appear to be confined to employers. But that is hardly so, for recognised labour representatives in the House of Commons have been inquiring whether the Government intend bringing in a new Bill to amend the Act, so as to prevent employers from contracting themselves out of it. Having received a negative reply, Mr. Macdonald has actually introduced a Bill himself to amend it. The present position seems therefore to be one of apprehensiveness instead of satisfaction; eagerness for fresh legislation rather than contentment with what has been done; and this is the case with both parties, though with different aims and objects. In short, the contest which should have been concluded in Parliament is now being continued outside. In our view both parties have been acting unwisely. The employers unwisely—though by no means unfairly—in seeking to neutralise the Act before it has been fairly tested; and the workmen unwisely in seeking to amend it—in the direction of greater stringency—before it has become clear how it is likely, as it stands, to affect their interests. It should be clearly borne in mind by both parties that this is a question, not of a new burden upon trade, but simply of the readjustment of an old one. The effect ought to be, firstly, to diminish the number and severity of accidents by forcing all who have any sort of control to increased carefulness; and, secondly, to shift the pressure occasioned by them from weak or innocent to strong or culpable shoulders. Accidental calamities to producers, if liable to recur, may be regarded as impediments to production, and constitute a proper charge upon it, tending to increase the cost to the ultimate consumer, that is to the general public. The general public will get the benefit of the diminution of accidents resulting from increased carefulness. The employers and workmen, whose voices are heard most loudly at the present moment, are both mistaken if they suppose that hitherto workmen, as a class, have borne pecuniary losses which, under the new Act, the employers, as a class, will have to bear. Let us suppose a case of accident involving personal injury, and liability for compensation under the old system. A subscription would probably have been got up for the sufferers, and the sum needed, or part of it, would have been paid by the public direct. If not, parochial, infirmary, or other charitable relief would have been forthcoming up to a certain value to keep alive those left dependent until they should become self-supporting. All these contributions come from the general public, and largely from the employer class. But that is not all. Workmen, in competing for employment, have always taken into account the riskiness of the occupation, avoiding, except at a higher rate of payment, those which are attended with extra risk, and competing for those without such disadvantage till the wages were lowered proportionately.

Any one who compares the average rate of wages earned by colliers as compared with ironstone miners; both as compared with ordinary agricultural labourers; and sailors, seagoing engineers, and stokers, as compared with the class from which they are drawn on shore, will at once notice that an extra price is and has always been paid as an equivalent for the extra risk run. Therefore employers have all along been paying workmen for their risk of personal injury, either by increased wages, or by subscriptions to benevolent institutions, or through the poor rate; or, where the general public—the universal ultimate customer—has contributed direct, the employer has refunded by selling his products so much cheaper, in reliance upon such help whenever needed. Looking at the question from any possible point of view, it becomes clear the "have-nots" must be supported by the "haves." Otherwise the tendency would be towards diminution of the working population, which would bring higher wages, and so eventually extract the same payment in another form. If, then, the employing class have hitherto been actually paying, in some form or other, compensation to workmen for personal injury, and passing the charge forward to their customers, until it finally reached the ultimate consumer, how will it be now? Will they have to bear it themselves, or bear it twice over? It is argued that this cannot be, and for the following reasons:—Workmen will now begin to take into account that they need not consider this item of risk at all. In comparing different occupations in respect of personal danger, they will see that all occupations are now on an equality, in so far as the pecuniary compensation recoverable can make up for loss of life or limb. The thrifty man who was accustomed to insure against accidents will now no longer need to do so, and will be able to take so much lower wages. Of course, he will, as heretofore, get as much as he can for his labour; but in times of scarcity of work he will inevitably be forced down to a proportionate extent on this account. The thriftless man who relied on the public through charitable institutions and through the rates before, will rely on the public through the employers now. The employers will have to establish insurance companies at once. These will, for an annual charge per workman, undertake the risk, or the major part of it. The premium payable to the insurance office will be a charge on production. It will not be an extra charge, but will merely take the place of other charges, which have hitherto been paid with the same ultimate destination and effect. These older contributions will be withdrawn or decreased. Poor rates ought to diminish. Benefit societies, accidental insurance societies, and the like, may lose the reason of their existence. Subscriptions, levies, and so forth, for injured and for the relatives of accidentally killed workmen, whether promoted by employers, fellow workmen, or the public, will go out of fashion. Where hospitals or infirmaries are made use of, it will now be only fair that patients entitled to compensation shall be asked to pay for the benefit they take; and many similar alterations will ensue, the net result being that the old burden will still be borne by the ultimate consumer as heretofore, but will reach him through somewhat new channels. All these are arguments, but they should not be pushed too far, for it must be borne in mind that only one element of danger in employment has been removed, namely, the result of employers' negligence. In the case of every accident not referable to such cause, the men's insurance, benefit, and other societies will continue to have an ample field, and we doubt whether rates will be materially or at all reduced. Returning to our starting point, we think the pith of the discussion is that the new measure should not be resisted or amended as yet, but simply acquiesced in and provided for. We therefore would make two suggestions—one to the workmen, that they should be patient, leaving it alone, that is unamended, for the present, and that in putting it into operation they should evince a conciliatory and compromising spirit, and discourage all attempts which some of their number may be disposed to make, to get the "last drop of blood" from an unfortunate employer. The other suggestion is that insurance societies which employers may be driven to join may possibly adopt some plan by which no insured shall be fully insured, the reason being that by leaving a margin of risk it is to be supposed that the insured will be more careful.

DOCTOR J. H. MACLEAN'S "PEACE MAKERS."

UNDER this title the *Army and Navy Journal* of January 8th gives a long illustrated description of a new armament of a startling character, devised by a Doctor McLean, of St. Louis, and in course of experimental manufacture at New Haven, United States. The inventor appears to be prompted by a kind of patriotic philanthropy to devote himself to the construction of ingenious machines for the destruction of life, convinced that it only needs a sufficient stride in this direction to abolish war. Our readers will, therefore, understand that every refinement of destructive power argues a corresponding intensity in desire on the part of the doctor to save life. From a pecuniary point of view we are shown little beyond the fact that a gentleman of very large wealth is the responsible head of the enterprise. Perhaps on the same homœopathic principle by which war is to be killed, the present manufacturers of war material are to be deprived of their profits by the vastly greater gains of the benevolent doctor. However, our business is with the actual designs, and these are so numerous and original that we cannot hope to do them justice; for it appears that the doctor's "active brain" has "evolved new conceptions, until an entire system, offensive and defensive, comprising permanent and floating impregnable fortresses, ships shot and torpedo-proof, torpedoes and projectiles of various sizes is the object of its contemplation."

The starting point appears to have been a new breech system, designed to admit of large guns being made in parts to take to pieces when required, to secure safety with increased powder charges, to consume the powder perfectly, to render fuses unnecessary, and prevent all escape of gas, to combine rapidity and simplicity, and lastly, to take up the recoil of the gun. Our readers will perceive what a blow even this elementary design deals to inventors—perhaps Armstrong, Krupp, Noble, Boxer, Moncrieff, and Morgan, more especially. We are unable to gather the exact means by which success is achieved, for the writer regrets that "thus far no cuts have been made," so that we must be content with a very few words, which convey so little that we do not give them. Our contemporary then conducts us through illustrated descriptions of very varied designs. The "General Sherman" and "General Grant" appear to be light magazine field guns on siege carriages, mounted on rather sporting-looking platform wagons. The latter fires forty-eight shots in a minute. The "Annihilator," the "Besom," and the "Lady McLean" are machine guns; the latter has seventy-two magazines, containing 1152 cartridges. It would be obviously futile to endeavour to describe such designs in a few lines. A more simple matter is the pattern of iron shield proposed under the name of "iron forms." It consists of folding hinged plates of iron, not unlike those tried several years since at Chatham, but brought into a more complete shape. The plates are hinged neatly together, so as to enable them to form a continuous iron breastwork; or they may be formed into boxes, and filled with earth, and so built up into regular battery parapets. There is something to be said for this device in siege operations, but the weight would probably be too great to admit of its general use in the field as contemplated. Dr. McLean quietly settles this question by assuming that 10,000 men supplied with shields are equal to 20,000 without—an assumption that at once suggests similar reasoning in other matters. The fact is, that the advantage of such shields at all is not extraordinary, though we should be inclined to think them good under certain conditions. If freely used as depicted, however, they must frequently fall into the hands of the enemy, a consideration which disposes of the idea that they would enable a campaign to be conducted with half the troops otherwise required. It is to be observed also that they admit of being turned by an enemy much more readily than an ordinary field trench when it is captured. For permanent iron defences against heavy artillery Dr. McLean proposes to use plates placed like books in a shelf and bolted together, the edges of the plates being presented to the fire of the enemy. This is an ingenious substitute for thickly rolled iron, but we do not believe it would answer. A shot, we should expect, would drive plates out of the row, breaking the bolts and quickly destroying the whole structure. How bolts could be expected to stand transverse shearing under such circumstances we cannot explain, except by the fact that such designs have not been proved. The double turret of horizontal plates is one of the weakest designs we have ever seen. It consists of a double dome built up of horizontal plates apparently. We should expect the first powerful shot to shear the bolts and drive in some plates, and then one or two well-directed shells ought, we think, to blow the whole structure to pieces; unless, indeed, the quantity of iron used was totally out of proportion to that generally employed, which it is in the figure given, where we should suppose at least 70in. of iron was contemplated for the outside walls alone, judging from the size of the men shown.

Another figure depicts a cross section of a floating iron fortress, in which apparently two guns revolve on one table fixed breech to breech—a feature that in itself speaks volumes. Let the reader try and work it out. Is it supposed that the guns are to be pointed at anything? If so, is it probable that an enemy will appear in two directions so exactly opposite to one another that the guns can fire at both? Or is one gun to fire and then the other to be run round to fire in its turn? If so, is it to be loaded while it is being run round? and even if so, why not have both guns abreast, which necessitates much less room and much less labour and waste of time. In fact, the man who, having seen two guns abreast of one another in a turret, designs such a thing as this, shows a marvellous preference for what is utterly bad. Here is a turret of uncouthly large size, yet without room for the recoil of the guns, and arranged so as practically to render only one of the two guns available, for clearly it would be better only to work one than to waste time and labour by bringing the other round. We think after this illustration our readers will hardly care to hear of the "Octopus torpedo" which travels three miles an hour, and which, "if dispatched in any considerable number," "will be certain to reach and cling to its object till its mission is performed," or of a 100-ton gun which takes into small pieces, so as to enable the "monster to travel piecemeal."

The fact is we have felt doubtful about mentioning this armament at all. Can it be that the *Army and Navy Journal* is indulging in a joke? At all events it is a fact that eight full pages of the journal are devoted to the subject. We, therefore, commend it to such of our readers as are curious on the subject of an enterprise stated to be in actual operation on a large scale.

GAS PRODUCTION IN CLEVELAND.

The Middlesbrough Corporation, which owns the gasworks supplying the borough, publishes from time to time valuable and interesting statements illustrative of the extent and cost of the production of gas in that borough. Of the first of the facts which appears in the most recent of these is one proving that indirectly as well as directly the revival in the iron trade is greatly benefitting Cleveland and Durham. In Middlesbrough there are now sold about 2,000,000 cubic feet more gas than there were a year ago, and there is ground for the belief that the neighbouring towns are receiving a similar benefit. Confining our remarks for the present to Middlesbrough, it may be said that in the month of November last—that being the latest period to which the figures are yet obtainable—there was made at the gasworks of the borough the quantity of 18,630,000 cubic feet of gas. This was a fair amount for what may be called a comparatively young borough, and one subject to periods of fluctuation in trade. It is not so satisfactory to find that more than one-eighth part of the whole was disposed of as "leakage." In producing the gas slightly over 1799½ tons of coals were used, so that the production of gas was at the fair average of 10,350 cubic feet of gas for every ton of coals used. The cost of production of the gas may be thus stated:—Wages, 6·93d. per thousand cubic feet of gas sold, the quantity sold being that made less the leakage; coals, 10·28d. per thousand feet; lime, 0·11d. per thousand feet; tallow, oil, and stores, 0·06d. per thousand feet; salaries, 1·09d. per thousand feet; and general charges, such as gas for works, rates, bad debts, &c., 4·64d. per thousand feet. The total gross cost, then, is 1s. 11·11d. per thousand feet sold. The residual products yield: Tar, 2·03d. per thousand feet; ammoniacal liquor, 3·03d.; coke, 5·30d.; and other items give a total of 11·33d. per thousand feet. The net cost of the gas, then, appears to have been 11·78d. per thousand feet of gas sold. The net price received for gas sold is, it may be said, a fraction less than 3s. per thousand feet, and the balance towards interest, redemption, and profit is considerable—£1581 in the month named—which, though one of the winter months, is not the largest in production or yield. It may be added that the cost is slightly more than it was a year ago, and the sums received for residual products slightly less, so that the example quoted is not a favourable one. When it is added that the production of gas has varied in recent years from 140,000,000 cubic feet to 167,800,000 cubic feet yearly; that the illuminating power is declared as equal to 16·02 candles; and that the cost of coals may be taken as from 8s. to 9s. per ton at the works, the figures for forming an opinion as to the economical working are at hand. It may be said that the purchase of the gasworks has been one of the most fortunate of the ventures of this corporation, for it has made a large profit yearly after paying interest and redemption, and there are all the indications that the profit will be considerably increased for some time to come. It it evident that there remains, and will remain, a large field for the use of gas for illuminating purposes, and it is possible, and even certain, that its use for purposes of power-production and for heating will grow, so that in the great towns the production may be expected to increase, if the producers will aim at improving the product and lowering the price.

THE MANCHESTER, SHEFFIELD, AND LINCOLN RAILWAY.

From the official reports and statements of accounts of the Manchester, Sheffield, and Lincolnshire Railway Company, it appears that during the half-year just closed there was expended on capital account £237,108. Of this £107,391 was expended on lines open for traffic, chiefly in the construction of way and stations, and their extensions, and including over £12,000 spent on the block system. On the lines in course of construction £12,512 only was spent; on the working stock £34,392. This latter item includes the purchase of four tank engines and two contractors' engines, 311 goods wagons, and £2376 spent on vacuum brakes. On the dock works at Grimsby £15,108 has been spent; and the balance of the total expenditure on the capital account has been spent in the subscriptions to joint lines, such as the Cheshire lines, and the Wigan Junction Railway. If we contrast these sums with those intended to be spent in the half-year that is now entered upon, we shall obtain some idea of the state of the works; of those proposed, and of the probable effect on some of the engineering and contracting trades in the district that is served by the Manchester, Sheffield, and Lincolnshire Railway. It is proposed in the current half-year to expend on lines open for traffic £116,730—rather more than was expended in the past half-year—and the bulk of this is to be expended at Gorton, Sheffield, Staleybridge, and Grimsby. On rolling stock the estimated expenditure is £35,000; on lines in course of construction—the Barnsley coal line and others—£34,000; and in subscriptions to joint and other railways, £110,000. Except in the two last items there is not a material difference between the amount actually spent in the past half-year and in that estimated as needed to be spent in the one now entered on, and looking to the fact that in the future the sums proposed to be expended on the lines open, and those that are in course of construction are comparatively small, it may be believed that the capital expenditure on this line is likely to be speedily reduced. There has been in the past half-year a satisfactory growth in the revenue, and with the continuance of this that may be expected from the revival of trade now known, a better return may be hoped in the early future on the capital that has been invested in this line. It serves a rich district, and it has recently spent very large sums on the port of Grimsby which it has been fostering, so that the looked-for return should not be small. The parent system in the past half-year has done well in earning an increase of £30,197 on the revenue, at a cost of £11,284; but in the fact that the joint lines have given only a net increase of £13,422, and that the increase in the working expenses has been to the amount of £15,232, there is the explanation of the reason why the deferred stock in the Manchester and Sheffield has received no dividend for the past year. If the joint lines were made feeders of the net revenue instead of suckers, the prospects of the Manchester, Sheffield, and Lincolnshire Company would be brighter even than they are.

LITERATURE.

The Principles of Graphic Statics. By Geo. Sydenham Clarke, Lieut., R.E. E. F. and N. Spon. 1880.

The author of this work complains in his preface that "the study of Graphic Statics, as a subject *sui generis*, has made but little progress in England. While in many of the great engineering schools of the Continent it is thought worthy of a professional chair, in England it is left to be gleaned almost haphazard." We are by no means sure, however, that the English practice in this respect is really to be condemned. A subject which is to be treated as *sui generis*, and taught by a separate professor, ought either to be, like statics and dynamics, the complete discussion of some one branch of science, or else, like the differential calculus, the description of a method of calculation so important and so universally applied that its principles deserve a separate study. Now graphic statics does not fall under either of these classes. It is the description of a particular method, —the graphic—as applied to parts only of a particular science—statics. We say to parts only, because it soon becomes evident that there are many portions of statics to which it cannot be applied with nearly the same facility as methods of computation, and other parts to which it cannot be applied at all. But a special professor of graphic statics will inevitably ignore this fact as much as possible, in order to make the most of his subject: he will insist on applying the graphic method to all problems where it can be applied at all, at whatever expense of time and trouble, and the parts where it cannot be applied he will be tempted to slur over or disregard. We are not, therefore, disposed to regret the fact that we have no such professors in England.

Our conviction is, in fact, that the graphic method in statics is only an adjunct, useful in particular cases; and further, that as such it should never be employed except by those who have already obtained a good grasp of the subject by other means. This last conclusion is to some extent a necessary one, as is sufficiently shown by the book before us. Let no draughtsman imagine that by taking his drawing-board and instruments and setting this book before him he can master the science of statics, without reading any other basis than a little arithmetic and Euclid. At the very outset he will find that the Parallelogram of Forces is simply stated and not proved; and further on he will be expected to know what is meant by a "moment" or a "couple," and understand the advantages of readily computing them. In fact, if he attempts to study the book with no other foundation of knowledge, a few pages will suffice to land him in hopeless confusion. There is no short cut to the exact sciences; and no approach to precise statics, except by a laborious, but most salutary progress through algebra, trigonometry, and analytical geometry. When, by their aid, the student has mastered the main principles and chief problems of statics, it will be time to take up graphic methods, and see how far he can clear his conceptions and lighten his practical work by their employment.

The point for which we wish to contend is, that graphic and computative methods should not be taught separately, but conjointly, and that each should be employed in turn whenever it is shorter and simpler for the particular problem in hand. The same, we are inclined to think, might be done in other subjects; *e.g.*, the student of Euclid, Book II., might be saved the labour of wading through long propositions, to prove what algebra would give in a couple of lines. But confining ourselves to statics, our first aim should be to determine what parts of the subject are best treated by graphic and what by computative methods. We could wish that Mr. Clarke, who has studied the subject so thoroughly, had given us his views upon this point. All that can be gathered from him on this head is by noting which propositions he has given, and which he has omitted; and as to these we are unable at all times to approve his selection. Graphic methods, it should be observed, though tempting in many cases, and most valuable in some, have certain general disadvantages, which practically limit their use. For example, every engineer who has been through the shops will probably remember one workman at least who was profoundly versed in the mysteries of the slide-rule, and was always anxious to demonstrate to his mates the marvellous calculations which he could effect by its aid. Now the slide-rule is simply an instrument for performing mathematical calculations by graphic methods; but it is scarcely ever used by educated engineers, who find that they can perform their calculations quite as rapidly and safely by ordinary computation; and what are the reasons of this? Firstly, that method is pretty sure to be the most generally used which requires the least amount of apparatus, and can be combined most readily with other work. An arithmetical calculator needs nothing beyond a pencil and a bit of paper, or the margin of the book he is reading; while the graphic calculator is helpless when away from his T-square and compasses, as the mechanic is when his slide-rule is out of his pocket. Again, an arithmetical calculation, once made, can be checked over again at any moment without any apparatus whatever, simply by running the eye over the figures. To check a graphic calculation, the measurements, angles, &c., must all be gone through again, exactly as they were at first. This difficulty is sure in practice to prevent many calculations from being checked at all, and thus to lead to frequent errors. Thirdly, every one who has conducted long series of arithmetical calculations, knows that there are generally circumstances which enable him greatly to simplify and shorten the process; for instance, in calculating the strains on girders, the points of application of the load are almost always at equal intervals, and the load at each point nearly constant. No assistance of this sort is obtained in graphic methods. Lastly, the result of a graphic method must always be an approximation, given by the reading of a scale; and therefore an approximation, the probable error of which there is no means of determining. In most practical cases this is of no great importance, but it still leaves a somewhat unsatisfactory impression.

Hence, if the actual time of reaching the same result by arithmetical and graphic methods be compared, we believe that the advantage will remain, oftener than is supposed, on the side of the former; except in cases where the number of operations to be performed is considerable, and their nature such as lends itself specially to linear transformation. On this ground we venture to think that several of the propositions in the present volume might have been dispensed with. Thus, the work opens with a chapter on graphic arithmetic, showing how we may multiply, divide, obtain powers or roots, &c., by means of lines or diagrams. We doubt if there is one of these problems which would not take longer time if worked out in this form than by simple arithmetic, and are sure there is none that would not easily be distanced with the aid of logarithms. Mr. Clarke observes that graphic methods are easily grasped by working men; but surely it would be no less easy to teach such men the use of logarithms, even where they did not understand their principles. From arithmetic we pass at once to statics, without any allusion to trigonometry; although in commencing statics we at once see that a knowledge of trigonometry is assumed to have been acquired. The parallelogram of forces being assumed, the ordinary modes of fixing the conditions of equilibrium of a body under any forces in one plane, by means of the funicular polygon, is worked out at length. As the funicular polygon is the foundation of the graphic method, this is desirable; but there is some confusion in the subsidiary propositions, *e.g.*, in page 16 we have the proposition to "resolve a force in three directions," whereas the real enunciation is "to find the forces acting along three given lines, of which a given force is the resultant." The principle is then applied very briefly to the case of the arch, which might well have been dwelt upon at greater length, as it is one which is peculiarly susceptible to graphic treatment. The next application is to determine the moments of forces about any point; but in this case we think the arithmetical will generally beat the graphic method, unless where the directions of the forces are much varied, and their values very irregular.

We are now introduced, after a brief general dissertation on reciprocal figures, to what is really the main work of the book, namely, the application of graphic methods to the determination of stresses in framed structures. Here we are on safe ground, where the advantages of the graphic method are incontestable; and, so far as we are able to judge, this ground is ably covered, and with due attention to practical requirements. The general method is first described. Then several of the most common forms of roof-truss are taken, both for small and large spans, and the stress diagram worked out for each. This is a common problem, and one where the method shows perhaps to more advantage than anywhere else, owing to the number and variety of the strains, and the accuracy with which they can be fixed. The question of wind pressure is next considered, and it is stated that in England it has been variously taken at 40 lb. and 50 lb. per square foot. Recent events have shown that the limits taken have varied much more widely, and that the matter is still very much an open one. The chapter ends with brief articles on the Warren and Bollman girders, which seem a little out of place.

Chapter V. deals with the action of stationary loads, with various distribution, on beams. As to many persons that word still suggests nothing but a rectangular section, like that of a beam of timber, it might have been stated that the whole investigation applies equally well to any structure, cantilever, or girder which is exposed to a cross-breaking strain. All that it proposes to calculate is the nature and amount of the stresses upon any section of given depth; the form of the section, and therefore its resistances to the strain, are left for the present out of account. The next chapter deals with travelling loads, and very properly gives chief attention to the case of railway bridges. We come then to braced and lattice girders, of which three forms only are considered—the Warren, the bowstring suspension, and the ordinary bowstring. It seems a pity that some of the American forms of truss should not have found a place here. From this we return, somewhat unexpectedly, to consider the centre of parallel forces and the centre of gravity. Graphic methods are given for determining the latter, in the case of polygons, circular segments, and other figures. It is needless to say that these are very much longer than the simple and well-known plan of cutting the section out in cardboard or zinc, and suspending it from two points in succession; whilst they are probably at least as liable to error. The latter method has been long in successful use by Mr. B. Baker, as we learn from his paper on the "Practical Strength of Beams," lately read before the Institution of Civil Engineers; and as it is really a mere extension of graphic methods, we think Mr. Clarke would have done well to mention it. In Ch. IX. we pass on to moments of inertia, and the modes of determining these by means of the central ellipse; and in Ch. X., these principles are applied to their usual object—the determining the moment of resistance of a given beam. Mr. Clarke has here introduced from Germany a new term, "kern," to express the locus of the stress centre of a section, when the axis, about which the moment of inertia is taken, is made to move so as always to pass through one point, and one only, of the outline of the section; and he gives the form of this kern for various simple figures, including I sections, L sections, &c. In this chapter a useful table of the moments of inertia for various common sections is also given; but, on the whole, this, the last chapter of the book, has a decidedly fragmentary character; and a student coming to this part of the subject for the first time would be considerably puzzled as to its drift and purpose. This is, in fact, a final instance of the essential difficulty attaching to any book which deals only with graphic methods.

We have not hesitated to speak frankly as to the defects in this work, partly because we think them inherent in this method of treating the subject, and partly because the book is really so good that we wish to see it improved to the utmost. We will not dwell on minor points, except to express our regret that a large number of the figures have been relegated to a set of lithographed plates at the end. The tiresome process of glancing perpetually from the text to the figures and back again, which is inseparable from the reading of a work on graphic methods, becomes almost insufferable when the two are on widely separated pages. Woodcuts carefully inserted at the right spot are the only satisfactory method. Even so the difficulty of comparing text and figures has apparently produced some errors, *e.g.*, two misprints—0 for 1 and 0 for 2—at the bottom of the very first page.

It will be seen that we are inclined to wish that Mr. Clarke had written either a shorter book or a longer one. If he had strictly confined himself to those problems in statics which are treated with decidedly greater convenience by the graphic method than by any other, then much which is here included might have been omitted, and this would have left room for further detail on some important points, such as the arch. But what we would far rather see would be a work on statics for practical purposes, starting from first principles, and proceeding on the old lines, but differing from such works as Rankine's "Applied Mechanics" by being far shorter and simpler, and from ordinary theoretical works by confining itself to those branches which have a practical interest, and by using graphic or algebraic methods in turn, as each was most suitable to the matter in hand. The college at Cooper's Hill possesses in Prof. Calcott Reilly, Prof. Unwin, and Mr. Clarke himself, three gentlemen admirably qualified to produce such a work, and we cannot conclude better than by commending it to their joint attention.

SELECTED AMERICAN PATENTS.

IN round numbers, 260 patents are issued every week in the United States. The number is sometimes greater—seldom less. These patents ostensibly represent a great deal of inventive work; but hitherto next to nothing of the character of this work, or of the nature of the inventions patented, has been known in this country. We believe that a great many of our readers would like to learn something concerning the inventions patented in the United States, and we therefore commence this week the publication of selections from the Official Gazette of the United States Patent-office.

It will easily be understood that we cannot possibly find space for more than a few American patents each week; but at the end of the year our readers will find that they have had the opportunity of learning something concerning some hundreds of those inventions which possess most interest for English readers. In other words, we shall use the utmost care only to publish those drawings and specifications which represent the very best work of its kind that the American inventor can do. It must not be supposed that our readers will lose a great deal by not having the whole American weekly list before them. As a matter of fact, American patented inventions are peculiar in their character, and the greater part of them possess only a very circumscribed value and a purely local interest; many, indeed, being for the merest trifles. Collar and sleeve buttons, hand stamps, egg whisks, potato and apple parers, packing boxes, curtain fixtures, carpet stretchers, sewing machine attachments, tea and coffee-pots, and such like, appear in the Official Gazette by the dozen. There also are to be found a very large number of patents which only interest Americans—as, for example, patents for car couplers, spark arresters, ore separators, &c. In agricultural machinery, strange as the statement may appear to many persons, very few of the inventions aie useful, we will not say out of America, but out of the district in which the inventor lives. Thus we have devices for scraping mould-boards of ploughs, which only apply to one special form of plough, as indigenous to a district as the turnwrest is to Kent; and fittings for reaping machines, which would be quite useless in a crop much more than 2ft. high; or a seed-depositing machine, which can only serve to plant Indian corn; or a hoe for rice crops. Such things it would be useless to illustrate in our pages. We shall take care, however, that every American device likely to prove useful to the English agriculturist as it is, or capable of being improved upon here, shall be adequately set forth in our columns.

It will be seen that the descriptive particulars are given in language very different from that of our own abstracts of specifications. We describe the American inventions in the words found in the Official Gazette. It is claimed that in the United States official examination practically precludes the patenting of old devices. Our readers will soon be able to judge for themselves how far this claim is justified by the facts. Furthermore, should they be disposed at any time to regard the patents we illustrate as uninteresting or trivial, we beg that they will bear in mind that they are the best and most likely to be generally useful, patented week by week in the United States. Finally, we would point out that a comparison of the character of the inventions patented in England with those patented in the United States appears to us to be on the whole very much in favour of the English inventor. There can be no doubt that much more that is insignificant is patented in the United States than in this country. First, because patents are cheaper at the other side of the Atlantic than they are here, and, secondly, because the facilities for making money out of patents are greatly enlarged by the circumstance that in a young and pushing country men are continually investing in new plant, while the American inventor is as a rule quite satisfied with royalties at which the English inventor would not look. The American if he clears a couple of hundred dollars by an invention is well pleased. The English inventor would expect at least £200 for the same thing. For important inventions, involving new principles, we may search almost in vain in the United States Patent-office. There are, of course, a very few exceptions to this rule; but inventions concerning little every-day matters, which after all concern social life very nearly, are plentiful; and to thousands of men it is really far more important that they should be saved trouble in putting in a pair of sleeve links, than it is that steel should be freed from phosphorus, or that engines should burn but 1½ lb. of coal per horse per hour; and the inventor of the convenient sleeve link will probably make fifty dollars out of his patent, and go on his way rejoicing, while the man who sets about improving steel will lose—if he has it—a large fortune and his peace of mind. Americans are wise in their generation. They are contented, in the matter of patents, with small profits and quick returns; and so it happens that the cream of American invention — the devices, that is to say, which possess a cosmopolitan interest —can be set forth in a comparatively small space.

KENYON'S INDICATOR.—We are requested to state that Messrs. C. Wilden King and Co., 41 and 42, Parliament-street, Westminster, are sole agents for Kenyon's Patent Indicators, illustrated in our last impression.

LAUNCH ON THE TYNE.—On Saturday a steamer of 3500 tons burthen was launched by Messrs. Wigham Richardson, and Co., from their Neptune Shipyard for Messrs. Stumore, Weston, and Co., of London and Liverpool. She is intended for the American trade, is specially fitted up for cattle, and has engines by the same builders of 1300 effective horse-power; the boilers, three in number, comprising the very latest improvements for economy of fuel, and for burning any kind of coal. She was christened by Miss Mary Down, from Edgebaston, the "Barden Tower," the name of the lovely seat of the Duke of Devonshire on the Wharfe. Immediately after the launch she was taken under the builders' 100-ton shear-legs to be masted and to have the machinery put on board. The building has been superintended by Messrs. Ashlin and Asbridge, naval architects and consulting engineers, of Liverpool. This is the third steamer built by Messrs. Richardson for Messrs. Stumore, Weston, and Co., who have also lately added the Cunard liner, the Algeria, to their fleet.

THE INSTITUTION OF CIVIL ENGINEERS.—We are asked to announce that meetings of the students of this Institution will be held at 7 o'clock on the undermentioned Friday evenings, for reading and discussing the following papers: February, 4th, "Boilers," by William Marriott—Mr. Bramwell, F.R.S., vice-president, will preside; February 11th, "The Internal Corrosion of Cast Iron Pipes," by Mathew Buchan Jamieson—Mr. Rawlinson, C.B., member of Council, will preside; February 18th, "The Road to Northampton Railway," by John Edward Waller—Mr. Bruce, member of Council, will preside; February 25th, "Sewer Work," by Robert Henry Thorpe—Sir Joseph Bazalgette, C.B., vice-president, will preside. It has been intimated that the Council are prepared to award, for a paper of adequate importance, a Miller scholarship of £40 per annum tenable for three years, as well as Miller prizes for other approved communications; and it is stated that a second series of students' meetings will be appointed if a sufficient number of suitable papers are received.

KING'S COLLEGE ENGINEERING SOCIETY.—At the weekly meeting of this Society, held on Friday, January 28th, an interesting discussion took place on the merits of "Stone *v.* Iron for Bridge Construction." The debate was opened by the president, Mr. H. H. Parkinson, who strongly advocated the use of stone in all cases where practicable, claiming for it superiority over iron in durability, strength, stability, and architectural beauty. Mr. R. Ellis, on the other hand, urged that iron was preferable, not only as regards primary cost, but also in consideration of its lightness, facility and rapidity of construction, and the greater spans that were obtainable. Mr. Harry J. Thompson, in viewing the subject from both scientific and practical points, considered that the present methods of testing iron structures were ineffective, and predicted that the iron bridges of the present age would give much trouble to the engineers of the future. A spirited discussion was continued by Messrs. F. Thomas, S. Hanner, A. Sharpe, Douglas and other members, and after a few closing remarks from the president the meeting adjourned. At the meetings to be held during the month of February the following papers are announced for reading and discussion. February 4th, "Sea Walls," Mr. E. Thrupp; February 11th, "Organ Construction," Mr. F. Nunn; February 18th, "Style in Architecture," Mr. C. Bradley, A.H.C.; February 25th, "Sugar Manufacture," Mr. S. Brunton.

LETTERS TO THE EDITOR.

We do not hold ourselves responsible for the opinions of our correspondents.)

FIRE ENGINES AT MELBOURNE EXHIBITION.

SIR,—In the *Argus* account of the steam fire engine trial appearing in your last issue, it was omitted to be stated that the "Merryweather" steamer was a single cylinder engine, whereas the "Shand and Mason" steamer was a treble cylinder engine of much greater weight, which explains the difference in the working results.

Greenwich-road, London. MERRYWEATHER AND SONS.

February 2nd.

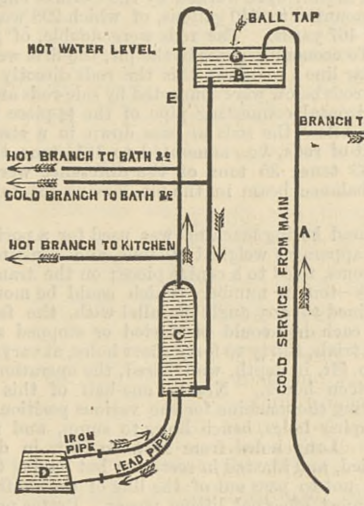
JONES'S VERTICAL BOILER.

SIR,—Referring to your notice of one of our specialities—"Jones's patent vertical boiler"—in last week's ENGINEER, we have only just completed arrangements with the patentee for "sole manufacturing;" hence, strictly, the statement was so far anticipatory. We have a large number of these boilers now at work, and are daily receiving the most satisfactory reports of their excellent results as regards superior economy and freedom from priming or scaling. With the special modern plant just laid down by us, we shall in future be able to supply our numerous customers without any delay. C. WILDEN KING AND CO.

41 and 42, Parliament-street, London, S.W., February 1st.

KITCHEN BOILER EXPLOSIONS.

SIR,—I was much interested in reading your article in this week's ENGINEER on kitchen boiler explosions; and I have the pleasure to enclose a sketch showing the system adopted by me in several houses in this town, and which has hitherto worked perfectly. I shall be extremely obliged by your opinion of same, and any suggestion or improvements you may make shall have my very careful attention. If you can find space for this and the sketch in your valuable paper, I shall be pleased, and the sketch may be useful to those who are fitting up hot-water apparatus in their houses.



The cold-water service from main rises direct through the pipe A to the cold-water cistern B, which is placed under the roof. The cold water descends and enters the bottom of the copper cylinder C, thence to the bottom of boiler D, and returns back to the cylinder C hot. It then rises from the hot cylinder C to the same level as the water in the cold cistern B, the pipe E projecting and being turned over the cistern B as shown. The end of this pipe E is always open, so that any sudden accumulation of steam would merely blow off into the cold cistern B, and do no harm. I may say that the pipes from kitchen boiler D are made of wrought iron till they project through the brick wall or jamb of fireplace, and then they are connected by lead piping to the cylinder C. I think by this arrangement there can be very little danger of an explosion. I shall feel obliged by any improvements you or any of your readers may suggest. CORRESPONDENT.

31, Westbourne-street, Stockton-on-Tees,
January 24th.

SIR,—The usual list of killed and wounded from this cause has already far exceeded its average annual proportions. Why such a cumbrous and costly mode of heating baths is persisted in is difficult to tell, but it is probable that until the plumber is made liable to be brought up for manslaughter there will be no change. The average Briton is far too conservative to give up an old system for a better. There is not the slightest reason why a kitchen or bath boiler should ever explode if properly fixed by a plumber who has the smallest amount of common sense. There are two simple ways by which an explosion can be totally prevented—one by fixing a dead weight safety valve which should be for convenience fixed when the apparatus is put up first. The other is to cut a hole in the hot water return pipe a little distance above the boiler, this hole being from ½in. to 1in. in diameter, and to solder over this a piece of sheet lead about $\frac{1}{32}$in. thick, just sufficient to stand safely the general water pressure, making in fact a weak place in the system of pipes which will be the first to give way. This hole must be cut in such a position that the pipe is certain to be warmed from the fire, and as near as possible to the boiler. It must also be where, in case of the sheet lead being blown out, the water will not be thrown into the room, but into the fire so as to extinguish it. Any plumber should do this for a shilling or two, and although it is liable to make a mess it only does this when an explosion would occur in its absence. It is also easy to put an escape pipe through which the water could be led away to the outside of the building in case of accident. This thin lead safety disc might be made so as to fix in a brass socket and be easily replaced if an accident did occur. The whole system of circulating boilers as at present fixed is radically wrong, as, with few exceptions, the hot water is rarely to be got when wanted in any quantity, and the cost in fuel expended is utterly out of proportion to the useful result obtained. There are many simpler, cheaper, and more satisfactory arrangements which can be fixed at less than one-tenth the cost, and of all these the best is a galvanised iron or copper cylinder of about eight gallons capacity, with a tap, and a good gas heating burner underneath it, the cylinder having a loose lid and a water supply tap over it for filling as required. After some months' daily experience with this there is no doubt that it is far cheaper to use than the circulating boiler system, and far more useful for general work. It has also the advantage of absolute safety under any possible condition. In case of a stoppage preventing the use of the kitchen fire, the use of gas for cooking prevents the slightest difficulty or inconvenience. This has now attained such perfection that it is more than probable that a good gas cooking apparatus, even if got as a makeshift, will quickly find its proper place, and permanently supersede the fire for all work. It is generally considered that circulating boilers with a reserve cylinder are safe from explosion. This is a mistake, as a case where the cylinder burst and flooded the house has come under my notice within the last few days, and this is by no means the first accident of the kind which I have known. I shall be glad to give any further information on this matter to those interested, but must desire that any letters shall be as concise as possible. THOS. FLETCHER, F.C.S.

4, Museum-street, Warrington.

THE INSTITUTION OF CIVIL ENGINEERS.

At the Meeting on Tuesday, the 18th of January, Mr. James Abernethy, F.R.S.E., President, in the chair, the paper read was on "Deep Winning of Coal in South Wales," by Messrs. Thomas Forster Brown and George Frederick Adams, MM. Inst. C.E. The authors, who were professionally associated with Harris's Navigation Pits, the deepest winning in the district, described the operations as a fair example of the details connected with winning deep coals in South Wales. The depth of the lowest seam at present sunk to was 760 yards; the pits were each 17ft. in diameter inside the walling. In addition to the depth, a special feature was the thickness of hard and heavily-watered rock penetrated. Guide ropes, upon the Galloway principle, were used in sinking, and the value of this system was shown in the saving of over two minutes in steadying the bowk at the bottom of the pit at depths of 475 and 530 yards, the total time occupied in clearance at the latter depth being three minutes twenty-six seconds. The method of dealing with the various feeders of water during sinking was described: one of the pits was drained by a hole bored by the diamond machine, which was put down, at a depth of 175 yards from the surface, for a farther depth of 860ft. Where the strata were conformable, and cut up by faults which intersected all the measures, considerable objection existed to metal tubbing, even for comparatively shallow depths; for the water could rarely be prevented from forcing its way through fissures into the underlying strata. Moreover, provision had to be made for the probable working of the Brithdir seam, a very watery measure, lying at a depth of 250 yards. On account of these and other circumstances, it was ultimately decided to provide for the permanent pumping of all the feeders, and a powerful 100in. Cornish pumping engine was erected. The parallel motion for the main pump rods was obtained by a gudgeon, attached to the top of rods carrying two slide blocks, which worked in cast iron guides 13ft. long and 27in. wide. This gudgeon was attached to the beam by two hammered iron radius-rods 43ft. long, 10in. wide, and tapering from 3in. thick at the top and bottom to 1½in. at the middle. The space between the rods was filled with pitch pine 12in. thick at the top and bottom and 18in. wide in the middle. Five lifts, three of which were 26in. in diameter, and the others 22in. and 21½in., were worked by the Cornish engine. The total feeders amounted to 440 gallons, of which 298 were pumped from a depth of 467 yards. The rods were double, of pitch pine, 16in. square. To economise space in the pit, the lifts were fixed in one perpendicular line; to effect this the rods directly above the plunger and the rods below were connected by side-rods and distance pieces; the horizontal connecting pipe of the H-piece being cast semi-circular to allow the rods to pass down in a straight line. The total weight of rods, &c., amounted to 181½ tons, that of the water being 133 tons; 35 tons of the difference were counterbalanced by a balance beam in the pit, leaving 13½ tons to overcome friction.

A large diamond boring machine was used for a portion of the sinking. The apparatus weighed 10 tons, and consisted of four beams, or transoms, fixed to a centre piece; on the transoms were placed the drills—ten in number—which could be moved to any part of, or inclined to any angle parallel with, the face of the transoms, and each drill could be started or stopped singly. In making the first trials, thirty to forty short holes, at varying angles, and from 3ft. to 5ft. in depth, were bored, the operation requiring twelve to fourteen hours. Nearly one-half of this time was occupied in jacking the machine for the various positions required to bore the sumping holes, bench holes to sump, and finally the cropping holes. Long holes from 15ft. to 30ft. in depth were subsequently tried, and blasted in sections; but having to be bored vertically, so as not to pass out of the line of the shaft, they had not always the most effectual lifting power. Better progress was made with single drills, but the cost of diamonds became too great for the frequent holes and changes, and the contracting company completed their contract by means of a percussive drill, designed by Colonel Beaumont. "Ingersoll" drills were afterwards used; these had a diameter of 3¼in., and a stroke of 4½in., and gave excellent results; the only difficulty experienced being in the wear and tear of the tappets, which, when they broke, generally caused damage in the cylinder.

In hard and wet rock dynamite was found to be a much more effective explosive than gunpowder, requiring about half the number of holes, and saving tamping. In shale, without water, powder was more effective, dynamite being more rapid in its action. In sinking through three yards of dry Pennant rock, the cost of powder and dynamite were, respectively, £12 1s. 3d.. and £10 1s. 8d.

Under the circumstances which attended this sinking in hard and wet rocks, 3 yards were considered good progress by hand, and 4½ yards by machine per week; but the authors were of opinion that this rate ought to be improved upon with further experience; they had also arrived at the conclusion that the cost of sinking by machine was less than by hand labour. The average rate of sinking, including walling, but exclusive of stoppages, was 3·77 yards per week, there being nearly an equal per centage of hard rock and shale: the actual sinking occupied about one-half the total time, and walling 12 per cent. The south pit, which was the deeper of the two, was commenced in February, 1873, and finished in February, 1879. The average cost per yard of sinking in shale by hand and without pumps, near the bottom of the shaft was £11 19s. 6·8d.; with pumps, £13 2s. 8·9d.; in hard Pennant rock by hand without pumps it was £40 8s. 5·4d.; with pumps, £44 13s. 2·9d. In Pennant rock with pumps and three drills the cost was £34 3s. The cost of the 18in. walling without pumps, including the proportion of iron curbs, came to £11 7s. 10d. per yard in depth, or £1 3s. 10d. per cubic yard; with pumps, to £1 7s. 5d. per cubic yard. These averages included all labour, stores, coal, &c., the items of which were given in a tabulated form.

The authors alluded to a furnace as being probably the most effective means of ventilation at such a depth; but leaving this question for future consideration, they had meantime erected a Schiele fan 14ft. 3in. in diameter, and capable of producing a current of about 250,000 cubic feet per minute; this has been done after a series of experiments in various districts. The authors stated their objections to the positive type ventilators, viz.: that in the event of obstructions occurring in the air-ways, undue pressure might be applied to separation doors, air crossings, &c.; besides which they caused a vibratory motion, were costly to erect, and the working parts, in some cases, were liable to get out of repair. Of the closed fans, which, it was stated, gave slightly better results than open fans, the Guibal and Schiele were the best.

The winding engine was designed to raise 2000 tons of coal in ten hours of constant drawing; the weight, exclusive of the rope, being 10½ tons, and the velocity of the ascending cage 40ft. to 45ft. per second. The scroll drum, with a smaller diameter of 18ft., rising by fourteen coils to 32ft., was considered the best method of counterbalancing the rope. The cylinders were 54in. in diameter with 7ft. stroke; they were inverted and placed on cast iron supports, the drum being fixed below on masonry pillars. The valves were double beat, and for the steam valves Barclay's simple trip expansion gear was used. The rope was a parallel flat rope of the best selected steel, and consisted of 114 No. 11 gauge wires. The calculated breaking strain was 104 tons, and the factor of safety was 9.

The pit frame, which was entirely of wrought iron, sheaves, cages, trams, and guides in the pit were fully described; also a scheme for loading and unloading a single-decked cage by gravitation of tubs; the empty trams were hoisted about 6ft., and made to run down an inclined way to the cage, being stopped and relieved by a system of catches. The cage was so arranged that on landing on the steps the bottom was inclined. The shaft pillar was 400 yards square, and the laying out of roads and method of working trams about the pit bottom were fully explained.

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

(*From our own Correspondent.*)

Coal has risen 1s. per ton. The condition of the iron trade during February will determine if the advance is to be only very temporary or of prolonged duration.

Pig iron buyers had to pay more money because of the rise. There were consumers of pigs for which 42s. 6d. are asked, who had bought at 37s. 6d. supplies that are now running out, and who had hoped to repeat the order upon similar terms; but they were unsuccessful. Makers required 40s., and consumers had to give way. At the same time finished iron makers who were not in urgent need held off, hoping to satisfy their requirements on quite as good terms later on. Part-mine iron changed hands at £2 10s. per ton, and all-mine pigs were procurable at 2s. 6d. under makers' quotations of £3 5s. With delivery into next month makers' No. 3 could not be bought at under 40s. 6d. at the furnaces, and No. 3 warrants were held for 41s. 9d. per ton. Northampton pigs were quoted £2 10s., and so too were Derbyshire, but the consumers of the former expressed confidence in their ability to buy at 47s. 6d. No transactions calling for record in either brand were announced. Hematites at 75s. were unsaleable, but best cold-blast pigs suitable for chilled roll casting and other high-class work were in revived demand.

Most works are resuming with more orders in hand than when the frost stopped them.

Plates and angles and T's are again sought after for consumption in the local yards, and tank and similar qualities of plates were here and there called for, both in Birmingham and in Wolverhampton. As a rule consumers were able to place their orders for these inferior qualities at a trifle less money than would have been taken on quarter-day. Sheets are quoted at £7 10s. The difference of £1 between singles and doubles, and of £1 10s. between doubles and latens, was maintained in the majority of instances. As to high-class sheets, however, the full 30s. between each grade was upheld. Hoops were mostly dearer upon the week by 5s. per ton. Yesterday and to-day a fair quotation for Staffordshire branded hoops was £6 15s. at works.

Galvanised sheets were again priced somewhat high by a few firms, as much as £15 per ton being sought for 24 w.g. delivered at the ports, and £17 for 26 w.g.; yet there were other makers who would have booked at £13 10s. and £15 10s. per ton respectively. The orders on hand are enough to keep leading makers well employed throughout most of the current quarter. The colonial demand is steadily improving, and shipments are going forward to Italy, Sweden, Denmark, and South America.

Tin-plates were to-day mostly quoted at 18s. for coke qualities per box, and from 21s. to 22s. for charcoals; yet one firm cited special sales a day or two ago at 28s. for coke and 23s. for charcoals. The business has lately been very irregular. Yesterday and to-day the demand was only languid.

Coal is now quoted at 10s. for furnace, and 8s. 6d. for forge sorts, and 5s. is the price asked for engine slack.

Local engineering concerns are doing more in their foundry than in their purely engineering departments. The chilled roll makers are busier than for a long time recently. Work of this sort is in hand for France, Belgium, and Germany, together with Russia and Australia. Constructive work is resumed in the yards. The condition of the cut nail trade is depressed. The mail delivered this week from the West Indies was quite up to the recent satisfactory average.

The dispute amongst the Lancashire boilermakers is interfering with the demand for plates at the mills of the North Staffordshire ironmasters, whose merchant iron mills are also beginning to need more work.

The pig iron trade is but quiet. Mischief is threatened to both ironmasters and also colliery owners in North Staffordshire by the action of the colliers, who, at a meeting which was addressed by Lancashire colliers on strike, resolved to give notice for a rise of 15 per cent., on the plea that their employers are getting better prices, and doing a better business in supplying consumers in the Lancashire district.

The rise of coal in South Staffordshire carries a rise also in colliers' wages to the extent of 3d. per day in the thick coal seams, and 1½d. in the thin.

The South Staffordshire Mines Drainage Commissioners, at their meeting yesterday afternoon, made known that a large proportion of the money which they had expected to raise by their new loan had been secured.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Lancashire makers of pig iron report only a very dull inquiry, and they are now mostly engaged working off old orders. There is still no disposition to sell for a longer period than three months, but, if anything, rather more anxiety to secure orders is being displayed. The quoted prices for delivery equal to Manchester remain at 46s. 6d. for No. 4 forge, and 47s. 6d. for No. 3 foundry. For outside brands of pig iron coming into this district quotations are nominally without material alteration from last week, but the transactions reported in this market are very limited in extent, and where any alteration does take place in prices it is in favour of the buyer. Although the finished iron trade all through is still only dull, there is generally a healthy feeling. Considerable orders for finished iron of various descriptions have lately been put into the market by the railway companies, some fair transactions in hoops for shipment to America are reported, and in various branches of industry outlets are being found for different classes of manufactured iron, which are indications of an increasing volume of consumption. Finished iron makers consequently, although but moderately employed just at present, are only prepared with concessions to secure prompt specifications, and for forward deliveries are very firm. Quotations are unaltered, bars delivered into the Manchester district averaging about £6 per ton.

In the engineering and machine making branches of trade the position of affairs is without material change. Local establishments are moderately employed, but there is very little work ahead, and there is not yet any substantial improvement in the cotton trade to justify the expectation of any large orders for machinery being given out at present in this district. For the work which is offered the competition is so keen that prices are cut down to the lowest possible figure.

So far as the coal trade is concerned, the strike continues throughout the West Lancashire districts, and consumers to a large extent are still dependent upon outside districts for supplies. Since the break up of the frost these have been coming to hand more regularly, but the railway companies do not yet appear to be in a position to deal promptly with the large quantity of coal which is now being sent over their lines into Lancashire. Delays on delivery are still generally complained of, and the inconvenience suffered by consumers arises almost solely from this cause, the quantity of coal offering from outside districts being more than sufficient to meet all requirements. Consumers who deal directly with the Manchester firms whose men are at work are being supplied at the prices fixed by the advance made in January, but numbers of buyers are compelled to obtain their supplies from outside districts or through dealers, and in these cases extra rates have to be paid, although prices have been tending downwards during the week. Common round coal for steam and forge purposes delivered into the Manchester district are fetching about 10s. per ton, and engine fuel about 7s. 6d. to 8s. per ton.

So uneasy a feeling has been created in the Wigan district owing to the violent conduct of the men on strike, that on Friday last it was considered advisable to postpone a meeting of the Manchester Geological Society, which had been arranged to be held in that town, owing to the apprehension that the meeting together of a number of colliery proprietors might lead to disturbance. During the last few days strong precautions have, however, been taken to prevent any further breach of the peace on the part of the men.

The law as it relates to the rateability of machinery, tools, and plant, was the subject of a paper read at a meeting of the Manchester Scientific and Mechanical Society on Friday, by Mr. G. C. B. Corbett, who urged an alteration of the law so as to include in the rateable hereditament all machinery, plant, and furniture which might be placed on the premises for permanent use by the occupier during the continuance of his occupation, in which case houses would be assessed at their rent as furnished houses, and mills as furnished mills, and this he thought would result in a more equal distribution of the burdens of maintaining the poor and providing for local government expenses.

The proposal to which I referred some time back for requesting Government to appoint special commissions to investigate the desirableness of widening and deepening the bed of the river Irwell, with the view of preventing the recurrence of floods, and also of converting the river into a navigable stream between Salford and the Mersey, was brought before the Salford Corporation at their meeting on Wednesday, but it was resolved that the question of the tidal navigation of the Irwell should be referred to the River Conservancy Committee for consideration, with the request to report to the Council.

Barrow.—My information this week, collected from a variety of reliable sources, shows that so far as the demand for hematite pig iron is concerned, it is very fairly maintained. It is expected that continental users will need more than usual, and particularly Russia and Germany. American inquiries are coming to hand in pretty fair numbers, but on the whole, I find a dulness this week, which was not quite expected. The new year set in with a brisk demand, and a falling off just now was hardly looked for. I find at this time of the year, on referring back, a cessation in the demand usually sets in for a short time. The slackness will be of a very temporary character. It is known that America wants hematite pig iron largely, and orders from that quarter must soon be forthcoming. Bessemer qualities are quoted at 67s. per ton at makers' works, while Nos. 1, 2, 3 forge are realising from 65s. to 66s. I find it impossible in every case to give anything like a correct figure, as many producers are well sold forward, and at present they are only doing business with the best firms, and even with these at special terms. I have nothing new to chronicle in the steel trade. There is a good demand for both rails and plates. Steel mills are briskly employed and there is no lack of orders. Iron shipbuilders still maintain the great activity which I have for some time past noticed. In this department of trade there is not likely to be any scarcity of work for a long time; not only are good orders held, but specifications for new contracts are being wanted quicker than it is possible to get them out. Iron ore finds a good market at from 13s. 6d. to 16s. 6d. per ton at the pit. Raisers of ore find plenty of buyers. Coal and coke are in good request, though the South Lancashire colliers' strike is affecting the supply. Shipping is very fairly employed for the time of the year.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

Interest at present chiefly centres in the coal trade. In the Barnsley district the prices have increased even for local sale, 10s. per ton being a common price in the town itself. At Sheffield branch and first house coal are higher still. Very little steam coal has been sent away of late by water, owing to the canals and the Humber ports being almost unapproachable through the ice. For gas coal there is a brisk demand, and companies are pressing for heavier deliveries. There is still a large call for steam and other coal from Lancashire, but the demand is now subsiding. Thirteen thousand miners in the South Yorkshire district are said to contemplate a strike for 10 per cent. advance in wages. At several collieries the employers, to prevent anything like interruption to business, offered 2½ and 5 per cent., and the men replied that the resolution of the Union did not permit them to take less than 10 per cent. Still I do not think we shall have any extensive strike. Manver's Main, where the sliding scale arrangement was agreed to last week, is sure to be an example pretty generally followed.

Prices of iron are stiffening, and makers anticipate better returns for their labour. Business in several of the leading branches, and in other departments, has been considerably interfered with by the severe weather. Higher prices charged for fuel during the temporary interruption of traffic, limited work in some of the larger factories and rolling mills. The thaw will soon make things "level" again.

Messrs. John Brown and Co., Limited, have been remarkably successful with their last test—made on Tuesday at Portsmouth. The plate was made upon the principle of the last patent taken out by the chairman of the company, Mr. J. D. Ellis, and represented the armour they have in hand for the Conqueror and Majestic. The plate, which had been manufactured for the Conqueror, had been cut down to 8ft. long by 5ft. 9in. wide, being 10½in. thick, to suit the frame on board the Nettle, where the experiments took place. It was fastened to the backing by means of four bolts, as usual, screwed into the back of the plate. The test to which it was subjected is the one adopted for steel-faced armour 11in. thick, viz., 12½-ton muzzle-loading rifled gun; distance, 30ft.; charge, 50 lb. battery pebble powder; chilled Palliser shot, each 250 lb. weight; three shots, fired at a triangle, the points of impact being about 2ft. apart. The first shot gave a penetration of 5in.; the second, 4·9in.; the third, 5·6in.—all unprecedentedly small. This damage is considered slight, and the result regarded as very satisfactory. This test will pass the plates on hand for the Conqueror and Majestic. The same firm are in the act of delivering the steel-faced armour-plates for the turrets of the Ajax, which has been sent round from Pembroke to be finished at Chatham.

In addition to the list of orders I sent you a short time ago, I hear of another very heavy contract for railway material which has been placed in this district—no less than 2000 pairs of wheels for the Lancashire and Yorkshire Railway Company, which has placed the order with Messrs. J. Armstrong and Co., of Rotherham.

I am told that the largest Indian order ever received in Sheffield came to hand last week, and was obtained by Messrs. John Copley and Sons, manufacturers of table cutlery, pen, pocket, and dagger knives, &c., Richmond Works, Creswick-street.

In May last several interesting experiments were conducted at Whirlow Bridge, near Sheffield, by Mr. William Atkinson, marine engineer, of 10, Rock-lane, Sheffield, with apparatus he has invented and patented for the raising of sunken ships. His plan is to raise such vessels by means of a series of submarine buoys, which can be made any size, to lift 100, 500, or 1000 tons. The experiments were very fully reported in the local papers at the time, and were stated to be very successful. A limited company has been formed to acquire and work Mr. Atkinson's patents. The capital is £100,000 in £2 shares, and it is proposed to call up £20,000. The promoters anticipate a profit of 37½ per cent. on the called-up capital. If this scheme be successful, it will prove an extraordinary exception to the rule.

The Staveley Coal and Iron Company, Limited, announce the payment of an interim dividend on account of the current year at the rate of £2 per share on the A and C shares, and of 6s. 8d. per share on the B and D shares. These amounts are the same as those paid last year.

A sale of much interest to local manufacturers and merchants took place on Tuesday—that of the goodwill and a couple of corporate and registered trade marks, one of which was granted by the Cutlers' Company in 1795, and the other in 1843. The trade marks belonged to the estate—in liquidation—of Messrs. Joseph Teuton and Sons, steel, file, and cutlery manufacturers, and general merchants, of the Sykes Works, Eyre-street. The works have gained considerable reputation for files and steel in Australia and other markets, including, among the home markets, that of Ireland. The marks were purchased, after a keen competition, by Mr. Blaydes—Messrs. E. Blaydes and Co., cutlery manufacturers and general factors, Advance Works—for £335.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

But little business was done on Tuesday at Middlesbrough Exchange. The general thaw which commenced on the previous Wednesday has certainly removed most of the many difficulties which have recently beset the trade. But the heavy stocks which are known to have been accumulating are having a depressing effect. The actual amount of increase cannot be known till towards the end of the week, when the statistics for January will be issued. Few competent judges put the estimate at less than 50,000 tons. Shipments foreign and coastwise are nearly 30,000 tons less than in December. They amount only to 48,000 tons, and are the lowest known for many months. No doubt the present open weather will lead to a certain revival in the coasting trade ; but northern foreign ports will be blocked with ice for some time to come. The price of No. 3 foundry iron is 40s. per ton for prompt, 40s. 3d. for next week, and 40s. 6d. for delivery over the month. Forge iron is fully 1s. per ton less. Scarcity of limestone and of water at some of the furnaces has thrown them out of order, and an excessive make of forge iron is the result. Complaints are made by manufacturers that some of this is of unusually silicious character, resulting in loss of yield and extra consumption of fettling in the puddling furnace. This is always the case when from any cause the regular working of blast furnaces is interfered with, and nothing but time and a restoration to uniformity of treatment can cure the evil.

Connal's stocks show an increase of 2450 tons during the week, the total at Middlesbrough being 136,211 tons. There is still a fair demand for warrants, purchasers being willing to give from 1s. 6d. to 1s. 9d. per ton more for them than for prompt iron. It is estimated that the excess of production over distribution and consumption cannot be less at the moment than 15,000 tons per week in the Middlesbrough and Glasgow markets taken together.

The manufactured iron trade may be considered steady at the same prices as last week. Had the frost continued, it certainly would have been flatter, as there was scarcely a shipyard on the coast, which was not forced to discontinue operations. Now, however, all have got to work again, and are beginning to press for materials. Inquiry for forward delivery is still very brisk, but makers are generally unwilling to quote until they see which way the pig iron market is likely to go.

An interesting contract case between two local firms was tried at York Assizes on the 26th ult. Messrs. Johnson and Reay, iron manufacturers, of Stockton, had sold to Messrs. R. Dixon and Co., shipbuilders, of Middlesbrough, a certain quantity of iron plates, on certain conditions. Upon the line marked "Quality," in the contract note, were filled in the words, "Crown, to pass Lloyd's survey." In the month of May, 1879, the contract being still in force, the price of plates had fallen considerably below the contract price; so low indeed that to continue making them was quite unremunerative. Messrs. Johnson and Reay decided to close their works, and informed Messrs. R. Dixon and Co. of the circumstance, and said that they would supply another make of plates fulfilling the contract conditions. Messrs. Dixon replied that they would not accept any other, as they considered they had bought one particular make in the quality of which they had confidence. They were willing, however, to defer the contract until sellers' works should be re-opened. Messrs. Johnson and Reay said, in answer to this, that they might never re-open their works, and insisted on their right to supply under the contract any plates which were of "Crown quality and would pass Lloyds' survey." A dead lock ensued, and an action was commenced by sellers, but apparently it was not pushed to an issue at the time. The following autumn, what is known as the "American spurt" began, and by January, 1880, the price of plates had risen above the price of the contract in question. Messrs. Dixon now began to specify and press Johnson and Reay for delivery, and their overtures being rejected they claimed damages. The action has now been tried before Mr. Justice Manisty, and he, without hearing witnesses on either side, has decided in favour of Johnson and Reay, subject to a reference to determine the market values of plates at the dates in question. It is understood, however, that leave has been given to the other side to appeal, and that the case will be carried to a higher court.

The directors of the Consett Iron Company, Limited, have announced their intention to pay a dividend of 15s. per share, on the 15th inst., to all shareholders upon the books on the 5th inst.

The dispute in the South Stockton Shipyard still continues. A member of the firm—Richardson, Duck, and Co.—had an interview on the 1st inst. with the platers-helpers, and offered them 1s. per week advance at once, and a second 1s. when a similar advance was given at a neighbouring yard. This offer was immediately declined, the men claiming 2s. at once, and declaring they would remain out till they got it.

Steel blooms or "cogged ingots" continued to be sent in considerable quantities to the United States, the new direct line of steamers from Hartlepool to New York being utilised for the purpose. The enterprising firm of Furness and Co., who established the line, bring back American produce of all sorts. This finds a ready market in the populous iron and coal districts of the north, and the new trade is no doubt equally beneficial to senders and receivers.

It is announced that Mr. Swan, of electric lamp celebrity, being dissatisfied with the imperfect exhibition of his lamps at the recent meeting of the Cleveland Engineers, has offered to read a paper at their next meeting, and illustrate it with a sufficient number of his lamps in good working order. The offer has been accepted, and Mr. E. W. Richards, the president, has undertaken, as before, to provide dynamo-electric machines. No doubt the corporation engine will again be available, if no other. Mr. Swan is certainly wise to make an effort to do away with the bad impression given as to his lamps, owing to their imperfect action at the January meeting, and there is no doubt that the members will have a most interesting evening. It is but fair to Mr. Shoolbred to add that the failure alluded to was no fault of his, but was due to accident, or to want of time or care on the part of the senders of the apparatus. It will be remembered that sixteen out of twenty Swan lamps were smashed in transit, and the remainder only arrived while the meeting was being held, and too late to fix properly.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Glasgow iron market has again been very dull this week, and there does not appear much prospect of an early improvement. Advices from the United States are decidedly the reverse of encouraging. There is a good demand there for Bessemer pig and steel rails, but Scotch pig iron, according to the information sent to some of the most influential iron merchants in Glasgow, is not wanted, and, indeed, cannot be disposed of at an advantage. I am aware that certain ironmasters have been shipping pigs to New York, and selling them too ; but this is done considerably under market prices. The capacity of the American ironworks for producing crude iron has of late been very greatly increased, and it is no exaggeration to affirm that the time appears at length to have arrived when the Americans are in a position to make as much iron as they require.

Business was done in the warrant market on Friday forenoon at 52s. 8d. to 52s. 4d. cash and 52s. 10d. to 52s. 6d. one month, the afternoon quotations being 52s. 4½d. to 52s. 3d. cash, and 52s. 6d. to 52s. 5½d. one month. Monday's market was a shade weaker, and on Tuesday business was flat from 53s. 4d. cash and 52s. 6d. one month to 52s. 2d. cash and 52s. 4d. one month. The market was flat on Wednesday, when the price declined to 51s. 7½d. cash. To-day—Thursday—business commenced at the above figure, but improved to 51s. 9d. cash, and 51s. 11d. one month.

Makers' prices have a downward tendency, the quotations being as follows :—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 61s. 6d.; No. 3, 53s. 6d.; Coltness, No. 1, 68s.; No. 3, 54s.; Langloan, No. 1, 63s.; No. 3, 52s. 6d.; Summerlee, No. 1, 62s. 6d.; No. 3, 53s. 6d.; Calder, No. 1, 61s. 6d.; No. 3, 54s.; Carnbroe, No. 1, 59s.; No. 3, 53s. 6d.; Clyde. No. 1, 53s.; No. 3, 50s. 6d.; Monkland, No. 1, 52s. 6d.; No. 3, 50s. 6d.; Quarter, No. 1, 52s. 6d.; No. 3, 50s. 6d.; Govan, at Broomielaw, No. 1, 52s. 6d.; No. 3, 50s. 6d.; Shotts, at Leith, No. 1, 63s.; No. 3, 54s. 6d.; Carron, at Grangemouth, No. 1, 55s. 6d.; ditto specially selected. 57s. 3d.; No. 3, 53s. 6d.; Kinneil, at Bo'ness, No. 1, 54s.; No. 3, 51s. 6d.; Glengarnock, at Ardrossan, No. 1, 58s. 6d.; No. 3, 54s.; Eglinton, No. 1, 53s. 6d.; No. 3, 50s. 6d.; Dalmellington, ditto ditto.

The manufactured iron trade continues busy.

The coal trade is fairly active, there having been a good demand as a result of the cold weather, and better prices have been obtained for household sorts. There is little or no change in the value of shipping iron. In the eastern mining counties the trade is dull.

This week Messrs. William Dixon, Limited, of the Govan Colliery, voluntarily advanced the wages of their colliers 6d. per day, but as yet the advance has been given only in a few isolated cases. At a conference of miners' delegates in Glasgow, on Monday, the men were advised to press for an advance of 6d. per day, and a resolution was adopted to the effect that if the advance was not conceded by the 14tn inst., when the delegates again meet, "effective steps" be taken to enforce the demand.

About 100 boiler-makers have been engaged in Glasgow, and proceeded this week to New York, where they are to be employed in a shipbuilding yard.

The report of the directors of the Caradon Copper Company to the annual meeting in Glasgow, states that the low prices obtained for copper and ore have told unfavourably upon the operations of 1880. So far the explorations in the mines had not answered expectations. The future of the mine, the report says, must depend upon the discoveries yet to be made.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

Quotations in steam coal have advanced by 1s. 6d. per ton, but possibly an "all round" advance will not exceed 1s. per ton. Upon that advance rests the success of the Miners' Permanent Fund. Instead of slowly progressing as the light illumines the rather obtuse minds of the workers, it would go up with a bound were the colliers to see a distinct addition to their wages. The local papers abound with controversy in respect of the inquest and the explosion at Penygraig. One advocates returning to the old pillar and stall method, "long wall" giving such a sweep for the explosive gas to riot in. Another suggests arches here and there, or anything to break the line. An ingenious colliery manager hints that the issue of blowers during certain barometrical conditions is due really to a magnetic throb which goes through the mineral veins at times and seasons. Another excellent idea is given by a gentleman of considerable experience. He states that explosions invariably occur in the infancy of a colliery, and not in its old age; and he maintains that no colliery should be worked except after certain defined plans which should be submitted to a duly authorised person, who could see at once a dangerous point, such as foul air coming by the return way into workings, or the position of the lamp room, as at Penygraig. Tapping virgin soil, he states, should be a most cautious operation, and done under approved rules, for the Rhondda and other coal measures abound with gas at a pressure of 100 lb. to the square inch.

Mr. Galloway has invented an excellent little instrument that demonstrates the action of coal-dust under the influence of carburetted hydrogen gas. Mr. T. Riche's, the locomotive superintendent, T. V. R., Cardiff, new hopper dredger named the Ely, built by Simons, Renfrewshire, under his direction, is not only complex, but simple, and the seeming paradox is shown by the excellent way in which it dredges to 30ft., cuts its own floatation in shoals, carries its own dredgings, loads barges, and also tows them.

Considerable rejoicing has been expressed at Cwmavon by the announcement that Mr. Shaw will remain there.

A considerable degree of firmness characterises the iron trade, and though no advanced quotations are given, prices are sufficiently stiff to indicate an upward movement. Steel rails are fixed at £6, hematite pigs not unlikely to touch £4. Old rails and scrap in request.

Tin-plate still keeps dull. I have seen an offer as low as 14s. 3d. for ordinary coke plates delivered at Cardiff.

The Rhymney Iron Company has declared a dividend on the half-year of 15s. on each £50 share, and 4s. 6d. upon the £15 shares. Shares now range from 34 to 36. They were going steadily up and touched 39, but so much scrip was sent into the market that depression followed. Still those conversant with the works think that an investment is sound. The works are being conducted with great vigour and marked ability.

Pig iron and "blooms" are in demand for the States.

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.

25th January, 1881.

319. Jacquard Machines, W. P. Thompson.—(*W. Talbot and W. Heyworth, Philadelphia.*)
320. Gas Engines, C. M. Sombart, Magdeburg.
321. Harbour & Dock Works, W. R. Kinipple, London.
322. Ships or Vessels, C. Cullen, Rosherville.
323. Chronograph Watches, W. Williams, Bury.
324. Cards, C. M. Sombart.—(*P. Leclerc, Germany.*)
325. Hinges, C. H. & F. W. Brampton, Birmingham.
326. Sewing Machines, R. H. Brandon.—(*J. H. Morley, Holyoke, U.S.*)
327. Gas Flues, C. Haupt, Brieg.
328. Pigments, J. B. Orr, London.
329. Carbonic Acid, &c., J. Williamson, Westoe.
330. Horseshoes, W. Bishop, Lower Edmonton.
331. Sugar, C. Scheibler, Berlin.
332. Tables or Tablets, W. Winter, Leeds.
333. Treating Blood, &c., C. Forrest, Upton.
334. Washing, &c., Apparatus, D. Burns, Brookside.
335. Gas Stoves, T. Fletcher, Warrington.
336. Feeding Gear, M. Gandy, Liverpool.
337. Fastenings, J. Hinks & T. Hooper, Birmingham.

26th January, 1881.

338. Trimming-up, &c., Wheat or Rye, W. P. Thompson.—(*W. Lauhoff, Detroit.*)
339. Reaping Machine, A. Boss.—(*S. Sudheim, Cassel.*)
340. Mules, A. Bates.—(*A. Wintgens, Dahlhausen.*)
341. Rock Crushers, J. King.—(*E. Forster, Pittsburgh.*)
342. Hansom Cabs, W. Johnstone, Edinburgh.
343. Fire-bars, E. G. Brewer.—(*J. Alves, Dunedin.*)
344. Treating Grain, A. Gillman & S. Spencer, London.
345. Compasses, H. Schoening, Cardiff.
346. Printing, C. R. F. Schloesser, Manchester.
347. Clearing Snow, &c., L. Metcalfe, Didsbury.
348. Cutting Apparatus, W. C. Pellatt, London.
349. Ships or Vessels, J. Betteley, London.
350. Speed Regulator, R. J. Smith, Sunderland.
351. Warming Apparatus, R. Jackson, Leeds.
352. Railway Wheels, J. W. Howard, London, and D. H. O'N. Neale, Woodford.
353. Engines, R. Brown, Morton.
354. Pumping Engines, M. Silvester, Brixton.
355. Treating Rags, &c., C. W. Smith, Aston.
356. Bicycles, &c., T. Warwick, Aston.

27th January, 1881.

357. Dry Gas-meters, W. Haldane, Edinburgh.
358. Rolling Metal Wires, &c., A. Hughes, Glasgow.
359. Separating Apparatus, D. MacEachran, Greenock.
360. Rotary Fans, J. S. Davidson, C. R. Steele, and J. Lyon, Whitehaven.
361. Saddles, A. Scholefield, Halifax.
362. Sausage Machine, W. H. Skipper, London.
363. Steam Boilers, W. Lord, Bury.
364. Scarf, &c., Fastenings, R. T. Williams, London.
365. Acid, W. J. Cooper, London.
366. Aerated Liquids, F. Wirth.—(*H. and J. F. Beins, Groningen.*)
367. Regulating, &c., Apparatus, J. H. Johnson.—(*V. G. Jurion, France.*)
368. Gas, S. Holman, London.
369. Motive-power, G. Temple, Rotherham.
370. Gas Motor Engines, H. P. Holt, Leeds, and F. W. Crossley, Manchester.
371. Corrugated Metal Plates, H. A. Bonneville.—(*A. A. Raud, France.*)
372. Raising Sunken Ships, &c., O. Wolff.—(*A. Lehmann, Dresden.*)
373. Ships' Sleeping Berths, W. R. Lake.—(*The Brunswick Berth Company* (*Incorporated*), *Boston, U.S.*)
374. Hatching, &c., Apparatus, W. L. Wise.—(*F. Martini and Co., Frauenfeld.*)
375. Cheques, &c., A. Dupré and O. Hehner, London.
376. Earthenware Pipes, S. C. Homersham, London.
377. Valve, &c., E. Field and F. M. Cotton, London.

28th January, 1881.

378. Shoeing Horses, &c., J. Offord, London.
379. Distributing Apparatus, T. E. Golding, London.
380. Door Fasteners, W. Leggott, Bradford.
381. Boiler Composition, H. Portway, Bradford.
382. Brakes, J. Lansley, Basingstoke.
383. Permanent Way, R. S. Dugdale, Huddersfield.
384. Tobacco-pipes, C. M. P. H. Triscott, London.
385. Chronographs, J. H. Johnson.—(*A. L. Strasburger, France.*)
386. Starch, &c., W. R. Lake.—(*T. A. and W. T. Jebb, Buffalo, U.S.*)
387. Fire-grates, J. Britton, Stamford.
388. Rollers, W. R. Schürmann, Düsseldorf.
389. India-rubber Hose, J. Burbridge, R. C. Thorpe, and T. Oakley, Tottenham.
390. Respirators, E. Rinzi & A. A. Berthier, London.
391. Lamps, T. Tongue and T. E. Bladon, Birmingham.
392. Thawing Ice, T. J. Sloan, London.
393. Chains, F. Ley.—(*J. M. Dodge, Chicago, U.S.*)
394. Gas-burners, W. W. Wynne.—(*J. N. Chamberlain, Springfield, U.S., and A. W. Rice, Hudson, U.S.*)

29th January, 1881.

395. Embossed Impressions, J. S. Sworder, Loughton.
396. Looms, J. Brownlie, Glasgow.
397. Fire-arms, J. T. and J. Rogers, Birmingham.
398. Scales, H. J. Haddan.—(*L. Colassot, France.*)
399. Steaming Fabrics, E. Buckley, Manchester.
400. Wire Fencing, G. B. Smith, Glasgow.
401. Bracelet Fastenings, E. Atkins, Birmingham.
402. Sheep-shears, P. Ashberry, Sheffield.
403. Ventilating Pots, &c., T. Bate, Kilburn.
404. Bottle, &c., Stoppers, N. Thompson, London.
405. Purses, P. Lack.—(*L. Knittel, Germany.*)
406. Ice, J. Hopkinson, Manchester.
407. Looms, J. Kenyon, Blackburn.
408. Steam Engine, H. H. Lake.—(*P. B. and F. E. Besnard, Nantes.*)

31st January, 1881.

409. Drying Coffee, J. Gordon.—(*J. Stewart, Guatemala.*
410. Cistern Valve, S. J. Newman, Inchbrook.
411. Spinning Apparatus, J. Hodgkinson, Bolton.
412. Railway Signals, T. Masters, Coventry.
413. Unhairing Hides, &c., E. G. Brewer.—(*A. W. Reid, Schenectany, and J. E. Reid and E. Potter, Boston.*)
414. Non-corrodible Compositions, H. H. Lake.—(*J. B. M. Fillon and C. L. de Capitani, Milan.*)
415. Threshing Machines, J. W. Lee, Cambridge.
416. Low-water Alarm, &c. Valve, G. Wilson, London.
417. Signalling Apparatus, J. N. Maskelyne, London.
418. Stoppers for Bottles, &c., B. Zibach, London.

Inventions Protected for Six Months on deposit of Complete Specifications.

284. Wind Engine, &c., A. M. Clark, Chancery-lane, London.—A communication from M. E. de la Torre, Mexico.—*22nd January*, 1881.
326. Sewing Machines, &c., R. H. Brandon, Rue Laffitte, Paris.—A communication from J. H. Morley, Holyoke, U.S.—*25th January*, 1881.
394. Gas Burners, W. W. Wynne, Chancery-lane, London.—A communication from J. N. Chamberlain, Springfield, and A. W. Rice, Hudson, Columbia, U.S.—*28th January*, 1881.

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

321. Axle-boxes, F. Attock, Newton Heath.—*24th January*, 1878.
328. Grinding, &c., Glass, W. R. Lake, Southampton-buildings, London.—*24th January*, 1878.
345. Wheels, J. Braby, Rudgwick.—*26th January*, 1878.
431. Bricks, &c., T. Evans, Abergwili.—*1st February*, 1878.
343. Game Board, P. Lawrence, Farringdon-road, London.—*26th January*, 1878.
407. Pumps, G. W. Hobbs, Market Harborough.—*31st January*, 1878.
412. Umbrella, &c., Runners, W. Holland, Birmingham.—*31st January*, 1878.
360. Decorating Surfaces, L. Q. Brin, Borough, London.—*28th January*, 1878.
364. Tin and Terne Plate, E. Morewood, Llanelly.—*28th January*, 1878
365. Coating Metals, E. Morewood, Llanelly.—*28th January*, 1878.
409. Weaving Fancy Fabrics, J. Hamilton, Strathaven.—*31st January*, 1878.
427. Oil Boxes. P. Jensen, Chancery-lane, London.—*1st February*, 1878.
691. Brake Apparatus, F. W. Webb, Crewe.—*20th February*, 1878.

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

327. Injectors, A. Budenberg, Manchester.—*26th January*, 1874.
442. Actuating Railway Points, &c., F. W. Webb, Crewe.—*4th February*, 1874.
494. Actuating Railway Points, &c., F. W. Webb, Crewe.—*7th February*, 1874.
357. Washing Machines, E. Taylor, Blackburn.—*28th January*, 1874.
387. Silk Crape, R. H. Kay and A. T. Richardson, Gutter-lane, London.—*30th January*, 1874.
495. Salicylic Acid, J. H. Johnson, Lincoln's-inn-fields, London.—*17th February*, 1874.
1698. Gas-meters, W. J. Warner, South Shields, and W. Cowan, Edinburgh.—*13th May*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 18th February, 1881.

3831. Folding Chairs, G. A. Dallas, Bethnal Green road, London.—*22nd September*, 1880.
3832. Dynamo-electric Machines, W. Elmore, Blackfriars-road, London.—*22nd September*, 1880.
3838. Band or Rope, S. Hirst, C. Earnshaw, and A. Holroyd, Marsden.—*22nd September*, 1880.
3853. Cleaning Boots, &c., T. Lever, Nelson.—*23rd September*, 1880.
3860. Steering, &c., Apparatus, J. Whittingham, the Cross, Nantwich.—*23rd September*, 1880.
3865. Coal Gas, F. Weston, Chryssell-road, Brixton.—*24th September*, 1880.
3870. Splitting Wood, &c., T. Redmayne, Sheffield.—*24th September*, 1880.
3888. Securing the Weight Rope to Looms, W. Houlker, Accrington.—*25th September*, 1880.
3910. Knife-cleaning, &c., Machine, H. Woodward, Regent's Park, London.—*27th September*, 1880.
3918. Curing Diphtheria, &c., F. van Sandau, King-street, Cheapside, London.—A communication from S. H. Longard.—*27th September*, 1880.
3927. Hauling Fishing Nets, G. Howard, Ann's-place, Sykes-street, Hull.—*28th September*, 1880.
3933. Railway Rails, E. Rider, New York, U.S.—*28th September*, 1880.
3945. Spindle Bearings, J. Elce, Manchester.—*29th September*, 1880.
3946. Railway Chairs, W. C. Wood, Barnard Castle.—*29th September*, 1880.
3948. Targets, L. J. Crossley, Halifax.—*29th September*, 1880.
3961. Fastening for Belts, &c., P. A. Martin, Great Charles-street, Birmingham.—*30th September*, 1880.
3987. Lamps, C. W. Torr, Birmingham.—*1st October*, 1880.
3988. Steam Cultivation, D. Greig and T. Benstead, Leeds.—*1st October*, 1880.
4008. Warming, &c., Apparatus, G. Jennings, Palace Wharf, Stangate, London.—*2nd October*, 1880.
4023. Buttons, J. A. R. de Barazia, La Rochelle, France.—*4th October*, 1880.
4058. Matches, F. Wirth, Germany.—A communication from G. Sebold.—*6th October*, 1880.
4206. Velvet Pile Carpets, &c., T. B. Worth, Stourport.—*15th October*, 1880.
4333. Kilns, P. Montagné, France.—*23rd October*, 1880.
4529. Treating Pelts, E. P. Alexander, Southampton-buildings, London.—A communication from A. Fraser.—*4th November*, 1880.
2562. Looms, P. Young and J. Mathieson, Glasgow.—*6th November*, 1880.
4662. Steam Boilers, S. Ballian, Constantinople.—*12th November*, 1880.
4936. Roll Tobacco, A. T. Lendrum, Belfast.—*27th November*, 1880.
5258. Carding Engines, G. and J. Aimers, Galashiels, and D. Wright, Selkirk.—*15th December*, 1880.
5281. Working Traffic, J. S. Hughes, Portmadoc, Carnarvon.—*16th December*, 1880.
5392. Microscopes, J. M. Moss, Patricroft, Manchester.—*22nd December*, 1880.
5403. Breech-loading Mechanism, D. Fraser, Edinburg.—*23rd December*, 1880.
5427. Blowing, &c., Apparatus, E. P. Alexander, Southampton-buildings, London.—A communication from O. S. Presbrey.—*24th December*, 1880.
5466. Transfers, A. E. McDonald, New York, U.S.—*29th November*, 1880.
27. Lime-light, Lamps, A. M. Khotinsky, St. Petersburgh.—*4th January*, 1881.
284. Wind Engine, &c., A. M. Clark, Chancery-lane, London.—A communication from M. E. de la Torre.—*22nd January*, 1881.

Last day for filing opposition, 22nd February, 1881

3825. Kitchen Ranges, R. Neville, Butleigh-court, Glastonbury.—*21st September*, 1880.
3902. Stamping Letters, C. Pieper, Berlin.—A communication from W. Löffelhardt.—*27th September*, 1880.
3903. Condensing Distilled Vapours, T. W. Duffy and T. L. Makin, Liverpool.—*27th September*, 1880.
3911. Flooring Cramps, W. Riley, Keighley.—*27th September* 1880.

3912. Roving Frames, T. E. Smith, Royd Works, Keighley.—*27th September*, 1880.
3913. Velocipedes, H. J. Lawson, Coventry.—*27th September*, 1880.
3931. Omnibuses, H. W. Hart, Palace-chambers, Westminster.—*28th September*, 1880.
3932. Paper Bags, J. Baldwin, Birmingham.- *28th September*, 1880.
3937. Portable, &c., Engines, F. Savage, King's Lynn.—*28th September*, 1880,
3939. Colouring Alcohol, E. H. T. Liveing, Queen Ann-street, London.—*29th September*, 1880.
3949. Consuming Smoke, J. Teer, Salford.—*29th September*, 1880.
3951. Cog Wheels, &c., A. B. Child, London.—Com. from F. Wegmann.—*29th September*, 1880.
3952. Charging Cartridge Shells, &c., W. R. Lake, Southampton-buildings, London.—A communication from S. Marelli.—*29th September*, 1880.
3958. Measuring Thicknesses, J. Milner, Alderney-street, Pimlico.—*30th September*, 1880.
3960. Fire-escapes, G. Tiviotdale, Cheny-street, Birmingham.—*30th September*, 1880.
3969. Examining Apparatus, A. Steenberg, Copenhagen.—Com. from R. Jensen.—*30th September*, 1880.
3989. Indicating Apparatus, B. Tower, Beaufort-terrace, West Brompton, London.—*2nd October*, 1880.
4026. Hardening Cement, &c., W. R. Lake, Southampton-buildings, London.—A communication from A. Magaud.—*4th October*, 1880.
4081. Electrical Signal Apparatus, W. R. Lake, Southampton-buildings, London.—A communication from A. Lemaire and E. Lebrun.—*7th October*, 1880.
4109. Ordnance, A. Noble, Jesmonddine House, Newcastle-upon-Tyne.—*9th October*, 1880.
4196. Heating Apparatus, W. Love, Glasgow.—*15th October*, 1880.
4222. Treating Coffee, E. G. Brewer, Chancery-lane, London.—Com. from P. Pesier.—*16th October*, 1880.
4256. Indicating Apparatus, J. H. Beeteley, Fleet-street, London.—*19th October*, 1880.
4338. Gas Valves, P. J. Wates, Balham, and S. and J. Chandler, Newington-causeway, London.—*25th October*, 1880.
4409. Screens, T. Davids and C. Weiss, Hanover.—*28th October*, 1880.
4424. Valve Gear, J. Crighton, R. Crighton, and P. Chell, Manchester.—*29th October*, 1880.
4576. Producing Designs, W. L. Wise, Whitehall-place, Westminster.—A communication from H. Gmeiner.—*8th November*, 1880.
4586. Regulating, &c., Injection Water, J. Griffiths, Water-street, Liverpool.—*9th November*, 1880.
4933. Electric Lamps, J. W. Swan, Newcastle-on-Tyne.—*27th November*, 1880.
5000. Rag Engine, R. K. Miller, Edinburgh.—*1st December*, 1880.
5108. Securing Ends of Wire, H. Eyre and E. Heathfield, Leadenhall-street, London.—*7th December*, 1880.
5149. Hydraulic Lifts, E. B. Ellington, Chester.—*9th December*, 1880.
5159. Straining Paper Pulp, A. Paisley, Clyde Paper Mills, Lanark.—*10th December*, 1880.
5180. Preparing Alkali Salts, J. A. Dixon, Glasgow.—Com. from C. Kœing.—*11th December*, 1880.
5218. Metallic Alloys, G. Höper, Chancery-lane, London.—*13th December*, 1880.
5287. Sulphate of Alumina, B. E. R. Newlands, East Ham, Essex.—*17th December*, 1880.
5295. Window Sashes, W. Phillips, Leeds.—*17th December*, 1880.
5327. Colouring Matters, J. A. Dixon, Glasgow.—Com. from C. Kœing.—*20th December*, 1880.
5337. Fire Extincteurs, E. D. Bruneel, Sheffield.—Com. from H. Gübler.—*20th December*, 1880.
5396. Treating Ores, J. H. Johnson, Lincoln's-inn-fields, London.—A communication from P. G. L. G. Designolle.—*23rd December*, 1880.
5471. Gas Motor Engines, R. Hutchinson, Mildmay-grove, London.—*29th December*, 1880.
5491. Printing Machines, J. Foster, Preston.—*30th December*, 1880.
60. Gas Motor Engines, C. D. Abel, Southampton-buildings, London.—A communication from N. A. Otto.—*5th January*, 1881.
99. Securing Stoppers in Bottles, &c., T. Burns, Wolverhampton.—*8th January*, 1881.
196. Flue Tubes, J. A. and J. Hopkinson, Huddersfield.—*14th January*, 1881.
229. Restoring Waste India-rubber, &c., H. H. Lake, Southampton-buildings, London.—A communication from H. A. Clark.—*18th January*, 1881.
274. Watches, W. R. Lake, Southampton-buildings, London.—A communication from T. C. Comstock.—*21st January* 1881.
275. Electric Semaphores, W. R. Lake, Southampton-buildings, London.—A communication from F. R. F. Brown.—*21st January*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 28th January*, 1881.)

3143. Pianofortes, H. W. Pohlmann, Halifax.—*30th July*, 1880.
3153. Water-closets, T. W. Helliwell, Brighouse, Yorkshire.—*31st July*, 1880.
3156. Engraving Rollers, E. T. Gadd, Salford.—*31st July*, 1880.
3167. Wheels and Rails, J. Ormerod, Manchester.—*2nd August*, 1880.
3168. Drawing Curves, A. R. Molison, Swansea.—*2nd August*, 1880.
3171. Separating Mineral Matters, &c., S. Hallam and G. L. Scott, Manchester.—*3rd August*, 1880.
3172. Purifying Apparatus, W. Lyon, Cowper's-court, Cornhill, London.—*3rd August*, 1880.
3178. Brewing, P. L. Manbré, Valenciennes, France.—*3rd August*, 1880.
3181. Treating Copper, &c., J. H. Johnson, Lincoln's-inn-fields, London.—*3rd August*, 1880.
3182. Gas Motor Engines, F. W. Turner, St. Albans Ironworks, St. Albans.—*3rd August*, 1880.
3189. Screw Propellers, J. Robertson, Govan, Renfrewshire.—*4th August*, 1880.
3198. Steam Engines, W. H. Beck, Cannon-street, London.—*4th August*, 1880.
3205. Tinder-boxes, F. Grimal, Paris.—*5th August*, 1880.
3206. Lavatories, B. Finch, High Holborn, London.—*5th August*, 1880.
3214. Germinating Apparatus, E. de Pass, Fleet-street, London.—*5th August*, 1880.
3230. Disintegrating Apparatus, F. C. Glaser, Berlin.—*7th August*, 1880.
3264. Filtration of Sugar, H. Springmann, Gneisenau-strasse.—*10th August*, 1880.
3267. Gas-purifiers, &c., J. Whiteley and R. Pickles, Bradford.—*10th August*, 1880.
3279. Pulleys, F. A. Harrison and C. Priestland, Birmingham.—*11th August*, 1880.
3285. Fire-arms, C. T. H. Bennett, Launceston, and S. le N. Neave, New-inn, London.—*11th August*, 1880.
3288. Purifying Illuminating Gas, J. Ireland, Plymouth.—*12th August*, 1880.
3290. Smutter, &c., Machines, W. B. Dell, Mark-lane, London.—*12th August*, 1880.
3315. Spring Mattresses, &c., W. R. Lake, Southampton-buildings, London.—*14th August*, 1880.
3361. Refining Sugar, A. Sauvée, Parliament-street, Westminster.—*19th August*, 1880.
4006. Waste Water Preventers, F. J. Henderson, King's Cross-road, London.—*2nd October*, 1880.
4129. Electrical Signalling Apparatus, W. R. Lake, Southampton-buildings, London.—*11th October*, 1880.
4269. Hydraulic Lifts, E. B. Ellington, Chester.—*20th October*, 1880.
4406. Spinning Apparatus, F. Craven and A. Craven, Bradford.—*28th October*, 1880.
4485. Ingot Moulds, D. McKechnie, Stevenston, N.B.—*3rd November*, 1880.
4573. Recovering Indigo, F. A. Gatty, Accrington.—*8th November*, 1880.
4643. Explosive Compounds, C. D. Abel, Southampton-buildings, London.—*11th November*, 1880.
4799. Velocipedes, Sir T. G. A. Parkyns, Stapleton.—*20th November*, 1880.
4884. Lead, &c., Holders, J. H. Johnson, Lincoln's-inn-fields, London.—*24th November*, 1880.
4917. Bobbin-net, &c., Machines, J. R. Hancock, New Basford.—*26th November*, 1880.
4928. Gloves, H. Urwick, St. John's-hill, Wandsworth.—*26th November*, 1880.
4972. Firegrates, A. C. Engert, Mills-lane, Bromley-by-Bow, London.—*29th November*, 1880.
5011. Diving Apparatus, S. P. M. Tasker, Philadelphia, U.S.—*1st December*, 1880.
5039. Screw-nuts, H. J. Haddan, Strand, London.—*3rd December*, 1880.
5091. Electricity, H. J. Haddan, Strand, London.—*7th December*, 1880.

(*List of Letters Patent which passed the Great Seal on the 1st February*, 1881.)

2866. Match-boxes, C. Kesseler, Berlin.—*12th July*, 1880.
3179. Umbrellas, F. Engel, Hamburg.—*3rd August*, 1880.
3180. Feed-water Apparatus, F. H. F. Engel, Hamburg.—*3rd August*, 1880.
3187. Moulding Bricks, &c., J. and T. Brittain, Chesterton, Stafford.—*4th August*, 1880.
3192. Ruling Apparatus, W. L. Wise, Whitehall-place, Westminster.—*1st February*, 1881.
3197. Power Looms, W. H. Beck, Cannon-street, London.—*4th August*, 1880.
3202. Governors, &c., W. Chadburn, Liverpool.—*5th August*, 1880.
3210. Fire-boxes, D. McI. Reid, Inchicore Lodge, Dublin.—*5th August*, 1880.
3224. Stop-watches, L. A. Groth, Finsbury-pavement, London.—*6th August*, 1880.
3225. Meter for Water, &c., L. A. Groth, Finsbury-pavement, London.—*6th August*, 1880.
3237. Fog Signal Apparatus, H. Whitehead, Bucknall, R. Hodgson and T. Dodd, Winsford.—*7th August*, 1880.
3286. Spinning Machinery, J. H. Johnson, Lincoln's-inn-fields, London.—*11th August*, 1880.
3300. Tempering Cast Steel, C. Kesseler, Mohren-strasse, Berlin.—*13th August*, 1880.
3339. Transporting Grain, J. Wetter, Strand, London.—*17th August*, 1880.
3365. Forming Moulds, H. J. Haddan, Strand, London.—*19th August*, 1880.
3457. Spikes, W. Clark, Chancery-lane, London.—*26th August*, 1880.
3478. Bicycles, N. K. Husberg, Stockholm.—*27th August*, 1880.
3556. Air, &c., Pumps, W. P. Thompson, High Holborn, London.—*2nd September*, 1880.
3610. Fluffing, &c., Machines, J. M. Jones, Wrexham.—*6th September*, 1880.
3834. Quarrying Stone, J. Williams, Commercial-road, Liverpool.—*22nd September*, 1880.
4132. Treating Fibrous Materials, F. F. Seeland, Newark, U.S.—*12th October*, 1880.
4456. Holders for Embroidery, &c., A. G. Duncan, Goldsmith-street, London.—*1st November*, 1880.
4588. Decorating Frames, &c., M. Hartmann, Amsterdam.—*9th November*, 1880.
4648. Digging Machinery, G. Robson, Sunderland, and E. Herdman, Pará, Brazil.—*11th November*, 1880.
4663. Obtaining Oils from Fish, W. R. Deheer, Hull.—*12th November*, 1880.
4696. Spinning Machinery, H. M. Girdwood, Belfast.—*15th November*, 1880.
4734. Hauling, &c., Machines, W. H. Harfield, Mansion House-buildings, London,—*17th November*, 1880.
4821. Preparing Oil, W. R. Lake, Southampton-buildings, London.—*20th November*, 1880.
4842. Looms, W. Adam, Kidderminster.—*22nd November*, 1880.
4850. Switches, S. Pitt, Sutton.—*23rd November*, 1880.
4866. Electric Lighting Apparatus, W. Lake, Southampton-buildings, London.—*23rd November*, 1880.
4890. Metallic Packings, J. A. Osgood, Middlesex, U.S., & E. Monroe, New York.—*24th November*, 1880.
4910. Preserving Meat, &c., G. W. von Nawrocki, Leipziger-strasse, Berlin.—*25th November*, 1880.
4968. Dissolving, &c., Apparatus, J. F. N. Macay, Chancery-lane, London.—*29th November*, 1880.
5010. Removing Dust from Carpets, A. J. Boult, High Holborn, London.—*1st December*, 1880.
5152. Electric Drills, S. Pitt, Sutton.—*9th December*, 1880.
5160. Evacuating Fire-damps, F. Wodiczka, Graz.—*10th December*, 1880.

List of Specifications published during the week ending January 29th, 1881.

2669, 1s.; 1990, 10d.; 2073, 6d.; 2090, 6d.; 2091, 6d.; 2145, 6d.; 2217, 6d.; 2475, 8d.; 2491, 6d.; 2495, 6d.; 2504, 6d.; 2518, 6d.; 2530, 6d.; 2531, 6d.; 2534, 6d.; 2552, 1s.; 2554, 6d.; 2567, 6d.; 2569, 1s.; 2575, 6d.; 2581, 2d.; 2583, 2d.; 2587, 2d.; 2595, 2d.; 2604, 6d.; 2608, 2d.; 2611, 6d.; 2621, 8d.; 2622, 6d.; 2623, 6d.; 2629, 2d.; 2632, 2d.; 2634, 6d.; 2636, 6d.; 2641, 6d.; 2642, 2d.; 2644, 2d.; 2646, 4d.; 2649, 2d.; 2650, 4d.; 2651, 2d.; 2652, 2d.; 2653, 4d.; 2654, 6d.; 2656, 2d.; 2657, 2d.; 2658, 6d.; 2659, 2d.; 2660, 2d.; 2661, 8d.; 2662, 2d.; 2663, 2d.; 2664, 6d.; 2665, 6d.; 2667, 6d.; 2670, 2d.; 2671, 6d.; 2672, 6d.; 2675, 2d.; 2677, 2d.; 2678, 2d.; 2679, 2d.; 2681, 4d.; 2682, 4d.; 2683, 6d.; 2684, 2d.; 2685, 2d.; 2686, 2d.; 2687, 2d.; 2688, 2d.; 2690, 6d.; 2691, 6d.; 2692, 2d.; 2694, 2d.; 2696, 6d.; 2697, 4d.; 2698, 2d.; 2699, 2d.; 2701, 2d.; 2702, 6d.; 2704, 6d.; 2706, 6d.; 2707, 2d.; 2708, 2d.; 2709, 6d.; 2712, 2d.; 2713, 2d.; 2716, 2d.; 2719, d.; 2721, 4d.; 2723, 6d.; 2728, 4d.; 2746, 6d.; 2766, 6d.; 2820, 6d.; 2879, 6d.; 3226, 6d.; 3761, 2d.; 4412, 6d.: 4489, 6d.; 4567, 6d.

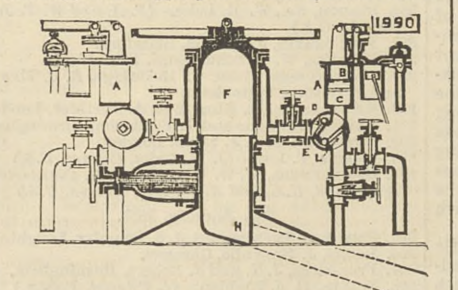
*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane,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

ABSTRACTS OF SPECIFICATIONS.

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

1990. Propelling and Steering Vessels, &c., *G. and G. Pfannkuche.—Dated 14th May*, 1880. 10*d*.

A is a cylinder divided into two parts, the upper one of which, marked B, is destined to receive a charge of exploding gas or gaseous mixture, whilst the lower one C becomes filled through the valve L with the water that is to be ejected by the exploded gaseous mixture and to be used for the formation of water columns. Now suppose the upper part B of the cylinder A to be



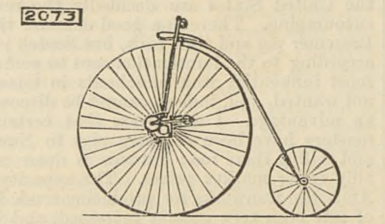
charged with the gaseous mixture, the lower part C to be filled with water, and then the gaseous mixture to be brought to explosion, the consequences will be that the water contained in the chamber C is forced by the expansion of the gases through valves D, and through the sluice cock E into the large air vessel F, whence, under the pressure in the air vessel, it finds its way through the orifice H into the water surrounding the vessel.

2011. Cheques, Bills, &c., *A. T. King.—Dated 17th May*, 1880.—(*Provisional protection not allowed.*) 2*d*.

Rows of figures are placed at each side of the cheque, and when filled in part of these columns are torn off so as to indicate the sum the cheque is drawn for.

2073. Driving Mechanism for Bicycles, &c., *J. Dutton.—Dated 21st May*, 1880. 6*d*.

This consists of a spur wheel on the axis of the main wheel or wheels of the vehicle and a second spur wheel in gear with the first. The axis of the second spur wheel is carried by an arm so contrived that this axis can be clamped in different positions, either higher or lower as may be required, but always with the two spur wheels in gear. In the case of a bicycle this arm



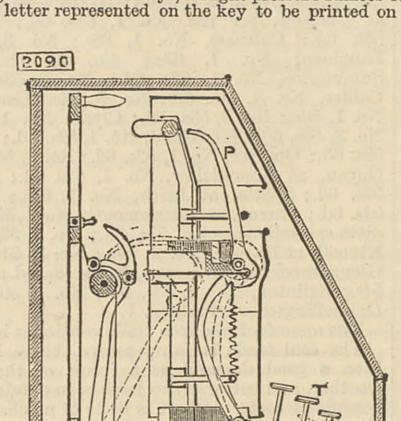
is attached to the fork on which are the bearings for the axis of the main wheel and the arm is formed as a segment of a circle, of which when the arm is in place the axis of the main wheel is the centre. Fast with the second spur wheel there is a ratchet wheel and a pawl engages with the ratchet teeth. The pawl is carried by a lever mounted on the axis of the second spur wheel, so as to be able to turn freely thereon; the same lever is formed at its rear end as a treadle and the foot of the rider is placed on the treadle.

2076. Velocipedes, *Sir T. G. A. Parkyns, Bart.—Dated 21st May*, 1880.—(*Void.*) 2*d*.

Steam power is applied to drive the vehicle, the boiler for producing steam being heated by liquid fuel.

2090. Type Writing Apparatus, *J. G. Tongue.—Dated 22nd May*, 1880.—(*A communication from E. Recordon.*) 6*d*.

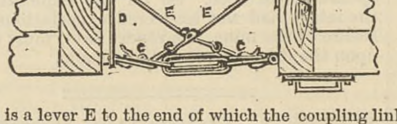
The apparatus is worked by means of a key-board composed of three rows of keys T, on which are inscribed the letters of the alphabet, &c. In placing the finger on one of the keys, a slight pressure suffices for the letter represented on the key to be printed on a



sheet of paper placed vertically at the back of the printing apparatus. In the printing of each letter the paper moves automatically the width of a letter, in order to receive the printing of the following letter at the side of the former one. P are the printing levers carrying at their upper ends the engraved letter corresponding to that seen on each key under a glass plate

2091. Coupling and Uncoupling Railway Wagons, &c., *J., W. T., E., and J. Hill.—Dated 22nd May*, 1880. 6*d*.

A cross bar B is supported in guides and is provided with a handle D, by which it is operated. Attached



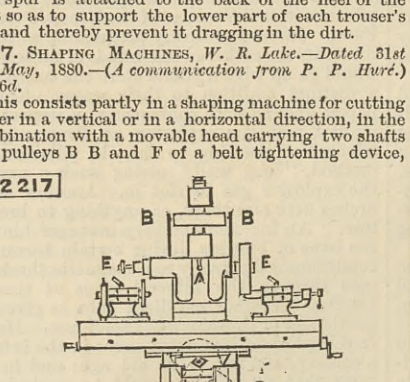
to B is a lever E to the end of which the coupling link C is connected by a joint, so as to be raised for passing it over the draw bar hook.

2103. Protecting Trousers against Wear and Dirt, *M. Loeb.—Dated 24th May*, 1880.—(*Provisional protection not allowed.*) 2*d*.

A spur is attached to the back of the heel of the boot so as to support the lower part of each trouser's leg, and thereby prevent it dragging in the dirt.

2217. Shaping Machines, *W. R. Lake.—Dated 31st May*, 1880.—(*A communication from P. P. Huré.*) 6*d*.

This consists partly in a shaping machine for cutting either in a vertical or in a horizontal direction, in the combination with a movable head carrying two shafts and pulleys B B and F of a belt tightening device,



pivotted on the shaft of the driving cone and held in position by a screw upon a quadrant in such a manner as to serve for driving either the pulleys B B or the shaft A, or the pulley F of the shaft E without altering the length of the driving belt.

2145. Liquor Stands or Frames, &c, *H. T. Fellows.—Dated 26th May*, 1880. 6*d*.

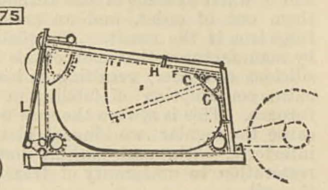
This consists in the combination with stands or frames of a locking slide working on the underside of the top horizontal bar or plate of the stand, the said slide being furnished on its underside with a peg or projection or with pegs or projections, equal in number to and situated at the same distances apart as the stoppers or covers of the bottles or vessels in the stand, the locking slide when in one position causing its stems to be brought over the stoppers or covers of the bottles or vessels, and when in another position removing its stems from over the said bottles or vessels.

2285. Candlesticks, &c., *E. Henneguin and H. Callard.—Dated 5th June*, 1880.—(*Provisional protection not allowed.*) 2*d*.

The different candlesticks of a household are provided with numbers corresponding to the numbers of the different chambers, so as to be able to see if any occupant has entered his apartment.

2475. Sheaf Binding, *J. Harrison.—Dated 18th June*, 1880. 8*d*.

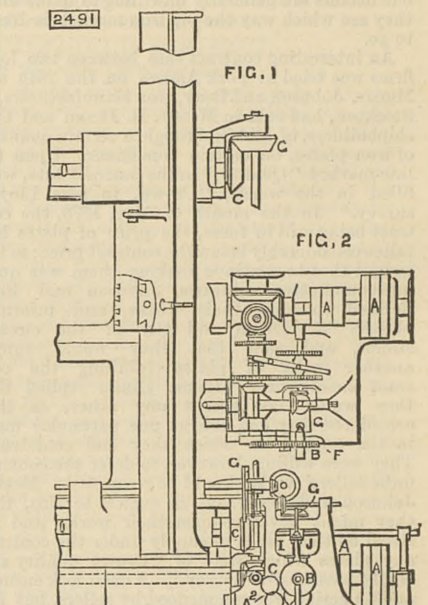
A pitch chain wheel on the main wheel drives the binding mechanism. An upright frame supports four chain pulleys over which passes a chain having a clip F for holding and conveying one end of the string. Guides G, placed at points round the upright frame, hold the string in the form of a large loop while the sheaf is being pushed partly through the frame by the revolving rake of the machine. To each side of the frame is attached a separate piece forming together a platform for the reception of the sheaf; they



are placed a short distance apart so as to leave a slit for the passage of the string. The clip F when moving along the top of the frame comes in contact with a trigger H which releases the holders and the clip then draws the string tight round the sheaf until it takes up the other part of the string. A short distance beyond the point where the clip has hold of both parts of the string is placed the apparatus for forming of the knot. The lever L takes up the slack when the string is released from the holders G. The knotting apparatus is of special construction.

2491. Slotting and Planing Machines, *J. Barrow and J. Craven.—Dated 19th June*, 1880. 6*d*.

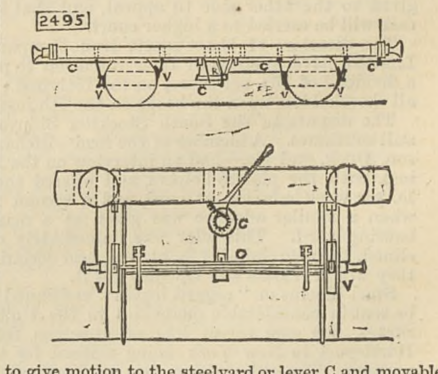
Fig. 1 is a front elevation, and Fig. 2 a plan. A A are the driving pulleys which give motion to the spur whee B in either direction by the intermediate pinions C D. Either of the pinions may be geared into the spur wheel B by turning a plate which carries



them on the centre or axis A^2. The spur wheel B is loose on the shaft which operates the feed motion, but may be firmly connected (so as to rotate with it) to it by means of a clutch F operated by the lever G; upon a vertical shaft is fixed the cam I, which on making one revolution comes in contact with the bowl J fixed on the lever G, and throws the clutch out of gear, the desired feed having then been effected.

2495. Brake Apparatus, *J. Hirsiger.—Dated 19th June*, 1880. 6*d*.

This consists in the arrangement, combination, and construction of brake apparatus, in which the longitudinal shaft G connected with every carriage is caused



to give motion to the steelyard or lever C and movable weight R to actuate the brake blocks V, whereby a regulated pressure can be put upon all the wheels of each carriage of a train.

2496. Steam Wheels, *J. T. Howson and W. Tate.—Dated 19th June*, 1880.—(*Not proceeded with.*) 2*d*.

The wheel is constructed as a plate wheel, that is to say without arms, the heavy rim and the centre boss being connected by a web or plate. The steam pockets are formed in the periphery of the wheel, and may be of any desired number, according to the diameter of the wheel. The wheel being secured it is mounted in a suitable casing.

2503. Dyeing Cotton Fabrics, *E. Poselt and R. Peters.—Dated 21st June*, 1880.—(*Not proceeded with.*) 2*d*.

The fabric is passed over rollers in a cistern containing hot water, then through squeezing rollers to a second cistern containing a mixture consisting of 13½ gallons water, 13½ gallons solution of chloride of iron, 3½ gallons aniline oil, 4½ gallons muriatic acid, 6¾ lb. chlorate of potash, and 4¾ lb. sulphate of copper. The fabric is then washed and allowed to age from eight to ten hours, when it is passed through a cistern and receives an injection or shower of concentrated solution of bichromate of potash, made acidulous by muriatic acid. The fabric is then washed and passed through a cistern containing a mixture of muriatic acid, bichromate of potash, and sulphate of iron or copper. The dyeing is then finished by passing the fabric through a bath of dye woods and sulphuric acid.

2504. DISTILLATION OF SPIRITUOUS LIQUORS, &c., *A. Dudgeon.—Dated 21st June, 1880.* 6d.

The distillation of low wines into coarse spirits is effected in the still shown in the drawing, the low wines being kept boiling by a close steam coil B, and the circulation maintained by an open steam pipe C. The vapour outlet A from the still is conducted into a chamber containing a two-way valve, so that it can be

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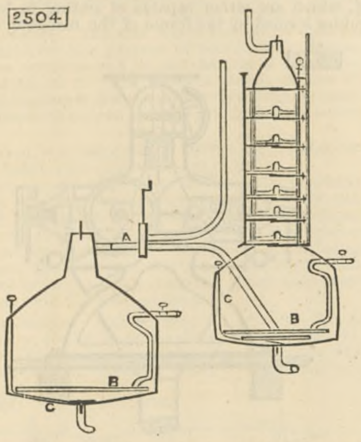

conducted to a separate condenser or into the bottom of the spirit still. The condensing cold water coils in the spirit still are arranged so as to always be filled with water, the outlet of each coil being above the inlet, and each supplied by a separate valve, arranged so that they may be worked together or separately. The pipes through which the vapours pass from chamber to chamber are formed so that the vapour may be caused to impinge against a bell-shaped, flat, hollow disc.

2505. LOCK MECHANISM OF GUNS, RIFLES, &c., *T. and T. Woodward.—Dated 21st June, 1880.—(Not proceeded with.)* 2d.

To push the hammer into full cock the stand side of the main spring is extended, so as to play over or come in contact with an arm of the hammer. The stand side of the main spring is controlled by a movable stud operated either automatically on the opening or closing of the gun, or is extended and worked by a lever. A second improvement consists in extending the sear or hook (which holds the hammer at full cock) forward, and provide it with a second hook, which should the hammer be accidentally jarred off the usual hook, it is caught by the second hook before reaching the cap or striker.

2515. BICYCLES, *M. H. Gerring and R. E. Rumsey.—Dated 21st June, 1880.—(Not proceeded with.)* 2d.

An excentric is fitted, about the driving axle, to each branch of the steering fork in such a position as to increase the radius of the crank, when such increased radius will be most effective. Each excentric is fitted with a strap provided with an arm to which the crank pin is fixed.

2516. BETANAPHTHYLAMINE AND BETANAPHTHYLANILINE, &c., *C. D. Abel.—Dated 21st June, 1880.—(A communication from E. Oehler.)—(Not proceeded with.)* 2d.

Betanaphthol, or its substituted derivatives, or combinations of these bodies with metallic oxides or mixtures thereof, are heated for a considerable time at a high temperature, together with salts of ammonia, or of substituted ammonia, either alone or with addition of neutral bodies, and the bases thus produced are separated by any suitable means from the substances that do not enter into the reaction, or from impurities produced.

2518. HEATING AND VENTILATING, *O. Sheppy.—Dated 21st June, 1880.* 6d.

A is the outer casing of the stove; B is the hot-air chamber lined with fire-brick or tiles and fitted with baffle plates; C is a perforated gas tube or row of burners for heating the hot-air chamber. This hot-air chamber B communicates with the room by means of the connecting pipes $B^1 B^1$, the mouths of which pass

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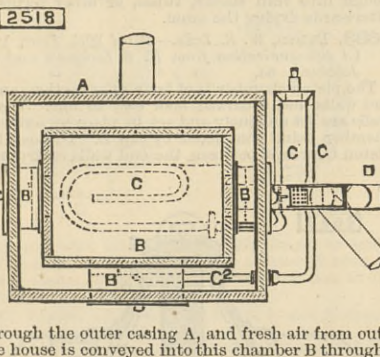

through the outer casing A, and fresh air from outside the house is conveyed into this chamber B through the inlet pipe D. $C^1 C^1$ are pipes conveying gas to the main burners or perforated gas tube C, and also to a small flat flame burner C^2 situate towards the front of the stove, and serving to cast a warm glow through the red glass, with which the front of the stove may preferably be fitted.

2530. PLATES FOR SHOES, &c., *R. Chapman.—Dated 22nd June, 1880.* 6d.

This consists of a socket or foundation plate which is fixed and retained on the heel or other part of the boot, and a slide or wearing part which is fixed to the socket plate by means of screws and retained in position by one or more stays or wards.

2531. FEEDING APPARATUS FOR THRASHING MACHINES, *J. W. Fison and C. Lack.—Dated 22nd June, 1880.* 6d.

A number of prongs are secured at their centre to a cross-bar warping in bearings. The upper ends of these prongs are also connected by a crossbar, to

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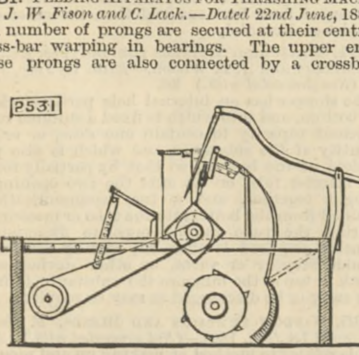

which is attached a spring lever with its outer end gripped at the back of the apparatus. The prongs work in connection with a square roller, and can be adjusted to or from this roller.

2534. PACKING CASES, *F. Hoyer.—Dated 22nd June, 1880.* 6d.

This relates to so constructing packing cases, that the same are collapsible, or can be easily taken to pieces or folded together when empty.

2552. KNITTING MACHINERY, *S. Lowe and J. W. Lamb.—Dated 23rd June, 1880.* 1s.

The needle bar A carries the bearded needles, which receive an up-and-down motion, but without any dwell in their downward progress. In front of the needles is mounted a set of points E carried by the horizontal bar X and standing parallel with and opposite the stems of their respective needles. These

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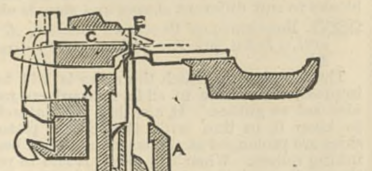

points have a short vertical motion, and between them project the jack sinkers C and the dividing sinkers, when they are required to act upon the thread, pressing it against the points in the same way as heretofore against the needle stems. As the thread is laid over the points E the jack sinkers C will advance to form the required amount of slack thread, and the dividing sinkers will then advance and divide the slack thread upon the points. The points then retire

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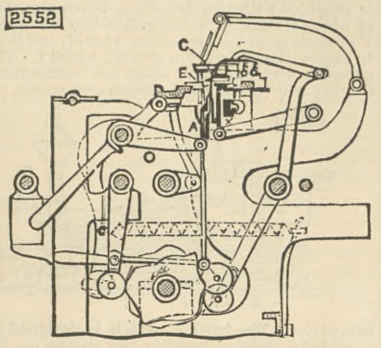

and allow both jack and dividing sinkers to carry the divided thread to the advancing needles. At this moment the sinkers effect a more complete dividing of the thread, and then retire to allow the knitting to proceed. Two threads are laid in for every complete rotation of the cam shaft instead of one. The second figure shows the position the knitting instruments assume at the moment the thread is being laid upon the webs of the sinkers.

2554. STEAM BOILERS, *G. E. Vaughan.—Dated 23rd June, 1880.—(A communication from J. M. F. du Temple.)* 6d.

The boiler is composed of two reservoirs or collectors communicating directly with each other by one or several pipes of large calibre, and by a number of small zigzag vaporising tubes which are alone exposed to the fire. The tubes are provided at each end with conical bronze ferrules, secured in corresponding holes, pierced in the collectors (as shown in the second Fig.),

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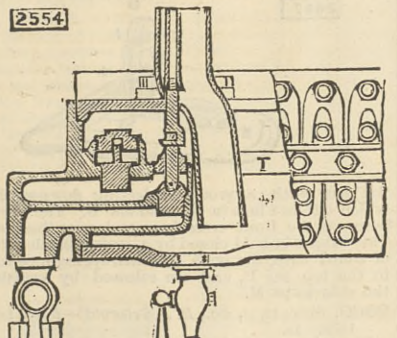

by means of forked levers, of which the longest branch clamps the tube above the collet of the ferrule, and engages on a T-shaped piece, which separates the holes of two series on each of the reservoirs, while the other branch receives a screw which forces the lever

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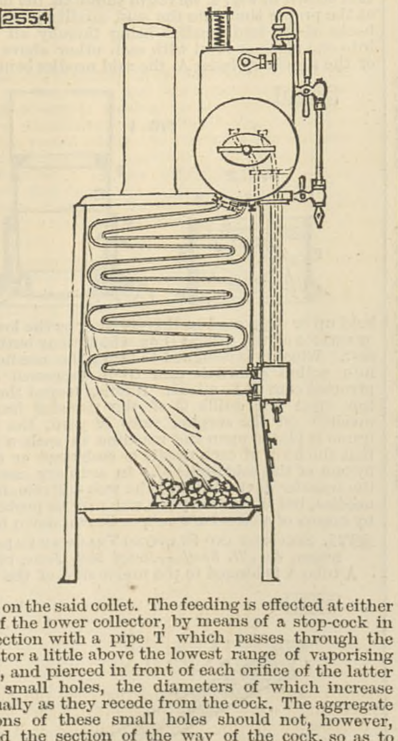

down on the said collet. The feeding is effected at either end of the lower collector, by means of a stop-cock in connection with a pipe T which passes through the collector a little above the lowest range of vaporising tubes, and pierced in front of each orifice of the latter with small holes, the diameters of which increase gradually as they recede from the cock. The aggregate sections of these small holes should not, however, exceed the section of the way of the cock, so as to insure as far as possible the simultaneous admission of the feed water into all the vaporising tubes which are most exposed to the action of the fire.

2569. MACHINE SCREWS, *J. Wetter.—Dated 23rd June, 1880.—(A communication from W. H. Eddy.)* 1s.

This machine performs the operation of shaving or trimming the head of each blank, nicking such head, reshaving or finishing it, transferring the blank to threading mechanism, and while so transferring it turning it over end for end and finally threading and discharging it.

2575. CUTTING BLANKS FOR ENVELOPES, &c., *R. Fenner.—Dated 24th June, 1880.* 6d.

A rising and falling table and a hinged platen are employed as usual, but the table D receives its motion through cranks on the shaft S. The hinged platen B is lowered by hand, and catches F engage with recesses in the framing, so as to form a surface for resisting the pressure of the cut. A snug I on the

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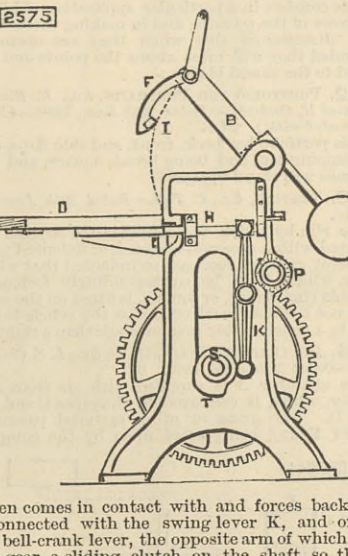

platen comes in contact with and forces back a bolt H connected with the swing lever K, and one arm of a bell-crank lever, the opposite arm of which throws into gear a sliding clutch on the shaft, so that the action of lowering the platen automatically causes the rising and falling motion of the table. The cam T serves to throw the clutch out of gear again through the rod K and bell-crank lever.

2581. STEAM ROAD ROLLERS AND TRACTION ENGINES, *T. Green and J. Thyne.—Dated 24th June, 1800.—(Not proceeded with.)* 2d.

To the underside of the boiler is fixed a bracket projecting to the front and having a socket formed in it. The socket receives a vertical spindle having a collar upon it, which bears upon the lower end of the socket. Below the collar there is a duplex knuckle-like joint, with a joint pin connecting the spindle with the centre of a bridge piece or fork, which spans a pair of supporting rollers or wheels, and has bearings formed at its extremities in which the fore axle is held. Brackets from the ends of the fork arms carry scrapers at the back of the rollers or wheels, and front scrapers are also attached to the portion of the bridge piece or fork which extends over the rollers or wheels.

2583. RAISING AND FORCING LIQUIDS, &c., *J. W. Midgley.—Dated 24th June, 1880.—(Not proceeded with.)* 2d.

A cistern and ball tap is placed in an elevated position. The cistern is supplied with town or other waters. From the cistern is a pipe or pipes to the receiver or receivers, the pipes having a four-way and check valve. The cisterns firstly contain air, and are connected to the vessels or barrels containing the fluid to be raised. The water from the cistern entering the bottom of the receiver compresses the air in the receivers, and a pressure is put upon the liquid—to be raised or forced—in the vessel or barrel, and its contents are raised or forced to any height lower than the supply cistern.

2587. TRICYCLES, *J. H. Walsh.—Dated 25th June, 1880.—(Not proceeded with.)* 2d.

This relates partly to an arrangement whereby the steering wheel can be locked or steadied as required, by the pressure of the rider's back and receive the necessary guiding from the action of either of his shoulders respectively.

2595. INDIA-RUBBER PRODUCTS, *H. Gerner.—Dated 25th June, 1880.—(Not proceeded with.)* 2d.

This consists in the process of mixing in proportions productive of either hard, semi-hard, or soft materials, india-rubber, camphor, and sulphur, together with the flours of agricultural fruits, germs, &c., which do or do not contain sulphur, and then properly vulcanising the mixture.

2604. LIGHTING AND HEATING APPARATUS, *J. C. T. Thomas.—Dated 26th June, 1880.* 6d.

The drawing shows a vertical sectional elevation of the lamp or lighting apparatus. A is the oil tank or reservoir; B the wick tube provided with holes for the escape of vaporised oil; C the burner with its slot arranged diagonally in relation to the parabolic reflectors; and F the milled head of the wick pinion spindle. The whole of the above parts are connected together and are attached by a hinged joint, and secured by a catch to the upper part of the lantern. G is a metal chimney with holes at H H for the emission of

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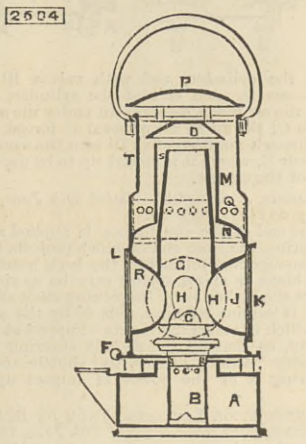

light. Around these holes are secured the inner ends of the parabolic chambers J J made of bright or reflecting material. The outer ends of the chambers are closed by sheets of glass K K carried in sliding frames L L. Around the upper part of the chimney is a perforated plate N furnished with a tubular deflector, guide, or wall M, so arranged as to leave an annular space S, for the circulation of air between M and the chimney, to prevent overheating of the outer casing T of the lamp. O is a deflector attached to the hinged cover P. Q Q are ventilating holes protected against draughts by a guard plate, and R R are small holes communicating from the chambers into the body of the lamp.

2607. CHRONOGRAPH WATCHES, *J. Wetter.—Dated 26th June, 1880.—(A communication from Le Coultre et Compagnie.)—(Not proceeded with.)* 2d.

This consists in the application of a toothed roller, which, when brought in contact with a toothed wheel (preferably by supporting the roller in a pivotted lever acted upon by a spring), shares the motion of the latter, the said toothed wheel being fixed on a pinion completing a revolution once per hour, or per minute, or in any other suitable space of time.

2608. STEAM GENERATORS, *J. Nicholson.—Dated 26th June, 1880.—(Not proceeded with.)* 2d.

This consists partly in constructing a steam generator having any desired shell form, with one or more rows of vertical water tubes communicating with the water in the generator above and below the furnace or fire-place, and with horizontal tubes to conduct the heating gases or products of combustion to the chimney.

2611. SHIPS' BERTHS, &c., *B. J. B. Mills.—Dated 26th June, 1880.—(A communication from J. C. Thompson.)* 6d.

A are berths or pitch frames, and B roll frames suspending the pitch frames from either side in the centre of the direction of their length, and such frames B are supported in the bulkheads by axes of motion. The berths A are controlled by the pendulous weight

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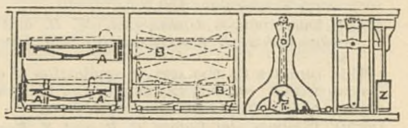

Y to counteract the pitching motion of the vessel, and the roll frames B are controlled by the pendulous weight Z to counteract the rolling motion of the vessel. The weights Y and Z being connected by suitable means with their respective frames A and B.

2612. GARTERS, &c., *E. V. Emery.—Dated 26th June, 1880.* 6d.

This consists in fixing spikes, pins, or their equivalents on to a band or strip for the purpose of holding a flexible material when brought over it, and it is specially applicable to garters for holding up socks or stockings.

2614. ACCUMULATORS, &c., *A. Wadsworth.—Dated 26th June, 1880.—(Not proceeded with.)* 2d.

The pressure is applied downwards instead of upwards, and an accumulator is used provided with a table which fits inside the accumulator.

2616. CONTINUOUS RAILWAY BRAKES, *R. Elgey.—Dated 26th June, 1880.—(Not proceeded with.)* 2d.

This consists of an arrangement whereby the brakes of railway trains may be applied to arrest or retard their motion by means of hand levers, or levers actuated by compressed air or steam, or by a combination of two or more of such means.

2618. MANUFACTURE OF IRON AND STEEL, &c., *G. Ellinor.—Dated 26th June, 1880.—(Not proceeded with.)* 4d.

This consists in the removal of phosphorus and sulphur from steel and iron, or from the ores from which metallic iron or steel are made by the use of calcium hydrate, or magneto-calcium hydrate, or quick lime or other forms of lime or its carbonates, in combination with a liquid volatile hydrocarbon oil.

2620. RAILS AND CHAIRS FOR RAILWAYS, &c., *W. Brown.—Dated 26th June, 1880.—(Not proceeded with.)* 2d.

The rails are made very light and seat themselves firmly in their chairs and no keys or wedges are required.

2621. MEASURING AND CUTTING OUT OF CLOTH, &c., *W. R. Lake.—Dated 26th June, 1880.—(A communication from F. Fabre.)* 8d.

The apparatus is designed to indicate or show the required configuration of the separate parts, so that they may be accurately cut according to the measurement of the person for whom the garment is to be made, or according to any desired measurement.

2622. GRINDING TOOLS, *W. Watson.—Dated 26th June, 1880.* 6d.

A is the stone; B the frame to which are attached inclined, grooved, or slotted standards or frames C, having adjustable brackets or levers D or carriers pivotted on shaft E^1, or fixed by bolts and nuts in slots of standards. These brackets, levers, or carriers are provided with vertical slots G, and have the shaft E^1 passed through them, upon the ends of which are fixed or keyed two levers R and R^1, having curved or

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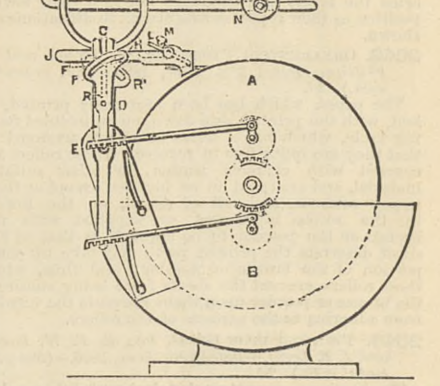

excentric slots F and F^1 in the upper ends thereof, the slots F and F^1 being set so as to act in opposite directions to each other. Through the slots G, G, F, and F^1 is passed the loose shaft or spindle H^1 upon which the tool-holder is pivotted. The tool-holder is preferably of a lever-like form, and the tool is held in the holder by an adjustable nip lever L and screw M, and brought to bear upon the stone by means of springs, cords, weights, or levers, preferably by weight and lever N.

2623. PILE FABRICS, *D. Marcon.—Dated 28th June, 1880.* 6d.

The ground and back warps are both supplied from the warp beam A, and the pile is supplied from the

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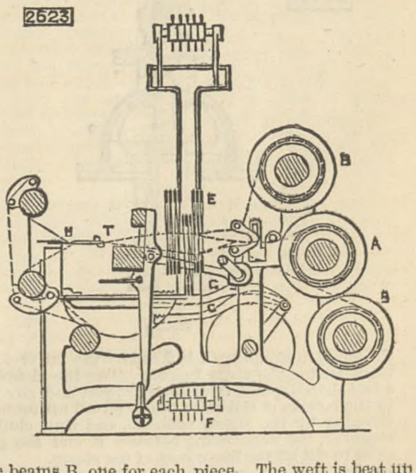


pile beams B, one for each piece. The weft is beat up by the sley at suitable times. The shedding of the warps is effected by the shafts or healds E, actuated as follows: Four shafts for the pile warps, or two for each pile warp; six shafts for the ground warps, or three for each, the healds E being raised and depressed at suitable times by the tappets F acting on the treadles G. The cutting arrangement consists of a disc H revolving between two plates loosely connected to the carriage, and traversed across the loom upon the slide rail. The cutting edge of H is kept sharp by grinding faces fixed at both top and bottom round the periphery. A wire T is inserted between the ground and back warps at each shed, and regulates the height of the pile.

2629. WEIGHING APPARATUS, *J. Wetter.—Dated 28th June*, 1880.—*(A communication from E. Fagel.)—(Not proceeded with.)* 2d.

This consists in applying a weigh-beam provided with a series of knife edges forming a scale and serving for the suspension of a movable weight, so that the addition or withdrawal of weights for weighing different objects may be dispensed with, and the weight of the objects accurately ascertained by moving the suspended weight along the weigh-beam.

2631. DECOMPOSING SUBSTANCES, *W. H. and A. B. Hodge and J. J. Eastich.—Dated 28th June*, 1880. 4d.

This consists in the use or application of electro-decomposition or electrolysis for the treatment of organic or inorganic substances or bodies.

2632. PICKERS FOR LOOMS, *C. F. and E. Burslem.—Dated 28th June*, 1880.—*(Not proceeded with.)* 2d.

A light metal frame slides upon the spindle or guides, and jaws extend therefrom, within which is placed leather, buffalo hide, vulcanite, rubber, wood, or similar material, which is to act against the shuttle.

2634. PIPES FOR SMOKING TOBACCO, *A. A. Percy.—Dated 28th June*, 1880. 6d.

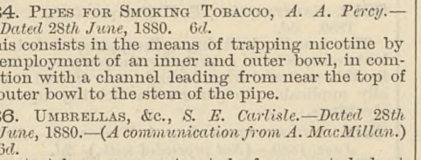
This consists in the means of trapping nicotine by the employment of an inner and outer bowl, in combination with a channel leading from near the top of the outer bowl to the stem of the pipe.

2636. UMBRELLAS, &c., *S. E. Carlisle.—Dated 28th June*, 1880.—*(A communication from A. MacMillan.)* 6d.

The stretchers are constructed of corrugated sheet steel, and the ribs are formed of semi-tubular steel, so that when closed the stretchers fit into and over the edges of the ribs, thus allowing the ribs to fit nearly close to the stick when the umbrella is closed.

2641. RAISING SUNKEN VESSELS, WEIGHTS, &c., *H. F. Brion.—Dated 26th June*, 1880. 6d.

This consists essentially in the employment of levers, which are mounted upon floating vessels for the purpose of raising sunken bodies, or upon wagons or suitable frames for raising or lowering weights. The drawing shows the levers mounted upon a truck or wagon A, upon which the support L is pivotted. The levers B and C turn upon the fulcrum at the top of the support. Ropes, chains, or cables E and F pass over pulleys at the ends of the short arms of the levers, and are attached to the weight. These ropes, chains, or cables pass along the levers B and C, and over the pulleys at the extremities of their longer arms, when they are wound on to the winch G. When it is



intended to raise a weight the two levers are lowered to their lowest position, and the ropes, chains, and cables are attached to the weight. One rope is then wound up on the winch, so as to bring its lever into the position shown by the lever C. The weight will then have been raised a certain distance, and the rope F will be taut and serve to sustain the weight, whilst the other rope will be slack. This rope will then be wound up till the lever B is raised to its highest position, thus raising the weight still higher. The rope F will now be slack, and ready to be wound up again. By suitably weighting the ends of the shorter arms the levers will gradually fall into their lowest position as their ropes become slack. Modifications are shown.

2642. ORNAMENTING PAPER, &c., *J. Salmon and R. Phillips.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

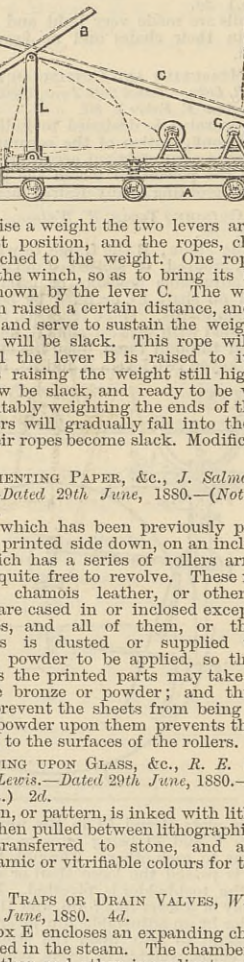
The paper, which has been previously printed, is laid, with the printed side down, on an inclined feeding table, which has a series of rollers arranged so that they are quite free to revolve. These rollers are covered with chamois leather, or other suitable material, and are cased in or inclosed except at their upper surfaces, and all of them, or the lowest in the series is dusted or supplied with the bronze or the powder to be applied, so that as the sheet descends the printed parts may take up some portion of the bronze or powder; and thus, while these rollers prevent the sheets from being smeared, the bronze or powder upon them prevents the varnish from adhering to the surfaces of the rollers.

2644. PRINTING UPON GLASS, &c., *R. E. W. Bowen and J. E. Lewis.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

The specimen, or pattern, is inked with lithographic transfer ink, then pulled between lithographic transfer paper, then transferred to stone, and afterwards printed in ceramic or vitrifiable colours for transfer to glass.

2646. STEAM TRAPS OR DRAIN VALVES, *W. Davis.—Dated 29th June*, 1880. 4d.

The valve box E encloses an expanding chamber C, and is immersed in the steam. The chamber contains a mixture of ether and other ingredients, and as the chamber expands it closes the aperture of the outlet G and stops the escape of steam. When condensation takes place in the valve box or water is carried over with the steam; the water reduces the temperature of



the spirit in chamber C, and causes the latter to contract, letting the water run off. Over the chamber is a bell-shaped guard D of spun copper, and any water in the bottom of the valve box is forced up round the chamber by the steam pressure, and thus chills the chamber, the water being between it and the guard, so as to cut off the fierce heat of the steam.

2649. SEAT AND LIFE SAVING APPARATUS FOR SHIPS, *J. Wetter.—Dated 29th June*, 1880.—*(A communication from B. King.)—(Not proceeded with.)* 2d.

This consists partly in making the ends of the seat in the shape of light rollers, preferably made hollow for containing provisions and water, and having sufficient buoyancy to keep several persons afloat, the two rollers being connected by a rod or axle passing through the axis of the rollers, and capable of fixing each roller between two screw nuts.

2650. BICYCLES, *J. Symes.—Dated 29th June*, 1880. 4d.

This consists in the construction of bicycles whereby they can be propelled by the action of the feet of the rider on the ground.

2651. SCISSORS, *F. Wick.—Dated 29th June*, 1880.—*(A communication from P. D. Hartkoff.)—(Not proceeded with.)* 2d.

This consists in a particular application of hinges to the bows of the scissors, and in making these bows of such dimensions that when they are opened and extended they will meet above the points and form a shield to the closed blades.

2652. PORTFOLIO FOR PORTRAITS, &c., *E. Binnechère and H. Cochard.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

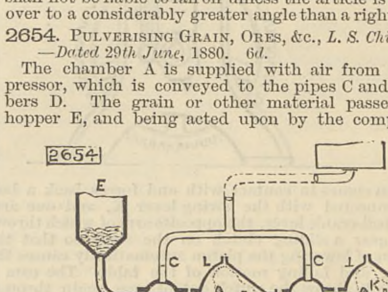
This portfolio has back, front, and side flaps, and an overlapping top, and being broad, square, and flat at the base will stand upright.

2653. TEAPOTS, &c., *C. Taft.—Dated 29th June*, 1880. 4d.

The rim by which the cover is to be secured is constructed with a grooved, recessed, or indented portion, so deeply grooved, recessed, or indented that when the cover, which is to be correspondingly formed with suitable rim, flange, or tongue, is fitted on the same, it shall not be liable to fall off unless the article is turned over to a considerably greater angle than a right angle.

2654. PULVERISING GRAIN, ORES, &c., *L. S. Chichester.—Dated 29th June*, 1880. 6d.

The chamber A is supplied with air from a compressor, which is conveyed to the pipes C and chambers D. The grain or other material passes from hopper E, and being acted upon by the compressed



air entering chamber D is forced against arget K in chamber L, against the sides of which it is thrown, and passes through into the second chamber D, where it is again acted upon by the compressed air, and forced against a second target also contained in a chamber, as many targets being employed as may be necessary to complete the pulverisation of the material.

2656. EXHAUSTING CONDENSERS, &c., *R. S. Candlish and W. J. Norris.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

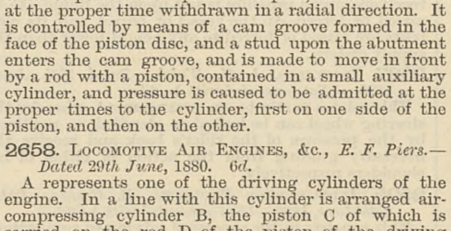
This consists essentially in dealing with the water and gases in the condenser quite independently, the air pump exhausting air only, and not drawing air and water.

2657. ROTARY ENGINES, *W. Allan.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

A disc is fast upon the shaft to be driven. On the face of this disc there is a projecting "piston," which is received into an annular groove in the face of a second or fixed disc. Within the groove in the fixed disc—which groove is termed the "cylinder"—a stop or abutment is provided; the passages for entrance or exhaust are on each side of the abutment piece. In order to permit the "piston" to pass, the abutment is at the proper time withdrawn in a radial direction. It is controlled by means of a cam groove formed in the face of the piston disc, and a stud upon the abutment enters the cam groove, and is made to move in front by a rod with a piston, contained in a small auxiliary cylinder, and pressure is caused to be admitted at the proper times to the cylinder, first on one side of the piston, and then on the other.

2658. LOCOMOTIVE AIR ENGINES, &c., *E. F. Piers.—Dated 29th June*, 1880. 6d.

A represents one of the driving cylinders of the engine. In a line with this cylinder is arranged air-compressing cylinder B, the piston C of which is carried on the rod D of the piston of the driving cylinder so as to receive motion from the same. The air-compressing cylinder is provided with valves A[1]A[1], one at each end of the cylinder, for the admission of



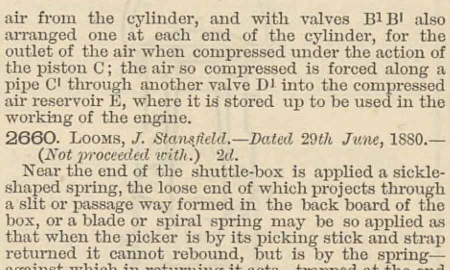
air from the cylinder, and with valves B[1]B[1] also arranged one at each end of the cylinder, for the outlet of the air when compressed under the action of the piston C; the air so compressed is forced along a pipe C[1] through another valve D[1] into the compressed air reservoir E, where it is stored up to be used in the working of the engine.

2660. LOOMS, *J. Stansfield.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

Near the end of the shuttle-box is applied a sickle-shaped spring, the loose end of which projects through a slit or passage way formed in the back board of the box, or a blade or spiral spring may be so applied as that when the picker is by its picking stick and strap returned it cannot rebound, but is by the spring—against which in returning it acts—trapped at the end of the box, so that on the shuttle entering the box the ordinary "swell" acts on the shuttle and eases it, depriving it of the power of impact upon the picker.

2661. PRESSING OR LEVELLING YARN ON BEAMS FOR WEAVING, *A. Hitchon.—Dated 29th June*, 1880. 8d.

The drawing shows part of a tape machine fitted with the improved apparatus. A is the yarn beam; B a pressing roller revolving on the antifriction bowl



C, the ends of which rest in slots formed in the radial arms D, which radiate on a shaft extending across the end of the machine. A weight secured thereon imparts the pressure to the yarn wound on the beam A. This shaft is supported at one end in a bearing formed in a vibrating lever E actuated from the side shaft F by pulleys and bands, and worm and worm-wheel H, to which a pin is fixed, connected by rod I to lever E. By the vibration of rod E one end of the roller B is moved obliquely each way out of its parallel position with the yarn beam. The rotation of the latter causes the presser roller not only to revolve, but to traverse alternately from one flange to the other of the yarn beam when moved obliquely in reverse position.

2662. MANUFACTURE OF HATS, *J. Taylor.—Dated 29th July*, 1880.—*(Not proceeded with.)* 2d.

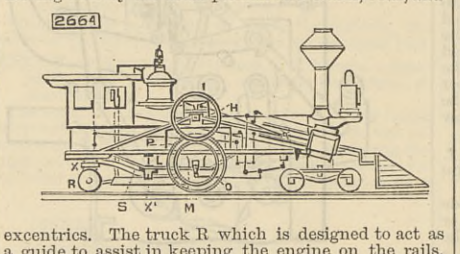
This relates partly to the construction of a block to be used on the lathe and setting frames of hat-making machinery, whereby the necessity of having different blocks to suit different shapes and sizes is obviated.

2663. BOOKBINDERS' BLOCKING PRESSES, *A. W. Brecknall.—Dated 29th June*, 1880.—*(Not proceeded with.)* 2d.

The top plate on which the cover is laid to take the impression is made to slide forward on rods which also act as guides. It also has sides attached to it to keep it in line with the under plate. These sides are prolonged at the back, and form bearings for inking rollers. When the cover is laid in position on the plate, and the plate pushed in—by means of a handle attached to the front—to take the impression, the rollers attached thereto protrude at the back and impinge on an iron ink-distributing cylinder or drum, which is caused to revolve as the hand lever is brought down to give the impression by being connected by means of levers and a rack and pinion, or other suitable mechanism, to such hand lever.

2664. LOCOMOTIVE ENGINES, *W. R. Lake.—Dated 29th June*, 1880.—*(A communication from E. Fontaine.)* 6d.

Driving wheels I are provided which are not in direct contact with the rails, but which are placed above and transmit motion to wheels L on the rails. This wheel is provided with two treads or bearing surfaces, one of which O runs upon the rail, while the other tread P projects from the face of the wheel L and is designed to gear with the driver or driving wheel I. The steam cylinder and the valve chest are connected to the driving axle by the usual pitman and crank, rods, and



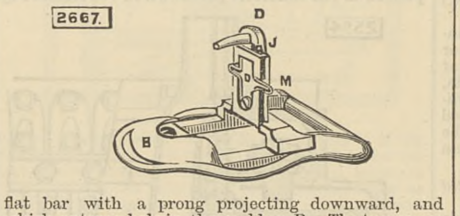
excentrics. The truck R which is designed to act as a guide to assist in keeping the engine on the rails, is supplied with elastic bearings X, and the equiliser S is also provided with an elastic bearing X[1], so arranged that the weight of that portion of the locomotive which is supported by the front truck is thrown upon the axle H and driving wheels L, and transmitted through the said wheel L to the rails.

2665. CASINGS FOR UNDERGROUND TELEGRAPH WIRES, &c., *W. R. Lake.—Dated 29th June*, 1880.—*(A communication from R. B. Lamb.)* 6d.

This consists of blocks of terra-cotta or other suitable material, having one or more passages or channels lined with india-rubber, or equivalent material.

2667. HARNESS BUCKLES, *A. M. Clark.—Dated 29th June*, 1880.—*(A communication from J. A. Gavitt and W. W. Gardner.)* 6d.

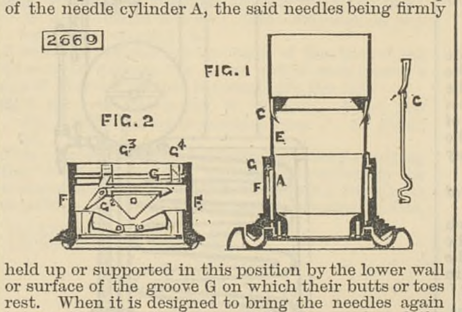
The frame of the buckle is cast in one piece, and consists of side, end, and cross bars to which latter the tongue D is hinged. This tongue is a straight



flat bar with a prong projecting downward, and which enters a hole in the end bar B. The tug passes between the front cross bars and over the rear bar. The tongue is held closed by a spring catch J, formed of coiled wire, the ends of which spring into recesses in the top bar B, and are released by pressing on the side loops M.

2669. STOCKINGS, &c., *H. J. Griswold.—Dated 1st July*, 1879. 1s.

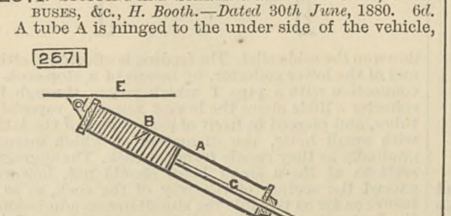
Fig. 1 is a vertical transverse section through the cam ring and needle cylinder of a machine and shows one form of transfer device in position for transferring the web from the same to the needles. Fig. 2 is a vertical transverse section of the said cam ring, showing the arrangement of the cams and grooves for bringing the needles all into one plane. In the top of the cam ring F is constructed an auxiliary groove G which has a portion or portions of its lower wall cut away. In combination with this groove is arranged a pivotted cam G[2] and a switch cam G[3] which, when in the position shown in Fig. 2, serves to shunt all the needles E at the proper time into the said auxiliary groove, the hooks of the said needles being thereby all brought into one plane or level with each other above the top of the needle cylinder A, the said needles being firmly



held up or supported in this position by the lower wall or surface of the groove G on which their butts or toes rest. When it is designed to bring the needles again into action a switch cam G[4] is depressed and the pivotted cam G[2] is raised. Having looped the ribbed top upon the quills C of the transfer frame and ravelled off the surplus rows of yarn, the transfer frame is placed upon the machine in such a manner that the hook of each needle is embraced or enclosed by one of the said quills C. In ordinary cases when the transfer device is lifted the web will remain on the needles, but if necessary the web may be pushed down by means of a circular comb, or drawn down by hand.

2671. STOPPING AND STARTING TRAMWAY CARS, OMNIBUSES, &c., *H. Booth.—Dated 30th June*, 1880. 6d.

A tube A is hinged to the under side of the vehicle,



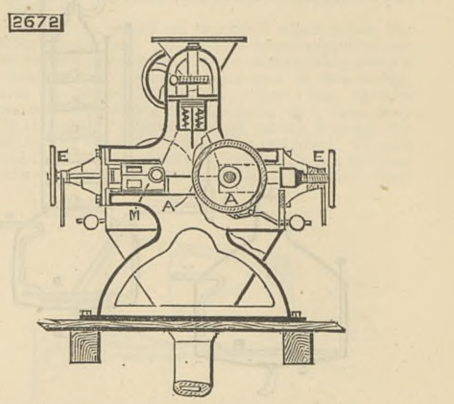
and contains a spiral spring B, the lower end of which bears against a collar on a steel rod C. The lower end of this rod projects through the end of the tube, and its pointed end bears on the road, when it is lowered for this purpose. Should the vehicle be stopped in ascending an incline, the weight of the car will compress the spring, so that when the vehicle starts again the spring will exert a pressure, and thereby assist in propelling the vehicle.

2670. BOTTLES FOR CARRYING MESSAGES AT SEA, *G. C. Pulford.—Dated 30th June*, 1880.—*(Not proceeded with.)* 2d.

The bottle is constructed of india-rubber or water-proofed canvas, or a combination of both.

2672. ROLLER MILLS, *C. Pieper.—Dated 30th June*, 1880.—*(A communication from M. Martin.)* 6d.

The rollers A A revolve by their journals in bearings M, which are either capable of sliding in horizontal guides formed by the frame of the machine, or which



are made movable in any suitable manner; springs composed in the style of carriage springs press on the bearings. The tension of these springs, and, consequently, the pressure of the rollers against each other, can be regulated by the screws E.

2675. SPINNING AND DOUBLING COTTON, &c., *E. Hird.—Dated 30th June*, 1880.—*(Not proceeded with.)* 2d.

A stationary tube or bolster is fixed in the footstep rail, at the top of which is fixed a bush of suitable material to act as a bearer to the spindle, the bottom of the tube being prepared to receive the bottom end of vertical spindle, and forms the footstep.

2677. SWEEPING FLOORS AND CARPETS, *G. H. Ellis.—Dated 30th June*, 1880.—*(Not proceeded with.)* 2d.

An oblong flat case or box, open at the bottom, is made to run on rollers, and within this is formed a circular recess. Into this recess is disposed horizontally a series of arms, upon which sweepers are fixed, formed of pieces of leather or other suitable material, one side being cut into fringes.

2678. TILLING LAND, *T. R. H. Fiskin.—Dated 30th June*, 1880.—*(Not proceeded with.)* 2d.

This consists in apparatus for enabling power to be more efficiently and simply conveyed from the engine or other source of power to ploughs or other cultivating implements, and to anchors used in connection therewith.

2679. WATER METERS, *R. Schloesser.—Dated 30th June*, 1880.—*(A communication from Messrs Dreyer, Rosenkranz, and Droop.)—(Not proceeded with.)* 2d.

This consists principally of a circular shallow vessel in which is placed centrally a vertical spindle, which is so mounted as to be capable of revolving, and which is provided with six horizontal arms. Three of these arms carry small wings or vanes, and as water flows through the vessel, in passing from the inlet to the outlet, the fluid pressure carries these vanes with it like floating bodies, and the other three form stops between the inlet and outlet passages.

2681. MANUFACTURE OF YARN, *W. R. Lake.—Dated 30th June*, 1880.—*(A communication from J. Riessberger.)* 4d.

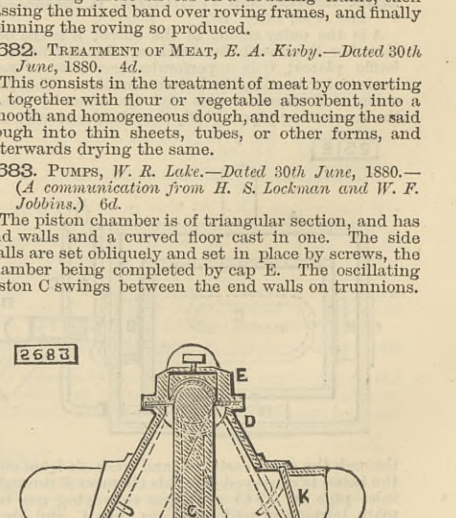
This consists in the process of making mixed yarn by forming separate slivers of worsted and of cotton, then mixing these slivers on a doubling frame, then passing the mixed band over roving frames, and finally spinning the roving so produced.

2682. TREATMENT OF MEAT, *E. A. Kirby.—Dated 30th June*, 1880. 4d.

This consists in the treatment of meat by converting it, together with flour or vegetable absorbent, into a smooth and homogeneous dough, and reducing the said dough into thin sheets, tubes, or other forms, and afterwards drying the same.

2683. PUMPS, *W. R. Lake.—Dated 30th June*, 1880.—*(A communication from H. S. Lockman and W. F. Jobbins.)* 6d.

The piston chamber is of triangular section, and has end walls and a curved floor cast in one. The side walls are set obliquely and set in place by screws, the chamber being completed by cap E. The oscillating piston C swings between the end walls on trunnions.



Motion is imparted to the piston by a lever or other suitable means. The water is admitted alternately to first one then the other side of the piston by the tube D fitted with suitable valves, and a discharge pipe fitted with similar valves also communicates with both sides of the piston, so that the water is admitted and discharged from first one and then the other side of the piston alternately.

2684. MEASURING STOPPERS FOR BOTTLES, &c., *F. N. Mackay and A. E. Weston.—Dated 1st July*, 1880.—*(Not proceeded with.)* 2d.

The stopper has an internal hole partly blocked at the bottom, and into which is fixed a suitable tube of sufficient capacity to contain one dose, or required quantity of the substance, and which is also partly blocked at the bottom, so that by partially rotating the interior tube on its axis the two openings are brought together, and a free communication is obtained from the bottle into the tube or measure. By rotating the tube in the opposite direction the quantity required is shut off, and by removing a suitable stopper or valve, or other device, at the mouth or top of the measure the substance is free to flow away or be discharged as may be required.

2685. WINDOW CURTAINS AND BLINDS, *E. Hooke.—Dated 1st July*, 1880.—*(Not proceeded with.)* 2d.

This relates to method of making up and mounting window curtains, blinds, or screens made of paper and other materials.

2686. HOBBY OR TOY HORSES, *S. Loebl.—Dated 1st July*, 1880.—*(Not proceeded with.)* 2d.

Between the fore legs is placed a guiding wheel, which is mounted on a forked rod suitably supported and passing through the neck and fore quarters of the horse. This rod, which is free to rotate so as to cause the guiding or steering wheel to turn, terminates at its upper end in a cross bar, whose outer ends are provided with reins, which on being pulled to the right or left impart a corresponding movement to and actuate the said guiding or steering wheel.

2687. SWEEPING CHIMNEYS, *W. Ross.—Dated 1st July*, 1880. 2d.

A sheave is fixed on the top of the chimney and a wire connects the sheave and the fireplate having loops for attaching the brush. An iron rod is fixed on the fire-grate by means of a screw clasp which grips the bar, and turning the screw firmly secures the rod to the grate. This rod is sufficiently long to admit of an arm sliding upwards or downwards at the will of the operator, and has a screw to secure it when in the required position. The arm has a horizontal spindle with a handle for the purpose of turning it. It has also on the opposite end to the handle a V sheave securely fixed on it. The wire is placed in the V sheave and the arm is pressed tightly down and secured, and the handle is turned and the brush ascends to the top.

2688. PIPES FOR SMOKING, *J. McDonald.—Dated 1st July*, 1880.—(*Not proceeded with.*) 2d.

The bowl is preferably made of vulcanite, in which is placed a removable or separable lining by preference of burned clay, which is perforated near its bottom, and has such a shape that it fits tightly in the interior of the bowl, excepting at its bottom, a space being left between the bottom of the lining and the bottom of the bowl to form a small chamber, which is in communication with the stem of the pipe.

2690. TELEGRAPH WIRES, &c., *C. Moseley, W. F. Bottomley, and W. E. Heys.—Dated 1st July*, 1880. 6d.

Fig. 1 shows in elevation, and Fig. 2 in plan, the method adopted in erecting a line. The poles are

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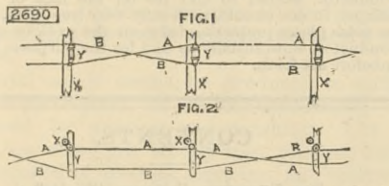

marked X, and the arms are marked Y; A and B the wires constituting the metallic circuit. The insulators are placed one above and one below the arm, two to each arm.

2691. OIL-CANS, *J. Heselwood and H. Webster.—Dated 1st July*, 1880. 6d.

The object of this can is to prevent waste, for which purpose at the base of the spout is a valve seating with a hole larger in diameter than the rod C, which passes through it and carries two valves D. The spindle

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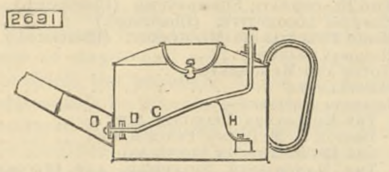

passes out and is fitted with a button near the handle of the can. The outer valve is kept against the outer side of the seating by the spring H. By pressing the button the outer valve is removed from the seating, allowing oil to flow through the opening; but if pressed too far the inner valve closes this opening and prevents the flow of the oil.

2692. SEPARATION OF POTATOES, *D. Bragg.—Dated 1st July*, 1880.—(*Not proceeded with.*) 2d.

Two oscillating screens are employed fitted with strong wire riddles, and worked from the same shaft by two excentrics, one for each shaker.

2694. COLOUR BOX AND PALETTE, *R. Spear.—Dated 1st July*, 1880.—(*A communication from Spear and Bergmann.*)—(*Not proceeded with.*) 2d.

A suitable slab is employed with depressions to receive the saucers and brushes. To outside of the slab is hinged the lid, and to the other side is hinged a handle provided with an elliptical hole through which to pass the thumb.

2696. DIFFERENTIAL SCREW DEVICES FOR FASTENING OR ADJUSTING, *J. Hastie.—Dated 1st July*, 1880. 6d.

In one arrangement two nuts A and B are employed, one of which (A) is formed with an internal screw thread to screw upon a bolt C or upon a stud, spindle,

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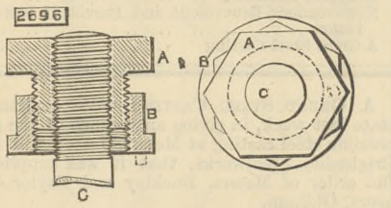

or rod, and with an external screw thread to screw into the other nut B, which latter is formed with an internal screw thread to fit the external one of the first nut A.

2697. PARING THE BRIMS OF HATS, *F. and F. Cree.—Dated 1st July*, 1880. 4d.

Upon turning the shaft B round by means of the handle D, the bowl E will revolve, and cause the hat to turn round against the curved guide plate I, whilst

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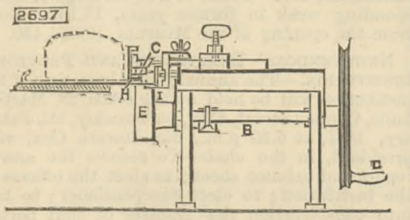

a stationary knife G will pare the inner edge of the curl as it revolves, the pressing plate H holding the brim down and preventing the knife from cutting through the same.

2698. CUTTING KNITTED FABRICS, *H. A. Martin.—Dated 1st July*, 1880.—(*Not proceeded with.*) 2d.

This consists in knitting the fabric without omitting the loop, but in knitting the said fabric perfectly cylindrical without a blank or space, and in cutting the same at an oblique angle to the bottom of the fabric, so that when opened out the twills shall be at an angle to the outside edges. The fabric may be cut by inserting a flat board within the cylindrical fabric, and in cutting the fabric from corner to corner of the board.

2699. HOSE OR SOCKS, *W. J. Ford.—Dated 1st July*, 1880.—(*Not proceeded with.*) 2d.

A seamless leg-piece is first produced upon a circular frame. This leg-piece, having been completed so far as the instep, is removed from the needles, and is taken to another circular frame of smaller size, suitable to produce a seamless foot. In placing the work upon the second circular machine, the loops of the instep part only of the leg-piece are run upon the needles, so that on the completion of the seamless foot the work consists of two seamless tubes of different diameter connected in front or at the instep, but separated behind or where the heel is to be worked. The heel is afterwards produced in a separate frame, the loops remaining at the bottom of the leg-piece, being run on to the needles of this frame. Toe-pieces are also, in like manner, worked upon the end of the seamless foot, and these are joined up to close in the foot.

2701. TUNS, CASKS, OR BARRELS, *L. A. Groth.—Dated 1st July*, 1880.—(*A communication from Dr. C. Stahlschmidt.*)—(*Not proceeded with.*) 2d.

The staves of the barrels, if old, are scraped and cleaned up; or on the other hand, the new wood is subjected to a heating treatment interiorly, either by means of fire directly or by hot air, until the outsides of the staves are warm to the hand. Melted paraffine is then to be cast in or poured over the casks, the warmed wood whereof will readily absorb the paraffine, which will fill cleanly into the grooves.

2702. FINGER GUIDES FOR TYPE-WRITING MACHINES, *A. M. Clark.—Dated 1st July*, 1880.—(*A communication from A. M. Da Costa.*) 6d.

The key-board is provided with guides for the fingers, so that the keys may be instantaneously found without the aid of sight, for which purpose one or more longitudinal bars and one or more transverse bars are

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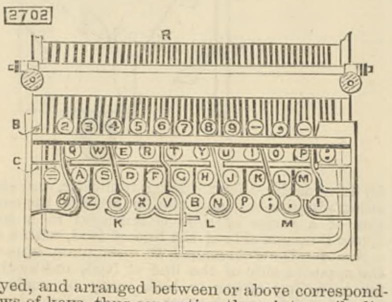

employed, and arranged between or above corresponding rows of keys, thus separating them into easily distinguishable sets, and the former also serve as guides, along which the fingers are passed to find and reach different keys. In the drawing B and C are the longitudinal bars and K L M the transverse bars. The projections R divide the numerals into groups.

2704. TRIMMING SHIPS' CARGOES OF GRAIN, &c., *W. S. Brice.—Dated 2nd July*, 1880. 6d.

This consists in a shovel A, preferably in the shape of a rectangular board. To this board is attached a rope B at right angles, fastened at or near each of the

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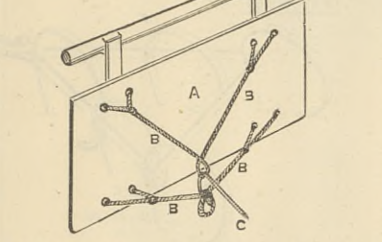

corners of the shovel blade. To the back of and above the shovel blade, by means of two strong supports, is arranged a handle by which to actuate or guide the shovel. C is a hauling rope.

2706. SNOW, *F. N. Mackay.—Dated 2nd July*, 1880. 6d.

One method of manufacturing snow consists in the use of the apparatus shown at Fig. 1, and consisting of a chamber round which the refrigerating fluid circulates and maintains a temperature within the chamber below freezing point. A perforated tube 4 conveys water at about 35 deg. F. to the chamber 1, which it enters in jets of spray, and becoming frozen falls as snow on the door 6. Another method consists of a drum rotating in the liquid to be frozen, and through

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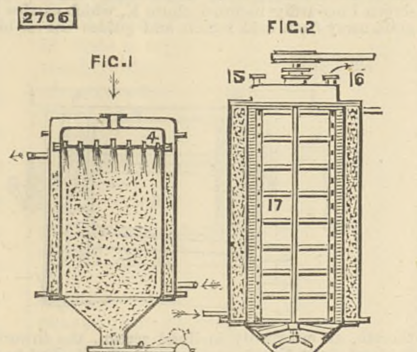

which the refrigerating liquid circulates, so that ice is formed on the drum, and is removed in the form of snow by a scraper resting on the periphery of the drum. A third method shown at Fig. 2 consists of cylinder 1, round which the refrigerating fluid circulates. Air containing moisture is caused to enter and leave chamber 1 by the openings 15 and 16, such moisture being deposited on the sides of the chamber in the form of snow as the air passes through it, and is removed by a rotating brush 17, and falls on the door 6 at the bottom.

2707. CLEANING AND POLISHING TABLE KNIVES, &c., *J. Pinchbeck.—Dated 2nd July*, 1880.—(*Not proceeded with.*) 2d.

In a piece of wood a recess is worked to receive a pad of vulcanised india-rubber. On each side of this pad is fixed a C spring, and on the top limbs of the springs bearings are fixed, which form part of the sides of the hopper into which the cleaning powder is placed. In these bearings revolve a spindle upon which a roller of vulcanised india-rubber or other suitable substance is fixed, and at the extremity a crank handle, by which motion is imparted to the roller.

2708. OPERATING RAILWAY BRAKES, *A. W. Pigott.—Dated 2nd July*, 1880.—(*Not proceeded with.*) 2d.

Water or other fluids is used to act on pistons or rams, and such fluid is brought into operation by means of pumps operated by the axles of the bearing wheels, the direction of flow of the liquid being effected by a valve capable of being shifted by excentric or otherwise, so as to cause its pulley to be held in contact with that on the axle of the bearing wheels, or withdrawn therefrom.

2712. REPAIRING AFTER-PART OF SCREW STEAMERS, &c., WITHOUT USE OF DRY DOCKS, *H. Hornby.—Dated 2nd July*, 1880.—(*Not proceeded with.*) 2d.

A chamber is constructed, which may be called a partial floating dock, open at one end, and wide enough to let the largest screw propeller pass, for which it is intended, while the length is sufficient to reach with the open end some distance beyond the screw propeller, and leave some working space behind the ship.

2713. RAISING SUNKEN VESSELS, *D. W. Sargent.—Dated 2nd July*, 1880.—(*Not proceeded with.*) 2d.

This consists in employing levers fixed on a floating vessel, ropes being passed over the levers and attached to the sunken vessel and worked by a windlass.

2709. TOOLS FOR CUTTING TUBES OR PIPES, *S. Buckley.—Dated 2nd July*, 1880. 6d.

This invention consists principally in combining with the tube cutter a small adjustable tool D which projects inwards through the claw B, its cutting edge

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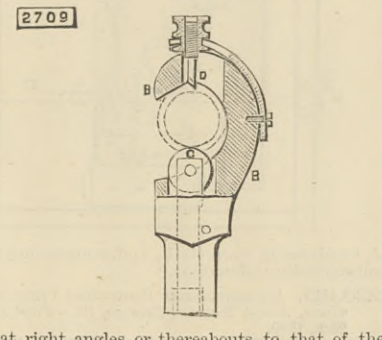

being at right angles or thereabouts to that of the cutting disc C, so that as the cutting proceeds this tool D removes the burr as fast as it is thrown up the cutting disc or discs.

2716. REVOLVING OR ENDLESS TRAVELLING RAILWAYS, *J. A. Mays.—Dated 2nd July*, 1880.—(*Not proceeded with.*) 2d.

This relates to improvements on patent No. 4109, dated 16th October, 1878. For the purpose of diminishing the noise which arises when the rail at the rear of the wheel strikes against the rear face or periphery of the wheel on being lifted from a horizontal to a vertical position, it is proposed that the blow shall be taken by suitably constructed springs or buffers, placed either upon the wheel itself or upon the rails or other parts of the revolving railway, or upon some part of the vehicle.

2719. MATERIALS FOR CLARIFYING SUGAR, OILS, &c., *C. G. Pfander.—Dated 2nd July*, 1880. 2d.

This consists in the employment of charcoal saturated with blood, and suitably dried.

2721. SUBSTITUTE FOR EYES OR EYELETS OF BOOTS, &c., *B. J. B. Mills.—Dated 2nd July*, 1880.—(*A communication from C. Varlot.*)—(*Not proceeded with.*) 4d.

This consists of a metal loop or bridge piece eyeletted or otherwise rivetted or fastened to the article.

2723. ADJUSTING SPRINGS FOR DOORS, &c., *M. Stobbs.—Dated 3rd July*, 1880. 6d.

In the top end of the spring a block or solid piece A is secured, in which two holes $A^1 A^1$ traversing each other at right angles, are made for the purpose of inserting a small rod or key to act as a lever for turning

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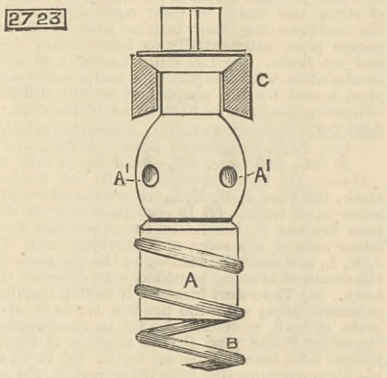

or twisting the spring B. The block or solid piece A is formed cylindrical, and is passed through a collar C cast or formed upon a plate, which is secured to the door or the door jamb. The spring is retained at the bottom on a pivot pin passed through a solid block to which the spring is secured.

2728. PUMPS, *A. M. Clark.—Dated 3rd July*, 1880.—(*A communication from E. Leprohon.*) 4d.

This relates to cast iron pumps, and has for its object to enable the water above and below the foot valve and in the suction pipe to be run off to avoid the bursting of the pump by frost. A is the barrel, B the

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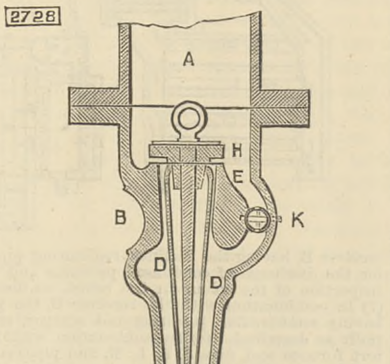

tail piece, with a bye-way H for running off the water controlled by a cock K. The valve seat E is cast in one with the tail piece, and the valve is fitted therein, and consists of a boss with a central stem and three or more equidistant rods D converging and united to a pointed weight F. The frame thus formed serves to guide the valve.

2746. SHEEP-SHEARS, *W. E. Gedge.—Dated 5th July*, 1880.—(*A communication from J. Corey and N. W. Spaulding.*) 6d.

A A are the blades of a pair of shears, and B is the connecting curved or bow spring, which unites the rear ends of the shanks C. A curved or U-shaped spring D is secured between the shanks. The ends of this spring are bent outward so that they may be

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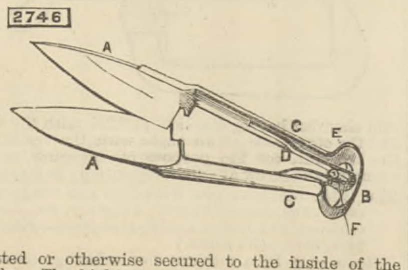

rivetted or otherwise secured to the inside of the shanks. The bight or curve E of the spring which unites the parallel sides D is carried back into the bow. Between the parallel sides D of the spring is placed a fulcrum F, which may be moved from the curve E to the opposite end, and fixed at any desired point.

2766. STEERING VESSELS, *T. Glover, jun.—Dated 6th July*, 1880. 6d.

This relates to the method of transmitting the power from the bridge steering apparatus to the tiller of the rudder, and consists of doubling the purchase block by means of a block with a traveller attached to the

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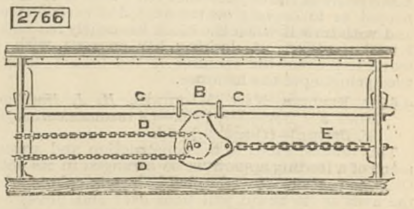

top of it. A is the purchase block attached to the traveller B, sliding freely on bar C, accordingly as the tension upon the chain D to wheel amidships is increased or relieved by the action of the steering wheel. E is the chain to the tiller.

2820. PROTECTORS FOR THE SOLES AND HEELS OF BOOTS AND SHOES, &c., *C. H. Pugh.—Dated 9th July*, 1880. 6d.

This consists in constructing studs or protectors of metallic frames containing reticulations or openings for the reception of pieces of leather, wood, or other hard and durable material in combination with countersunk holes in the said metallic frames for the purpose of receiving the heads of fixing screws or nails.

2615. MANUFACTURING FANCY YARNS, *J. Law and W. and T. Kitchin.—Dated 26th June*, 1880.—(*Not proceeded with.*) 2d.

This relates to improvements on patent No. 4703, A.D. 1879. In addition to the forward motion an intermittent lateral motion is imparted to the frame and apparatus, so that the several coloured slubbing from which the "knobs" are made will be changed in position in relation to the doffer, and various coloured deposits of slubbing will be rubbed upon and incorporated with each finished slubbing of yarn.

2659. CONNECTIONS OF LAMPS, &c., *A. Clark.—Dated 29th June*, 1880.—(*Not proceeded with.*) 2d.

This consists in the construction and combination of parts for connecting the reservoirs of oil and spirit lamps, flower vases, centre pieces, and other articles, to their pillars or stands, and for connecting the burners of oil and spirit lamps to their reservoirs.

2879. FOUNTAIN OR RESERVOIR PENS, *W. R. Lake. Dated 12th July*, 1880.—(*A communication from A. T. Cross.*)—(*Complete.*) 6d.

This consists partly of an ink delivering tube of small diameter in combination with an enclosed tube clearing spindle provided with means, extending through an enclosing tube to the upper portion of the ink reservoir, for drawing it upward or backward against the downward action of a spring.

3226. CLIPPING SEALSKINS, *L. A. Groth.—Dated 6th August*, 1880.—(*A communication from F. F. and G. Cimiotti.*) 6d.

This consists of a knife-edged bar, over which the sealskin is tightly stretched, and intermittently fed by means of winding and unwinding rollers C C_1. The narrow portion or strip of the skin directly over the knife edge is exposed to a vertical blast of air

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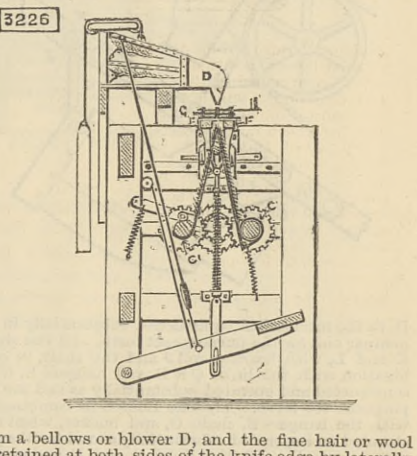


from a bellows or blower D, and the fine hair or wool is retained at both sides of the knife edge by laterally movable guard-combs F. The stiff bristles projecting through and above the combs are then clipped off by horizontal knives or shears G arranged above the combs.

3377. MANUFACTURE OF SHEETS OF INDIA-RUBBER, *D. Gaussen.—Dated 19th August*, 1880. 6d.

This consists in corrugating, fluting, or arching the material on both sides and also in uniting the corrugated sheets to produce cylinders or tubes.

3500. CLOSING OR FASTENING GLOVES, *J. Tréfousse.—Dated 28th August*, 1880. 6d.

This consists in closing or fastening gloves by means of nippers or pincers throughout their length, and on either side of the glove opening, the said pincers being made from a metal piece folded in two for forming surfaces more apart at the mouth than at the bottom, so as to allow of the ready introduction of and nipping or catching of the lace serving to close the glove.

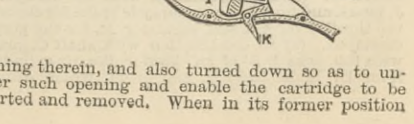
3761. HEAVY GUNS, *J. B. Howell.—Dated 16th September*, 1880. 2d.

An ingot is cast which may be hollow or solid, to form the barrel or tube, and is subjected to the action of a hammer, squeezer, or similar compressing apparatus. The block or tube is then reheated and when at a sufficient heat to liquefy a flux, borax, or other suitable flux is applied to the surface of the block or tube, and it is at once placed in a prepared mould. A quantity of molten fluid steel is then run round it sufficient to produce the thickness required at this stage of the process, and which welds and becomes perfectly combined with the metal of the block; this is again subjected to the action of the hammer or squeezer, and again placed in the furnace. These operations are repeated until the desired size is attained, the block being afterwards bored and finished in the usual manner.

4412. BREECH-LOADING FIRE-ARMS, *A. J. Boult.—Dated 28th October*, 1880.—(*A communication from H. P. Houghton.*)—(*Complete.*) 6d.

Pivotted at its lower end within the stock is a breech block D, which is capable of being turned against the rear end of the barrel, so as to close the

4412

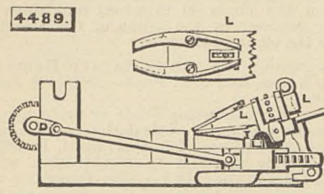


opening therein, and also turned down so as to uncover such opening and enable the cartridge to be inserted and removed. When in its former position the block is locked by the piece E, provided with a lug by which it is worked, and a spring to keep it in its locked position. The hammer F is pivotted at the same point as the block D, and is thrown forward by a flat spring G secured at its front end to the barrel, and at its rear end by a bridle to a lug on the hammer. The hammer is cocked by the downward movement of the block and locking piece; a pawl forming part of the sear I retains the hammer in its cocked position, and is released by a trigger K which acts on the sear. L is the extractor pivotted at the same point as the breech block, to which it is so connected as to operate on the exploded cartridge case and withdraw it when the block has nearly reached its lowest position. A locking bar engages with the sear I to prevent the opening of the breech block or the springing of the hammer.

4489. FEEDING NAIL MACHINES, *H. J. Haddan.—Dated 3rd November, 1880.—(A communication from W. Briggs.)—(Complete.)* 6d.

This relates, First, to the construction and arrangement of a feeding apparatus so arranged in its action that the parts employed to hold the plate from which the nails ar· to be cut will turn over and present the plate to be cut, and then remain stationary a sufficient

4489.



amount of time for the operation of cutting to be fully performed, when it again turns over and acts in a similar way. The second part consists in the construction and arrangement of the jaws employed for holding and guiding the said plate from which the nails are cut. The first part consists in the combination with the barrel L of a rack or similar device for revolving said barrel operated by a crank I, which is in turn operated by a crank D. The second Fig. shows a plan of the upper inclined surface of the rear part of the barrel L.

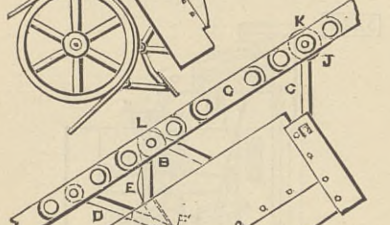
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

236,138. DREDGING BUCKET, *John A. Ball, Oakland, Cal.—Filed July 23rd, 1879.*

Brief.—The bucket has an externally-swinging bottom connected to the chain by two pairs of bars or links. One pair is pivotted to the chain concentrically with the bucket support; the other at a point further in the rear. In passing the straight portions of the course the bottom is thrown up against the bucket; but in passing round a pulley the curving of the chain throws the bottom back from the bucket and releases the contents thereof. *Claim.*—(1) The bucket, having he gate F attached to the link E, by which it is connected to the belts or chains and operated by the link

236.138

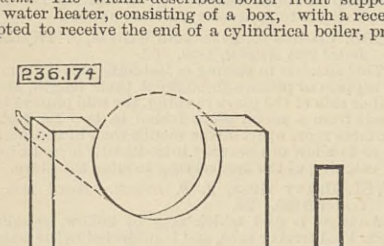


D, or the mechanical equivalents, substantially in the manner and for the purposes set forth. (2) The shafts K and L, with bearing roll J and the shaft, in combination with the links C E D and hangers B, when constructed and operated substantially as and for the purposes set forth. (3) The links C in combination with the hangers B, chain G, and bucket, when constructed and operated substantially as and for the purposes set forth. (4) The links D and E and gate F, when combined and operated as and for the purposes set forth. (5) The gate F, attached to the link E and operated in connection with the hangers B, connecting links C and D, and bucket, substantially as and for the purposes set forth.

236,174. BOILER FRONT, *Thomas H. Parvin and John Parvin, Carmi, Ill.—Filed May 13th, 1880.—(Model.)*

Claim.—The within-described boiler front support and water heater, consisting of a box, with a recess adapted to receive the end of a cylindrical boiler, pro-

236.174

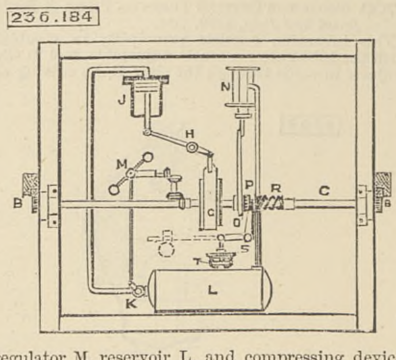


vided with fuel and ashpit openings, communicating with an inlet pipe and with the boiler, but detachable from the latter and from the walls of the fireplace, and constituting the front and supporting the end of the boiler, as set forth.

236,184. PNEUMATIC BRAKE FOR ELEVATORS, &c., *John H. J. Schmidt, Cincinnati, Ohio, assignor of one-half to Frank X. Oehler, same place.—Filed July 22nd, 1880.—(No model.)*

Claim.—(1) In combination with a pneumatic elevator brake, the driving shaft C, air compressor N, excentric O, shiftable clutch P, lever S, piston T, spring R, and receiver L, which receiver communicates with the cylinder for the purpose of permitting the compressed air to operate the piston T, as herein described. (2) In combination with the air cylinder J, pipe K and tank L of a pneumatic brake for elevators, the throttle valve K and regulator M, for the purpose described. (3) In combination with shaft C, gearing with the racks B B¹ of an elevator, the air cylinder J, lever H, brake band G, and drum, which drum is attached to said shaft, as herein explained. (4) The combination of driving shaft C, brake apparatus G H

236.184

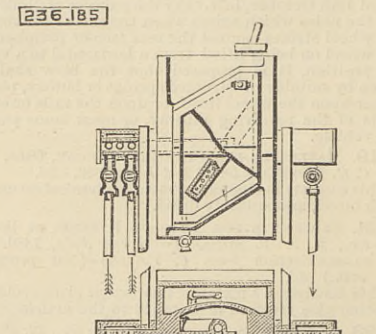


J, regulator M, reservoir L, and compressing devices substantially as described.

236,185. APPARATUS FOR PRODUCING CHILLED CASTINGS, *Joseph Seaman, Chicago, Ill.—Filed January 28th, 1880.*

Claim.—(1) The combination of the hollow chill block provided with journals, by which it is supported so as to be capable of rocking in its bearings, and the steam and water inlet pipes provided with cocks and communicating with the chill block, substantially as and for the purposes hereinbefore set forth. (2) The tubular journals, in connection with chill blocks, one

236.185

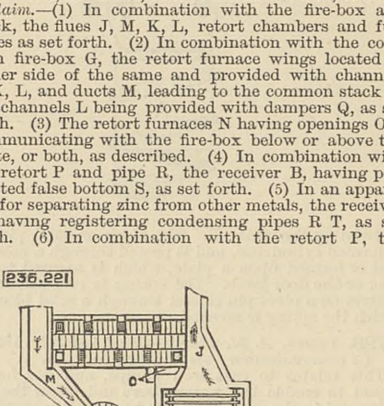


of which journals serves as an inlet pipe for the supply of steam and water, or their equivalents, as tempering mediums, the other tubular journal serves as an escape pipe, substantially as hereinbefore described and set forth. (3) The chill, having a chamber, in combination with a supply pipe and a perforated cross pipe, as and for the purpose of equally diffusing the tempering medium on to the face of the chill.

236,221. SPELTER FURNACE, *Albert Harnickell, Brooklyn, N.Y., assignor to George A. Pope and George B. Cole, Baltimore, Md.—Filed March 14th, 1879.*

Claim.—(1) In combination with the fire-box and stack, the flues J, M, K, L, retort chambers and furnaces as set forth. (2) In combination with the common fire-box G, the retort furnace wings located at either side of the same and provided with channels J, K, L, and ducts M, leading to the common stack E, the channels L being provided with dampers Q, as set forth. (3) The retort furnaces N having openings O O communicating with the fire-box below or above the grate, or both, as described. (4) In combination with the retort P and pipe R, the receiver B, having perforated false bottom S, as set forth. (5) In an apparatus for separating zinc from other metals, the receiver B, having registering condensing pipes R T, as set forth. (6) In combination with the retort P, the

236.221

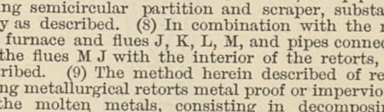


receiver B, having the inclined registering pipes R T for the discharge of condensed products and for the inspection of the colour in the retort, as described. (7) In combination with the receiver B, the pipe T, having semicircular partition and scraper, substantially as described. (8) In combination with the retort furnace and flues J, K, L, M, and pipes connecting the flues M J with the interior of the retorts, as described. (9) The method herein described of rendering metallurgical retorts metal proof or impervious to the molten metals, consisting in decomposing within the retorts a hydrocarbon gas, whereby the walls of the retorts become coated and impregnated with graphitic carbon, as set forth. (10) In an apparatus for the separation of zinc from other metals by distillation, a retort having its interior surface coated with graphitic carbon deposited from a hydrocarbon decomposed within the retort, as set forth.

236,239. CLAMP, *Edward L. Morris, Boston, Mass.—Filed May 21st, 1880.—(No model.)*

Claim.—In a clamp having bearing surfaces C D, between which articles are to be griped, the sliding wedge-shaped half-nut G, constructed to operate in connection with the screw B and the chamber E, the

236.239



said chamber having one side parallel with the screw and the other side at an angle with the screw to fit the half-nut, for the purpose of engaging or disengaging the screw at will, substantially as described.

236,245. MACHINE FOR REDUCING AND STRAIGHTENING TUBES, *Joshua Nuttall, Allegheny, Pa., assignor to himself and Joshua Rhodes, same place.—Filed July 24th, 1880.—(No model.)*

Claim.—(1) In a machine for reducing, rounding, and straightening pipes, tubes, and rods, a plurality or series of rolls arranged in close succession in a common frame on one side of the line of feed, said rolls having their axes parallel and all crossing the line of feed at other than a right angle, in combination with a set or series of like number of rolls arranged in similar succession in a common frame on the opposite side of the line of feed, the latter set or series also crossing the line of feed, but in a different direction from the first set or series, substantially as set forth.

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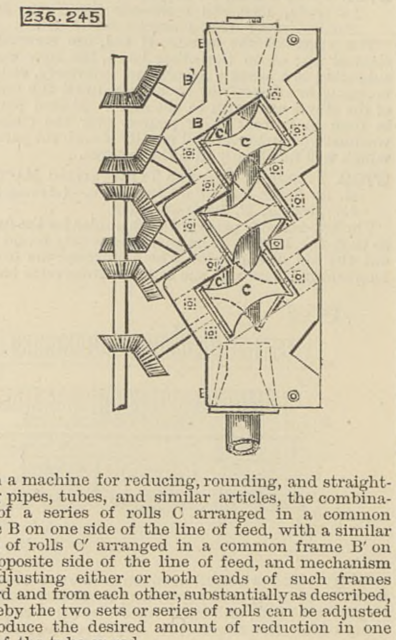
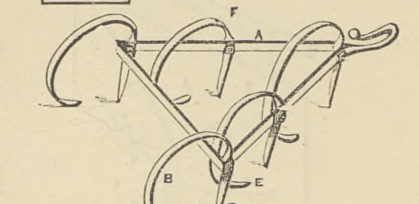


(2) In a machine for reducing, rounding, and straightening pipes, tubes, and similar articles, the combination of a series of rolls C arranged in a common frame B on one side of the line of feed, with a similar series of rolls C' arranged in a common frame B' on the opposite side of the line of feed, and mechanism for adjusting either or both ends of such frames toward and from each other, substantially as described, whereby the two sets or series of rolls can be adjusted to produce the desired amount of reduction in one pass of the tube or rod.

236,256. SPRING-TOOTH HARROW, *Oscar J. Punches, Plymouth, Mich.—Filed November 10th, 1880.—(No model.)*

Claim.—(1) A double harrow tooth formed of a bar of curved spring metal, with a rigid cutting tooth in front and a spring tooth in rear, substantially as described. (2) A double harrow tooth formed of a bar curved spring metal, with a rigid cutting tooth in front and a spring tooth in rear, the rigid cutting tooth being twisted so as to present its edge to the

236.256



flat portion of the spring tooth, substantially as described. (3) The curved double harrow tooth B, having the spring point C, twist perforated socket and rigid cutting teeth D with its plane perpendicular to the flat portion of the spring tooth E, substantially as described. (4) The combination, with a harrow frame A of the curved double harrow tooth B, having the spring point E, twist rigid cutting tooth D and pivotal bolt F, substantially as described.

236,269. GRAIN SEPARATOR, *Cyrus Smith, Canton, Ohio.—Filed July 7th, 1880.—(No model.)*

Claim.—In a winnower, the combination, with the fan of the vibrating shoe, constructed with the upper screen I inwardly inclined chute K, which carries the grain away from said screen and guides the air-blast

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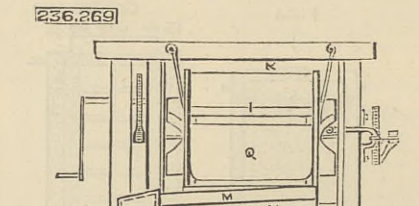
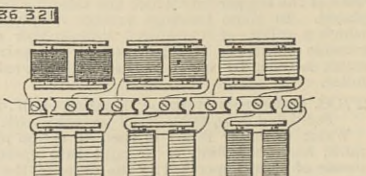


thereto, an outwardly inclined screen, the inwardly inclined chute N, the grain trough M attached to the rear of the shoe, and the shield or apron Q between the grain trough and the chute K, substantially as and for the purposes set forth.

236,321. DUPLEX TELEGRAPH, *Joseph E. Fenn, Elizabeth, N.J., assignor to the Western Union Telegraph Company, New York.—Filed October 28th, 1880.—(No model.)*

Claim.—(1) The combination, substantially as hereinbefore set forth, of a duplex telegraph apparatus and a main line, with a bar of soft iron having its ends so connected that it will form a closed magnetic circuit, and a coil or helix enveloping said bar, or a portion thereof, which coil is included in the main circuit at a point between the main line and the receiving instrument. (2) The combination, substantially as hereinbefore set forth, of two or more detached and independent cores or bars of soft iron, of equal, or substantially equally, magnetic length, and each forming a closed magnetic circuit surrounded by a series of helices having unlike numbers of con-

236.321

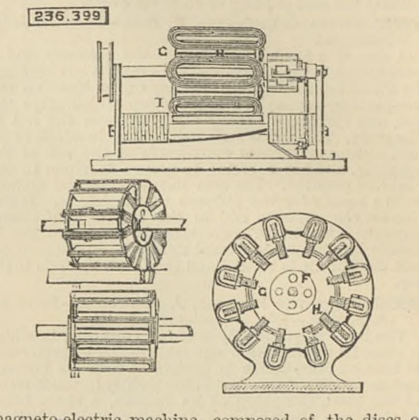


volutions respectively, and a commutator, whereby the helices surrounding any one or more of said independent cores or bars may be included in or cut out of a circuit. (3) The combination, substantially as hereinbefore set forth, of two or more detached and independent cores or bars of soft iron of different magnetic lengths, surrounded by a series of helices having an equal, or substantially equal, number of convolutions, and a commutator, whereby the helices surrounding any one of said independent cores or bars may be included in or cut out of the circuit.

236,399. MAGNETO-ELECTRIC MACHINE, *Alfred G. Holcombe, New York, and John N. Crandall, Norwich, Conn.—Filed January 23rd, 1880.*

Claim.—(1) A magneto-electric machine in which the whole induced conductor, wound to and fro longitudinally on a cylindrical armature, and having no pole pieces projecting between its sections, is in one circuit, with only two free ends, in combination with a series of field magnets, substantially as and for the purpose hereinbefore set forth. (2) The armature of a

236.399



magneto-electric machine, composed of the discs or rings G, with or without the brass hubs F and bars H, in combination with the conductor I, wound longitudinally to and fro thereon and secured to the bars H, substantially as set forth. (3) An armature for a magneto-electric machine, composed of a magnetic cylinder, either solid or with interstices, having a conductor wound to and fro on the face or faces thereof, in one circuit, with only two free ends, with no poles pieces projecting between the sections of the conductor, substantially as and for the purposes hereinbefore set forth.

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A GREAT STEEL CASTING.—We omitted to state last week, in giving an account of the great crucible steel casting at Messrs. Jessop and Sons' Brightside Steelworks, that it was supplied to the order of Messrs. Buckley and Taylor, engineers, Oldham.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Jan. 29th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 6681; mercantile marine, building materials, and other collections, 1856. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1073; mercantile marine, building materials, and other collections, 137. Total, 9747. Average of corresponding week in former years, 15,142. Total from the opening of the Museum, 19,666,430.

NEWSVENDORS' BENEVOLENT AND PROVIDENT INSTITUTION.—The annual general meeting of this institution will be held at the office, 28, Martin's Lane, Cannon-street, City, on Tuesday, 8th February, 1881, at 6.30 p.m., Mr. Horace Cox, vice-president, in the chair—To receive the annual report and balance sheet; to elect the officers of the institution; to elect one pensioner; to take into consideration the transfer of that portion of the capital of the society, now invested in consols, into such other security or securities as the meeting may direct; and other ordinary business.