July 13, 1937. H. FORD ET AL 2,086,610

PISTON MOLD

Filed July 1, 1935 2 Sheets-Sheet 1

Fig. 1.

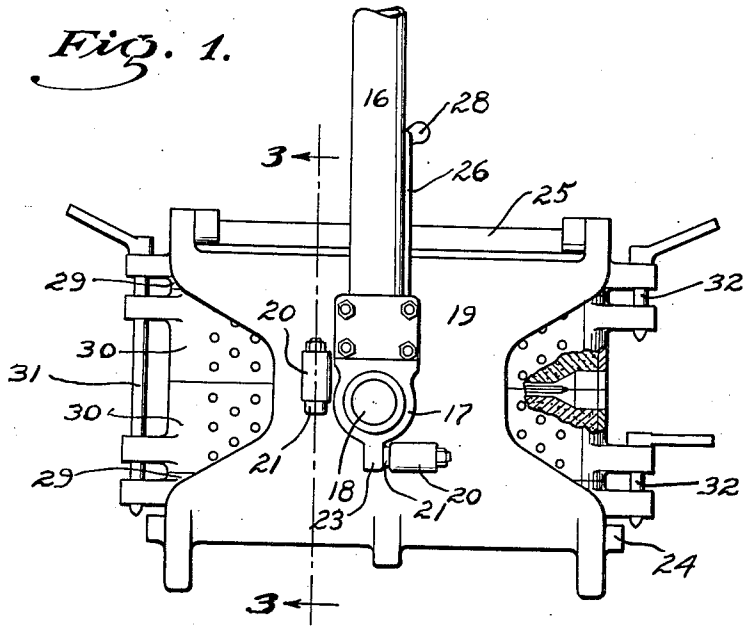
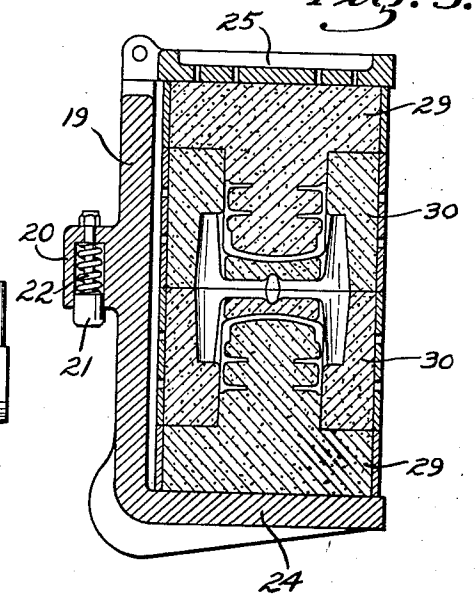


Fig. 3.



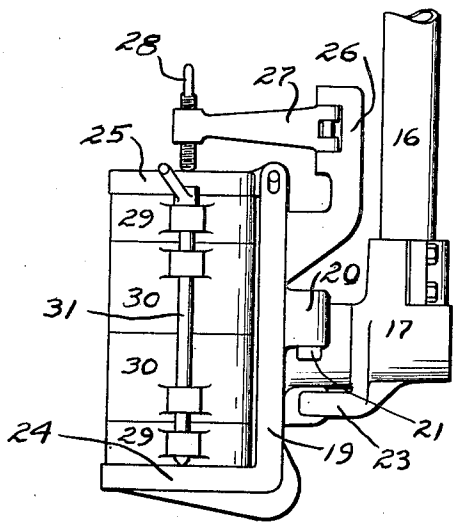


Fig. 2.

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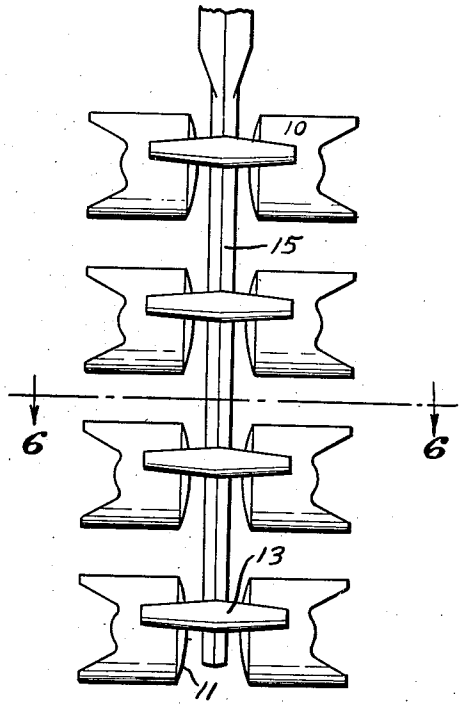


Fig. 4

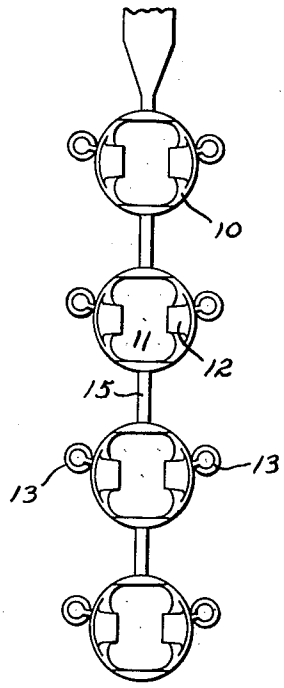


Fig. 5.

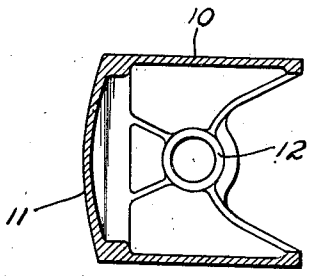


Fig. 7.

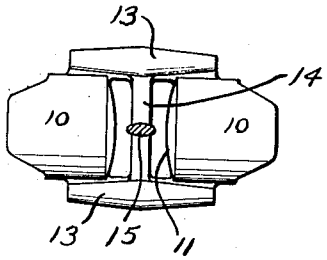


Fig. 6.

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2,086,610

PISTON MOLD

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Application July 1, 1935, Serial No. 29,194

4 Claims. (Cl. 22—113)

The object of our invention is to provide a mold for casting thin walled steel pistons of a size suitable for use in automobile engines. While it has been practical in the past to cast thin walled pistons of aluminum or iron, still no one, to the applicants' knowledge, has devised a mold by means of which thin walled pistons might be cast from steel. The higher melting temperature of steel has restricted its use to castings having thicker walls. The particular steel alloy used with our mold forms no part of this invention; nevertheless, it may be well to mention that the mold must accommodate steel which is poured at a temperature of 2850° F. to 2925° F. This increased temperature aggravates the shrinkage troubles heretofore inherent in casting thin walled castings.

Still a further object of our invention is to provide a mold whereby a relatively large number of pistons may be simultaneously formed and wherein the weight of each of the pistons is maintained within a small predetermined limit. It is essential in high speed internal-combustion engines that all of the pistons be manufactured having a predetermined weight in order that the engine counterbalancing will be effective. In the past great difficulty has been encountered in casting a plurality of pistons in a single mold and maintaining the weight of the pistons uniform. Invariably the castings which are located at one part of the mold weigh more than those which are located at another part thereof. This is probably due to a variation in the shrinkage of the several castings. It should be kept in mind that all of the pistons must be turned to the same outside diameter, and that the inside diameter may not be machined, due to the piston pin bosses and stiffening ribs. Consequently, only a small variation in the inside diameter causes a considerable variation in the finished weight of the piston. This is especially true in the case of thin walled castings.

An important advantage of our improved mold is that all of the pistons cast therein shrink uniformly. This is due to the fact that a shrinkage pocket is provided for each piston, which pockets are located in exactly the same position relative to each of the pistons, so that as each casting cools the metal is drawn under identical conditions for all castings. The runners which supply the shrinkage pockets have considerably smaller cross sections than the shrinkage pockets so that before the metal is drawn from these pockets, the runners have solidified and consequently there is no pressure exerted by the metal in the riser upon the individual shrinkage pockets.

Still a further object of our invention is to provide a novel type of mold construction wherein the usual cope flask is eliminated. The conventional practice in casting pistons is to provide a drag flask which forms the piston core, over which a cheek flask is placed, this cheek flask forming the outside and top of the piston. A cope flask is then placed on top of the cheek flask, the runners, risers and shrinkage pockets being formed in the cope. In our improved mold the aforementioned cope flask is eliminated. This is accomplished by providing one half of the runners, risers and shrinkage pockets in the upper face of the cheek flask. A pair of drag and cheek flasks are assembled in the usual way and then one of this pair is inverted so as to lay on top of the other pair of flasks. The whole unit is then rotated through 90 degrees and the metal poured in the riser which is formed between the two cheeks. By this means two rows of pistons are simultaneously cast, each piston of which is spaced the same relative to its shrinkage pockets and runners.

A further advantage of this mold is that, due to the single riser supplying both rows of pistons almost a fifty per cent reduction in the back stock results.

With these and other objects in view our invention consists in the arrangement, construction and combination of the various parts of our improved device, as described in the specification, claimed in our claims and illustrated in the accompanying drawings, in which:

Figure 1 shows a rear elevation of our improved mold construction.

Figure 2 shows an end elevation of the mold, shown in Figure 1.

Figure 3 shows a sectional view, taken on the line 3—3 of Figure 1.

Figure 4 shows a side elevation of a group of eight pistons as they are cast in the mold described, the group being shown in the position in which they are poured.

Figure 5 shows an end view of the group, shown in Figure 4.

Figure 6 shows a sectional view, taken on the line 6—6 of Figure 4, and

Figure 7 shows a central sectional view through one of the pistons which are shown in Figures 4 and 5.

Referring to the accompanying drawings, we have used the reference numeral 10 to indicate one of the pistons which our mold is designed to

cast. These pistons are of the conventional shape and consist of a cylindrical skirt portion having a head 11 formed over one end thereof with piston pin bosses 12 extending inwardly from about the center of the skirt portion. It will be noted that the skirt portion of the piston has exceptionally thin walls while the piston head is several times as thick.

Eight of these pistons are arranged to be cast in one mold, the pistons being arranged in two rows with the heads of the pistons of each row facing each other. It will be noted from Figures 4 and 5 that each pair of opposed pistons are connected by a pair of shrinkage members 13 which members extend parallel to the axes of the pistons, one on each side thereof. These shrinkage members extend about one third of the way along the piston skirts and, as is shown in Figure 6, each pair of members 13 have their center points connected by a transverse runner 14, while a vertical riser 15 connects the centers of each of the transverse runners 14.

To form the casting, the metal is poured down through the riser 15 and flows through the transverse runners 14 into the shrinkage members 13 so as to simultaneously feed the metal to both sides of each individual piston mold. The runners 14 are considerably smaller in cross section than the members 13 so that as the casting cools the runners 14 solidify before the metal in the members 13, with the result that metal is drawn from each end of each shrinkage member 13 after the transverse runners 14 have solidified. Consequently, each piston in the both rows draws metal from the two adjacent shrinkage members under exactly the same conditions. Thus castings of uniform weight result.

Our improved mold for forming the above described casting is adapted to be supported from an overhead conveyor system by means of vertical supporting pipe 16, the upper end of which is secured to a conveyor in the conventional manner. The lower end of the pipe 16 is attached to a bracket 17, which bracket is provided with a transversely extending trunnion 18 upon which a carriage 19 is rotatably mounted. The carriage 19 is provided with a pair of bosses 20 cast on its rear face, in each of which bosses a plunger 21 is reciprocally mounted. Each of the plungers 21 is urged to its outermost position by means of a compression spring 22. The two bosses 20 are arranged at a 90 degree angle around the axis of the carriage 19, and an ear 23 extends from the bracket 17 to position between the two plungers 21. When the carriage 19 is in the loading position, as shown in the drawings, then one of the plungers 21 will coact with one side of the ear 23, and when the carriage is rotated counterclockwise through 90 degrees from the position shown in Figure 1, the other plunger 21 will coact with the other side of the ear to resiliently stop the carriage at the end of its 90 degree movement.

It will be noted from Figure 1 that the axis of the carriage 19 is spaced both below the center of gravity of the carriage and to the left of the longitudinal center of this carriage. When the carriage is in its loading position, it will remain in this position due to the overbalanced weight on the right hand side thereof. When, however, the carriage is moved counterclockwise through 90 degrees, then the carriage will remain in this new position, due to the overbalance on the lefthand side of the unit. Thus, no locking of the carriage is required in either its loading or its pouring positions.

The carriage 19 is cast integrally with a base 24, commonly known as a board, while a cover 25 is hinged to the upper face of the carriage 19. The carriage 19 has a bracket 26 cast integrally therewith which extends up above the cover 25 and in which bracket an arm 27 is pivotally secured. The arm is arranged to swing over the center portion of the cover 25. A thumb screw 28 is secured in the free end of the arm which thumb screw may be tightened down against the cover 25. The four flasks which make up our improved mold are adapted to be clamped between the board 24 and the cover 25.

This mold is made entirely from green sand and is composed of two identical pairs of flasks. It is quite possible that all of the flasks and molds therein should be construed as a drag mold, inasmuch as none of the flasks are placed on top of each other when the casting is being poured. However, as the molds are set up in a vertical position, it may be desirable to term the lower flask the drag flask, as in the conventional mold. This lower flask, which we have given the reference numeral 29, is filled with green sand and is shaped to form the inside coring of four pistons. A second flask 30 is provided with a mold having four openings corresponding to the outside of the pistons to be cast. This mold is also provided with channels corresponding to half of the members 13, runners 14 and riser 15. In assembling the mold the flask 30 is placed over a flask 29 and the unit is placed upon the board 24. Then a second unit composed of flasks 29 and 30 is inverted and placed upon the top of the flask 30. The cover place 25 is then lowered against the upper of the flasks 29 and secured in position by means of the thumb screw 28. The carriage 19 is then rotated through 90 degrees so that the channel for forming the riser and runners is on the top. It will be desirable to secure one end of the four flasks in alignment by means of a long pin 31 while a pair of short pins 32 secure the pouring end of each pair of flasks 29 and 30 in alignment. It is not particularly important whether or not the two pairs of flasks exactly line up as the parting joint between the two units forms only the runners, risers and shrinkage member.

Among the many advantages arising from the use of our improved device, it may be well to mention that two rows of thin walled pistons may be simultaneously cast of high melting temperature alloy steels and all of these pistons will be of uniform weight. A further advantage results because the back stock resulting in this mold is only about half that resulting with other types of molds. Still further, the placing of the two mold units back to back eliminates the use of the conventional cope and contributes materially to the reduced cost of castings made with this mold construction.

Some changes may be made in the arrangement, construction and combination of the various parts of our improved device without departing from the spirit of our invention, and it is our intention to cover by our claims such changes as may reasonably be included within the scope thereof.

We claim as our invention:

1. The method of forming internal-combustion engine pistons comprising, casting said pistons in two vertical rows, the axes of said pistons being horizontal with the piston heads facing each

other, there being a riser extending vertically between said rows, and the corresponding pistons in each row being connected by a pair of shrinkage members, and said riser having lateral runners of lesser cross section than said shrinkage members extending therefrom to each of said shrinkage members.

2. The method of forming internal combustion engine pistons comprising, casting said pistons in two vertical rows with a riser extending vertically between said rows, the corresponding pistons in each row being connected by a shrinkage member, and said riser having lateral runners of lesser cross section than said shrinkage member extending therefrom to each of said shrinkage members.

3. The method of forming internal combustion engine pistons comprising, casting said pistons with their axes horizontal, the pistons being arranged in two vertical rows with the heads of said pistons facing each other, and with a riser extending vertically between said rows, there being a pair of shrinkage members connecting the corresponding pistons in each row, and a runner extending laterally from said riser to each of said shrinkage members, said runner having a cross section less than either said riser or shrinkage members.

4. The method of simultaneously forming a plurality of internal combustion engine pistons comprising, casting said pistons with their axes in horizontal planes, said pistons being arranged in two vertical rows, with each piston in one row horizontally aligned with a piston in the other row, and each pair of aligned pistons being connected at opposite sides and in a horizontal plane by a pair of shrinkage members, there being a riser extending vertically between said pistons and shrinkage members, which riser is connected to each of said shrinkage members by a horizontally extending runner, said runners having a cross section less than either said riser or shrinkage members.

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