May 18, 1926. 1,584,954

H. S. LEE ET AL

CONTROL FOR PERMANENT MOLD DISTORTION

Filed June 23, 1925 2 Sheets-Sheet 1

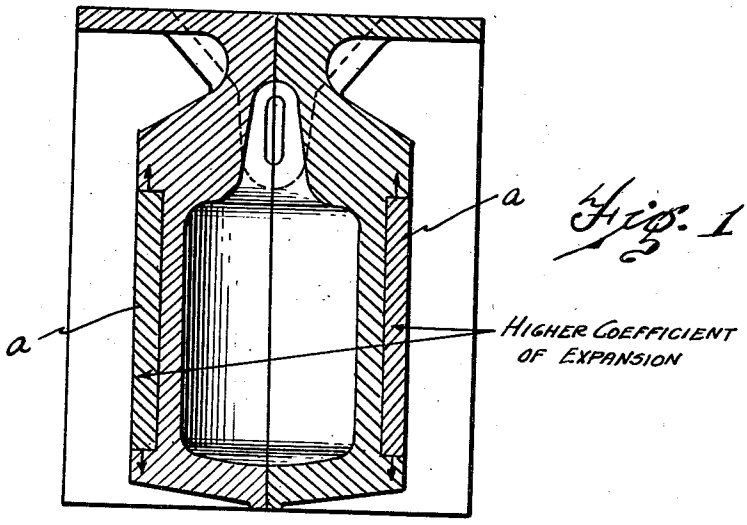


Fig. 1

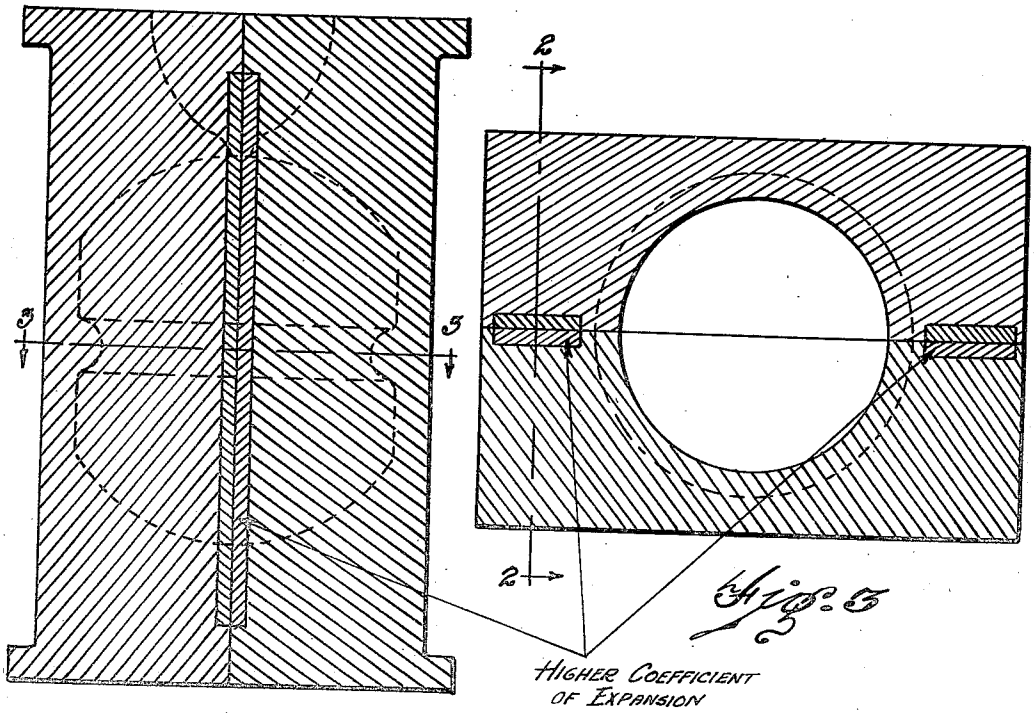


Fig. 3

Fig. 2

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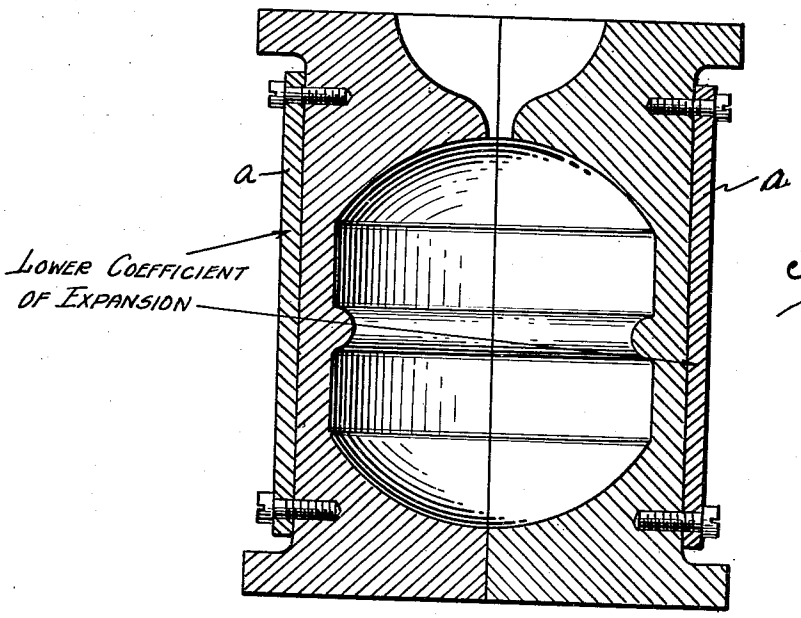


Fig. 4

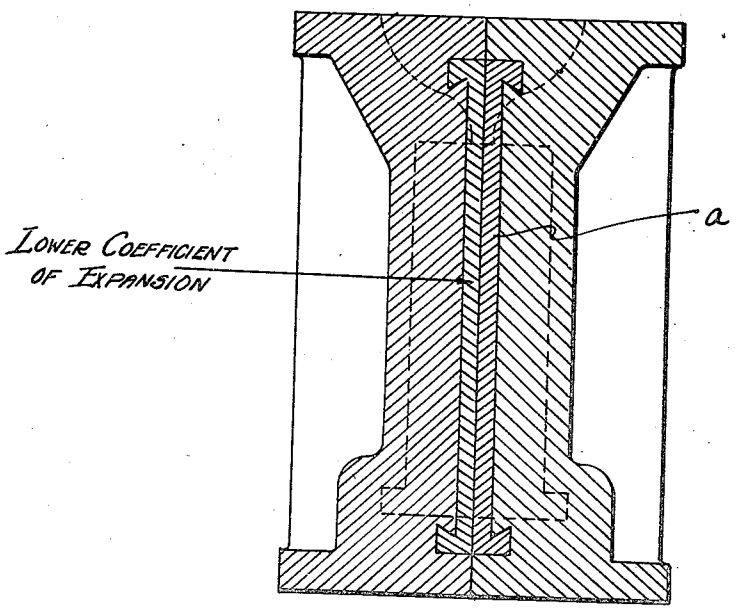


Fig. 5

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UNITED STATES PATENT OFFICE.

HARRY S. LEE AND AMOS E. CHAFFEE, OF PLYMOUTH, MICHIGAN; SAID CHAFFEE ASSIGNOR TO SAID LEE.

CONTROL FOR PERMANENT MOLD DISTORTION.

Application filed June 23, 1925. Serial No. 39,053.

This invention relates to the control of the bowing or warping action that takes place in permanent molds. Permanent molds constructed of iron or other metals obviously become hotter adjacent the mold cavities than in other parts, and consequently there is a tendency for them to distort slightly. The amount of this distortion and the direction of the distortion depends both on the metal used and the design of the mold sections.

In order to get a fairly accurate casting, and also to prevent leakage along the parting line, it is desirable in some way to control this distortion or bowing action. This bowing action is particularly evident in molds where they are relatively long and thin.

In the prior application of Harry S. Lee, Amos E. Chaffee and Fred Millard, Serial No. 10,830, this condition is recognized, and a mechanical design for automatically affording a countervailing pressure is provided. There is also described in this prior application a thermo-responsive element. This is claimed only specifically in connection with the mechanical design which is relied upon chiefly to afford the automatically applied countervailing pressure.

It is the object of the present invention to meet and furnish a solution of this mold distortion in quite a different way. This is accomplished in connection with the present invention by utilization of thermally-responsive elements to afford a countervailing thrust or tension, for the purpose of neutralizing these mold section distortions.

It will be recognized by the foundry man that these distortions will vary in amount and direction, and in accordance with the particular mold section design and the metal of which the same is constructed. Therefore we have given several illustrations of various molds, and have shown several forms of thermally-responsive elements which can be used to neutralize the bowing tendencies. These, however, are by no means all the different forms of molds and distortions that one will meet in foundry practice with permanent molds, nor are they by any means the only way that these distortions forces can be more or less neutralized by the interposition of suitable thermally-responsive elements. They simply illustrate various typical examples which come within the scope of our broad invention.

Referring to the drawings:

Fig. 1 is a cross section of a pair of mold sections where the mold sections tend to bend outwardly.

Fig. 2 is a section through a mold which has heavy ends and thin at the mid portion, where there will likely be a tendency of the mold sections to bow inwardly. This is a section taken on the line 2—2 of Fig. 3.

Fig. 3 is a cross section on the line 3—3 of Fig. 2.

Fig. 4 is a section of another mold where there will be a tendency of the mold sections to bow inwardly, and this is resisted by thermally-responsive tie-strips on the outside of the mold.

Fig. 5 is a section of another mold in which the sections tend to bow outwardly, and where this is resisted by tie-inserts on the inside faces of the mold.

In the form of mold shown in Fig. 1, the mold sections sometimes called the dies, are constructed of metal and are of such a design as experience has shown that there is a tendency to bow slightly outwardly. *a*—*a* designates the inserts on the outside faces of these mold sections. These inserts are of metal having a relatively higher co-efficient of expansion than the metal of which the mold sections are mainly constructed. It will therefore be apparent that when the inside walls of the mold heat up by repeated casting operations they will tend to expand and bow the mold sections outwardly. However, the inserts will also heat up but not to as great a degree as the metal on the inside, but having a relatively greater co-efficient of expansion the insert will expand approximately equally with the metal of the mold. Thus it will be evident that these forces tend to neutralize each other and countervail the bowing action.

We find that vanadium chrome or nickel alloy, and numerous other metals, can be used for the purpose of inserts. The selection of the metal may be readily made as the co-efficient of expansion of well known

metals can be readily learned, and utilized in countervailing what has been observed to be the distortion in any given design of mold section or dies constructed of a given metal. The character of the insert and size of the insert will have to be largely determined after experience has taught one the amount of distortion that is to be met with in a given design of die or mold section.

In some special forms of mold sections or dies, it will probably be found that the tendency of the sections to bow is toward the inside, particularly in certain forms of dies that have relatively thin mid portions and relatively heavy ends. In such a die the countervailing thermally-responsive element may be inserted in the meeting faces of the dies, as shown in Figs. 2 and 3.

In Fig. 4 is shown another use of a thermally-responsive element in neutralizing the distortion strains. In this figure is shown a set of mold sections in which, due to the design and the metal of which they are made, the bowing will be towards the center. To counteract this a different character of thermo-responsive element is employed, namely,—one which has a less co-efficient of expansion and consequently this becomes a tension member or tie member and tends to countervail the bowing action by tension applied to the two ends.

In Fig. 5 the tendency of the dies is to bow outwardly, and here the tension inserts are placed in the meeting faces of the mold and these inserts are of a material having a less co-efficient of expansion, so that it imposes a tension stress on the ends of the mold section, which tends to resist the outward bowing. The same principle is involved in the thermally-responsive elements shown in Figs. 4 and 5, as in those shown in Figs. 1, 2 and 3, except the former are tension members and the latter are pressure members.

What we claim is:

1. A pair of permanent mold sections tending to distort slightly when heating up, and thermally-responsive means for countervailing such distortion by interposing thermally controlled resistance thereto.

2. In a permanent mold, a pair of metal mold sections having a tendency to bow when heated up, and thermally-responsive means for counteracting this bowing tendency by exerting a resistance.

3. In a permanent mold, a pair of metal mold sections having a tendency to distort or bow, and a thermally-responsive element having a relatively different co-efficient of expansion and properly placed to counteract such bowing tendency.

4. In a permanent mold, the combination of a pair of mold sections which tend to bow, and an insert having a different co-efficient of expansion which is calculated for neutralizing the expansion strain set up on the inside of the mold.

5. In a permanent mold, the combination of a pair of metal mold sections having a tendency to bow due to the heating up of the mold cavities, and a thermally-responsive element having a relatively different co-efficient of expansion properly placed on mold sections, depending upon the direction of bowing to countervail this bowing tendency.

6. The method of countervailing the tendency of permanent metal mold sections to distort under heat, which comprises the determination of the direction of the distortion, and then the interposition at the proper place of a thermally-responsive element of relatively different co-efficient of expansion which tends to neutralize such distortion.

In testimony whereof we have affixed our signatures.

HARRY S. LEE.
AMOS E. CHAFFEE.