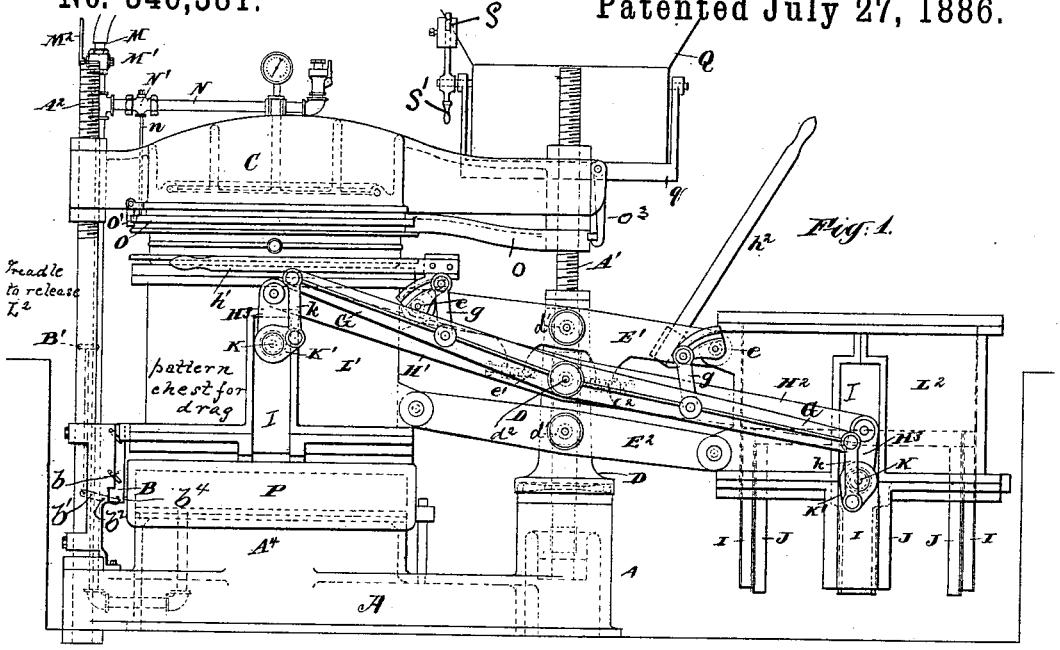
(No Model.)

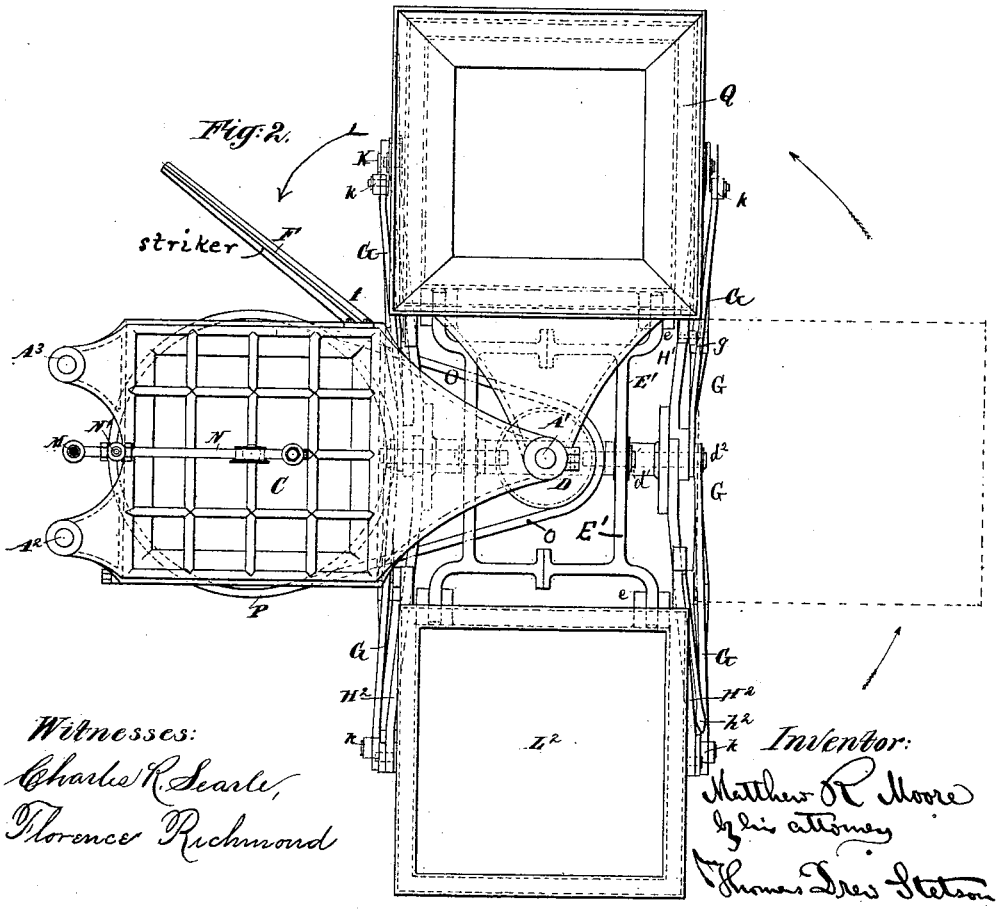
2 Sheets—Sheet 1.

M. R. MOORE.

SAND MOLDING MACHINE.

No. 346,381. Patented July 27, 1886.





(No Model.)

2 Sheets—Sheet 2.

M. R. MOORE.

SAND MOLDING MACHINE.

No. 346,381. Patented July 27, 1886.

Fig. 3.

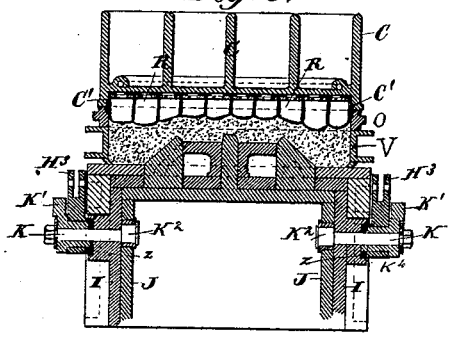


Fig. 4.

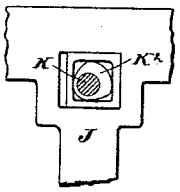


Fig. 5.

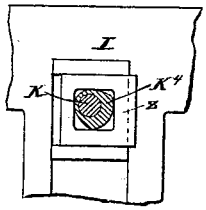


Fig. 6.

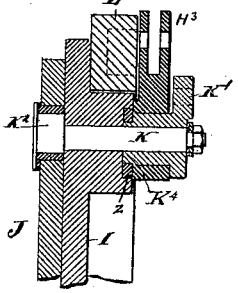


Fig. 7.

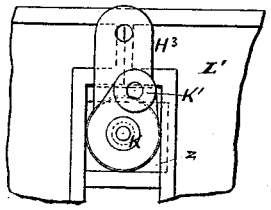
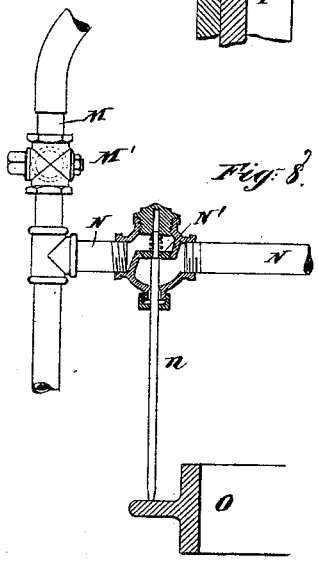


Fig. 8.



Witnesses:
Charles R. Searle,
Florence Richmond.

Inventor:
Matthew R. Moore
by his attorney
Thomas Dyer Stetson

UNITED STATES PATENT OFFICE.

MATTHEW ROBERT MOORE, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE PNEUMATIC COMPANY, OF SAME PLACE.

SAND-MOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 346,381, dated July 27, 1886.

Application filed April 30, 1886. Serial No. 200,682. (No model.)

To all whom it may concern:

Be it known that I, MATTHEW ROBERT MOORE, of Indianapolis, Marion county, in the State of Indiana, have invented a certain new and useful Improvement in Machines for Making Sand Molds for Casting Metals; and I do hereby declare that the following is a full and exact description thereof.

My improved machine for making sand molds for castings compresses the properly-dampened molding-sand around the patterns by means of a yielding or flexible presser, effecting the operation rapidly, according to the method for which Letters Patent were granted me, numbered 302,349, and bearing date July 22, 1884; reissued February 24, 1885, and numbered 10,562.

My machine corresponds in its working principle and in many of its parts to the machine described in that patent, but differs in important points. The raising of the cover into the vertical position made the former machine so high that it was difficult to operate. A counter-weight was required to facilitate the raising of the cover, and when moderate dimensions were exceeded such weight was inconveniently great. The strains experienced when large areas were under pressure rendered the clamping of the cover insecure or clumsy, or both, and the operation was slow and laborious. The present invention is designed to obviate these defects. It can be very easily and expeditiously handled. It produces the two parts of the mold (nowel and cope) alternately. The molds can be closed and clamped for pouring as fast as made. I employ two pattern-boxes with two sets of mechanism, and combine them under conditions which allow the whole system to be turned around horizontally, and also allow each pattern-chest to be raised and lowered alternately. The patterns and their connected parts are subdivided, and the patterns and their operating mechanism in one pattern-chest balance the patterns and their operating mechanism in the other chest. I have also devised convenient arrangements for effecting the several movements.

The accompanying drawings represent what I consider the best means of carrying out the invention.

Figure 1 is a general side elevation. Fig. 2 is a plan view. The pattern-chests and their connections are turned at right angles to the position shown in Fig. 1. Fig. 3 is a vertical transverse section through the pattern-chest. Figs. 4, 5, 6, and 7 show details of the pattern-chest. Figs. 4, 5, and 7 are elevations. Fig. 6 is a vertical section. Fig. 8 is an elevation, partly in vertical section.

Similar letters of reference indicate like parts in all the figures where they occur.

The cover C is adjustably fixed in a horizontal position by means of nuts set on threaded posts $A' A^2 A^3$, strongly set in a base, A. This cover is equipped with diaphragms or bags of india-rubber or analogous material on its under face, connected by pipes with a source of air or other fluid under pressure controlled by a valve, M'.

Surrounding the post A' near the center of the apparatus, and capable of revolving upon it, is a sleeve, D, on which, by a system of levers, a pair of pattern-chests, $L' L^2$, are mounted, so that the system is capable of revolving, and also of allowing the pattern-chests to be alternately raised and lowered by tilting the levers, while the chests are balancing each other, and each chest is preserving always a horizontal position. The bottom of the sleeve D is flanged, and rests on a ring of anti-friction rollers, which carry the weight and allow it to turn easily. One of the pattern-chests contains the patterns, &c., required to form the nowel or drag. The other carries those which form the cope of the mold. The two pattern-chests and the flasks to be placed thereon should be similar in size. The two levers $E' E^2$ are pivoted to the arms d' on the sleeve D at different levels, one above the other, being centered on steel trunnions d', (shown in dotted lines in Fig. 2,) and are knuckled to the pattern-chests at corresponding points, so that the pattern-chests and the flasks carried thereon can move up and down alternately while stiffly held level at all times. The tilting motion of the levers $E' E^2$, and consequently the rising and sinking of the pattern chests, is limited as required by adjustable stops $e' e^2$, which are made in form of screws tapped through arms extending down from the upper lever, E'. These screw stops, in the extreme

position of the tilting, strike against the arms d^2 and arrest the motion. These levers are broad, and connect with the pattern-chests at points widely separated laterally, so that they hold the pattern-chests firmly against all twisting strains.

In molding many shapes it is desirable to divide the pattern and draw the parts successively. Each pattern-chest is provided with two or more pattern-slides, I J, one within the other, to which the various parts into which the pattern has been divided are attached. I so connect the parts of the pattern by these slides that they can be drawn from the sand successively, being operated by means of the hand-levers h' h^2, which are pivoted on each side to the knuckles *e* of the pattern-chests, and are connected by links *g* to levers G. These levers G, by links *k*, connect to cranks K′ on short shafts K, extending through the trunnions of the outer slides, I, and carrying cams K^2 K^2, working in horizontal slots in the interior slides, J, so that a partial revolution of the shafts will give a vertical movement to each slide, but not to all the slides at the same time. The mechanisms in the two pattern-chests are alike, and that on one side of each chest is a counterpart of that on the other side. A description of one shaft and its connections will suffice for all. A cam, K^4, on each shaft K operates in a horizontally-sliding box, *z*, which serves as a fastening dog or bolt on the outer slide, I. By engaging a corresponding recess in the adjacent portion of the slide I, it locks the latter against falling until the inner slide, J, has been drawn from the sand by the action of the cams K^2. After the action of the cams K has drawn down the inner slide, J, the cams K^4 withdraw the bolt or box *z* from its recess, and then the slide I is at liberty to be forced down from the sand, the cams K moving idly during the time when the cams K^4 are operating. Now, a further movement of the lever G, operated by h' or h^2, carries the loosened pattern-slides down together as far as may be required. The arrangement of these parts is shown in detail in Figs. 4, 5, 6, and 7. Only two pattern-slides in each pattern-box are shown; but as many as desired may be similarly operated, the shafts K being prolonged and bearing cams to suit. The outer pattern-slides, I, of the two chests are connected with each other by means of levers H′ H^2. I show two levers, H′ H^2; but they are adjustably secured together, and comprise, essentially, a single lever supported upon the arm d^2 upon each side of the machine. Each lever or half-lever H′ H^2, by means of a link, H^3, serves to support by its trunnions one of the slides I. The chests thus balance each other and require no counter-weight. A single sand-box, O, is mounted on the post A′ with liberty to sweep horizontally around. It can be used over a flask on either pattern-chest to hold the extra sand to be compressed into the flask. It sweeps only a quarter of a circle, being moved back and forward between the filling and the compressing points.

O^3 is a catch or hook which serves to support the sand-box.

I make in the base A under the cover C a stationary piston, A^4, of large area, (shown in dotted lines in Fig. 1,) which is turned off and provided with packing. On this piston A^4 a cylindrical cap, P, correspondingly bored, is tightly fitted, with liberty for the cap to rise and sink. Steam, air, or other fluid under pressure being admitted between the cap and the piston causes the cap to rise and carry up the pattern-chest and its load against the cover, and firmly hold them there during the compressing operation. This may be done by fluid from the same source and at the same tension as depresses the diaphragm or diaphragms in the cover, because the piston is of sufficiently greater area than the faces of the diaphragms.

In order to bring the parts in position for the compressing operation, a flask and superposed sand-box are placed on a pattern-chest, and the movable parts are rotated to bring said chest beneath the sand-hopper Q, where the flask and sand-box are filled. Coming from the feeding or filling hopper Q toward the cover C with a surplus of sand, the flask and sand-box outweigh the corresponding parts on the opposite ends of the levers E′ E^2 and are kept down by gravity, so as by the horizontal rotary motion to sweep under the cover. A swinging gravity-catch, O′, pivoted above to the frame, engages any suitable notch or shoulder formed on or in the sand-box to stop said sand-box and hold it in proper place under the cap. Next the valve M′ is opened, admitting air at a high pressure to raise the cap P, and the pattern-chest, flask, and sand-box are thus raised up against the cover C. The joint between the bottom face of the cover and the top of the sand-box is guarded on the inside by a sheet-metal packing, C′, which projects downward from the face of the cover, as seen in Fig. 3. It prevents the india-rubber or other flexible material of the presser from being injured by the joint. By the means just described pressure will be admitted to the space under the movable cap P through a suitable pipe, M, and valve M′, operated by a hand-lever, M^2. I provide a connected pipe, N, and valve N′, arranged as shown, so that the contact of the flange on the sand-box O with the valve-stem *n* of the valve N′ (see Fig. 8) will open the valve and will determine the admission of compressed air to the pressers R, and consequently the application of pressure to the sand in the sand-box and flask. Operating this valve N′ in this manner prevents the accidental or inadvertent operation of the presser (which might injure it) when the flask is not in position to receive pressure. A catch, B, on the base retains either pattern-chest in its proper position when brought under the cover for pressing until the pressing is completed. Then it is detached by the action of the foot of the attend-

ant on the treadle B′, when the pattern-chests and their attachments are set free and are ready to be turned around.

I show the catch B as formed with inclined slots *b*, which receive pins projecting from any convenient part of the frame. A lever, *b′*, pivoted at b^2 and operated by a treadle, B′, engages under a pin, b^4, on the catch B and forces the catch upward. As the pins ride in the inclined slots the catch is forced outward until the pattern-chest is released. The catch B engages any convenient notch or shoulder on the pattern-chest.

Operation: The machine being so placed that the pattern-chests occupy the positions indicated in Fig. 2, the one, L′, on the upper side in Fig. 2—which I will, for convenience of description, term the "north side"—which contains the pattern for the drag, will be immediately under the feeding-hopper Q. An empty flask having been previously placed on it and the pattern-slides raised and locked by using the levers h' and h^2, the attendant brings the sand-box over and allows it to rest on the top of the flask. He then opens the gate *q* of the feeding-hopper and allows the flask and sand-box to fill with sand. This gate *q* is represented as connected rigidly to a rocking shaft, which latter is provided with a weight, S, to automatically close it, and a handle, S′, by which to open it at will. He then allows the gate or sand-valve *q* to close, and turns the entire system of revolving mechanism in the direction shown by the arrows. The adjustable striker or scraper F, attached to the side of the cover C by screws *f*, set in slots, sweeps off all superfluous sand from the top of the sand-box as it passes under the striker. When the right position is reached, the entire revolving system is arrested and held by the catches B and O′ against further horizontal movement, but left free to be lifted under the cap. The same or another attendant then slowly turns the valve M′, admitting the air to raise the cap P, and the pattern-chest, flask, and sand-box supported thereon are carried up against the cover C. Next, by the action of the sand-box against the valve-stem *n* the valve N′ is opened, and air is admitted through the pipe N to act upon the cover C, and the diaphragms held under it sink, compressing the dampened sand uniformly upon and around the pattern. Meantime an assistant is placing an empty flask on the opposite pattern-chest, L^2, which contains the cope pattern. The valve M′ being now turned to shut off the supply of compressed air and to liberate that already received, the flask is relieved from pressure, and the diaphragms are drawn up by their own elasticity or by any other convenient means. A fine wire may be drawn across by hand or by machinery, if found necessary or desirable, to cleanly divide the compressed sand, remaining in the sand-box from that in the flask. The attendant next trips the catch B with his foot and pushes the pattern-chest forward in the same direction as before. The sand-box, being held by its catch O′, cannot go with the flask which moves out from under it, the compressed sand falling out of the sand-box, and being scraped off the top of the flask by the lower edge of the sand-box. The machine having made a half-revolution, the drag pattern-chest L^2 is at the south side in the position in Fig. 2 originally occupied by L′. The assistant, by operating the lever h' or h^2, as the case may be, draws the pattern and then helps the off-bearer to lift the flask from the machine. Another attendant meanwhile uncatches the sand-box O, swings it to the top of the cope-flask, which is now on the north side, under the feeding-hopper, and again operates the sand-valve *q* and fills the flask for the cope, which is in its turn compressed. So they proceed, making drag and cope alternately, until the floor is full.

I claim as my invention—

1. The combination, with a cover, C, and provisions for compressing a mold thereunder, and a sand-hopper, of two or more pattern-chests revolving on a common vertical center, D, and operating horizontally to pass successively under said hopper and cover, as herein specified.

2. The main levers E′ E^2, mounted one above the other, and taking hold of the pattern-chests at correspondingly separated points, combined with said pattern-chests and with a central standard, and arranged for joint operation as herein specified.

3. The sheet-metal packing C′ and cover C, in combination with the sand-box O, pattern-box L′, and the piston and cylinder A^4 P for raising the latter, and with the air-bags R for compressing the sand in a mold, all arranged for joint operation as herein specified.

4. The sand-hopper Q and valve *q*, cover C, and means for supporting and adjusting said cover, the sleeve D, levers E′ E^2, and pattern-boxes L′ L^2, combined and arranged for joint operation as herein specified.

5. The parts P and A^4, arranged to serve as a piston and cylinder, with means for admitting fluid to act therein, in combination with the pattern-chests L′ L^2, connecting-levers E′ E^2, and adjustable top or cover C, adapted for joint operation, as herein specified.

6. The catch B and operating means B′, in combination with a cover, C, and two or more pattern-boxes, L′ L^2, arranged to balance each other and to rotate as herein specified.

7. The sand-box O, in combination with two or more pattern-boxes, L′ L^2, and turning on a common center therewith, as herein specified.

8. The catch O′, in combination with the sand-box O and two or more revolving pattern-boxes, L′ L^2, the piston and cylinder A^4 P, and cover C, for compressing the sand in the mold, all arranged for joint operation substantially as herein specified.

9. The combination, with two pattern-chests, L′ L^2, of two or more pattern-slides, I J, and connecting-levers H′ H^2, arranged to also bal-

ance each other, and rise and sink independently thereof, as herein specified.

10. In a machine for making sand molds for casting, having means for compressing from above, a stationary silhouette-plate, two or more pattern-slides, I J, carrying the parts of a divided pattern, in combination with suitable means for operating the slide, whereby one portion of a pattern may be first withdrawn, leaving another portion to support the sand, and then the other portion be withdrawn, as herein specified.

11. In a sand-molding machine having means for compressing from above, and a pattern-chest, L', two or more slides, I J, respectively carrying portions of a divided pattern, in combination with each other, with a stationary silhouette-plate, and with partially-revolving shafts K, carrying cams K^2 K^4, arranged to cause the withdrawal of the respective portions of the pattern at different periods, as herein specified.

12. In a machine for making sand molds for casting, two or more pattern-slides, I J, in combination with the partially-rotating shafts K, cams K^2 K^2, and operating-cranks K', with the links *k* and *k*, levers G, and operating hand-levers *h' h²*, arranged for joint operation as herein specified.

13. In a machine for making sand molds for casting, the locking means *z*, in combination with two or more pattern-slides, I J, and with the shafts K, carrying cams K^2 K^2 K^4 K^4, arranged for joint operation as herein specified.

14. The scraper F and adjusting and holding means *f*, in combination with two or more pattern-chests, L' L^2, sand-box O, hopper Q, and valve *q*, and with provisions for compressing the sand under the cover C, as herein specified.

15. The valve-stem *n* and connected valve N' in the pipe N, in combination with the sand-box O and its connections and provisions for raising and lowering the latter, arranged to serve as herein specified.

In testimony whereof I have hereunto set my hand, at Indianapolis, Indiana, this 5th day of March, 1886, in the presence of two subscribing witnesses.

MATTHEW ROBERT MOORE.

Witnesses:
ROLLIN DEFREES,
HENRY HUGH HANNA.