(No Model.)

M. R. MOORE.

SAND MOLDING MACHINE.

No. 364,948. Patented June 14, 1887.

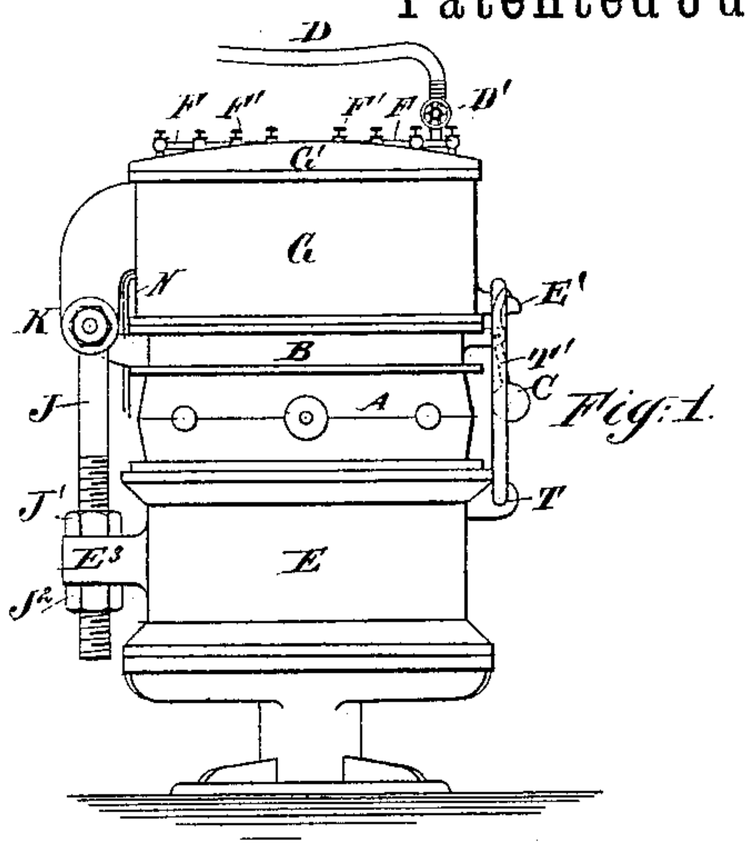


Fig: 1.

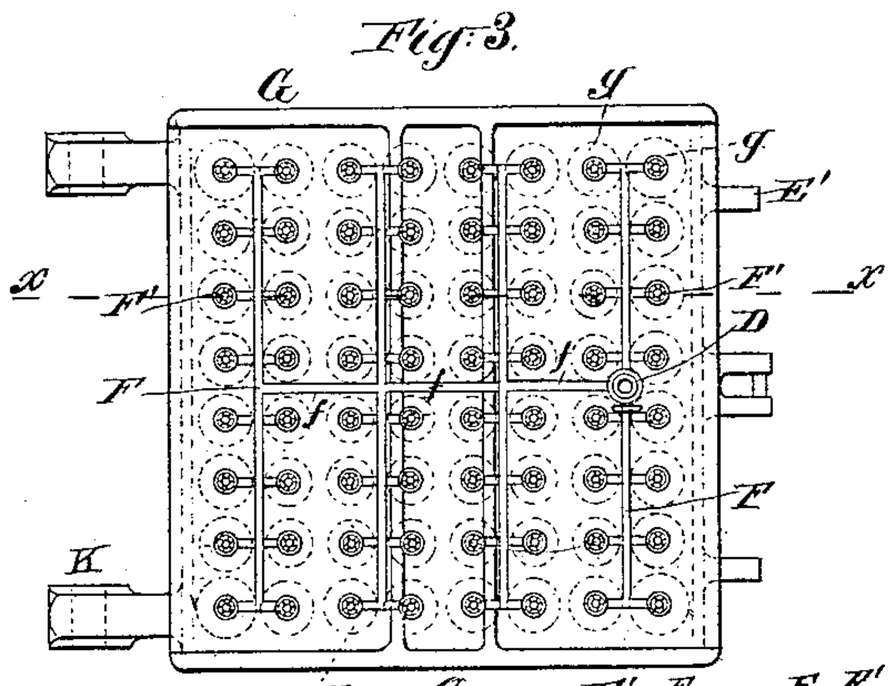


Fig: 3.

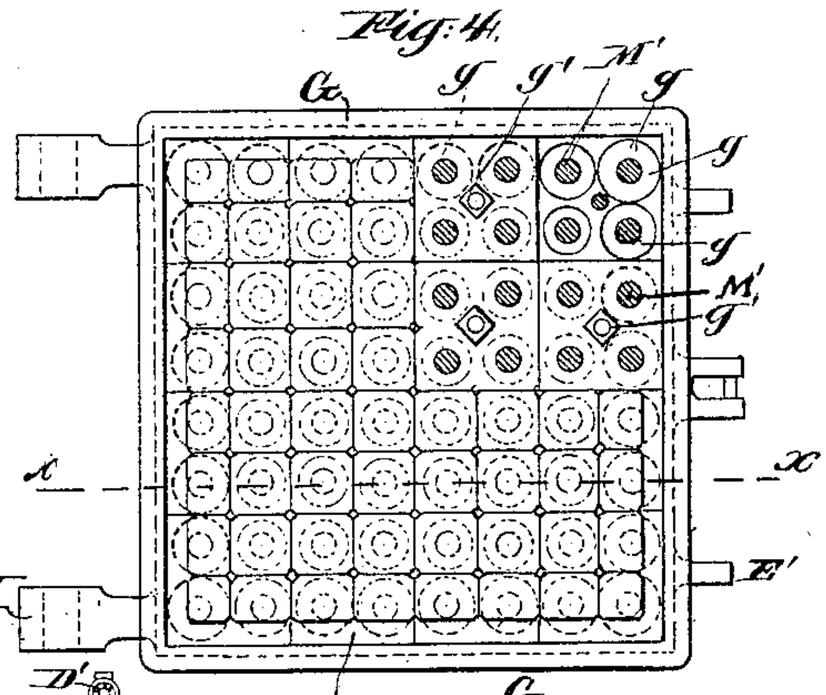


Fig: 4.

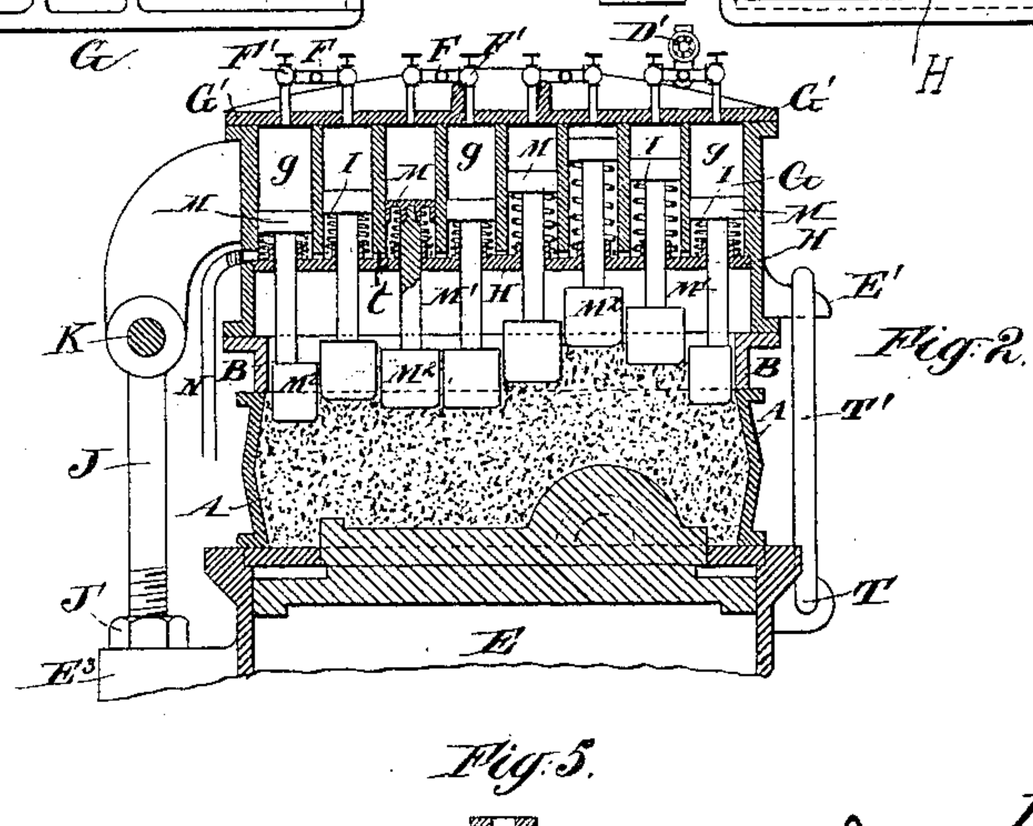
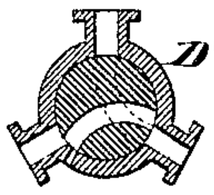


Fig: 2.

Fig: 5.



Witnesses:
Charles R. Searle,
F. A. Boyle

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

UNITED STATES PATENT OFFICE.

MATTHEW ROBERT MOORE, OF INDIANAPOLIS, INDIANA.

SAND-MOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 364,948, dated June 14, 1887.

Application filed February 6, 1886. Serial No. 190,992. (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 Molds for Castings, of which the following is a specification.

My improved machine is of the class in which several inventions have been previously patented to myself and others, having a quantity of properly mixed and dampened earth, technically denominated "sand," deposited loosely upon the pattern in a "flask," and in which such sand is by the action of the machine compressed to the proper approximately-uniform extent. The degree of compression is important. Successful operation requires, on the one hand, that the loose earthy material be compacted so much as to maintain itself against the pressure of the melted metal, when admitted, and, on the other hand, that it shall be sufficiently porous to allow the escape of air and vapor. Peculiar difficulties are encountered in effecting a uniform compression of the earthy material when the pattern is of such form as to be much higher in one part of the flask than in another. The sand being applied in such quantities as to fill the flask, and also a sand-box or other receptacle above it, the upper surface being level, or nearly so, the different depths of the loose earthy material in different parts of the flask require a correspondingly-increased descent of the rammer or other compressing agent over those parts of the flask where the pattern is absent, or where, if present, it is thin or low.

My machine acts on the sand through instrumentalities closely analogous to the rammer of the hand-workman. A series of vertical parallel rammers, each consisting of a bar capable of endwise movement, and at the bottom of a suitable head of rubber or other material adapted to effect an efficient ramming of the sand, is furnished at the top with a separate forcing means for each rammer, comprising a piston which fits closely in an inclosing-cylinder, with suitable connections for admitting steam, air, or other fluid under pressure. Efficient means being provided for lifting the rammers after each operation, the pressure of the fluid on the several pistons forces all down together, the several pistons and their connections descending to different extents, according to the form and size of the pattern being molded. The upper surface of the sand is afterward evened by hand or other suitable means, and the flask being removed and a new one substituted, the machine is ready to repeat the operation indefinitely.

I provide efficient means for guiding the parallel bars, which I will term "piston-rods," and for defending the delicate parts of the apparatus against the entrance of sand and dust.

The friction of the sand against the inner surface of the flask offers a resistance to the descent of the rammers along the edge. This is still further increased at the corners. I offset this inequality in the resistance at the edges and corners, and induce a stronger sinking of the rammers wherever desired, by employing cylinders and pistons which are of a correspondingly-greater area, so that considerably more force of the steam or air is applied on a rammer at one point than at another. Another feature contributing to this end is the employment of rammer-heads of different areas and arranging them at proportionally-different distances apart between centers, so that a given piston acts on less sand where the depressing or ramming force is required to be greatest.

I provide means for shutting off certain of the pistons and rammers, so that the machine can be adapted for ramming flasks of different sizes.

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 general side elevation of the machine, with a flask in place and conditioned for work. Figs. 2, 3, and 4 are on a larger scale. Fig. 2 is a vertical section through the flask and immediately adjacent parts on the lines *x x* in Figs. 3 and 4, showing the series of separate pistons in the act of completing the compression of the sand. Fig. 3 is a plan view of the same. Fig. 4 is a view of the platen and its attachments from below, with certain parts removed. Fig. 5 is a still larger scale. It is a vertical section through a valve which controls the pressure on all the pistons.

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

A is the flask, which may be of cast-iron, of a double-taper form to better retain the sand.

E is the lower portion of the machine, and J stout upright bolts, adjustable by nuts J′ J² in the lugs E³, to allow the raising and lowering of the hinge-joint K, on which turns a rigid platen, G, and certain attachments which perform important functions. In this platen a number of cylindrical cavities are cored or bored, or both, as indicated by *g*. On its upper surface is tightly fitted a rigid cover or cylinder-head, G′, secured by bolts at the several points *g*′. I provide pipes F, controlled by cocks F′, and communicating with a single main pipe, *f*, through which steam, compressed air, or other fluid under pressure is received and allowed to act in the several cylinders *g* and to be discharged at will, the whole controlled by a single valve, D′, operated by the attendant.

M M are pistons fitting tightly and easily in the several cylinders *g*. Each is connected by a piston-rod, M′, with a rammer-head, M², which latter may be of wood or other material adapted to act properly on the dampened earth under the pressure received from the piston. I prefer that the rammer-head M² be of soft vulcanized rubber, with the sides perpendicular and the lower faces slightly rounded.

H is a bottom plate, bolted or otherwise secured in the position represented, and adapted to perform the double functions of guiding the piston-rods M′ and forming a tight stop to serve in case water shall from any cause reach the space below the pistons. A notch, *t*, or other aperture, is made in the base of each cylinder *g*, which allows the water falling in one cylinder to circulate into the next. The whole series of the cylinders are thus connected at the bottom.

N is a rubber hose which conducts away the water and prevents its accumulating so as to induce mischief.

B is a sand-box turning on the hinge or axis K, and adapted to be lifted and lowered with the platen, or separately. A catch, C, locks the sand-box and platen together when desired.

I I are spiral springs abutting against the bottom plate, H, and lifting on the several pistons M.

Larger cylinders, *g*, and corresponding larger pistons, M, should be used in positions where for any reason extra resistance is to be overcome, or an extra degree of compression of the sand is to be induced. In case my machine shall be made for molding always the same work of one special size and style of pattern, I can increase or diminish the size of the cylinders *g*, and of their corresponding contained pistons, M, in the center or any other position of the set, so as with the steam or other fluid of uniform pressure to modify the separate forcing means for each rammer-head; or, in other words, to give any required variation in the force with which the several rammers M² are depressed. In general, larger cylinders and pistons should be employed along the edges, and still larger at the corners. This will aid to overcome the friction due to the contact with the flask. There may be variations in other parts of the patterns, so as to have larger pistons where the sand over the pattern or between parts of the pattern is deeper, and consequently the rammers should be urged down with more force. The rammer-heads M² are also varied in size to contribute to the same end, the edge rammers being smaller, and the corner rammers being still smaller than those which act on the main surface of the flask. The effect of contracting the size of the rammer-heads is to concentrate the force of the pistons on a smaller area of the sand. Both the greater area of the corner pistons and the reduced area of the corner rammer-heads contribute to press down the sand in the corners of the mold with more force than in the middle. This is a desirable end to attain.

In operating, the flask A is placed in position, the sand-box depressed, and sand introduced either from a suitable spout above (not represented) or by shoveling, or other ordinary or suitable means. Then the platen G is brought down upon the sand-box, and is held down by stout hooks T′, turning on pivots T, and engaging over suitable stout pins, E′, on the platen. Now the the cock D is turned in the position to admit steam and depress the rammers. Next it is turned into the position to shut off steam and ultimately discharge it. Next the clamping-hooks T′ are detached from the pins E′, and the platen, with its pistons and rammers, is lifted. The sand-box B is lifted either simultaneously or at a later stage, and all the sand is removed which projects above the top of the flask A. One good way to cut off the surplus sand is by employing a small wire with suitable handles or other operating means, and moving it across the space between the flask A and the sand-box B. The sand thus loosened is subsequently scraped off by hand or by any suitable machine.

Fig. 4 shows some of the rammers removed from a quarter of the lower face of the platen. In the upper right-hand corner of this figure is a small portion in which the plate H and the pistons and their connections are removed. It will be observed that the bottom plate, H, is made in sections fitted tightly together, and each secured to the casting G′ by single bolts. This forms a convenient and ready means for removing a piston which needs attention without disturbing any other except three immediately adjacent.

My machine might be used with some success in compressing the sand on a pattern placed on an ordinary mold-board. In such cases the flask should be removed from the machine with the pattern still remaining in the sand, and after being turned over in this

condition the pattern could be drawn out in the ordinary manner. I prefer the employment of what I term a "silhouette-plate," cut or otherwise shaped to allow the pattern to rise and sink through it, making a close joint therewith. Through this the pattern is moved up and down as required by mechanism operating in the part E, attached to and forming part of the machine, and the flasks are introduced, filled, and the filling compressed and the pattern drawn rapidly without turning over.

Stout hose D being applied, or other suitable connection being made from the valve D′ to a steam-boiler, other hose, N, being properly connected to lead away water, flasks and patterns being provided, and a suitable supply of properly-tempered sand, the machine is operated by placing the flasks and molds with the proper quantity of sand successively under the rammers M^2 and turning the valve D′. The action of the steam on the upper faces of the several pistons M causes the whole set of pistons to descend until a certain amount of resistance is experienced by each of the several rammer-heads. In this movement they depress the rammers M^2 upon the sand in the flask to the varying extents required and leave the sand properly compressed. The action is closely analogous to that of the hand-rammer skillfully wielded by the moulder.

The fact that instead of a single rammer being made to repeat its blows over the entire surface a series of rammers are depressed simultaneously over the whole surface, I esteem an advantage. It prevents the sand from escaping laterally from each rammer-head. The effect on the sand is practically uniform.

I believe the invention may be best worked by admitting the steam or other fluid to all the pistons and employing always flasks of uniform size; but by closing certain of the cocks F′ and leaving others open I can throw out of use certain rammers as required. Thus by shutting the connection to all the exterior cylinders I can leave the machine in condition to ram a flask which is of less area than that for which all the rammers should be used.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. I can use a greater or less number of the cylinders *g* and pistons M. A smaller diameter of the pistons and cylinders for a given size of rammer-heads may serve.

Additions may be made. I can employ packing at the points where the piston-rods M′ move through the bottom plate, H. I can use other obvious means instead of springs to elevate the several rammers after each operation. I can employ an arm and balance-weight in the obvious position to entirely or partially counterbalance the weight of the platen and its attachments.

Instead of steam from a boiler, I can use compressed air or other gaseous fluid to operate the pistons, receiving such fluid from a suitable reservoir, into which it may be constantly or intermittently compressed by any suitable means. I believe it practicable to use water from an elevated reservoir to depress the pistons.

Instead of varying the sizes both of the pistons and of the rammer-heads, I can attain the desired end by making a sufficient variation in the size of the pistons and leaving the rammer-heads of uniform size, or making the rammer-heads of different sizes and having the pistons of uniform size. It is sufficient that the ratio of the pressure to the area of the sand acted on be sufficiently varied to induce the desired difference in the effect.

Parts of the invention may be used without the whole. I can, by operating the several valves successively, induce the desired action of the several rammers M^2 successively. I can dispense with the different ratio of pistons to heads at different points and have all the pistons equal and all the rammer-heads equal.

Instead of notches to allow the water from the bottom of each cylinder to flow horizontally to the drain-hose N, the parts may be made entirely disconnected—that is to say, the hollow cylinder *g* need not extend down to the bottom plate, H, at any point; but I esteem it better to let the parts G and H brace each other. I prefer the whole as shown.

So much of present application as refers to a group of reciprocating rammers, a casing inclosing them, and means for admitting fluid under pressure to force them in one direction, combined with springs for returning them to a normal position after the pressure is released, is made subject-matter for and claimed in a separate application, No. 195,697, filed March 18, 1886.

I claim as my invention—

1. In a machine for making sand molds, a series of rammers covering the surface of the flask, capable of independent motion, and mechanism for forcing the series of rammers against the sand by means of fluid-pressure, substantially as herein specified.

2. In a machine for making molds for castings, the series of separately-moving rammers, and separate forcing means for each, combined and arranged as herein specified.

3. In a machine for producing molds for castings, the series of pistons M, piston-rods M′, and rammers M^2, in combination with the series of cylinders *g*, connections F, for supplying fluid to the whole, and the attached support E, adapted to support a flask, A, all arranged for joint operation, as herein specified.

4. The springs I, in combination with the series of pistons M and connected rammers M^2, arranged to bring the rammers promptly up after each depression, as herein specified.

5. In a machine for making sand molds for castings, a series of cylinders with pistons and connected rammers working separately, the area of any piston relatively to the area of its

rammer being greater where greater ramming force is required, substantially as and for the purposes herein specified.

6. The guides H, arranged as shown, in combination with the pistons M, rammers M^2, piston-rods M′, and provisions for admitting and discharging fluid, as herein specified.

7. The series of cylinders *g*, each inclosing a piston, M, operating a connected rammer, M^2, in combination with the guides H and drain-pipe N, and with the pipes F, cocks or valves F′, and a single cock or valve, D′, controlling the whole, arranged to serve as herein specified.

8. In a machine for making sand molds for castings, a flexible or yielding presser consisting of the combination of rammers M^2, piston-rods M′, pistons M, spiral springs I, cylinders *g*, and cylinder-heads H, constructed and operating substantially as shown and described.

9. A series of unconnected rammers covering the surface of the flask, each rammer being free to move to effect pressure on the sand independently of the others, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, at Indianapolis, Indiana, this 1st day of February, 1886, in the presence of two subscribing witnesses.

MATTHEW ROBERT MOORE.

Witnesses:

ROLLIN DEFREES,

EUGENE KEYT MARQUIS.