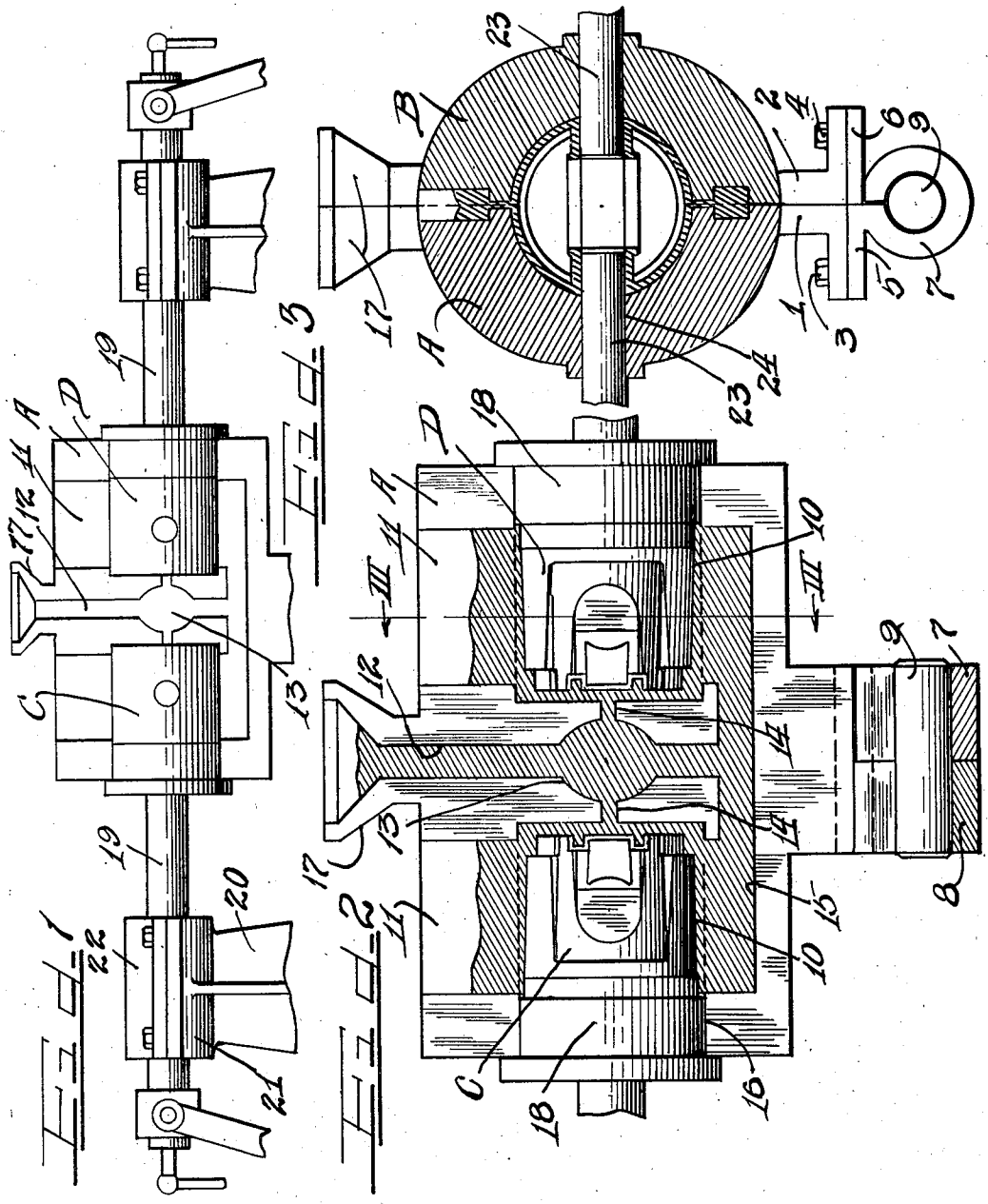
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METHOD OF MAKING PISTONS

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METHOD OF MAKING PISTONS

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5 Claims. (Cl. 22—200)

The present invention relates to a method of making pistons, and more particularly to pistons for internal combustion engines, and contemplates the manufacture of pistons in multiple.

The present invention relates to a method of making pistons in such manner as to enable piston manufacture in quantity lots on a production basis, whereby the manufacturing cost per piston may be materially reduced.

Another object of the present invention has to do with a novel method of casting pistons wherein an excessive supply of molten metal is utilized for supplying metal to the heavier sections of the piston castings while cooling.

A further object of the present invention has to do with a novel method of casting pistons in multiple, with the pistons cast in horizontal position and the skirts of the pistons extending away from each other, and furthermore the supplying of metal to the skirts and heads of the pistons, during the cooling, to compensate for crystallization shrinkage.

A still further object of the present invention is to provide a novel method of manufacturing pistons for considerably shortening the time required for the casting operations, and which method produces larger production yield per mold per day, and which produces castings in which the physical structure of the metal is of relatively fine grain and relatively uniform throughout the pistons.

The invention has for a further object the provision of a novel method of casting internal combustion engine pistons in horizontal position and in multiple.

Generally speaking, the method of the present invention contemplates casting pistons in multiple, with the pistons horizontally cast, and so arranged that the pistons are cast in pairs or in groups of pairs, with the heads of the pairs adjacent each other, and an ingate provided with expansion provision, sufficiently close to the castings to supply metal to the heavier sections of the pistons while cooling and to be in heat transfer relation with the piston castings in the mold cavities.

The invention contemplates the formation of castings in multiple, thereby expediting production and reducing labor costs.

The above, other and further objects of the present invention will be apparent from the following description and accompanying drawing.

The accompanying drawing illustrates one form of apparatus whereby the method of the present invention may be practiced, and the views thereof are as follows:

Figure 1 is a side elevational view of one of two cooperating mold sections, in casting position, with the cores in place, and illustrating one manner of supporting the cores, and indicating, fragmentally, means for moving the cores into and out of casting position.

Figure 2 is an axial sectional view of a mold section, with the cores in elevation, and showing, in section, the cast pistons, the ingate, expansion ball, risers, and sprue, and illustrating the manufacture of pistons in multiple in accordance with the present invention.

Figure 3 is a transverse vertical sectional view through the illustrated form of mold, and a cast piston, showing core prints in place for forming the wrist pin holes in the bosses. In this figure, the core is removed, for clearness.

The drawing will now be explained.

The present invention is a division of copending application, Serial No. 8,987, filed March 2, 1935.

The illustrated form of mold consists of two sections, A and B, which are adapted to be moved against and away from each other. The sections are shown as hingedly connected by means of legs 1 and 2 on the sections A and B respectively, which legs, in turn, are secured by bolts 3 and 4 to flanges 5 and 6 of a hinge which comprises eyes 7 and 8 receiving a pintle pin 9. The mold may be mounted in any convenient manner for ready operation.

The sections A and B are counterparts; therefore the description of one will suffice for both.

The section A is shown as provided with two horizontally disposed semi-cylindrical cavities, which are axially spaced and horizontally disposed, with the outer ends of the cavities opening through the ends of the section. Riser cavities 11 of relatively shallow depth are also provided, as well an ingate 12, which is illustrated as fashioned with an enlargement or expansion ball 13 disposed between the piston cavities 10 and communicating with these cavities by means of passages 14. The lower end of the ingate 12, is shown, in the present embodiment, as communicating with axially extending cavity or sprue 15, which also supplies molten metal from the ingate to the bottoms of the piston cavities 10. The sprue cavity 15 is shallow, as may be observed in Figure 3.

Each mold section, A and B, is provided at its ends with a semi-cylindrical seat 16 for receiving and encompassing the cores which are inserted

endwise into the mold cavities 10 by axial movement.

Each of the mold sections is provided with an upstanding head or neck 17 which, when the sections are together in casting position, cooperate to form a bullet mold entrance for the ingate. These necks 17 extend above the mold sections to provide, in the ingate, a head of molten metal to compensate for crystallization shrinkage as the castings cool.

It is of course understood that when the sections A and B are brought together for casting purposes, the semi-cylindrical cavities 10 cooperate to form cylindrical cavities, and the ingate, sprue, and riser cavities in each section cooperate with the corresponding parts in the other section to complete the mold.

The cores herein illustrated are the metallic cores of the aforesaid copending application, but it is to be understood that the cores could be of sand or otherwise, to conform to the characteristics of the metal utilized for casting pistons.

The cores herein illustrated are designated respectively as C and D, and are adapted to enter the piston cavities 10 by endwise movement into the cavities. The cores are fashioned with cylindrical portions 18 which enter the cylindrical portions formed by the closing of the sections A and B together, thus making the semi-cylindrical portions 16 into cylindrical portions, for thus closing the ends of the piston cavities of the mold.

The cores C and D are herein shown as supported by means of rods 19, which are mounted in suitable uprights 20, carrying bearing elements 21 and 22 for supporting the rods 19 and permitting reciprocal movement thereof in service.

The cores C and D, herein illustrated, as before stated, are metal cores, and therefore supporting these cores on the rods 19 enables speedy operation of the cores as to insertion and withdrawal with respect to the piston cavities of the mold. When, however, sand cores or cores of other types are utilized, these would be inserted by hand, through the ends of the mold sections, when together in casting position, in which event the rods 19 and the supports 20 would be eliminated.

The method of the present invention is carried out as follows:

Sections A and B are closed against each other to form the cylindrical piston cavities 10 and the cooperating gate, sprue, and riser arrangement. The cores C and D are then inserted in the ends of the mold, closing these ends, and thus being properly positioned within the piston cavities.

The metal is then poured into the head 17, whereupon it passes downwardly through the ingate, through the connections 14, the sprue portions 15 of the gate, and then into the mold cavities, and eventually entering the riser spaces 11. Sufficient molten metal is supplied to the mold to fill the ingate approximately to the upper extremity of the head 17, thereby assuring a sufficient head of molten metal in the ingate and the expansion ball 13 to supply additional metal to the castings, and for heat transfer, while cooling, to compensate for the usual shrinkage.

The provision of the enlargement of the ingate is adjacent the heavier sections of the pistons, so as to assure at all times a supply of metal to the heavier sections of the pistons, thereby affording a plentiful supply of metal to the pistons, so that formation of cracks in the pistons is prevented. The exteriors of the pistons are fashioned by the contours of the mold cavities 10, while the cores C and D form the interiors of the pistons.

When the casting operation has been completed, if the cores C and D are metal and mounted on the rods 19, the rods are actuated to withdraw the cores from the mold, and the sections A and B are then separated. When the mold sections A and B have been separated, the finished product, consisting of the two pistons and such portions of the metal as may be in the ingate, sprue portion 15, and riser portions 11, and branches 14, is then removed from the mold, and, when sufficiently cool, the scrap metal is removed from the pistons by sawing or other suitable operation.

The piston blanks thus formed are then subjected to suitable machine operations to bring the pistons to finished size, and also to form the usual piston ring grooves in the head portion of the pistons.

Prior to the time of the casting operation, core prints 23 are introduced in properly disposed apertures 24 in the sections, which core prints form the interiors of the wrist pin bushings, that is, form the wrist pin bearing portions of the pistons.

The method of the present invention contemplates the formation of pistons in multiple, by casting operations, and, as illustrated herein, two such pistons are cast at a pouring. It is to be understood of course that the mold may be constructed to form more than two pistons at a time, multiples of two being readily cast in accordance with the method of the present invention.

It has been found that the method of the present invention lends itself readily to rapid production of uniform pistons so that the labor incidental to the molding operation is reduced to a minimum. The manner of supporting the cores C and D on rods 19, or equivalent structures reduces the time necessary for setting the cores for the casting operation, the whole method expediting to a considerable extent the amount of time necessary for arranging the mold for casting operation and thus expediting quantity production.

The provision of the enlargement or expansion ball in the ingate, together with the risers and sprue portions of the mold is such that every casting formed is full, free of cracks and blow holes, and of uniform texture throughout its extent, thin sections as well as thick sections.

When sand cores are utilized, these may be crumpled away from the interior of the piston castings, after the castings have been removed from the mold.

Instead of utilizing the specific enlargement 13, as shown, in the ingate, the ingate could be formed otherwise to provide a sufficient supply of metal to the piston castings while cooling.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

The invention is claimed as follows:

1. That improvement in the method of simultaneously casting a plurality of internal combustion engine pistons which comprises the steps of forming a plurality of piston casting cavities in a mold with the axes horizontal and the head forming ends of the cavities facing each other,

forming in the mold a single feeder which when the mold is in casting position extends downwardly between and past the facing head forming ends of the cavities and sufficiently closely adjacent said ends to be in heat transfer relation therewith, forming in the mold a plurality of connections from the feeder to each cavity with one of the connections to each cavity opening into the cavity through a side of the same, and supplying molten metal to said feeder connections and cavities.

2. That improvement in the method of simultaneously casting a plurality of internal combustion engine pistons which comprises the steps of forming in a mold a plurality of piston casting cavities with the axes horizontal and the head forming ends thereof facing each other, forming in the mold a single feeder which extends downwardly between and past the ends of said cavities and in sufficiently close proximity thereto to be in heat transfer relation therewith when the mold is in casting position, providing a connection from the feeder to each cavity to supply metal through the sides of the cavities, and supplying molten metal to the feeder connections and cavities.

3. That improvement in the method of simultaneously casting a plurality of internal combustion engine pistons which comprises the steps of forming a plurality of piston casting cavities in a mold with the axes horizontal and the head forming ends of the cavities facing each other, and conducting molten metal to the cavities in a path part of which is vertical and extends downwardly between and past the head ends of the cavities and in heat transfer relation therewith and a part of which is horizontal and supplies metal to the sides of the cavities.

4. That improvement in the method of simultaneously casting a plurality of internal combustion engine pistons which comprises forming in a mold a pluraltiy of piston casting cavities with their axes horizontal and the head-forming ends thereof facing each other and the skirt-forming cavities extending away from each other, forming in the mold a feeder which extends downwardly between and past said ends in heat transfer relation therewith, providing connections from said feeder to said head ends and to said skirt-forming cavities, and supplying molten metal to said feeder for passage through said connections to said cavities.

5. That improvement in the method of simultaneously casting a plurality of internal combustion engine pistons which comprises forming in a mold a plurality of piston casting cavities with their axes horizontal and the head-forming ends thereof facing each other and the skirt-forming cavities extending away from each other, forming in the mold a feeder which extends downwardly between and past said ends in heat transfer relation therewith, providing connections from said feeder to said head ends and to said skirt-forming cavities, forming a riser in said mold lengthwise of each of said skirt-forming cavities, and supplying molten metal to said feeder for passage through said connections to said cavities, with the excess of such metal flowing upwardly into said risers.

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