(No Model.)

2 Sheets—Sheet 1.

M. R. MOORE.

MACHINE FOR MAKING MOLDS FOR CASTING.

No. 331,208. Patented Nov. 24, 1885.

Fig: 1.

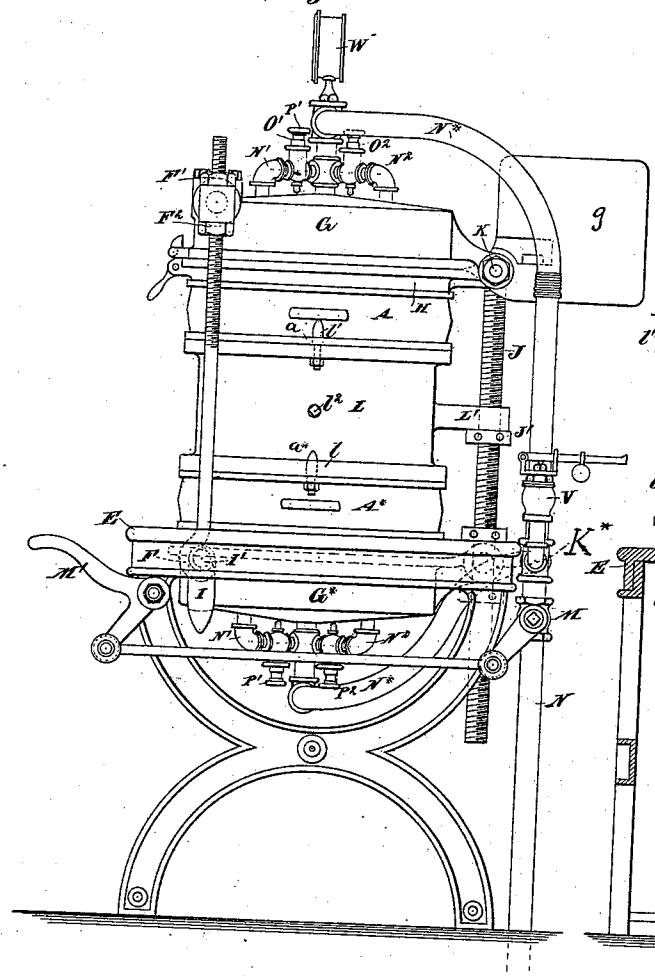
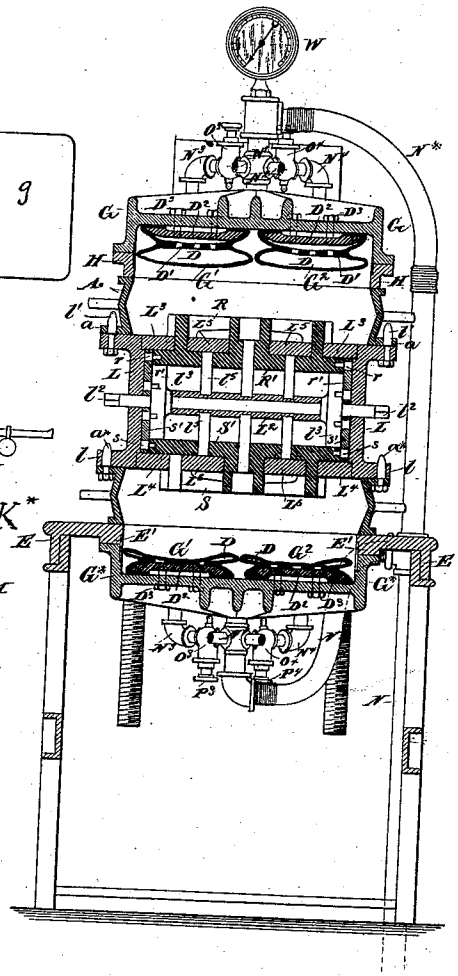


Fig: 2.



Witnesses:
Charles R. Searle,
Maurice Ellison

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

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

2 Sheets—Sheet 2.

M. R. MOORE.

MACHINE FOR MAKING MOLDS FOR CASTING.

No. 331,208. Patented Nov. 24, 1885.

Fig. 3.

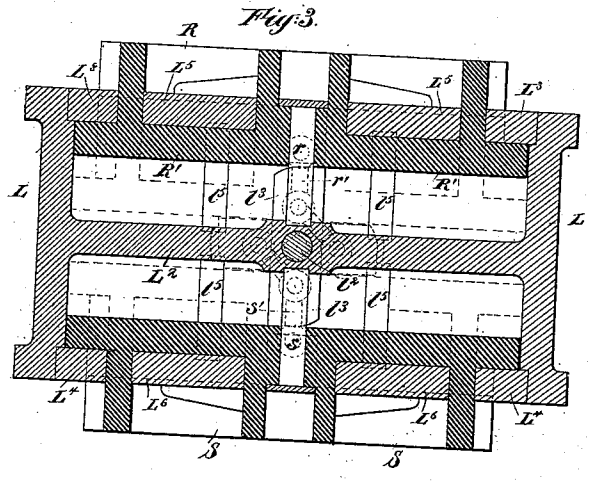


Fig. 4.

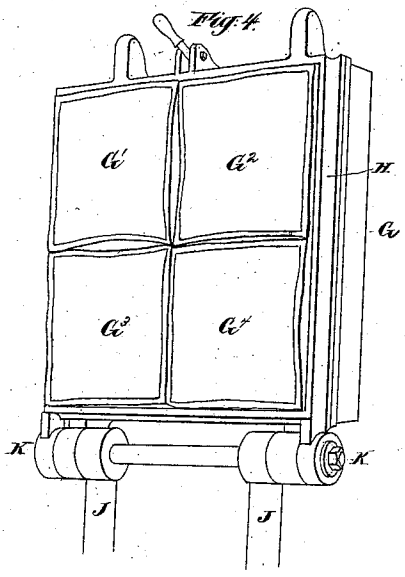


Fig. 5.

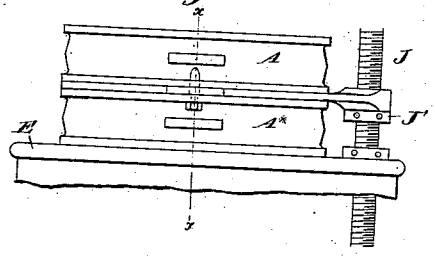
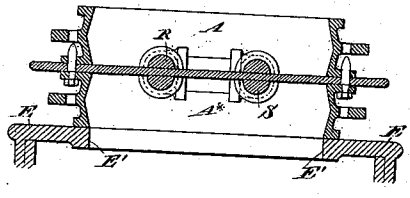


Fig. 6.



Witnesses:

Charles R. Searle,

Maniere Ellison

Inventor:

Matthew R. Moore

by his attorneys

Thomas Drew Stetson

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

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

MACHINE FOR MAKING MOLDS FOR CASTING.

SPECIFICATION forming part of Letters Patent No. 331,208, dated November 24, 1885.

Application filed July 24, 1885. Serial No. 172,512. (No model.)

To all whom it may concern:

Be it known that I, MATTHEW R. MOORE, of Indianapolis, Marion county, in the State of Indiana, have invented a certain new and useful Improvement in Machines for Making Molds for Castings, of which the following is a specification.

Machines have been recently introduced, and are much approved, which serve to rapidly compress the properly mixed and dampened earth, technically denominated "sand," in the rigid frames, technically denominated "flasks," employed in molding iron and other metals. Such a machine, employing a fluid as a means of transmission of the pressure, is set forth in a patent to me, dated July 22, 1884, No. 302,349; reissued February 24, 1885, No. 10,562. I have devised an important improvement, applicable to nearly all machines of this class.

In compressing the sand upon a pattern of greatly-varying thickness my previously-described machine, by means of its yielding pressure, was capable of depressing the upper surface of the sand more at one point than at another, and by that means was able to approximate to an even compression of the sand over the entire pattern.

My present invention goes farther. I provide for applying a greater pressure on those parts of the mold where the pattern is lowest, and where, consequently, the sand to be compressed is deepest.

Another feature of my present invention, which is in some respects of still more importance, is the provision for conveniently compressing the sand in two half-flasks—to wit, both the cope and the drag—at the same time. I make the machine duplex, having a quantity of sand in a drag, and in an attachment which I will call a "sand-box," below the pattern, and compressing it against the pattern from below by forcing such sand upward, while another quantity of sand in another half-flask—the cope and attached sand-box or top piece above the pattern—is compressed by a pressure from above by forcing such sand downward. I will designate as "air-bags" the several diaphragms and spaces for fluid to distend them, although other fluids than air may be used, if preferred. I can use any fluid or semi-fluid or thin plastic material. Preferably the strong pressure induced on the upper face of the mass of sand is, in a machine constructed according to my present invention, balanced by an equal pressure exerted by the diaphragms, which are forced upward from below with the proper variations of pressure on the different parts both below and above. I provide means for automatically regulating the variable pressure on the several different parts of the mold, both on the under side and on the upper side. I regulate the pressure in each air-bag independently of the others. I thus give any required amount of excess of pressure on one part over that on another part of the flask. I employ a device which I term a "pattern-box," so connected as to be readily swung into and out of position for work, capable by a single movement of moving the parts of the pattern reciprocally downward and upward into the flasks, and withdrawing them by a reverse movement after the pressure has been applied for a sufficient time by the other means. For castings which do not require the pattern-box I can use a match-plate. The machine is capable of being adjusted to a considerable range of heights of the flasks and of the pattern-boxes.

It will now be understood that both on the under side and upper side, instead of employing one single diaphragm extending over the whole face of the sand, I divide the area into any required number of separate sections. I will describe them as four. Each is a separate and distinct diaphragm. Each is connected with a common passage through a regulating device, which may be adjusted to shut off the further reception of air when different degrees of pressure are attained in the respective air-bags. Thus one may receive the air until the pressure is twenty pounds per square inch, and then the supply will be shut off, while another receives the air until the pressure is fifty pounds per square inch.

I esteem it preferable, although not absolutely essential to some degree of success, that the aggregate pressure on the under face pressing up from below against the mass of sand in the lower flask shall be just equal to the aggregate pressure on the diaphragms which act on the sand in the flask on the upper side of

the pattern, with a slight excess of pressure on the lower side to compensate for the weight of the material. The adjustment of the pressures in this manner is to relieve the match-plate or other central portions of the apparatus from strain; but if the parts are strong I can operate successfully with considerable differences in the aggregate pressures.

It is not essential to success that the inequalities in the pressures on the different sections shall be exactly equal. Some forms of patterns may require a maximum pressure on the under side opposite a less pressure on the upper side. The pressures can be so adjusted when required.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a side elevation, and Fig. 2 is a vertical section. These views show all the novel parts, with so much of the ordinary parts as is necessary to show their relations thereto. Fig. 3 is a vertical section of the central removable portion, which I call the "pattern-box," on a larger scale. It is a section in a plane at right angles to that in Fig. 2. Fig. 4 is a perspective view of the upper platen in a raised position Figs. 5 and 6 show a portion of the mechanism when the machine is adjusted to use a match-plate. Fig. 5 is an elevation, and Fig. 6 is a vertical section on line *x x* in Fig. 5.

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

E is a part of the stationary frame-work.

J are screw-posts stiffly supported on the frame-work E, and adjustable up and down to accommodate flasks of different heights.

K is the hinge-bolt on which the upper platen turns.

The main part of the top of the frame E, I will term a "table." In its middle is a hole of the shape and dimensions of the inside of the flask to be used. Surrounding the hole is a flange or combing, E′, which projects downward and forms a sand-box of sufficient depth to contain the surplus sand which is to be forced into the drag of the flask in the process of molding.

Below the framing E is attached what I term the "lower platen," G*, lying face upward, and carrying on its upper side diaphragms and air-bags, with provisions for inflating them upward, which may be similar to the corresponding parts on the under face of the upper platen, G. The latter is provided with a counter-weight, *g*, and with hooks F, which are adjustable with nuts $F' F^2$.

N* is a flexible hose, of stout vulcanized india-rubber or other suitable material, bringing air, water, or other fluid under pressure from a capacious chamber, (not shown,) which receives the fluid constantly or at intervals from a pump or other supplying means. (Not represented.)

The provisions for compressing the sand in the several parts of each flask, giving a greater pressure on one part than on another, are the same on the lower platen as on the upper, but in reversed position. I will describe that on the upper platen.

On the under face of the platen G are four distinct and independent diaphragms, marked, respectively, $G' G^2 G^3 G^4$. Each is capable of being expanded downward by the pressure of air or other fluid received from a common source through a corresponding number of pipes, $N' N^2 N^3 N^4$. These pipes (shown clearly in Figs. 2 and 3) are provided each with an independent pressure-regulator marked, respectively, $O' O^2 O^3 O^4$, which is adjusted to regulate the air or other fluid flowing through, so as to give any required pressure less than that received through the common induction-pipe N, which latter connects through a stop-cock, M, with the flexible hose N*.

The regulating devices may be of the construction set forth in the patent to Nelson Curtis, August 23, 1881, No. 246,088. Each is capable of adjustment by means of its screw. Setting the screw P′ in one of the devices, O′, farther inward will adjust that regulating device to a higher pressure, and will admit the air to the corresponding diaphragm, G′, until a corresponding higher pressure is attained and the surface of the sand under it is correspondingly more depressed and the sand more compacted. Adjusting the screw P′ higher will have the opposite effect. The air or other fluid will be shut off sooner, the surface of the sand will be less depressed under the corresponding diaphragm, and the sand there will be less compacted.

It is important that the several diaphragms shall be depressed to the required varying extents without allowing the excess of pressure which obtains on one to act laterally to a sufficient extent to encroach upon the other spaces. I attain this by a peculiar construction of what I term "air-bags," D, one over or behind each diaphragm. Each is constructed in two or more horizontal layers separated by flexible and nearly or quite inextensible horizontal webs. I have shown but one such web, D′, in each air-bag; but the number may be increased, if preferred. Fig. 2 shows this construction clearly. The horizontal webs D′ may be strong fabrics of hemp, linen, or cotton saturated with india-rubber and vulcanized. They are capable of enduring a tensile strain in all directions due to the pressure of the air or other fluid against the sides or bounding walls of the cushions. These webs are perforated, so that the air can flow with sufficient freedom up and down and exert its full pressure on the diaphragm which forms its working-face. The lower platen, G*, is equipped in a precisely similar manner with the sectional diaphragms and air-bags, and the air is admitted to the several sections through similarly-adjusted pressure-regulators. The air is admitted to and shut off from both the upper and lower series

of air-bags by a single valve, M, equipped with convenient connections, as shown, for operating it from the front side of the machine at will. This valve M is a two-way valve. Turning it in one position allows the air to be admitted from the hose N* through the several regulating devices O P and act on the several diaphragms connected with each platen.

The lower platen, G*, is hinged at K* to the framing E at the back side, (the right-hand side in Fig. 1,) while at the front it is supported by the yoke I, which is attached to the framing by trunnions I'. The trunnions are longer than their bearings, leaving a space between the bearings and the body of the yoke. By swinging the yoke forward the front edge of the platen is released, so that it may be dropped for convenience of cleaning or adjustment when required, which need not be except at long intervals.

When the mold is to be pressed, the hooks F are extended through slots in the table and grasp the trunnions I' of the yoke I between their bearings and the body of the yoke. Thus the strain of pressing is taken off the frame and confined to the platens and their attachments, which are made strong enough to withstand it.

On the right-hand back screw, adjustably supported by a nut, J', is a flanged collar, L', to which the pattern-box L is bolted. This allows the patterns to be placed in the flask or swung back out of the way, and holds them securely within convenient reach of the workman operating the machine. The pattern-box has the same horizontal dimensions as the flasks with which it is to be used, and such depth as may be required by the class of work to be done. At the bottom edges of the pattern-box are lugs l, perforated to fit the steady-pins a* of the drag, and at the top are corresponding steady-pins, l', to fit the lugs a of the cope. The pattern-box is open both at top and bottom, but contains a horizontal septum or partition, L^2, through its middle, dividing it into two equal parts. In the plane of this partition lies a shaft, l^2, having double-ended cranks or tumblers l^3. These tumblers work through holes provided for that purpose in the septum L^2. The ends of the shafts project through the sides of the box, and are squared to receive a handle or wrench, whereby the shaft may be partially turned. The patterns are divided along the line where the parting of the mold will come, and the parts R and S are fastened upon two pattern-plates, R' and S', which are of such size as to fit easily within the pattern-box. In the edges of each pattern-plate, opposite the ends of the tumbler-shaft, are slots containing wrist-pins r s, whereby the pattern-plates are connected to the tumblers l^3 by means of the links r' s'. When in position shown in full lines, Figs. 2 and 3, the tumblers l^3 form distance-pieces between the two pattern-plates, holding them firmly apart in opposition to the pressure brought against the patterns in pressing the mold. Two silhouette-plates, L^3 L^4, fitting rabbets in the upper and lower edges, form the top and bottom of the pattern-box, to which they are fastened, and through them the parts of the pattern R S project. These important parts are fully described in a patent to me, dated May 26, 1885, No. 318,783. Each is a plane plate with an aperture or apertures matching closely to the shape of the pattern or patterns to be moved smoothly and strongly through it. When the shaft l^2 is turned a quarter-revolution, the tumblers, links, and plates assume the relation shown by dotted lines in Fig. 3, thus withdrawing the patterns. Parts L^5 L^6 of the silhouette, which lie within the pattern and are cut off from the silhouette by the pattern, or which for any reason require to be supported when the pattern is withdrawn, are held up by "stools" or stems l^5, connecting them with the septum L^2 through holes in the pattern-plates. The arms or web of the gear shown, and also the core which forms the bore of the hub, are supported by stools l^5. It will be readily seen how the patterns are projected and withdrawn by oscillating the shaft.

Instead of making the silhouettes always plane, they can be variously curved or dished, taking care that they properly match together. Parts of the pattern may in molding some forms be mounted on the silhouettes, which thus to a limited extent serve as match-plates, while other parts of the pattern are carried on the pattern-plate. The construction in this respect may be similar to that fully shown in my patent of May 26, 1885, referred to.

I use the term "part" or "half-flask" to indicate either a cope or a nowel.

The mode of operating the machine is as follows: The lower platen, G*, being in the position shown, and the upper one, G, with sand-box attached, thrown up to a vertical position, and the pattern-box swinging aside, the half-flask, serving as the drag, is placed on the table squarely over the lower sand-box, and it and the lower sand-box, formed by the lip E', are filled with screened molding sand let down from a hopper (not shown) suspended over the machine, or supplied in any other convenient way. The pattern-box L is then swung around, lifted a little, and gently dropped over the steady-pins of the flask. Then the half-flask A for the cope is placed upon it, the upper sand-box, H, unlatched and brought down upon it. Next the flask and upper sand-box are evenly filled with screened sand from the same source as before or from any other source. The platen G is then brought down upon the flask, and the hooks F are engaged firmly with the yoke I. Then, after giving a quarter-revolution to the shaft l^2 to depress the lower pattern, S, through its silhouette-plate L^4 to the proper extent toward or into the sand of the lower part or drag, A*, and to raise the upper pattern, R, to the proper extent through its silhouette-plate into the sand of the upper part or cope, A, a touch on the lever M' throws on the air-pressure and

instantly rams both parts of the mold, the air-bag expanding upward from the lower platen, G*, and compressing the sand in the drag A* at the same time as the air-bags (similarly lettered D) expand downward from the upper platen, G, and compress the sand in the cope A. After the sand in a flask has been thus compressed, which may be effected in a few seconds, the valve M is turned into the position to release the pressure, allowing the air to escape from all the air-bags. The hooks F are then detached, the platen G raised, and the cope removed. A piece of fine steel wire having convenient handles attached is then drawn between the upper sand-box, H, and the cope A, and also between the table and the drag A*, thus cutting off evenly the sand not pressed into the mold. The upper platen, G, is then lifted by turning on the axis K, taking the upper sand-box, H, with it. The patterns are now withdrawn, as before described, the cope is lifted off, the pattern-box lifted carefully to clear the pins and swung around out of the way, the cope replaced, and the whole mold taken off together and deposited on the casting-floor. If there are cores to be set, the parts of the flask will of course be carried away separately. If snap-flasks are used, they are opened, leaving the mold, and brought back to the machine. Three or more snap-flasks will be required to keep one machine running. A mold can usually be made while one is being carried away.

When the castings to be produced are of such shape as to render practicable the use of a match-plate, the arrangement shown in Figs. 5 and 6 is used, the example being the pattern for four bends.

Before putting another drag on the machine the compacted sand left in the lower sand-box is broken up with the hands or otherwise reduced to the required plastic condition, and the operation described is repeated as often as desired.

Each air-bag is held in place by means of a clamping-plate, D^2, and two bolts, D^3. (See Fig. 2.) This arrangement renders the removal and repairing or renewing of the bags very easy.

The pressure is shown by the gage W and limited by the safety-valve V.

Pattern-plates and silhouettes for many different patterns may be fitted to and used with the same pattern-box.

Modifications may be made in the forms and proportions within wide limits. The number of separate sections or diaphragms G' G^2, &c., may be increased indefinitely. A less number than four may be sufficient in some cases.

Parts of the invention may be used without the whole. I can dispense with the horizontal partitions or webs D', allowing the lateral expansion of the bags which are subjected to the greatest pressure of air to be restrained by other means, or allowing them to serve without any other restraint than such as the ordinary form of rectangular or even spheroidal air-bags would impose.

I can in some cases use with advantage two or more tumbler-shafts, l^2, with corresponding connections to the pattern. When more than one tumbler-shaft is used, they should be geared together, so as to be operated by one hand.

I can use the machine with only one half-flask, making one of the sets of flexible diaphragms available to compress the sand in such half-flask, any suitable means being employed to constitute an abutment or resistance to press in the opposite direction against the sand.

The construction of the pattern-box and its contained mechanism is made the subject of a separate application for patent, Serial No. 179,186, filed October 7, 1885.

I claim as my invention—

1. The combination, with a platen, of two or more flexible diaphragms containing a fluid adapted to expand and yield independently and to serve with a flask and pattern, as herein specified.

2. In a machine for making molds for castings, the combination, with a platen, of two flexible diaphragms adapted to yield independently, connections for leading a fluid to each, and means, as the reducers O, for independently adjusting the pressure in each, all substantially as herein specified.

3. The construction of the series of air-bags D, each with means, as the open-work webs D', for restraining the lateral expansion, so as to allow the several bags to lie adjacent and cover the whole surface of the platen and be filled with fluid at different pressures without crowding each other, all substantially as herein specified.

4. In a machine for making molds for castings, one or more flexible pressers, G' G^2, with provisions for subjecting the same to a fluid-pressure arranged to press the sand in one direction, in combination with suitable means for pressing the sand in the opposite direction, and with provisions for introducing half-flasks and patterns in the space between, as herein specified.

5. In a machine for making molds for castings, one or more flexible pressers, G' G^2, with means for applying fluid-pressure to act in one direction, in combination with one or more flexible pressers, G' G^2, with means for applying fluid pressure to act in a direction opposite to the first-named, and with provisions for introducing half-flasks and patterns in the space between, as herein specified.

6. In an apparatus for making molds for castings, a pattern-box, L, turning on a center, J, supported on the framing, in combination with the two flasks A A*, and with one or more diaphragms, G' G', arranged to be distended from below, and with one or more diaphragms, G' G', carried on a platen, G, turning on a hinge, K, arranged to be dis-

tended from above, and with suitable connections for supplying air or other fluid under pressure to both series of diaphragms, all combined and arranged for joint operation, substantially as herein specified.

In testimony whereof I have hereunto set my hand, at Indianapolis, Indiana, this 2d day of July, 1885, in the presence of two subscribing witnesses.

MATTHEW R. MOORE.

Witnesses:
EUGENE K. MARQUIS,
WILLIAM F. LUPTON.