

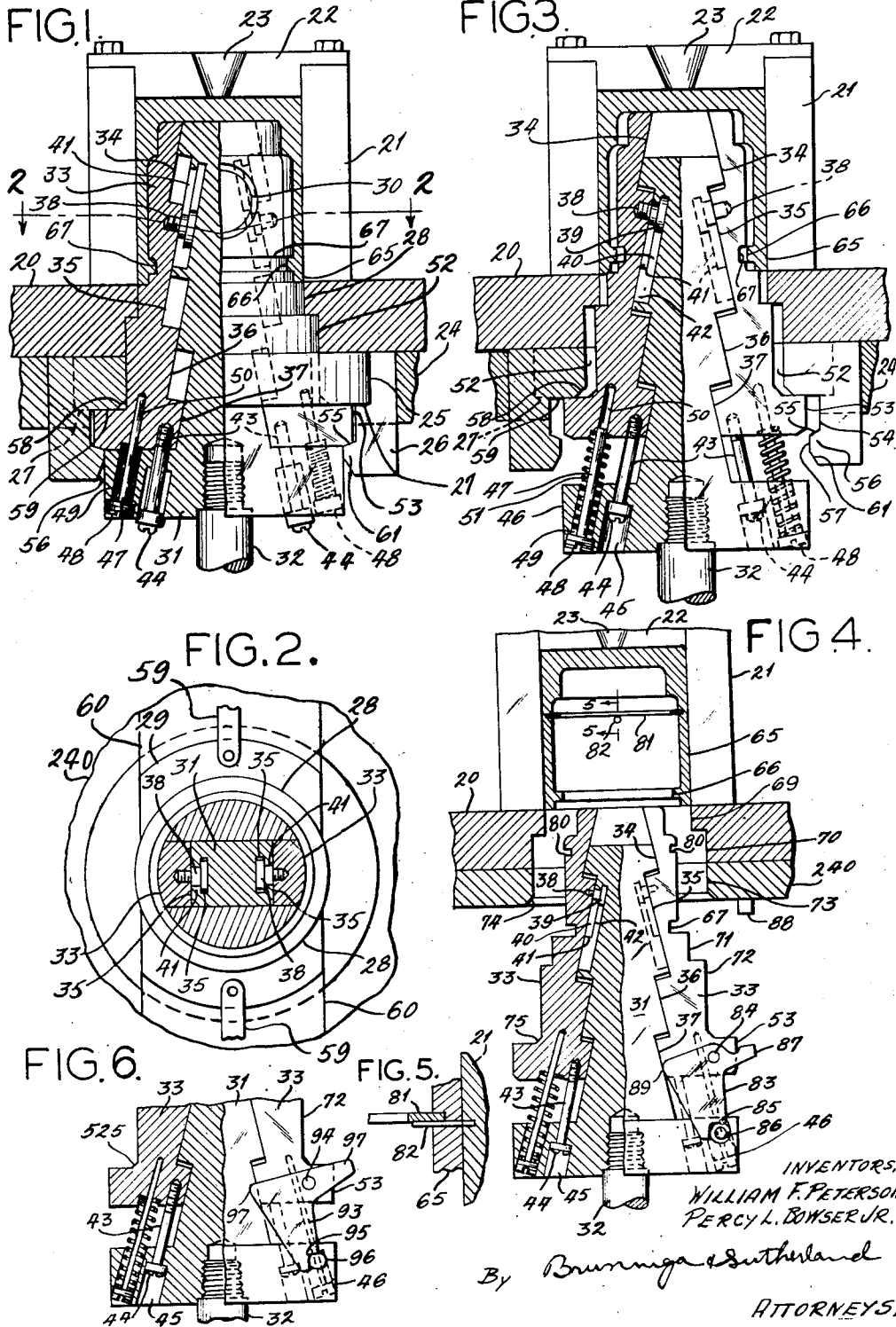
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PISTON MOLDING MACHINE

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PISTON MOLDING MACHINE

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This invention relates to apparatus for molding aluminum pistons having cores.

Some pistons are provided with inserts, such as rings of a lower coefficient of expansion than aluminum, viz., steel, for controlling the expansion of the piston; examples of such pistons are disclosed in Patent Nos. 2,737,426, 2,737,427, and 2,737,428, issued March 6, 1956, whose applications were copending with this application. In the pistons of the patents the rings are incorporated in the castings and they project beyond the inside surface of the piston along one or both thrust faces. Such rings are, therefore, positioned in the mold cavity to project into the mold cavity between the mold and the core for incorporation in the piston casting. The core, particularly the middle core, must be movable into and out of the mold, but must be constructed in such a manner so as to be collapsible when moved into the mold to clear the ring, but expansible when in the mold to complete the cavity for casting of the piston metal therein. Upon completion of the casting, the middle core must again be collapsed to clear the ring.

In Patent Nos. 2,676,371 and 2,676,372, issued April 27, 1954, the cores are particularly designed to clear a projection on the inside of the piston casting. The middle core is a sectional core, comprising sections which are movable together and which are movable relatively, together with means cooperating with the sections adapted upon relative longitudinal movement of those sections in one direction to collapse the sections laterally, and adapted upon relative longitudinal movement of the sections in the opposite direction to expand the sections laterally. In the core of Patent No. 2,676,372, springs are provided to move the sections relatively to collapsed position.

In Patent No. 2,676,372, the springs do not provide means for positively holding the sections when collapsed, against expanding during the movement of the sections into the mold. As noted, it is necessary that the sections remain collapsed until they are fully moved into the mold, otherwise the outside sections are liable to strike the insert or ring. That problem was not involved in casting the piston of Patent Nos. 2,676,371 and 2,676,372, because after casting and removal of the piston, the inside of the mold has no inward projection as in the case of an insert or ring.

One of the objects of this invention, therefore, is to provide a piston molding machine, in which an insert or ring is positioned in the mold to project into the mold cavity, and in which the core is so constructed as to clear the ring when the core is moved into the mold and which will again clear the ring when the core is moved out of the mold after completion of the casting.

Another object of this invention is to provide a collapsible and expansible core of the type described in the above patents in which the sections are positively held in collapsed condition until the core has moved fully into the mold.

In accordance with this invention, means are provided for retaining the middle core collapsed during

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movement into the mold in order to clear the ring, for permitting expansion of the middle core when in the mold, and for again permitting collapse of the core after completion of the casting to release it from the casting and the ring incorporated therein. Upon completion of the casting the side cores cooperating with the middle core move into the space vacated by the middle core to permit the piston casting to be picked off after opening of the mold, and these side cores are then moved out to receive the middle core.

Further objects will appear from the detail description taken in connection with the accompanying drawing, in which will be set forth illustrative embodiments of this invention. It is understood, however, that this invention is susceptible of various embodiments within the scope of the appended claims.

In the embodiments of this invention, the core is generally of the structure disclosed in Patent No. 2,676,372, although this invention may be applied to a core of Patent No. 2,676,371.

In the drawings, the embodiment shown is of the general structure of Patent No. 2,676,372, of which Figures 1, 2 and 3 correspond to Figures 1, 2 and 3 of the patent, namely:

Figure 1 is an elevation partly in section showing the core parts in extended or expanded position;

Figure 2 is a section on the line 2—2 of Figure 1; but in accordance with this invention.

Figure 3 is a view similar to Figure 1, but showing the core parts collapsed.

Figure 4 is a view similar to Figure 3, in which the middle core has been withdrawn from the mold and showing the improvement embodying this invention;

Figure 5 is a detail of Figure 4, showing the placement of the steel insert in the mold; and,

Figure 6 is a view similar to Figure 4, but showing another embodiment of this invention.

Referring to the accompanying, it will only be necessary to refer to the following parts because otherwise the parts are numbered as in Patent No. 2,676,372. Referring to Figures 2, 4 and 5, 20 designates a base plate of the frame of a molding machine, providing a support for a pair of mold halves 21, each having one-half of a top part 22 forming a gate 23; Figure 4 only shows one-half of a set of a pair of molds divided along the plane of the sheet. The mold halves 21 are arranged to slide on the support 20 (Figures 2 and 4 towards and from the observer) so as to open and close the mold, and such sliding can be accomplished by suitable mechanism (not shown). In this application the parts 24, 25, 26, 27, 52, 54, 55, 56, 59 and 61, in Figures 1 and 3, are omitted and below the plate 20 is a plate 240, Figure 4. A pair of side sections 28 of a core, Figure 2, have extensions 29 mounted on the subbase 240 so as to slide thereon in guides 60 (up and down, Figure 2) and they are connected by links 59 to suitable mechanism. The side sections 28 have recesses 30 as in Figure 1, to form wrist pin bosses, and each mold half may have a core to form holes in the bosses for the wrist pin. The structure in that respect is generally as shown and described in Patent No. 1,952,199, Figures 6 and 7, which shows mechanism for moving the mold halves and for moving the side sections of the core. That patent also discloses a middle core between the side core sections to complete the core structure, this core being moved down so as to permit the side sections to move into the space vacated by the middle section. That middle core is also operated by mechanism as shown in that patent, a part of which is here shown as a rod 32.

In accordance with the illustrative embodiment of this invention, as in Patent No. 2,676,372, the middle section of the core is of a special construction in order to enable

it to be collapsed and extended laterally. However, the core is recessed, as shown at 80, Fig. 4, to receive the laterally extending ring 81, and also recessed at 67 to form the laterally extending ledge 66 as in the patent. It will be understood, of course, that where such a laterally extending part is only at one face of the piston only the core portion forming that part need be provided and retracted. If, however, there are parts at opposite faces of the piston walls, then both sides of the piston will be provided with portions forming those parts. This middle core section can now be moved down below the side sections in order to enable them to move into the space vacated by the middle section. This middle core section may be of various forms, but a particular embodiment will now be described.

Referring again to Figures 2 and 4, the middle core section comprises an inner section 31 having a screw threaded connection with a rod 32 as in Patent No. 1,952,199. Lateral sections 33 engage the middle section for relative sliding movement. The inner engaging faces of the sections are inclined towards the center of the middle section, but the incline is in the form of a series of stepped inclines 34, 35, 36 and 37 which are arranged in series and in each of which the inclination is abrupt with reference to the center line of the middle section. The inner and outer sections are held in assembled relation by any suitable means constructed to permit such relative movement. As shown, each lateral section is provided with a screw 38 having a head 39 moving in a slot 40 having the same inclination as the faces 35 and provided with shoulders 41 terminating below the lower end of the shoulder in order to provide an opening 42 somewhat larger than the head 39. This construction is such that when a lateral section is placed against the middle section, the head 39 may be slipped into the recess part 42 and thereafter be moved under the shoulder 41. A screw 43 is threaded into each lateral section and has a head 44 in the bore 45 in the lateral part 46 of the middle section. A pin 47 has a threaded slotted head 48 threaded into a bore 49 in each extension 46. This pin extends into a bore 50 in each lateral section and there is a spring 51 between the head 48 and each lateral section. By the construction just described, the sections of the middle core will not only be held in assembled relation, but they can be adjusted relatively and held to any desired tension by adjustment of the heads 44 and 48.

As in Figure 4, and as in Patent No. 2,676,372, the plate 20 has a recess 69 to receive the parts 71 of the lateral sections 33 and a recess 70 to receive the parts 72 of the lateral sections. However, the plate 240 is also recessed at 73 to receive the parts 72. The lateral parts 53 of the sections 33 here abut against the plate 240 and this plate has inclines 74 to guide the parts 72 into the recess 73, the junction of the parts 53 and 72 being formed as shown at 75.

As shown in Figure 4, a steel insert 81 of any standard structure, viz., as in Patent No. 2,737,427, is designed to be cast in the skirt of the piston 65. In order to position such an insert, a pin 82 is provided on each mold half 21 and on which the insert 81 is then laid as is usual in casting such an insert in the piston. The core is provided with recesses 80 which may extend partially or entirely around the core, depending upon the nature of the insert and its relation to the piston itself. After casting the mold halves 21 are moved apart, withdrawing the pin from the casting. As in Patent No. 2,676,372, the inside piston wall may be provided with an inward extension 66, generally annular in shape, and which is formed by an annular recess 67 in the core and which may extend entirely around the core. In Patent No. 2,676,372, springs 51 are relied on to collapse the sections of the middle core and hold them in collapsed condition. While such a construction is operative, particularly to form the ledge 66 on the casting, which is ab-

sent when the piston is removed from the mold, it is not as reliable as desired, particularly where as noted above, the mold is provided with means for supporting a steel insert which must be cleared by the middle core before it is extended. Of course, when the middle core is withdrawn from the mold, as shown in Figure 4, the side cores 28 are moved together so that they will also clear the insert. However, after the insert 80 is in place, the side cores are moved apart and the middle core is moved in between these side cores and then expanded.

In order to provide means for positively holding and interlocking the sections of the middle core collapsed before they are moved into the mold, this improvement provides means as follows: Referring first to Figure 4, 83 designates an element in the form of a plate or detent which is pivoted at 84 on the side extension 53 of one of the side sections 33, and this element is provided with a shoulder 85 or stud engaging with a pin or roller 86 on the extension 46 of the middle section 31. The element 83 is provided with an extension 87 adapted to engage a stop pin or lug 88 on the base part 240. The plate has an extension 89 to the left, Figure 4, of the pivot 84 so as to provide a counterweight in order to move the plate counterclockwise on its pivot.

In the embodiment shown in Figure 6, the structure is generally similar to that shown in Figure 4, that is, an element 93 or detent pivoted at 94 on the extension 53 of a side section 33 has a shoulder 95 engaging a pin or stud 96 on the extension 46 of the middle core, and this element also has an extension 97 which is arranged to engage a stop pin like 88 on the base 240 as shown in Figure 4. The plate has an extension 97 to the left, Figure 5, of the pivot 94 so as to provide a counterweight in order to move the plate counterclockwise on its pivot.

The operation of expanding and contracting the middle core is accomplished generally in the same manner as in Patent No. 2,676,372; that is, the stepped inclines 34, 35, 36 and 37 form complementary cooperating meshing cam elements on the inter-engaging sections and spaced therealong; and these cam elements project laterally to the extents corresponding to the extent of the inward projections of the steel insert 81, and where employed to the extent of the inward projection of the ledge 66.

In the construction heretofore described, as in Patent No. 2,676,372, the side sections 28 are constructed to clear the casting, irrespective of the form of the casting part extending circumferentially and radially of the inside of the piston skirt, and irrespective of whether the core portion or portions forming such part or parts extend into the side cores. That is because not only will the side cores move away from the casting into the space vacated by the inner and lateral core sections, but the chords on the inside of the side cores are shorter than the diameter of the casting, even inside of an insert, an insert ring or ledge.

Referring to Figure 4, this shows the steel insert 81 in the mold supported by pins 82 on the mold section 21 and the middle core with its sections is shown as described down below the mold and collapsed sidewise; at this time the element 83 will positively and non-yieldingly interlock the sections of the middle core in collapsed condition. At this time the side cores 28 will have been moved out as shown in Figure 2, the circumferential groove in the side cores taking over the insert 81. The middle core is now moved up into the space vacated by the side cores so that the grooves 80 will be in positions opposite the insert 81. This movement of the sections 31 and 33 continues until the extensions 53 of the sections 33 engage the bottom of the plate 240. At the end of the movement of the side sections, the extension 87 of the element 83 will engage the stop 88 so as to move the element to release the roller 86. The center section of the middle section 31 will thereafter move upwardly so as to expand the side sections 33 of the middle core

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causing the grooves 80 in the side sections to take over the insert 81; and during this movement, the springs 51 will compress and be placed under tension. The mold is now in position where the piston metal can be poured into the mold to form the casting. After the casting has solidified, the rod 32 will be moved down and during that movement the springs 51 will cooperate with the interengaging part of the sections of the middle core to contract the middle core until the grooves 80 move out of engagement with the insert, and where there is a ledge 66 to move the grooves 67 out of engagement therewith, so as to entirely free the center core from the inside of the piston. The entire center core can then move down to the position shown in Figure 4, and at the end of that movement the shoulders 85 of the counter-weighted element 83 will move clockwise so as to cause the shoulder 85 to snap over the roller 86. The side cores 28 can then be moved into the space vacated by the center core so as to also release them from the piston and the insert 81 and the extension 66 therein so that the mold can then be opened and the piston picked off. The operation of the Figure 6 embodiment is similar to that shown in Figure 4.

It will, therefore, be seen that in accordance with this invention, non-yielding means is provided for positively interlocking or holding the sections of the middle core when collapsed against expanding during a predetermined movement, and thereafter to permit the sections to expand. More specifically stated, non-yielding means is provided for positively interlocking or holding the sections of the middle core when collapsed, against expanding until the sections are repositioned vertically in the mold; the sections being, however, freed by release of the interlocking means to permit the sections to move longitudinally relatively to expand the sections. When the core is positioned to receive the ring; and upon completion of the casting, the sections are first contracted to release them from the ring 81 and from the ledge 67 and the core is then withdrawn downwardly from the casting. In accordance with this invention, therefore, the construction is such that damage to the ledge, the insert and to the core parts is avoided.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In an apparatus for molding aluminum trunk pistons, comprising, a mold shaped to the exterior of the piston, a core shaped to the interior of the piston and forming with said mold a cavity for the piston casting, means for positioning in the mold cavity, a ring of a lower coefficient of expansion than aluminum for incorporation in the casting and for controlling the expansion of the piston, so as to project into the mold cavity beyond the inside surface of the casting along one or both thrust faces, the outside of said core being recessed in the thrust face region to receive the ring so projecting, said core embodying a series of sections in the thrust face region, which are laterally collapsible to clear the ring and which are laterally expansible to receive the ring, means for moving said sections into and out of said mold, and means interlocking said sections collapsed during their movement into said mold in order to clear the ring.

2. In an apparatus for molding aluminum trunk pistons, comprising, a mold shaped to the exterior of the piston, a core shaped to the interior of the piston and forming with said mold a cavity for the piston casting, means for positioning in the mold cavity, a ring of a lower coefficient of expansion than aluminum for incorporation in the casting and for controlling the expansion of the piston, so as to project into the mold cavity beyond the inside surface of the casting along one or both thrust faces, the outside of said core being recessed in the thrust face region to receive the ring so projecting, said core embodying a series of sections in the thrust face re-

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gion, which are laterally collapsible to clear the ring and which are laterally expansible to receive the ring, means for moving said sections into and out of said mold, means interlocking said sections collapsed during their movement into said mold in order to clear the ring, and means for unlocking said sections for expansion when they are positioned in the mold to receive the ring.

3. In an apparatus for molding aluminum trunk pistons, comprising, a mold shaped to the exterior of the piston, a core shaped to the interior of the piston and forming with said mold a cavity for the piston casting, means for positioning in the mold cavity, a ring of a lower coefficient of expansion than aluminum for incorporation in the casting and for controlling the expansion of the piston, so as to project into the mold cavity beyond the inside surface of the casting along one or both thrust faces, the outside of said core being recessed in the thrust face region to receive the ring so projecting, said core embodying a middle core in the thrust face region and consisting of a series of sections which are relatively movable longitudinally, means cooperating with said sections adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal movement of said sections in the opposite direction to expand said sections laterally, means for moving said core into and out of said mold, and means for locking said sections against expanding during their movement into the mold in order to clear the ring.

4. In an apparatus for molding aluminum trunk pistons, comprising, a mold shaped to the exterior of the piston, a core shaped to the interior of the piston and forming with said mold a cavity for the piston casting, means for positioning in the mold cavity, a ring of a lower coefficient of expansion than aluminum for incorporation in the casting and for controlling the expansion of the piston, so as to project into the mold cavity beyond the inside surface of the casting along one or both thrust faces, the outside of said core being recessed in the thrust face region to receive the ring so projecting, said core embodying a middle core in the thrust face region and consisting of a series of sections which are relatively movable longitudinally, means cooperating with said sections adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal of said sections in the opposite direction to expand said sections laterally, means for moving said core into and out of said mold, means for locking said sections against expanding during their movement into the mold in order to clear the ring, and means for unlocking said sections and for expanding the same when they are positioned in the mold to receive the ring.

5. A piston molding core, comprising, a section, another section mounted thereon and movable relative thereto, means cooperating with said sections adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal movement of said sections in the opposite direction to expand said sections laterally and non-yielding means for positively interlocking said sections when collapsed against expanding.

6. A piston molding core, comprising, a section, another section mounted thereon and movable relative thereto, means cooperating with said sections adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal movement of said sections in the opposite direction to expand said sections laterally, and non-yielding means for positively interlocking said sections when collapsed against expanding, said non-yielding means being releasable to permit said sections to expand upon their relative movement.

7. A piston molding core, comprising, a middle sec-

tion, side sections mounted on said middle section and movable relative thereto, means cooperating with said sections adapted upon movement of said middle section in one direction longitudinally of said side sections to collapse said side sections laterally and adapted upon movement of said middle sections in the opposite direction longitudinally of said side sections to expand said side sections laterally, and non-yielding means for positively interlocking said sections when collapsed against expanding.

8. A piston molding core, comprising a middle section, side sections mounted on said middle section and movable relative thereto, means cooperating with said sections adapted upon movement of said middle section in one direction longitudinally of said side sections to collapse said side sections laterally and adapted upon movement of said middle section in the opposite direction longitudinally of said side sections to expand said side sections laterally, and non-yielding means for positively interlocking said sections when collapsed against expanding, said non-yielding means being releasable to permit said sections to expand upon their relative movement.

9. A piston molding core, comprising, a section, another section mounted thereon and movable relative thereto, the engaging faces of said sections having cooperating meshing cam elements, adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal movement of said sections in the opposite direction to expand said sections laterally, and a detent mounted on one section and engageable with the other section for positively interlocking said sections when collapsed, said detent being movable to unlock said sections to permit said sections to expand upon their relative movement.

10. In an apparatus for molding pistons and having a mold shaped to the exterior of the piston, a core shaped to the interior of the piston, comprising, a section, another section mounted thereon and movable relative thereto, means cooperating with said sections adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal movement of said sections in the opposite direction to expand said sections laterally, means for moving said sections when collapsed collectively out of the mold and of the piston therein and for again moving said sections collectively into the mold, and non-yielding means for positively interlocking said sections when collapsed against expanding until said sections are repositioned in the mold.

11. In an apparatus for molding pistons and having a mold shaped to the exterior of the piston, a core shaped to the interior of the piston, comprising, a middle section, side sections mounted on said middle section and movable

relative thereto, means cooperating with said sections adapted upon movement of said middle section in one direction longitudinally of said side sections to collapse said side sections laterally and adapted upon movement of said middle section in the opposite direction longitudinally of said side sections to expand said side sections laterally, means for moving said sections when collapsed collectively out of the mold and the piston therein and for again moving said sections collectively into the mold, and non-yielding means for positively interlocking said sections when collapsed against expanding until said sections are repositioned in the mold.

12. In an apparatus for molding pistons and having a mold shaped to the exterior of the piston, a core shaped to the interior of the piston, comprising, a section, another section mounted thereon and movable relative thereto, means cooperating with said sections adapted upon relative longitudinal movement of said sections in one direction to collapse said sections laterally and adapted upon relative longitudinal movement of said sections in the opposite direction to expand said sections laterally, means for moving said sections when collapsed collectively out of the mold and of the piston therein and for again moving said sections collectively into the mold, and an element connecting said sections for positively holding said sections when collapsed against expanding, said element engaging a part connected with the mold adapted to free said element so as to permit said sections to move longitudinally relatively to expand said sections.

13. In an apparatus for molding pistons and having a mold shaped to the exterior of the piston, a core shaped to the interior of the piston, comprising, a middle section, side sections mounted on said middle section and movable relative thereto, means cooperating with said sections adapted upon movement of said middle section in one direction longitudinally of said side sections to collapse said side sections laterally and adapted upon movement of said middle section in the opposite direction longitudinally of said side sections to expand said side sections laterally, means for moving said sections when collapsed collectively out of the mold and the piston therein and for again moving said sections collectively into the mold, and an element connecting said middle section with one of said side sections for positively holding said sections when collapsed against expanding, said element engaging a part connected with the mold adapted to free said element so as to permit said middle section to move longitudinally relative said side sections to expand said sections.

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