

Sept. 27, 1927.

1,643,780

H. S. LEE

AIR COOLING OF PERMANENT MOLDS

Filed Aug. 24, 1925

4 Sheets-Sheet 1

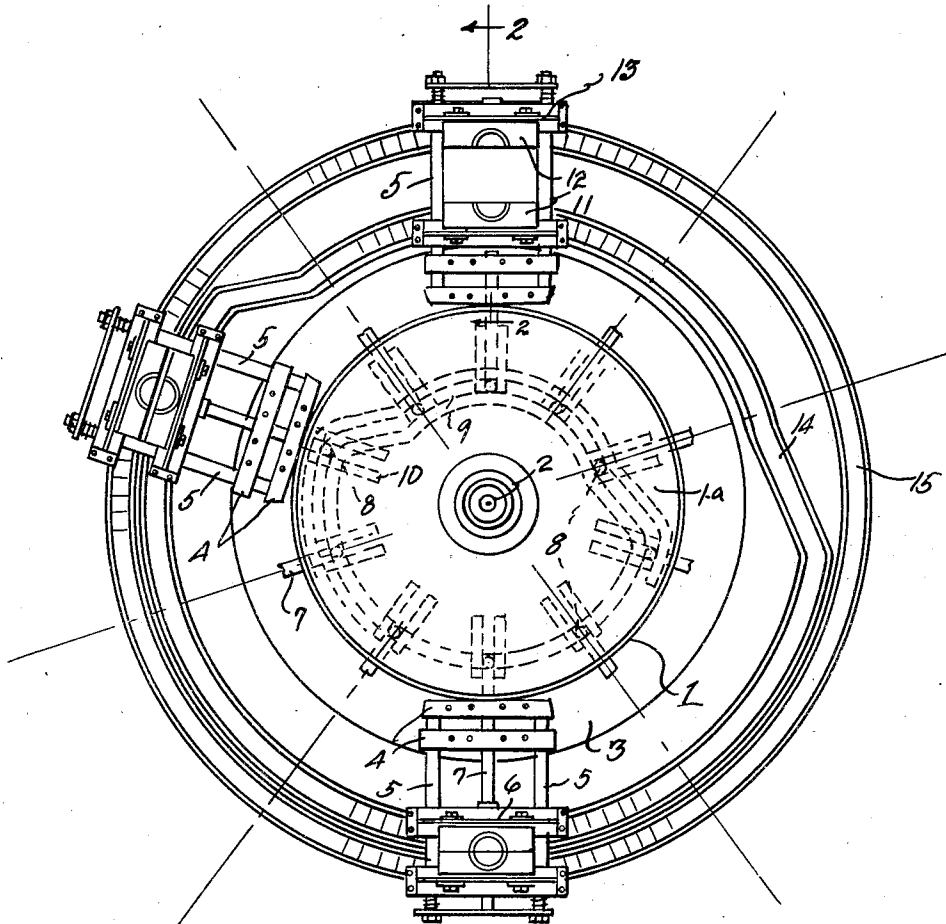


Fig. 1

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4 Sheets-Sheet 2

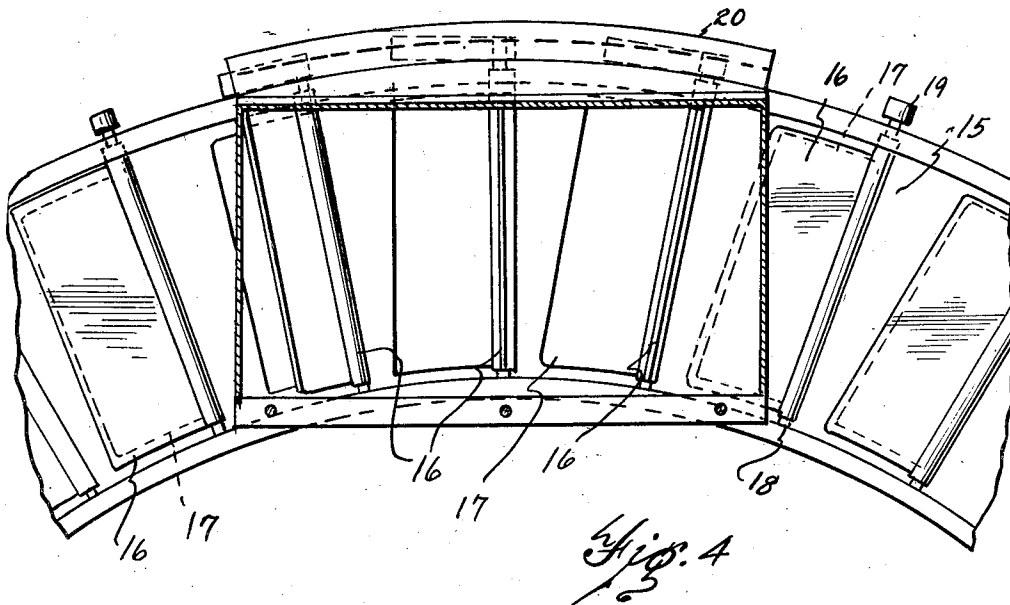
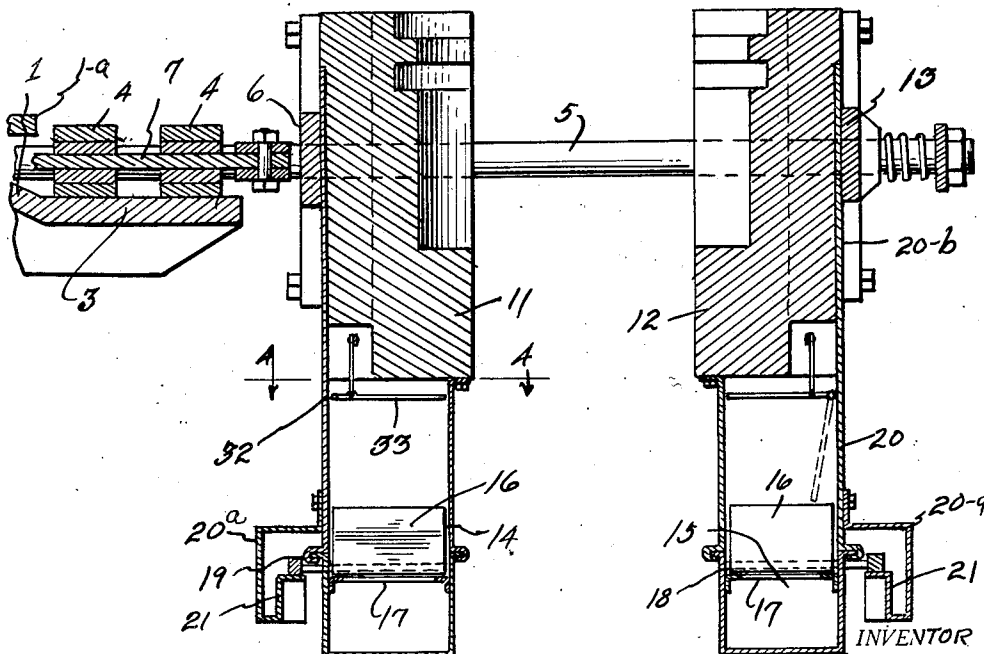


Fig. 2

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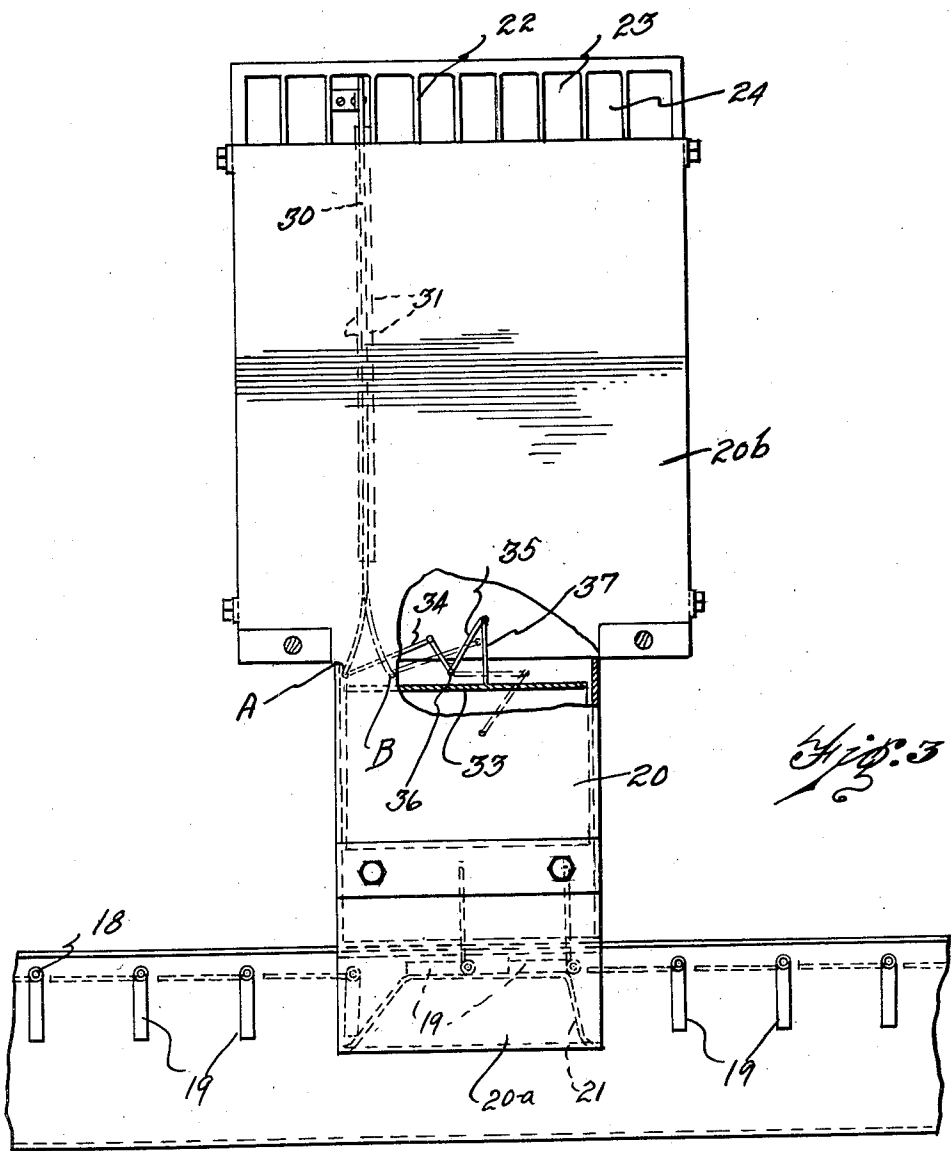
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4 Sheets-Sheet 4

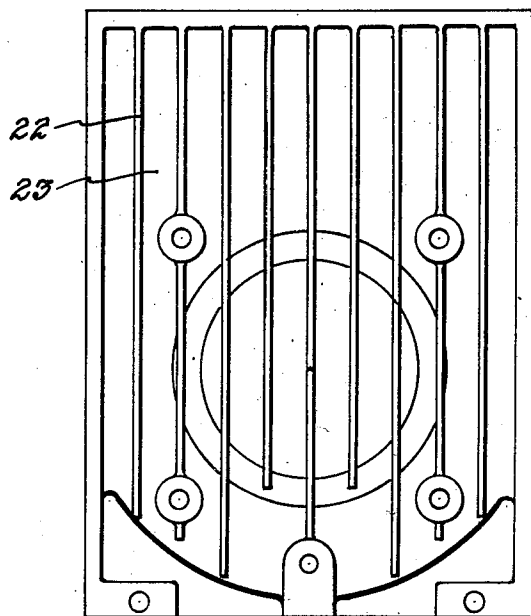


Fig. 5

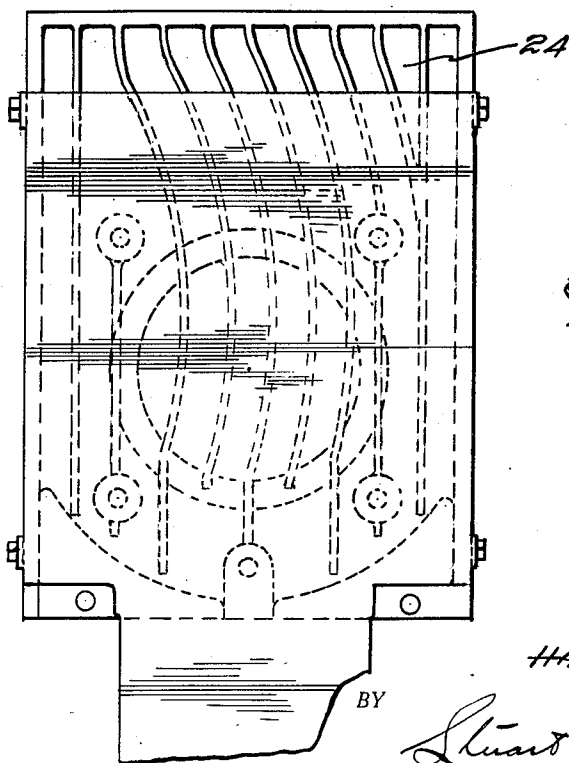


Fig. 6

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UNITED STATES PATENT OFFICE.

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AIR COOLING OF PERMANENT MOLDS.

Application filed August 24, 1925. Serial No. 51,973.

This invention relates to permanent mold apparatus and methods of cooling the molds, and especially for making iron castings in permanent metal molds.

The primary object is to increase the rate of production of castings. This is accomplished by forced cooling of the molds which become heated by the castings, the iron being usually poured at above 2000° F. If iron castings are chilled too rapidly, however, there is a tendency for hard areas to appear in the surface of the castings which greatly interfere with subsequent machining operations.

It is important that the mold be maintained at a constant relatively high temperature so as to prevent the chilling of the casting. At the same time the mold must be prevented from getting too hot and the object of my invention is to remove or carry away the heat from the mold at just the necessary rate to maintain this constant temperature.

A further object is an automatic control which regulates the rate at which the heat is withdrawn so as to maintain the mold at an even or constant temperature.

The above and other objects which will hereinafter appear, are attained by improvements embodying new and useful features as disclosed in this application. To enable others skilled in the art to fully comprehend the essential features of the improvements, drawings illustrating a preferred form have been annexed as a part of this disclosure.

In the drawings:

Fig. 1 is a plan view of the preferred form of apparatus showing a few molds assembled on the machine.

Fig. 2 is a section on the plane indicated by line 2—2 of Fig. 1.

Fig. 3 is an outside front elevation.

Fig. 4 is a plan sectional view taken on the line 4—4 of Fig. 2 and showing the outer air duct and related parts.

Fig. 5 is an elevation of the back of one of the mold sections.

Fig. 6 is an elevation of a modified form of the back of one of the mold sections with different shaped slots and fins.

The apparatus or machine illustrated has a stationary table 1^a and a rotating table 1 mounted to rotate horizontally about a verti-

cal pivot 2. Secured on the depressed outer rim 3 of the rotating table 1 are pairs of bearing blocks 4 which support guide rods 5 on which slide the inner mold section carriers 6. Bearing blocks 4 also serve to guide the sliding center rods 7 which reciprocate the inner mold section carriers in accordance with the action of rollers 8 engaging in the cam race 9 non-rotatably fixed beneath the stationary table 1^a, and between guide blocks 10 secured to the table. Each permanent mold consists of sections 11, 12. Section 12 is fastened on outer mold section carrier 13 secured on the guide rod 5. The mold section 11 is fastened to inner mold section carrier 6 which is mounted to slide on guide rods 5.

Beneath the paths of travel of the mold section carriers are arranged air ducts 14, 15. Duct 15 is circular to correspond with the travel of carrier 13, while duct 14 is parallel to the cam race 9 to correspond with the travel of carrier 6. Extending along the top of ducts 14, 15, are flapper valves 16 normally covering openings 17 in the ducts. Each flapper valve is pivoted at 18 and has a crank arm 19 which by its weight normally tends to hold the valve closed. Depending from the lower portion of each mold section is a housing 20 which is provided with an extension 20^b which is secured to the back of the mold and a casing 20^a having a cam 21 is secured to the housing 20 which lifts the arms 19 to open the flapper valves 16 within the casing. The back of each mold section has slots 23 to provide passages for air between cooling fins 22. The extension or back plate 20^b does not cover the entire back of the mold but stops short of the top so as to provide an air inlet opening 24 through which the air is admitted into the passages 23 between the cooling fins 22.

Each mold is opened and closed at the appointed time by the table rotating and the roller traveling in the cam race. Each casing 20^a depending from its corresponding housing 20 freely passes along one of the ducts and opens valves 16 located within the casing. As each duct is connected with a source of suction, air is sucked through the inlet opening 24 into the passages between the cooling fins 22 for facilitating the dis-

sipation of heat, the air passing down through openings 17 to be carried off through each duct. As soon as the cam 21 passes by a flapper valve, its arm 19 swings down to close the valve to prevent unnecessary leakage of air. The suction also aids to maintain the valves tightly closed.

An important feature of this invention is the automatic control for the cooling of the mold. It is preferable to maintain the face of the mold at about 900° F. Obviously the back of the mold is somewhat cooler than the face of the mold, say for example, the back of the mold has a temperature of approximately 700° when the face of the mold has a temperature of 900°. As more of the cool air is caused to travel down the passageway 23 between the fins on the back of the mold, more heat will be withdrawn from the mold. Secured in one of these passageways 23 on the back of the mold, is a thermal element 30 which is preferably held by suitable guides 31 for the major portion of its length. This thermal element may be of any suitable construction and is preferably formed of two pieces of strip metal, one of which has a greater co-efficient of expanse than the other.

In Fig. 3 I show the two positions of this thermal element and designate the same as A and B. When the temperature reaches the maximum, the thermal element is in the position designated as B and in the position A at the minimum position. Pivoted as at 32 is a valve 33. Fig. 2 shows this valve as closed. To the end of the thermal element is secured a link 34. The other end of said link is secured to a bell crank 35 pivoted at 36. A link 37 connects the other end of the bell crank with the flap valve 33. As the temperature on the back of the mold raises, the thermal element will move from position A towards position B, thereby opening the valve 33 through the link and crank connection above described. The opening of the valve 33 permits additional air to be drawn through the passageway 33 in the back of the mold and consequently removes heat from the mold at a greater rate of speed, thereby lowering the temperature at the back of the mold.

This automatic thermal control obviously can be nicely timed and regulated to maintain the back of the mold at a constant temperature. Of course there might be slight fluctuations, but the temperature is maintained relatively constant.

What I claim is:

1. In a permanent mold apparatus, in combination, a mold having cooling fins, and an adjacent duct for fluid to cause the fluid to flow against the fins.

2. In a permanent mold apparatus, in combination, a mold mounted to travel in a path, and a duct for fluid extending along

the path of travel of the mold and constructed to cause fluid to flow against the mold during travel of the same.

3. In a permanent mold apparatus, in combination, a mold mounted to travel in a path, a duct for fluid extending along the path of travel of the mold and provided with a plurality of valves extending along the duct, and means adapted to open each valve while the mold is adjacent the valve.

4. In a permanent mold apparatus, in combination, a mold mounted to travel in a path, a duct for fluid extending along the path of travel of the mold and provided with a plurality of valves extending along the duct, and means traveling with the mold to open each valve while the mold is adjacent the valve.

5. In a permanent mold apparatus, in combination, a mold mounted to travel in a path, a duct for fluid extending along the path of travel of the mold, a plurality of valves mounted along the face of the duct which is nearest the path of travel of the mold, and means traveling with the mold to open each valve while the mold is adjacent the valve.

6. In a permanent mold apparatus, in combination, a mold mounted to travel in a path, a duct for air or the like extending along the path of travel of the mold, a plurality of valves mounted along the face of the duct which is nearest the path of travel of the mold, said valves opening outwardly away from the duct and a cam traveling with the mold to open each valve while the mold is adjacent the valve.

7. In a permanent mold apparatus, in combination, a two section mold whose sections are mounted to travel together, cam means adapted to cause one of said mold sections to be reciprocated relatively to the other mold section during the travel of the sections, and a duct for fluid extending along the path of travel of each mold section and constructed to cause fluid to flow against the mold sections during the travel of the same.

8. In a permanent mold apparatus, in combination, a two section mold whose sections are mounted to rotate together, cam means adapted to cause one of said mold sections to be reciprocated relatively to the other mold section during the rotation of the sections, and a duct for fluid extending along the path of travel of each mold section and constructed to cause fluid to flow against the mold sections during the travel of the same.

9. In a permanent mold apparatus, in combination, movable molds, and means actuated by the movement of the molds for causing fluid to flow against the molds.

10. The method of casting metal in traveling permanent molds which comprises intermittently introducing metal into the molds and maintaining the walls of the mold rela-

tively cold by introducing a cooling fluid against an external part of the mold while the mold is travelling.

11. In a molding apparatus, a mold, a support therefor, means for moving the mold in a cyclic path to receive molten metal and form the same, and means for causing fluid to flow against the mold throughout its entire cyclic path.

12. In a molding apparatus, a mold, a support therefor, means for moving the mold in a cyclic path to receive molten metal and form the same, a duct for a cooling fluid,

and means for causing the cooling fluid to flow against the mold while the mold is moving in its path. 15

13. The method of casting metal in travelling permanent molds which comprises intermittently introducing metal into the molds and maintaining the molds relatively cold by introducing a cooling fluid against the molds while the said molds are travelling. 20

In testimony whereof I have affixed my signature.

HARRY S. LEE.