THE MILLING EXHIBITION.

No. II.

IN this article we propose to consider further the leading features of the new middlings processes, and to point out by means of diagrams the action of the principal machines now used in high and middle grinding.

High grinding, as it is now called, originated in Vienna, and produces the largest quantity of pure white flour from the corn. Its principle is, as before stated, pulverising by successive operations, sometimes carried to a great number, and purifying from light particles at each stage. At first this was done by means of millstones set at a slight distance apart; the grain was then lightly rubbed and broken, the fluffy and branny particles being cracked off without being powdered. These were separated by various means, and the hard pieces of broken corn passed between a second set of stones, set rather closer together than the last, so as to break the corn still further, and separate more of the light particles; the hard particles were passed again through stones set still closer than the last, and so on, until at length a fine granulated middlings was obtained perfectly free from bran and germination, and this was ground to fine flour between millstones or smooth rollers. During these successive breaks a small quantity of flour was produced, and was taken off at various points in the process, kept separate, or mixed together as required. By these processes the Hungarian flour, remarkable for its whiteness and purity, was produced.

A further development of this process is the superseding of millstones by rollers; in the first instance the rollers were principally used for finishing the middlings, but after a time fluted rolls were found to be equally good, if not better, for breaking up the wheat from the whole grain, and now there are many mills using an entire plant of rollers without millstones. The rolls for the first breaks are made with coarse teeth, generally of chilled cast iron, or in some cases of hard porcelain, the successive breaks being made through rolls of increasing fineness of tooth, the middlings as before being finished through smooth rollers.

Middle grinding, sometimes called "gradual reduction," is a modification of the above, and generally consists of two stages—first, coarse grinding between stones, separating the light particles from the middlings, then finishing between millstones specially faced for the purpose. The term "gradual reduction," although applied technically to middle grinding, is not a very happy designation, and it equally well applies to "high grinding." The Americans, we believe, also term "middle grinding" the "new process."

Another process, rather different from either high or low grinding, but rather partaking of the nature of low grinding, is the following: First, crushing the whole grain between pairs of smooth rolls driven at the same speed; secondly, passing the product from these rolls through a machine called a dismembrator—somewhat similar to Carr's disintegrator—to separate the adhering particles from each other; thirdly, dressing through "centrifugals" and "purifiers" to separate flour and light particles, leaving the pure middlings to be finished through a further system of crushing rolls and dressing machines.

Many years ago we remember seeing a machine for taking the outer skin off the grain called a hulling machine, which consisted of a drum revolving on a vertical axis; around the drum a case of a slightly larger internal diameter; both drum and case were fitted with a great number of steel blades formed of ribbon steel, and placed alternately with pieces of cardboard. In the annexed diagram, Fig. 1, the lines represent the steel and the spaces the cardboard distance pieces, and the steel and cardboard are held into cast iron frames by suitable means. Thus forming a peculiar kind of scraping machine, the corn passed through this was decorticated or freed from its outer husk. A second machine used in conjunction with this was a roller mill with steel rollers, fluted by being screw-cut with a right and left many-threaded screw. The result of crossing the two threads being a series of prismoidal points, as shown in the diagram Fig. 2, these rollers were mounted

FIG. 1

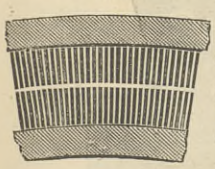
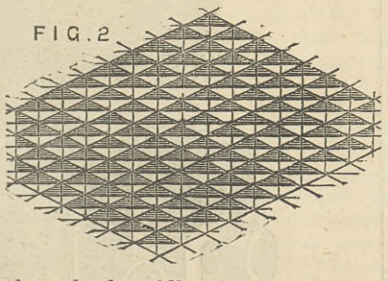


FIG. 2



on horizontal axes and revolved rapidly; the object was to reduce the wheat to coarse granules called semolina. We are not aware whether this apparatus was a success; but as it contains some of the elements of the new machinery, is therefore interesting. After passing through the rolls the semolina was ground to flour by stones of small diameter. These machines were first introduced into this country about twenty years ago by Mr. Buchholz, and were used in corn mills in Ipswich and a few other places.

We will now pass on to the more immediate object of this article, namely, the examination from a mechanical point of view of the principal machines used in the new processes and their action on the different materials of the grain, including only those which deal with the corn after it has been cleaned and received into the mill from the "smut house." A rough classification into divisions and subdivisions of the different machines will assist in explaining these actions and purposes.

CLASSIFICATION OF MACHINES.

First Division.—Granulating or breaking-up machines, which may be divided into and consist of: Millstones; fluted rolls; smooth crushing rolls; disintegrators.

Second Division.—Machines for fine grinding the granulated products of the first division consisting of: Millstones; smooth rolls.

Third Division.—Machines for separating the products of the first division, principally by size of particles, consisting of: Revolving reels, covered with wire of perforated metal; reciprocating sifters.

Fourth Division.—Machines for separating particles by weight, consisting of: Centrifugal machines; "purifiers," with air currents.

Fifth Division.—Machines for separating different particles of flour by re-dressing, consisting of: Centrifugals; revolving reels.

Sixth Division.—Machines for separating adhering particles from one another, comprising: Detachers; centrifugals; dismembrators.*

Seventh Division.—Miscellaneous machines for treating bran, &c.

First Division.—Breaking or granulating machines.

First Subdivision.—Millstones: Of these little need be said, as their construction and mounting are familiar to most of our readers. A few improvements, however, have been introduced with a view of rendering them more suitable for grinding middlings. These will be noticed in their proper place under the second division.

Second Subdivision.—Fluted rollers: Of these there are numerous varieties, and we will endeavour to explain their action by means of diagrams. They are made of porcelain and of chilled cast iron, the latter being the most used. The chilled iron rolls are constructed as follows:—After being cast in suitable "chills," they are mounted on truly-turned spindles, and are then ground to a cylindrical form by traversing emery wheels, the roll being revolved slowly on its own axis at the same time that the emery wheel, revolving rapidly, is traversed backwards and forwards along the whole length of the roll. After being ground up perfectly true, the rolls are fluted in a special kind of lathe. The tool, held in a suitable slide-rest, travels along the length of the roll, while the latter makes part of a revolution on its own axis, thus giving a slight twist to the flutes. This twisting of the flutes gives them more of a splitting action on wheat grains, and causes the machine to work more smoothly. The porcelain rolls are made in the form of hollow cylinders, about 2in. or 3in. thick, and are mounted on spindles by means of cast iron disc ends and through bolts. They are finished by turning with a diamond tool and grinding. We are not aware that the manufacture of porcelain rollers has been taken up in this country, of chilled iron rolls there are many makers. There are numerous forms of the teeth or flutes, the most important of which are shown in the diagram. For each of these forms of tooth special merit is claimed by the promoters; the best form, however, seems to be the ratchet type, shown in Fig. 3. The radial side of tooth on

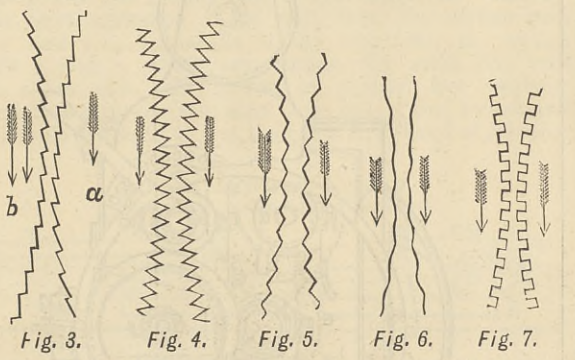
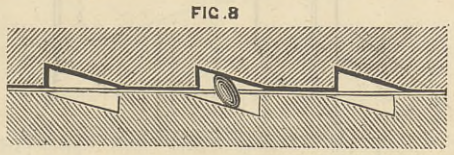


Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

the roll A, which revolves slower than the roll B, forms a sort of resting place for the grain for a moment, while the teeth of roll B, revolving much faster, splits the grain without any rubbing action. Some of the other forms of teeth made, as Figs. 6 and 7, would seem to give a bruising action rather than cutting or splitting. The action of the millstone is very different. The diagram, Fig. 8, represents

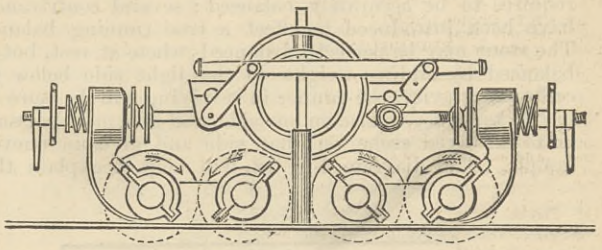
FIG. 8



a section through the furrows of a pair of millstones. It will be seen that in the former case, with the rolls, the grain is only acted on for a moment of time, and then falls quite away from any further action, but in the latter case the grain is forcibly broken, and then carried round by the revolving stone until it chances to get out at the circumference, being a much longer time in contact with the grinding surface. As the wheat is broken up finer by the successive breaks, the rolls are used with proportionately finer teeth, varying from eight to the inch for the first break to about thirty to the inch for the last break. The frames in which rolls and their driving and adjusting gear are mounted have received great attention from machinists, the object being in the framing for fluted rolls to have the bearing of one roll fixed, and the other so arranged that the movable roll can approach closely to the fixed one, but never to come in contact. A steady and slightly elastic pressure is also necessary, so as to give sufficient resistance to enable the grain to be thoroughly broken, but elastic enough to yield if any foreign body should find its way between the rolls, which would be damaged if rigidly fixed at a given distance apart. The rolls are sometimes arranged side by side horizontally, one or more pairs in a frame. Fig. 9 shows an arrangement in diagram of two pairs in one frame. The pressure is applied by means of levers and springs. Set screws or other suitable means are used between the bearings of the fixed and movable rolls, to enable the distance between them to be adjusted and to prevent actual contact of their toothed peripheries.

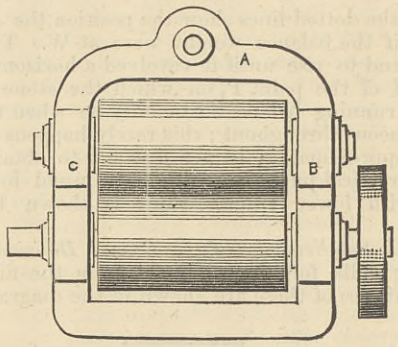
Third Subdivision.—Smooth crushing rolls: We only here refer to those used for the first crushing, not those used for middlings crushing or fine grinding. The smooth rolls for the first crushing do not appear to be in great variety; one good example may be taken. In this machine one roll is driven by a belt, and revolves in fixed bearings; the bearings of the other roll are carried in a massive cast iron frame; to the centre of this frame, A in Fig. 10, a strong and elastic pressure is applied by means

FIG. 9



of a spring and adjusting screw. The pressure of the periphery of this roll against the periphery of the other roll causes it to revolve at the same surface speed, thereby producing a simple crushing or bruising action without any rubbing. Fig. 10 shows a plan in diagram; the frame A B C is free to move on centre A; this allows the surface of the rolls to be kept in contact throughout their length, even if the bearings wear unequally. To avoid repetition

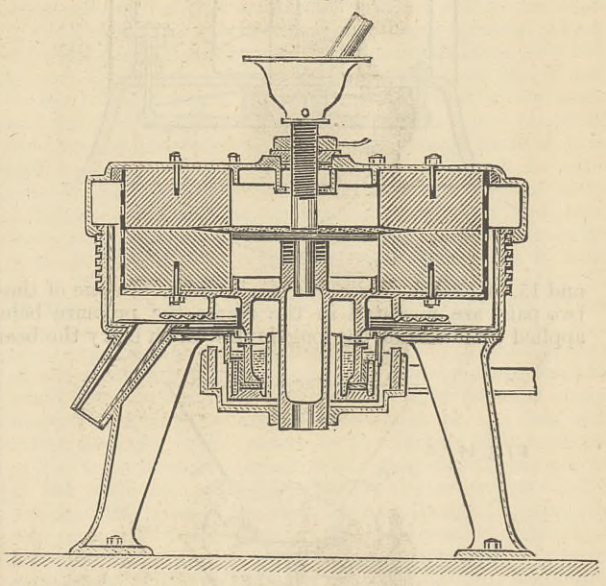
FIG. 10



we leave detailed explanation of the frames and adjusting gear; those will be more minutely described when we come to the smooth rolls under the second division.

Fourth Subdivision.—Disintegrators: Many varieties of these have been recommended for breaking up wheat and other materials. One of the well-known Carr's disintegrators has been much used, but we do not find that their use in modern milling is very prevalent; their high speed renders them somewhat wasteful of power. For disintegrating materials of a soft and tenacious nature they are very successful. One form of disintegrator, which seems to have been the parent of a good many others used with more or less success for disintegrating a variety of substances, from old boots, guano mixed with feathers, old bottles, &c., we remember seeing near Liverpool some years ago. It consisted of three cases mounted on a massive bedplate; in each case a disc fixed on a spindle with chilled cast blocks firmly bolted to its edge revolved rapidly. The internal circumference of each case was lined with chilled

FIG. 11



cast iron segments, corrugated when used for cereals. The materials were fed into the centre of the first case, broken up by being thrown by centrifugal force against chilled iron segments, and thrown out through pipes fixed near the circumference of the case into the centre of the next. The second disc, revolving more rapidly than the first, further broke up the substances, and passed them out at the circumference into the centre of the third case. Here the disc revolved still faster, and reduced the material to powder, ejected it with great velocity through pipes in the circumference into a long chamber with a hoppered side; here the coarsest particles settled by gravitation close to the entrance, the particles increasing in fineness towards the further end of the chamber; a worm and spouts at the bottom of the chamber enabled the material to be taken off at various points. This machine takes considerable power to drive it, but will powder almost any substance. Many modifications of this revolving disc have been made, but, as we have before said, do not seem to be received with much favour in high-class milling, except as detacheurs or dismembrators, and then they take more of the revolving cage form of the Carr's disintegrator type.

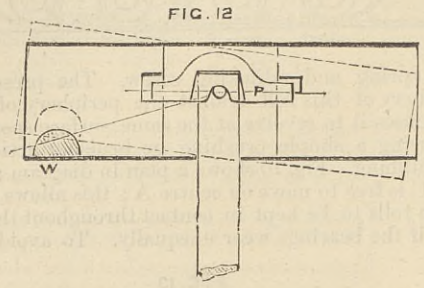
Second Division.—Machines for fine grinding the granulated products of the first division machines.

First Subdivision.—Millstones: For this purpose the stones used are mostly of small diameter dressed with

* This and one or two others are milling terms and not ours.

great care, and are constructed with either the upper or lower stone as the runner. Those with the upper stone as runner are of the usual types, too well known to need explanation. Fig. 11 is an example with the lower stone runner, and in this form the stone is fixed rigidly to the spindle. More often the stone is driven so as to be free from the spindle to all but its rotary motion. It then requires to be accurately balanced; several contrivances have been introduced to effect a true running balance. The stone may be perfectly balanced when at rest, but if balanced by adding weight to the light side below its centre of gravity, the runner in revolving will be sure to have a tendency to rise on one side, and give more pressure on to the fixed stone on that side and give an uneven sample. The diagram Fig. 12 will help to explain this

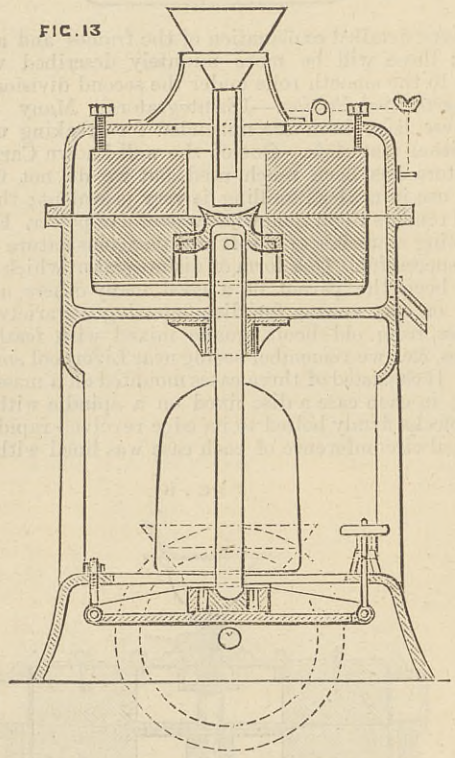
FIG. 12



action; the dotted lines show the position the stone would assume if the balance weight were at W. The point W would tend to rise until it revolved a horizontal plane at the level of the point P, on which the stone is centred. Perfect running balances can only be when the stone is homogeneous throughout; this rarely happens in practice, but an approximation is not difficult to obtain sufficient for all practical purposes. The most usual form of millstone with lower runner stone is shown by diagram Fig. 13.

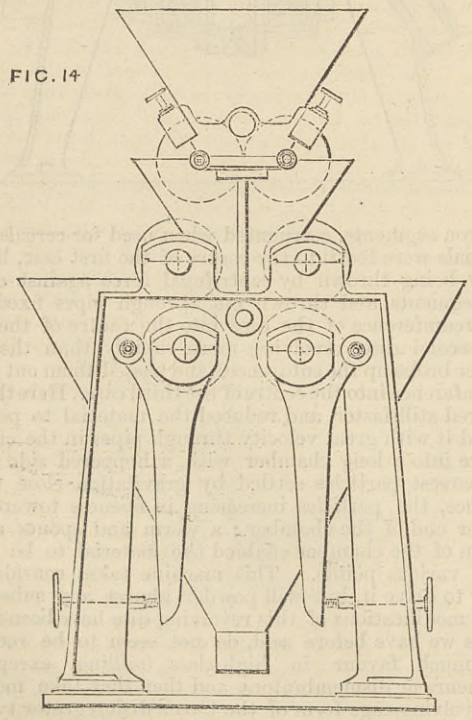
Second Subdivision (of the Second Division).—Smooth crushing rolls for the products from the first division. Two varieties of these are shown in the diagrams Figs. 14

FIG. 13



and 15, of Escher Wyss and Co.'s make. In one of these two pairs are mounted in the frame, the pressure being applied by means of the long levers which carry the bear-

FIG. 14



ings of the movable roll. To the lower end of these levers adjusting screws with hand wheels and springs are placed. The feed is regulated by two feed rolls. In Fig. 15 the pairs of rolls are arranged one above the other, and the pressure is applied by means of screws and springs direct without levers. The feed passes in succession through the three pairs of rolls. The third variety, Mechwart's patent,

FIG. 15.

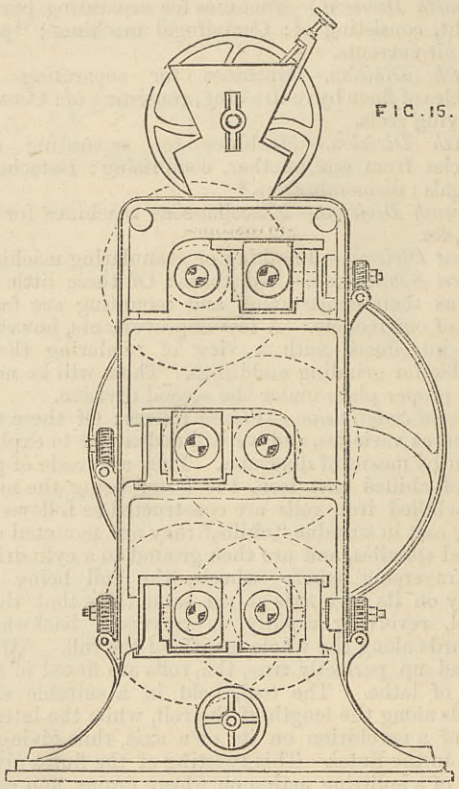
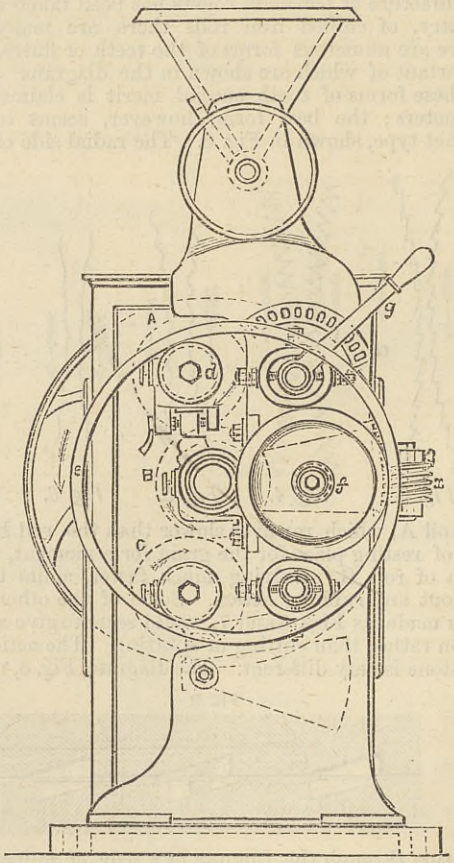


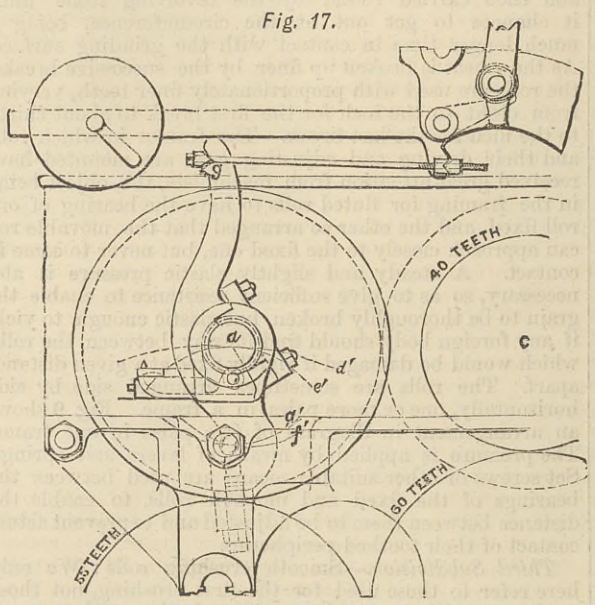
Fig. 16, with chilled cast iron rolls, contains a very neat and ingenious device for applying the pressure. This has been described before (ENGINEER, page 90, July 30th,

Fig. 16.



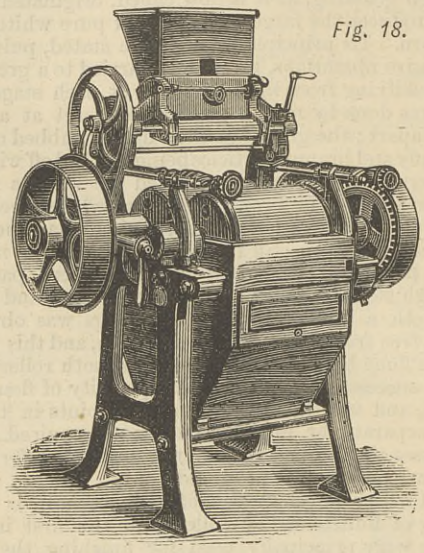
1880). The upper and lower rolls A and C are here pressed against the middle roll B, by means of anti-friction steel ring, running in friction rollers mounted on the roll spindles. Pressure is applied or taken off by the handle

Fig. 17.



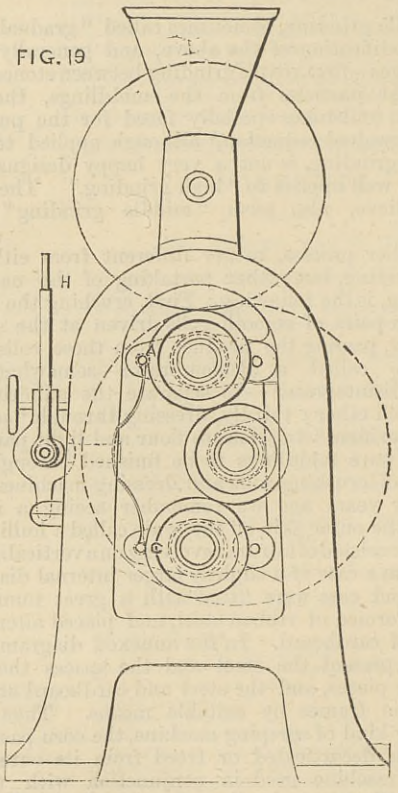
G, which pushes forward or pulls back the roll A, so that its friction roller bears against the inner surface of the ring, thereby causing more or less tension on the ring, and corresponding pressure of the two outer rolls on to the middle one. The rolls have each a spur wheel on their spindles, gearing into each other, and the middle roll has the driving pulley. The cog wheels are generally arranged so as to run the middle roll faster than the upper and lower, the differential speed giving a better grinding action on the middlings, and requiring less pressure on the rolls.

Fig. 18.



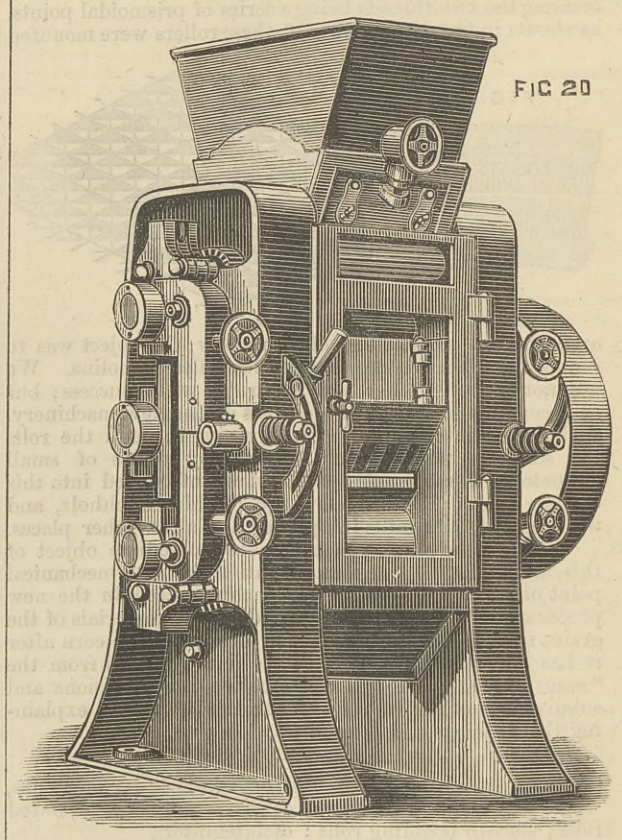
Figs. 17 and 18 show another example — Wegman's — with porcelain rolls, also described before—ENGINEER, page 61, July 25th, 1879. Here the rolls are arranged horizontally, and the pressure is applied by means of compound levers and adjustable weights. These rolls are now driven differentially by gearing, and the weights for applying the pressure are superseded by springs, the system of levers remaining much the same. Fig. 19 shows a diagram

FIG. 19



of the framing and pressure arrangement of Turner and Carter's three-roller mill. Here the frame is cast in one

FIG 20



piece, and is of very neat design. The pressure adjustment is novel and very simple. The two outer rolls are mounted on short levers A and C, one end turning on a pin—which

is adjustable to preserve the parallelism of the rolls—in a lug cast on the frame; between the other ends a bow spring of flat steel extends, a pair of links take hold of the middle of this spring, and are moved backwards and forwards by an excentric. The excentric is carried on a spindle extending across the front of the machine, so as to operate on both ends of the roll at once by means of a hand lever H; the excentric is turned partly round, and by pulling out the middle of the spring causes the two outer rolls to be pulled in to the middle roll; if the spring were quite straight when so pulled, the pressure would be rigid, but as it still remains slightly curved, enough elasticity remains to prevent any damage by pieces of metal, &c., passing inadvertently into the rolls. The middle roll is fixed to the frame. There are many other good points about this machine, which we hope to describe and illustrate further.

Fig. 20 illustrates Daverio's mill, which is another example of the three-roll type. The upper and lower rolls are brought to bear against the middle rolls by means of levers, springs, and an excentric, adjustments being provided to equalise the pressure at both ends of the rolls, and also to release the pressure quietly, without disturbing the adjustment. In the mills with three rolls the feed is arranged so as to be split, and half goes between the top and middle rolls and half between the middle and bottom rolls; thus three rolls can do the work of four.

There are many other varieties of rolls, but we think those selected contain the principal elements of all smooth-roller mills. The differential speed used almost universally in these machines has many advantages. It enables the middlings to be ground without much pressure, and does not bruise so much as is the case with rolls running at the same speed. They are also said to flatten out or laminate the soft substances, and render them easier to be got rid of by purifying, &c. This flattening out of the bran is a feature of the new process of roller milling. By millstones the bran is torn to pieces or ground up. With rolls the bran is cracked off in the first part of the process by fluted rolls, and nearly freed from the semolina. In reducing the semolina and middlings, the remaining bran particles are flattened out, their somewhat plastic nature admitting of this.

This brings us to the third division of our subject, the consideration of which we must reserve for another article.

THE IRON AND STEEL INSTITUTE.

OUR abstract report of the proceedings of this Institute last week closed with the business of Wednesday. On Thursday morning, the 5th inst., the proceedings commenced with a paper by Mr. Charles Markham, of Staveley, on

EXPERIMENTS MADE TO DETERMINE CERTAIN PHYSICAL PROPERTIES OF CAST IRON.

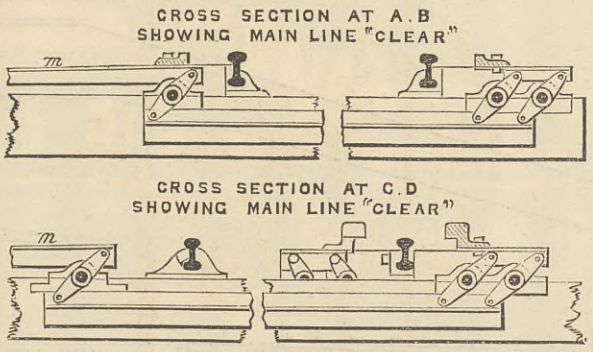
The object of these experiments was to determine whether there is any truth in the allegation that cast iron expands in passing from the state of fusion to that of viscous solidity previous to its contraction from that point downwards to normal temperatures. After referring to the papers previously read before the Institute by Mr. Wrightson and Mr. Bell, the author explained his reasons for objecting to their conclusions, and then described his experiments. These consisted in casting several bars in open sand moulds about 5in. by 4in. and about 31ft. in length. One end of each of these moulds was formed by a heavy imbedded bar, and the other by a small movable plate, a short distance from another heavy imbedded bar, the space between these being measured by callipers before and at the time of the pouring of the mould and during the cooling. None of these long bars showed the slightest evidence of expansion from the moment of casting, but the contraction on a bar of 31ft. 5·3125in. in length contracted during cooling 4·4375in., or 1·19 per cent. of the whole length. Another bar, 31ft. 6in. contracted 3·375in., while another 33ft. in length, which was covered with sand to prevent rapid cooling, also contracted 3·375in. A second series of experiments consisted in casting a number of cylindrical bars 9ft. 4·5in. in length and 4in. in diameter, in a vertical position, arrangements being made for measuring the change of length of the bar after pouring. None of these showed any signs of expansion. The fact that a piece of cold iron when immersed in molten iron of the same specific gravity at normal temperatures rose to the surface after a few seconds' immersion, was thus evidently not due to change of specific gravity, but to some other cause. This cause Mr. Markham endeavoured to ascertain by putting a number of pieces of pig, and rough and turned cylinders about 5in. in diameter, into the molten metal when cold, and when heated to dull redness. From the results of these experiments the author came to the conclusion that the explanation of the rise to the surface of such pieces after first sinking when immersed at normal temperatures, is that a film of molten iron, or iron in a semi-fluid state, forms upon the piece, and thus increases its volume and causes it to float, and that the efficacy of this film is increased by the gases given off by the piece on being heated, and which are held between it and the film. The specimens which were made red hot previous to immersion did not sink.

The discussion on this paper was taken after some other papers had been read, but we may give the gist of it in this place. There was on the whole very little disposition exhibited to accept Mr. Markham's conclusions as proved by his experiments. It was considered that his methods of measurement were not in some respects calculated to secure sufficient accuracy to settle a question of phenomena which apparently depends upon very small quantities, either in specific gravity, or surface and lineal measurements. Mr. Markham considered that by operating upon a large scale, the necessity for exceeding minuteness was avoided, but Mr. Wrightson, who has made a number of experiments in various ways, would not admit this, and with respect to the long bars, thought that the grip of the sand in the long moulds was probably sufficient to cause the expansion, if it took place, to do so by increasing the depth of the bar, as it was most free to expand in the vertical direction. He referred to Mr. I. L. Bell's experiment described before the Institute last year, which we consider was certainly the most satisfactory experiment of its kind yet made on the subject, as a proof that expansion does take place, and as supporting his own views; but as Mr. Bell afterwards remarked, his experiment showed that the expansion on a cylinder 6ft. in length and 6in. in diameter was only 0·104in., and was thus wholly insufficient to explain the cause of floatation by difference in specific gravity. It is needless to follow the arguments that were adduced to show that the film or coating which adheres to an immersed lump of cold iron could not cause floatation, as any of our readers interested in the subject will see that no argument is necessary to show the fallacy of the idea. Mr. Bell thought that the exclusion of gases by the immersed lump as it became heated might be sufficient to cause floatation by reason of the difficulty which such gases would experience in escaping from most of the surfaces of the piece. In reply to the discussion, Mr. Markham asserted the correctness of his experiments, and said that in practical founding no expansion was ever exhibited, though it was necessary to allow for contraction in many ways. It may be remarked that neither Mr. Markham's paper nor the discussion thereon afforded any real help to the explanation of the cause or causes of the floatation of cold cast iron on liquid cast iron, and that the question remains in very much the same position as that in which it was left by Mallet's experiments (Proc. Roy. Soc., 1875).

Mr. Markham's paper was followed by one by Mr. Price Williams, on

IRON AND STEEL PERMANENT WAY.

Mr. Williams first referred to the number of accidents arising from defects in permanent way, especially of those in points and crossings; then briefly described the forms of points, switches, and crossings commonly in use and the objections most usually made to them. Subsequently he described the continuous crossings he designed some years ago, and then the switches and crossings which he has recently designed, as illustrated shaded. The switches and crossings are shown as set to divert a train from a main line on to the junction or branch line; the first operation is to unlock the switch and crossing motion bars by means of the locking bar apparatus attached both to the switches and crossing motion bars. This is effected by means of the lever L operating upon the locking bars *a a a a*, so as just to release them from the switch-crossing motion bars *m m m m*, this first operation at the same time raising the up and down main line distant signals to "danger." The next operation is to pull over the switch rails *b b′* and *c c′*, by means of the lever M; the switch rails *b* and *c*, which are outside the main line rails on either side, are moved in parallel but opposite directions towards the main line rails; the switch rail b^1, which is hinged to *b* at the point X, is fixed at its other



extremity by fish-plates to the junction rail, and the opposite switch rail *c′*, which is similarly fixed to the other junction rail at Y, moves parallel with b^1 and in the same direction as the switch rail *b*, so as to join up with the switch rail *c* in the position shown where the switchings and crossings are shown as set for the junction or branch line. Simultaneously with this movement of the switches, the lever M pulls over the crossing or gate pieces G G These are moved in opposite directions in precisely the same manner as already described in the case of the switches, the locking bar lever which up to this time has remained midway between the extremities of the motion arc, is now quite pulled over through the remainder of the throw. The other locking bars *a a a a*, are thus similarly inserted and locked in the motion bars *m m m m*, and by this means the switches and crossings are secured while the train is passed over on to the branch line. The way in which a train is passed from the main line rails on to the junction or branch line is as follows:—The two outside switch rails *b* and *c*, which, when pulled over, fit into a slight recess on the outside of the main line rails, form between the points *p p′* and *k k′* two inclined planes, the gradient of which is about one in ninety, and such as in that distance to give a rise of about 2½in., which is fully sufficient to allow for the clearance of the tire flanges when the rails become worn. This amount of super-elevation of the rail *c* is maintained throughout until the main line rails are cleared of the crossing, thus affording the requisite super-elevation of the outer rail of the junction curve, not possible with ordinary through crossings.

The paper concluded with a description of the steel sleeper and chair made by Mr. F. W. Webb, and laid down on the London and North-Western Railway, near Crewe Station. The sleeper is of the plain open ended inverted channel form, the chair consisting of an angle piece pressed into form from short pieces cut from 6in. steel bars about ½in. thick rolled from the rail ends, a central rib similar to that on cast iron chairs being formed in the pressing process which gives stiffness to the chair. Each chair is fixed with three rivets, a piece of bitumenised paper being rivetted up between the sleeper and chair. Each sleeper weighs 140 lb., or about the same as a 9ft. × 12in. × 6in. fir sleeper; and the two pieces forming the chair together with the six rivets weigh 23 lb., the whole weight with 84 lb. steel rails being thus just about double the weight of the rails. The permanent way thus constructed has been in use several months at the place named, and with satisfactory results.

A statement showing the number of railway accidents and the number of persons killed and wounded during the years 1856-1879, was appended to the paper, showing that over 37 per cent. of all the deaths by accident on railways have been due to defective permanent way. The author exhibited a model showing the complete system above described.

In the discussion, Mr. Webb said it was important that steel should be utilised in the construction of permanent way, not only because a large number of steel mills might otherwise run short of work in time to come, but because every wood sleeper bought meant 2s. or 2s. 6d. sent out of the country. He remarked that a mile of the steel permanent way described above was laid partly in ashes, partly in broken boulder, partly in clay, and partly in something else, so as to test it under all conditions of ballast. That in ashes had not shown any signs of corrosion, and the rivets had not in any places loosened, as it was thought by some they might owing to the compression of the paper. All the sleepers complete with the chair were dipped in a hot bath of tar, boiled oil, and lime, and then thoroughly sprinkled with sand, by which they are given an asphaltic coating. The sleepers are placed 3ft. apart centre to centre, and cost about 12s. each, but will cost less when, and if, after further experiment, it is found justifiable to put down special plant to make them. A steel wedge of the exterior form, and to take the place of the ordinary wood key, was exhibited, the wedge being a mere shell with a swell on one part which made the wedge spring into its place. With this Mr. Webb thinks wood may be entirely dispensed with in permanent way.

Mr. W. R. Browne remarked that it had been noticed in Germany that in cases of derailment that part of the permanent way which was laid with wood sleepers suffered very much more than that laid with the iron sleepers now so common in that country. He also observed, with respect to the breakage of steel rails, that these had been found to fail more frequently in the winter on the Lower Silesian Railway, and much more frequently in those parts which ran through woods. This he considered was probably due to the greater quantity of water present at any time in such situations, and thus when frost came the road was frozen into a more compact whole than where the ballast and bed were dry. Mr. Wood, who some time ago read a paper on some iron sleepers which have now been for a considerable period under trial on the North-Eastern Railway, referred to the necessity for using a sufficient length of sleeper in order that the ends should not be first forced down and the ballast pushed away by passing trains and then bent by subsequent trains. Nine feet, as used in this country, was sufficient, but attempts had been made on the Continent to use 7ft. 6in. sleepers, but without success. He remarked that creosoting had been abandoned for wood sleepers on the Continent; but then he also said that broken stone ballast was now universally used; and as in this matter he seems to have forgotten the miles of road laid in Belgium on ashes and sand, and the hundreds of miles on nothing but sand in the Berlin plain; he perhaps also forgot some on which creosoting is still employed. Mr. Jeremiah Head referred in very favourable terms to the iron sleepers of Mr. Wood on the North-Eastern Railway, and said that under work and weather they had stood well, corrosion being unnoticeable except between chair and rail, though some of it is laid in ashes. In his sleepers Mr. Webb had, he considered, made an improvement by putting a piece of plate under the rail and fixed by the rivets that held the chair jaws, as this piece not only strengthened the sleeper in its weakest part, but provided for corrosion where it took place most rapidly. Mr. Head remarked of Mr. P. Williams's system of switches and crossings that his invention was a development of the old jump rail system, and another gentleman said that the principle was the same as that of the arrangement many years ago used by contractors to avoid cutting rails. This speaker thought that for many places the spring or whip points would be the best and safest, as these were opened by the flanges of the wheels of the train from the branch while they closed themselves to the main line. He objected to the reduction of the width of the tread of the main line rail, though the strength was returned by filling up the side. It was also remarked that an objection to Mr. Williams's system was the necessary ascent of the train on the switch rails. Mr. Williams, in reply, said that everything had been subordinated to the strength and perfection of the main line, the rails being continuous throughout, and that with respect to locking the points, they were so arranged that they must remain either one way or the other, as the counter rails must lie in the recesses made for them, or be under the line rail, in which case they were held by the passing train.

The next paper read was by Captain W. R. Jones, of the Edgar Thomson Steel Works, on

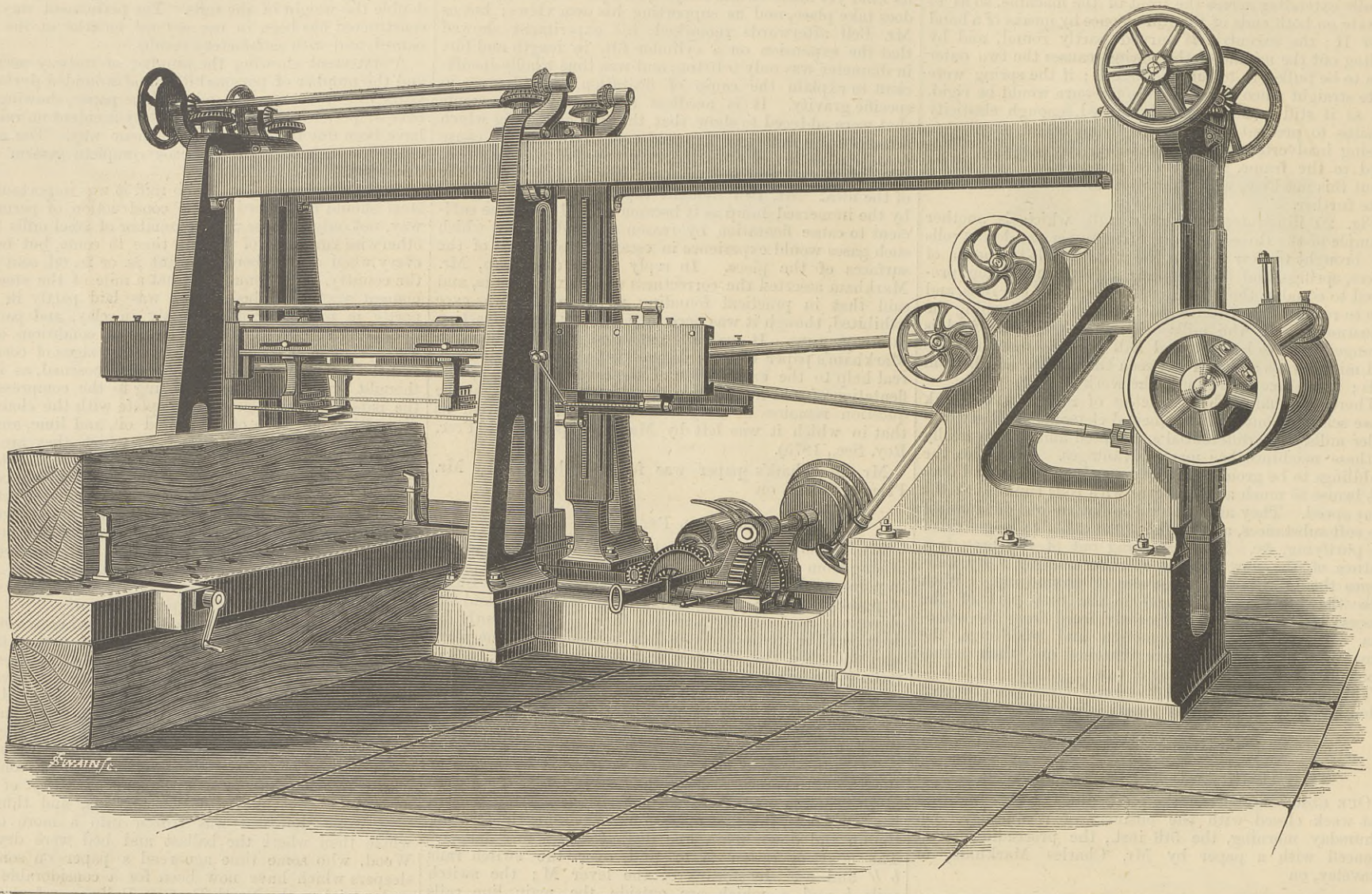
THE MANUFACTURE OF BESSEMER STEEL AND STEEL RAILS IN THE UNITED STATES.

This paper was a history of the operations at the above works during the year 1880. These works are somewhat celebrated for turning out about double the quantity of steel ingots that can or have been turned out in any English works. It may, therefore, be of use to give the particulars of the plant. The converting works contain four re-melting cupolas, and four other cupolas for melting spiegeleisen. Three of the re-melting cupolas are of the following dimensions:—Inside diameter of shell, 85in.; distance from hearth to charging door, 14ft.; inside diameter of lining, 59in., reduced at the boshes to 48in., all provided with six tuyeres, the area of which is $34\frac{6}{10}$ square inches. The fourth iron cupola has a diameter inside of

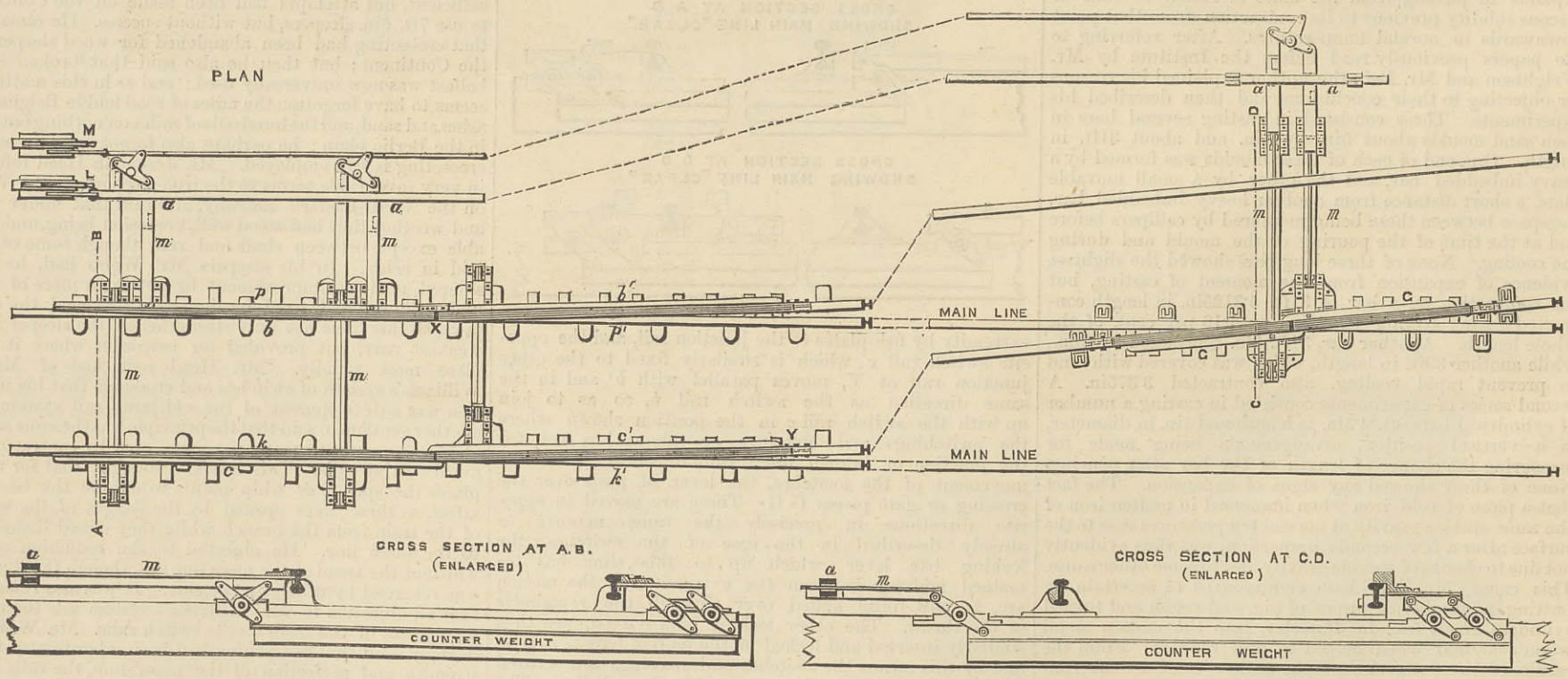
DOUBLE HORIZONTAL SAW FRAME.

MESSRS. T. ROBINSON AND SON, ROCHDALE, ENGINEERS

(*For description see page* 350.)



MR. PRICE WILLIAMS' SWITCHES AND CROSSINGS.



shell of 96in.; inside diameter of lining, 66in., reduced at the bosh to 48in. This last cupola has been kept in operation 141 hours. The whole of the iron cupolas are to be made of the same dimensions as the large one, it being a great advantage to run the cupolas 141 hours or longer before dropping the bottom. The inside diameter of the shells of the spiegel cupolas is 55in., the inside diameter of the lining being 28in., which is reduced at the boshes to 21in. The blast for all the cupolas is furnished by three No. 7 Baker blowers, with an average blast pressure of eight ounces. These blowers have been found to be best adapted for cupola practice, furnishing a steady positive blast, requiring the minimum of power, durable, and trustworthy. The converting vessels—7 tons—are the same size as those generally used by American Bessemer works, which is much greater than that generally adopted in England. The number of pounds of metal charged is regulated by the weight of rail to be made, the heats varying from seventy-one 4-ton heats to seventy-three 4-ton heats. Two vertical blowing engines, built by Messrs. Mackintosh, Hemphill, and Co., with steam cylinder 42in. diameter, and blowing cylinder 56in. in diameter, and 48in. stroke, supply blast for the converters with an average pressure of 23 lb. In a few months the two 7-ton converter plant is to be changed for a three 10-ton converter plant. The following gives the results of the year's working in tons of 2240 lb.:—

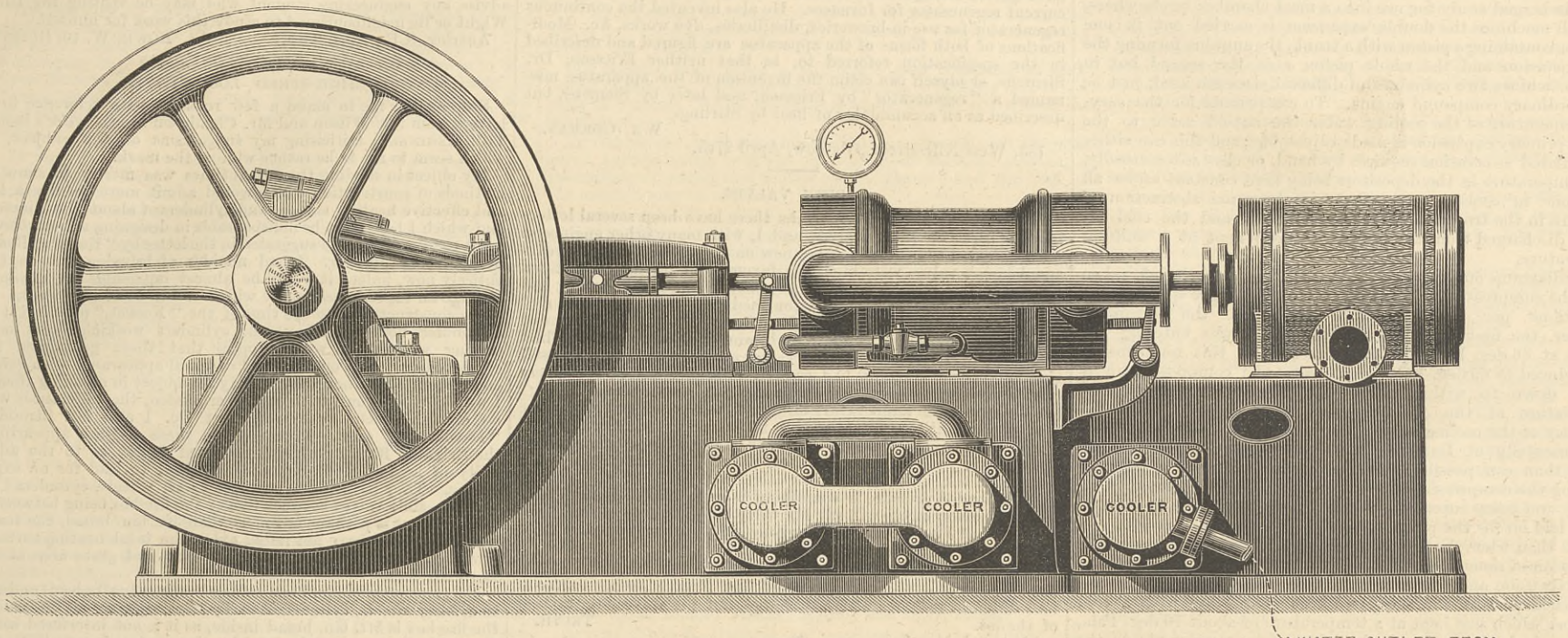
Product of Converters.	
Ingots, 86·50 per cent.	123,303
Scrap, 3·12 ,, ,, ...	4,445
Loss, 10·38 ,, ,, ...	14,799
Blooming Department.	
Ingots bloomed	123,676
Blooms produced, 94·19 per cent.	116,487
Scrap produced, 4·01 ,, ,, ...	4,965
Loss in blooming 1·80 ,, ,, ... 2,	2,222
Rail Department.	
Blooms rolled	111,705
Rails produced, 89·60 per cent.	100,094
Scrap produced, 7·14 ,, ,, ...	7,971
Loss in rail mill, 3·25 ,, ,, ...	3,640
Average number of tons steel per cupola ...	655·86
Average number of tons steel per vessel lining	12,330·00
Average number of tons steel per vessel bottom	90·00
Average number of tons steel per steel ladle ...	91·62
Average number of tons steel per ingot mould	110·00

In one week since the paper was written the output was 3433 tons of ingots, representing 3482 tons of steel and 2823 tons of rails. Thus, although more work is got out of the converters, much less work is done in the rolling mill than in this country; the rail train consists of three stands of three high rolls 23in. at pitch line.

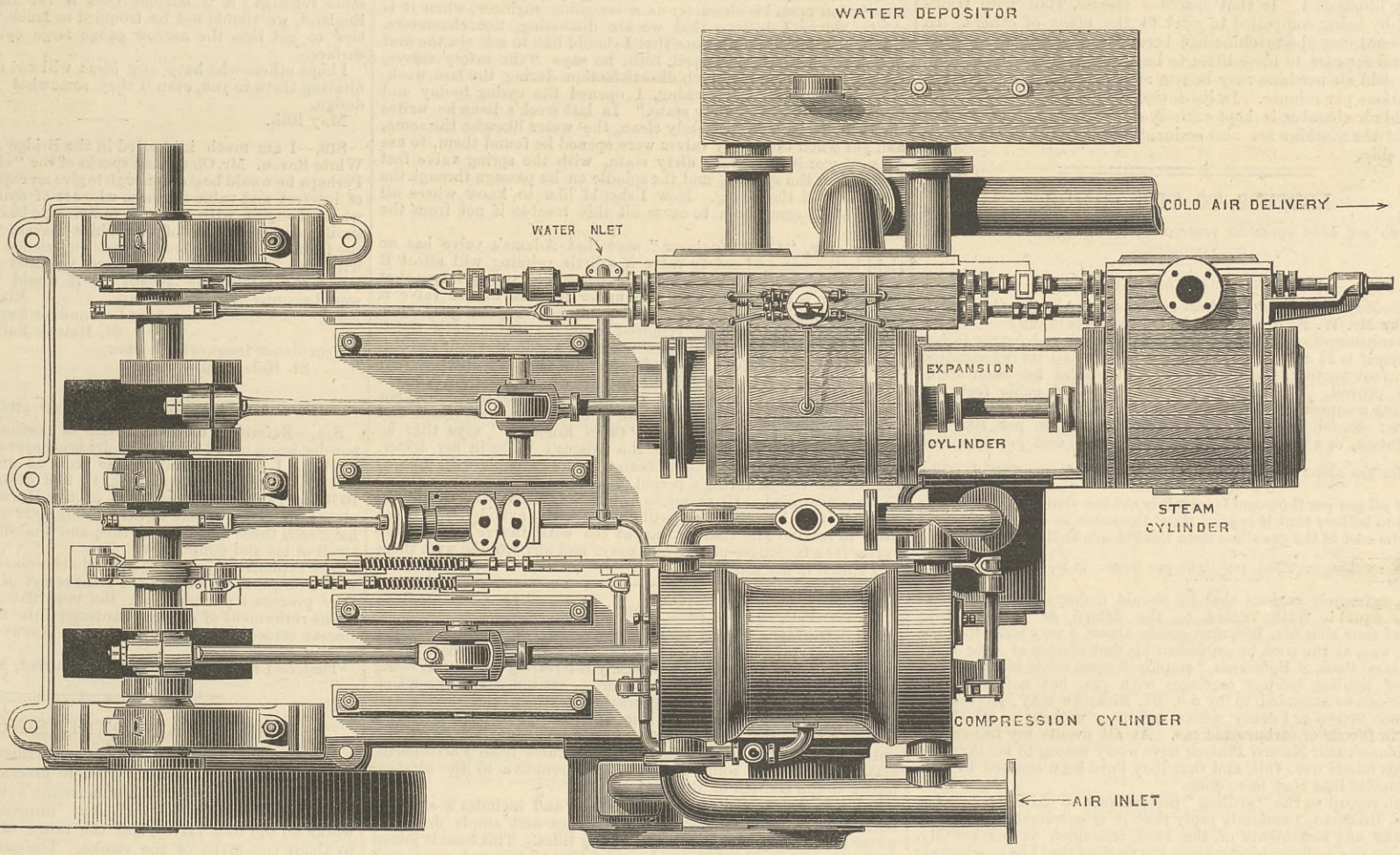
In the discussion on this paper, which was in the end postpone duntil the autumn meeting, in order that Mr. Jones should reply, Mr. Webb said that equally good steel might be made by the Bessemer and the Siemens method, either hard or very soft, but by the Bessemer method he perhaps got very soft steel the more easily, and from the Siemens a tougher hard metal the more easily. Mr. Ellis, of Messrs. John Brown and Co., said that they now experienced no difficulty in producing steel by the Bessemer process, uniform in quality, and capable of standing every possible test. Mr. Windsor Richards remarked that 3000 tons per week from one pair of converters was about double what his people could do, but he could beat Mr. Jones in rolling. He mentioned that steam at 150 lb. per square inch had been found useless for compressing ingots, and 300 was about to be tried with a new boiler. Mr. Walker said that probably the cost per ton was as much, or perhaps considerably more in America than here, and if

HORIZONTAL DRY AIR REFRIGERATOR.

MESSRS. J. AND E. HALL, DARTFORD, ENGINEERS.



SIDE ELEVATION



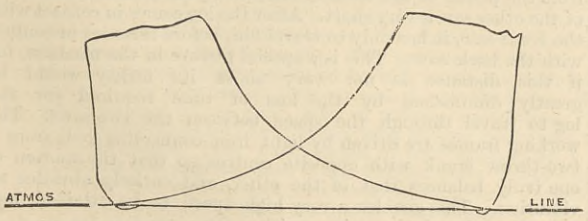
so the extra output did not represent any greater return on the capital employed. He noticed that the American blowing engines and cupolas were larger than those used in England, and mentioned, with respect to the character of Bessemer steel, that he had made a set of plant which was regularly employed in producing the best tool steel, cold blast iron being used for the purpose. The President made a few remarks, and suggested the postponement of the discussion. He announced that it was proposed to hold the autumn meeting, which would take place in London, in October instead of August.

On Friday morning, the 6th inst., the proceedings were resumed, but we reserve our report for another impression.

HORIZONTAL DRY AIR REFRIGERATOR.

ON Tuesday, Wednesday, and Thursday last week a large number of scientific and other gentlemen interested in mechanical refrigeration visited the works of Messrs. J. and E. Hall, of Dartford, to inspect the working of one of their improved hori-

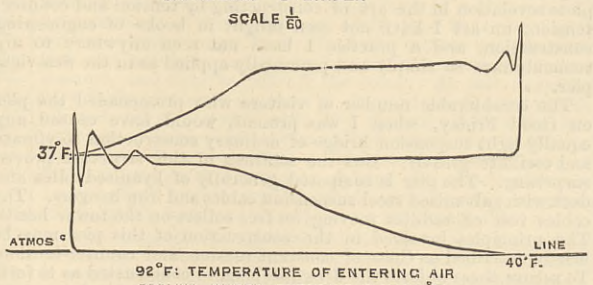
COMPRESSION CYLINDER
SCALE $\frac{1}{60}$



zontal dry air refrigerators. Among those present were Messrs. Wm. Denny, J. G. Dunlop, W. Thompson, H. P. McDonald, Killingworth Hedges, A. H. J. Baass, Thos. Archer, J. K. Kilbourne, Wm. Lant Carpenter, Manuel, R. Laidley Mart, Saul Samuel, S. Yardley, C. H. Willis, A Van de Velde, J. Imray, J. G. Hepburn, J. McFarlane Gray, Malcolm Campbell, Bisset, &c. &c.

The machine which is illustrated on above, is designed to deliver about 10,000 cubic feet of cold air per hour, when running at the rate of 100 revolutions per minute, and is capable of reducing the temperature of the air from 90 deg. above, to about 50 deg. below zero, Fah., with an initial temperature of cooling water of 90 deg. to 95 deg. Fah. It can, however, be run at as high a speed as 140 revolutions per minute. The air is compressed in a water-jacketted, double-acting compression cylinder, to

EXPANSION CYLINDER
SCALE $\frac{1}{60}$

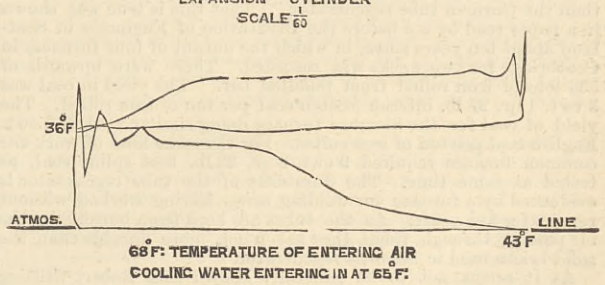


92°F: TEMPERATURE OF ENTERING AIR
COOLING WATER ENTERING IN AT 86°F:

about 55 lb. per square inch—more or less according to the temperature of the cooling water—the inlet valve being worked from a cam on the crank shaft, to ensure a full cylinder of air at each stroke, and the outlet valves being self-acting, specially constructed to avoid noise in working and breakages, which have given rise to so much annoyance in other cold air machines. The compressed air, still at a high temperature, is then passed through a series of coolers constructed on the same tubular principle as those illustrated in THE ENGINEER for October 1st, 1880, where it parts with a great deal of its heat, and is reduced to within 4 deg. or 5 deg. of the initial temperature of the cooling water. Here also a considerable portion of the moisture, which, when fresh air is being used, must of necessity enter the compression cylinder, is condensed and deposited as water.

After being cooled, the compressed air is then admitted to the expansion cylinder, but as it still contains a large quantity of water in solution, which if expansion was carried immediately to atmospheric pressure would, from the extreme cold, be converted into snow and ice, with a positive certainty of causing great trouble in the valves and passages. It is got rid of by a process invented by Mr. Lightfoot, which is at the same time extremely

EXPANSION CYLINDER
SCALE $\frac{1}{60}$



68°F: TEMPERATURE OF ENTERING AIR
COOLING WATER ENTERING IN AT 65°F:

125 REVS. PER MINUTE
OR 312 FT. PER MINUTE PISTON SPEED

simple and beautiful in action, and efficient. Instead of reducing the compressed air at once to atmospheric pressure, it is at first only partially expanded to such an extent that the temperature is lowered to about 35 deg. to 40 deg. Fah., with the result that very nearly the whole of the contained aqueous vapour is condensed into water. The partially expanded air which now contains the water as a thick mist is then admitted into a vessel containing a number of grids, through which it passes, parting all the while with its moisture, which gradually collects at the bottom and is blown off. The surface area of the grids is so arranged that by the time the air has passed through them it is

quite free from moisture, with the exception of the very trifling amount which it can hold in solution at about 35 deg. Fah., and 30 lb. pressure. The expansion is then continued to atmospheric pressure and the cooled air containing only a trace of snow is then discharged ready for use into a meat chamber or elsewhere. In small machines the double expansion is carried out in one cylinder containing a piston with a trunk, the annulus forming the first expansion and the whole piston area the second, but in larger machines two cylinders of different sizes are used, just as in an ordinary compound engine. To compensate for the varying temperature of the cooling water the cut-off valve to the first or primary expansion is made adjustable; and this can either be regulated as occasion requires by hand, or else automatically. The temperature in the depositors being kept constant under all variations in cooling water, there is the same abstraction of moisture in the tropics as in colder climates, and the cold air finally discharged from the machine is also kept at a uniform temperature.

The diagrams on p. 349 are reduced from the originals taken from the compression cylinder when running at the speed of 125 revolutions per minute, and also from the expansion cylinder, the first when the cooling water was entering the coolers at 86 deg. Fah., and the latter when this temperature was reduced to 65 deg. Fah. In all cases the compressed air is cooled down to within from 3 deg. to 5 deg. of the initial temperature of the cooling water, thus showing the great efficiency of the cooling apparatus. The machine has been run experimentally at Dartford, under conditions perhaps more trying than can possibly occur, even in the tropics, the air entering the compression cylinder being artificially heated up to 85 deg. and being supersaturated at that temperature by a jet of steam laid on for the purpose. In this case no more snow was formed than when dealing with air containing a very much less proportion of moisture. The vapour was condensed previous to final expansion and abstracted as water in the drying apparatus. The machine was exhibited at work in connection with a cold chamber which was kept at a temperature of about 10 deg. Fah., besides which several hundredweights of ice were made in the few days during which the experiments lasted. This machine is in all respects an improvement on the machine which we have already illustrated. In that machine Messrs. Hall were trammelled by being compelled to work to the plans of others. In the present case the machine has been designed by Mr. Lightfoot, and appears to leave little to be desired. It is a new thing that a cold air machine may be run at any speed from 32 to 120 revolutions per minute. In its action it is perfectly steady, and the cold air chamber is kept entirely clear of snow. The dimensions of the machine are also eminently favourable to its use on board ship.

LETTERS TO THE EDITOR.

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

LIGHTING RAILWAY CARRIAGES.

SIR,—May I be allowed a short space to reply to the statements made by Mr. W. B. Rickman in last week's ENGINEER?

The consumption of carburetted gas as employed by my father and myself is $1\frac{1}{4}$ cubic feet per hour per light, and its illuminating power, foot for foot, is equal to that of oil gas, as has been abundantly proved. The cost of gas per thousand cubic feet, not including compression—as that is the same in both cases—is as follows:—3s. 6d. per 1000 for ordinary gas + 2s. per 1000 for carburation, or a total of 5s. 6d. per 1000. The cost per hour per light for gas alone is therefore $\frac{1\frac{1}{4}}{1000} \times$ 5s. 6d. or ·0825d. The cost of oil gas per thousand is certainly not less than 15s., and I have reason to believe that it is even more than this, so that for an equal light the cost of the gas alone upon the Pintsch or Bower first system is $\frac{1\frac{1}{4}}{1000} \times$ 15s. or ·225d. per light per hour. It is, as Mr. Rickman states, extremely curious that he should manage to make these results equal! With regard to the fifteen or twenty years, lapse of time that Mr. Rickman speaks about, I may state that my father was, at the time he published his first edition of the "Gas Engineers' Book of Reference," employed upon other business than that of lighting railway carriages with gas, but now that the matter can be attended to by me, Mr. Rickman may rest assured that not fifteen or twenty weeks will pass without a stir being made in favour of carburetted gas. At all events my father was the pioneer, and Messrs. Pintsch have every reason to be thankful that his hands were full, and that they have been enabled to reap the benefits that they have done.

With regard to the "grilling" performance so näively pointed at by Mr. Rickman, I can only reply that it is extremely premature to make any statements of the kind, inasmuch as neither Mr. Rickman nor anyone else can know the method that I have adopted; and I take this opportunity of assuring him and your readers generally, that there is not the slightest fear of any such occurrence, even in the event of a collision; but if there were, I do not think that it would make much difference whether people were "grilled" by oil in the lamps as commonly used, by the oil used by us, or whether they were both grilled and blown up by oil gas underneath the carriages. ANTHONY SPENCER BOWER.

St. Neots, May 4th.

REGENERATORS.

SIR,—In your issue of the 8th inst., in reviewing "Examples of Steam, Air, and Gas Engines," &c., by John Bourne, C.E., it is stated, "He further thinks the Siemens regenerator less effective than the Gorman tube regenerator." That this is true was shown in a paper read by me before the Institution of Engineers in Scotland about ten years since, in which the output of four furnaces in Coatbridge for two weeks was recorded. There were upwards of 536 tons of iron rolled from puddled bar. The yield in coal was 3 cwt. 1 qr. 27 lb. inferior Scotch coal per ton of iron rolled. The yield of coal for the Siemens furnace doing similar work is 6 cwt. English coal per ton of iron rolled. For the same kind of work the common furnace required 9 cwt. 2 qr. 23 lb. best splint coal, as tested at same time. The durability of the tube regenerator is evidenced by a furnace for welding scrap having worked without repairs for five years. As the tubes are kept from burning by the air passing through them, they are much more durable than the solid bricks used in Siemens regenerator.

As it seems not to be generally known that Robert Stirling patented an apparatus for "diminishing the consumption of fuel"—first in glass-house and other furnaces, whenever a high degree of heat is required, and secondly in breweries, distilleries, dye works, and other manufactories, by transferring heat from one portion of liquid, air, or vapour to another—I quote from his specification of patent of 1816:—"The hot liquid, gas, or body to be cooled is by any means made to enter the passage at A, and to pass along to the other extremity B. In its progress it gives out its heat to the sides of the passage, or to any bodies contained in it, and issues at B—the opposite end—at nearly the original temperature of the passage. When the temperature of the passage at B has been raised a few degrees, the motion of the fluid from A to B is stopped, and a portion of the fluid which is required to be heated . . . is made to traverse the same passage in a contrary direction, *i.e.*, from B to A, by which means it receives heat from the sides of the passage or other bodies contained in it, and issues at A at nearly the same temperature with the fluid to be cooled. When the temperature of the passage at A has been lowered a few degrees, the process is again stopped, and a portion of the fluid to be cooled is made to pass from A to B, and so on alternately." I have quoted enough to show that Stirling invented the reversing current regenerator for furnaces. He also invented the continuous regenerator for use in breweries, distilleries, dye works, &c. Modifications of both forms of the apparatus are figured and described in the specification referred to, so that neither Ericsson, Dr. Siemens, or myself can claim the invention of the apparatus, misnamed a "regenerator" by Ericsson, and later by Siemens, but described as an accumulator of heat by Stirling.

WM. GORMAN.

153, West Nile-street, Glasgow, April 27th.

SAFETY VALVES.

SIR,—During the last few weeks there have been several letters in your paper on safety valves, and I, with many other engineers, would be glad to hear something new on the subject. A few years ago Adams's valves were highly in favour, and having been at sea for some years with them under my charge, and never having had the slightest trouble, I am astonished at "Chief Engineer's" letter; and after my experience, I am inclined to think there must have been something wrong, and would like to ask "Chief Engineer" (1) Did you see your valves opened and satisfy yourself that valves and spindles had enough clearance before they were closed up? (2) Did you see them thoroughly tested before sailing? (3) What was the temperature on top of boilers where valves were placed, and if it was very hot did it not occur to you as chief engineer that you should see that your valves were eased every day, especially if your boilers were liable to prime? Springs will sometimes give out, but that Adams's valves will not shut within 10 lb. of their loaded pressure is something new to me. Almost every maker a person meets will say his valve is as good as Adams' and cheaper, but I have never met anyone who will say what "Chief Engineer" says about them.

I have never had the pleasure of meeting Mr. Adams, but if I should meet him to-morrow I could say I have spring valves of four different makers under my charge, but his valves are the best of the lot. TRUTH.

Liverpool, May 3rd.

SIR,—In reading "Chief Engineer's" letter in last week's issue I was rather amused at him for thinking that I had been casting imputation upon his character as a sea-going engineer, when it is safety valves I believe that we are discussing, not characters. Now there are a few questions that I should like to ask—in the first place, in his letter of April 19th, he says "the safety valves, having been giving me much dissatisfaction during the last week, alternately leaking and sticking, I opened the casing to-day and found them in a very dirty state." In last week's issue he writes that the boilers were perfectly clean, the water likewise the same, and yet when the safety valves were opened he found them, to use his own words, in a very dirty state, with the spring valve fast jammed on the spindle, and the spindle on its passage through the lower part of the casing. Now I should like to know where all the dirt had come from to cause all this trouble if not from the boiler.

Now, Sir, "Chief Engineer" says that Adams's valve has no right to the name of safety valve if a little priming will affect it and cause it to leak. Well, my experience of all safety valves that I have seen is that if any dirt gets under the face of the valve it will leak, but by turning the valve round, or giving it a good blow through, the dirt will be removed and the valve keep tight. Which would "Chief Engineer" prefer in a gale of wind, the old-fashioned loaded valve that would roar off at every lurch or heel over of the ship, especially if she has a list to one side, or Adams's spring valve that all the rolling and pitching in the world does not affect, but remains tight, giving you a chance to save steam and make a passage? In conclusion, "Chief Engineer" says that he can see no case made out for the Adams's valve in my letter. Surely he does not think that because he had trouble with two or four of the valves during a period of six months that they are all to be condemned. He seems to think that because they did not act well with him that they will not act with anybody else. I beg leave to remind him that I was at sea with twelve of Adams's valves for a far longer period, and never had any trouble with them as I stated in my last letter. J. H. W.

May 10th.

SEA VIEW PIER.

SIR,—During a recent ramble in the Isle of Wight I had the pleasure of inspecting at Sea-view—about two and a-half miles east of Ryde—a work of an unusually interesting character, being a suspension pier recently built for a limited company, which intends to open direct communication between this lovely and attractive watering place and the main land, and by a projected tramway from the pier to the nearest railway station, about two miles distant, will, with a service of steamers from Portsmouth, make the Sea-view route a charming alternative to the existing routes to the Garden of England.

The pier has a total length of 1000ft., and includes a strongly built head with convenient landing stages and ample depth of water for steam packets at lowest spring tides. This head is joined to the shore by a pier 15ft. wide, consisting of two end spans each about 140ft. long and three spans of 200ft. each. The extraordinarily light and airy appearance of the structure would lead the casual observer, while admiring it as "a thing of beauty" to regard it as far too fragile to become "a joy for ever;" and I gathered that during its erection comments of that character were occasionally made by local observers, their idea being that it would be blown down or washed away. But notwithstanding such freely-expressed opinions it has weathered without damage many severe tempests, including the great snowstorm of this year, and I learn from the testimony of eye-witnesses that during such storms not the slightest movement of the large spans was observable. This conduct in a suspension bridge is so unusual that my attention was drawn to the means by which it has been secured in this really remarkable structure at Sea-view; and it has to me proved a complete revelation in the art of constructing by tension and counter-tension, an art I have not seen taught in books of engineering construction, and a practice I have not seen anywhere to my remembrance so simply and practically applied as in the Sea-view pier.

The considerable number of visitors who promenaded the pier on Good Friday, when I was present, would have caused any equally light suspension bridge of ordinary construction to vibrate and oscillate greatly. But the stiffness of this structure proved surprising. The pier is composed generally of kyanised piles and deck with galvanised steel suspension cables and iron hangers. The cables rest on saddles moving on free rollers on the tower heads. The principles involved in the construction of this pier may be briefly described as those of constant tension and counter-tension. To secure these objects the deck has been so constructed as to form one long riband of kyanised timber. This is arched to about 4ft. at the centre of the 200ft. spans, and is held down transversely by knees and beams between each pair of towers. This deck is kept in constant tension by originally straining it from each end and by counter and upward pull of the hangers and cables. Lateral stiffness is secured, firstly, by the known method of spreading the cables about 6ft. further apart, where they rest on their saddles, so that all the hangers are inclined outwards; and, secondly, by the arched tensional deck just described. This continuation of tension and counter-tension stores up force which is ever exerted to maintain the pier in its normal condition, whether the disturbing influences are tending to produce oscillation or longitudinal wave-like motion; other matters of detail have also evidently received due consideration. By this, to me, novel method of construction remarkable rigidity has been secured at a minimum cost and weight, and without encroaching on the valuable clear space under the deck.

I hope the engineer of the pier will himself take an early opportunity of contributing to the profession a fuller exposition of the principles and methods of his work. In the meantime, I would advise any engineering student who may be visiting the Isle of Wight or its neighbourhood to study this work for himself.

Anerley, S.E., April 25th. EDWIN W. DE RUSETT.

HIGH-SPEED LOCOMOTIVES.

SIR,—Allow me to make a few remarks with reference to the letters from Mr. Wilson and Mr. Cleminson in last week's issue of THE ENGINEER, criticising my suggestions on this subject, and which seem to me to be rather wide of the mark.

My object in sending the two outlines was merely to show two methods of construction which would admit more readily a large and effective heating surface and cylinders of about 20in. diameter, and which I believe to be indispensable in designing a locomotive to meet the requirements suggested in the letter by "Running Board," in a previous number. I had no idea of bringing out anything entirely new, indeed it would be almost impossible for anyone to arrange an express locomotive which would be totally unlike anything constructed since the time of the "Rocket," provided it had a tubular boiler, fire-box, and cylinders working direct on the driving wheels. It would appear that these gentlemen have compared only the outlines and external appearance with existing engines, and have not seen clearly my object in selecting them; so I will here point out, with your permission, the differences which do exist between my arrangement No. 1 and Mr. Stroudley's "Devonshire" class. Previously to these engines appearing on the Brighton Railway I had entertained doubts as to the advisability of having a 6ft. 6in. coupled-wheel to lead for an express engine. They have inside bearings to all wheels, cylinders $17\frac{1}{4}$in. by 26in., slide valves between them; the fire-box being between the inside frames is perhaps not more than 3ft. 6in. broad, the trailing wheels I believe have not radial axles, the total heating surface is probably not more than 1300 square feet, and grate area at most 17 square feet.

My arrangement No. 1 has outside bearings to all wheels and inside to driving wheels, cylinders 20in. by 22in., slide valves underneath; the fire-box is 5ft. 6in. broad inside, as it is not interfered with by the inside frames, and the total heating surface is over 1700 square feet, with a grate area of 29 square feet.

The Irish locomotive referred to by Mr. Wilson will bear the same remarks; it is obvious that if the Irish gauge existed in England, we should not be troubled so much with the question of how to get into the narrow gauge large cylinders and heating surface.

I hope others who have any ideas will not refrain from communicating them to you, even if they somewhat represent an extinct design. E. L. PEARCE.

May 10th.

SIR,—I am much interested in the Bridge Adams's locomotive, White Raven. Mr. Cleminson speaks of the "elements" being fatal. Perhaps he would be good enough to give an explanation that may be of interest and value to those who are of opinion that the eight-wheeled engine with Adams's radial axle-boxes, constructed on a similar design to that of the White Raven, will be the engine of the future. If it is from actual experience Mr. Cleminson had with the White Raven, or from acquired knowledge that he infers the fatality he speaks of, it would be satisfactory if he would express himself in detail. ED. BARROWS,

Late Locomotive Superintendent to the St. Helen's Railway Company.

Providence Ironworks, Sutton, St. Helens, May 10th.

DREDGING SHOT AND SHELL.

SIR,—Referring to your notice of ancient shells filled with powder being raised during the dredging operations in the Colombo Harbour, I may say that it has been no uncommon occurrence, and within my own experience, to find cannon balls up to about 10 lb. to 14 lb. weight roll out of the Harwich stone when it is placed under the rollers in the manufacture of Roman cement. I have seen three instances of this, and the shot still retained the smell of tar and gunpowder.

The explanation given to my inquiries was that during the war with France, Harwich was the great resort of privateers, and that they practised gunnery over the mud flats, which, on the subsequent retirement of the sea, hardened into the stone from which Roman cement is manufactured. ARTHUR FOLKARD.

M. Inst. C.E.

Thatched House Club, St. James's-street, May 10th.

HORIZONTAL CONDENSING ENGINE.

WE give this week the first of several illustrations of an engine which exemplifies modern French practice of the best kind. The engine is fitted with Zimmermann's valve gear, which we shall describe fully in our next impression. One excentric works all the four valves, and the range of admission is limited to about two-fifths of the stroke. The general features of the engine are shown very clearly by our engraving, page 352.

ROBINSON'S PATENT DOUBLE HORIZONTAL SAW FRAME.

THE illustration, page 348, represents a double horizontal saw frame, recently patented by Messrs. Thos. Robinson & Son, Limited, wood-cutting machinists, Rochdale. Machines of a similar type, but constructed to work with only one saw, have long been used for sawing logs of costly wood, such as mahogany, &c., into panels and boards, and for the conversion of rough-shaped timber, such as oak and ash tree trunks, &c. It is claimed that the double machine here illustrated not only possesses all the advantages of the single bladed machine for this class of work, but is capable of producing more than double the amount of boards, with considerably less wear and tear, and a very slight increase in the amount of power required for driving, owing to its working parts being truly balanced in equilibrium.

The saws are each carried in a separate working frame, which can be independently raised or lowered to any position necessary to determine the thickness of board to be sawn; and if for any special work it is desirable to saw with only one blade at once, the other can be raised so as to be clear of the log. The distance from the points of the teeth of one saw to the points of the teeth of the other saw is very short. After the log comes in contact with the front saw, it has only to travel 9in. before it comes in contact with the back saw. This is a special feature in the machine, for if this distance is not very short its utility would be greatly diminished by the loss of time required for the log to travel through the space between the two saws. The working frames are driven by light iron connecting rods from a two-throw crank with opposite centres, so that the motion of one truly balances that of the other, and entirely obviates all vibration. This enables a very high speed to be attained, and only slight foundations are requisite.

This firm have manufactured over 250 machines of the single type, and it is only fair to assume they have been guided by their long experience in this speciality to produce a machine that will commend itself to the timber trade generally.

RAILWAY MATTERS.

THE design and construction of a bridge over the Forth officially occupy the attention of four eminent engineers of Westminster, and more will be heard of the Forth Bridge and Forth Bridge Company in a short time.

THE Minister of Works, New South Wales, estimates the expenditure required for railway extension and other works at five and a-half millions. The proposed extensions are Sydney to Wollongong and Kiama, Homebush to Waratah, Albury to the River Murray, including part cost of the bridge, Goulburn to Cooma, Narrandera to Jerilderie, Murrumburrah to Blayney—the total mileage of contemplated railway extension being nearly 600 miles.

IN reporting on the collision which occurred in February last on the Midland Railway, near Leicester, Major-General Hutchinson remarks: "This collision affords another instance of the untrustworthiness of wire-worked points. The Midland Railway Company are quite aware of this, and the superintendent informs me that they are substituting rod-working for wire-working as fast as they are able; the substitution of rod for wire was in progress when this collision occurred."

AN incident suggestive of what might happen in a signal box, and, as a result, outside it, is given in the following:—"As the 1 a.m. mail train from Southampton to London neared Woking, on Friday morning the 6th inst., the driver noticed the danger signal on at Sheerwater, and stopped his train. After waiting 25 minutes the fireman went to the signal box to ascertain the cause of the delay, and found the signalman, Samuel Gunner, dead in his box. There were no signs of foul play. Less than half-an-hour previously the deceased had signalled a train to Woking. He had been in the service of the company thirty years.

IN concluding his report on the accident and collision which occurred on the 5th February, between Stonea and Manea stations, on the Peterborough and Ely branch of the Great Eastern Railway, when a great deal of stock and one engine were greatly damaged, Major-General Hutchinson says:—"Had the train been fitted with a continuous brake, by the application of which the speed of each of the vehicles composing the train would have been uniformly retarded, it would probably have been brought to rest in more or less regular order and without having fouled the down line, and the collision with the down goods train would then have been avoided."

THE local authorities of Smethwick are desirous that the London and North-Western Railway Company should improve the railway accommodation of their town. They wish the removal of the present goods station to High Park-road, and the erection of a new passenger station in High-street, outside the site of the old goods station. They would also like the erection of a bridge over the level crossing in Rolf-street—a step that would necessitate the lowering of the line about 4ft. Mr. R. Moon, chairman of the North-Western Company, with other officials, had an interview with the Smethwick Local Board this week, at which Mr. Moon held out little hope of the realisation of the board's scheme, as the directors considered it very expensive. He submitted an alternative scheme, but promised to lay the board's proposal before the directors for reconsideration.

AN escape from a shocking death is reported as follows by the *Leeds Mercury*:—"As the 9.40 a.m. train from Scarborough to Hull was nearing the Walton-street Crossing on Friday morning last, the driver observed a woman crossing the line. The train was only a few yards distant, and not having time to whistle, the driver promptly applied the Westinghouse brakes, with which the train was fitted, and brought the engine to a standstill in a few moments. The woman had a most marvellous escape, for the buffers of the engine just grazed her as it was stopped. The train was going at a pace exceeding twenty miles, and must have cut the woman to pieces but for the measures taken by the driver. It is thought the woman was deaf. The admirable presence of mind exhibited by the driver in applying the brakes with such promptitude was much praised."

A SELECT Committee of the House of Commons has been sitting on the Bill promoted by the North British Railway Company for the construction of a new railway bridge over the Tay, and on Wednesday the preamble of the Bill was declared to be proved. The proposed structure, which is for a double line of rails, is designed by Mr. W. H. Barlow, M.I.C.E., and is estimated to cost about £670,000, as against the £350,000 which was spent on the single-line bridge destroyed in December, 1879. It will be raised on entirely new foundations, and the committee have stipulated that every caisson in the piers shall be properly adjusted to bear at least 33 per cent. above the maximum weight to which it can be subjected. The height has been reduced 11ft. below that of the old structure, thus giving a waterway for ships passing to Perth and Newburgh of 77ft. instead of 88ft.

DURING last February there was, according to the *Railroad Gazette*, a total of 149 railway accidents in America, by which 27 persons were killed and 253 injured. Twenty accidents caused the death of one or more persons; 32 caused injury but not death, and no injury serious enough for record took place in 97, or two-thirds of the whole number. As compared with February, 1880, there was an increase of 85 accidents, of 11 in the number killed, and of 204 in that injured. These accidents may be classed as to their nature and causes as follows:—Rear collisions, 26; butting collisions, 10; crossing collision, 1. Total, 37. Derailments: Broken rail, 19; broken wheel, 14; broken axle, 6; broken bridge, 7; loose wheel, 1; spreading of rails, 2; wash-out, 1; land-slide, 3; snow, 3; accidental obstruction, 3; misplaced switch, 3; unexplained, 37. Total, 99. Broken wheel not causing derailment, 4; broken connecting-rod, 9. Total, 149. Three collisions were caused by trains breaking in two; two by misplaced switches; three by mistakes in orders; one each by carelessness in side-tracking cars, by a flying switch, by fog, and by derailment of a train. The number of collisions was remarkably small in proportion to the whole number of accidents, being hardly one-fourth.

A GOOD deal has been said and written of late, says the *Indianapolis Medical Journal*, about the first railroad and the first locomotive in the West. The first railroad built west of the Alleghanies was constructed between Frankfort and Lexington, Kentucky, a distance of twenty-two miles. The first locomotive run in the West was run over this road. The first locomotive that turned a wheel in Indiana was borrowed of this road in 1837, by the Madison and Indianapolis Railroad. It was brought down the Kentucky river from Frankfort on a flat-boat or scow. It made its first trip on the 25th December—Christmas Day—1837, running westward from the top of the hill at Madison, ten or twelve miles. This road was not finished to Indianapolis until June, 1848. The first railroad track laid down in Indiana was in 1834. It was on the Lawrenceburg, Shelbyville, and Indianapolis Railroad, and extended three miles eastward towards Lawrenceburg from Shelbyville. It was never ironed, if it was intended to iron it, and there never was a locomotive upon it. The superstructure was all of sawed timber, and the rails were of oak, sawed 4in. square and 16ft. in length. The grading and bridging were very substantial, the track filled in with earth, and the bridges floored. The only motive power ever used was the horse. There were two cars on the road, both of unique construction. They were weather-boarded like a house, with shingle roofs, and about 18ft. in length. They were lighted by four windows on a side, consisting of four panes, each of 8in. by 10in. glass. These windows were placed so high up that your correspondent, then a small boy, had to climb upon the plain wooden seats and stand on tip-toe to see out of them. When the first locomotive in Indiana made its first trip there were but 1460 miles of railroad in the United States. Now every county in Indiana is touched by a railroad, except Perry, Crawford, Harrison, Switzerland, Ohio, and Brown.

NOTES AND MEMORANDA.

IT is said that eelskins make the best possible strings for lacing belts.

THERE are now 2,217,000 acres under cultivation in South Australia, a larger area than any other Australian colony.

THE application of powdered pine wood charcoal to burns and scalds has been recommended by a foundry workman as giving speedy relief and cure.

FOR staining wood green a mixture is used consisting of half-pound of the best verdigris and one ounce of indigo; boil in six pints of vinegar. Allow the veneers to simmer till the colour has penetrated.

To remove the smell from mineral oil, the *Chemist and Druggist* says: Agitate briskly with the oil a saturated alcoholic solution of submuriate of potash and caustic soda. About 5 to 9 per cent. of the solution may be necessary.

A COMPANY in Tasmania has recently sent to Launceston a cake of gold of 1202 ounces, valued at £4820, obtained from 776 tons of stone; and another crushing company sent 2122 ounces from only 418 tons of quartz, or an average of over 5 ounces to the ton.

M. LABRE, pharmacien at Jaligny, has recorded that, by collecting, melting, and filtering pure snow, he has obtained a supply of distilled water perfectly insensible to all the tests for impurity, such as nitrate of silver, perchloride of mercury, soluble salts of baryta, alkaline carbonates, and oxalate of ammonia.

THE census of the United states newspapers shows that there are 962 daily papers published, including 80 that have been suspended and 114 new ones started during the census year. These dailies have an aggregate daily circulation of 3,581,187, costing the public 26,250,100 dols. annually. New York has 115 daily papers; Pennsylvania, 98; Illinois, 73; Ohio, 54; and California, 54.

AT the close of last year there were 170,103 miles of telegraph line in the United States, and during the year 33,155,991 messages were sent. The miles of wire were about 300,000. This does not include the lines used exclusively for railroad business. The other countries having the greatest length of lines are as follows:—Russia, 56,170 miles; Germany, 41,431; France, 36,970; Austria-Hungary, 30,403; Australia, 26,842; Great Britain, 23,156; British India, 18,209; Turkey, 17,085; and Italy, 15,864.

ACCORDING to M. Daubrée, an examination of the vitrified forts of Craig Phadrick, near Inverness, and of Hartmannswillerkof, Alsace, shows that their materials must have been subjected to sufficiently high temperature to dissipate the mica and to fuse much of the felspar, the minerals produced at the cost of these two presenting evident similarities. He considers that the method of heating was transported, not re-invented in the several countries. The Alsace forts seem to have been of brown porphyry, but the crystalline products of the heating are similar to the others.

M. TROUVE has made experiments with an English made tricycle, weighing about 55 kilogs. He fixed two of his electric motors, supplied with electricity by three secondary cells, such as he uses for his polyscopes, to each side of the machine, the motors being connected one to each crank. A friend rode the machine, which traversed the Rue de Valois, an asphalted street, at the speed of an ordinary cab. The experiment was continued for an hour. The total weight of the tricycle with M. Trouvé's friend on it was 160 kilogs., and the effective force produced by the two motors, seven kilogrammetres. The *Electrician* says, M. Trouvé is at work on a motor, the effective force of which he puts at 10 kilogrammetres, and with which he hopes to attain a speed of from 20 to 30 kilometres an hour.

THE composition of the artificial stone from which the articles exhibited in the Paris exhibition by M. Dumesnil were made, is said to be as follows:—In 500 litres—110 gallons—of water, are dissolved 7 kilos.—15½ lb.—of alum, 6 kilos.—13¼ lb.—of slaked lime, and 1 kilo.—2¼ lb.—of yellow ochre, to which is added 1 kilo. of glue dissolved in 5 litres—1 gallon—of hot water. In this mixture, 900 litres—198 gallons—of plaster of Paris are tempered, and then half the quantity of fine river sand, free from clay, is added. This preparation, according to the *Journal* of the Society of Arts, run in moulds, sets in about twelve hours, and acquires great hardness. To protect the building blocks, thus obtained, from the action of rain, it is sufficient to give them three coats of silicate of potass dissolved in water.

To prevent explosion of petroleum, vapour, or fire from the ignition of oil in stores, M. Schlumberger in a note to the Société Française d'Hygiène on the "Automatic Extinction of Petroleum Fires," proposes to place on each barrel of petroleum a large bottle of liquid ammonia, so that, at the least explosion or on contact with the flames, the glass will be broken and the vapour of the liberated ammonia will form an automatic mode of extinction. The author states that he speaks from practical experience, and that he has frequently been indebted to ammonia for safety while conducting distillations of a dangerous character. He suggests that the plan should be extended to mining operations, and that easily broken vessels filled with ammonia should be stored wherever there may be a risk of accident from fire-damp explosions. Carbonic oxide cannot burn in an ammoniacal atmosphere.

THE census returns show that the same order of changes are going on in London as in other large towns as Manchester. The last returns show, for instance, that the population of St. Marylebone is 155,004, since 1871 a decrease of 4165; Islington has 282,620, or 68,842 more than in 1871; St. Pancras, 236,208, increase 14,743; Hastings, 42,256, or 12,967 more than in 1871; Reading, 42,050, or 9737 more than in 1871; Hackney, 163,609, increase 48,542; Oldham, 111,343, increase 28,714; Bolton, 105,450, increase 22,596; Blackburn, 104,012, increase 27,675; Preston, 96,525, increase 11,098; Rochdale, 68,865, increase 24,309; Burnley, 63,502, increase 19,662; Wigan, 48,196, increase 9101; Barrow, 47,097, increase 28,752; Warrington, 37,482, increase 5338; Ashton-under-Lyne, 37,049, increase 5064; Southport, 32,164, increase 14,080; Norwich, 87,841, increase 7459; Warminster, 13,840, decrease 1320; Jersey, 51,020, decrease 5600.

THE process by which the tree calf ornamentation is effected by bookbinders is described as follows in one of Messrs. Cassell's publications:—The cover, which must not be too thick, is bent upwards away from the book into the form of a channel. This is held slanting, at an angle, say, of 30 deg.; it is then sprinkled with pure water pretty freely, until the various spots begin to run into one another, and to find their way down to the central channel, and thus to fall off the cover. At this moment some very finely powdered copperas is dropped on the wet spots, and allowed to run down with the stream. Where the water is sufficient it carries off the iron, but where the leather is only damped it allows the colour to sink down into the skin. Some little experience and neatness of hand are required to give the desired effect, and to produce on the two covers a corresponding effect, which, however, should not be too closely alike.

FROM experiments on the radiation and conduction of heat in rarefied gases, Herr Graetz—*Wied. Ann.*, No. 13—finds the results in much better agreement with Stefan's law of radiation than with that of Dulong and Petit, and "it may be affirmed that in the temperature-interval from 0 deg. to 250 deg. Cent. the radiation is very nearly proportional to the fourth power of the temperature." The factor of proportionality σ—in Stefan's formula $Q = \sigma T^4$—is then that amount of heat which is radiated from one square centimetre of a substance of − 272 deg. Cent. in a second towards a space of the absolute temperature 0 deg. (− 273 deg.). By the method of least squares Herr Graetz finds

$$\sigma \text{ for glass} = 1{\cdot}0846^{-12} \frac{\text{gramme Centigrade}}{\text{centim. seconds}}.$$

Certain divergences at low temperatures suggest that while the intensity of radiation grows with rising temperature, it perhaps grows differently for different heat colours.

MISCELLANEA.

THE Trinity House Corporation has again accepted the tender of Messrs. J. Defries and Sons, for the year's supply of glass cylinders for the lighthouses and light ships.

FOR weighing machines of various kinds at the Melbourne Exhibition the highest awards have been made to Messrs. Henry Pooley and Sons, of Liverpool and London.

MESSRS. JOHN C. ONIONS, Bradford-street, Birmingham, have been awarded two first orders of merit—highest award—and one second for their collection of forges, bellows, &c., exhibited by them at Melbourne.

AT Tarlee, South Australia, a Mr. W. L. Neale recently gave a lecture on the telephone, and enabled the audience to hear distinctly the Adelaide Post-office chimes, at a distance of seventy miles from the lecture room.

MESSRS. HAYWARD TYLER AND CO. have been awarded at the Melbourne Exhibition, 1881, the first order of merit for the aërated water machinery exhibited by them, and also a second order of merit for a special machine.

MESSRS. HATTON, SONS, AND CO., of Bilston and Kidderminster, have received an award of the first order of merit at the Melbourne Exhibition for excellence of quality in the manufacture of their sheet iron, tin-plates, and large-sized tin sheets. This firm also received a similar award at the Sydney Exhibition last year.

IN addition to the three highest class awards granted to Messrs. Thos. Robinson and Son, Rochdale, for their machinery at the Melbourne Exhibition, they now learn by telegram that the jurors have awarded them the "Commissioners' Gold Medal" for the excellence of their steam engines and wood working machinery.

THE *Melbourne Argus* reports that Messrs. Hunt and Tawell, of Earls Colne, Essex, have been very successful at the Melbourne Exhibition. They have been awarded a first order of merit for their horse-powers, for their hand and horse-power thrashing machines, corn crushers, field rollers, seed drills; and for their winnowing machines and chaff-cutters a second order of merit.

A NEW kind of sand paper is being introduced into this country by Mr. A. M. Woolf, of 119, New Bond-street. It is made by M. Schlesinger and Co., of the Hansa Mills, and it is claimed for it that while it is much more flexible than glass papers, the sand, crushed firestone, does not crumble off so rapidly. Samples of the paper which we have seen certainly show that the paper will stand work, and is economical as to price.

THE entries for an Art and Industrial Exhibition at Plymouth close on Monday next. Prizes to the extent of £200, and one-third of the profits, for supplementary prizes, are offered for the best productions of professional and amateur workmanship, paintings, drawings, machinery, &c. This exhibition is intended for sale as well as exhibit. Fullest particulars may be obtained from Mr. Martin, St. Andrew's Hall, Plymouth.

IN turning over a number of papers this week we came across a proposal made a little more than a year ago by Mr. A. Leutner to place a number of small, neatly ornamental kiosques in different parts of London for the sale of newspapers. Although there is much in favour of the proposal, we have heard nothing of it from that time till now, or of Mr. Leutner's application to the vestries of London for permission to place such structures at suitable places.

THE exhibition of wools, woollen manufactures, and allied industries to be held in the Crystal Palace, and which is to commence in June and close in October, ought to comprise a great deal of interest, and be of the value which attaches to special exhibitions. No charge is to be made for space and medals and certificates will be awarded. Motive power for working machinery will be provided free of charge. Mr. P. L. Simmonds, Crystal Palace, is the superintendent.

THE New Zealand Government are determined to foster some industries if they pay heavily for it. Bonuses have been offered by the Government for the production within New Zealand of the following articles:—£500 for linseed oil, and £100 for oil cake, made from seed grown in the Colony; £1000 for sugar made from beetroot grown in New Zealand; 50 per cent. on value of cocoons, or silkworms' eggs, to the total of £1000; and £500 for home manufactured starch.

A COURSE of six lectures on "The Science and Art of Sanitary Plumbing" will be given, under the auspices of the National Health Society, by Mr. S. Stevens Hellyer, at the House of the Society of Arts, on May 17th, June 1st, 14th, 28th, July 12th and 28th, at 7.30 p.m. The lectures will be especially addressed to working plumbers, and illustrated by examples, diagrams, and working models, and demonstrations. Examinations of a practical nature will be held at the close of the course, and two large silver medals, several smaller silver and bronze medals, and certificates of proficiency, will be awarded by the National Health Society.

THE water used for the supply of Paris is derived from two sources, rivers and springs. That from the former is cold in winter and warm in summer, and is also less pure than that from the latter, which is of an equable temperature of from 10 deg. to 12 deg. Cent. The sewage authorities are anxious to separate the destinations of these two waters, and devote the spring water entirely to the private service, leaving the river water—drawn from the Seine, the Marne, and the Canal de l'Ourcq—supplemented by 7000 metres from artesian wells, to flood the sewers and lay the dust. For this purpose they aim at increasing their daily supply, so as to command a possible maximum of 500,000 cubic metres daily, and keep up a reserve to provide for times of drought.

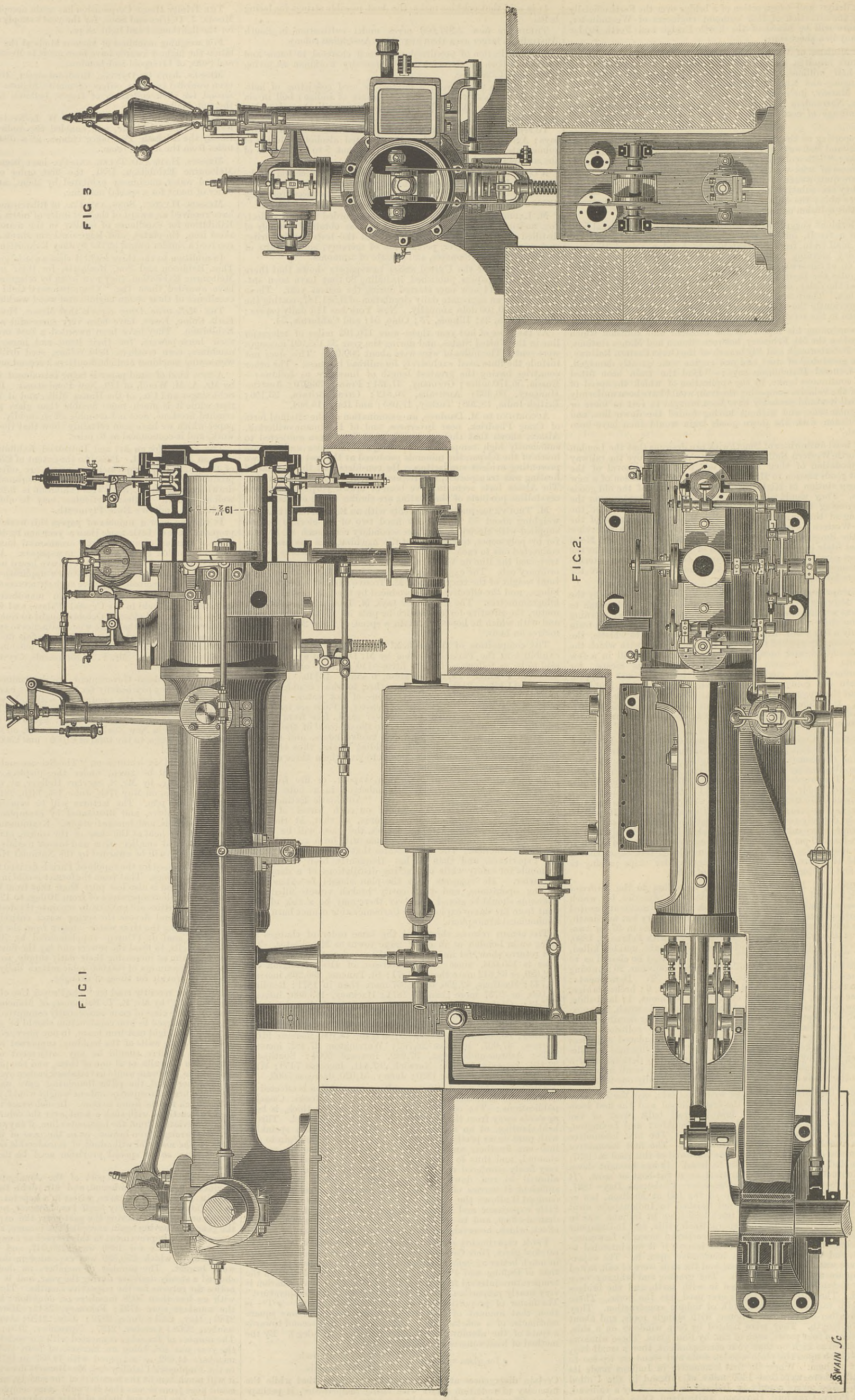
IN a paper recently read on "The Proper Use of Iron for Building Purposes," by Mr. E. T. Bellhouse, of Manchester, the author remarked, one class of error occasionally committed by designers not thoroughly versed in iron construction should be specially avoided. I have seen a rigid cast iron beam, in one piece, resting at each end upon the main walls of the building, supported in the centre by a column. If there should be any settlement or sinking in the foundation of walls, or of one of them, and the pillar stone should remain firm, the beam would have its back broken over the column. If, on the other hand, the pillar foundation gave way, and the walls remained firm, the superincumbent weight would, in all probability, be too much for the beam to bear. In such a case there should have been two castings, with such a joint over the column as to admit of a slight deviation from the horizontal line, if any such should occur. In using wrought iron beams—as in the case of timber—the elasticity of the material will admit of considerable deflection without any danger, so no special provision need be made for the contingency.

THE thirtieth annual report of the Amalgamated Society of Engineers has just been issued, and Mr. John Burnett, the secretary, in his general remarks, writes in a hopeful tone with regard to the future. The society itself has, however, not been in a very prosperous condition during the past year, the expenditure during the year 1880 having again exceeded the income, although there is a considerable improvement in this respect as compared with 1879. The total income for 1880 was £128,047, and the expenditure £139,090, of which £56,580 was expended in donation or out-of-work benefit. The number of members on donation, however, showed a steady decrease during the year, and it is interesting to notice the returns for the respective months. The year 1879 closed with no less than 5028 members on donation; in January, 1880, the numbers were 4737; February, 3842; March, 3157; April, 2786; May, 2331; June, 2279; July, 2170; August, 2064; September, 2068; October, 2137; November, 2154; January, 2014. The number of branches connected with the society at the close of the year was 405, being an increase of four, and the number of members 44,692, as compared with 44,087 in 1879. With regard to the Employers' Liability Act, Mr. Burnett does not consider that it will much benefit the members of the society, and the most they could hope from it was that it would cause employers to be more careful of the lives and limbs of their workpeople.

HORIZONTAL CONDENSING ENGINE.

SOCIÉTÉ ANONYME DE CONSTRUCTIONS MÉCANIQUE, ST. QUENTIN, FRANCE, ENGINEERS.

For description see page 350.



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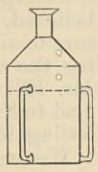
F. S. (Pendleton).—*We have no knowledge of the paper to which you refer. It is not impossible that the Secretary of the Society of Arts, John-street, Adelphi, may be able to help you in your search.*

W. M. (Whitehaven).—*Spretson's book "On Casting and Founding," published by E. and F. N. Spon. Overman's "Moulders' and Founders' Guide," published in this country by Messrs. Trubner and Co. If you have access to the volumes of the "Practical Mechanics' Journal" for* 1860 *to* 1869, *you will find some excellent articles on the subject therein.*

S. J. C. (Sandhurst).—*We fear nothing will cure the priming of your boiler. You may try the effect of putting three tubes* 1½*in. diameter with short elbows, outside, and spaced at equal distances all round, the tubes to lead from about the usual water level down to the bottom of the boiler as in annexed sketch. This will promote circulation, carrying the water back to the bottom of the boiler. Your screw seems to be of too quick a pitch. Try one with a* 3*ft. pitch, and if this cannot be done readily, make the blades of the existing screw a little narrower by rounding off the leading outer corners.*



STUBBS'S GAUGE.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers inform me where I can get weights per square foot by Stubbs' gauge—not B.W. gauge? J. P. C.

Swansea, May 7th.

ROCK DRILLS.

(*To the Editor of The Engineer.*)

SIR,—I shall be much obliged to any one who will give me the addresses of the makers of Warrington's rock drill, Brydon and Davidson's, Rand's, Barrows, and Reynolds. A. T.

Manchester, May 9th.

WATCH FUSEE CHAINS.

(*To the Editor of The Engineer.*)

SIR,—Can any reader tell me how the fusee chains of watches are made? In small watches the separate parts of these chains are almost invisible without a glass. TIME.

London, May 11th.

BRIGHTON BEACH.

(*To the Editor of The Engineer.*)

SIR,—Just one word of correction of an error in my letter in your issue of the 6th inst. In the paragraph beginning, "I would here wish to remark," the words "that we have only our own interests to protect" should be in inverted commas—they are your words, not mine.

E. B. ELLICE-CLARK.

4, Westminster-chambers, Victoria-street, London, S.W., May 10th.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, May 17th, at 8 p.m.: Paper to be discussed, "On Torpedo Boats and Light Yachts for High-Speed Steam Navigation," by Mr. John I. Thornycroft, M. Inst. C.E.

THE METEOROLOGICAL SOCIETY.—Wednesday, May 18th, at 7 p.m.: "Comparison of Robinson's and Osler's Anemometers, with Remarks on Anemometry in General," by Mr. Richard H. Curtis, F.M.S "Notes on Waterspouts observed at Cannes in January or February, 1872," by the Hon. F. A. Rollo Russell, M.A., F.M.S. "On some Swedish Meteorological Observations in Connection with the Return of the Seasons," by Mr. Alexander Beazeley, M. Inst. C E.

CHEMICAL SOCIETY.—Thursday, May 19th, at 8 p.m.: "On the Reaction between Hydrogen and Nitric Oxide in the Presence of Spongy Platinum," by Mr. Lewis T. Wright. "A Method for the Ready Estimation of a Soluble Sulphide and Free Sulphurous or Free Sulphuric Acid, even in the Presence of Sulphates," by Mr. O. V. Pisani.

SOCIETY OF ARTS.—Monday, May 16th, at 8 p.m.: Cantor Lectures. "Colour Blindness, and its Influence upon Various Industries," by Mr. R. Brudenell Carter, F.R.C.S. Lecture I.—Introductory—Nature of colour vision generally. Solar light—its composition. The prismatic spectrum. Invisibility of certain elements of the spectrum to the colour-blind. Appearance of the combinations of the remaining elements. Varieties and definitions of the resulting colour blindness. Wednesday, May 18th, at 8 p.m.: Ordinary meeting, "The Electrical Railway, and the Transmission of Power by Electricity," by Mr. Alexander Siemens. Dr. C. W. Siemens, LL.D., F.R.S., will preside.

THE ENGINEER.

MAY 13, 1881.

THE GUN QUESTION.

THE information recently supplied to the House by Mr. Trevelyan, and the questions asked by Mr. W. H. Smith, have naturally brought up again the question of the rival systems of construction of ordnance. It is urged with much force that we need a large supply of powerful breech-loading guns, and that it is desirable to have it with as little delay as possible. If, then, a really good and powerful new type gun can be obtained without doubt at once, it seems wise to take the responsibility of immediately giving an order. This appears to be the case. The Elswick firm, who have really taken the lead in the development of new type guns, have actually had their ordnance under Government trial for the last two years. They have fired their guns with an enormous amount of stored up work in them, and the trial has been very successful. Does it not appear reasonable and fair to them to begin by ordering guns from them? We ask this question, not as a preliminary to contradiction, because we do not see cause to contradict it. We think if a certain number of guns are immediately wanted, it is reasonable and right to give the preference to those who stand in the position held by Elswick. This, however, is not the last word to be spoken on the question. While we believe that in the investigation of the problem how to burn powder to the best advantage, England has been well to the front, it has happened that the conclusions we arrived at were not on the whole favourable to our own service guns. In the development of length our quick burning powder originally placed us at a disadvantage; so did muzzle-loading. Hence it is that we need to bestir ourselves to equip our navy afresh. We are almost tempted to digress here, and point out that the small number of inferior guns carried in our ships of war further tells against us. Speaking generally, we carry much fewer guns of medium size than the French. Perhaps we were right when our armour was able to defy the power of such guns; but directly it becomes possible for a medium gun to pierce our sides, everything is changed. So far, then, there is much in favour of vigorous action.

We have, however, considered only the length, proportions, and method of loading our guns. Where so much has recently been developed, has anything happened to bring up the question of actual construction? If so, seeing that we are likely to make a large number of guns for our service, surely special attention deserves to be given to this. Now we all know that where great efforts are made to increase power we are sure to learn the measure of strength we possess, and especially has this held true in this country; because we have enlarged the chambers of our guns to a great extent as a substitute for deficiency in length. But chambering a gun is likely to bring a peculiar kind of strain on it. The surface at the bottom of the bore being increased, the gun's projectile will stand in a mechanical relation favourable to its discharge, but throwing increased longitudinal strain on the gun. This, with other causes, may have contributed to some of the results which have occurred. As a matter of fact, at all events, we have had more notorious instances of guns made in this country bursting or yielding during the last two and a-half years than we have known since the first introduction of built up-ordnance. As we pointed out in a recent article, there is reason to fear that confidence in our guns is much shaken abroad, and that Krupp supplies guns where English ordnance used to go, even in vessels fitting out in the Thames. We especially wish to avoid raising the question of any particular accident. We only speak generally as to broad facts. We will suppose that it was perfectly right and natural that every gun should have yielded as it did; that we are convinced that the Thunderer gun was bound to protest against double loading; that the 100-ton gun showed how safely and gracefully a monstrous gun could pull asunder; and that the Angamos gun lies safe and sound, minus its trunnion ring, waiting to assert its innocence and strength whenever it may be fished up. Supposing all this, which has much to support it, the fact remains that steel guns have not had attention called to them in this way to the same extent latterly, and no one can pretend to say that our own service system stands as high as it did. Five years ago it was held that steel guns were liable to burst very dangerously, and those of wrought iron only to rend open under any strain. It would be difficult to maintain this in the presence of the fragments of the two Thunderer guns. Or if we go so far as to make special allowance for guns whose charges were exploded under compression and with exceptional violence, yet many will not do so. Rightly or wrongly, our wrought iron system of construction has had its reputation questioned abroad and at home. We do not mean that powerful guns cannot be made on it, for most of the very powerful guns existing are actually made on it. We do say, however, that immediate supplies of guns should be limited, and the whole question of construction should be fairly tried. If Elswick deserves consideration for the leading part it has taken in bringing out new type guns, may not the same plea be urged for Whitworth and Vavasseur for developing the manufacture of steel guns? If steel is good, the country will reap the benefit of the efforts made by private firms in the teeth of sweeping condemnation and discouragement. As we have pointed out, steel now claims the very qualities that caused us originally to give the preference to wrought iron. Personally we look upon steel as liable still to deceive. It has ways that need to be better understood yet, and we could quote examples of guns in support of what we say; but we may fairly question whether steel may not be proved to have powers so far in excess of those of wrought iron that a built-up gun may be made with sufficient margin to cover any danger arising from uncertainty, and yet able to bear more than our present service guns. Lastly, on the other hand, we have Sir W. Palliser's guns, adopted on a sweeping scale on the other side of the Atlantic—guns which have never been fairly burst, or anything like it, to our knowledge.

We have not the slightest wish to contrast our own system unfavourably with these. We only urge that its credit is so far questioned that we have no right to be satisfied without a trial. If we had either of the other systems in the service we should plead equally for this. Even from the point of view of our own Gun Factories and that of Elswick, we should urge a fair trial. Perhaps of the two, Elswick is specially responsible for the confidence placed in our present system. We hear of an officer urging a plea somewhat in the following language:—"You may set us down as prejudiced, but look at Elswick. Armstrong and Noble are not fools. Their credit and profits depend on the excellence of their guns, and they prefer the same system that we do." Clearly the question can only be settled by a thorough trial, and we trust that the country will be satisfied with nothing less. If our present system is the best, it will be well worth our while even pecuniarily to prove it so abroad. Our private factories really save us the necessity of having two or three Arsenals. It is important for their credit that they should be demonstrated to have guns capable of competing against the world. Let such a competition be invited. We are supposed to have a new committee deserving of extraordinary confidence. We have the highest authority for assigning to them independence tempered with discretion. What a happy position, then, are we in for the trial we suggest.

THE CORROSION OF IRON AND MILD STEEL.

THE minds of those interested in the extended use of mild steel for constructive purposes have lately been somewhat troubled. Mr. Philips, secretary to the late Admiralty Boiler Committee, read a paper a few weeks since before the Institution of Civil Engineers setting forth the results of certain experiments made by that committee, together with certain others since made by himself. The conclusions deducible from these experiments were that mild steel under almost all conditions to which it is likely in practice to be exposed, corrodes much faster than wrought iron. If this be really the case it naturally follows that mild steel is a much less trustworthy material than it was supposed to be; and the reduction of weight of scantlings now allowed by Lloyd's surveyors in consideration of superior tensile strength, ought to be in future prohibited, while the reduction in thickness in steel plates for marine boilers, as compared with iron, must also be discontinued. For it is not so much the strength of a structure when brand new that needs consideration, as its strength after a few years of active or passive service. If corrosion should be proved to be likely to do its deadly work upon steel considerably more rapidly and completely than upon iron, how can original reductions of thickness be any longer safely permitted when the more corrodible material is used? It is true that some rather severe criticisms were passed on Mr. Philip's paper during its discussion, but inasmuch as the Institution of Civil Engineers' meetings are not open to the public, nor attended otherwise than occasionally by members of the iron and steel trades, the unfavourable effect of the paper as regards mild steel might be considered still to remain in full force. In this position of affairs Mr. Parker's paper upon the same subject was placed first on the list at the recent meeting in London of the Iron and Steel Institute, and was generally pronounced to be extremely opportune. There is scarcely anyone whose evidence on such a matter is entitled to more respect, whether on account of the writer's great practical experience, his thorough technical knowledge, his independent position, or his fearless candour, as testified by his recent paper on the Livadia's boilers. Mr. Parker was therefore expected to give valuable and trustworthy evidence, and so he did. Let us now consider what he said.

He first reviewed the experiments made by the Admiralty Boiler Committee, admitting that on the surface they appeared decidedly unfavourable to steel. He considered, however, that the deductions made from them were open to question, because in making the tests due care had not been taken to prevent galvanic action. He did not refer to the tests which Mr. Philips had subsequently made privately and on his own responsibility. Why this omission was made has yet to be explained. He next reviewed the experiments made more than forty years ago by Mr. Robert Mallet, and though he recognised some value in them, he considered that they also, on account of their want of completeness, are unavailing in settling the present question. He then carefully described his own experiments, made by exposing six bright and six black discs to six varieties of corroding conditions, obtained from each of two makers of common iron, four of high-class iron and four of mild steel plates. The discs were in all cases 4½in. diameter by ¼in. thick. By means of glass insulators, and by carefully excluding other metals from the test groups, he endeavoured to avoid galvanic action. He first gave the results obtained from the six groups of bright specimens, and afterwards from those which had been exposed to the black or unscaled condition. In the case of the bright specimens the loss by corrosion is given in pounds per square foot per annum. For the sake of simplicity we have further condensed the results to one average for cold and one for hot corrosion. The former includes exposing to the action of cold sea-water, bilge water, and the London atmosphere; the latter includes three experiments in the water spaces of sea-going boilers under slightly different circumstances. The mean result in pounds per square foot per annum is as follows:—Cold: Common iron, ·267; best Yorkshire iron, ·294; mild steel, ·318. Hot: Common iron, ·261; best Yorkshire iron, ·298; mild steel, ·376. In other words, the excess of liability to corrode over and above common iron plates is as follows:—Cold: Best Yorkshire, 10 per cent.; mild steel, 19 per cent. Hot: Best Yorkshire, 14 per cent.; mild steel, 44 per cent.

The common iron comprised specimens of Cleveland and of Glasgow plates; the best Yorkshire of Leeds, Bowling, Farnley, and Lowmoor; and the mild steel of Landore, Shef-

field, Bolton, and the Steel Company of Scotland's make. Leaving these startling results of the experiments with the bright discs for a moment, let us proceed to the consideration of those with the black discs. Here Mr. Parker does not give us the loss in pounds per square foot per annum, but having in his mind the fact that a plate perforated by pitting is as much spoilt as one rusted away equally over its surface, he confines himself to determining the average depth of corrosion locally, where accidentally denuded of scale, of black plates compared with the same generally of bright plates. He finds a great increase of irregularity resulting from carelessness in leaving the scale on. Thus with the bright specimens, the ratio 80 : 100 about expresses the maximum variation in the loss between any two specimens similarly tested, whether common or best Yorkshire iron, or mild steel. But with the black specimens, whilst 40 : 100 expresses the maximum variation for common iron, 30 : 100 expresses that for best Yorkshire iron, and 20 : 100 for mild steel. The fickleness of unscaled mild steel as to corrosion is apparently much greater than that of best Yorkshire iron, and double that of common iron. The general conclusion drawn by Mr. Parker from the experiments with the black specimens is, that leaving the scale on induces pitting, which is tantamount to more rapid destruction of the plates. Although scale may be, and no doubt is, a protection to the part it covers, it evidently contributes to the more rapid destruction of the neighbouring parts; and therefore, unless it be complete and enduring, as it may some day be made by the "Bower-Barff" process, it is worse than useless. Mr. Parker advocates—and in this we fully agree with him—that in the meantime all scale should carefully be removed, leaving the bare metallic plate to ordinary oxidising influences, in case of the removal of paint, or of such other covering as may be artificially given to it when the structure is new. Dismissing for this reason further consideration of unscaled plates, we have only to deal with those which have been scaled, and which are, therefore, correctly represented by the bright specimens. Indeed, as soon as the first film of rust pervades a bright plate, it is in exactly the same condition as a new plate from which the scale had been carefully removed. The question we have placed before us is, how is mild steel likely to stand corrosion in ships and in boilers, as compared with the iron of which these structures have hitherto been mostly made? Here, we regret to say, we find ourselves somewhat at variance from Mr. Parker. We accept, or rather, we do not dispute his facts; but his conclusion seems to us unwarranted, and to some extent misleading. Perhaps we ought rather to say that the general impression conveyed by his own summing up of his paper is not, in our opinion, justified by his experiments. It is almost impossible at one sitting to grasp the full bearings of a technical paper, such as this, containing a number of statistical figures; and an audience naturally looks for guidance to the writer as to the conclusions they may properly draw. It is these conclusions which we, after a careful re-perusal, are disposed to find fault with. The following are extracts from Mr. Parker's paper, containing the conclusions referred to:—"Although the average loss of steel is a little greater than of iron, the difference is so slight that for practical purposes it is safe to assume that bright steel, exposed to sea or bilge water, corrodes no faster than bright iron, especially than the better qualities of iron." "When exposed to the atmosphere, although there is no great difference between the common and the better sorts of iron, the steel appears to have lost considerably more than either Lowmoor or any other iron, and the same is the case with those discs exposed to the action of boiling water with or without zinc. Again, in another place—"So that although the present experiments confirm the prevailing impression that bright mild steel does corrode faster than iron, when we get from cold sea-water to the condition of a marine boiler the difference is not so great as to establish the matter beyond question." And further on—"It would perhaps not be far wrong, speaking generally, to say that the different pieces of iron differed as much among themselves as they did from steel; and certainly the effect produced on my mind after carefully weighing the results of the experiments has not been to raise any apprehension that steel boilers or steel ships are likely in the future to corrode to any serious extent more rapidly than iron." As to the practical working of the 1100 steel boilers now in use—"Greater irregularity in the corrosion of the steel is reported, due to the unequal action of the scale;" and, finally—"Neither from the series of experiments which I have described, nor from our daily experience up to the present time, is there any reason to believe that the question of corrosion is likely to form a bar to the extended use of steel for marine boiler-making purposes."

Now, when we consider that no ship afloat has been built of "Lowmoor" or any other prime brands of "best Yorkshire iron," or is any ever likely to be on account of the cost, there is no use introducing into the discussion the liability of such brands to corrosion as compared with steel in ship construction. Having successfully driven iron nearly out of the market for rails, steel-makers are now naturally endeavouring to do the same as regards shipbuilding material. But it is the so-called common irons of Cleveland and Glasgow that have to be superseded, if any, and not those of Lowmoor or the Leeds district. In ships the corroding elements to be contended with are three, every part of the hull being liable to be acted on by one or other of these. They are cold sea water, bilge water, and the atmosphere. The practical aim of the manufacturer must therefore be, to make iron or steel which will stand any of these destructive agencies—and no one can say to which one a particular plate will be most subjected. We therefore have amalgamated Mr. Parker's first three columns of results into one general result for "cold corroding," which nearly corresponds with ship-plate corrosion. This we have shown drives us to the startling conclusion that mild steel corrodes 19 per cent. faster than the iron ship plates at present in use. In other words, by the time a clean, unpainted Cleveland ship plate $\frac{5}{8}$in. thick has corroded away, a $\frac{3}{4}$in. mild steel plate would also be completely oxidised; and yet, the steel ships now under construction and afloat are not 20 per cent. thicker—as it would appear they ought to be—but 20 per cent. thinner than they would have been of iron.

As to boilers, the fact brought out by Mr. Parker that mild steel in boiler water spaces corrodes 44 per cent., and best Yorkshire iron 14 per cent. quicker than common iron, is startling in the extreme. Indeed, had Mr. Philips been present at the discussion—and it is a matter of regret that he was not—he would have been justified in making some rather pertinent and forcible observations. He might have said very properly, "It is contended that the Boiler Committee's experiments are valueless, and by inference that my whole paper, which included other confirmatory experiments, should be discredited; and yet this new set of experiments, in the making of which all previous faults have been avoided, has produced very similar results. I claim that the position I took has been strengthened, and not weakened." It must not be supposed that common iron is out of court in consideration of this part of the question. Common iron, as here understood, is the iron of the Cleveland and Glasgow districts. Large quantities of boiler plates are made in both these districts for marine and other purposes; and these are more carefully made than ship plates, yet they are mainly from the native pig irons; and as far as resistance to corrosion goes, there is no doubt they have all the good qualities of the lower brands. It is probable that the weight of iron from the whole best Yorkshire district worked up annually into marine boilers is quite insignificant compared to what at present is being supplied by Glasgow and the North of England. Indeed, mild steel has for long been so much cheaper in comparison that the question for consideration has been—"Shall it be Cleveland or Scotch iron boiler plate, or shall it be mild steel?" And not, "Shall it be mild steel or Best Yorkshire iron?" The very high initial cost and the heavy extras rigidly enforced, amounting in many cases to £50 to £60 per ton, have precluded the use of Yorkshire iron except, as it were, as a luxury. Much more might be said, if space permitted, about the physical properties of iron and steel. Professor Kennedy's paper, recently read before the Institution of Mechanical Engineers, and the discussion thereon, disclosed some remarkable facts, hitherto unknown or unappreciated. Among these we may mention—(1) That permanent set commences with mild steel—which alone is admissible for ships or boilers—at about 8 tons per square inch, as compared with 11 or 12 tons with North-country iron; (2) that at about 18 tons per square inch a distinctive "breaking down" or disintegration takes place, which has no analogy in iron short of its final breaking strain of, say, 21 tons per square inch; and (3) that for thicknesses above $\frac{3}{4}$in. or $\frac{7}{8}$in. mild steel is no stronger, and on account of the impossibility of doing sufficient work upon it, less trustworthy than iron. But our present object has been to discuss Mr. Parker's valuable paper upon corrosion, and therefore we content ourselves with simply alluding to the physical peculiarities of steel just named. In conclusion, we would ask shipowners, shipbuilders, ship insurers, and underwriters' surveyors to pause for a moment and ponder deeply, whether, metaphorically speaking, it is not possible there may be "rocks ahead" which will, in a not very distant future, play havoc with structures made of extra thin plates of extra corrodible material.

BRIGHTON BEACH.

THE letter with which we were favoured by Mr. Ellice-Clark with reference to the works now proceeding at Hove, and which we published in our issue of May 6th, has done much towards clearing up several of the points which we discussed partly on data furnished by the *Brighton Herald*, and we should be wanting in courtesy towards Mr. Ellice-Clark did we not admit that, in one instance at all events, our strictures upon his design of the work had been based upon an erroneous impression derived from a misunderstanding. In our last article we stated that we could see no advantage in so designing the concrete blocks as to make the voussoirs of an arch. From what we read, we had believed it to be Mr. Ellice-Clark's intention to form the entire body of the concrete groynes by a series of concentric arch rings. By his letter our misapprehension is entirely removed, and we are fully at one with him as to the strengthening likely to be derived by the series of arched bays his illustrative sketch showed.

We cannot, however, so fully agree in Mr. Ellice-Clark's dictum that "Long experience has demonstrated that to ensure this—the arrest of travelling beach—groynes must be carried out a certain distance seawards." We are inclined still to think that, supposing the groynes to be high enough to prevent wash of beach base at high tides, it would be all that is required to stay the shingle from further eastward progress. We have seen—we think at Worthing—a short sea-wall forming a T-end to a groyne, which, we believe, if there be real force in Mr Ellice-Clark's argument that a projecting groyne be necessary, would obviate the passage of shingle round a groyne stopped as we have suggested at the normal extension line of the beach. We have so freely stated in previous articles our opinion that in works for tidal action arrest there is a great element of uncertainty, that we fully guard ourselves against the presumption of offering an infallible criticism or suggestion, and we are fully prepared to recognise the value of Mr. Ellice-Clark's design illustrated by the sketch in his letter for a series of trending groynes. Looking at his sketch reminds us forcibly of a wave-line, and the nearer wave action can be approximated to in works of the kind, the more likely are they, we hold, to be successful. The reasons assigned for limiting the size of the concrete blocks to a mass capable of being carried by two men are unanswerable in the face of the very great increase in cost which the adoption of larger blocks would have involved; that is, always supposing that those now employed are by the interlocking, joint-breaking, and dowelling given to them, certain to answer their intended purpose.

Mr. Ellice-Clark has to a great extent met our objections to the limited quantity of water used with the cement, by his statement that the blocks are rammed home as the mixture is put into the mould. No doubt this would set free the air and remove the objection we raised. But since writing our last article on this subject it has occurred to us to look more fully into the conditions stated by the *Brighton Herald*, under which the cement for the works is being supplied by the makers, and we see reason to fear that by the insisting on so high a resistance to tensile strain as 420 lb. to the square inch, a danger has been incurred, lest, to obtain the required strength, the proportion of lime in the cement should become injuriously high. Such proportion would not probably have been of importance but for two facts. The first is the use of salt water in the mixing. We believe the first authorities, including Sir John Coode in most of his recent harbour works, abandoned the practice of using salt water in such constructions, and we can hardly conceive the neeessity for it when we read of the quantity of fresh water daily pumped out from the excavations and arising from land springs. The second fact, giving rise to the abandonment referred to, is, what is now well known to engineers, that in all concrete construction exposed by the ebb and flow of tide to alternations of wet and dry intervals, the concrete has shown a tendency, within the ranges of such ebb and flow, to rapid decay, and this tendency has been more strongly marked in all such structures when sea water has been employed in mixing the cement. The concrete in such places can be readily picked out with the finger, so rotten does its face in time become; and analyses made of the efflorescence, which we have before spoken of as being long continued, has demonstrated that there is a decomposition of the materials of the cement, due, it is believed, to the effects of the alternation of wet and exposure to air. It will be of interest to observe if, by restricting the quantity of water used in moulding the blocks, Mr. Ellice-Clark has obviated this result. We shall be glad to learn that he has so succeeded, but we confess to feeling doubtful about it.

We feel sure the Hove Commissioners and their engineers must agree, as Mr. Ellice-Clark writes that he does, in our view as to the necesity of legislative control in works of this nature. In the case of the town authorities there is the strong pecuniary argument to certify to the genuineness of their view, for all the expense they are now incurring has arisen, we believe, from the absence of such control being exercised over towns further to the westward; and we are fully inclined to give to the Hove Commissioners that credit for boldness in carrying out what is to a certain extent experimental work, which their engineer, Mr. Ellice-Clark, claims for them.

RED-HOT BOILERS.

THE Manchester Steam Users' Association being wealthy is able to spend money on scientific research of a very practical and useful character. Experiments were made some years since by Mr. Lavington Fletcher, the able engineer of the association, on a large boiler specially constructed for the purpose; and these experiments taught engineers something about the strength of flues, the fitting of manholes, and many other points. More recently Mr. Fletcher has been experimenting on the strength of rivetted joints in boilers, and we have given some of the results at which he has arrived in our report of the Proceedings of the Institution of Mechanical Engineers, last week. Not content with all this good work, the Association is now having a full-sized mill boiler built, with which to try an interesting experiment. The boiler will be fired in the ordinary way; then it will be allowed to get short of water, until the furnace crowns become red-hot, and cold water will then be showered on them. This costly experiment will be carried out to convince sceptics that an explosion cannot be caused in this way. Mr. Fletcher knows the kind of people with whom he has to do; and thinks no doubt that he can by ocular demonstration prove that an explosion cannot be produced by turning feed-water into a red-hot boiler, in a way that will set all doubts at rest; and we hope he will be successful. The popular theory is—or shall we say was?—that when cold water was turned on hot iron an enormous quantity of steam was made, which could not escape, and the boiler burst. The theory was absurd, but none the less popular. Its absurdity can be proved without the aid of a boiler. The specific heat of water is nearly nine times that of wrought iron; that is to say, one pound of iron in cooling one degree can only surrender heat enough to raise one-ninth of a pound of water one degree. If we suppose a boiler, working at 50 lb. on the square inch, to have two flues 2ft. 10in. in diameter and 30ft. long, and that the crowns of these flues are $\frac{5}{8}$in. thick, and that the boiler becomes short of water, so that a strip of the crown of each flue 1·5ft. wide becomes overheated, we shall then have 90 square feet of iron, weighing 1350 lb., heated, say, to 1400 deg.—a bright red approaching white. Now let feed water at 100 deg. be turned in; each pound of this water will demand to convert it into steam of 50 lb. pressure, about 1100 deg. The temperature in the boiler will be 300 deg., consequently the iron can only cool down to this point, and 1400 — 300 = 1100; but 9 lb. of iron contains at any given temperature only as much heat as one pound of water at the same temperature; and this being the case a moment's thought will show that, under the conditions stated, if we divide the total weight of overheated iron by nine we shall get the weight of steam which it can make from feed-water at 100 deg. Now $\frac{1350}{9} = 150$, and 150 lb. of steam at 50 lb. pressure would occupy 975ft.; but the boiler must be more than half empty, or the crowns of the flues could not be exposed to the extent stated. Assuming its diameter to be 7ft. 6in., the steam space would have at the time a capacity of at least 700 cubic feet. As this is already full of steam at 50 lb., it is clear that the steam made by the heated iron must have a greater pressure, and a smaller volume; and a simple calculation which we need not give in detail will show that even if no outlet whatever existed for steam, the pressure could not exceed 165 lb. absolute,

or 150 lb. above the atmosphere—but this is a strain which a 7ft. 6in. shell ought to withstand very readily. The bursting pressure of such a shell, double rivetted, and of ½in. plates, is 365 lb. But it should be evident that the conditions could never be brought about. It would be impossible to get tubes to retain their shape under a pressure of 50 lb. on the square inch if they were heated to a bright red heat as stated; and it is very difficult to see how under any circumstances they could be heated red hot, as we have supposed for the sake of argument, from end to end. Mr. Fletcher will of course have negative results from his experiments; he cannot burst the shell of his boiler.

In dealing with the subject, however, it is well to bear in mind that the capacity of the steam space in a boiler may exercise a very important influence. Thus if Mr. Fletcher were to take a vessel of small capacity and overheat it, and inject water, he might very readily have an explosion. This has no doubt taken place with kitchen boilers of cast iron. These are thick, small, and of weak form. A boiler having a capacity of about 2 cubic feet will weigh say 150 lb., and this if heated red hot would, as we have seen, make over 16 lb. of steam. It is not probable that the whole of such a boiler would be so heated, but it might easily convert 5 lb. of water into steam of 200 lb. pressure having a volume of over 11 cubic feet. If the steam could not escape, and was all retained in the boiler, it would have a pressure of over 1000 lb. on the square inch; and it is clear that if the generation of steam was very rapid only an enormous orifice could save the boiler. There is on record a case in which a woman attempted to pour a pail full of cold water into a kitchen boiler which was red hot at the time; the boiler was shattered by a violent explosion, and if we mistake not the woman was killed. No doubt the water was run in rapidly through a filling hole, and the steam was produced so quickly, that a momentary strain was put on the metal which it could not withstand. Events such as these have fostered the popular belief in the danger of turning fresh water into a red hot boiler, which belief has no real foundation. It must not be forgotten, however, that a catastrophe may be brought about in a different way by turning the feed into a boiler when short of water. At such a time, especially if there is a heavy fire on, the water will be in violent ebullition, and will wash over and cool the plates, preventing them from becoming red hot; but if the feed be put on full, ebullition will be checked, the water-level will fall, the crown plates will be exposed, become red hot and collapse. But this must not be attributed to an abnormal augmentation of pressure due to cold water and hot iron coming in contact with each other.

We would suggest to Mr. Fletcher the propriety of extending his investigations, and endeavouring to arrive at some explanation of the cause of the coming down of marine boiler furnaces. We illustrated in our impression for March 25th, a pile of flues which had thus partially collapsed. It was believed that Fox's system of corrugating flues would have prevented this, but the hope has not been realised. The Assyrian Monarch, a large, full-powered steamer, built by Messrs. Earle and Co., has collapsed one of her corrugated flues. It is said that the flue shows signs of over-heating. It must not be forgotten that in marine boilers it is almost impossible for a furnace crown to be over-heated by shortness of water. Over each crown the water stands in an average boiler quite 6ft. deep. Mr. Parker, of Lloyd's, has been investigating these failures, which have now reached such a point in number and importance as to threaten seriously to impair the value of high pressures at sea; and we believe he is disposed to conclude that the over-heating is due to the formation of a thin coating of grease on the outside of the flue, which effectually prevents the water from coming in contact with the metal. Failures of flues by over-heating when the boiler is well supplied with water are not unknown in Mr. Fletcher's own practice, and he would do a good work if he would further investigate this subject. Not, perhaps, unnaturally, a large number of people, especially makers of cylinder lubricants, are disposed to question the accuracy of Mr. Parker's conclusions; and if Mr. Fletcher can strengthen his hands by an independent investigation, he will do something worthy of much praise.

NORTHERN GAS PRODUCTION.

ONE of the effects of the attention that has been given to the electric light is shown in the general attempt of the gas companies and owners to cheapen the price of gas. In the Teeside district there have been several reductions in the price of gas announced by companies and corporations, but as the average price varies from about 2s. 6d. to 4s. per 1000 cubic feet, it is evident that the northern towns are not amongst those that have the benefit of the cheapest gas. In one of these towns where the price is comparatively low, there is a consumption of about 115 millions cubic feet, which may be said to be about 3000ft. per year for every person in the district supplied. This is a very small consumption when tested with that of other towns, and especially in the towns where gas is cheap, and where it is used largely for power and for fuel. In some of these north country towns there is an intention to extend the use of gas for cooking purposes, and the owning corporations are expressing their willingness to supply stoves and other apparatus on hire for use. By this method, and in others that might be named, there is a certainty of the increase of the use of gas. It affords many advantages for use as a fuel. It may be made cheaply, it is cleanly in use, capable of instant and ready regulation, and can be immediately lit or put out—advantages that will make it much more used for fires in offices, consulting rooms, and other places where attendance to a fire is not convenient, and there can be no doubt that there will be an extension of the use of gas for cooking purposes, as its value in this direction is better known; whilst it is probable that as the gas companies find that in some of the large areas its use is restricted, they will endeavour to introduce gas into cottages for lighting purposes much more than they have done—possibly by some such method in regard to payment as now prevails in respect to the water supply. In all these ways, if the companies or corporations that supply the gas will take the initiative, they will that find that the use of gas will continually grow. But one of the essentials for that growth is greater cheapness. Hitherto, the use of gas has been much of a monopoly—that is to say that gas has had a monopoly for the lighting of towns. Now for all its uses it will have competition, though in a restricted area, and hence there will be the usual results of competition. In the north of England there are many advantages possessed by the gas producers, not the least of which is the cheapness of coal, which is given by proximity to the coal-fields. But in the north there has not been so full a use of the product as there has been in the south, and it will now be forced on the companies to cultivate the sale in much the same manner that a private trader would have done. With greater cheapness, and the cultivation of the trade, there should be a very great extension of the consumption of gas in the northern towns, as well as the use of the electric light, which comes slowly into use.

WATER SUPPLY IN THE MIDLANDS.

COMMENDABLE enterprise is being shown by the corporations of Birmingham and Wolverhampton in securing an ample supply of good water at all times available for the use of the inhabitants. In connection with conspicuous additions to their pumping plant, the Town Council of Birmingham have accepted tenders for the construction of a reservoir, 98 acres in area, and capable of holding 400 million gallons. Such a reserve supply will make the town comparatively independent for a whole month of any accident to the pumping machinery, or of any cessation of flow through a protracted drought. The Corporation of Wolverhampton have it in contemplation to take similar action in their case, by the construction of a reservoir of 20 acres. Meantime they are about to spend £8150 in additional sinking through the red rock, and in the requisite increased pumping appliances. A decision to spend that sum was virtually arrived at on Monday, when the council received their water committee's report, and accepted the tender of the Lilleshall Company for the supply and erection of the engine and pumps for the sum of £4430. The low price of coal is greatly helping all the water companies. When coal was dear, the people of Wolverhampton had to pay a water rate of 7½ per cent.; they are now paying 5 per cent.; and the favourable balance at the end of the last financial year's working was £5000. There is, therefore, every probability of the whole £8000 being paid out of profit, together with the additional £650 a year as working charges. Whether or not history repeats itself in respect of the price of coal hereafter, the committee have done wisely in making economy of working a leading requirement in the machinery which they have selected.

LITERATURE.

Society of Engineers' Transactions for 1880. London: E. and F. N. SPON. 1881.

THE Society of Engineers was established in 1854, and at first included in its ranks many gentlemen who were not, strictly speaking, engineers at all. As time passed, however, some of these members died, and others retired. The Society now has about 300 members, and as much caution has been observed in electing candidates, it may be safely said that it represents in a very full sense of the word the profession. The age of the Society, the circumstance that it has hardly ever been distracted by internal warfare, and the positions held by a very large number of its members, all contribute to give it high rank, and to remove it from the category of only too many other bodies which are not representative and exert little influence. The transactions of a society or institution supply evidence of its merits or demerits, and the transactions of the Society of Engineers for 1880 are not inferior to those which it has previously issued year after year. The volume contains the inaugural address of the president, Mr. Bernays, and six papers, "On the Utilisation of Coal Slack in the Manufacture of Coke;" "On Distilling and Hoisting Machinery for Sea-going Ships;" "On Sensitiveness and Isochronism in Governors;" "On Modern Steel as a Structural Material;" "Engineering Notes on Cyprus;" and "On the National Value of Cheap Patents." There is, besides, an account of the vacation visits paid by the members of the Society to various places of interest. The volume is sufficiently, though not profusely, illustrated.

The inaugural address is very good; indeed, in many respects it is the best thing of its kind of the year. Mr. Bernays took for his theme the position of the Society of Engineers in its relation to the profession at large; and in handling his subject he showed that the papers read, and the visits paid during the vacation, are closely connected with many of the most important subjects of the present day. He went over a large range, and he had something to say on each paper and its discussion which was of value. He concluded his address with the following words, which deserve reproduction, and give a good idea of Mr. Bernays's style. Quoting Redtenbacher, the Rankine of Germany, Mr. Bernays said:—

His motto may be rendered into English thus:—"The general principles of mechanics constitute the only true and lasting basis, not only of engineering science, but for the whole vast realm of sciences penetrating into mysteries of nature"—or, in other words, nothing can be undertaken in this world of ours, no action or reaction can take place, which cannot finally be reduced to a mechanical problem; and whether a science is called physics or chemistry; whether we combine or dissolve bodies; whether it is a question of heat, or light, or electricity; whether we consider the motion or inter-action of the stars, the movements of the winds or of the waves, the growing of plants, and even the descent and evolution of man, the more nearly the explanation of a natural phenomenon approaches a mechanical solution the more accurate such explanation is likely to be; and as it is the engineer, in the widest sense of the term, who will ultimately have to deal with every natural phenomenon, in one form or another, in his endeavours to make the 'forces of nature subservient to the uses of man,' it is to the young engineer the key of the whole situation must be given, by inculcating him, at the very commencement, with sound principles of mechanics."

The two first papers in the volume are on two important subjects, concerning which there is actually no literature in existence. That on coke may be regarded as a complete monograph, and, taken with the discussion, may be said to supply all the information available concerning the productions from small coal. In the same way, the paper on hoisting and distilling machinery supplies information which cannot be had elsewhere. It is to be regretted that the discussion which followed was not longer and more interesting. When papers on recondite subjects are read, this is often the case, those who listen being unable from their ignorance to criticise, and consequently contenting themselves with asking questions. The paper on governors, by Mr. Rigg, might be regarded as a chapter from a larger work. It is in itself complete, but it is somewhat narrow in its range. It may be said of it, however, that it introduces those who study it to the very latest developments of the steam engine governor, and we are not aware that in any English treatise on the steam engine has the relay system been dealt with in the same way; indeed, we are not quite certain that it has been handled at all by English writers under this title. "Whenever a governor," writes Mr. Rigg, "directs the action of an independent power to do certain work, the system becomes one of relay, and this is a plan, in one form or another, applied to many high-class engines."

Mr. Rigg's paper was the last read before the summer holiday season, during which no papers are read. Instead, the Society of Engineers does that which hardly any other body does in England. Trips are made to various places of interest, and it is very difficult to overrate the value of these trips, especially to the younger members of the profession, as a means of instruction. After the first visit, which was paid to the South Metropolitan and Crystal Palace Gasworks, a number of the members dined together at the Crystal Palace, on the 29th of June, 1880. A couple of pages are devoted to abstracts of the speeches made on this occasion, and we feel tempted to quote from the speech made by Mr. Livesey, engineer of the South Metropolitan Gasworks. He proposed the "Success and Prosperity of the Society of Engineers," and he said much that applies to all societies of the kind. "One of their great wants is a supply of good papers, and nothing teaches a man so much about a subject as writing a paper on it." Mr. Livesey holds that much of the prosperity of the Society is due to the practice of visiting works, "which enable many men to see, touch, and handle that which before they only knew as a drawing." This was suggestive and to the point, and we may add that the credit of inventing this system of paying visits is due to Mr. A. Williams, the honorary secretary and treasurer.

After the vacation two papers were read, one by Mr. Beaumont on steel, and the other by Mr. Grierson on patents. Both papers have been very fully considered in our own pages already, and it is therefore not necessary to say much concerning them now. The first puts certain things concerning the failure of steel in a clear light; as regards the second, we believe that Mr. Grierson is entirely mistaken in his views, but his paper sets forth these views very clearly and compactly. The volume is well printed on good paper, and will add to the reputation of the Society.

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

(*From our own Correspondent.*)

UPON 'Change in Birmingham this afternoon, and yesterday in Wolverhampton, the sheet makers were short of orders from the galvanisers. Orders on Russian account for sheets have been mostly secured by Warrington makers, on account of their lesser prices. Sheets, singles, were quoted £7 5s. to £7 15s.; doubles, £8 5s.; and latens, £9 to £9 5s. Some brands of galvanised sheets were lower by 10s. per ton compared with two or three weeks back.

The Australian mail which has been delivered this week has not brought the galvanisers any large accession of orders. When the mail left Melbourne, corrugated iron was quoted at £20 10s. for 26 w.g. of ordinary brands. Fine brands were offered at £21 10s. to £22. Two hundred cases of "Stork" brand had been sold, chiefly "to arrive," at full rates. Sheet iron was going off quietly. Assortments of Nos. 8 to 18 were selling at £11; while for Nos. 20 to 26, £13 was obtained. Plates were steady at from £9 to £11. Bar and wrought iron was moving also at £9 to £11. Hoop iron "for trade purposes" was offered at £10 to £11. Tin-plates were saleable at 15 per cent. advance on invoice for good assortments at say 21s. 6d. for I.C. coke.

The demand this afternoon for stamping sheets and tin-plates was active. The bulk of the orders are coming just now from the United States, Australia, the Cape, Germany, and Russia.

Hoops and strips are in capital sale, chiefly for local consumption, but also for Australia and the Continent. Some makers report that they have two months' work ahead. Prices vary very much, in some instances as much as 20s. and 30s. per ton for iron which is all of a similar class and of very similar quality. From £6 5s. to £6 10s. at works is quoted for hoops, but some people are accepting less. Common gas tube strip is at a minimum of £5 12s. 6d., and between this figure and £8 10s., which is being obtained for strips for brass-cased tubes, the quotations are very numerous.

Boiler-plates were £8 to £9 and £9 10s., according to make. Marked bars varied from £7 12s. 6d. to £7 10s. and £7, and medium and common bars from £6 10s. to £5 10s. per ton.

In pig iron, competition was severe amongst representatives of distant makers. Northampton, North Staffordshire, and Wigan part-mine pigs were all about 45s. per ton, and Northampton sorts, 42s. 6d. to 45s. Native cinder pigs were 40s. to 37s. 6d. A few part-mine and cinder pig firms reported that they were selling all their make. In the case of Messrs. Alfred Hickman and Son, this means the sale of no less than 1150 or 1200 tons weekly. In the face of Shropshire all-mine pigs at £3, and Staffordshire ditto at £3 2s. 6d., hematite agents were not this afternoon able to do much. Their lowest quotation was £3 5s.—the figure asked for the hematites of the Wigan Coal and Iron Company, and also for an exceptional lot of Welsh hematites that were on offer. Tredegar hematites remained at £3 7s. 6d., and a sale of a 500-ton lot was reported. Barrow hematites were still quoted at £3 10s.

Our constructive engineers are on the look-out for a share of the ironwork that will be required for the large extensions that are contemplated by the Midland Railway Company at the Liverpool terminus.

The engine which the Lilleshall Engineering Company, Shropshire, is going to supply to the Wolverhampton Corporation for erection at their Cosford Brook pumping station is to pump 4,000,000 gallons per day. It is a single cylinder Cornish, having a stroke of 8ft., and a 56in. cylinder. It will make ten strokes per minute, will be fitted with Davey's patent differential valve gear, and a surface condenser. It will work a pump with a 32in. bucket, 120ft. deep, and also a high-lift pump with a 17in. ram, and a 24in. bucket, and having a 4ft. stroke. In this latter case the water will be raised 280ft. To drive the engine two double flue boilers—30ft. long by 7ft. diameter—will be put down, but the applications for these are not yet issued.

The cable and anchor business is not active. The yards are kept going mostly by small orders. Local makers learn that the Scotch and North of England shipbuilders are placing their cable and anchor orders chiefly in their own localities. As part of the outfit of one of the splendid steamers now being built upon the Clyde for the American trade, an anchor of enormous size, has lately been despatched from the yard of Messrs. Hy. P. Parkes and Ross, of Tipton. It weighs 5 tons 15 cwt., and is believed to be second in size only to the anchor of the Great Eastern—which was also made by this firm eight years ago. The cable for this monster

anchor is going from the yard of Messrs. Noah Hingley, and Son, of Dudley.

It is reported that at the close of the next month Mr. Richard Williams, the managing director of the Patent Shaft and Axletree Works, Wednesbury, will resign his position as manager, and that the present deputy manager—Mr. Wailes—is likely to succeed him. It is not, however, understood that Mr. Williams will withdraw his interest from this important Staffordshire concern.

Messrs. T. Icke and Son, of the Heath Leather Works, West Bromwich, have just manufactured two very large machine-made driving leather belts. One belt is 469ft. long, 14½in. wide, ¾in. thick, and weighs about one ton. In making it up 24,000 copper rivets, weighing 2½ cwt., have been used. The length of the other belt is 180ft., the width 15in., and the thickness ¾in.

The employers of the bedstead peg and stud makers in the Blackheath, Rowley, and Old Hill districts, have granted an advance of 2s. per cwt. The men have resumed work after a fortnight's strike.

Two gentlemen from Birmingham are to attend a sitting of the parliamentary committee on railway rates on the 30th inst., to give evidence on the subject of inquiry in its bearing upon the trade of Birmingham and the district. The evidence has been prepared conjointly by a committee of the Chamber of Commerce and a committee appointed by local manufacturers.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron trade of this district continues in almost as depressed a condition as it is possible to imagine. Consumers at present seem to be in want of little or no iron, and, in the face of the decided weakness shown by sellers, merchants are not disposed to enter into speculative transactions for forward delivery, although iron is offered over the whole of the year at very low figures.

There was again a very dull market at Manchester on Tuesday, and but few inquiries were reported for either pig or manufactured iron. Here and there orders are, of course, being given out, but where business is done it is at lower prices. Lancashire makers of pig iron are still asking 44s. for No. 4 forge, and 45s. for No. 3 foundry, less 2½ per cent. delivered into the Manchester district, but the sales effected are only very limited in extent. Tolerably good deliveries are, however, still being made on account of old contracts, and these, with the few new orders coming in, keep going the limited number of furnaces at present in blast. In outside brands coming into this market, prices, where they have been tested, are easier. I have heard of one considerable sale of Lincolnshire forge iron at as low as 42s., less 2½ per cent. for delivery equal to Manchester, and Middlesbrough g.m.b.'s, for delivery over the next three months, are offered at 45s. 4d. per ton net cash, with sellers up to the end of the year at about 1s. per ton above this figure.

There is very little change to report with regard to the position of finished ironmakers. Where forges are busy it is chiefly on old orders, as, except for shipment, there are but few new inquiries in the market. Where any activity can be reported, it is chiefly in railway materials, and some fair enquiries are coming in for light rails for export, the quotations for which, delivered equal to Liverpool, are about £5 17s. 6d. to £6 per ton. For bars delivered into the Manchester district, the average prices remain at about £5 12s. 6d. to £5 15s., and hoops can be bought at about £6 5s. to £6 10s. per ton.

Engineers generally throughout the district are but moderately employed, and but few new orders are reported to be coming in, whilst so far as machinists are concerned, I hear that some of the principal firms are decidedly in a worse position than they were a short time back.

In the coal trade less activity is generally reported. This, of course, is due largely to the lessened requirements for the better classes of round coal for house fire purposes; but as the falling off in the demand in this direction is accompanied by a continued very limited inquiry for the commoner classes of round coal for ironmaking and steam purposes, a general weakness is imparted to the market, and prices for all descriptions of round coal are easier. For the better classes of round coal at the pit mouth, 8s. 6d. to 9s. per ton are about the average quotations; for seconds, 6s. 9d. to 7s. 3d.; and for common round coals, 5s. 3d. to 5s. 9d. Engine classes of fuel are firm at about 4s. 6d. to 5s. for good steam burgy; and 4s. to 4s. 6d. for good slack.

Shipping generally is dull, and steam coal delivered at Garston and Liverpool is being offered at under 7s. per ton.

Messrs. W. and J. Galloway and Sons are just completing a new moulding shop at their Knott Mills Ironworks. This shop, which will provide accommodation for about 200 moulders, will be one of the largest in the district, and Messrs. Galloway, in its construction, have adopted all the modern improvements available to render it as perfect as possible. The main feature kept in view has been to construct a moulding shop which can be so worked that the castings are allowed to cool down slowly before they are lifted out of the sand, which, I need scarcely add, is a very essential point, particularly in heavy castings, many of which at Messrs. Galloway's works weigh up to 20 tons—in securing proper annealing and maintaining the toughness of the iron. To attain this the shop has been laid out in two sections, worked alternately, so that castings put down one day are allowed to remain in the sand the whole of the following day to cool, instead of, as is most frequently the case, being taken up during the night after they have been cast. The moulding shop itself has an area of 170ft. by 112ft., and is well lighted entirely from the roof, which is carried at a height of 48ft. from the floor on massive iron columns, bolted firmly down into stone and brickwork foundations, the outer walls being substantial brickwork unbroken by windows. The shop is traversed from end to end by a couple of travelling cranes capable of lifting from 20 to 30 tons, and arranged to run at three different speeds, according to the weight of material to be dealt with, and the iron columns, of which there are twelve, are constructed to carry interchangeable ten ton jib cranes which can be readily removed and fixed on any one column as required, by means of the travellers. Ample space is also provided for drying stoves, storage for moulding boxes, and for sand mixing, &c. For melting the iron three cupola furnaces have been erected 40ft. in height, and with outside diameters of 7ft., 5ft. 6in., and 4ft., the total melting capacity of which is about twenty-two tons per hour. These furnaces are supplied with Baker's blowers on a duplex arrangement, so as to prevent any risk of stoppage in case of accident, whilst the whole blast can be applied to the three furnaces simultaneously when required. In order to give as large a capacity as possible to the furnaces, an extra height has been allowed between the bottom and the charging doors, and steam lifting machinery is being erected for lifting the metal, &c., into the furnaces.

The stoves for drying the cores are also constructed on a duplex system, permitting of one side being worked without the other, and they are heated by furnaces constructed underground and completely closed. By this arrangement the stoves are heated entirely from the floor, and the hot air being passed from the stoves through the furnaces, considerable economy in the consumption of fuel is secured, whilst stoking is performed outside the building altogether. By this arrangement the cores are kept perfectly clean; in fact the stove itself might be whitewashed. The driving power required for the shop is obtained by means of rope gearing from a central engine of 120-horse power, which actuates the whole of the machinery throughout the works. This, I may mention, is one of Messrs. Galloway's compound engines, with instantaneous recoil cut-off gear, of similar type to the one which gained the prize at the Paris Exhibition, and the first of its class which the firm constructed.

In connection with the inaugural meetings of the National Association of Inspectors of Weights and Measures, which have been held in Manchester during the week, there has been an interesting exhibition of weighing and measuring appliances. Sir Joseph Whitworth exhibited one of his machines for measuring from 12in. up to one hundred thousandth part of an inch; and Messrs. Pooley, of Manchester and London, amongst their exhibits had a working model on a scale of 3ft. to the inch of a 14ft. railway weighing bridge with a capacity up to 10 tons or up to 5 cwt. in the model. The chief feature of the weighbridge was the readiness with which it could be thrown in or out of gear by the action of a lever, the bridge when out of gear becoming as rigid as any portion of the permanent way by being liberated completely from the weighing levers and dropped on to solid bearings.

Barrow.—The hematite pig iron market this week is much steadier in tone, and matters wear a slightly better look just now. I am assured that the demand for this metal has been much better this week than one or two weeks preceding it, and I know some very fair orders have been booked; but orders taken at present low rates cannot be said to be satisfactory, and makers do not care to do business on a large scale until higher prices are obtainable. The output of iron at the furnaces is very heavy, and the amount of metal being delivered is also very large—so much so that stocks have been reduced a great deal, yet prices do not show even the slightest advance, nor are there any signs discernible of any immediate advance taking place. The iron trade is not what it was expected it would be at this time of the spring of 1881. If the present demand is only maintained for some little time stocks will be worked down. Prices may then show some inclination to increase, but I cannot see at present any chance of this immediately being so. Present prices are, No. 1 Bessemer, at works, 58s.; No. 2, at 57s.; and No. 3, at 55s. 6d. Forge samples are quoted at the same. In the steel trade matters can be considered more satisfactory. I know very good orders have been booked, and inquiries are being pretty freely made. Steel makers, however, are somewhat similarly placed as producers of pig iron, low prices being the rule, and makers do not care about accepting heavy contracts, the orders they have in hand being at much better prices than can be got now. Iron shipbuilders still busy. Iron founders, boilermakers, engineers, and others, fairly employed. Shipping much brisker. Iron ore in good demand at late rates.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A PARAGRAPH is going the round of the press to the effect that Messrs. John Brown and Co., Atlas Works, had secured very heavy Government orders for armour-plates, which would keep them going well into the autumn. On inquiry at the works I find that this refers to the order I mentioned last week—1200 tons of composite armour-plates for H.M.S. Colossus and Majestic, which, as I stated correctly at the time, is divided between the two great companies, the Atlas and the Cyclops—600 tons for each. Though a considerable order for steel-faced plates, the Atlas establishment is a vast concern, and needs a good deal more than that to keep it going well into the winter.

I heard the other day of the Aldwarke Main—Messrs. John Brown and Co., Limited—obtaining an advance of 9d. per ton for steam coal. The rise, I am assured, was quite exceptional, and was for a very small quantity.

Heavy orders continue to be received for steel rails, prices still keeping very low. Ship-plates and boiler-plates are also in request; several good orders have recently been received from New South Wales and South America. There is a considerable business doing in propeller blades for Atlantic steamers, which are chiefly sent to Liverpool and Glasgow. They are being produced at the Atlas Works; railway tires, axles, and springs are also largely called for by home railway companies.

The silver and electro-plating trades are very dull, except in the case of one or two old-established firms, one of whom has a large shipping order in course of completion.

Messrs. Brown, Bayley, and Dixon, Limited, will probably be reconstructed after all. The creditors' committee have recommended the acceptance of the offer by the shareholders of a composition of 6s. 8d. in the pound. A meeting of the creditors will be held to adopt the committee's recommendation. The shareholders will in all probability form a new company to carry on the business.

On Wednesday morning I saw an armour-plate rolled at the Atlas Works—Messrs. John Brown and Co., Limited—on the "Ellis" principle of production. When the able chairman of this company invented his composite armour I gave a description of it in THE ENGINEER. Since that time very great improvements have been made in the process. The plate is now constructed in a manner which appears to be as near perfection as can be possibly obtained, and ought to repay the firm for the anxiety they must have had during the last two years. Now the plate has two-thirds iron and one-third steel, the steel being the face and the iron the back. Instead of the iron forming a framework, into the centre of which the steel is poured when the plate is placed horizontally, the steel face is now rolled, and a space left between the steel face and the iron backing. Into this space the molten steel is poured from the ladle, the plate being up-ended and lowered into a pit for the purpose. The result is that the scale, instead of being spread over the surface, is gathered at the end, and can be completely cut away. A perfect weld is also obtained by this means. The plate I saw rolled was 25 tons weight, its dimensions 8ft. 9in. by 6ft. 10in. In the rough the plate was 24in. thick, finished it will be 16in. It is one of a series at present being built for H.M.S. Majestic. Similar plates are being made for H.M.S. Colossus.

The pier at Coatham, half a mile off, is still in the condition it was left by the sea when last it carried away several hundred feet, and, inasmuch as the company which owns it has no funds, it is likely to remain unrepaired for the present. Inasmuch, however, as one pier is quite enough for the wants of the place, the loss of the other is not felt.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

EXTREME dulness was again the chief feature of the iron market held at Middlesbrough on Tuesday. It has become more and more evident that the sanguine views which were so freely indulged in at the beginning of the year as to the recovery of trade in the spring have been entirely unwarranted. Now when distribution and consumption should be at their maximum, there is no increase of the one or the other. Warrant holders and purchasers who artificially kept up prices by buying and keeping in hand all the excess of make for several months, are now in many cases only too desirous to sell out, thereby increasing the glut. No. 3 g. m. b. pig iron has fallen to 37s. per ton, No. 4 forge is 36s. 3d., and warrants about 37s. 6d. Curiously enough prices were almost exactly the same this time last year, as they were in the course of falling from the extremely high point to which they rose the previous January or February. But though prices of pig iron are the same now as a year ago, it would seem as though the actual position of sellers is very much worse. During the year from May 1st, 1880, to May 1st, 1881, the stocks have increased from 243,885 to 411,981 tons, being a difference of 168,096 tons. This gives an average monthly accumulation of 14,008 tons. Now the make of April, 1880, was 162,226, and of April, 1881, 176,964 tons, being an increase of make of 14,738 tons. It would therefore appear that with equal prices, and with a downward tendency at both the epochs under consideration, the supply of pig iron is from 14,000 to 15,000 tons per month greater than the present demand, or than the average demand during the previous twelve months, and the sum of the accumulation at that rate of the whole twelve months is weighing down the trade in addition to previous accumulations. The outlook under these circumstances is far from bright, and it is already beginning to have marked effects. Makers are much more anxious to sell than they were, and are now willing to extend deliveries over four or five months without extra charge. This is really a great advantage to consumers, and should tend to increase business; for when smelters will not sell ahead except at a considerable increase in price, consumers who are usually obliged to commit themselves, must either pay the extra, or confine themselves to dealing with merchants, or run the risk of the market, all of which are impediments to consumption.

The stock in Connal's stores is now 169,854 tons, being an increase of 834 tons during the week. Their Glasgow stock is 554,086 tons.

Manufactured iron continues in steady demand. Specifications against old contracts are coming in freely, and the mills are running regularly. Plates are selling at from £6 2s. 6d. to £6 5s.; and bars and angles at from £5 7s. 6d. to £5 10s. free on trucks Middlesbrough, cash less 2½.

The extensions which have for long been in progress at the Eston Steel Works are now almost complete. A new rail and angle mill will, it is expected, be started some time this week. Last week some test blooms were rolled successfully into billets, angles, &c. The general arrangement of the machinery is the same as in the older part of the works, that is, the ingots are heated in gas furnaces, then cogged down into blooms in a cogging mill driven by a strong pair of reversing engines singly geared into the train. The new cogging mill has been in operation some weeks making blooms for export to the United States. The finishing mill is reversing and direct-acting, with steam reversing gear worked from a "pulpit" overlooking the engine and train. Another pair of powerful reversing engines has also been lately put down in No. 1 mill, and these will be started in the course of a few days. There are now three of these working three complete mills. The compound or high and low-pressure principle has been adopted in order to economise steam as much as possible.

The repairs to the iron pier at Redcar, which was broken by a wreck in December last, are gradually progressing, and it is hoped that all will be complete by July. The principal difficulty met with is the great depth of sand which has accumulated over the rocks upon which the pier is built. The cast iron columns are rooted into this rock by boring holes with jumper drills, and fixing them with wooden wedges or with rust. The 6ft. or 8ft. of sand which is now found above the rock makes it difficult to work the drill, whilst it is not deep enough or stable enough to justify the adoption of screw piles at that particular place. There is no doubt, however, but that the difficulty will be got over with time and patience.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE iron trade, so far from showing any improvement, appears to be in a less satisfactory state than it was last week, unless it can be regarded as a favourable matter that prices have receded, and may therefore be somewhat nearer the point at which additional buying might be induced. On the publication of the Board of Trade returns at the beginning of the week, their unfavourable nature had a depressing effect, and as the additions to stock were larger than usual, and the week's shipments smaller than had been anticipated, the market became very flat. Neither in the home nor the foreign departments of the trade is there perceptible any immediate prospect of an improved business, and if ironmasters and merchants are not content to rest satisfied with the present amount of business, prices will either have to be materially reduced, or the amount of production curtailed. The ironmasters are understood to be very unwilling to resort to the latter alternative, as it greatly damages the furnaces, and adds so considerably to the proportionate cost of working. Upwards of 3000 tons of pig iron have been added to the stock in Messrs. Connal and Co.'s stores during the week, which now amount to the unprecedentedly large total of 554,647 tons.

Business was done in the warrant market on Friday morning at from 47s. 4½d. to 47s. 3d. cash and 47s. 6d. to 47s. 4½d. one month, the afternoon quotations being 47s. 4d. to 47s. 2d. cash. The prices further declined on Monday, when business was done in the forenoon at 46s. 10½d. to 46s. 8d. cash, and 47s. to 46s. 9d. one month, and in the afternoon at 46s. 7d. to 46s. 8d. cash, and 46s. 8½d. to 46s. 9d. one month. The prices declined further on Wednesday, when a large business was done down to 45s. 9d. cash and 45s. 10½d. one month. Business was done to-day—Thursday—at 45s. 5½d. cash and 45s. 10½d. one month.

The prices of makers' iron have declined in second hands during the week from 6d. to 1s. per ton, the quotations being as follows:—G.m.b. f.o.b. at Glasgow, per ton, No. 1, 48s.; No. 3, 46s.; Gartsherrie, No. 1, 57s.; No. 3, 49s.; Coltness, 57s. and 49s.; Langloan, 57s. 6d. and 49s. 6d.; Summerlee, 56s. and 49s.; Calder, 57s. and 49s.; Carnbroe, 52s. 6d. and 48s.; Clyde, 48s. 6d. and 46s.; Monkland, 48s. and 46s.; Quarter, 48s. and 46s.; Govan, at Broomielaw, 48s. and 46s.; Shotts, at Leith, 57s. 6d. and 50s.; Carron, at Grangemouth, 52s. 6d. (specially selected, 56s.); No. 3, 51s. 6d.; Kinneil, at Bo'ness, 48s. and 46s.; Glengarnock, at Ardrossan, 52s. 6d. and 48s.; Eglinton, 47s. 6d. and 45s. 6d.; Dalmellington, 47s. 6d. and 45s. 6d.

The coal trade continues fairly active, although the shipments from Glasgow were not quite so large as in the preceding week. The inland trade is not so brisk, and prices of all sorts except good steam coals are rather easier. In the eastern mining counties the volume of the coal trade is gradually increasing.

The strike of ship joiners at Glasgow has come to an end this week owing to the employers having conceded the men's full demand of 7½ per cent.

Damage to the extent of £2500 was done by fire a few days ago in Messrs. G. Edward and Co.'s Hercules Engineering Works at Johnstone.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

THE staple trades have exhibited unusual buoyancy of late, and instead of having to report busy trade at one port, and semi-stagnation at another, the duty, and a pleasant one, is to record thorough animation all over the district. Two especial features deserve to be noted, the re-opening of a colliery at Llansamlet, and the re-starting of a tin-plate works near Maesteg. The latter place has been idle for several weeks owing to the action of a few puddlers. Now they are in full work again. This makes the number of re-started works four within the last few weeks.

The tin-plate trade, which has been so long dormant, is evidently improving. The rise of 2s. on ordinary coke-plates is sustained. I find by recent returns that in the whole kingdom there are 96 tin-plate works and 295 mills. Ten works are still idle. In Monmouthshire alone 48 mills are stopped, and the make seems more limited there than in Glamorganshire. The dispute at the Old Lodge, Llanelly, is coming to an end.

Cyfarthfa is to be converted into a steel works. It has been imperatively decided, first, to give notice to the whole of the ironworkers that their services at the end of May will no longer be required; secondly, to stop all blast furnaces, mills, and forges, and all branches connected with them, and, this done, to proceed to carry out on the latest models an extensive steel works. Notice has been given to the men, and the other arrangements are only questions of time.

The proceedings *in re* the Penygraig explosion against the manager at Cardiff, last week collapsed entirely.

The coal trade is as active as I have known it. In all parts of the district the despatch of coal is very great. This generally applies to steam coal. House coal is slack.

Bars are in the market from £5 2s. 6d.; rails, £5 to £5 10s.

The old members have been elected by the colliers for the sliding scale. D. Morgan, Aberaman, to be secretary.

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 annoyanc 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.

3rd May, 1881.

1898. FOLDING PAPER, J. H. Johnson.—(*W. Cross, U.S.*)
1899. MIXING DOUGH, D. McKay & A. Knox, Glasgow.
1900. SUPPLYING HOT WATER, T. Jackson, Edinburgh.
1901. HARVESTERS, E. Alexander.—(*S. Maddin, U.S.*)
1902. CUTTING TUBES, W. Maiden, Chester, and E. F. Cowley, Walsall.
1903. FIREPLACES, M. Ingram, Manchester.
1904. ORNAMENTING WOOD, A. Martin, London.
1905. ELECTRO-TELEGRAPHIC APPARATUS, J. H. Thomson, Shoeburyness.
1906. SIZING, &c., CORKS, J. Liston, Glasgow.
1907. WORKING, &c., the PRESSING BARS of PAPER-CUTTING MACHINES, H. J. Haddan.—(*F. A. Barthel, Leipzig, Saxony.*)
1908. PARING KNIVES, W. P. O'Reilly, Peckham.
1909. MAGNESIA, H. Wedekind.—(*H. Hauinschild, Berlin.*)
1910. SHAPING, &c., METALS, H. E. Newton.—(*E. F. D. Deboutteville, Paris.*)
1911. FOOD, A. E. Brooke-Hunt, Peer's Court.
1912. BURNISHING HEELS of BOOTS, W. R. Lake.—(*Z. Beaudry, U. Beliveau, T. L. Hoitt, H. L. Brown, and J. E. Peck, U.S.*)
1913. PERFORATED CYLINDERS, &c., W. R. Lake.—(*A. Reeve, Camden, New Jersey, U.S.*)
1914. GIVING INFORMATION, W. R. Lake.—(*E. S. Boynton, U.S.*)
1915. WHITE ZINC PIGMENT, W. Lake.—(*J. Cawley, U.S.*)
1916. DESULPHURISING ORES, W. Lake.—(*F. W. Wiesebrock, New York.*)
1917. SEPARATORS, B. J. B. Mills.—(*J. Sternberg, U.S.*)
1918. CARBON CONDUCTORS, E. Brewer.—(*A. Edison, U.S.*)
1919. LATHES, G. W. von Nawrocki.—(*Werkzeug und Maschinenfabrik Oerlikon, Oerlikon.*)
1920. HARVESTING MACHINES, B. Samuelson and W. G. Manwaring, Banbury.
1921. REELING, &c., SILK, J H. Johnson.—(*E. Weber, Milan, Italy.*)
1922. ELECTRIC LAMP, J. B. Rogers, London.

4th May, 1881.

1923. SEPARATING IRON, D. MacEachran, Greenock.
1924. DRYING, &c., MATRIXES, J. E. Taylor, P. Allen, W. Evans, and D. Braithwaite, Manchester.
1925. COOLING LIQUIDS, J. Askew, London.
1926. CLINOMETER, &c., F. Barker, London.
1927. PAVING FLAGS, &c., H. Hill, Macclesfield.
1928. VULCANISED CAOUTCHOUC, G. Scott, Manchester.
1929. ALARM SIGNALS, C. (P. Ambjorn) de Sparre, Paris.
1930. VENTILATING, F. H. Engel.—(*B. Ohle, Hamburg.*)
1931. TREATING FABRICS, H. J. Haddan.—(*J. Tisselin, Paris.*)
1932. WEAVING, T. Stevens, Newgate-street, London.
1933. MOVIVE-POWER, D. Woollatt, Burton-on-Trent.
1934. MILLS, J. H. Johnson.—(*W. Seck, Germany.*)
1935. FEEDING-BOTTLES, J. Hickisson, London.
1936. CUTTING CHEESE, &c., J. Richardson, Gainsboro'.
1937. BLEACHING, C. T. Jacoby and W. Jennings, Nottingham.
1938. MAIN, &c., BLOCK BEARINGS, M. H. Gerring, Farringdon, and R. E. Rumsey, Lewisham.
1939. GETTING COAL, &c., C. S. Smith, Leicester, and T. Moore, Shipley.
1940. COMBUSTIBLE GAS, N. A. Otto, Germany.
1941. TIRES, A. Longsdon.—(*A. Krupp, Essen.*)
1942. ELECTRIC ARC LAMPS, J. Brockie, Brixton.)
1943. ELECTRIC LIGHTING, E. Brewer.—(*T. Edison, U.S.*)
1944. REFRIGERATING MACHINES, M. J. Klein, U.S.
1945. SEPARATING PARTICLES from ESCAPING AIR, L. Fiechter.—(*Christian, Bros., & Co., Minneapolis.*)
1946. REGISTERING, &c., FARES, T. Wilson, London.
1947. LIQUOR, FRAMES, W. Shorwood, Birmingham.
1948. LABELS, A. Gorse, Aston, near Birmingham.
1949. KNITTING, E. Brydges.—(*E. G. Wege, Germany.*)
1950. TELEPHONIC, &c., APPARATUS, W. R. Lake.—(*L. Maiche, Paris.*)
1951. SEWING MACHINES, M. C. and T. J. Denne, Holmesdale Lodge, Rede Hill.

5th May, 1881.

1952. FEEDING BOTTLES, J. Thomas, Brixton.
1953. CONTROLLING WATER LEVEL in STEAM BOILERS, C. Pieper.—(*R. Schwartzkopff, Berlin.*)
1954. SLIDING WINDOWS, F. Attock, Newton Heath.
1955. ROTARY ENGINES, H. Thibalt & T. Hawkins, U.S.
1956. RESPIRATORY APPARATUS, W. R. Lake.—(*A Khotinsky, Paris.*)
1957. SULPHURIC ACID, W. Weldon.—(*F. Benker and H. Lasne, France.*)
1958. CENTRIFUGAL MACHINES, C. D. Abel.—(*E. Langen, Cologne, Germany.*)
1959. VALVE-GEAR, R. H. Robinson, Marlpool House.
1960. METALLIC BOOTS, &c., H. J. Haddan.—(*C. J. Tisserand, France.*)
1961. MAGNETO-ELECTRIC MACHINES, P. Higgs, U.S.
1962. ELONGATING NAIL BLANKS, H. J. Haddan.—*J. H. Peck, Montreal.*)
1963. PENCIL CASES, G. W. von Nawrocki.—(*J. Faber, Nuremberg, Berlin.*)
1964. DOOR KNOBS, A. and R. F. Heath, Birmingham.
1965. VENT PEG, A. Whicker, Birmingham.
1966. MEASURING LIQUIDS, W. Jones, Manchester.
1967. INSOLES of BOOTS, W. H. Stevens, Leicester.
1968. ELECTRIC LIGHTING, W. R. Lake.—(*N. Bouliguine, Paris.*)

6th May, 1881.

1969. DARK LANTERNS, A. M. Hopkins, Birmingham.
1970. PARANITRO COMPOUNDS, C. D. Abel.—(*Messrs. Bindschedler and Busch, Basle, Switzerland.*)
1971. LACING HOOKS, H. J. Haddan.—(*G. Prentice, U.S.*)
1972. ACOUSTIC INSTRUMENTS, F. Wirth.—(*A. Rettig, Saarbrucken, Germany.*)
1973. STAMPING PAPERS, H. C. Gover, London.
1974. CONDENSING FUMES, H. N. Lay, Rumleigh, and H. Bulford, Calstock.
1975. METALLIC CASES, G. W. Hinchley, Handsworth.
1976. STOVES, J. Carrick, Glasgow.
1977. TILLAGE of LAND, F. H. P. P. Oram, Tottenham.
1978. SWEETMEATS, S. P. Wilding.—(*Thiele and Holzhause, Magdeburg, Germany.*)
1979. FURS, W. H. Beck.—(*F. Jungmann, Paris.*)
1980. PORTABLE BED, E. Edwards.—(*H. Strauss, Nuremburg, Germany.*)

7th May, 1881.

1981. CORNICE POLES, G. Giles, Birmingham.
1982. SMOOTHING IRONS, T. McCracken, Ardmore.
1983. STOVES, &c., C. J. Pollard, Burnley.
1984. CUTTING OPEN TIN CASES, H. Knight, Ryde.
1985. LAUNDRY BOILERS, L. J. Groves, Glasgow.
1986. TOILET VINEGAR, H. J. Allison.—(*E. Redares and L. Bouviez, Marseilles, France.*)
1987. SPINNING COTTON, T. Coulthard, Preston.
1988. SPINNING, &c., A. Munzenger, Switzerland.
1989. FASTENINGS for BOOKS, S. Posen, London.
1990. FIRE ALARM, E. de Pass.—(*La Société François Lebacq et Kretz, Paris.*)
1991. UMBRELLAS, H. A. Davis, London.
1992. BOLTING REELS, T. Sheldon, Osney.
1993. FASTENINGS for LIDS, E. G. C. Bomford, Fladbury.
1994. LATHES, G. E. Sherwin, Birmingham.
1995. BREAKING STONES, W. R. Lake.—(*P. Gates, U.S.*)
1996. HOLDING HATS, &c., M. Conrad, London.
1997. CIGARETTES, F. Hipgrave, London.
1998. SPECULUM TUBES, J. H. Aveling and J. J. Hicks, London.
1999. BOOTS, &c., W. R. Lake.—(*G. Spencer, U.S.*)

9th May, 1881.

2000. WINDOW-FRAMES, E. Edwards.—(*C. A. Schutz, Stralsund, Germany.*)
2001. CASING for the INTERIOR of METALLIC CARTRIDGES, H. A. Bonneville.—(*A. A. Biennait, Paris.*)
2002. PENCILS, &c., E. Wolff, London.
2003. FIRE-ARMS, W. W. Greener, Birmingham.
2004 SEWAGE, H. Collet, Avenue d'Eylau, Paris.
2005. PAPER CLOTH, W. T. Harvey, London.
2006. CORKING BOTTLES, J. P. Jackson.—(*M. C. Douché, Paris.*)
2007. GAS, J. L. Walker and J. W. Jowett, Elland.
2008. BEVERAGES, B. Hunt.—(*Y. Marchier, France.*)
2009. COMBING FIBRES, J. F. Harrison, Bradford.
2010. WARMING, H. J. Haddan.—(*A. Godefroy, France.*)
2011. CAR-WHEELS, E. L. Taylor, Philadelphia.
2012. HOISTING, &c., H. J. Haddan.—(*A. Guerolt and A. Blondel, France.*)
2013. GENERATING ELECTRICITY, A. Masson, France.
2014. SCALES, Dr. O. Gerike, Berlin.
2015. DOOR-HANDLES, W. Lake.—(*W. Gonne, Canada.*)
2016. ENGRAVING, J. Johnson.—(*S. Crocker, Railton.*)
2017. SODA, E. Solvay, Brussels.
2018. LINING, &c., CARRIAGES, G. D. Peters, London.
2019. SUGAR, W. R. Lake.—(*A. Brear, U.S.*)
2020. BAROMETERS, B. J. B. Mills.—(*Messrs. S. Guichard and Co., Paris.*)
2021. WINDOW-SASHES, E. V. Harris, Winchester.
2022. CHAIR, T. Harrison and C. W. Garthwaite, Huddersfield.
2023. GAS-BURNERS, H. Zwanziger.—(*J. Janky and J. and C. Rimanoczy, Vienna, Austria.*)
2024. BOOTS, M. Nicolson, Parliament-street, London.
2025. ELLIPTIC SPRING, A. M. Clark.—(*B. S. Clark and E. K. Righter, New York, and E. Cliff, Newark.*)

Inventions Protected for Six Months on deposit of Complete Specifications.

1912. BURNISHING the HEELS of BOOTS, W. R. Lake, Southampton-buildings, London.—A communication from Z. Beaudry, U. Beliveau, T. L. Hoitt, H. L. Brown, and J. E. Peck, U.S.—*3rd May*, 1881.
1913. PERFORATED CYLINDERS, &c., W. R. Lake, Southampton-buildings, London.—A communication from A. Reeve, Camden, New Jersey, U.S.—*3rd May*, 1881.
1914. GIVING INFORMATION, W. R. Lake, Southampton-buildings, London.—A communication from E. S. Boynton, Bridgport, U.S.—*3rd May*, 1881.
1944. REFRIGERATING MACHINES, M. J. Klein, New York.—*4th May*, 1881.
1955. ROTARY ENGINES, H. Thibalt and T. Hawkins, San Francisco, U.S.—*5th May*, 1881.
1961. MAGNETO-ELECTRIC MACHINES, P. Higgs, New York, U.S.—*5th May*, 1881.
1962. ELONGATING NAIL BLANKS, H. J. Haddan, Strand, Westminster.—A communication from J. H. Peck, Montreal.—*5th May*, 1881.
1971. LACING HOOKS, &c., H. J. Haddan, Strand, Westminster.—A communication from G. W. Prentice, Providence, U.S.—*6th May*, 1881.

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

1785. TIN PLATES, &c., G. Hatton, Kidderminster.—*3rd May*, 1878.
1956. COMBING TEXTILE FABRICS, E. Hubner, Paris.—*15th May*, 1878.
1862. STEAM MOTIVE POWER ENGINE, A. F. Caron and E. Julien, Paris.—*9th May*, 1878.
1877. MOVABLE HUTS, &c., C. H. Tollet, Paris.—*10th May*, 1878.
1936. SHELTER TENTS, C. H. Leycester, Gwynfe, South Wales.—*15th May*, 1878.
1968. BREECH-LOADING FIRE-ARMS, T. Perkes, London.—*16th May*, 1878.
2018. IMITATION LEATHER, W. R. Lake, London.—*20th May*, 1878.
1817. BUFFER SPRINGS, H. A. Silver, Sun-court, London.—*6th May*, 1878.
1828. SCREENING COALS, J. S. Dixon, Glasgow.—*7th May*, 1878.
1846. STEAM BOILERS, J. S. Stubbs, Manchester.—*8th May*, 1878.
1904. SUGAR, J. F. C. Farquhar and J. B. Macfarlane, London.—*11th May*, 1878.
2030. STEAM ENGINES, F. P. Preston, J. T. Prestige, and E. J. Preston, Deptford, and J. Dalby, Ipswich.—*21st May*, 1878.
2476. CUTTING STRIPS of CARDBOAD, W. W. De la Rue, London.—*21st June*, 1878.
1841. PRINTING, &c., E. Brace, Glasgow, N.B.—*8th May*, 1878.
1874. SULPHATE of LIME, F. J. Cheesbrough, Liverpool.—*9th May*, 1878.
1845. METALLIC TILES, H. Gardner, London.—*8th May*, 1878.
1848. COUPLING, &c., RAILWAY TRUCKS, W. Mewlam, Stockton-on-Tees.—*8th May*, 1878.
1880. WATER GRATES, &c., G. Green, W. A. Green, and J. G. Green, Aberystwith.—*10th May*, 1878.
1930. RAILWAY BUFFERS, G. Turton, Sheffield.—*14th May*, 1878.
1992. CUTTING TIMBER, J. J. Long, Glasgow.—*17th May*, 1878.
2049. LOCOMOTIVE and other BOILERS, W. R. Lake, London.—*22nd May*, 1878.

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

1619. FLUID METERS, H. Frost, Manchester.—*7th May*, 1874.
1584. REGULATING the SUPPLY of GAS, W. T. Sugg, Westminster.—*5th May*, 1874.
1623. REGENERATIVE HOT BLAST STOVES, C. Cochrane, Stourbridge, and E. A. Cowper, London.—*8th May*, 1874.
1943. WORKING VALVES, H. Davey, Leeds.—*4th June*, 1874.
1599. PREPARING COTTON, &c., T. H. Rushton, Bolton.—*6th May*, 1874.
1628. METALLIC COMPOSITIONS, E. P. H. Vaughan, London.—*8th May*, 1874.
2372. TWIST LACE MACHINES, J. Hancock, Nottingham.—*5th May*, 1874.
1314. TREATMENT of WOOL, &c., A. Smith, Manchester.—*16th April*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 27th May, 1881.

4967. DETERMINING the QUANTITY of WATER CARRIED by STEAM, C. D. Abel, Southampton-buildings, London.—Com. from F. A. Brocq.—*29th November*, 1880.
5483. WHEELS, J. Trippett and T. Walton, Sheffield.—*30th December*, 1880.
5495. ADMITTING AIR to FIREPLACES, R. Burchell, Kettering.—*30th December*, 1880.
5509. CHIMNEY-PIECES, J. H. Corke, Bradford House, Somers-road, Southsea.—*31st December*, 1880.
1. IMPARTING MOTION to VENTILATING, &c., APPLIANCES, G. D. Robertson, Palace-chambers, Westminster.—*1st January*, 1881.
12. MOTIVE-POWER ENGINE, G. O. Topham, Maida Vale, London.—*1st January*, 1881.
13. LITHOGRAPHIC MACHINES, G. Newsum, Leeds.—*3rd January*, 1881.
16. SCREW STEAMSHIPS, T. F. Irwin, Liverpool.—*3rd January*, 1881.
17. YEAST, S. Fulda, Bow, London.—*3rd January*, 1881.
18. TIP WAGONS, &c., G. Allix, Fleet-street, London.—*3rd January*, 1881.
22. ARTICLES of CAST IRON, C. F. Claus, Mark-lane, London.—A communication from Dr. H. Uelsmann.—*3rd January*, 1881.
23. COUPLING APPARATUS, H. H. Lake, London.—A Com. from G. F. Adams.—*3rd January*, 1881.
25. CUTTING SHEET METAL, J. H. Johnson, London.—Com. from C. Donnay.—*3rd January*, 1881.
26. WEIGHING YARN, &c., J. H. Johnson, London.—Com. from J. L. Mouchére.—*3rd January*, 1881.
32. STRAINING PAPER PULP, D. Bentley, Church-road, St. Anne's-on-the-Sea.—*4th January*, 1881.
42. DRYING and BURNING BRICKS, &c., J. Craven, Wakefield, and H. Chamberlain, Barnsley.—*4th January*, 1881.
43. WASHING and CLEANSING, A. Watt, Lewisham.—*4th January*, 1881.
44. ARTIFICIAL LEATHER, T. E. Hardy, Battersea.—*4th January*, 1881.
45. EXPANSION GEAR, J. Bodington, Harborne, near Birmingham.—*4th January*, 1881.
65. ELECTRIC LIGHTING, P. M. Justice, London.—Com. from H. C. Spalding.—*6th January*, 1881.
67. BALE-TIES or HOOP LOCKS, E. Hale, Wigan.—*6th January*, 1881.
68. WEAVING, G. H. Hodgson and J. Broadley, Bradford.—*6th January*, 1881.
106. PENHOLDERS, R. Spear, North-buildings, London.—*8th January*, 1881.
126. EYELET TAPE or BINDING, W. Pretty, jun., Ipswich.—*11th January*, 1881.
156. FURNACES, J. H. Johnson, London.—A communication from M. Perret.—*12th January*, 1881.
165. CARPET-CLEANING MACHINES, J. H. Johnson, London.—Com. from W. McArthur.—*13th January*, 1881.
184. CARBONATE of POTASSIUM, E. P. Alexander, London.—Com. from C. R. Engel —*14th January*, 1881.
221. VINEGAR, H. H. Lake, London.—A communication from O. F. Boomer & H. R. Randall.—*18th January*, 1881.
232. WHEELS, A. M. Clark, London.—A communication from A. B. Fabregas.—*19th January*, 1881.
277. ORE SEPARATORS, R. H. Brandon, Paris.—A communication from E. B. Hastings, J. F. Holbrook, and R. L. Goddard, U.S.—*21st January*, 1881.
305. GAS STOVES, A. C. Henderson, London.—Com. from Messrs. André & Legrand.—*24th January*, 1881.
328. PIGMENTS, J. B. Orr, Cannon-street, London.—*25th January*, 1881.
464. FILTERING, E. P. Alexander, London.—Com. from P. Casamajor and C. H. Senff.—*3rd February*, 1881.
483. WHEELS, A. M. Clark, London.—A communication from A. B. Fabregas.—*4th February*, 1881.
509. KILNS, A. S. Tomkins, F. M. Courage, and F. A. Cracknall, London.—*7th February*, 1881.
579. ELECTRO-PHOTOGRAPHICAL RECEIVERS, H. Chameroy, France.—*10th February*, 1881.
979. DISPLAYING ARTICLES, F. McIlvenna, Liverpool.—*8th March*, 1881.
981. POTTERY, &c., T. Willett, Burslem.—*8th March*, 1881.
1042. SHEEP SHEARS, T. A. and R. H. Sorby, Sheffield.—*11th March*, 1881.
1078. CALORIC MOTOR ENGINES, H. C. F. Jenkin and A. C. Jameson, Edinburgh.—*12th March*, 1881.
1130. CALORIC MOTOR ENGINES, H. C. F. Jenkin and A. C. Jameson, Edinburgh.—*16th March*, 1881.
1160. CALORIC MOTOR ENGINES, H. C. F. Jenkin and A. C. Jameson, Edinburgh.—*17th March*, 1881.
1204. BEVERAGES, R. Bull, Colls-road, Peckham.—*18th March*, 1881.
1329. VALVES, L. Berry, Rotherham.—*25th March*, 1881.
1343. MAGAZINE GUNS, P. Mauser, Oberndorf, Germany.—*25th March*, 1881.
1397. FIELD ROLLERS, R. Maynard, jun., Whittlesford, near Cambridge.—*30th March*, 1881.
1409. GAS-MOTOR ENGINES, J. E. A. Gwynne and W. I. Ellis, Strand.—*31st March*, 1881.
1414. METAL PIPES, J. S. Rigby, Farnworth, Widnes, and J. Mangnall, Manchester.—*31st March*, 1881.
1518. GAS VALVES, G. Waller, Holland-street, Southwark.—*7th April*, 1881.
1535. HORSESHOES, J. P. Rothwell, Lytham.—*7th April*, 1881.
1550. PROTECTING MAGNETIC NEEDLES from LOCAL ATTRACTION, J. S. Gisborne, Manchester.—*9th April*, 1881.
1583. SEWING MACHINES, J. H. Johnson, London.—Com. from C. Wilcox and J. Gibbs.—*12th April*, 1881.
1670. ELECTRIC LAMPS, G. S. Grimston, Holly Lodge, Brockley-road, Kent.—*16th April*, 1881.
1677. COKE OVENS, J. Hunter, Hedley Hope Colliery, near Towlaw.—*16th April*, 1881.

Last day for filing opposition, 31st May, 1881.

31. CLEANSING SCREENS, P. Van Gelder and T. Apsimon, Liverpool.—*4th January*, 1881.
37. PARING FELT HAT RIMS, R. Grimshaw, Stockport.—*4th January*, 1881.
46. HOT-WATER APPARATUS, E. F. Osborne, St. Paul, U.S.—*4th January*, 1881.
53. VENETIAN BLIND ACTIONS, H. Tyler, London.—*5th January*, 1881.
56. MECHANICAL TELEGRAPHS, W. Chadburn, Liverpool.—*5th January*, 1881.
61. ACTUATING SEWING MACHINES, J. Holden, Swindon.—*5th January*, 1881.
62. INKSTANDS, R. G. Chipperfield, London.—*5th January*, 1881.
66. BLIND ROLLERS, J. E. Ditchfield and K. Hothersall, Manchester.—*6th January*, 1881.
71. FEEDING BOTTLES, T. Marshall, London.—*6th January*, 1881.
83. CIRCULAR REVOLVING MEASURE, H. J. Allison, London.—A communication from M. J. Mourrier.—*7th January*, 1881.
87. GAS REGULATORS, H. E. Newton, London.—Com. from Avoiron and Clément.—*7th January*, 1881.
93. TELEPHONIC APPARATUS, J. Imray, London.—A communication from Dr. C. Herz.—*8th January*, 1881.
96. METAL FENCING, R. R. Main and J. Dick, Glasgow.—*8th January*, 1881.
98. STEAM GENERATORS, S. Dawson and J. Dawson, Mossley.—*8th January*, 1881.
103. VENTILATING COAL MINES, J. W. Hackworth, Darlington.—*8th January*, 1881.
132. BUILDING HARBOURS, S. Lake and T. W. Taylor, Westminster.—*11th January*, 1881.
133. GUIDING CAISSONS, &c., S. Lake and T. W. Taylor, Westminster.—*11th January*, 1881.
143. PICKS, AXES, &c., T. Brown, Sheffield.—*12th January*, 1881.
145. COVERING WATER-CLOSET SEATS, W R. Lake, London.—A communication from M. Bonneford.—*12th January*, 1881.
157. COLOURING FIBROUS MATERIALS, J. Young, jun., Kelly, N.B.—*12th January*, 1881.
163. DUMPING BOATS, &c., H. E. Newton, London.—Com. from N. Barney.—*13th January*, 1881.
178. SIFTING APPARATUSES, C. Pieper, Berlin.—Com. from A. Nagel and R. Kaemp.—*14th January*, 1881.
336. MECHANICAL MOTION, M. Gandy, Liverpool.—*25th January*, 1881.
394. GAS BURNERS, W. W. Wynne, London.—A communication from J. N. Chamberlain and A. W. Rice.—*28th January*, 1881.
631. RAILWAY BRAKES, W. L. Wise, London.—A communication from J. Carpenter.—*14th February*, 1881.
637. ROLLING MILLS, P. Kirk, Workington.—*15th February*, 1881.
722. ROTARY ENGINES, E. A. Brydges, Upton.—A communication from R. Lehmann.—*19th February*, 1881.
759. PREVENTING INCRUSTATION in BOILERS, W. P. Thompson, London.—A communication from J. Lallemand.—*23rd February*, 1881.
851. STREET PAVING, E. A. Brydges, Upton.—Com. from Count L. von Hegnenberg.—*28th February*, 1881.
1099. HOLDING a SHADE on a CANDLE, W. R. Lake, London.—Com. from A. W. Crockett.—*14th March*, 1881.
1251. DIP PIPE, S. Chandler and G. W. Stevenson, London.—*22nd March*, 1881.
1280. VALVE GEAR, W. Johnson, Liverpool.—*23rd March*, 1881.
1413. SEWAGE WORKS, W. H. Denham, Southsea.—*31st March*, 1881.
1585. GAS, J. Somerville, Denmark Park.—*12th April*, 1881.
1588. COUPLING APPARATUS, W. R. Lake, London.—Com. from W. Scott.—*12th April*, 1881.
1603. PRESSURE RECORDING GAUGES, M. B. Edson, Brooklyn, U.S.—*12th April*, 1881.
1623. FUSIBLE COMPOUNDS, J. D'Arcy, Belvedere.—*13th April*, 1881.
1709. PULLEY BLOCKS, T. H. Ward and E. Howl, Tipton.—*19th April*, 1881.
1710. AERIAL BALLOONS, G. E. Vaughan, London.—Com. from Count A. Apraxine.—*20th April*, 1881.
1762. ELECTRIC INSULATION, J. A. Fleming, Cambridge.—*23rd April*, 1881.
1862. CENTRIFUGAL MACHINES, W. R. Lake, London.—Com. from S. S. Hepworth.—*29th April*, 1881.
1863. SHEARING HORSES, &c., A. M. Clark, London.—Com. from Bariquand and Son.—*29th April*, 1881.
1962. ELONGATING NAIL BLANKS, H. J. Haddan.—A communication from J. H. Peck.—*5th May*, 1881.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 6th May, 1881.)

4434. TELEGRAPHIC RECORDING APPARATUS, T. M. Foote, Brooklyn.—*30th October*, 1880.
4589. DRESS for GRINDING, &c., MILLS, J. Higginbottom, Seel-street, Liverpool.—*9th November*, 1880.
4620. LOCKS, E. Pfeiffer, Queen Victoria-street, London.—*10th November*, 1880.
4621. MAGNETO-ELECTRIC SIGNAL APPARATUS, E. G. Brewer, London.—*10th November*, 1880.
4639. PURIFYING the FEED-WATER of STEAM BOILERS, W. Hanson, Bradford.—*11th November*, 1880.
4652. CONSUMING SMOKE, &c., J. Teale, Holbeck, near Leeds.—*11th November*, 1880.
4661. LETTER FILE, W. Downe and W. F. Lotz, Barbican, London.—*12th November*, 1880.
4662. STEAM BOILERS, S. Ballian, Constantinople.—*12th November*, 1880.
4678. LOOMS, J. Hindle, Blackburn.—*13th November*, 1880.
4680. MEASURING LIQUIDS, J. Wilson, Orchard-street, London.—*13th November*, 1880.
4684. FURNACES, &c., T. J. Constantine, Fleet-street, London.—*13th November*, 1880.
4737. LOOMS, E. Crossley, Halifax.—*17th November*, 1880.
4749. SHAPING SOAP, J. O'Keefe and W. Robertson, Liverpool.—*18th November*, 1880.
193. PRINTING, &c., TEXTILE FABRICS, W. Mather, Salford.—*14th January*, 1881.
553. ICE, J. H. Willcox, Liverpool.—*9th February*, 1881.
690. STEAMING TEXTILE FABRICS, J. Parkinson, West Leigh.—*17th February*, 1881.
837. KNITTED FABRICS, F. Caldwell, Loughborough.—*28th February*, 1881.

(*List of Letters Patent which passed the Great Seal on the 10th May*, 1881.)

1935. CHECKING, &c., FARES, G. H. Manton, Liverpool.—*11th May*, 1881.
4637. PULVERISING, T. R. Jordan, Gracechurch-street, London.—*11th November*, 1880.
4671. CUTTING EDGES of LAWNS, &c., W. Clark, Oxford-street, London.—*13th November*, 1880.
4675. FOLDING COUCH, A. and E. Lloyd, Charlotte-street, London.—*13th November*, 1880.
4688. GIGAR-CLIPPER, F. H. F. Engel, Hamburg, Germany.—*13th November*, 1880.
4690. POLES, H. J. Dickinson, Enbridge, Newbury, Berkshire.—*13th November*, 1880.
4697. RIBBING APPARATUS, W. H. Beck, Cannon-street, London.—*15th Nvvember*, 1880.
4702. BUTTONS, &c., F. H. F. Engel, Hamburg, Germany.—*15th November*, 1880.
4711. WRITING TABLES, C. D. Abel, Southampton-buildings, London.—*16th November*, 1880.
4722. BRICKS, F. Wirth, Frankfort-on-the-Maine, Germany.—*16th November*, 1880.
4723. STEAM BOILERS, J. Howden, Lanark, N.B., and W. B. Hill, Liverpool.—*16th November*, 1880.
4754. STEERING GEAR, R. Wotherspoon, Liverpool.—*18th November*, 1880.
4762. SPANNERS, &c., W. Thomson, Glasgow.—*18th November*, 1880
4778. DOUBLE-SIDED DRYING FELTS, E. Dordet, Saint Junien, France.—*19th November*, 1880.
4779. ELECTRO-MAGNETIC APPARATUS, F. Harmant, Paris.—*19th November*, 1880.
4781. WATCH-CASES, W. R. Lake, Southampton-buildings, London.—*19th November*, 1880.
4782. COUNTING LETTERS IMPRESSED on STAMPS, H. Furguson, Boyson-road, Camberwell, and H. R. Kempe, Barnet.—*19th November*, 1880.
4784. BEVERAGE, J. McWilliam, Mansion House-buildings, London.—*19th November*, 1880.
4819. GAS ENGINES, H. L. Müller and W. Adkins, Birmingham.—*20th November*, 1880.
4843. ATTACHING CURTAINS, &c., G. Moore, Oxford-square, London.—*22nd November*, 1880.
4849. COOKING APPARATUS, L W. Leeds, Woburn-place, London.—*23rd November*, 1880.
4855. VENTILATING, W. R. Lake, Southampton-buildings, London.—*23rd November*, 1880.
4857. BUCKLES, T. Walker, Birmingham.—*23rd November*, 1880.
4858. SCUTCHING FLAX, &c., W. R. Lake, Southampton-buildings, London.—*23rd November*, 1880.
4887. SPEAKING TUBES, &c., G. Jennings and E. G. Brewer, Stangate.—*14th November*, 1880.
4909. DIAPHRAGM SHIPS' PUMPS, J. Edson, Boston.—*25th November*, 1880.
4927. CLOSING JARS, H. Doulton, High-street, Lambeth.—*26th November*, 1880.
4959. BRICK, H. A. Bonneville, Cannon-street, London.—*29th November*, 1880.
5009. CHILLED ROLLS, F. Wirth, Frankfort-on-the-Maine, Germany.—*1st December*, 1880.
5080. CLOCKS, A. M. Clark, Chancery-lane, London.—*6th December*, 1880.
5111. CATCHING INSECTS, A. Nash, Canterbury.—*8th December*, 1880.
5121. REGULATING WINDOW-BLIND CORDS, C. E. Gibson, Birmingham.—*8th December*, 1880.
5136. SHAFT COUPLINGS, A. M. Clark, Chancery-lane, London.—*8th December*, 1880.
5199. MOWING, &c., MACHINE, H. H. Lake, Southampton-buildings, London.—*11th December*, 1880.
5221. GRINDING MILLS, C. M. Sombart, Magdeburg, Germany.—*13th December*, 1880.
5271. SHEET REGISTERING APPARATUS, W. R. Lake, London.—*15th December*, 1880.
5280. TOBACCO PIPES, H. E. Gräpel and J. Candelent, Birmingham.—*16th December*, 1880.
5289. BRAKE, G. M. F. Molesworth, Northdown Hall, Bideford, Devonshire.—*17th December*, 1880.
5312. HEATING, &c., HUMAN BODIES, W. P. Thompson, High Holborn, London.—*18th December*, 1880.
5332. PRESERVING FOOD, J. Eckart, München, Bavaria.—*20th December*, 1880.
5349. CASTRATING HORSES, J. Scott, Craigends, Denniston.—*21st December*, 1880.
5477. SADDLE BARS, Sir T. Dancer and E. Chappell, Malmesbury.—*29th December*, 1880.
370. GAS MOTOR ENGINES, H. P. Holt, Leeds, and F. W. Crossley, Manchester.—*27th January*, 1881.
590. PLAITERS, W. Mather, Salford Ironworks, Manchester.—*10th February*, 1881.
611. BREWING, W. W. Davenport, Birmingham.—*12th February*, 1881.
652. COMMUNICATING MOTION from one SHAFT to ANOTHER, J. Walter, London.—*15th February*, 1881.
679. TRICYCLES, &c., J. Harrington, Norman's-buildings, London.—*16th February*, 1881.
735. PREVENTING EXPLOSIONS, J. Tattersall, Manchester.—*21st February*, 1881.
790. HEATING METALLURGICAL, &c., FURNACES, G. E. Vaughan, London.—*24th February*, 1881
797. LIFE-BUOYS, R. Whitby, Greenwich.—*24th February*, 1881.
802. BUNDLING FIRE-WOOD, E. Pace and J. H. Howard, Bow Common, London.—*25th February*, 1881.

887. JOURNALS, &c., J. Imray, Southampton-buildings, London.—*2nd March*, 1881.
894. ELECTRIC LAMPS, J. J. Sachs, Sunbury, London.—*2nd March*, 1881.
899. VALVES, W. Wright, Plymouth.—*2nd March*, 1881.
929. VELOCIPEDES, J. Hopwood, Heaton Norris.—*4th March*, 1881.
938. COLOURING MATTERS, C. D. Abel, Southampton-buildings, London.—*4th March*, 1881.
939. COLOURING MATTERS, C. D. Abel, Southampton-buildings, London.—*4th March*, 1881.
970. MINING LAMP, F. Foster and H. A. Fleuss, London.—*7th March*, 1881.
978. OPERATING FOG BELLS OR GONGS, W. P. Thompson, High Holborn, London.—*8th March*, 1881.
999. DYEING COTTON YARNS, F. A. Gatty, Accrington.—*9th March*, 1881.
1032. SHEAF-BINDING MECHANISM, J. Howard and E. T. Bousfield, Bedford.—*14th March*, 1881.

List of Specifications published during the week ending May 7th 1881.

3080, 8d.; 3197, 4d.; 3231, 6d.; 3266, 6d.; 3316, 2d.; 3318, 6d.; 3344, 2d.; 3406, 4d.; 3522, 2d.; 3612, 2d.; 3632, 2d.; 3665, 2d.; 3705, 6d.; 3769, 6d.; 3775, 1s. 2d.; 3792, 8d.; 3803, 1s.; 3812, 6d.; 3831, 4d.; 3834, 6d.; 3869, 6d.; 3877, 8d.; 3893, 6d.; 3894, 1s. 6d.; 3895, 6d.; 3897, 8d.; 3903, 6d.; 3917, 6d.; 3925, 6d.; 3927, 6d.; 3932, 4d.; 3936, 6d.; 3941, 4d.; 3944, 8d.; 3953, 8d.; 3959, 6d.; 3960, 4d.; 3961, 6d.; 3966, 6d.; 3969, 6d.; 3979, 6d.; 3982, 6d.; 3995, 6d.; 3998, 4d.; 4000, 6d.; 4019, 2d.; 4022, 2d.; 4024, 6d.; 4026, 3d.; 4028, 2d.; 4029, 2d.; 4030, 2d.; 4031, 2d.; 4035, 2d.; 4037, 6d.; 4039, 6d.; 4042, 2d.; 4043, 2d.; 4044, 8d.; 4046, 6d.; 4048, 2d.; 4052, 2d.; 4053, 2d.; 4055, 2d.; 3057, 2d.; 4059, 2d.; 4068, 4d.; 4069, 2d.; 4071, 2d.; 4072, 4d.; 4074, 2d.; 4082, 2d.; 4083, 2d.; 4084, 2d.; 4086, 6d.; 4087, 2d.; 4089, 2d.; 4092, 2d.; 4093, 2d.; 4094, 4d.; 4095, 3d.; 4102, 2d.; 4103, 2d.; 4106, 2d.; 4107, 4d.; 4108, 2d.; 4111, 2d.; 4113, 2d.; 4132, 6d.; 4205, 8d.; 4206, 2d.; 4285, 4d.; 4324, 6d.; 5160, 6d.; 5226, 8d.; 275, 6d.; 431, 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.

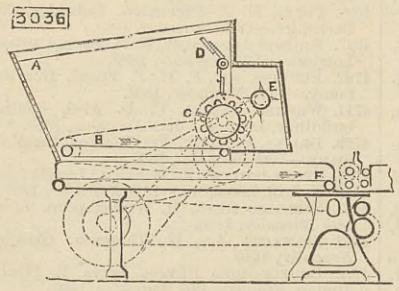
ABSTRACTS OF SPECIFICATIONS.

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

3036. FEEDING, OPENING AND SCUTCHING MACHINES, *J. P. Butterworth and W. Lord.—Dated 23rd July*, 1880. *8d.*

At the bottom of the hopper A is a lattice or apron B which may be driven in any convenient manner and at any speed, according to the feed required. Near the bottom of the front of the hopper is placed a roller C covered with teeth for the purpose of taking the cotton or other fibre from the lattice, from which roller the cotton is removed by a rake, beater, or roller

3036

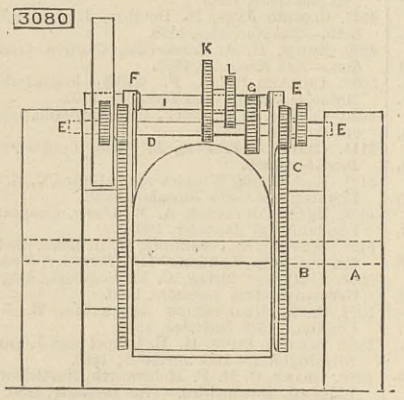


E placed outside the hopper and above or below a second lattice F which feeds the opener or scutcher. To prevent the spiked or toothed roller taking up too much cotton from the lattice B, above it is placed an oscillating board, or shaker, or roller D, which strikes back the superfluous cotton.

3080. CULTIVATING LAND, *W. Barford and T. Perkins.—Dated 26th July*, 1880. *8d.*

This relates especially to the winding engines and apparatus by which ploughs and other implements are drawn over the land. The drawing shows an end view of part of a winding engine. A are the driving wheels; B the winding drums on the same axle as the main wheels, one on each side of the engine, and just within the wheels. On the inside of each driving wheel is a toothed wheel or ring of teeth, and on each winding drum a toothed wheel C; D is a transverse horizontal shaft, having on it at each end a pair of clutch pinions E and F, which are able to slide along feathers on the shaft D into different positions. In one position the pinion E gears with the toothed ring or wheel on the interior of the driving wheel, and in another position the pinion F gears with the toothed

3080



wheel C on the winding drum. On the transverse shaft D is also a toothed wheel G which gears with a toothed wheel on the counter shaft I. On the counter-shaft I are also two clutch wheels K L capable of being slidden along a feather on the shaft. On the crank shaft of the engine are keyed two pinions. By sliding the clutch wheels K and L along the counter shaft, the wheel K can be brought into gear with one pinion and the wheel L into gear with the other pinion. On the crank shaft of the engine is also a clutch pinion capable of being slidden along a feather on the shaft. By sliding the pinion along the shaft it can be put into or out of gear with the toothed wheel on the counter shaft I. It will thus be seen that either the drums or the main wheels can be driven at either one or other of three different speeds of driving, or can be put altogether out of gear, as desired.

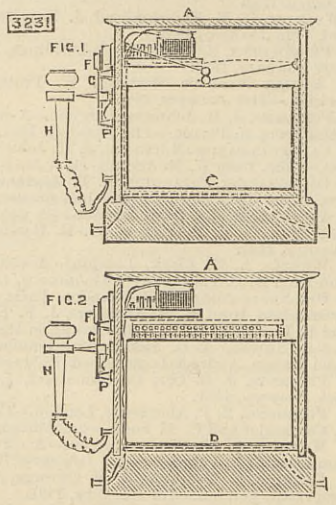
3197. POWER LOOMS FOR WEAVING, *W. H. Bee.—Dated 4th August*, 1880.—(*A communication from J. Lehoux and A. Rigot.—(Void.)* 4d.

This consists, First, in certain means of beating up the sley beam in the same manner as in weaving by hand; Secondly, in the substitution for cord or chain brakes with levers and weights or springs of regulators for unwinding the warp and for winding up the cloth. Thirdly, in a new arrangement of pedals.

3231. IMPROVEMENTS IN TELEPHONIC APPARATUS, *H. L. Lake.—Dated 7th August*, 1880.—(*A communication from L. Maiche.*) *6d.*

The object of the invention is to transmit sound over long distances by means of what the inventor calls electrophones. The apparatus is combined with the ordinary telephone, which serves as a receiving instrument, repeating at a distance all the sounds that have acted upon the electrophone. This latter consists of carbon contact pieces mounted upon a bell or sonorous box of (preferably) glass, the contact pieces being placed as near as possible to the edge of the box. These transform the sonorous vibrations of the substance of the sonorous box, in front of which the speaking is carried on, into mechanical action, and these vibrations produce differences of pressure between the carbons, and consequently variations in the intensity of the current, these variations in intensity produce induced currents in a (say Ruhmkorff) coil, and these induced currents are transmitted along the line to actuate the receiving telephone. Fig. 1 shows the apparatus, and Fig. 2 is a modifica-

3231

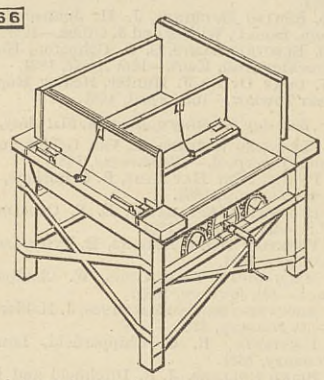


tion thereof. The space between the walls of the sonorous vessel and the wooden case A is filled with wadding. Upon the sonorous vessel C are placed the carbon contact pieces. A carries also a signalling stud F and movable lever G, which supports telephone H and acts as a commutator. To attract the attention of anyone at the receiving station it is sufficient to press F. The telephone resting on its support overcomes the tension of the spring M, and causes contact between the terminal P and the lever G. The battery current then flows, the coil is in requisite condition, for operating, the vibrator is thrown into rapid motion, and the induced currents rapidly repeated in the main wire act upon the telephone at the station communicated with, where a loud humming is heard, which is the call signal, thus dispensing with the usual electric bell.

3266. APPARATUS FOR EXHIBITING CARPETS, &c., BY SAMPLES, *A. Peterson.—Dated 10th August*, 1880. *6d.*

This comprises the construction of a device for exhibiting carpets or other goods or small pieces in such manner that the pattern on the sample is multiplied by surrounding mirrors, and so arranged that the samples may be of different directions across the plane of the table placed below the mirror. It also consists in having two independent mirrors hinged to cross pieces arranged to slide on ways at right angles to each other, so that either of them may be easily

3266



adjusted to or from a rigid rectangular mirror to suit any width of carpet or other goods, and in order that the true effect when exhibiting a border or stair carpet may be obtained, an arrangement of the mirrors is had by which the side mirror is laid horizontal, so that the pattern is only multiplied in length and not in width. The drawing is a perspective view of one style of construction, showing a side mirror moved inwards.

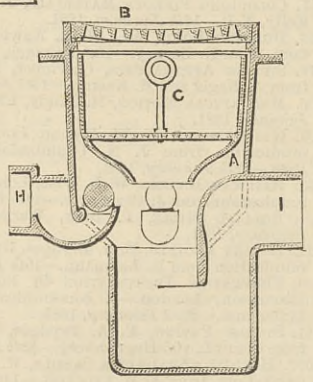
3316. MANUFACTURE OF DOCUMENTARY FORMS FOR PREVENTION OF FRAUD, *T. Mackarell and W. Ryland.—Dated 16th August*, 1880.—(*Provisional protection not allowed.*) *2d.*

This consists in covering the spaces on which words, figures, or marks have to be made in writing with a series or number of monograms, words, or other easily distinguishable designs, by printing such designs with ink containing the essential colouring ingredients of ordinary writing ink.

3318. SEWAGE TRAPS, &c., *C. Perks.—Dated 16th August*, 1880. *6d.*

The object of the invention is to prevent the ingress of solid matter into the drains, to prevent choking of

3318



the traps, and to avoid the entrance of gases into dwellings, and it consists of a trap box or disconnecting chamber A with a grating B over it. Within the box is a removable tray C, open at top and fitted with a grating. The box is continued below the tray, and there receives the sewage or other liquids through the pipe H, which is fitted with a suitable valve and forms a syphon to prevent the entrance of gas to the building. The exit pipe I, which is below the entrance of the sewage or sink pipe, is connected to the drain.

3344. OMNIBUSES, TRAMCARS, &c., *F. F. de Moraes.—Dated 17th August*, 1880.—(*Provisional protection not allowed.*) *2d.*

The object is to arrange three pairs of wheels under the body, the axles of the fore and aft pair being connected from opposite corners, that the turning action of one pair is communicated by rods to the other pair to facilitate the vehicle moving round corners in a more easy manner than at present.

3406. VALVES, *A. Sweet.—Dated 23rd August*, 1880. *4d.*

The seating piece is made of a cylindrical form, which works up and down without revolving in the body of the valve; in this piece is made an internal or female left-hand screw or thread; on one end of the spindle is made a corresponding external or male screw or thread, which works in the aforesaid cylinder; in the cap piece or body of the valve is cut a right-hand internal or female screw or thread. Immediately above the left-hand screw on the same spindle is cut a right-hand external or male screw or thread, corresponding to that in the body or cap piece and working in it.

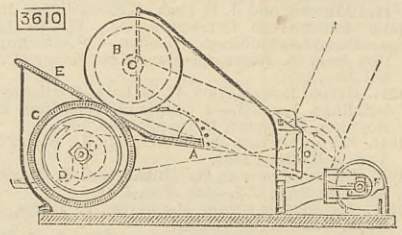
3522. GENERATING MOTIVE POWER, *G. Temple.—Dated 31st August*, 1880.—(*Not proceeded with.*) *2d.*

When the power employed for driving the motor is steam, the generator will be a steam boiler with furnace and flues, with water feed valve, float, index lever, and balance weight, for showing the height of the water in the boiler, safety valve, and steam stop valve, the said feed valve, float, and index safety valve, and stop valve, being in combination, or being separate and of ordinary design and construction; a steam pipe attached to the stop valve conveys the steam from the stop valve to the motor. The motor consists of a rotary disc engine.

3610. FLUFFING OR GROUNDING MACHINES, *J. M. Jones.—Dated 6th September*, 1880. *6d.*

This relates to producing a nappy or fluffy surface on skins or leather, and consists of an emery wheel and brush wheel together with a treadle device, a feed table, and a fan. The emery wheel B is mounted in a partly closed casing A, and below it, also in the casing, is the brush wheel C, the shaft of which is mounted

3610



in a treadle frame D, by operating which the roller C can be made to approach the roller B. E is the table on which the skins are placed, and passing between the rollers B and C has its surface raised, the material removed being drawn away from the casing by the fan F.

3612. HAT OR BONNET CASE, *L. Hutchings.—Dated 6th September*, 1880.—(*Void.*) *2d.*

An outer case or shell is formed, within which is arranged a second or inner case, so that there will be a space formed between the two cases or shells all round; and, again, within this last described second or inner case is fixed a cylindrical chamber or compartment for the reception of the hat or bonnet.

3632. PRINTING CHINTZ, *A. Rycroft.—Dated 7th September*, 1880.—(*Provisional protection not allowed.*) *2d.*

The object is the introduction of gold, silver, bronze, or other metallic ornamentation into chintzes.

3665. RECEPTACLE FOR CINDERS, *T. H. Williams.—Dated 9th September*, 1880.—(*Not proceeded with.*) *2d.*

This consists of an iron ash-box so placed under the grate as to fill the greater part of the space underneath the grate, and having as cover an iron screen kept in a reclining position towards the back, the result being that as the cinders fall from the grate they slide down the screen, leaving the ash to fall through into the box beneath.

3705. PURIFICATION OF AIR IN RAILWAY TUNNELS, &c., *J. C. W. Stanley.—Dated 11th September*, 1880. *6d.*

This consists in subjecting the impure atmosphere to the purifying influence of water, either alone or in combination with any known chemical purifying agents, and an apparatus for effecting this purpose.

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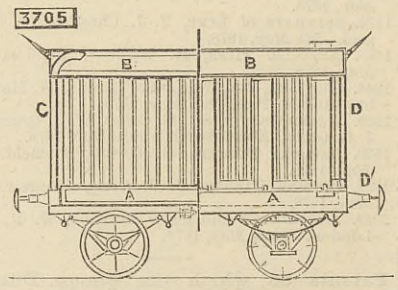

The drawing is an elevation, one half in section, of a railway carriage fitted in accordance with the invention. A is a bottom tank; and B is an upper tank. Between these two tanks perforated tubes C or wire gauze are placed, which will conduct the water from the upper to the lower tank, which in thus gravitating through the perforated pipes or down the gauze will present to the impure air a thin film of running water. D are shutters or louvres for catching the air worked by levers or equivalent D¹.

3769. GOVERNING THE SPEED OF STEAM ENGINES, &c., *J. G. Jones.—Dated 16th September*, 1880. *6d.*

The varying velocity of the steam on its way to the engine is caused to act upon apparatus applied to the steam pipe, so as to control the action of the ordinary

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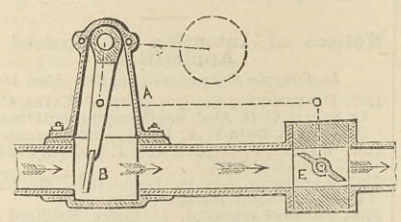

throttle valve. For this purpose in the steam pipe a chamber A is formed, and within it is suspended an arm carrying the disc B, upon which the steam acts. The arm is by suitable levers or rods connected to the throttle valve E.

3775. PRINTING PRESSES, *W. Morgan-Brown.—Dated 17th September*, 1880.—(*A communication from the Gilman Vertical Press Company.*) *1s. 2d.*

This relates to self-inking printing presses operated by a foot treadle, and the objects are to provide devices to guide and turn the platen in its upward and downward movements; to operate the ink roller frame carrier and ink table; to govern the movements of the tympan fingers; to carry the platen against the type-bed with greatly increased power, and for adjusting the face of the platen and of the type-bed to perfectly parallel planes. The bed B has a side

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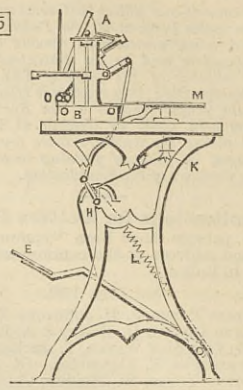

channel between the posts to receive the printer's chase, which is secured in place under the platen A by screws through the ends of the bed. A shaft H is reciprocated by the treadle E, and by means of rods D

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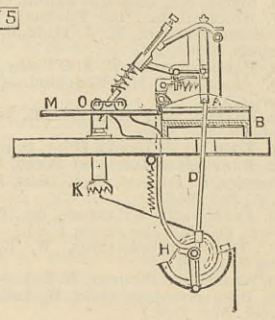
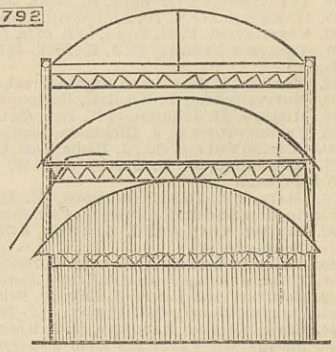


works the platen, the rods being made adjustable, and springs I tend to pull the treadle upwards. As the treadle is depressed a pawl on the shaft H moves the ratchet K secured to the inking table M, and at the same time the inking rollers O are moved back on to the inking table.

3792. HAY AND CORN BARNS, &c., *J. Coleman and Henson.—Dated 18th September*, 1880. *8d.*

The roof is so constructed that it can be raised to various heights in sections which overlap each other, thus forming, when all the bays are at full height, one continuous barn. The sides and ends consist of movable wings, which can be inclined so as to cover, when required, extra width all round, whilst should the wings not be required to form a roof, they can be

3792



used in extreme wet weather to keep the rain from driving in at the sides. In a three bay barn one bay can be used as a hay or corn barn, the middle or centre bay can be used as a cart or wagon shed, and the end bay as a loose box or lambing shed, or for various purposes of the like description. The drawing shows an end elevation of a three bay barn.

3812. COOLING AND BREAKING UP BLAST FURNACE SLAG, *J. A. Birkbeck.—Dated 20th September*, 1880. *6d.*

A taper core C is placed within the receptacle A to receive the slag, which is mounted on a trolly. The slag is run into the annular space S between the core

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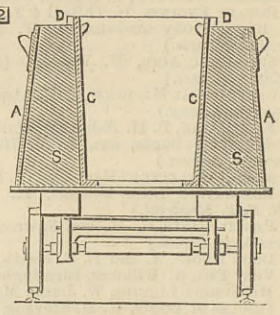

and the receptacle. The core is formed with projecting ribs D outside, so as to form corresponding recesses in the slag, which when cooling contracts and splits opposite the ribs, thus facilitating the operation of breaking up the slag. When required to remove the slag the core and receptacle are lifted up, leaving the slag on the trolly.

3803. OPERATING AND CONTROLLING RAILWAY SWITCHES, CROSSINGS, AND SIGNALS, &c., *W. R. Lake.—Dated 18th September*, 1880.—(*A communication from J. S. Williams.*) *1s.*

The First part of the invention relates to apparatus

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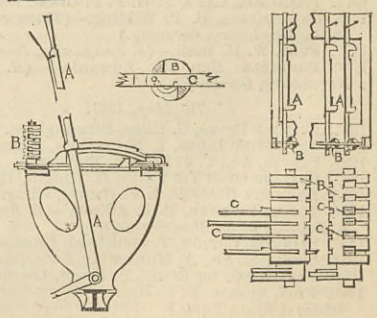


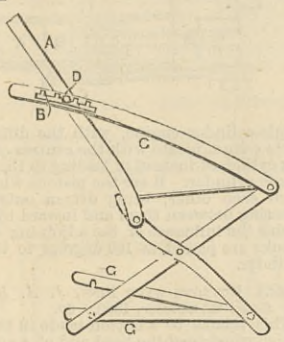
for preventing conflicting signals being given, and consists in interlocking the signal levers. The drawings show one method of effecting this object, Figs. 1

and 2 being a transverse and horizontal section of a frame of eight levers, and Fig. 3 enlarged views of the locking pieces. A are the levers, with each of which is combined a slotted locking drum or piece B turning upon its axis. These pieces have apertures through which a series of bars C can pass. The parts of the apertures are of different depth and width, and the bars C are of different thickness, so that when any portion of the deepest part of the bars C is in the aperture of the locking piece, it is impossible to move the latter and therefore to move the lever in connection with it. So as to move the bar C and bring its projections within the apertures, one of the levers A is connected to it through the locking piece. A Second part of the invention relates to controlling signals from different places, and includes compensating devices for the wires.

3831. FOLDING CHAIRS, *G. A. Dallas.—Dated 22nd September*, 1880. *4d.*

From either side of the chair back A at the point where the arms C are joined is a stud D, and in the ends of the arms are slots B with depressions in the top edges. By causing the stud to enter either of these

3831



depressions the angle of the back can be adjusted. At the sides of the bottom of the chair are fixed stretchers G, with a recess at one end to take over the back list of the chair.

3834. QUARRYING AND DRESSING STONE, *J. Williams.—Dated 22nd September*, 1880. *6d.*

Gantry or travelling beams are stretched across or along the quarry, and are arranged to travel along, whilst upon them are placed one or two carriages carrying saws or cutters, consisting of circular plates

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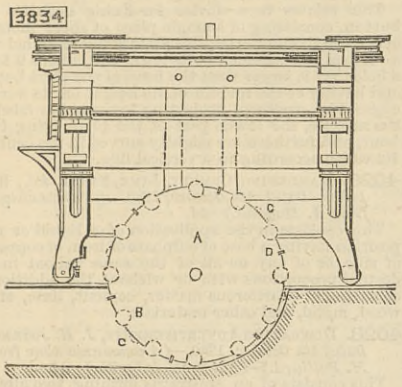

A, on the edge of which are cutters B to cut the stone at each side, and central cutters C to cut out the core, the pieces D taking out the grit or sand left by the cutters. These saws or cutters can be moved lengthwise on the gantry along rails, and can be driven by an engine on the gantry or by means of an endless rope.

3869. GAS ENGINES, *J. R. Purssell.—Dated 24th September*, 1880. *6d.*

A double piston or two pistons coupled work in a single cylinder having an explosion chamber at each end, the rod connecting the two pistons through a crosshead working from the centre of the cylinder upon the fly-wheel shaft by outside rods. The cylinder is open at each end, and other or outer pistons work within them, whose rods are connected to crank pins working segmental wheels gearing with other wheels, which cause the outer pistons to travel towards the centre to act in conjunction with the inner pistons moving from the centre to exhaust the residues of combustion after each explosion. By fitting two such

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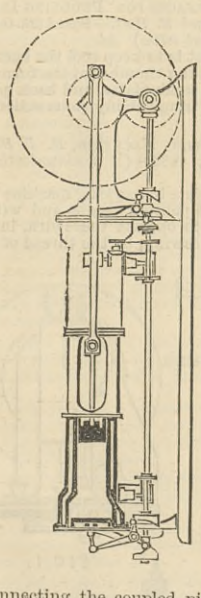
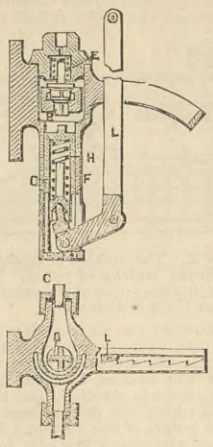


cylinders and connecting the coupled pistons to the crank shaft the explosion can be caused to follow each other in successive order, following the compression of each charge at either end of the cylinders at every half revolution of the crank shaft. The drawing is a sectional elevation of one of two coupled cylinder engines, the inner pistons of both being connected in pairs to a crank shaft common to both.

3877. STEAM BRAKE VALVES, *J. Dewrance and B. Malcolm.—Dated 24th September*, 1880. *8d.*

This relates to improvements on patent No. 4553, A.D. 1879, in which an equilibrium valve is employed to admit the steam to the brake cylinders at pressures varying according to the greater or less force with which it is desired to apply the brakes. In the former arrangement the valve was raised from its seat by the piston when moved upwards by the handle acting through an external spring. In the present arrangement the spring H is applied within the piston G made hollow to receive it, and the spring is in compression instead of in tension. The passage C to admit steam terminates between the two seats of the double valve B, which a spring E just keeps to its seats; F is the portion of the shell forming the cylinder, and G is the hollow piston supported by the spring H. The hand

3877



lever L works along a ratchet sector, which retains it in any position.

3893. DOMESTIC FIREPLACES, *J. Russell.—Dated 25th September*, 1880. *6d.*

A tube or sleeve A is provided, consisting of a frame wholly or partially open at each end; the opening or or openings may, for example, be complete or partial, and with perforations if desired. The tube or sleeve is made of any desired shape, and works in the flue through a plate B having an opening therein corresponding in size and shape with that of the tube or sleeve, which latter is suspended in the flue or chimney over the fireplace by chain, wire, cord, or otherwise; it might, for example, be connected to a rod, free to

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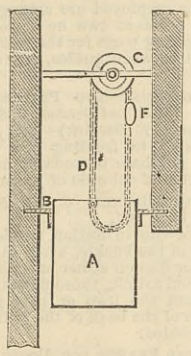

rise and fall in guides, and in such manner that the suspending medium shall allow the tube or sleeve to rise or fall, and to retain it in any desired position above the fireplace, and for this purpose the tube or sleeve may be connected to a chain passing over a pulley C or pulleys, and down to balance or counterweight F with compensating balance chain D, and thus the tube or sleeve is raised or lowered, and kept suspended in any position that may be desired or as necessity may require.

3895. CARRIAGE AXLES AND BUSHES, &c., *J. Dakers.—Dated 25th September*, 1880. *6d.*

Fig. 1 is a view of one modification partly in section, showing journal of axle fitted with two sliding collars and two spiral springs with a screwed on collar in the position it would assume when the carriage is in motion. A is the journal of action; B screwed on bearing collar, having only the inner side bevelled for

3895

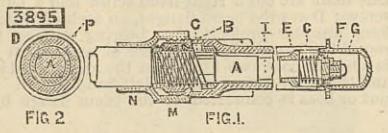

FIG 2 FIG. 1.

bearing against cap upon sudden lateral strain; C spiral spring; D sliding collar; E second sliding collar; F and G nuts; I space to reduce bearing; L bush; M cap screwed on outside of inner end of bush; N prolongation of cap to support axle arm. Fig. 2 is an end view, in which P is a flat on journal of axle, to prevent collar D from turning with bush; there is a similar flat on other end of journal for same purpose for collar E.

3897. WASHING MACHINES, *E. Clements.—Dated 25th September*, 1880. *8d.*

This relates to the application of an engine A to the frame of the washing machine, which by suitable mechanism drives the dasher and the self-acting reversing motion. The possibility of injury to the

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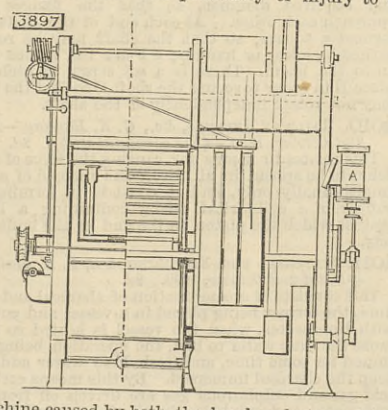

machine caused by both the hand and steam drivers being in gear together is prevented by bolts fixed between the starting lever of the steam motion and the clutch which throws into gear the hand motion, so arranged that one motion must be stopped before the other can be thrown into gear, each handle being locked by the other at all times.

3917. CROCHET-LIKE EDGINGS AND PILLARS, *J. Booth.—Dated 27th September*, 1880. *6d.*

So as to produce in the lace machine a closer

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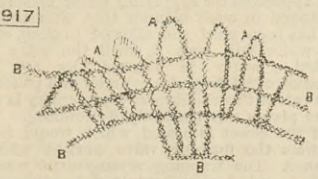
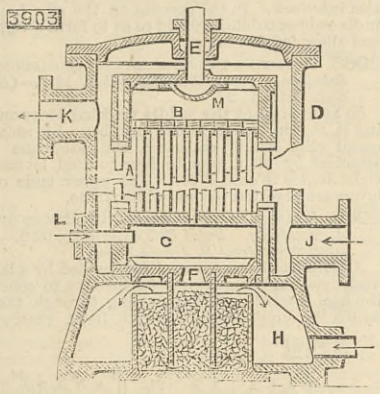


imitation of crochet edgings than has hitherto been made, a pillar or cord A having the appearance of a crochet pillar is first prepared and then afterwards interwoven in the lace machine with other crochet-like pillars B which are produced by the lace machine as the work proceeds.

3903. CONDENSING DISTILLED VAPOURS, *T. W. Duffy and T. L. Makin.—Dated 27th September*, 1880. *6d.*

This relates to apparatus in which vapours produced by distillation or otherwise are condensed and liquefied by passing in contact with cooled surfaces. A is a rest or cluster of glass tubes contained between the inlet chamber B and the outlet chamber C. D is an outer casing within which the tube cluster A and the chambers B and C are located. E is the steam inlet

3903



pipe to chamber B; and F is the distilled or condensed water outlet from the chamber C to the filter H which forms the base or bed of the condenser; J is the circulating water inlet to the casing D; K is the circulating water outlet for the casing D; L is a pipe leading from a fan, blower, or aërating appliance into the chamber C. The chamber B is provided with a rose M placed underneath the steam inlet pipe D so as to distribute the inlet steam over the surface of the chamber B, and prevent it from directly impinging on the tube cluster A.

3925. IMPROVEMENTS IN LIGHTNING CONDUCTORS, *S. Vyle.—Dated 28th September*, 1880. *6d.*

The conductors are constructed of copper with an insulated wire set within the core of an outer cable, the top of the wire being soldered or otherwise metallically connected with the top of the outer cable, which latter is inserted in the ground, whilst the insulated wire is carried from the bottom of the outer cable to any suitable adjacent place above ground and there connected with the key of a testing apparatus, which consists of a differential galvanometer, battery, switch, resistance coils, and connections. The back of the key connected to the testing wire may be earthed or not. To test the conductor, the key of the testing apparatus A is depressed, when the galvanometer needle is deflected. Unless the continuity of the wire and cable be good, no current will pass, and the needle will not be deflected. By disconnection at key B, which acts also as a switch, no

3925

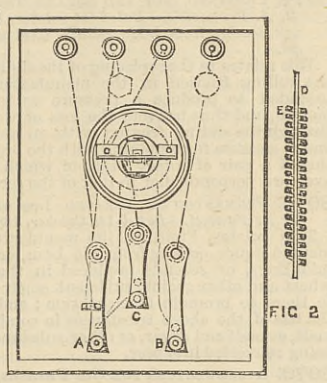


FIG. 1 FIG 2

current can pass through the other coil of the galvanometer, but on depressing B as well as A the current divides itself equally between the circuit formed by the insulated wire and outer cable, wire, or tube, and a resistance coil, which should be made exactly equal to the other circuit; this being so, any defect in the conductor would betray itself by the deflection of the needle. In this case an auxiliary key C is used, which when depressed at the same time as B shows whether the earth of the conductor is good, or whether the fault is above ground, as the current is then divided between B and C, whose resistances are equal. If right, the needle does not deflect. Fig. 1 shows the galvanometer, &c. Fig. 2 shows the conductor; D insulated wire set in outer cable E.

3927. HAULING IN FISHING NETS, *G. Howard.—Dated 28th September*, 1880. *6d.*

This relates to the use of a large and a small capstan combined for the purpose of hauling in and securing

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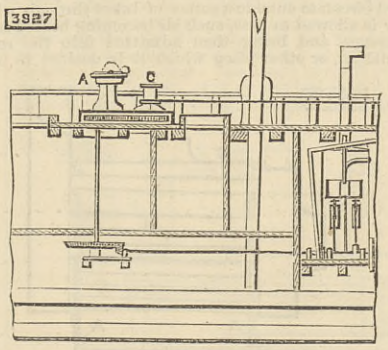
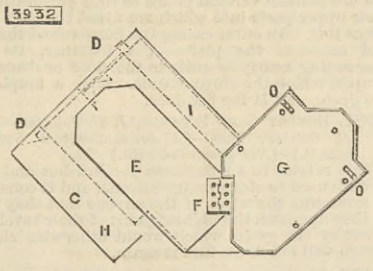


the nets on board fishing smacks, and it consists in working the small capstan C to get in the after end of the trawl beam by gearing on the main capstan A.

3932. MANUFACTURE OF PAPER BAGS, *J. Baldwin.—Dated 28th September*, 1880. *4d.*

Under a metal tympan a rectangular sheet of paper is laid upon the block, which paper is pasted on the

3932



edge to the outline of the cut edge of the tympan. The pasted sheet is then laid upon the flat surface C of the folding apparatus and up to the gauge studs D; whilst in this position a second tympan E, which is hinged as at F to the wood block G, is brought down on the paper as at E, and the sides H I of the paper, one of which has been already pasted under the first tympan, are folded and overlapped by the operator, and the tympan E, with the paper surrounding it in the form of a tube, is turned over on to the block G. The operator then opens the end of the paper tube, and doubles in the parts to form the bottom to the semi-octagonal form of the tympan E, and thus also forming an overlap. The second overlap is formed by taking a guide plate and laying this guide plate upon the partly-formed bag until its edge rests on the gauge studs O, the triangular part is turned over on the guide plate and the bag is complete.

3928. APPARATUS FOR GENERATING AND UTILISING ELECTRICITY, *W. R. Lake.—Dated 28th September*, 1880.—*(A communication from E. Thomson.)* *8d.*

This invention refers to various modifications in the construction of magneto and dynamo-electric machines. The field magnet coils serve also the purpose of directly magnetising the iron in the armature. This is accomplished by a modification in

3928 FIG. I

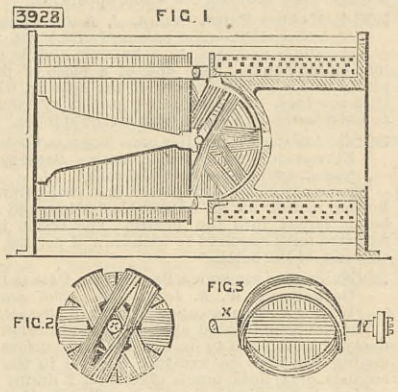


FIG. 2 FIG. 3

the winding. Then the internal and external effects of the coils are both utilised, and the insulated wire of the armature is at all times under the direct influence of the field magnets. Fig. 1 shows a side elevation, partly in section, of a machine; Figs. 2 and 3 show three coils of insulated wire as wound upon the armature, intersecting one another at the axis X at angles of approximately 60 deg.

3936. IMPROVEMENTS IN SHACKLE AND TERMINAL INSULATORS FOR TELEGRAPH WIRES, *J. W. Fletcher.—Dated 28th September*, 1880. *6d.*

The inventor's insulator is similar as regards its lower portion to the No. 8 insulator, the upper portion is also similar, but inverted, so that the open end of the double cup is both upwards and downwards. It is formed of, preferably, one piece of earthenware, and is mounted on a vertical bolt passing through it and the upper and lower arms of the pole. The upper cups of the insulator being open at the top, are provided with drainage holes by which they empty themselves of rain water or dirt. The inventor also makes them with the ordinary mushroom head.

3941. DOCKING KNIFE, *J. McKenny.—Dated 29th September*, 1880. *4d.*

This relates to apparatus for amputating or docking the tails of horses and other animals. A is the space

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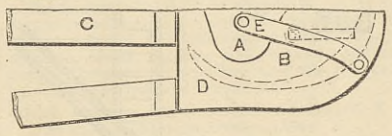

to receive the tail; B a blade secured to the handle C, and working between two jaws D, being connected by a link E working on a pivot, and having a pin which slides in a slot in the blade.

3944. LOOMS, *A. F. Firth and J. Boothman.—Dated 29th September*, 1880. *8d.*

This relates to apparatus for operating the fork of the wire motion, to the construction and arrangement of tappets and levers to work the healds and operate the lever and head of the wire motion. To the crosshead or slide 1 a lug 2 is attached, which at each forward movement pushes back the lever 3 carrying the wire fork 4, and at the same time forces back the spring 5, which gives the forward traverse to the fork. As soon as the crosshead commences its return traverse the spring 5 moves the fork lever and ferk forward until a catch-piece 9, attached to the fork lever, enters

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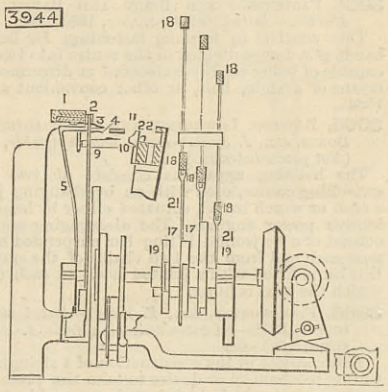

a catch-notch, whereby the lever is held until the beat up of the slay, whereon the incline 10 of the lug 11, fixed to the end of the shuttle box 22, comes in contact with the catch 9, raising the lever 3 out of the notch and its fork and wire over the wires in the body of the fabric, and into position for insertion in the open shed. For operating the healds the treadle levers 17 are so arranged with the healds 18 and treading tappets or cams 19, that the ends of the levers extend under the loom, and are connected by rods 21 to the heald, so that direct and positive motion upwards and downwards is secured and imparted to the healds.

3953. HOISTING AND CONVEYING COAL, &c., *B. Hunt.—Dated 29th September*, 1880.—*(A communication from A. E. Brown.)* *8d.*

This consists, First, in the application and use in a hoisting and conveying contrivance of a carriage frame, adapted to be supported and to travel on a cable or railway, and composed of a system of levers, such as that the weight of the suspended load exerts a tendency to retain the parts in each of the two conditions they must assume to retain and to release the suspension of the hoisting block and load; Secondly, the application and use of a carriage frame for supporting and adapted to release the suspended load, so made and operating as that in arriving at a down grade stop the momentum will gradually be absorbed either in the effort of lifting the load, which has to be made in order to effect its releasement from the suspending hooks of the carriage, or partially by such effort and partially by the pull of the hoist rope on the carriage in a reverse direction by the releasement of the load. Thirdly, the application and use, in combination with the carriage provided with any suitable means of engage-

ment, with the block to be suspended, of a hoist block having lugs or other devices designed to be held by such means of engagement located about coincident

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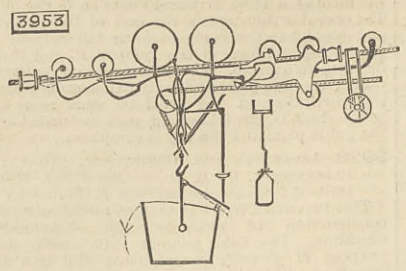

with the axis of the hoist block sheave. The drawing is a side view showing the whole apparatus.

3954. MAKING PAPER SPILLS, *J. Rettie.—Dated 29th September*, 1880.—(*Not proceeded with.*) 2*d*.

A spindle is mounted in a bearing, and is rotated by a crank handle. The end of a piece of paper is placed under a spring catch on the spindle, which is then revolved, the paper being guided by hand so as to twist round in a spiral form on the spindle.

3955. APPARATUS FOR HOLDING BOTTLES CONTAINING EFFERVESCENT LIQUIDS, *J. Rettie.—Dated 29th September*, 1880.—(*Not proceeded with.*) 2*d*.

The uncorked bottle is placed in a swing frame, the bottom resting on an adjustable seating, and a plug being forced into the mouth. The frame is then inverted until required to withdraw a portion of the contents of the bottle.

3956. PREPARATIONS FOR PREVENTING PAIN IN DENTAL OPERATIONS, *W. R. Lake.—Dated 29th September*, 1880.—(*A communication from H. E. Dennett.*) 4*d*.

The compound to be applied to the interior of the decayed tooth so as to deaden the nerve before introducing the tools to excavate and fill in the tooth, consists of 1 fluid ounce glycerine, 2 drams tannic acid, 4 grains chloral, the whole well mixed, and then strained or filtered until clear.

3959. PAPER MAKING MACHINES, *C. Herbert and J. Loch.—Dated 30th September*, 1880. 6*d*.

This consists in providing the vacuum boxes with a moving cover continually passing over the top of the box in the same direction as the wire web. The vacuum box is provided with open ends A to carry off

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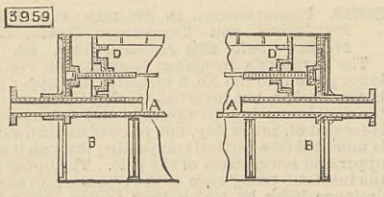

air and water, and it is placed within a cylinder B consisting of a perforated brass shell or of brass wire gauze, and caused to revolve round the vacuum box. D are adjustable cheeks to suit the width of the paper.

3960. FIRE-ESCAPES, *G. Tiviotdale.—Dated 30th September*, 1880. 4*d*.

A telescopic ladder A in two or more lengths is arranged on a universal joint B at about the middle of the length of the main ladder, this joint being fixed

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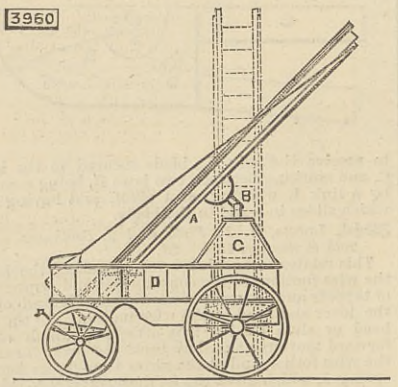

to a standard C mounted on a carriage D. By this means the ladder can be turned about into any desired position without moving the carriage.

3961. FASTENINGS FOR BELTS AND BANDS, *P. A. Martin.—Dated 20th September*, 1880. 6*d*.

This consists in forming fastenings for belts and bands of a device divided in the centre into two parts, capable of being readily connected or disconnected by means of a slide, bolt, or other convenient arrangement.

3965. RAISING, LOWERING, AND DISENGAGING SHIPS' BOATS, &c., *J. Scott.—Dated 30th September*, 1880.—(*Not proceeded with.*) 2*d*.

The hoisting apparatus consists of two strong swivelling cranes, each with an overhanging jib, and a crab or winch barrel, actuated either by hand or by motive power engines. The disengaging appliances consist of a horizontal lifting bar suspended by links near each end from the two chains of the crane, and this bar is fitted with a jointed hook at each end, on which the boat is hung.

3966. PIANOFORTES, &c., *F. Wolff.—Dated 30th September*, 1880.—(*A communication from A. Hellig.*)—(*Complete.*) 6*d*.

This consists in the construction of a stringing and tuning mechanism or device to take the place of the tuning pins, which is inserted removably into the rest board or tuning stock, the longitudinal axis of the said mechanism or device being in the same plane as the axis of the connecting end of the string, whereby

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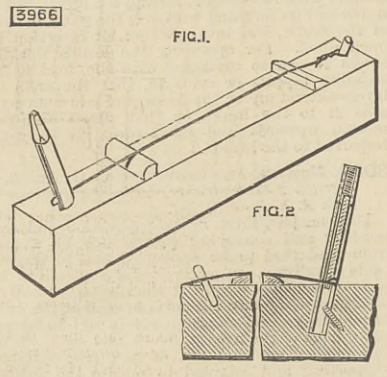


central direction of the tension of the string to the stringing and tuning device is secured. The said device is stationary in the rest board or tuning stock, the strings depending upon a central and rectilineal and not a tangential (peripherical) and rotary motion for their adjustment, which said rectilineal motion of the adjusting device is within a plane coinciding with the longitudinal axis of the connecting end of the string operated upon. Fig. 1 is a perspective view of the device, and Fig. 2 is a longitudinal vertical section.

3967. ROOFS FOR CONCRETE BUILDINGS, &c., *J. M. Tall.—Dated 30th September*, 1880.—(*Not proceeded with.*) 2*d*.

Rectangular slabs of concrete are used and are cast with a grooved rib along the top edge and a hooked projection also grooved but on the underside, along the bottom edge, so that when in position the hooked projection of one slab overlies the rib on the top of the abutting slab. The side edge of some of the slabs have ribs and others have hooked projections, which also interlock. In the grooves on the ribs lengths of india-rubber tubing are laid so as to form a tight joint and allow for shrinkage.

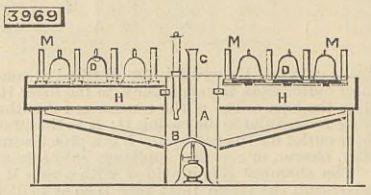
3968. MOUNTING THE SADDLES OF VELOCIPEDES, *A. G. Salamon.—Dated 30th September*, 1880.—(*Not proceeded with.*) 2*d*.

So as to prevent the saddle working loose and rocking it is connected to the backbone by means of a metal clip, which embraces the backbone and is attached by pivot pins to four jointed levers set at right angles to each other. The upper ends of these levers are pivotted to the saddle frame.

3969. EXAMINING THE GERMINATING POWER OF SEEDS, *A. Steenburg.—Dated 30th September*, 1880.—(*A communication from R. Jensen.*) 6*d*.

A cylindrical water vessel A is heated by a lamp, its under surface being funnel-shaped so as to concentrate the heat towards a flue C passing through the vessel which is supplied with water from reservoirs H

3969



connected to both the top and bottom of the vessel. The tops of the reservoirs are perforated, and on them are placed discs of felt with bosses on their undersides which enter the perforations and absorb the water. On the felt the seeds are placed, and over them glass bells D. For very small seeds tubes M are substituted for the bells.

3970. BREECH-LOADING FIRE-ARMS, *J. J. Atkinson.—Dated 30th September*, 1880.—(*Not proceeded with.*) 2*d*.

The barrel is attached to a metal part or "action" firmly secured to the stock, and on the action is a projection against which the movable breech block rests, and on the underside are ribs or flanges to strengthen it. The breech block is hinged so as to open and close by an up-and-down movement. A hollow is formed in the breech block in which the striker works, and on the tail end is a shoulder to operate the extractor, so that the exploded cartridge is removed, and the striker drawn back by the act of raising the breech block. A locking arrangement is employed.

3974. COMBINED NUT AND SQUARE THREAD SCREW, *H. A. Bonneville.—Dated 1st October*, 1880.—(*A communication from J. Marcelin.*)—(*Not proceeded with.*) 2*d*.

This relates to the replacing of the sliding friction by the rolling friction in the manufacture of screws intended to produce a pressure or to transmit a motion, and thus to avoid the loss of working power through the sliding friction with an ordinary screw, and it consists in combining with the ordinary square thread a pair of rotary discs, of which the rotating axes are perpendicular to that of the screw.

3975. FERMENTED OR AERATED LIQUORS OR BEERS, *J. A. Fawcett.—Dated 1st October*, 1880. 4*d*.

This relates, First, to the manufacture of a fermented liquor or beer from the bran, or husk, sharp, middlings, or seconds produced in the grinding of wheat and other grains, sufficient sugar being added to them to promote fermentation; and Secondly, to the use of the above substances in combination with malt, or malt and sugar, or other substances capable of being converted into beer.

3976. ACCUMULATORS FOR OIL PRESSES, &c., *R. Good and R. W. Menzies.—Dated 1st October*, 1880.—(*Not proceeded with.*) 2*d*.

The weighted accumulator is dispensed with, and an air vessel is substituted without weights or moving rams. This vessel is in connection with the pressure pipe from the pump to the press, and is in communication therewith at the bottom.

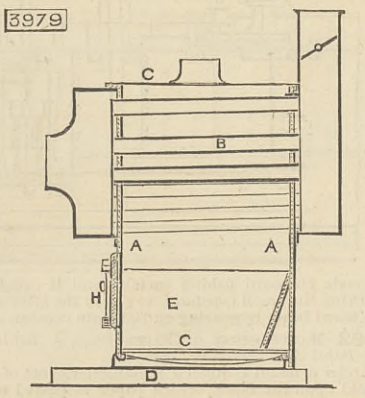
3977. BEVERAGE OR COMPOSITION OF FOOD, *W. P. Thompson.—Dated 1st October*, 1880.—(*A communication from P. Desgwin and Cie.*) 4*d*.

The stomachs of pigs, calves, and other animals are opened and the mucous membrane cleansed, and the digestive fluids are scraped off with a knife, and dried as quickly as possible at a heat not exceeding 90 deg. Fah. The pepsine thus obtained is reduced to a powder at once, or ground with cocoa or chocolate.

3979. STOVES, *W. Smith, jun.—Dated 1st October*, 1880. 6*d*.

This relates to that form of stove in which the flame and products of combustion are made to pass round and circulate outside a series of tubes through which air is allowed to pass, such air becoming heated in its passage, and being then admitted into the room, building, or other place which it is desired to heat.

3979



A A are parallel vertical plates having perforations at their upper parts into which are fitted the ends of the tubes B B. An outer casing C is fitted round the tubes and connects the plates A A together, its sides descending nearly or quite to the floor or base plate D upon which the stove stands. E is a fireplace, G the grate, and H the fire door.

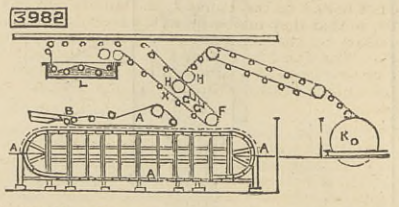
3981. ROTARY CORN SCREENS, *J. H. Johnson.—Dated 1st October*, 1880.—(*A communication from W. Bassett.*)—(*Not proceeded with.*) 2*d*.

This relates to a substitute for brushes and other devices used to clean rotary screens, and it consists in so arranging the wires of the screens that they widen as they approach the highest point of their revolution, whereby the grain which would otherwise clog the screen will fall down into it again.

3982. MANUFACTURE OF PAPER, &c., *Comte de Sparre.—Dated 1st October*, 1880. 6*d*.

This consists in the employment of boxes or moulds A connected together by hinges, and forming an endless chain which takes the place of the endless wire cloth. Each mould or box has at each side a rack, with which gear the wheels B to cause the endless chain to travel along. When the paper reaches the wet press cylinder F it is removed by the felt X, and the water extracted by the vacuum boxes G, when it passes through the press cylinders H to the drying

3982



cylinders K. The moulds or boxes are adjustable to suit different widths of paper. The endless felt X after quitting the paper at the press cylinders is washed in a vessel L filled with water.

3985. MOWING AND REAPING MACHINES, *A. C. Bamlett.—Dated 1st October*, 1880.—(*Not proceeded with.*) 2*d*.

To enable the driver to more readily elevate the points of the cutters, the bracket that carries the regulating lever is pivotted, and the lever has a projection on which the driver presses his foot, and so raises the points of the cutters. The front wheel is carried on a pivotted bracket, to which pivot the draught pole is attached. A clutch is used to put the machine in and out of gear, and it slides on a spiral feather on the main axle boss, so as to receive a slight rotary motion. An arm on the clutch is connected by a slotted rod to a pawl acting on a ratchet on the gear wheel. The clutch is acted on by a lever and raises or lowers the pawl in or out of gear. To draw the machine a short chain or link is attached to the draught pole, and two links are carried to the swingle-trees which are mounted on the end of a bar pivotted to the pole.

3986. REGULATING THE ADMISSION AND EMISSION OF STEAM TO AND FROM STEAM ENGINE CYLINDERS, &c., *M. Silvester.—Dated 1st October*, 1880.—(*Not proceeded with.*) 2*d*.

The valves employed are arranged so as to expose to the fluid pressure two or more surfaces of equal area, each having ports for the passage of fluid. The valve moves between guides, one of which is adjustable.

3990. PROTECTING AND PRESERVING WOOD, *L. A. Groth.—Dated 2nd October*, 1880.—(*A communication from A. E. Barthel.*)—(*Not proceeded with.*) 2*d*.

This consists in treating the wood first with a solution of sulphate of soda or magnesia, and then with a solution of chloride of barium.

3995. BRACE BUCKLE, *C. N. Eyland.—Dated 2nd October*, 1880. 6*d*.

One part of the invention consists in forming the loop or ring of the buckle, when in the rough, with an extra piece or flap on either or both sides of it, so that in the finished article, these pieces being turned over so as to form the loop or ring tubular, the rough cutting edge of the back of the ordinary stamped loop or ring is avoided.

3998. METAL FRAMES FOR DOORS, *H. Tonkinson and W. Rockliffe.—Dated 2nd October*, 1880. 4*d*.

A wooden pattern is prepared, from which an impression is taken, which forms a mould, and after the removal of the pattern an iron plate having the door opening previously cut out in the usual way, is substituted therein. Upon pouring fused metal in the mould box, it firmly adheres to certain parts of the iron plate, and thus forms a self-connecting beading or rim around the opening forming the doorway.

4000. WARP BEAMS, *J. R. Aldred.—Dated 2nd October*, 1880. 6*d*.

The drawing is a longitudinal elevation partly in section of a warp beam constructed according to the invention, in which A is the beam made of sheet iron, in each end of which is fitted a cast iron flanged boss or end piece B, to which the ends of the beam are fixed with screws or otherwise; C is a shaft extending through the beam and projecting a sufficient distance beyond the beam to form a bearing at each end; on this shaft are cut a right-hand screw and a left-hand screw; D are the beam flanges, on each of which is a long annular projection or bearing surface fitting round the beam. In the centre of each beam flange is a nut or boss, one fitting on the right-hand screw, and the other fitting on the left-hand screw. Each nut or boss is connected to the beam flange by two

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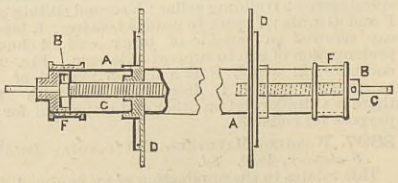

webs or feathers, which pass through longitudinal slots in the shell of the beam; these slots extend from the end towards the middle of the beam any required distance, so that the flanges may approach each other. At each end of the shaft C is formed a square, so that the shaft may be readily turned by a key or handle; F F are the ruffles fixed on to the beam. There is a set screw in each end piece B in order to secure the shaft C so that the beam may not rotate independently of the shaft.

4010. RAILWAY BUFFERS, &c., *G. K. Hannay.—Dated 2nd October*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to means for causing the force of a collision to be spread in all directions instead of acting longitudinally only, and it consists in forming the buffers of a cylindrical casing containing a liquid against which the piston on the end of the buffer rod acts.

4011. MATERIAL FOR FILTERING, &c., *P. A. Maignen.—Dated 2nd October*, 1880. 2*d*.

This consists of a combination of charcoal and pure lime, the former being placed in a vessel and covered with lime water, when the vessel is heated so as to cause the lime water to boil, the operation being continued for some time, and fresh lime water added to keep the charcoal immersed. By this means carbonic acid gas and sulphurous gas are driven off from the carbonates and sulphates in the lime water, leaving the pure lime, which is precipitated and becomes deposited in the pores of the charcoal.

4019. VELOCIPEDES, *J. L. Emary.—Dated 4th October*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to improvements in the driving mechanism of velocipedes.

4022. SUPPLYING WATER TO WATER-CLOSETS, *H. W. Pearson and J. H. Howell.—Dated 4th October*, 1880.—(*Not proceeded with.*) 2*d*.

The apparatus for supplying water to water-closets is arranged in such manner that after the flushing valve has been used and allowed to close, so that no more water will pass it until the valve is again actuated, water is allowed by an auxiliary apparatus, consisting of a cylinder and piston, to pass to the pan of the closet, and the quantity is regulated by the piston automatically descending. Thus the pan of the closet is sealed, which would not be the case were the flushing valve worked without this appliance. The trapping arrangement consists of a cylinder and piston contained together with the flushing valve, in the service box from which the water is drawn. The rod of the piston is actuated by an arm attached to the spindle and flushing valve. When the flushing valve is raised it raises the piston with it, and keeps it in this position as long as the flushing valve is held up.

4021. ENGINE CYLINDERS, *H. Eaton.—Dated 4th October*, 1880. 4*d*.

This relates to engines in which one cylinder is used for two pistons moving in opposite directions, and actuating the same or two different crank shafts. The drawing shows an engine with four cylinders A, two valve chests C and two crank shafts D. The cylinders are cast in two pairs, each pair having a slide valve actuated by a link and two excentrics for reversing. The valve gear is analogous to that of a double-acting

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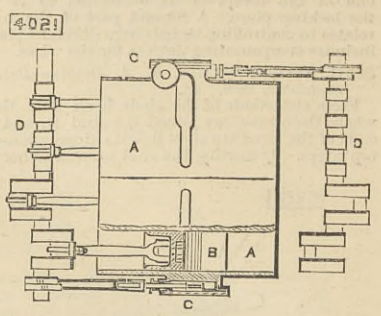

single-cylinder engine, with the difference that the ports communicate with the centres of the two adjoining cylinders instead of leading to the two ends of the single cylinder. B are the pistons which move to and from each other, being driven outwards by steam entering between them and inward by the crank shaft under the influence of the adjoining cylinder, whose cranks are placed at 180 degrees to those of the first cylinder.

4023. BUTTONS WITH PINS, *J. A. R. de Barazia.—Dated 4th October*, 1880. 6*d*.

This relates to a button made in two parts, one of which consists of the head and of a cylindrical hollow stem, having on its lower edge a notch of the form of an inverted T, and the other part of which consists of the base and of a stem which is also hollow and cylindrical, and which surrounds the notched stem, and which by means of a horizontal and diametrical pin is engaged with the short notch or depression at the bottom of the above-mentioned notch; the two parts of the button are maintained in this relative position by the elastic force of a rubber washer or of a metallic spring.

4024. NECKTIE FASTENING DEVICES, *L. Michaux.—Dated 4th October*, 1880. 6*d*.

This relates to a device for fixing neckties to a button, consisting of a single piece of sheet metal or other suitable material, this plate being provided with a vertical slot widened at its lower end, where it forms a hole that is larger than the head of the shirt button, and having at the middle of its height on its vertical edges, two swellings projecting towards the fabric of the necktie, the lower part of the plate being twice bent, and furthermore slightly curved in the centre of its width according to a vertical line.

4026. HARDENING CEMENT, LIME, STONE, &c., *W. R. Lake.—Dated 4th October*, 1880.—(*A communication from A. Magand.*) 4*d*.

This consists in the application of a liquid or composition having a base of sulphate of iron, of copper, or of zinc, or of any or all of the same mixed in any desired proportions with or without the addition of colouring or odoriferous matter, cement, lime, stone, wood, metal, and other materials.

4028. DISPLAYING ADVERTISEMENTS, *J. H. Johnson.—Dated 4th October*, 1880.—(*A communication from J. M. Paillard.*)—(*Not proceeded with.*) 2*d*.

This consists of an apparatus forming two albums, one of which is intended to be exhibited on the walls of public establishments, whilst the other is in the form of a book and is intended to be deposited on tables in the said establishments.

4029. MACHINERY FOR DRIVING VELOCIPEDES, &c., *O. Jones and W. O. Williams.—Dated 5th October*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in making the first motion wheel larger than the wheel on the axle of the travelling wheels of velocipedes, so that the wheels of the velocipede make more revolutions than the first motion wheel, and also in the manner of driving first motion wheel.

4030. BOOTS AND SHOES, *I. Silver and S. F. Feldman.—Dated 5th October*, 1880.—(*Not proceeded with.*) 2*d*.

The boot is lasted in the usual manner, but before putting in the middle sole or welt it is stitched all round the edge, and the sole is then attached to the boot, which is afterwards finished in the usual manner.

4031. FURNACES FOR PUDDLING IRON AND STEEL, *H. Jones and E. Holt.—Dated 5th October*, 1880.—(*Not proceeded with.*) 2*d*.

The object is to keep cool the bottom plates or bed of the puddling chamber of the furnace, as well as the flue plates, jamb plates, and back plates, so as to preserve them from the injurious action of the heat of the furnace.

4036. SEWING MACHINES, *H. J. Haddan.—Dated 5th October*, 1880.—(*A communication from J. Keith.* 6*d*.

This consists in a sewing machine provided not only with an eye-pointed needle, and with a shuttle or its equivalent to operate therewith, in order to perform lock-stitch sewing, by the thread of the shuttle being

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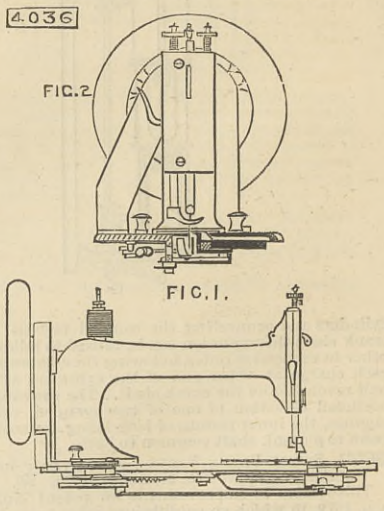

passed through the loops formed by the needle, but with a looping hook and a cast-off, and mechanism for operating them, so as to enable them with the needle, and without the aid of the shuttle, to perform chain-stitch sewing. It further consists in the combination of the looper and cast-off with means of raising and depressing them relatively to the needle and the shuttle, in order for the shuttle while in operation to play free of the looper, and the latter when the shuttle is out of its race to be adjusted to operate with the needle to perform chain-stitch sew-

ing. It further consists in the combination of a groove in the wall or side of the shuttle race with the looper and cast-off and the needle to operate therewith, such groove being for retaining the loop in a proper position while the looper and cast off may be advancing for the looper to seize the thread for the formation of the next succeeding loop. Fig. 1 is a side elevation, and Fig. 2 a front view (partially in section) of the machine.

4035. LOCKS AND LATCHES, *W. Sturmey.—Dated 5th October*, 1880.—(*Not proceeded with.*) 2*d.*

Both sides of the tail of the locking bolt are made alike, that is with a key gating on each side. The tumbler is placed centrally at the back of the locking bolt, and a stud upon the forward end of the tumbler is exactly behind or in front of a corresponding stud at the back of the locking bolt tail, according to whether the bolt is locked or unlocked. The back end of the tumbler works upon a stud carried by the lock case, and arms project upwards and downwards from the tumbler, and at right angles to its horizontal axis. The said arms bear against a vertical lever, which is carried on a stud near the top or bottom of the case, the said vertical lever being kept up against the said arms by means of an ordinary feather spring. There are two vertical key holes in line with one another vertically, but in opposite directions, one key hole being on one side of the locking bolt tail and tumbler, and the other on the other side, and thus whichever hand the lock or latch is used for, one of the key holes is always the right way up. The lock may be used either right or left handed.

4037. VELOCIPEDES, *L. Aviss.—Dated 5th October*, 1880. 6*d.*

This relates to means for obtaining increased speed with small driving wheels; B is the driving wheel revolving on a spindle F which is hollow, and through

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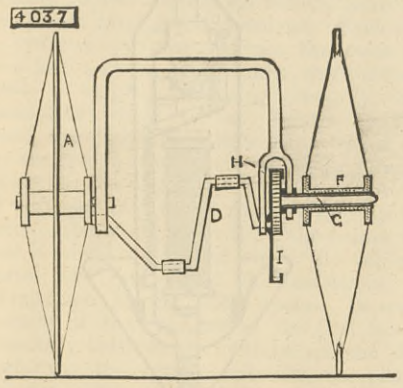

it passes the spindle G connected to the boss of the wheel and carrying a pinion H gearing with an internal wheel I fixed to the treadle axle D. The wheel A is shown as revolving loosely on a stud on the frame, but it may be driven in the same manner as wheel B.

4039. IMPROVEMENTS APPLICABLE TO TELEPHONES FOR THE PURPOSES OF SIGNALLING, *J. G. Lorrain.—Dated 5th October*, 1880.—(*A communication from G. Trouve.*) 6*d.*

Figs. 1 and 2 show the apparatus in detail. Through one side of the case A passes a spindle E provided with pointer *a* and with two cams F and G. E is kept always in communication with the line by means of the spring J, and the diaphragm is connected with a spring H screwed to the bottom of the recess provided for the coil C. E acts as a commutator. A small portion of the underside of M is scoured or scraped, and bears against three contact points I I^1 I^2 of copper set in the case A. I is connected with the wire passing from C; I^1 is perforated for the reception of a pin fixed to the diaphragm; and I^2 is in communication

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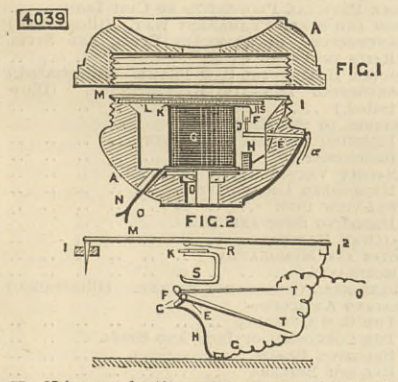


with H; N is a conducting wire connected with the pole of a battery and one of the poles of the coil; O is connected with the line wire and the spindle E by means of the spring J, so that when G presses on H, the battery current through N passes through C, then through M, thence through H, G, and E, and lastly to J, which is connected to O. By moving *a* so as to bring it opposite C (call) marked on the outside of the telephone case, E is rotated and G is thereby moved away from H and the circuit is open. F is then brought into contact with a finger S carried by a spring lever K supported at L. This lever is raised by F and comes in contact with a projector R formed by a grain of platinum attached to M near the centre. The arrangement of E acting as a communicator, and also serving to cause the diaphragm to act with a tremulous motion, enables the contact points to be moved for as small a distance as may be desired, and to thus adjust the apparatus at pleasure.

4042. RECORDING A SHIP'S COURSE, *A. Steenberg.—Dated 5th October*, 1880.—(*A communication from F Alsing, H. Sachmann, and C. Dous.—(Not proceeded with.*) 2*d.*

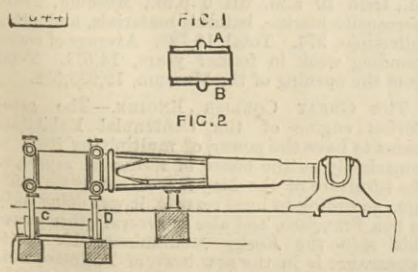
The object is to furnish compasses provided with a mechanism so constructed as to record all changes of direction in the ship's course and divide the diagram of the course into hour spaces.

4043. MANUFACTURE OF PIANOFORTES, &c., *A. A. Hely.—Dated 5th October*, 1880.—(*Not proceeded with.*) 2*d.*

The front, back, top, and sides of pianofortes and the like wooden-cased musical instruments are covered wholly or partly with glass.

4044. STEAM ENGINES, *G. F. Corliss.—Dated 5th October*, 1880.—(*A communication from G. H. Corliss.*) 8*d.*

This relates in part to engines described in patent



No. 5154, dated 16th December, 1878. Fig. 1 shows a cylinder with a jacket cast according to this invention. It will be seen that the strains resulting from unequal expansion and contraction, either in the body of the cylinder or in the jacket, are absorbed by the elasticity of the ring A B, thus obviating the risk of fracture or distortion of the cylinder itself. The Second part relates to means or arrangements designed to allow of expansion of the cylinder and of the other parts subjected to high pressures. In Fig. 2 the feet C and D are not bolted to the foundations but are left free to shift, so that they may take all the positions rendered necessary by the contraction and expansion of the parts. The Third part relates to the construction of the pistons of steam engines, which are kept tight by rings automatically tightened by the action of the steam.

4045. COUPLING AND UNCOUPLING RAILROAD CARS, *W. S. Sampson.—Dated 5th October*, 1880. 6*d.*

The coupling enables the carriages to be coupled and uncoupled without passing between them. The coupling hook B is fulcrumed to the draw bar A, beyond which it projects so as to slide over and enter an

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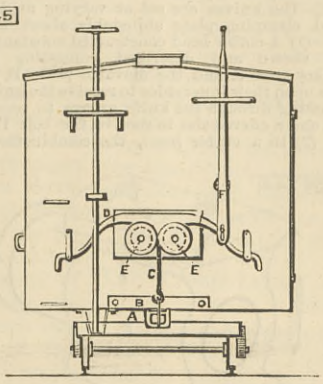

eye in the draw bar of the adjoining carriage. The hook is connected by a chain C to a horizontal bar D resting on two pulleys E, and capable of being operated from either side of the carriage, or through the lever F from the top of the carriage.

4046. BREECH-LOADING REPEATING FIRE-ARMS, *B. Burton.—Dated 5th October*, 1880. 6*d.*

This relates to improvements on patent No. 884, dated 11th March, 1874, and it consists in a spring tail to the extractor lever, whereby it is made to catch over and grasp the cartridge, ready to withdraw the same whether the firing pin is projected or not, and when the firing pin is thrown forward to fire the cartridge the cam on the piston rod passes beneath the lever portion of the extractor so as to hold it firmly. The bolt F slides in the breech receiver A, and is provided with a breech lock M, and there is a piston within the bolt and a spring to project the piston and firing pin J, when the piston is liberated from the trigger

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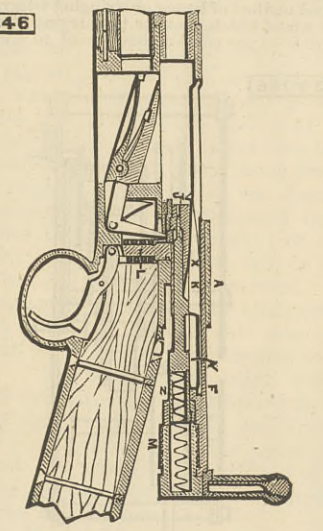

sear L. The lever and extractor K is pivotted at X. The rear end of the extractor is extended as a spring tail Y that enters a recess in the bolt. To prevent the breech lock being turned until it arrives at its proper place in the receiver, a groove is formed in it and straddles a spline upon the tail stock. So that the trigger may be held to prevent the firing pin being disengaged until the breech lock is in its place, a notch is formed in the sear or trigger bolt L and with it a projecting part Z engages, such part being also formed with a notch which comes opposite the sear when the breech lock is in place.

4048. DRIVING SCREW PROPELLERS, *H. F. Phillips.—Dated 5th October*, 1880.—(*Not proceeded with.*) 2*d.*

A small engine is employed running at a great speed and connected with the screw shaft in any well-known manner, so that the engine shaft shall make two or more revolutions to one of the screw shaft.

4052. ALTERING THE HEIGHT OF SEATS, TABLES, &c., *J. S. Henry.—Dated 5th October*, 1880.—(*A communication from V. Bareau and A. Croisé.—(Not proceeded with.*) 2*d.*

The top to be raised or lowered is provided on its underside, as near the edge as possible and in a circular line, with a series of inverted cones having on both sides a series of notches or projections, these notches or projections on the several cones being in a series on successive horizontal planes. These cones when the top is down are between an equal number of legs, standards, or projections on the under part of the seat, table, stand, or other article, and on the upper ends thereof the top of the article rests.

4053. BATHS, &c., *W. Towers.—Dated 6th October*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the construction of baths, lavatories, jaw-boxes, cisterns, and other similar water vessels, and of the overflow and outlet valve and fittings connected therewith, which are specially designed as an efficient and reliable means of trapping the sewer gas or preventing its escape through the discharge outlet in bath rooms or other apartments.

4055. TRAMWAY RAILS, &c., *H. Aitken.—Dated 6th October*, 1880.—(*Not proceeded with.*) 2*d.*

For tramway purposes the rail is constructed of cast iron. A mould is made in sand with the top face of the rail downwards. White pig iron is poured in to cover the whole wearing surface of the rail a sufficient depth. Having allowed this iron to become nearly set, softer or tougher iron is poured on the top thereof.

4057. CASTERS, *G. F. Redfern.—Dated 6th October*, 1880.—(*A communication from J. M. Harper.*)—(*Not proceeded with.*) 2*d.*

A cup is employed, adapted to receive the foot of the article, and this cup is provided with three or more radial arms, into which are journalled any suitable casters or rollers, which revolve freely The arms are thus extended radially to afford more extended bearings, to avoid tipping of the device when forced in any given direction.

4059. TRAVELLING BOXES AND BAGS, *H. Josselsohn and J. Goodman.—Dated 6th October*, 1880.—(*Not proceeded with.*) 2*d.*

This consists in the combination, forming one article, of a foot muff or receptacle for keeping the feet warm with a travelling box or bag, the said muff or receptacle being contrived in one of the sides of the box or bag, and provided with an opening to admit the feet.

4068. DYEING LEATHER BLACK, *N. G. Sörensen.—Dated 7th October*, 1880. 4*d.*

This consists in the method of imparting by the use of vanadic compounds or preparations, a black colour to leather, containing tannic acid, or gallic acid, or derivations or combinations thereof.

4069. PRESERVING ANIMAL AND VEGETABLE SUBSTANCES, *J. W. M. Miller.—Dated 7th October*, 1880.—(*Not proceeded with.*) 2*d.*

The preparation consists of the following ingredients: Diastase, glycerine, glucose, crystals of pure chloride of sodium, nitrate of potash, common salt, salicylic acid, salicylate soda, acetic acid, sea water, distilled water or pure water, honey and grape sugar, any two or more of which are mixed together with or without the aid of heat.

4071. LOCKS AND LATCHES, *F. H. Steeds.—Dated 7th October*, 1880.—(*Not proceeded with.*) 2*d*

To the spindle of the spring bolt or latch is attached an arm or lever, which in its normal position is preferably nearly horizontal. Jointed to the free end of the said arm or lever is a vertical rod. The said rod is of such a length that its lower end is situated a little above the bottom of the door and terminates in a horizontal pedal. The lever rod and pedal do not interfere with the use of the lock or latch in the ordinary way, that is, with the opening of the door by turning the knob with the hand, the lever turning on its fulcrum, and the rod and pedal descending when the knob is turned in a direction proper to withdraw the spring bolt, and returning to their normal position by the action of the spindle when the knob is loosed.

4072. COMPOSITIONS FOR PRESERVING BACON, &c., *J. P. Geary.—Dated 7th October*, 1880. 4*d.*

One solution is composed of salycilic acid 12 drachms, benzoic acid 4 drachms, borax 1 lb., nitric potash ½ lb., corrosive sublimate 40 grains, water 9 quarts. Two solutions are described, which are modifications of the above.

4074. CRANES, *R. C. Rapier.—Dated 7th October*, 1880. – (*Not proceeded with.*) 2*d.*

A fusee barrel is used, and the jib crane is attached to one end of the barrel, and is wound as many turns as may be necessary to lift the jib to its full height. The dead end of the load chain is passed over a pulley, on the jib head and led down and attached to the other end of the fusee barrel, so that it may be wound up turn for turn as the jib unwinds, and in such proportion that the one neutralises the other, and the load remains at the same level in all the positions of the jib.

4082. MOULDING PLANES, &c., *C. Pieper.—Dated 8th October*, 1880.—(*A communication from W. Grössler.*)—(*Not proceeded with.*) 2*d.*

The stock is by preference made of wood, and in this case of three main parts glued together lengthwise, the centre part being divided in the middle, where the iron and the wedge serving to fasten the latter pass through it. The surface of the middle part serving as bed for the iron may thus be moulded to the shape required by the rotating cutter before the parts are glued to each other. The stock may, however, also be made in one piece of paper pulp or out of sawdust with any known cement, by pressing such material into a suitable mould. The iron may be manufactured by turning the required moulding on a lathe into a ring of steel, and then cutting this ring into pieces of suitable length.

4083. GALVANISING ROLLER BATHS, *J. Tagell.—Dated 8th October*, 1880.—(*Not proceeded with.*) 2*d.*

On the top of the bath is secured a suitable casting running the lengthways of the bath, and at each end is secured a plummer block, through which runs a horizontal shaft. At one end of this shaft are the pulleys or gearing receiving the power for giving motion to the apparatus by steam or other power, and at the other end is keyed a bevel wheel, which gears into a corresponding bevel wheel which drives a vertical shaft, which said vertical shaft at its lower end, by means of suitable gearing, actuates the horizontal rollers working in the bath, through which the sheets of metal are drawn in the process of coating.

4084. DISINFECTING APPARATUS FOR WATER-CLOSETS, &c., *T. Duggan.—Dated 8th October*, 1880.—(*Not proceeded with.*) 2*d.*

This consists of a cylinder or tube open at both ends, and provided with flanges, for the purpose of attaching the apparatus to the water-closet basin, or insertion in connection with ordinary sewer pipes. Around the interior of this cylinder or tube is formed a shoulder or projection, against which a disc or circular plate is caused to abut, and on the outer circumference is arranged a chamber or receptacle for the purpose of holding a disinfecting liquid. In this chamber or receptacle a metal weight is suspended, and is connected to a lever hinge, on which hinge the circular plate operates.

4086. STEAM BOILERS, *H. J. Haddan.—Dated 8th October*, 1880.—(*A communication from P. Privat.*) 6*d.*

This relates to an internally-fired horizontal boiler provided with a return flue, and constructed in such a manner that the fire-box, flues, and smoke-box can be easily detached from the rest of the boiler for cleaning or repairing. The main portion or shell of the boiler is formed of a cylindrical and of an oval part 12, the latter being arranged to receive the

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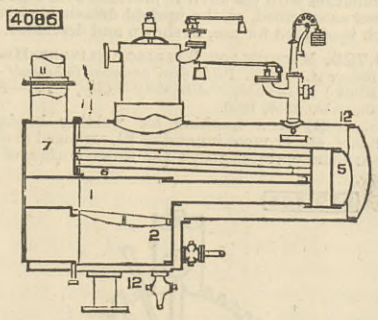


steam generated by the fire-box 1, an oval flue and the tubulous part 6, which constitute the principal part of the invention. The flame arising from the grate 2 passes through the oval flue into the smoke-box 5, which forces the products of combustion to return through the tubes 6, which form the return flue in order to reach the smoke-box 7 and the chimney 11.

4087. HOLDERS FOR THE STEMS OF BROKEN WINE GLASSES, &c., *A. L. Wharton.—Dated 8th October*, 1880.—(*Not proceeded with.*) 2*d.*

The holder consists of a base or foot, which may be similar to the base of a wine glass; a vertical tube attached to the base or made in one piece with the same; a clip placed at the top of the tube; a pusher enclosed in the tube, and so connected with the clip as to open or close the latter by its up or down motion, this motion being effected one way by hand, and the other way by a spiral spring.

4089. ROCKING HORSES OR CHAIRS, &c., *E. Davies.—8th October*, 1880.—(*Not proceeded with.*) 2*d.*

The horse or chair or other form of carrier is attached by means of pin joints to one or two upright rods or bars. The bottom or other ends of these bars are affixed by like pin joints to the main framing of the apparatus, In front and rear of these rocking rods or bars are one or more strong spiral or other springs, attached at one end to the rods or to the horse or chair, and at the other end to the main framing, or to a suitable bracket attached thereto.

4092. TRAMWAYS, *T. Kendall.—Dated 8th October*, 1880.—(*Not proceeded with.*) 2*d.*

The top portion of the rail is of ordinary construction, but that part which beds on the sleeper is made of an angular form, so that pressure coming upon it tightens it upon the sleeper and prevents its removal out of position, requiring thereby less keying or otherwise fastening down than rails generally used. The sleeper is grooved on its upper surface in an angular form to receive the rail.

4093. MANUFACTURE OF STEEL AND IRON AXLES, &c., *J. Duffield.—Dated 8th October*, 1880.—(*Not proceeded with.*) 2*d.*

An ingot bloom or bar of metal is placed in a sufficiently hot state between two horizontal metal plates, on the inner surfaces of which are fixed or formed suitable tapered swells or projections for the purpose of reducing the diameters when necessary.

4094. EXTRACTING COPPER AND OTHER METALS FROM THEIR ORES, &c., *W. Elmore.—Dated 8th October*, 1880. 4*d.*

This has for object and relates to the treatment of chloride and sulphate liquors in the extraction of metals from their ores by dynamo, galvanic, or voltaic electricity.

4095. REFUGE ROOMS AND BREATHING TUBES FOR MINES, *T. Harrison.—Dated 8th October*, 1880—(*Not proceeded with.*) 2*d.*

This consists in making refuge rooms of boiler plate or other material, these rooms being provided with air pumps. The Second part consists in laying tubes fitted with breathing taps to different parts of the mine.

4102. TURNING MACHINES, *J. Brown.—Dated 9th October*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to machines for turning or shaping wood, and is especially applicable to the turning or shaping of oval, elliptical, or surfaces irregular in form. The cutting apparatus consists of a disc, around the periphery of which a series of curved cutting tools are secured.

4103. PAPER-MAKERS' COTTON DRYING FELTS, *J. Crossley.—Dated 9th October*, 1880. 2*d.*

This consists in weaving the parts of which the joining is composed half the thickness of the other part on opposite sides of the fabric, so that when the two half thicknesses are laid together one over the other, and the warp ends are stitched in the ordinary manner, and upon both sides of the two half thicknesses so laid together, a flush and even joining is obtained, the joined surfaces being exactly equal in thickness to the other part of the felt.

4106. HOT-WATER APPARATUS, *E. S. Sheard, J. A. Denton, and G. Firth.—Dated 9th October*, 1880.—(*Not proceeded with.*) 2*d.*

The boiler consists of a hollow copper casing of rectangular form, having one side open. Across the open side are a series of pipes for the circulation of the water, and at right angles to these pipes are connected other pipes extending to the opposite side of the boiler. The boiler thus forms a double-sided box containing a number of vertical pipes and a smaller number of horizontal pipes.

4107. FABRICS OR MATERIALS FOR PROTECTIVE AND PRESERVATIVE PURPOSES, *J. C. Mewburn.—Dated 9th October*, 1880.—(*A communication from J. F. Rodgers, G. S. Page, and W. W. Adams.*) 4*d.*

The foundation fabric is dipped in, or is in some way covered with, a preservative liquid, consisting of one or more of the following substances:—Coal tar, creosote, cresol, carbolic acid, creosote oil, naphthaline, anthracene oil, paraffine, and the product of tar known to the trade as "light oil."

4108. PICKERS AND STOPPERS FOR LOOMS, *F. and J. Mitchell.—Dated 9th October*, 1880. 2*d.*

This consists in the construction of pickers and stoppers for looms from the material known as vulcanised fibre.

4111. SCREENING COAL, &c., *C. Beadle.—Dated 9th October*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to a screen, which can be quickly and readily changed from one gauge to another by moving the bars of the screening surface.

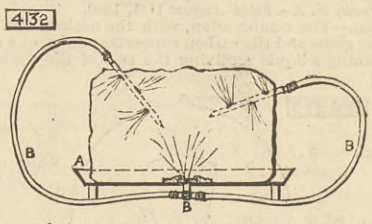
4113. CONVEYING MATERIALS, *E. G. Brewer.—Dated 9th October*, 1880.—(*A communication from W. Winterhalter.*)—(*Not proceeded with.*) 2*d.*

This consists in a conveyor tube provided with helical or angular blades on its inside; this tube revolving in suitable bearings and provided with the necessary inlets and outlets.

4132. TREATING BALES OF FIBROUS MATERIAL, *F. F. Seeland.—Dated 12th October*, 1880. 6*d.*

The bale is placed on the table A having turned-up

4132

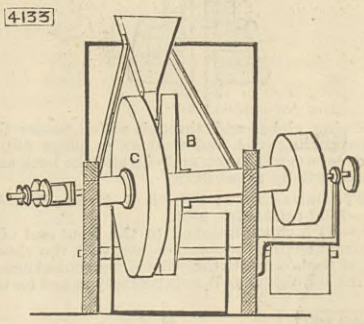


edges, and steam is injected into it from the pipe B as shown.

4133. GRINDING MILLS. *J. Rae.—Dated 12th October*, 1880. 8*d.*

Two circular plates or discs B and C, provided with grinding surfaces, are mounted on separate axes contiguous to each other, so that the back face of the one and the front face of the other shall rub together.

4133



These axes are not parallel to each other, but are so skewed that the opposed surfaces at the lower portion thereof, or at a point a suitable distance from the top, shall be very close together, while the upper portions are at an appreciable distance apart.

4151. STAYS AND CORSETS, *E. A. Allibert.—Dated 13th October*, 1880. 2*d.*

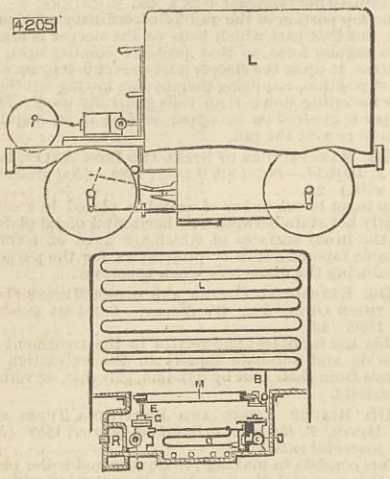
The stay or corset is made very deep in front and back, and short at the sides, so as to leave the hips uncovered. To the front and back pieces are attached bands of cloth, which extend and pass from back and front to the sides, and are drawn together over the hips by laces.

4205. COMPRESSED AIR ENGINES, *W. Dredge.—Dated 15th October*, 1880. 8*d.*

The drawings show the invention as applied to a

locomotive engine. Air is compressed in a tank by pumps, and the heat developed by the compression is removed by cold water. The compressed air is supplied to the reservoir L, and flows through the valve B to a regulator M, the valve being operated by the attendant. From the regulator it passes through pipe E to the valve box of the starting or stopping valve G corresponding to the throttle valve of an

4205



ordinary engine, and also controlled by the attendant. The air then enters the slide valve box, and into the cylinder O, the exhaust being discharged through the tubes Q into a second cylinder, and so on through four cylinders, finally passing to a small furnace R.

4206. VELVET PILE CARPETS AND RUGS, *T. B. Worth.—Dated 15th October*, 1880. *2d.*

This relates to means to enable thick carpets and rugs to be woven in an ordinary jacquard velvet pile power loom.

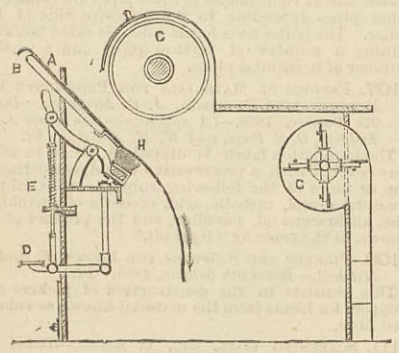
4285. REPAIRING AND LINING BESSEMER CONVERTERS AND FURNACES, *S. G. Thomas and P. C. Gilchrist.—Dated 21st October*, 1880. *4d.*

This consists, First, in repairing Bessemer converters and other furnaces, by means of a liquid or semi-liquid mixture of tar and lime without ramming; Secondly, in manufacturing hard shrunk lime for lining Bessemer converters and other metallurgical furnaces, by burning dolomite or limestone in a basic lined cupola at an intense white heat.

4324. FLUFFING AND WHITING LEATHER SKINS, *S. Haley.—Dated 23rd October*, 1880. *6d.*

The leather to be operated upon is introduced through the opening A, and rests upon the board B, which board also permits the leather to be guided to the

4324



proper place; C is an emery roller against which the leather is pressed by means of the treadle D; E is a spring for withdrawing the lever and brush H from contact with the roller. For the purpose of taking away the dust from the inside of the machine two fans G are employed.

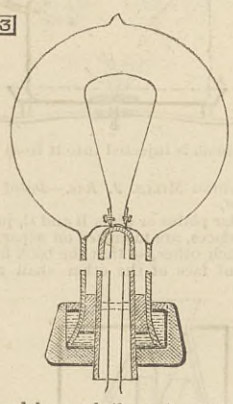
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

239,373. ELECTRIC LAMP, *Thomas A. Edison, Menlo Park, N. J.—Filed August 17th*, 1880.

Claim.—The combination, with the neck of the inclosing globe and the carbon supporting tube, of a cup containing a liquid receiving the end of the neck of

239.373

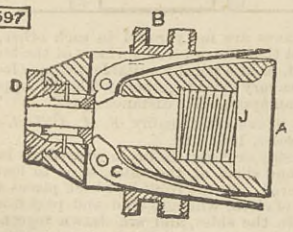


the inclosing globe, and through which passes the carbon supporting tube, and washers or plugs filling the space between the neck and cup and the neck and tube, substantially as set forth.

239,597. DRILL-CHUCK, *William L. Bergen, Batavia, Ill.—Filed October 7th*, 1880.

Claim.—(1) A chuck fastened to the front end of a lathe spindle having the combination, with the chuck body A, of the levers C C, the collet E, the conical nozzle D, and the sliding collar B, substantially as and for the

239.597

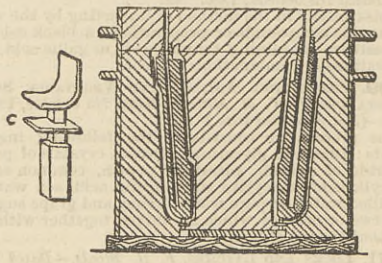


purpose described in the foregoing specification. (2) The projection of the body A behind the shoulder J (which screws against the collar of a lathe spindle on a lathe chuck), substanially as described in above specification.

239,609. DEVICE FOR MOULDING TUYERES, *John M. Hartman, Pa., assignor of one-half to Louis Taws, same place.—Filed January 21st*, 1881.

Claim.—(1) An anchor with a double or L-shaped flange, forming a support and a guide to a core, for purposes herein specified. (2) In combination with a double anchor inserted in a pattern, a flange C, to

239.609

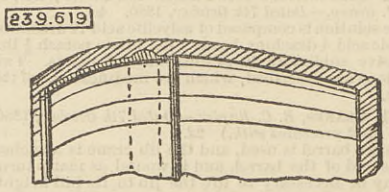


cover the hole in the pattern while moulding, and to prevent the moulding sand from getting between the flange C and the double flange, as herein described. (3) The combination of a double anchor having an L-shaped flange, and the bottom plate H, for supporting the anchors and cores substanially as set forth.

239,619. REPAIRING STEEL AND OTHER CRUCIBLES, *John Pedder, Pittsburg, Pa.—Filed February 17th*, 1881.

Claim.—(1) The herein-described process of repairing plumbago crucibles, consisting in forming at any desired place in the interior of the crucible, after it has stood one or more heats, a lining or case composed of plumbago, silicon and plumbago, or other suitable material, to build up the interior of the crucible, sub-

239.619



stantially as set forth. (2) In combination with a crucible having a lining or case of plumbago and silicon, or other suitable material, formed at any desired place on the interior of the crucible, a cap placed within the crucible to protect or sustain the inner lining, substantially as set forth.

339,621. APPARATUS FOR DEPHOSPHORISING IRON, *Eduard Pirath and Emil Pirath, Frankfort-on-the Main, Germany.—Filed May 7th*, 1880.

Claim.—The combination of a Bessemer converter and its blast pipe A with feed hopper B, having a

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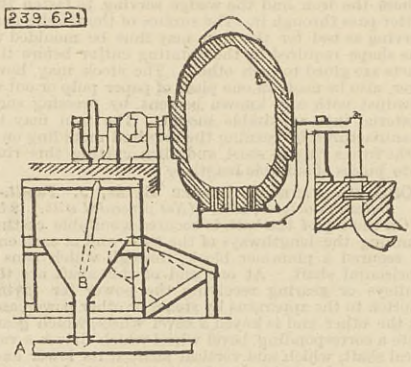
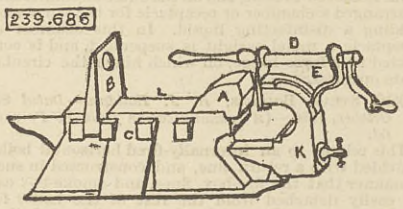


flexible neck and regulating valve, for supplying the powdered dephosphorising substance directly to the blast pipe, and with mechanism for oscillating the hopper, substantially as specified.

239,686. COMBINED ANVIL, VICE, AND DRILL, *Joseph L. Ware and W. Scott-Fleming, Pine Island, Minn.—Filed July 17th*, 1880.

Claim.—(1) The anvil L, having lugs C C C C, removable jaw A, and upright jaw B, in combination with outer jaw K, substanially as specified. (2) The drill head E, having boring mandril D, in combination

239.686



with the closing jaw K, to which it is attached, and the anvil L, having lugs C C, and upright detachable jaw B, substantially as shown and described. (3) The combination with the anvil L, provided with lugs C C, located as specified, of the upright detachable jaw B, which is adapted for use, as shown and described.

239,725. MACHINE FOR WELDING CYLINDER HEADS, *Robert A. Carter, Pittsburg, assignor to himself and Hugh McDonald, Allegheny City, Pa.—Filed December 13th*, 1880.

Claim.—(1) In a machine for welding heads in cylinders, one or more inner dies E^1, arranged to move outward and operate against the inner surface of the

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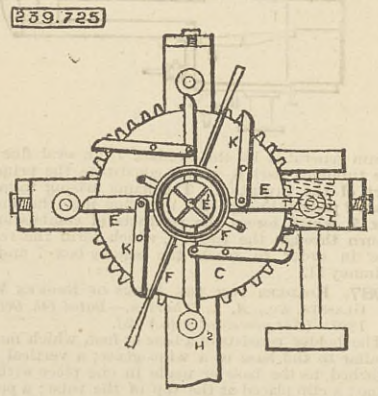
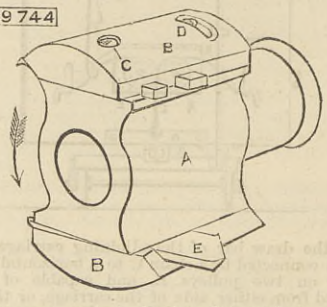


parts to be welded, in combination with an outer tire arranged to bear against the outer surface of the parts to be welded, and afford support thereto against the expanding force of the inner dies, and suitable mechanism for imparting to such inner dies an outward motion for the purpose of making the weld, and an inward motion alternating therewith, substantially as described. (2) In a machine for welding heads in cylinders, the combination of table C, band or tire F, secured to the table with provision for lateral movement of the band on the table as described, and two or more inner dies E^1, arranged to move outward from a common centre in opposite directions, and press the parts to be welded against the inclosing band, substantially as set forth. (3) The combination of stationary table C, bars E, arranged to slide radially on the table, dies E^1, secured on the inner ends of the bars, such dies having their outer edges or working faces formed in the same circle as the inner surface of the parts to be welded, inclosing-tire F, arranged to act against the outer surface of the cylinder, as described, pivotted levers K, rollers H^2, arranged to rotate around the table, and by bearing against the outer ends of the bars and levers to operate the dies, as described, and means for increasing and diminishing the extent of motion imparted to the dies by the rollers, substanially as and for the purpose set forth.

239,744. CUTTER HEAD, *John H. Eddy, Sidney, Ohio. Filed August 9th*, 1880.

Brief.—The knives are set at varying angles by a grooved clamping plate abjustable about a pivot. *Claim.*—(1) A cutter head constructed substantially as herein shown and described, consisting of the stationary part A and the movable parts B, having grooves upon their inner sides to receive the knives E, a hole passing through the knife groove to receive the bolt C, and a curved slot to receive the bolt D, as set forth. (2) In a cutter head, the combination, with

239.744



the stationary part A, having flat surfaces, of the movable parts B, having grooves in their inner sides to receive the knives E, having holes through them, passing through their grooves, to receive the pivotting bolts C, and curved slots to receive the fastening bolts D, substantially as herein shown and described, whereby the movable parts can be adjusted to adjust the knives to cut at any desired bevel, as set forth.

239,766. MECHANISM FOR LAYING TELEGRAPH WIRES, *Edwin T. Greenfield, Brooklyn, N.Y., assignor of one-half to the Holmes Burglar Alarm Telegraph Company.—Filed January 8th*, 1880.

Brief.—To carry a wire over buildings &c., a carrier propelled by spring and clockwork, and, travelling on an adjacent wire, carries the end thereof or a cord secured thereto. *Claim.*—(1) The herein before-described method of laying or stringing telegraphic or similar wires, which consists in carrying the end of the wire from one point of attachment to another by

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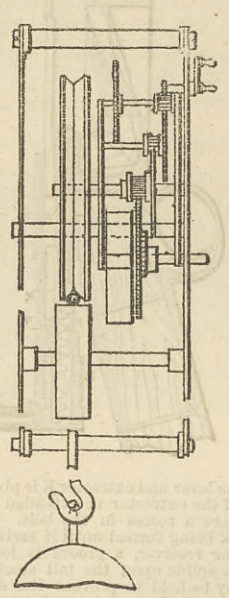

means of a carrier moving automatically along another wire, which follows the general direction between such points, substantially as set forth. (2) In a carrier constructed to move along a wire, a grooved wheel, in combination with a friction roller and driving mechanism, substantially as and for the purpose described. (3) In a carrier constructed to move along a wire, a main or driving spring, in combination with a grooved wheel and a friction roller, substantially as and for the purpose set forth.

239,818. TELEPHONE, *Joseph T. McConnel, Braddock, assignor to himself and Edward A. Kitsmiller, Hawkins Station, Pa.—Filed November 15th*, 1880.

Claim.—A receiving telephone having three or more

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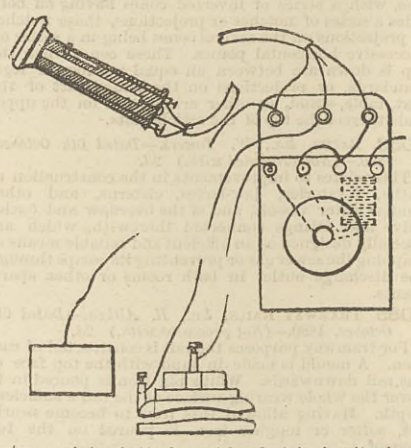

posts or points of attachment for electric circuit wires, two of which are connected by a make-and-break mechanism on such telephone, in combination with a separate battery transmitter, a main line circuit passing through the receiving telephone proper by the unconnected posts, and through the secondary coil of the transmitter, a local battery and a local circuit from such battery, through the speaking telephone and primary coil of the transmitter, to the two posts on the receiver, which are connected by the make-and-break mechanism, substantially as and for the purposes set forth.

239,834. ROPE FASTENING, *Joseph D. Paldi, Brockway, Mich.—Filed February 4th*, 1881.

Claim.—A rope fastening consisting of a partially-

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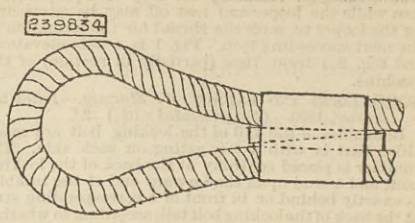

flattened metal tube combined with two wedges adapted to clamp the rope sections by being driven between the same in the tube, as described.

239,896. AUTOMATIC ELECTRIC GAS-LIGHTING APPARATUS, *Wilhelm Vogel, Freiburg, Baden, Germany, assignor to the firm of S. Dukas, same place.—Filed November 16th*, 1880.

Brief.—There is a primary and a secondary jet, each controlled by a rotary cock connected with the same electro-magnet. When the circuit is closed both cocks are turned and the secondary jet is ignited by a small platinum wire. When the primary jet has been thus lighted, the circuit is broken and the secondary jet shut off. *Claim.*—(1) The combination of the gas

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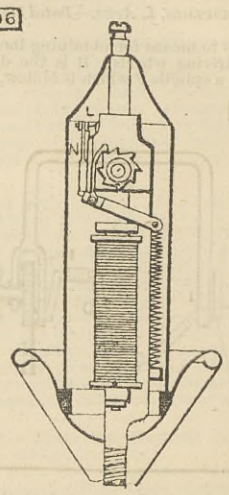

burner, electro-magnet, armature, and electric circuit with a rotary cock L, having an arm and a rod N, connecting it with the armature, an outlet M, adjacent to the burner, and a platinum wire in the circuit opposite said outlet, as set forth. (2) The combination of the gas burner, electro-magnet, armature, and electric circuit with cock K, its ratchet wheel and spring pawl connected to the armature, and the cock L, adapted to be operated by such armature, and having an outlet M, adjacent to the burner, and a platinum wire in the electric circuit opposite said opening, all substantially as described.

CONTENTS.

THE ENGINEER, May 13th, 1881.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—J. Stiven, chief engineer, to the Asia, additional for torpedo instruction; J. Maling, to the Duke of Wellington, additional for the Tay.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending May 7th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 6 p.m., Museum, 9487; mercantile marine, building materials, and other collections, 4476. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2461; mercantile marine, building materials, and other collections, 374. Total, 16,798. Average of corresponding week in former years, 14,671. Total from the opening of the Museum, 19,933,331.

THE GREAT CORLISS ENGINE.—The great Corliss engine of the Centennial Exhibition seems to have the power of multiplying itself as remarkably as the bones of mediæval saints, or the furniture of the May-flower. A little while ago, according to local reports, it was doing duty in San Francisco, and also in several other places this side the Rocky Mountains. Its latest appearance is in the new town of Pullman, near Chicago, where it gave impressiveness to the ceremony of inaugurating the Pullman Palace Car Works just started there.