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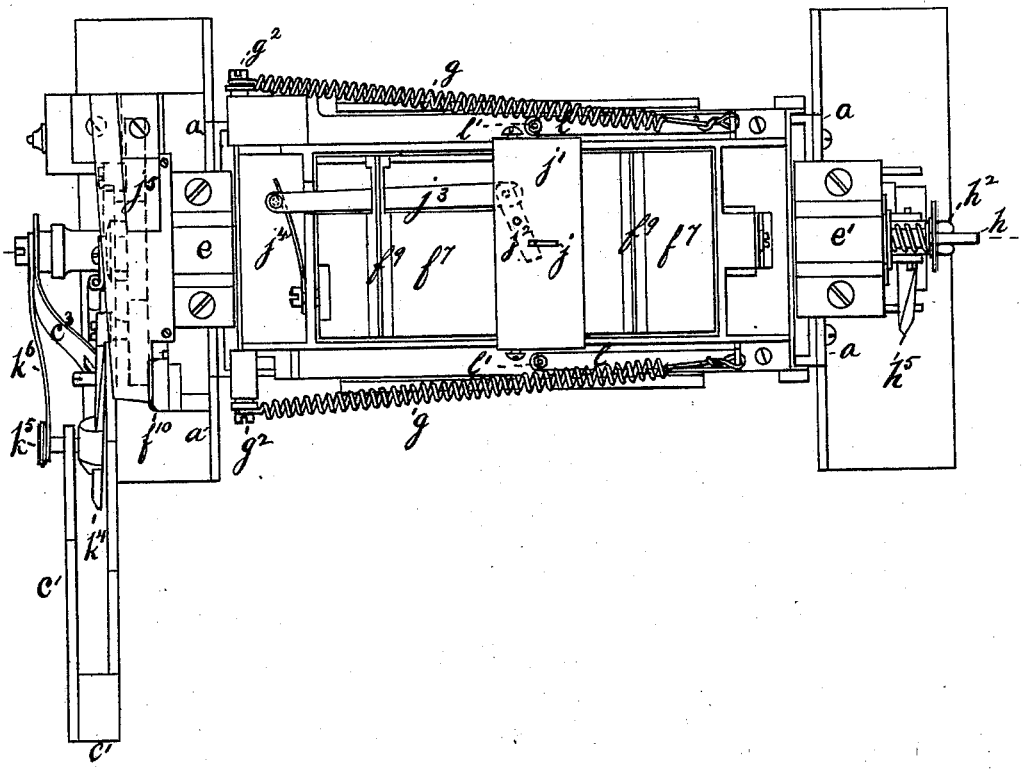
J. P. BROADMEADOW.

Foundry Apparatus.

No. 197,960. **Patented Dec. 11, 1877.**

Fig. 1.



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Foundry Apparatus.

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Fig. 11.

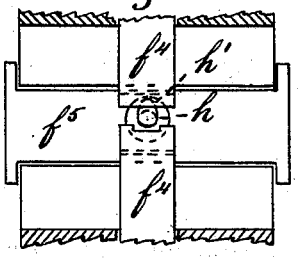

Fig. 2.

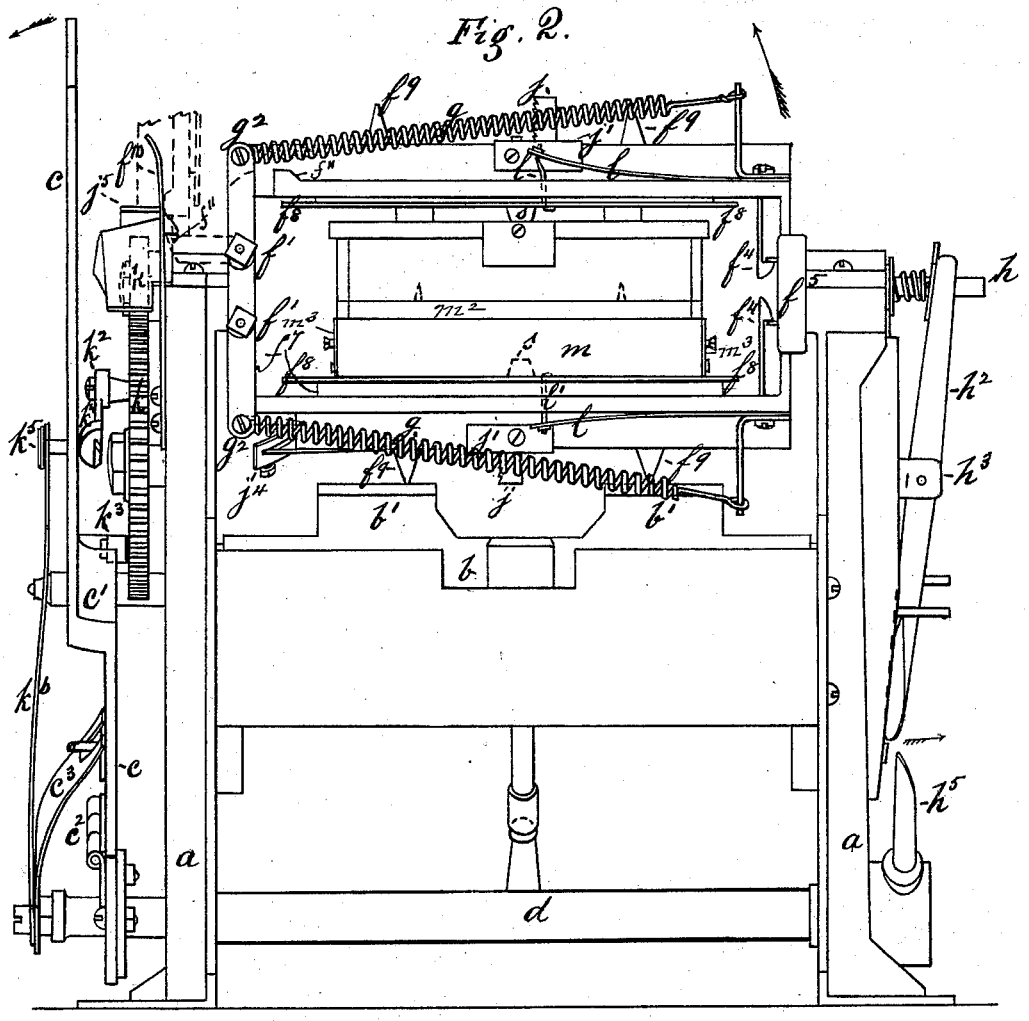

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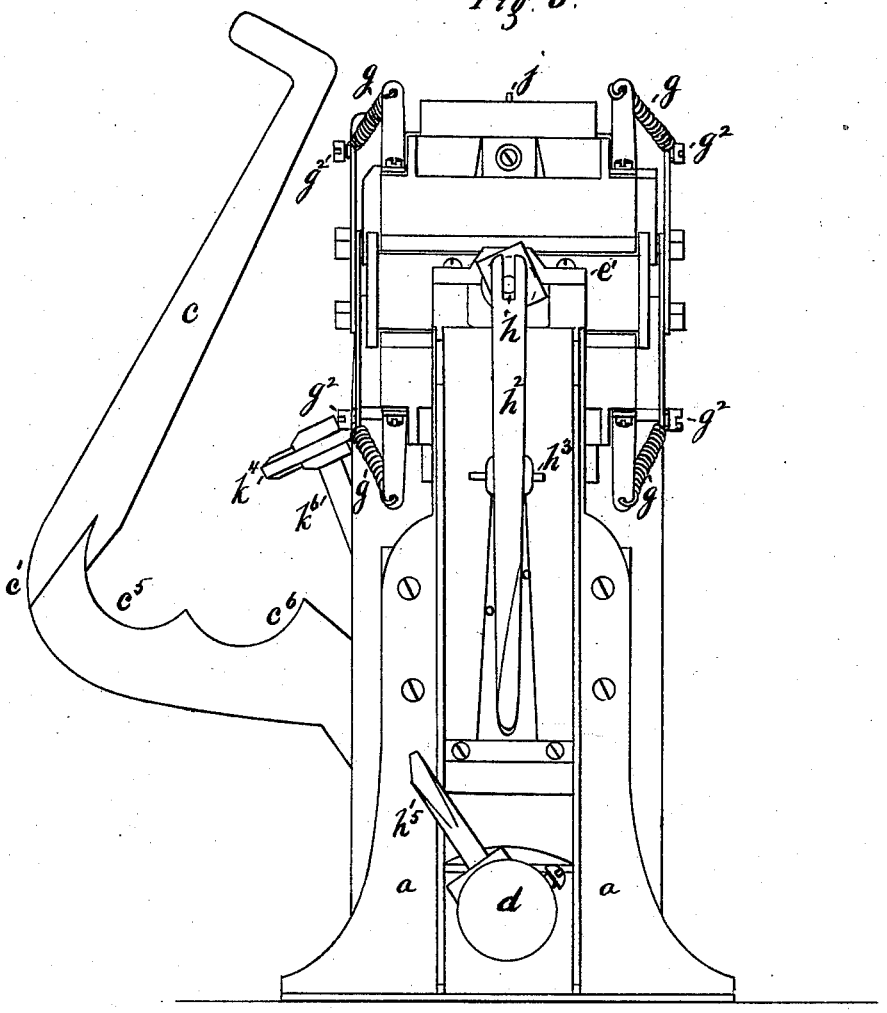
Fig. 3.



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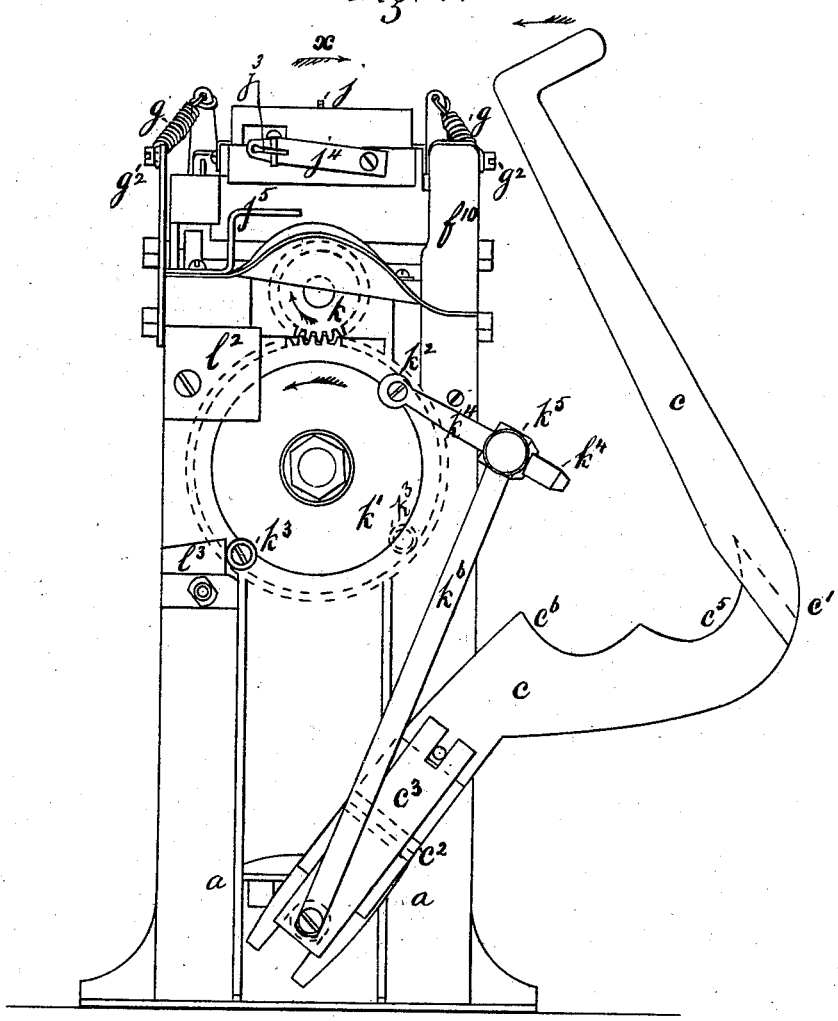
No. 197,960. Patented Dec. 11, 1877.

Fig. 4.



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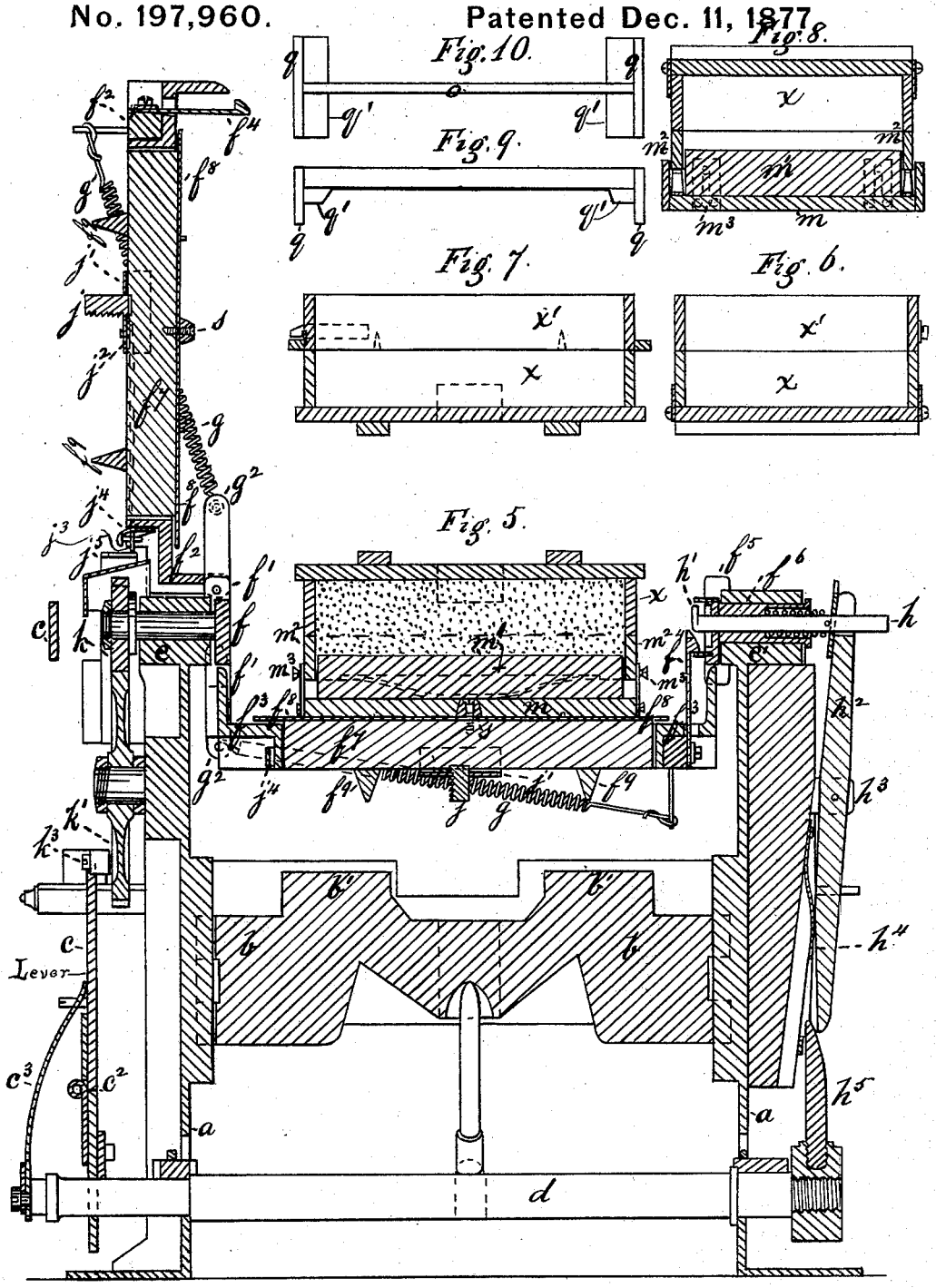

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UNITED STATES PATENT OFFICE.

JOHN P. BROADMEADOW, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR OF ONE-HALF HIS RIGHT TO HORACE L. EAMES, OF SAME PLACE.

IMPROVEMENT IN FOUNDRY APPARATUS.

Specification forming part of Letters Patent No. **197,960**, dated December 11, 1877; application filed August 1, 1877.

To all whom it may concern:

Be it known that I, JOHN P. BROADMEADOW, of the city of Bridgeport, in the State of Connecticut, have invented certain new and useful Apparatus to be used in Foundries; and that the following, taken in connection with the drawings, is a full, clear, and exact description thereof.

In the drawings, Figure 1 is a top view of the press or apparatus for holding the flask and pressing the sand therein. Fig. 2 is a side elevation of the same. Figs. 3 and 4 are elevations of the opposite ends thereof. Fig. 5 is a vertical longitudinal section through the same. Figs. 6 and 7 are details of a flask in cross and longitudinal section. Fig. 8 is a cross-section through a part of the flask and the follow-board or match-plate, with its elastic or compressible frame. Figs. 9 and 10 are views of a "strike," and Fig. 11 is a detail representing the latches and the latch-opener.

This machine has been invented with a view of diminishing the labor, and consequently the expense, of molding small castings in green sand, and acts upon the general plan heretofore used of compressing the sand in the cope and drag upon the pattern by machinery, instead of ramming the sand by hand. My machine, however, is of such a character that the molding can be completed without removing either part of the flask from the press, and so constructed that one half of the flask is griped after the sand in it is compressed, and can then be turned over while in the grasp of the clamp. After this the other half of the flask can be adjusted to it, and the molding completed in the press, thus saving the labor of removing one part of the flask from the machine, turning it upside down, and replacing it in the machine.

This press may be used with flasks and follow-boards, or pattern or match plates now known; but I have invented a follow-board or match-plate with a compressible or elastic frame, which is peculiarly adapted for use in my press.

In the drawings, the frame of the press is represented at *a a*, supporting at its lower part a rock-shaft, *d*, which, by means of an arm attached to the shaft, and a toggle or connecting rod, is connected with a cross-head, *b*, the whole construction being such that the rocking of the shaft *d* by the lever *c*, keyed thereon, will cause the cross-head to rise and fall.

In the upper part of the frame are secured two journal-boxes or pillow-blocks, *e e'*, one at each end thereof, and these journal-boxes support my revolving clamp.

This clamp is constructed as follows: A short shaft passes through the box *e*, and has fastened to the inner end of it a plate of metal, *f*, which may be of any form, by preference quadrangular. The upper and lower edges of the plate are provided with ears, to which are hinged at f^1 two quadrangular frames, f^2 f^3. These frames have ears corresponding with f^2 f^3, and on each provided at the ends farthest from the hinges with a spring-latch, f^4. These latches, when the frames are parallel with each other, catch in keepers attached to a quadrangular piece of metal, f^5, of the same shape as *f*, which is secured to a hollow axle or shaft, f^6, which latter rests in the journal-box *e'*. Hence it follows that the two frames and the two quadrangular pieces, when the latches are caught in the keepers, form, as it were, the ends, top, and bottom of a box, which can be revolved upon the shafts passing through the journal-boxes *e e'*. Each frame is, by preference, made of cast-iron, and has in it a piston or plunger, f^7, by preference made of wood. This piston can slide in the frame in a direction toward and away from the piston in the other frame, and I prefer to provide each piston with a sheet-iron face-plate, f^8, of greater area than the frame. (See, specially, Figs. 2 and 5.) When the clamp composed of the frames, pistons, and end plates, to which the frames are attached at one end by hinges, and at the other end by latches, is in the position shown in the drawings, or revolved one hundred and eighty degrees therefrom, the piston of the frame then lowermost can be raised by turning the lever *c*, thus causing *b* to rise and bring two projections, *b' b'*, on its upper face to bear against and move up two projections, f^9 f^9, attached to the piston. It thus appears that pressure can be applied to a body located between the pistons.

Each frame has applied to it two strong

springs, $g\ g$, which springs are secured at $g^2\ g^2$ to lugs projecting from the piece f, the construction being such that these springs will throw the frame then uppermost (when its latch is detached from the keeper) into the position shown in Fig. 5, so as to give free access to any flask then lying upon the piston then lowermost. These springs $g\ g$ may be dispensed with, and the frame then uppermost lifted up by hand.

In order to unlatch the latch then uppermost, I pass through the hollow shaft a rod, h. This rod has its inner end turned up, as at h^1, and is surrounded by a spring, which, acting against the bottom of a cylindrical cavity in the hollow shaft and a pin in the rod, tends always to press the rod outward or away from the latches. When this rod is shoved in, its upturned end will strike the spring-latch then uppermost and release it from its keeper, when the frame will, by its spring, be lifted into the position shown in Fig. 5. As it is best to move this rod through the same lever which lifts the cross-head, I have applied to the frame and to the rod h a lever, h^2, pivoted at h^3, which lever has, by preference, applied to its lower end a light spring, h^4, merely to steady the lever. The lower end of lever h^2 is beveled on a slant on both sides, (see Figs. 2, 3, and 5,) and a rocking arm, h^5, also beveled in the same way, (see the same figures,) is secured upon one end of the shaft d. The whole construction is such that when the lever c is lifted sufficiently far the arm h^5 will move inside of the lower end of the lever h^2, push this lower end outward and the rod h inward, and release the uppermost latch. When the lever c is brought down again the arm h^5 will pass outside of the lower end of h^2, and throw it in a little, but will produce no effect upon the rod h, which is pushed outward by its spring as soon as h^5 has passed by h^2 in the direction to unlatch the latch.

After the article between the pistons has been compressed it is necessary to hold the then lowermost piston fast in its frame, so as to clamp the compressed body between the pistons while the clamp is being turned over. In order to perform this duty, I have secured to each piston a small rack-plate, j, which passes through a slot in a metal plate, j^1, attached to the frame. Between this plate j^1 and the piston, and upon the plate, is mounted a dog-lever, j^2, connected at one end to a rod, j^3, which rod is pulled away from the lever by a spring, j^4. The whole construction is such that when either piston is shoved toward the other the rack-teeth oscillate the dog-lever, and when the piston rests it is held in its resting-place by the dog-lever and rack until the lever j^3 is shoved inward by hand against the force of the spring j^4, or until the end of rod j^3 nearest the spring strikes against the stop j^5, when the frame then uppermost is thrown into the position shown in Fig. 5. In order to hold the frame then uppermost in this position while inserting or taking out a flask or parts thereof, or other article, I have applied a spring-latch, f^{10}, at one end of the machine, (see specially Fig. 2, where dotted lines show part of the frame in the same position as in Fig. 5,) the latch catching over a projection, f^{11}, from the frame.

In order to throw the pistons back into their recesses at the time the dog-lever releases the rack-plate, I have applied to each frame $f^2\ f^3$ two springs, $l\ l$, connected to the sheet-metal face-plates of the pistons by rods $l^1\ l^1$, passing through holes in the frame. These springs tend always to force the pistons into their recesses, and do so force them when not resisted by the dog-lever and rack-plate.

In order to compress sand in one-half of a flask, (either the cope or the drag,) and then put the other half in proper relative position, and compress the sand in it, it is usually necessary to turn the first half upside down; at any rate this is the plan used in my machine. I have explained that the clamp, composed of frames and pistons, is so constructed as to be capable of revolution, and intend at times to so build the machine that it will be necessary to take hold of the clamp and turn it over by hand, or otherwise to apply a crank to the solid shaft and manipulate it by hand; but I prefer so to construct the machine that the clamp may be revolved by the same lever which causes the shaft d to rock, so that it raises the cross-head and unlatches the latch. The mechanism for this purpose is best seen in Figs. 2, 4, and 5.

Upon the end of the solid shaft of the clamp, and outside of the frame of the machine, a small cog-whel, k, is secured. This cog-wheel has in gear with it another cog-wheel, k^1, which latter has projecting from its surface two pins, $k^2\ k^3$. The pin k^2 has pivoted upon it an arm, k^4, which has secured (adjustably, by preference) upon it a third pin, k^5. This last pin has leading from it a supporting-link, k^6, which is pivoted at one end to k^5, and at the other end upon the shaft d. The whole construction is such that power applied to the pin k^5 will cause the cogs to revolve in the direction shown by arrows in Fig. 4, and such that after the clamp has thus been revolved one hundred and eighty degrees, power applied in the same direction to the pin k^3 will cause the cogs to move in a direction the reverse of the arrows, and return the clamp to its original position. In order thus to act upon the pins, the lever c is shaped in plan substantially as shown in Fig. 4, and has a bend in it at c^1. It is also made in two pieces, which are connected together by a hinge, as at c^2, and is further acted upon by a spring, which always tends to keep the two parts of the lever in line. If this lever c be swung outward on its hinge (see arrow, Fig. 2) and upward, (see arrow, Fig. 4,) the part c^5 of the lever will strike against k^5, and revolve the clamps in direction of arrow x, Fig. 4, until the pin k^2 strikes the stop l^2. After the clamp has been thus turned over, the lever c may be drawn back again, and the

spring c^3 may be permitted to move the two parts of the lever c into line. If the lever c be now lifted again with the parts in line, the part c^5 will pass between the arm k^4 and the face of the cog-wheel k^1; but the part c^6 of lever c will strike against the pin k^3, which then lies in the position shown by dotted lines in Fig. 4, and revolve the cogs in a direction the reverse of that shown by arrows in Fig. 4, until this pin k^3 strikes the stop l^3, thus bringing the clamp back to its original position. The bend at c^1 in the lever c is made for convenience only, so as to give room between the upper end of the lever and the machine, and the form of the lever is unimportant, so long as it is so shaped that it may act upon the pins, as described.

The bevels on the lever h^2 and arm h^5 are so arranged with reference to the pins k^3 k^5 that the spring-latch of the frame which is arriving at the uppermost position shall be detached from its keeper just before or just at the time that this frame becomes horizontal, and its springs will then lift it into the position shown in Fig. 5.

When the parts are in position, as shown in Fig. 5, any ordinary half-flask, with a pattern or match plate, with pattern attached, and follow-board, may be placed on the lower piston, care being taken to put blocks or cleats upon the follow-board, so as to leave room between the pistons to insert the other half of the flask after the sand in the first half has been compressed. When the half-flask, follow-board, &c., is in place, with the contained sand, the latch f^{10}, Fig. 2, is unlatched, and the half of the clamp then uppermost is shut down and latched, so as to assume the position of Fig. 2. A strong downward pull upon lever c will then cause the cross-head b to rise, which will elevate the piston then lowermost (see Fig. 2) and compress the sand. The piston will be held up by its rack-plate and dog-lever, the parts between the pistons being thus clamped. An upward motion of the lever c will then lower the cross-head b, turn the clamp and contained half-flask upside down, unlatch the frame then uppermost, and permit its springs to throw it into a vertical position, at the same time unlocking the piston and restoring it to its original position, thus leaving the half-flask rammed up and in proper position for the adjustment of the other half-flask. This other half-flask is then, with its usual appurtenances, applied as usual; then the frame then uppermost is unlatched from the latch which holds it open, and is shoved down to close the clamp, and is caught and held down by its latch, and the lever c depressed again to compress the sand in the second half-flask, when the whole may be removed either before or after a half-revolution of the clamp.

This machine is peculiarly applicable to the method of molding patented as of my invention on the 29th of November, 1859, in Letters Patent No. 26,231. I have, however, devised a follow-board with an elastic or compressible frame, which I prefer to use.

This follow-board or match-plate, with its frame, is represented in cross-section in Fig. 8, in longitudinal section in Fig. 5, and in side elevation in Fig. 2. A frame like the sides, ends, and bottom of a box is procured, (see m m,) and in it is secured a piece of plank, m^1, which is the follow-board, of such size and in such manner as to leave a space all round it, between it and the sides of the box. The sides and ends of the box need not be continuous, but may be replaced by ears or lugs attached to the bottom. (See Fig. 5, and dotted lines, Fig. 8.) Between the lugs or sides and ends of the box and the periphery of the piece of plank a second frame, m^2, which is the compressible frame, like the sides of a box, without top or bottom, is located, and this second or compressible frame would be shoved out of its containing-groove by springs (see, specially, dotted lines, Fig. 5) were it not prevented by pins m^3, Fig. 5, which pass through slots in the lugs or sides of the outer box. The whole construction is such that the compressible frame m^2 may slide, with reference to the piece of plank m^1, and have a tendency to form a ledge around it, and any proper construction which will produce this result may be used, it being obvious that the outer frame m may be dispensed with, and the pins made to project into and work in slots made in the sides of the piece of plank m^1. In practice, this compressible frame m^2 should be of the same area as a half-flask, and the pins and slots should permit the frame m^2 to project beyond the face of the piece of plank just so far as to form a cavity, which, with the half-flask, will contain the requisite quantity of sand before compression thereof. If the pattern is of such character that it can all be molded in one half of the flask, it is laid or secured upon the top of the piece of plank m^1; if of such character that it can be molded if made in one piece, but part in one half and part in the other of the flask, then it is partially embedded in the plank, which, in such case, may be replaced by a mass of plaster-of-paris; if the pattern is of such character that it must be in halves in order to be molded, then one half of it is to be secured to or embedded in the plank, or substitute for it.

The compressible frame and follow-board m^1 and its pattern are now to be placed on the lower piston; the half-flask is then put on top of it, and the cavity is then to be filled with sand, and the sand struck off by a common strike. Next a board is laid on top of the half-flask, all as shown in Fig. 5; then the upper frame is shut down and latched, and the lever pulled down, when the cross-head and lower piston will force the follow-board and pattern upward until the compressible frame comes level, or in the same plane with the follow-board m^1. Thus the molding in a half-flask will be completed. Next the clamp is to be revolved so as to turn the follow-board uppermost; the up-

per frame will then be unlatched and rise. The follow-board *m* and its compressible frame are now to be lifted off, leaving the pattern or part thereof in the sand, and the other half-flask put on, (see Figs. 6 and 7;) and if my former plan of molding is applied, this half-flask is to be filled with sand, and have applied on top of the sand a follow-board, which will fit inside of the flask, as directed in my patent before referred to. When all is in place the upper frame is shut down and latched, and the lever *c* moved downward, lifting the lower piston, and completing the molding in both halves of the flasks.

Instead of using my former process, I prefer, in small flasks, to use an upper half-flask of the ordinary size—that is, one which will not hold all the sand before it is compressed. When this ordinary half-flask is placed on top of the molded-up half-flask it is to be filled with sand and heaped up. I then strike the sand off by a strike, (see Figs. 9 and 10,) which has guides *q* attached to each end of it to guide it along the flask, and also guides *q'*, to sustain the acting surface or edge of the strike above the top of the flask. The height of the strike above the top edge of the flask, and consequently the height of the guide *q'*, is to be determined by the quantity of sand required to fill the flask before the sand is compressed. After the strike has done its duty the sand will still lie above the top of the flask, and upon this heaped-up sand any board large enough to cover the flask is placed; then the upper frame is shut down, and compression of the sand effected by the lever and piston. The advantage gained by the use of this strike is, that any board large enough to cover the flask can be used to compress the sand, while by my old plan it was necessary to have a board just large enough to enter the flask and act as a piston. As flasks of many different sizes are used in large foundries, many boards of different sizes were needed, and the expense was serious. By using such a strike as has been described, any board, however large, that can be placed between the pistons in the clamp can be used for different sizes of flasks.

The drawings show two studs, *s s*, one attached to each piston and projecting toward each other. These studs are so contrived that they may, when desired, enter slots or holes in the compressing-boards, and act upon sprue-patterns, so as to form the sprue-holes.

I claim as of my own invention—

1. A clamp capable of revolution and of compressing and holding compressed articles inclosed between its jaws, and consisting of end plates, frames, pistons, hinges, latches, and mechanism, substantially such as described, for holding the pistons in place after one of them has been forced toward the other, the clamp being constructed and capable of acting substantially as specified.

2. A clamp, substantially such as specified, in combination with a cross-head, as described, whereby either piston of the clamp may be forced toward the other.

3. In combination with pistons in a frame, mechanism, substantially such as described, for holding the pistons in the position to which they have been forced by a cross-head, the combination being and acting substantially as described.

4. In combination with a clamp, substantially such as specified, a rod acting in the hollow shaft thereof, and capable of unlatching the latch then uppermost, the combination being and operating substantially as herein set forth.

5. In combination with the clamp and the rod which unlatches one of the latches thereof, the mechanism whereby said rod is operated by the rock-shaft, the combination being and operating as described.

6. In combination with a clamp, substantially such as specified, the lever and the interposed mechanism, whereby the movement of the lever partially revolves the clamp, the combination being and operating substantially as described.

7. In combination with the frames and latches, and the shafts on which the frames revolve, the springs for lifting the frame of the clamp then uppermost into a vertical position, or nearly so, the combination being and operating substantially as described.

8. In combination with the pistons and the mechanism for holding them in the position to which they have been forced, and the spring for lifting the frames, the stop which releases the dog-lever from the rack-plate when the springs elevate the frame, the combination being and acting substantially as described.

9. The lever, rock-shaft, and cross-head, in combination with the apparatus for unlatching the uppermost latch, and the mechanism whereby the clamp may be partially revolved, so that the same lever may be used for compressing the sand, unlatching the latches, and revolving the clamp, substantially as set forth.

10. A follow-board with a compressible frame, constructed and capable of use substantially in the manner described.

11. In combination, a follow-board with a compressible frame and a half-flask, the two capable of holding the necessary quantity of sand before compression, and capable of use substantially as described.

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