March 19, 1946. P. E. FLOWERS 2,396,778

CORE CONTROLLING DEVICE FOR CASTING

Filed April 9, 1942

Fig. 2.

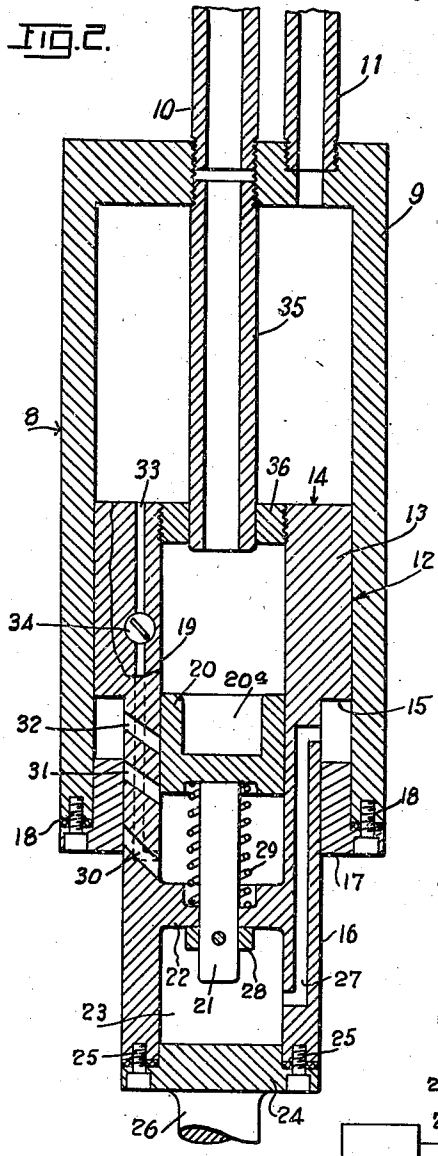



Fig. 3.

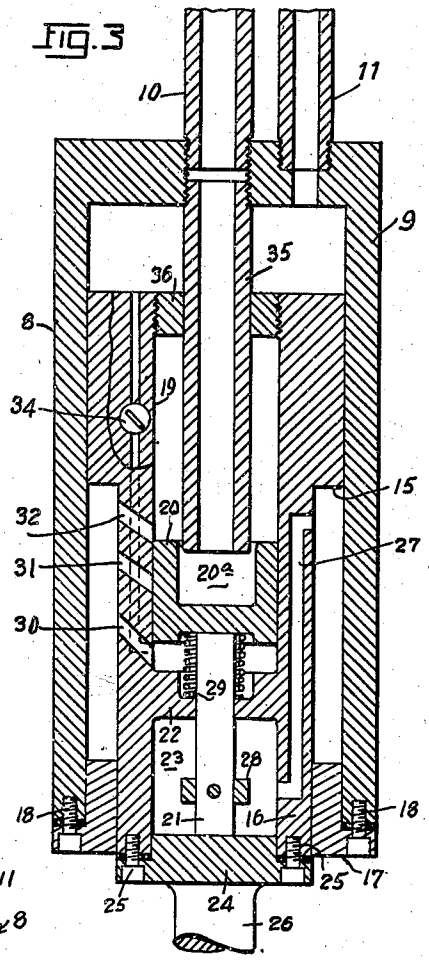
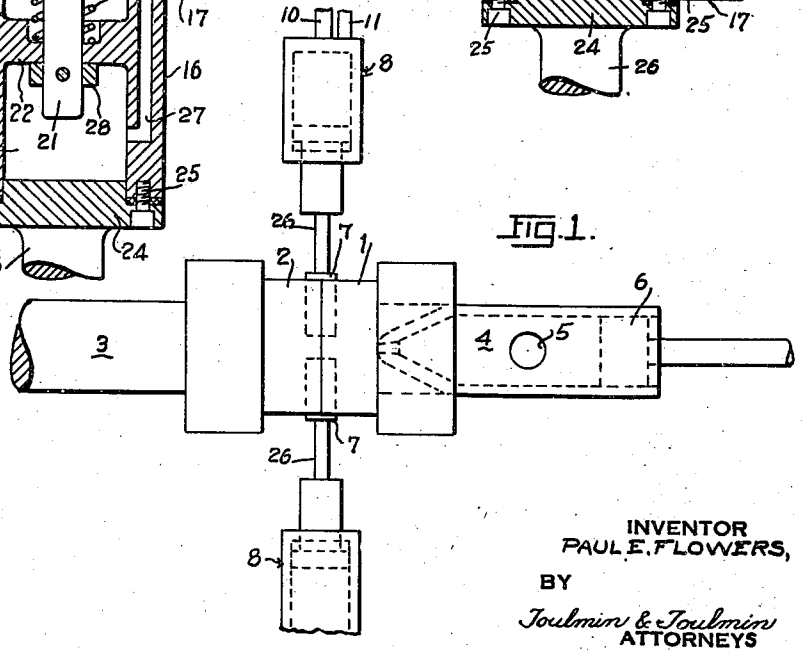



Fig. 1.




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## CORE CONTROLLING DEVICE FOR CASTING

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16 Claims. (Cl. 22—93)

This invention relates to casting and, in particular, to means for handling cores used for die casting.

The cores used in connection with casting operations performed on die casting machines are generally of solid material and employed for the casting of an indefinite number of work pieces. To this end means have been provided which insert a core into the mold of an injection machine and hold the core in its inserted position during the injection or casting operation.

After completion of the casting operation, the core is removed from the cast article and used for another casting operation.

Since, as is well known, the cast or injected metal freezes itself to the core, considerable power is required to crack the core loose from the cast article. To have this power available, core controlling devices as heretofore known are over-dimensioned, i. e., have a plunger of unduly large diameter, thereby materially impeding the operation of the casting machine itself and the handling of the core.

It is, therefore, an object of this invention to provide an improved core controlling device for use in connection with casting machines, which will overcome the above mentioned drawback.

It is another object of the invention to provide an improved core controlling device for casting machines, which is of a relatively small size but still has adequate power to withdraw the core or cores from a cast article.

Another object of the invention consists in the provision of a core controlling device which comprises means for automatically intensifying the pressure of the device when cracking the core or cores loose from the cast article, whereupon the pressure is automatically reduced to complete the withdrawal of the core from the finished article.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, in which:

Figure 1 diagrammatically indicates a core controlling device according to the invention in connection with a die casting machine.

Figure 2 is a section through the core controlling device itself, showing the device in a position which it occupies when the core handled thereby is fully inserted in the mold.

Figure 3 is a section similar to that of Figure 2, but showing the device in a position which it occupies at the end of a withdrawal of the core from the mold.

*General arrangement*

The core controlling device according to the invention comprises substantially a main plunger with an advancing area and a smaller retraction area, and furthermore comprises an intensifier cylinder-piston-assembly which becomes effective automatically at the initial phase of the withdrawal of a core from the mold and furnishes intensified pressure to the retraction area of the main plunger.

When the core has actually been cracked loose from the cast work piece, the intensifying action of the intensifier cylinder-piston-assembly automatically ceases and the core is withdrawn under the normal pressure acting on the retraction area of the main plunger.

*Structural arrangement*

Referring now to the drawings in detail, the arrangement shown in Figure 1 comprises a stationary mold half 1 and a movable mold half 2 pressed against the stationary mold half by a clamping ram 3. The stationary mold half 1 has rigidly connected thereto an injection cylinder 4 into which metal is fed through the opening 5, and from which the material is injected into the mold half 1 by means of the injection plunger 6.

In order to produce a casting with cavities therein, cores 7 are inserted into the mold halves 1 and 2 by means of core controlling devices, generally designated 8.

Figures 2 and 3, showing a section through the core controlling device, comprise a main cylinder 9 having connected thereto two pipe lines 10 and 11 which, in their turn, are alternately connected with a pressure fluid source and an exhaust, not shown in the drawing.

Reciprocably mounted in the main cylinder 9 is a main plunger, generally designated 12, and comprising a piston 13 with an advancing area 14 and a retraction area 15. Connected to the piston 13 is a piston rod 16 passing through the closure member 17 at the bottom of the main cylinder 9. The closure member 17 is connected to the main cylinder 9 in any convenient manner, for instance by screws 18.

The piston 13 comprises a cylinder 19 extending into the piston rod 16 and having reciprocably mounted therein a piston 20. The piston 20 has connected thereto an intensifier plunger 21 passing through the bottom 22 of the cylinder 19 into an intensifier cylinder 23, which latter is provided in the lower portion of the piston rod 16 and is closed by a closure member 24. The closure member 24 is connected to the piston rod 16 in any

convenient manner, for instance by screws 25. Connected to the closure member 24 is a rod 26 carrying the core 7.

The intensifier cylinder 23 is connected by a passageway 27 with the retraction area 15 of the main piston 13. The intensifier plunger 21 has connected to the lower end thereof a collar 28 adapted to abut the bottom 22 to thereby limit the upward movement of the piston 20. Arranged intermediate the piston 20 and bottom 22 and engaged thereby is a spring 29 surrounding the intensifier plunger 21.

The piston rod 16 is also provided with three inclined passageways 30, 31 and 32 adapted, at certain times, to establish fluid connection between the cylinder 19 and the retraction area 15. The plunger 21 also comprises a passageway 33 leading from the advancing area 14 of the main piston 13 to the lower portion of the cylinder 19 and including a check valve 34 opening in the direction from the lower portion of the cylinder 19 to the advancing area 14. The upper end of the cylinder 19 communicates through a conduit 35 with the conduit 10. The conduit 35 passes through and is slidable in a closure member 36 threaded into the main piston 13. The outer diameter of the conduit 35 is less than the diameter of the recess 20a in the piston 20 so that fluid from the recess 20a may pass into the upper portion of the cylinder 19 even when the conduit 35 extends into the recess 20a.

*Operation*

It may be assumed that the mold halves 1 and 2 have been closed and that a core is to be inserted into the mold halves 1 and 2. It may further be assumed that the core controlling device occupies the position shown in Figure 3 with the exception that the piston 20 is in its upper position in which the spring 29 is expanded. To insert the core 7 into the mold halves 1 and 2, the operator connects the pipe line 11 with a pressure fluid source and the pipe line 10 with an exhaust. Fluid pressure then passes through pipe line 11 and acts upon the advancing area 14 of the main piston 13 so as to move the main plunger 12 downwardly. The fluid expelled from the lower portion of the main cylinder 9, during the downward movement of the main plunger 12, passes through the passageway 31, the lower portion of the cylinder 19, the passageway 33 and check valve 34 into the upper portion of the main cylinder 9, where it likewise acts upon the advancing area 14 of the piston 13.

When the core 7 has been advanced to the desired extent, it engages an abutment and the main plunger 12 comes to a halt. The core controlling device then occupies the position of Figure 2 in which the passageway 31 has just been closed by the closure member 17. The main plunger 12 is then held under a predetermined pressure while the injection plunger is advanced to perform the injection operation.

When the casting operation has been completed and it is desired to withdraw the core 7 from the cast article, the operator reverses the connection of the fluid source and exhaust with the pipe lines 11 and 10 so that now pressure fluid is admitted through the pipe line 10, while fluid is exhausted through pipe line 11. In this way pressure fluid enters the recess 20a and from there flows into the upper portion of the cylinder 19. As soon as pressure builds up in the upper portion of the cylinder 19, the piston 20 moves downwardly against the thrust of the spring 29 so that the intensifier plunger 21 moves toward the closure member 24 for the cylinder 23. This causes increased pressure in the cylinder 23, which pressure is conveyed through the passageway 27 to the retraction area 15, thereby initiating the retraction stroke of the main plunger 12, rod 26 and core 7 connected thereto. In other words, an increased or intensified pressure acts upon the retraction area of the main plunger 12 for cracking the core 7 loose from the cast article.

Fluid pressure expelled from the lower portion of the piston 19, during the downward movement of the piston 20, passes through the passageway 33 and check valve 34 into the upper portion of the main cylinder 9 from where it escapes through the pipe line 11.

When the piston 20 has moved downwardly to such an extent that it releases the passageway 32, the core 7 has actually been cracked loose from the cast article, and now pressure fluid conveyed through conduits 10 and 35 will flow from the upper portion of the cylinder 19 through the passageway 32 directly to the retraction area 15 and complete the retraction or withdrawal of the core from the mold halves 1 and 2 at a reduced pressure while the intensifier is ineffective. When the core 7 is fully withdrawn, the core controlling device occupies the position shown in Figure 3. In this position the spring 29 is compressed and stays compressed as long as pressure prevails in the upper portion of the cylinder 19.

As soon as, for the initiation of a new working cycle of the plunger 12, the conduit 10 is connected with an exhaust and the conduit 11 with a pressure fluid source, the spring 29 pushes the piston 20 upwardly and the space beneath the piston 20 is filled by fluid passing from the lower portion of the cylinder 9 through the inclined passageway 30 into the lower portion of the cylinder 19, while fluid also passes from the lower portion of the cylinder 9 through the passageway 27 into the cylinder 23.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a main cylinder, a hollow main plunger reciprocable in said cylinder and having an advancing area and a retraction area, an intensifier plunger reciprocable in said main plunger for exerting intensified fluid pressure on one of said areas to move said main plunger, means for conveying fluid pressure to said intensifier plunger for moving the same in said main plunger, and means responsive to a predetermined movement of said intensifier plunger simultaneously to interrupt the intensifying action of the latter to permit the further supply of fluid pressure to said one area to continue the movement of said main plunger.

2. In combination, a main cylinder, a hollow main plunger reciprocable in said main cylinder and having an advancing area and a retraction area, an intensifier reciprocable in said main plunger and having an advancing area for advancing said intensifier and an intensifying area for displacing fluid at an intensified pressure to one of said areas to move said main plunger, means for supplying pressure fluid to the advancing area of said intensifier for actuating the same, and means responsive to a predetermined movement of said intensifier for directly conveying pressure fluid from the advancing area of said intensifier to said one area of said main plunger.

3. In combination, a main cylinder, a hollow main plunger reciprocable in said cylinder and having associated therewith fluid operable advancing and retracting means for reciprocating said plunger, an intensifier reciprocable in said main plunger, fluid operable means associated with said intensifier for advancing said intensifier independently of said main plunger, means responsive to an advancing movement of said intensifier for creating increased fluid pressure and conveying the same to said retracting means for actuating said plunger, and means controlled by said intensifier and adapted in response to a predetermined travel of said intensifier during the advancing movement of the latter to establish fluid connection between said fluid operable means and said retracting means for subjecting said retracting means to a reduced pressure.

4. In combination, a main cylinder, a hollow main plunger having an advancing area and a retraction area, an intensifier reciprocable in said main plunger and having a main area and an intensifying area, means for supplying pressure fluid to said main area to advance said intensifier, means responsive to the advancement of said intensifier for creating an intensified fluid pressure, means for conveying the same from said intensifying area to one of said areas of said main plunger for actuating the same, and means responsive to a predetermined advancement of said intensifier for establishing direct fluid communication between said main area and said one area of said main plunger.

5. In combination, a main cylinder, a hollow main plunger reciprocable in said main cylinder and having an advancing area and a retraction area, an intensifier reciprocable in said main plunger and having a main area for advancing said intensifier area for creating an intensified fluid pressure on said retraction area to thereby retract said main plunger, means for conveying pressure fluid from said intensifying area to said retraction area, and means responsive to a predetermined advancement of said intensifier for establishing direct fluid communication between said main area and said retraction area.

6. In combination, a main cylinder, a hollow main plunger having an advancing area and a retraction area, an intensifier having a main area for advancing said intensifier and an intensifying area for supplying fluid at an intensified pressure to said retraction area, conduit means continuously establishing fluid connection between said intensifying area and said retraction area, and means controlled by said intensifier and responsive to a predetermined movement of the latter for establishing direct fluid connection between said main area and said retraction area.

7. In combination, a main cylinder, a hollow main plunger having an advancing area and a retraction area and being reciprocable in said main cylinder, a first auxiliary cylinder in said main plunger, a second auxiliary cylinder in said main plunger, an auxiliary plunger reciprocable in said main cylinder, means for supplying pressure fluid to said first auxiliary cylinder to actuate said main plunger, an intensifier connected to said auxiliary plunger and operable thereby to create intensified pressure in said second auxiliary cylinder, means for conveying fluid from said second auxiliary cylinder to said retraction area to initiate a retraction stroke of said main plunger, and means responsive to a predetermined relative movement of said auxiliary plunger and said main plunger for establishing direct fluid connection between said first auxiliary cylinder and said retraction area to continue movement of said main plunger at a reduced pressure.

8. In combination, a main cylinder, a hollow main plunger reciprocable in said main cylinder, said main plunger having an advancing area and a retraction area, an intensifier reciprocable in said main plunger and operable to supply fluid at an intensified pressure to said retraction area to initiate a retraction stroke of said main plunger, means responsive to a predetermined relative movement of said intensifier and said main plunger for conveying pressure fluid to said retraction area while simultaneously making said intensifier ineffective, means for supplying pressure fluid to said advancing area to advance said main plunger, and means responsive to a predetermined advancing movement of said main plunger for returning said intensifier to its initial position.

9. In combination, a main cylinder, a hollow main plunger reciprocable in said main cylinder, a fluid operable intensifier reciprocable in said main plunger, means for advancing said intensifier to cause the latter to supply fluid at an intensified pressure to said main plunger to initiate movement of the latter in a predetermined direction, means responsive to a predetermined movement of the intensifier relative to said main plunger during the movement of the latter in said predetermined direction for bringing about a reduction in the pressure exerted on said main plunger, means for reversing the movement of said main plunger, and yielding means responsive to said reversal of said main plunger for returning said intensifier to its initial position.

10. In combination, a main cylinder, a main plunger having an advancing area and a retraction area and being reciprocable in said main cylinder, said plunger also comprising an actuating chamber and an intensifying chamber, an auxiliary piston reciprocable in said actuating chamber, an intensifier connected to said piston and reciprocable in said intensifying chamber for creating intensified pressure, means continuously effecting hydraulic connection between said intensifying chamber and said retraction area, first conduit means for connecting one side of said auxiliary piston with a pressure fluid source to actuate said intensifier, second conduit means for connecting the opposite side of said auxiliary piston with an exhaust, and third conduit means controlled by said auxiliary piston and responsive to a predetermined advancing movement of the latter to establish direct fluid connection between said retraction area and said first conduit means.

11. In a core controlling device for casting machines, a reciprocable control member, a core supported by said control member, said control member being movable selectively in a first direction for inserting said core into said mold or in a second direction for withdrawing said core from a cast article, an intensifier reciprocable within said reciprocable member for exerting intensified pressure on said reciprocable member to initiate a withdrawal movement of said core, and means responsive to a predetermined withdrawal movement of said core for continuing the withdrawal movement of the latter while making said intensifier ineffective.

12. In a core controlling device for casting machines, a hollow reciprocable member, fluid operable means associated with said member for reciprocating the same, a core supported by said

reciprocable member and movable by the latter selectively in a first direction to be inserted into a mold, or in a second direction to be withdrawn from a cast article in said mold, fluid operable intensifying means reciprocable within said reciprocable member for creating intensified pressure, means for conveying said intensified pressure to said reciprocable member to initiate movement of the latter in said second direction, and means responsive to a predetermined withdrawal movement of said core for making said intensifying means ineffective, while causing continuation of movement of said reciprocable member at a reduced pressure in said second direction.

13. In an apparatus for releasing a device that is tightly wedged in one position during the cycle of operation thereof that includes a main cylinder, a hollow main plunger reciprocable therein and having an advancing area and a retraction area, an intensifier plunger reciprocable within said hollow plunger and having an advancing area and an intensifying area associated therewith, conduit means continuously establishing fluid connection between said intensifying area and said retraction area, and means controlled by said intensifier responsive to a predetermined advancing movement of the latter for establishing direct fluid connection between said intensifier advancing area and said main plunger retraction area.

14. In an apparatus for reciprocating a member from one position to a second position and releasing said member from one of said positions in which it is wedged that includes, a cylinder, a hollow main plunger reciprocable within said cylinder and having associated therewith fluid operable advancing and retracting means for reciprocating said plunger, a differential plunger reciprocable in said main plunger, means for introducing fluid pressure to a larger area of said differential plunger for advancing the same independently of said main plunger, means associated with the smaller area of said differential plunger for creating a supply of fluid at increased pressure in response to the advancing movement thereof, and conduit means for conveying said increased pressure to said retracting means for actuating said plunger.

15. In an apparatus for reciprocating a member from one position to a second position and releasing said member from one of said positions in which it is wedged that includes, a cylinder, a hollow main plunger reciprocable within said cylinder and having associated therewith fluid operable advancing and retracting means for reciprocating said plunger, a differential plunger reciprocable in said main plunger, means for introducing fluid pressure to the larger area of said differential plunger for advancing the same independently of said main plunger, means associated with the smaller area of said differential plunger for creating a supply of fluid at increased pressure in response to the advancing movement thereof, conduit means for conveying said increased pressure to said retracting means for actuating said plunger, and means controlled by said differential plunger and adapted in response to a predetermined travel of said plunger during the advancing movement thereof to establish fluid connection between said larger area and said retracting means for actuating said retracting means at a reduced pressure.

16. In an apparatus for reciprocating a work member to and from working position and for releasing said member from said working position that include sa cylinder, a main plunger reciprocable within said cylinder and having advancing and retracting means associated therewith, said main plunger having therein a first cavity and a second cavity, a differential plunger reciprocable in said cavities and having the larger portion thereof disposed in said first cavity and the smaller portion thereof disposed in said second cavity, conduit means for introducing pressure fluid into said first cavity for advancing said differential plunger whereby to create an increased or intensified pressure in said second cavity in response to the movement of said smaller portion of said plunger, conduit means interconnecting said second cavity with said main plunger retracting means, and other conduit means adapted in response to a predetermined advancing movement of said differential plunger to connect said retracting means with said first cavity.

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