

June 11, 1940.

J. FLAMMANG ET AL

2,204,407

MOLDING MACHINE

Filed July 20, 1936

2 Sheets-Sheet 1

Fig. 1-

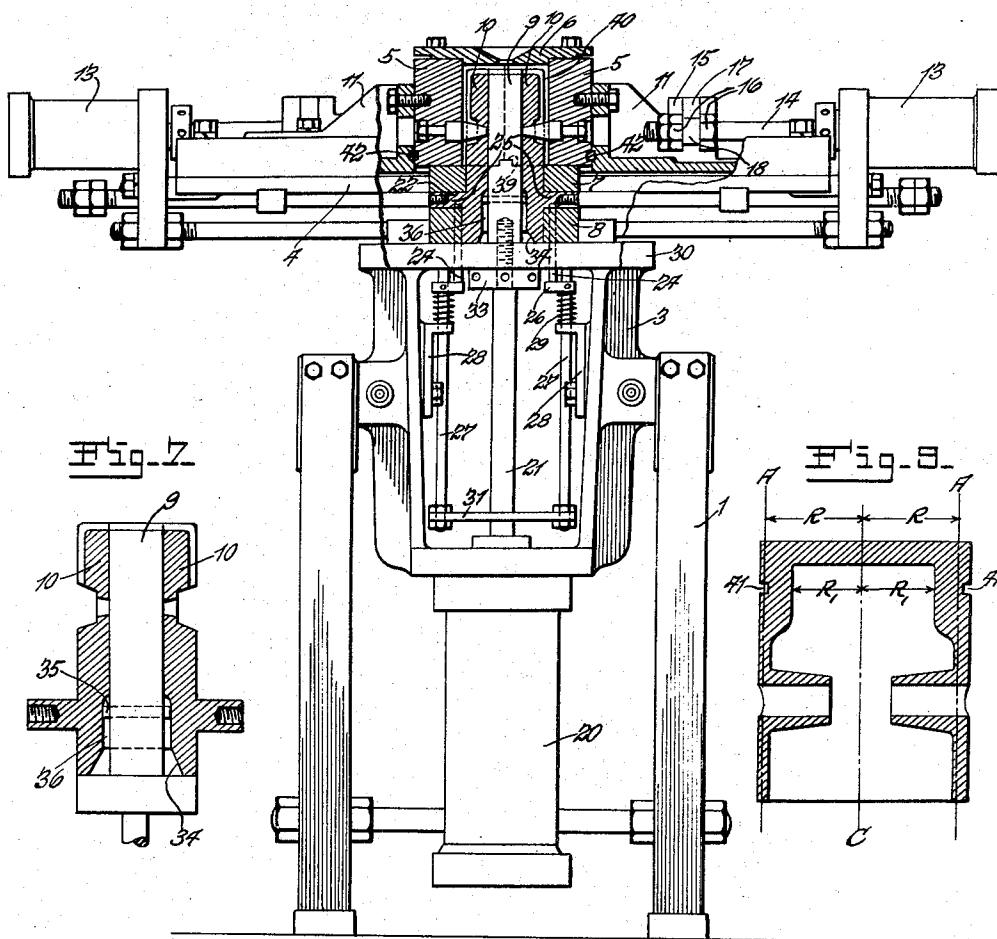


Fig. 2-

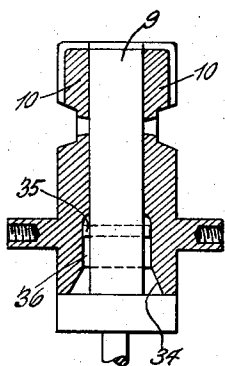


Fig. 3-

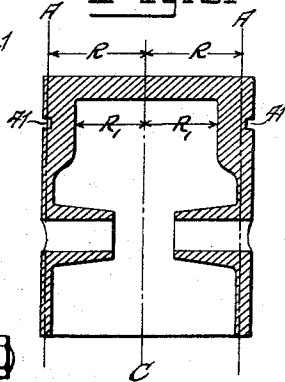
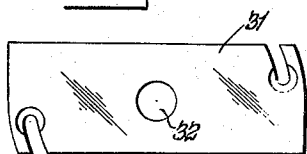


Fig. 4-



Inventors
John Flammang
Percy L. Bowser
by *Bumma & Clutterland*
Their Attorneys

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2 Sheets-Sheet 2

Fig. 2.

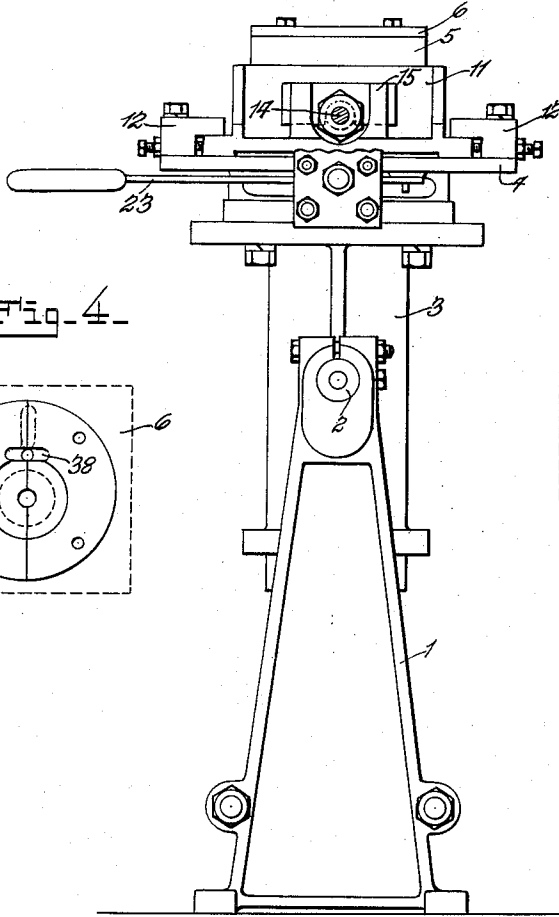


Fig. 4.

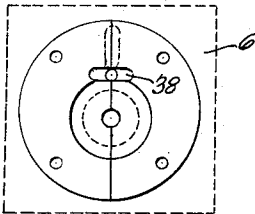


Fig. 3.

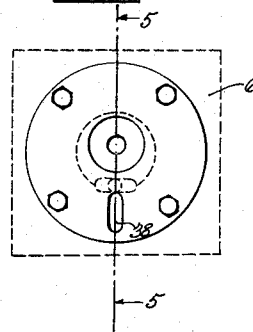
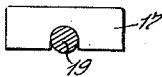


Fig. 5.



Fig. 6.



Inventors
John Flammang
Percy L. Bowser
By *Bruninga & Suteland*
Their Attorneys.

UNITED STATES PATENT OFFICE

2,204,407

MOLDING MACHINE

John Flammang and Percy L. Bowser, St. Louis, Mo., assignors to The Sterling Corporation, St. Louis, Mo., a corporation of Delaware

Application July 20, 1936, Serial No. 91,486

5 Claims. (Cl. 22—57)

This invention pertains to molding machines and more particularly to a machine for molding trunk pistons such as are used in internal combustion engines.

5 One of the objects in this invention is to provide a machine by means of which pistons may be cast with improved accuracy and in such a manner that inaccuracies may be more easily detected.

10 Another object is to provide a machine whereby the various sections of mold and core may be separated and reassembled by operation of the machine so that when reassembled the various parts will be accurately positioned with respect to one another so as to form a true casting.

15 Another object is to provide improvements in the gate structure whereby the pouring operation may be so improved as to provide better assurance for sound castings.

20 Another object is to provide automatic mechanism for operating sectional molds and cores which will operate rapidly and accurately and which will be safeguarded against mistakes of the operator.

25 Further objects will appear from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a front view of a molding machine embodying this invention,

30 Figure 2 is a side view of Figure 1,

Figure 3 is a top view of the mold cap.

Figure 4 is a bottom view of the cap shown in Figure 3,

Figure 5 is a section on line 5—5 of Figure 3,

35 Figure 6 is a detail of the drag block,

Figure 7 is an enlarged detail of Figure 1,

Figure 8 is a detail of the safety lock; and

Figure 9 is a longitudinal sectional view of a defective piston casting.

40 Referring now to the drawings 1 designates a supporting frame in which is mounted upon trunnions 2 a supporting bracket 3 which in turn carries a horizontally extending base 4. Mounted on the base 4 is a piston mold comprising

45 a pair of separable sections 5 surmounted by a mold cap 6, also sectionalized so as to open with the sections 5. Mounted in the base 4 are upper and lower locating rings 7 and 8 respectively in which the core for the mold is mounted. In the machine illustrated the core is made up of three sections, namely a center section 9 and two side sections 10. The side sections 10 are mounted in suitable channels in one of the locating rings 7 or 8 so that when the center section 9 is withdrawn downwardly the side sec-

tions may be moved inwardly into the space vacated by the section 9.

In order to render the side mold sections 5 slidable upon the base 4, there is provided for each section 5 a carrier or angle plate 11. Suitable 5 guides 12 are provided to guide the carriers 11 so that the mold sections 5 will move toward and away from each other in a straight line. Mounted at each end of the base 4 is a fluid pressure cylinder 13 having a piston rod 14 connected to 10 the carrier 11 so as to move the same back and forth in accordance with the fluid pressure introduced into the cylinder 13. The piston rod 14 is releasably connected to the carrier 11. In order to make such connections the carrier is 15 provided with four upstanding posts 15 spaced laterally of the carrier so as to permit the passage therebetween of the rod 14 and nuts 16 thereon, and spaced longitudinally so as to receive therebetween a drag block 17. The rod 14 20 has mounted thereon a collar 18 which is clamped in adjusted position upon the rod 14 by means of the nuts 16 which provide stops for the block 17. The drag block 17 is provided with a notch 19 arranged to fit over the collar 18. By properly 25 positioning the collar 18 between the posts 15 and then slipping the drag block 17 over the collar between the posts a connection is established between the rod 14 and the carrier 11, which provide respectively driving and driven 30 members with which the block 17 is only loosely engaged. This connection is easily broken or released by simply removing the block 17 without disturbing any other element of the connections between the power device 13 and the mold 35 section.

Mounted on the lower end of the bracket 3 is a fluid pressure cylinder 20 having a piston rod 21 upon the upper end of which the center core section 9 is mounted. Suitable means not shown 40 are provided for controlling the admission of fluid pressure to the cylinders 13 and 20 in proper order so as to draw back the mold sections 5 and to withdraw the center core section 9 downwardly. The side core sections 10 are mounted in 45 guide passages 22 in one or the other of the rings 7 and 8 so that they may be moved inwardly of the mold into the space vacated by the section 9 and in a rectilinear path so as to move clear of the interior portions of the casting without 50 danger of marring the same. This movement of the side core sections may be accomplished manually by the operator by means of handles 23 suitably connected to the core sections.

In order to prevent the side sections 10 from 55

being moved inwardly before the section 9 has cleared the space between them, automatic latching mechanism is provided. This mechanism comprises a pair of latching pins 24 extending through the lower ring 8 and adapted to engage suitable sockets 25 in the guide portions of the sections 10. Each pin 24 is carried by a block 26 adjustably mounted upon a vertically slidable rod 27. Each rod 27 may be guided in a suitable bracket 28 mounted on the bracket 3 and a spring 29 engaging the bracket 28 the block 26 serves to urge the rod 27 upwardly. This upward movement is arrested by engagement of its upper end with the top plate 30 of the bracket 3. The two rods 27 are joined at their lower ends by a cross member 31 having a perforation 32 at its center through which the piston rod 21 may pass. The rod 21 slides freely through the perforation 32 so that when it moves downwardly to withdraw the center section 9, at the lower extremity of its movement and after the section 9 has cleared the two side sections 10, a head 33, adjustable on the rod 21, engages the cross-member 31, drawing it downwardly and thereby withdrawing the pins 24 from the sockets 25 and releasing the side sections 10 for inward movement to free the casting. The lower ends of the side sections 10 are beveled outwardly as shown at 34 so that in case the side sections should still be in collapsed position when the center section 9 starts its upward movement to its casting position, the beveled surfaces 34 may serve as cam surfaces to cause the section 9 to force the sections 10 outwardly as it rises. As soon as the section 9 begins to rise the head 33 releases the cross-member 31, whereupon the spring 29 returns the pins 24 to locking position and causes them to snap into the sockets 25 as soon as the sections 10 have been moved outwardly.

In order to locate the several core sections more accurately with respect to each other the center section 9 is provided with a pair of guide pins 35 providing registering keys engageable in guide grooves 36 in the side sections 10. This serves to prevent lateral shift of the several sections with respect to one another.

The gate for pouring is placed in the mold cap 6 which, as has already been stated, is divided into half sections one of which is mounted upon each of the mold sections 5 so that the cap 6 is divided and separated to free the sprue when the mold is opened. Several forms of gates may be used in accordance with this invention. The cap 6 may be provided with a single gate 37, flared at its outer end and more restricted in cross section where it enters the mold matrix. As many piston castings are provided with a reinforcing rib extending across the inside of the piston head the core sections must be provided with a groove correspondingly positioned so as to form this rib. As the piston is cast with its head up, if the gate is placed in the center of the head the molten metal must be poured directly into this groove in the core. The repeated pouring of very hot metal into this groove causes the metal to flow into the mold along the groove rather than over the head of the piston core. This tends to concentrate the flow of highly heated metal continually along one particular part of the core so that this part is liable to be overheated and tends to become corroded at the point of impact of the molten metal. In accordance with this invention the gate 37 is shifted laterally. The amount of shift need be only sufficient so that when the metal is poured into the

gate it will not flow directly into the center groove in the core but will miss that groove and flow over the head of the core and into the body of the piston matrix. By slightly tilting the entire machine on its trunnions 2 toward the side toward which the gate 37 is shifted the effect will be to throw the incoming metal rearwardly and this helps to avoid pouring the metal into the groove in the core.

While the casting process may be carried out to advantage with only a single gate 37, this invention also contemplates providing a separate gate 38 so placed so as to enter the mold matrix close to one side thereof. This gate is used in addition to the gate 37. As will be seen from Figure 3 the gate 38, at its inlet, is flared or extended in a radial direction with respect to the matrix so as to render it more convenient to insert the snout of the ladle in pouring the metal. As seen in Figure 4 however, which shows a bottom view of the cap 6, the gate 38 is flared or extended in a direction circumferential to the mold matrix. This enables the incoming stream of metal to spread sidewise toward both sides of the matrix. At an intermediate position between the inlet and outlet ends of the gate 38 its cross section is practically circular and somewhat restricted as compared with the gate 37. When both of these gates are used the gate 37 really acts as a riser. The metal is poured in at the gate 38 and, after filling the matrix, the surplus metal rises in the gate 37. It will be noted that in this case the metal which rises in the gate 37 has come up from the mold and is therefore at about the same temperature as the metal of the piston head instead of being at a high temperature such as that of the metal in the ladle. Accordingly, the high temperature metal fresh from the ladle is held in a small gate 38 while a considerable volume of metal is held in the riser 37 but at a lower temperature. It will be seen that this arrangement enables these parts to cool down to solidification temperature much more quickly than if the entire mass of metal in the gate 37 were at the ladle temperature. Accordingly, the setting of the entire casting is hastened and the work can be carried out much more rapidly as it is not necessary for this extra volume of metal to cool down through such a great range of temperature before the casting can be removed.

In order to insure that when the mold sections 5 are closed they will take position concentric with the core one or more abutments 39 are provided on the ring 7, a corresponding recess being formed upon the section 5 so that when the mold sections are closed they are positioned by engagement with the abutment 39. As these abutments are located upon the same plate in which the core sections are located the mold sections will be accurately positioned concentric with the core so that the inner surface of the casting will be concentric with the outer surface thereof. In order to provide means for showing on the castings whether or not the mold has been accurately closed and located by the abutment 39 or whether there is an eccentricity of the exterior of the casting surface with respect to the interior thereof, the mold sections 5 are provided on the inner surface thereof with one or more prints 40 in order to form upon the casting a tell-tale impression 41. If the mold sections 5 are properly positioned the tell-tales 41 will be equidistant from the axis of the interior bore of the casting. Accordingly, when the outer

surface of the casting is turned to a round cylindrical form these impressions will be turned away equally and will both disappear at the same time. If however, the inner and outer casting surfaces are not concentric, these impressions will be unequally distant from the axis and upon turning the casting one will be removed before the other.

Figure 9, illustrates a casting made with the mold sections improperly located so that the outer surface is not concentric with the inner surface. The dotted lines A represent the surface of the cylinder to which the casting is machined. This cylinder, which has a radius R, is concentric with the axis C. The casting is usually located in the lathe by means of its inner surface having a radius R₁ with respect to the axis C. Accordingly, the cylinder A—A will be concentric with this inner surface. It will be noted that the tell-tale 41 on the left hand side of Figure 9 is only partly cut away by the turning operation while the one on the right hand is entirely removed. Upon inspection of the turned casting the presence of only one tell-tale will indicate a defective casting. The impression 41 may be of any desired shape as for instance a conical impression or one of spherical form will decrease in size as it is turned off so that the degree of eccentricity may be indicated by the size of the tell-tale remaining.

In the operation of this machine the same may be set upright on its support 1 as illustrated in Figure 2 or it may be tilted on the trunnions 2. With the mold sections 5 closed and the core sections in assembled relation within the mold as shown in Figure 1, the operator, by means of a suitable ladle takes a charge of molten metal from a suitable supply, and inserting the snout of the ladle into the inlet of the gate 38, pours the charge of metal into the mold until the metal rises in the riser 37 as described. In case only one gate 37 is used the metal is poured in at said gate and as the latter is displaced laterally from the axis of the mold matrix, the metal flows in laterally of the center of the core and flows over the top of the core and down into the lower portion of the matrix which forms the piston skirt. When the mold is full the metal rises in the gate 37 and the pouring is discontinued when said gate is practically full. One operator handles two machines so that after one mold has been poured the same is allowed to stand for an interval to permit the casting to set. During that interval the other machine is prepared for molding and the metal poured thereinto. By the time the second machine has been poured the casting in the first has practically set and the operator returns to it, manipulates suitable valves not shown for controlling the supply of fluid pressure to the cylinders 13 and 20. Arrangements for such controls may be made as described in Patent No. 1,952,200, issued to John Flammang, Percy L. Bowser and Herman Ernst, March 27, 1934. The cylinders 13 operate to draw apart the mold sections 5 thereby freeing the outside of the casting. The cylinder 20 withdraws the center core section 9. Upon completion of the withdrawal the head 33 depresses the cross member 31 thereby withdrawing the locking pins from the side core sections as already described. As soon as the operator is satisfied that the casting has cooled to a sufficient state of hardness he moves the two handles 23 towards each other, thereby moving the side core sections inwardly into the space

vacated by the section 9, separating the side sections from the interior of the casting and freeing the casting for removal. The casting is then removed with a suitable pair of tongs and the fluid pressure valve manipulated to close the mold sections and return the core section 9, the side sections 10 having previously been separated by means of handles 23.

When a different casting is to be made the mold section 5 may be changed. That is the present mold may be removed and a new mold mounted in the machine. In order to assure accurate positioning of the mold sections, keys 42 are provided. Each key is recessed into the mold section 5 and into its carrier 11. If desired these keys may be permanently secured to the carriers. This provides simple means for insuring that the side sections 10 shall be accurately positioned with respect to the base and with respect to each other.

It will be seen therefore that the invention provides a machine which may be handled rapidly in making a large number of castings and in which automatic devices insure that the parts are accurately located so that true castings are insured. Undue haste on the part of the operator is also insured against by provision of the latches 24. The gates are so arranged so as to provide ample metal therein for shrinkage and at a temperature such as to hasten cooling of the casting.

While this invention has been described as embodied in a unitary device, it will be understood that individual features and sub-combinations of this device may be useful by themselves without reference to other features or the complete combination, and that the employment of such individual features or sub-combinations is contemplated by this invention and within the scope of the appended claims.

It is further obvious that various changes may be made, within the scope of the appended claims, in the details of construction without departing from the spirit of this invention; it is understood, therefore, that the invention is not limited to the specific details shown and/or described.

We claim:

1. In a piston mold of the character described having a matrix in which the piston is cast with the head up, a gate for the mold having an inlet flared radially and an outlet into the matrix flared circumferentially with respect to the matrix.

2. In a molding machine of the character described, a base, a mold thereon, a sectional core for said mold comprising center and side sections, said sections being constructed and arranged for withdrawal successively with a succeeding section moving into the space vacated by a preceding section, and means other than the parting faces of said sections, positionable in the path of movement of the succeeding section for locking said succeeding section against movement before the preceding section has cleared said space.

3. In a molding machine of the character described, a base, a mold thereon, a sectional core for said mold comprising center and side sections, said sections being constructed and arranged for withdrawal successively with a succeeding section moving into the space vacated by a preceding section, means other than the parting faces of said sections, positionable in the path of movement of the succeeding section for locking said succeeding section against move-

ment before the preceding section has cleared said space and means operating when said preceding section has been completely withdrawn to release said locking means.

- 5 4. In a molding machine of the character described, a base, a mold thereon, a sectional core for said mold comprising center and side sections, said sections being constructed and arranged for withdrawal successively with a succeeding section moving into the space vacated
10 by a preceding section, and a latch for locking said succeeding section against movement before the preceding section has cleared said space, said preceding section moving in a path to en-
15 gage and release said latch when completely withdrawn.

5. In a piston molding machine, a base, a plurality of mold sections movable on said base to open and closed positions, a core having separable sections movable successively to positions to clear the casting, automatic means for moving
5 said mold and core sections, automatic means for positively locking certain of said core sections in casting position against movement to interfere with other core sections, and means actuated
10 by another core section upon completion of its withdrawing movement to unlock said locking means.

JOHN FLAMMANG.
PERCY L. BOWSER.