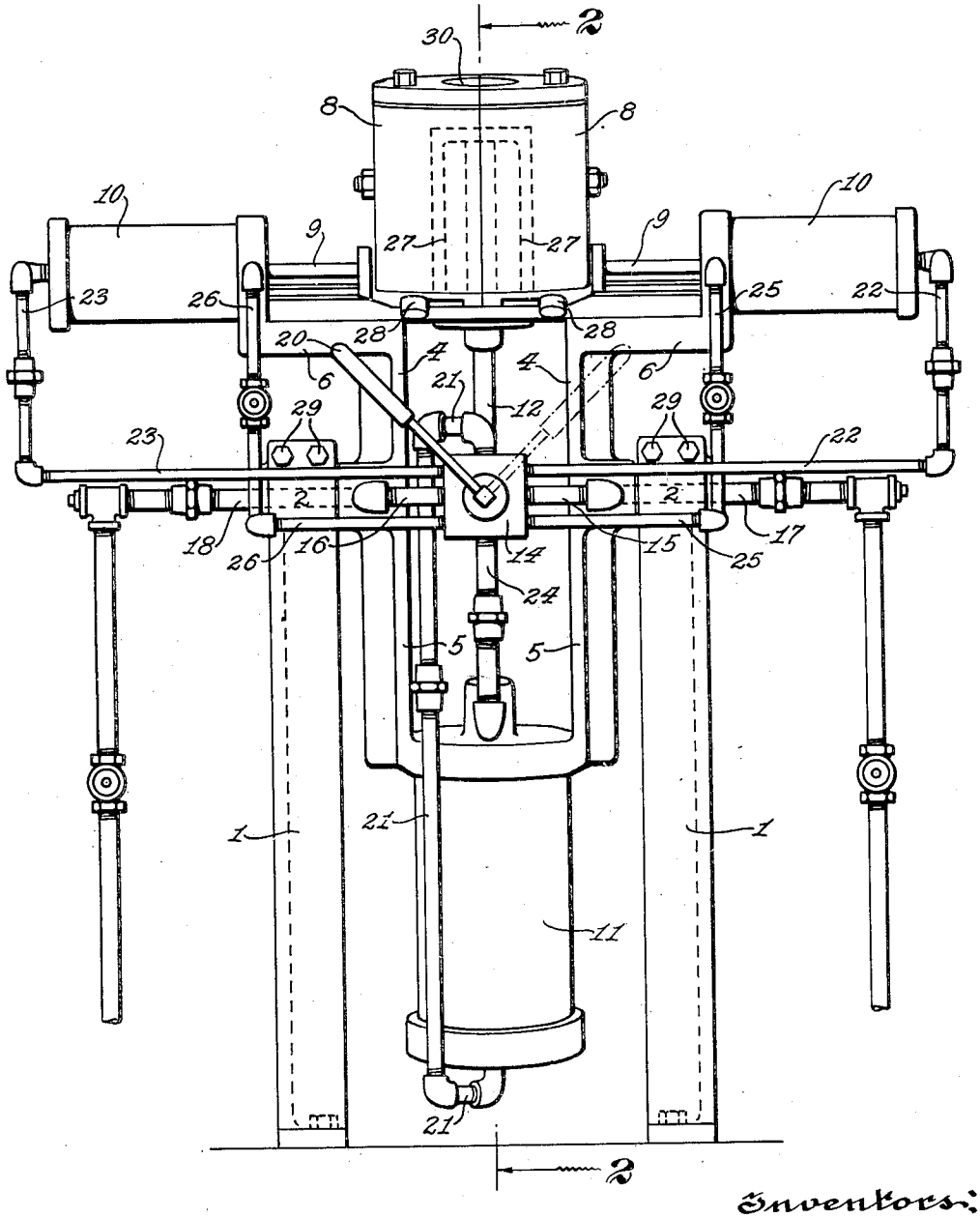
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APPARATUS FOR CASTING IN PERMANENT MOLDS

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Fig. 1.




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Fig. 2.

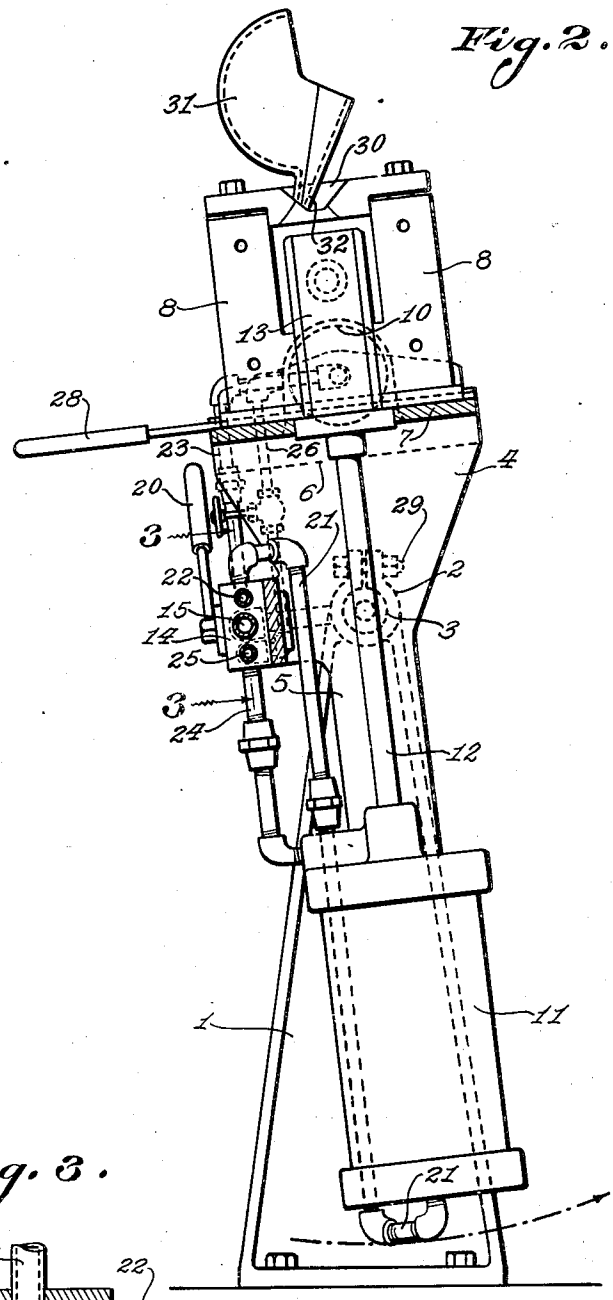
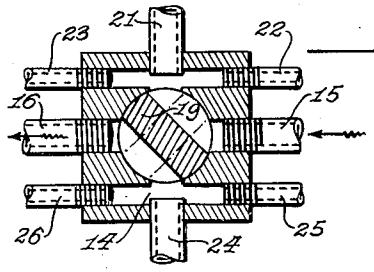



Fig. 3.




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## APPARATUS FOR CASTING IN PERMANENT MOLDS

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Application August 12, 1931, Serial No. 556,569

5 Claims. (Cl. 22—152)

This invention pertains to a method and apparatus for casting in permanent molds. More particularly, it pertains to a casting of such metals as aluminum and its alloys which have a large coefficient of thermal expansion so that the contraction of the casting on cooling is considerable.

It has been found that in casting metals of this type success in obtaining good castings depends to a large extent upon the possibility of eliminating entrapped air, and the faults due to so-called crystallization shrinkage. It has also been found that many of these difficulties may be overcome by controlling the manner in which the metal flows into the mold and over the matrix surfaces. In many mold matrices there are surfaces in a substantially horizontal position over which the metal must flow laterally while flowing vertically in adjacent passages. It may occur under these circumstances that both ends of a horizontal passage are closed by the vertical flow before the horizontal passage is completely filled. In such cases air may be entrapped in these horizontal passages and corresponding faults formed in the finished casting.

One of the objects of this invention, therefore, is to provide a method and apparatus which will overcome some of these difficulties.

Another object is to provide a method wherein the matrix surfaces are adjusted to such an inclination that horizontal flow of the metal is minimized.

Another object of this invention is to provide casting apparatus of novel design providing means for such adjustment of the matrix surfaces.

Another object is to provide such apparatus in which power may be applied for manipulating the mold and core parts.

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

Figure 1 is a front view of an apparatus embodying this invention and adapted for carrying out the method thereof;

Figure 2 is a section on line 2—2 of Figure 1; and

Figure 3 is a detail section of the control valve, on line 3—3 of Fig. 2.

Referring to the drawings, 1 designates a support or standard upon which the apparatus may be mounted. This may be provided with suitable bearings 2 adapted to receive trunnions 3 of a frame 4.

The frame 4 may be constructed of cast iron or other suitable material, and has generally a T-shape comprising a longitudinal extension 5 and lateral extensions 6 extending in opposite directions at the top of the extension 5. The extensions 6 are joined by a plate 7 on which are guided for sliding movement a pair of mold sections 8. The sections 8 are connected by piston rods 9 with pistons working in hydraulic cylinders 10 mounted on the frame 4 at the ends of the extensions 6. Mounted at the lower end of the downward extension 5 of the frame 4 is a hydraulic cylinder 11 whose piston rod 12 extends upwardly and carries at its upward end the central section 13 of a three-section core adapted for positioning between the mold sections 8 to furnish a core for the mold matrix.

In the apparatus illustrated the mold is designed for casting trunk pistons and the piston's matrix is located in the mold with the piston head up.

Mounted at the front of the apparatus is a control valve 14. A fluid pressure supply pipe 15 enters one side of the valve 14 and an exhaust pipe 16 leaves the valve on the opposite side. These pipes pass into passages formed in the frame 4 and pass out thru the trunnions thereof. External connections are made to these trunnions by a supply pipe 17 communicating with pipe 15 and connected with a suitable source of pressure supply. The exhaust pipe 16 conducts thru the trunnion to an exhaust pipe 18 which connects the pressure fluid back to a source of supply, not shown, to be re-circulated by a suitable pump or the like.

Within the valve 14 is a suitable vane 19 connected for manipulation by an external handle 20. With the vane 19 in the position shown in full lines in Fig. 3, the pressure pipe 15 is connected to supply pressure fluid to a pipe 21 connected to the lower end of the cylinder 11, and pipes 22 and 23 connected to the outer ends of the cylinders 10. At the same time the exhaust pipe 16 is connected with a pipe 24 leading to the upper end of the cylinder 11, and pipes 25 and 26 leading to the inner ends of the cylinders 10. In the position shown in Fig. 3, therefore, a valve is adjusted to cause the cylinders 10 to force the mold sections 8 together and the cylinder 11 to force its core section 13 upwardly into position within the mold.

By throwing the handle 20 to the position indicated in dotted lines in Fig. 1 the vane 19 may be swung to the position indicated in dotted lines in Fig. 3. This operates to change the connections to the cylinders in such a way as to cause the piston of cylinder 11 to withdraw the core

section 13, and the pistons of cylinders 10 to retract the mold sections 8 laterally so as to free the casting. The other two sections 27 of the core are also slidably mounted on the plate 7 and connected for manipulation by handles 28 so that they may be moved toward each other to collapsed position so as to free them from the interior of the casting.

As will be seen from Fig. 2, the bearings 2 are of the split form provided with clamping studs 29 so that the trunnions 3 may be fixed in position thereby. By loosening the studs 29 the frame 4 with the entire casting apparatus mounted thereon may be adjusted to any desired inclination. Such adjustment may be made so that practically all matrix surfaces are inclined. With the mold thus adjusted to inclined position, the molten metal may be poured into the gate 30 by means of a ladle 31, or other suitable device. This ladle may be provided with a nozzle or spout 32 formed to be insertable into the gate 30 and so as to provide for a quiet flow of metal into the mold matrix. The ladle may be so manipulated that the spout 32 will direct the flow of metal first into the lowermost portion of the mold matrix. The metal then rises quietly in the mold and flows along the angular surfaces easily, and quickly drives the entrapped air ahead of it so that such air may escape before being cut off by other metal. It has been found that each particular casting may require a particular adjustment of the angle of the mold in order to obtain the best results. It has also been found that uniform and solid castings are obtainable by this method and that rejects or spoiled castings are reduced to a minimum.

In the manipulation of the device, the angle having been adjusted the mold is closed as shown in Fig. 1, and the metal is poured from the ladle 31 into the mold in such a manner as to fill the latter quickly but with a quiet flow of metal. As soon as the metal has set the valve 14 is manipulated so as to cause the hydraulic cylinders to withdraw the core sections 13 and open the mold sections 8. This leaves the casting supported by the outer core sections 27. The operator now manipulates the handles 28 by pressing them together thereby collapsing the core section 27 and freeing the casting entirely which may now be removed by a pair of tongs or other suitable means. The handles 28 are then operated to spread the core section 27, and the valve 13 is thrown back to its first position whereupon the cylinders operate to return the core sections 13 and close the mold sections 8 in readiness for a new casting.

It will be noted that this invention provides a novel method of casting wherein a quiet and regular flow of metal is insured which takes place in such a manner that the air in the mold may escape without danger of being entrapped. The inclined position of the mold insures a uniform movement of metal over the matrix surfaces. The mounting of the entire apparatus on trunnions adapted for adjustment to any desired angle and thereby fixed in such adjustment provides for obtaining the best results with each particular type of casting. Whatever the adjustment, the entire mechanism is constant in the relation of its parts to each other, and the manipulation is uniform regardless of the angle of adjustment. The apparatus is compact and simple in construction, and such that it is rugged and capable of rough handling without injury.

While this has been described as a unitary device it will be understood, of course, that individual features or subcombinations thereof may be useful without reference to other features of the combination and the employment of such individual features and subcombinations is contemplated by this invention and within the scope of the appended claims.

It is 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 to be understood, therefore, that this invention is not limited to the specific details shown and/or described.

Having thus described the invention, what is claimed is:

1. Casting apparatus, comprising, a frame having a longitudinal extension and oppositely directed transverse extensions, an openable mold having sections movable on said transverse extension and a movable core element, and fluid-operated means on said extensions connected to move said mold sections and said core element.

2. Casting apparatus, comprising, a frame, a mold having sections mounted for movement on said frame, trunnions on said frame, supporting means adapted to receive said trunnions for adjustment of said frame to inclined position, and means for fixing said frame in adjusted inclined position.

3. Piston casting apparatus, comprising, a support, an openable mold having sections guided for movement on said support, a sectional core for said mold adapted to form the interior of the casting and having a middle section guided for withdrawing movement on said support, and power means for moving said mold sections and said middle core section.

4. Piston casting apparatus, comprising, a support, an openable mold having sections guided for movement on said support, a sectional core for said mold adapted to form the interior of the casting and having a middle section guided for withdrawing movement on said support, and fluid pressure means for moving said mold sections and said middle core section.

5. Piston casting apparatus, comprising, a support, an openable mold having sections guided for movement on said support, a sectional core for said mold adapted to form the interior of the casting and having a middle section guided for withdrawing movement on said support, fluid pressure means for moving said mold sections and said middle core section, a base, and means for adjusting said support on said base to hold said mold in inclined position.

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