

J. A. RATHBONE.
MOLDING MACHINE.
APPLICATION FILED MAR. 6, 1906.

1,001,887.

Patented Aug. 29, 1911.

3 SHEETS—SHEET 1.

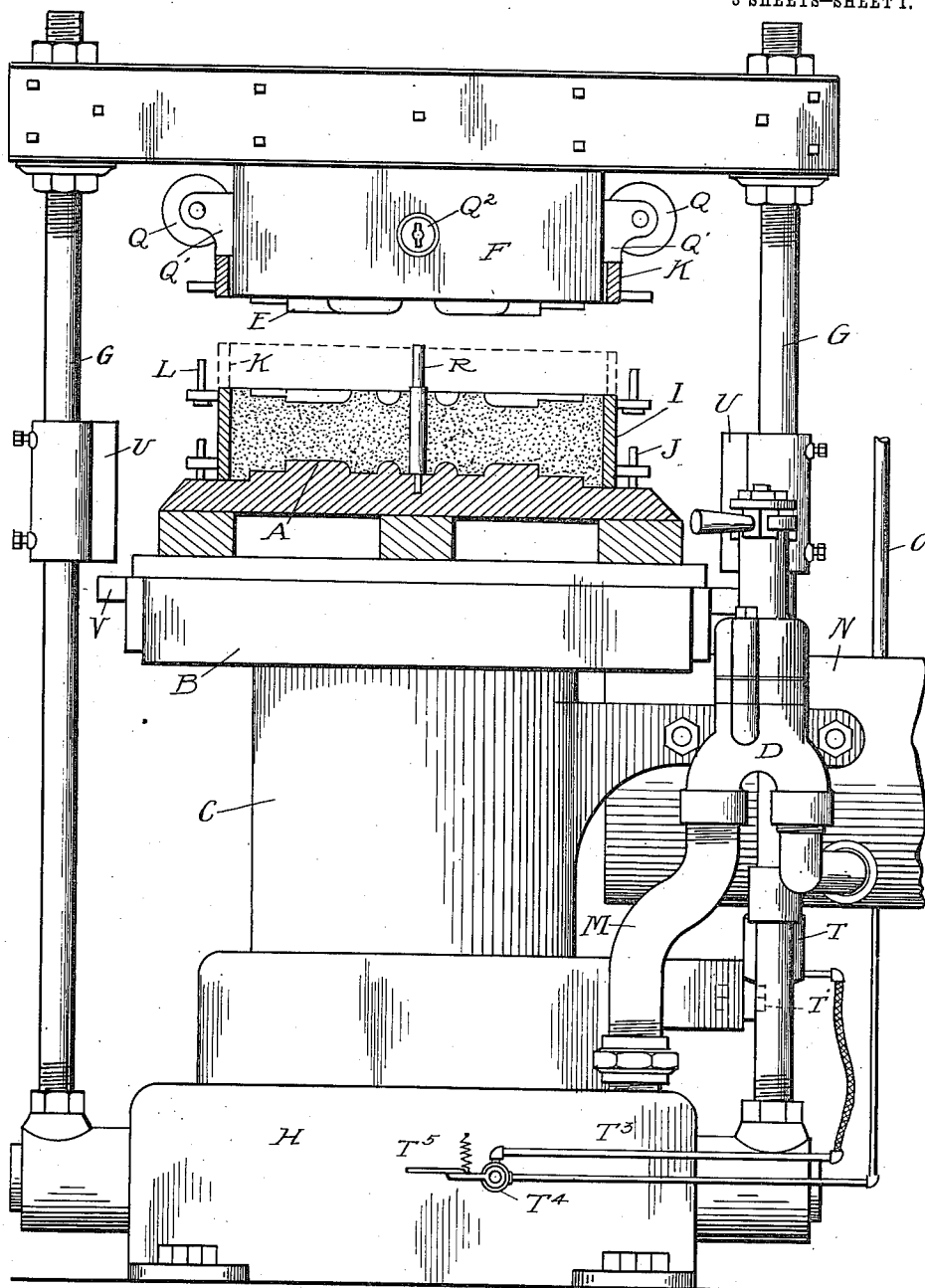


FIG. 1.

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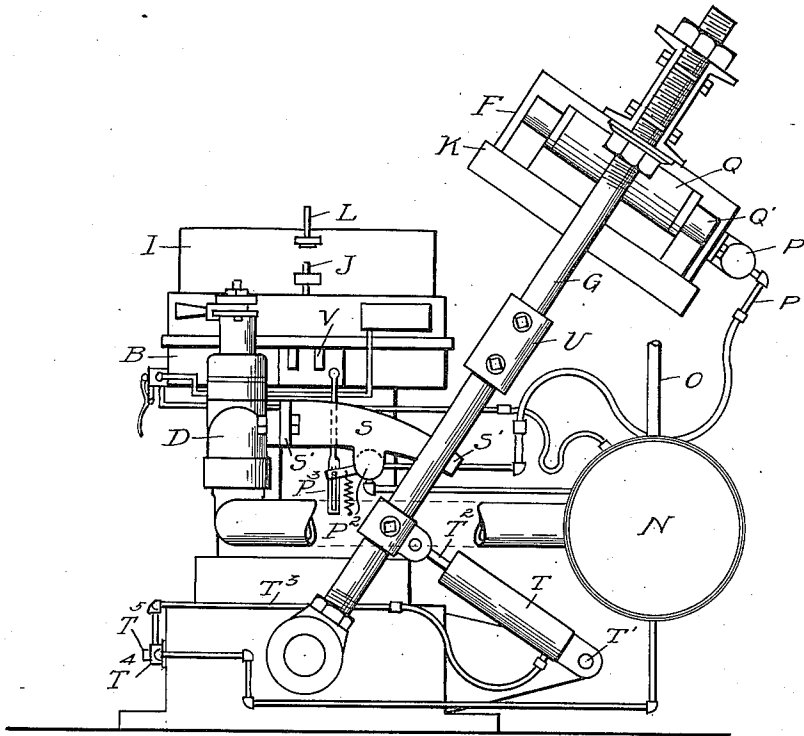


FIG. 2.

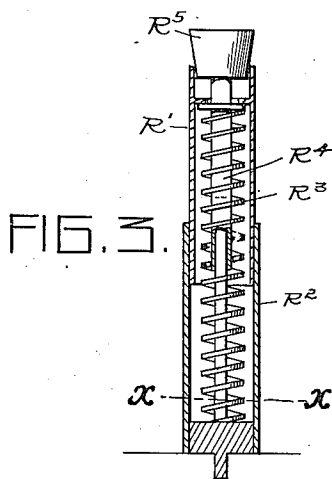


FIG. 3.

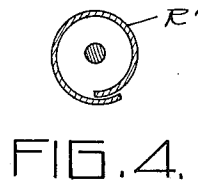


FIG. 4.

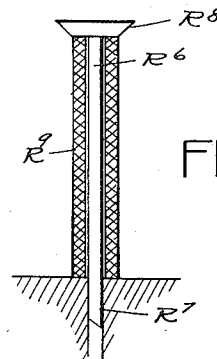


FIG. 5.

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3 SHEETS—SHEET 3.

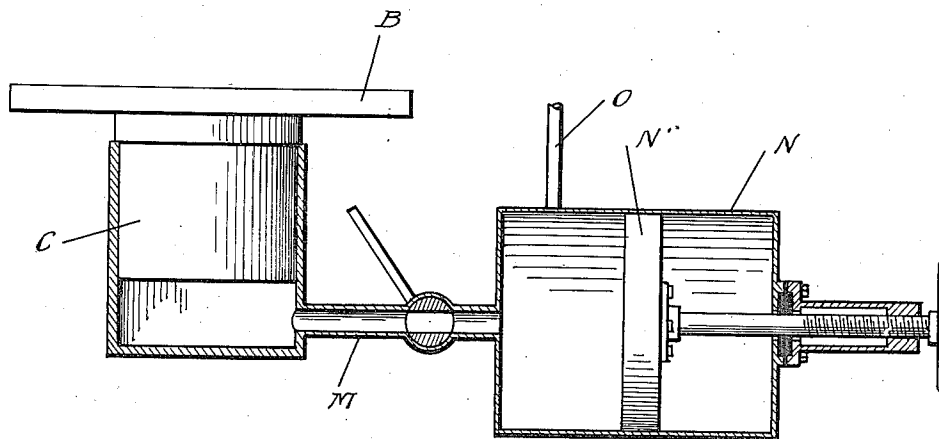


FIG. 6.

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UNITED STATES PATENT OFFICE.

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MOLDING-MACHINE.

1,001,887.

Specification of Letters Patent. Patented Aug. 29, 1911.

Application filed March 6, 1906. Serial No. 304,583.

To all whom it may concern:

Be it known that I, JOHN A. RATHBONE, a citizen of the United States of America, residing at Utica, in the county of Oneida and State of New York, have invented certain new and useful Improvements in Molding-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

It is the object of the invention to obtain a construction of molding machine which is particularly adapted for use in the so-called, "multiple molding," *i. e.* where the sand in the mold flask has molding faces formed on the opposite sides thereof for adjacent mold cavities. In the formation of molds of this character, the compacting of the sand is effected by the relative movement of opposed pattern faces, each of which forms a portion of a mold cavity. The lower pattern face forms the base, supporting the sand during compression, and the upper pattern face is pressed into the upper portion of the sand, the relative movement being continued until the sand is compressed to the proper density. It has, however, been found in practice, difficult to form a good molding face at the top of the flask and, as a consequence, the use of the machine for this purpose has been limited. The difficulty is due to the fact that the pressure of the upper pattern face into the loose sand produces varying degrees of hardness in the face of the mold cavity. Thus, the lower portions of the surface, formed by the deepest projections of the pattern, are usually hard, when the upper portions, formed by the interstices of the pattern, are so soft as not to permanently retain their shape. With the present invention, this difficulty has been overcome, primarily, by increasing the velocity of the movable part to such a degree that the compacting of sand against the upper pattern face is due to inertia; furthermore, this results in compressing the sand into all the interstices of the upper pattern face at the beginning of the sand compression, and subsequently compressing the body of sand between the opposed pattern faces, until the proper density is acquired.

A further feature of the invention is the means by which the actuating force is reduced and the movement is gradually retarded, so as to prevent too violent a shock;

and further, in the means for imparting a final powerful compression, in which the movement is very slow.

In addition to the features just described, the invention consists in the means employed for automatically lifting the sand frame and for automatically vibrating the pattern; and further, in the peculiar arrangement, construction and combination of parts, as hereinafter set forth.

In the drawings, Figure 1 is a sectional front elevation of the machine; Fig. 2 is a side elevation thereof; Fig. 3 is a longitudinal section through the sprue pattern; Fig. 4 is a cross section on line *x-x*, thereof; Fig. 5 is a section similar to Fig. 3, showing a modified construction of sprue pattern; and Fig. 6 is a diagrammatic sectional elevation of the machine, showing a modification.

The mold press which I employ may be of any suitable construction, in which there are two relatively movable heads for respectively receiving the upper and lower pattern members. As shown, the lower pattern member A is mounted upon a head B of a vertically-movable plunger, operating in a cylinder C, by means of compressed air or other motive fluid, controlled by a valve D. The upper pattern face E is secured to a head F, which in turn is secured to a swinging frame G, pivotally secured to a base H, upon which the cylinder C is mounted. The mold flask I is placed upon the mounting for the lower pattern member A and is held in proper position by engagement with suitable guide pins J thereon. Above the flask is a sand frame K resting thereon and positioned by engagement with guide pins L. Thus, when the lower and upper pattern heads are in alignment, the admission of the motive agent to the cylinder by the operation of the valve D will cause the upward movement of the head B, carrying the pattern A, the flask, and the sand frame, resulting in the compression of the sand against the upper pattern E. Upon the lowering of the head B, a flask is withdrawn from the upper pattern, permitting the frame G to be swung laterally, so as to provide clearance for the removal of the flask and disengagement of the mold from the lower pattern.

The head B, together with its actuating

plunger, and the pattern and mounting, mold flask, sand frame and sand, together constitute a considerable mass, the inertia of which must be overcome in imparting the required initial velocity thereto. This necessitates the operation of a much greater power than would be required for the movement of the same mass, at the slower speed that has heretofore been used. This increase in power I have attained by providing a relatively large inlet conduit M for the motive fluid, and a correspondingly large ported valve D controlling the same. As in most foundries the air compressor is located some distance from the various molding machines, a conduit of the necessary size of the inlet connection for the cylinder C, extending to the compressor, would increase the cost of equipment, or, where a shop is already provided with a compressed air system, would necessitate the enlargement of the supply mains. Inasmuch, however, as the machines are only operated intermittently, I have avoided the necessity of enlarging the supply connection by providing a storage tank N, adjacent to the machine to which the large conduit M is connected, but which receives its supply from a small conduit O of the system. The volume of air in the tank N is sufficient to act expansively and impart the required initial velocity to the plunger, but, on the other hand, is so limited that the pressure will rapidly fall during the continued movement of the plunger. This results in a constant diminution of the actuating force, at the same time that the resistance to the movement of the plunger is constantly increasing, by reason of the compression of the sand, the total effect being a gradual retarding of the movement, so as to overcome the inertia of the mass without a violent shock. The proportion of the parts is preferably such that the plunger will be brought practically to rest before the full degree of compression is accomplished, after which the rise in pressure in the tank N and cylinder C, due to the constant supply through the conduit O, will produce a final more powerful compression, which completes the mold.

It will be understood that, in proportioning the parts of the apparatus, consideration must be given to a large number of factors, such as the character of the pattern, the size of flask, the quantity of sand contained therein, and the mass of the plunger and other movable parts, but the effect to be accomplished is the proper compacting of the sand in the interstices of the upper pattern during the early part of the compression movement, due to the inertia, and the final compression of the mass by a slow, steady pressure.

After the completion of the compression

operation, the mold is withdrawn from the upper pattern by the return of the plunger, but it is necessary in this operation to free the pattern from the face of the mold cavity. This I have accomplished by providing an automatic vibrator, the operation of which occurs during the compression of the sand, as well as during the withdrawal of the pattern. As shown, the vibrator P is attached to the upper head F, and the supply conduit P' for the motive fluid has its valve P² provided with connections P³ to the head B, or other part movable with the plunger, this connection being preferably a slotted link, having a limited lost motion in relation to the lever of the valve. Thus, during the upward movement of the plunger, the valve P² is opened, throwing the vibrator into action and continuing the same until the return movement.

It has been stated that the sand frame K is placed upon the top of the flask I, its function being to hold the necessary quantity of loose sand to fill the flask when compressed. After the compression operation, this sand frame must be disengaged from the flask before the latter is removed and this I have automatically accomplished by the following mechanism:—Q are a pair of magnets, preferably electro-magnets, which are arranged upon opposite sides of the head F and are provided with depending pole-pieces Q'. These are so arranged that when the plunger is in its upper position, the upper edges of the flask will be in sufficiently close proximity to the poles of the magnet to be attracted by the latter and held in contact therewith during the return movement of the plunger. This will couple the sand frame to the head F, so that the swinging of the frame G laterally will carry the sand frame with it, providing clearance for the removal of the flask. After this operation and the placing of another flask upon the head B, the frame G is swung forward to align the head F with the head B and, by then breaking the current to the magnets Q, through the operation of a suitable switch Q², the sand frame is dropped into engagement with the guides L on the flask.

In place of the magnetic coupling means shown, any other automatic coupler, such for instance as a suction head or a mechanical catch, may be employed, but, where the electric current is available, the electric coupler is a convenient and easily operating means for accomplishing the purpose.

For multiple molding, each mold section must be provided with a sprue, extending completely through the same in alinement with the sprues on the adjacent sections. Such a sprue opening may be cut by the operator after the compression operation, but I preferably accomplish this automati-

cally by providing a compressible or telescopic sprue pattern R. As shown in Figs. 3 and 4, this pattern is formed of an upper section R' and a lower section R², telescopically engaging each other and held normally extended by an internal coil spring R³, surrounding a guide shank R⁴. If desired, means may be provided, such as the conical head R⁵, for expanding the diameter of the sections during the final compression, so as to provide a clearance for more readily disengaging the pattern from the mold. To permit of this expansion, the section R' is longitudinally slotted or formed of a spirally-bent cross section, as illustrated in Fig. 4. Thus, during the upward movement of the plunger, the upper section R', striking against the pattern head F, will be telescoped with the lower section and, during the final compression, will be expanded to enlarge its diameter, while during the return movement of the plunger it will elongate and contract in diameter and may then be removed.

The swinging frame G is capable of moving through a sufficient angle to place the upper head F in rear of the lower head, as illustrated in Fig. 2, a guide S and stops S' at opposite ends thereof serving to limit the movement. The movement of this frame is preferably accomplished partly by hand and partly by power. In the present construction, I have provided power connections for returning the frame, which is the movement requiring the greatest exertion when performed by hand, while the rearward movement of the frame is still performed by hand. As shown, T is a cylinder pivotally secured at T' to a stationary bearing of the machine and having its plunger T² pivotally connected to one of the side arms of the frame G. The motive fluid is admitted to the cylinder T through a conduit T³, having a valve T⁴ therein, which is under the control of the operator, as by means of a lever connection T⁵. This device enables the operator to at any time return the frame G, first, to register the head F with the head B and drop the sand frame K into engagement with the mold flask; and second, after the filling of the flask and frame with sand, to return the head in readiness for the compression operation.

It is essential to the operation of the apparatus that the heads F B should be accurately aligned with each other and held in such relation during the compression movement. To this end, I have provided guides U upon the opposite dies of the frame G, which are adapted to engage with bearings V on the head B of the plunger, during the upward movement of the latter. These guides U are so positioned in relation to the lugs V that, in the lower position of the

plunger, clearance is provided to permit the lateral swinging of the frame G, but, during the initial upward movement, the lugs and guides are engaged and remain so during the complete operation.

In Fig. 5 is illustrated a modified construction of sprue pattern, in which R⁶ is a shank telescopically engaging an aperture R⁷ in the lower pattern head, and having an enlarged head R⁸ at its upper end. R⁹ is a sleeve of rubber or other resilient compressible material arranged upon the shank R⁶. With this construction, during the compression of the sand, the shank R⁶ is moved into the aperture R⁷, contracting the sleeve R⁹ in length and simultaneously enlarging its diameter, while in the return movement said sleeve contracts in diameter as it elongates, so as to permit of easily withdrawing the same from the sand.

Where the machine is employed for a variety of work using mold flasks of different size and patterns of different character, it is desirable to adjust the actuating force to the changed conditions. This may be accomplished by the construction illustrated in Fig. 6, in which the tank N is adjustable in capacity as by means of the piston N' longitudinally movable therein. Whenever a change is made in the character of the work, this piston N' is adjusted to vary the size of the storage chamber for the compressed air, so as to proportion the force to the work to be performed.

What I claim as my invention is,—

1. The combination with a mold flask holder and a superposed pattern, of means for relatively moving the same with a velocity sufficient to fill the interstices of the pattern with sand by the inertia of the latter, and means whereby the actuating power is diminished as momentum of the moving part is acquired.

2. The combination with a mold flask holder and a superposed pattern, of means for relatively moving the same with a velocity sufficient to fill the interstices of the pattern with sand by the inertia of the latter, means whereby the actuating force is diminished in power as momentum is acquired, and is then increased to give a final powerful compression.

3. The combination with a mold flask holder and a superposed pattern, of a plunger for actuating the one in relation to the other, means for supplying a motive fluid to impart to said plunger a predetermined velocity, and for then automatically diminishing the pressure.

4. The combination with a mold flask holder and a superposed pattern, of a plunger for actuating the one in relation to the other, means for supplying a motive fluid to said plunger at a predetermined initial pressure to impart a predetermined velocity

thereto, and for diminishing the pressure during movement, and then increasing the pressure for a final compression.

5 In a molding machine the combination with a movable head and plunger for actuating the same, of a cooperating cylinder for said plunger, means for supplying an expansible motive fluid to said cylinder at a predetermined pressure to impart the initial movement to said plunger, and means for automatically restricting the fluid supply to permit expansion of the fluid within the cylinder and the resulting diminution in pressure, for the purpose described.

15 6. In a molding machine the combination with a movable head and plunger for actuating the same, of a cooperating cylinder for said plunger, means for supplying an expansible motive fluid to said cylinder at predetermined pressure to impart the required initial velocity to the plunger, and means whereby the supply of fluid is restricted to permit the diminution of pressure by expansion, and finally increased, for the purpose described.

7. In a molding machine the combination with a movable head and plunger for actuating the same, of a cooperating cylinder for said plunger, a storage chamber for the expansible motive fluid of predetermined capacity relative to the capacity of said cylinder, a valve-controlled connection between said storage chamber and cylinder, and a restricted supply connection to said storage chamber, for the purpose described.

35 8. In a molding machine the combination with a movable head and a plunger for actuating the same, of a cooperating cylinder for said plunger, a storage chamber for an expansible motive fluid, a valve-controlled connection between said storage chamber and the cylinder, a restricted supply connection to said storage chamber, and means for adjusting the capacity of the storage chamber relative to that of the cylinder, for the purpose described.

9. In a molding machine, the combination with a mold flask holder, a superposed head and a plunger for actuating the one in relation to the other, of a sand frame initially supported upon said mold flask and of a size to loosely fit said superposed head, an

electro-magnet on said head having pole pieces extending adjacent to the upper edge of said sand frame when in engagement with said head, and means for energizing said magnet to hold said frame upon the head. 55

10. In a molding machine the combination with a mold flask holder, a superposed head and a plunger for actuating the one in relation to the other, of a sand frame initially superposed upon said mold flask and of a size to loosely fit said superposed head, and electro-magnetic means for coupling said sand frame to said superposed head, whereby it will be disengaged from said flask. 65

11. In a molding machine the combination with opposed relatively movable molding heads, of a longitudinally collapsible sprue pattern secured to one head and extending into the path of the opposite head, and means for expanding the diameter of said pattern while contracted in length. 75

12. In a molding machine the combination with opposed relatively movable heads, of a sprue pattern around which the sand is compressed, and means for decreasing the diameter of said pattern after compression to permit of the longitudinal withdrawal of the same. 80

13. In a molding machine the combination with relatively movable opposed molding heads, of a compressible sprue pattern comprising a longitudinally movable core, and a surrounding sleeve of resilient compressible material adapted to be simultaneously contracted in length and enlarged in diameter. 90

14. In a molding machine, the combination with relatively movable opposed molding heads, of a cylindrical sprue pattern, comprising telescoping members, one of said members being adapted to be simultaneously contracted in length and enlarged in diameter. 95

In testimony whereof I affix my signature in presence of two witnesses.

JOHN A. RATHBONE.

Witnesses:

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HARRY F. GEORGE.

FILED 1901