MULTI-PART MOLD CLAMP

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Filed: June 7, 1974
Appl. No.: 477,534

U.S. Cl. 164/341; 164/60
Int. Cl. B22d 33/04; B22d 25/06
Field of Search 164/60, 137, 341; 249/139, 249/163

References Cited
UNITED STATES PATENTS
3,714,977 2/1973 Terkelsen 164/60
3,752,221 8/1973 Copley et al. 164/338

FOREIGN PATENTS OR APPLICATIONS
3,802,482 4/1974 Phipps 164/71
3,810,504 5/1974 Piwonka 164/60
2,085,254 12/1971 France 164/60

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ABSTRACT
A hold down device for securing one or a plurality of multi-part molds securely in position on a chill plate and at the same time holding the several parts of each multi-part mold in operative position with respect to one another during the casting operation.

6 Claims, 4 Drawing Figures
MULTI-PART MOLD CLAMP

SUMMARY OF THE INVENTION

The casting of conventionally or columnar grained articles especially from high temperature super alloys has previously been done in shell molds which are made around a wax pattern, the latter being melted out during the hardening of the mold. Such molds did not permit an inspection of the surfaces of the article forming cavity in the mold. This problem has been overcome by the preformed or molded multi-part mold of applicant's copending application Ser. No. 416,563 filed Nov. 16, 1973. This application describes a split mold that may have a center spacer and that will permit complete inspection of the inner mold surfaces before the casting operation. Such split molds must be held in assembled relation during the casting process.

According to the present invention the several parts of the mold are held together in proper relation to each other by the same device that serves to hold the mold on the chill plate during the casting process. To this end, the hold-down is a heavy plate that has one or more slots therein, each slot accepting a multi-part mold therein and by engagement with opposite sides of the mold holding the several parts in secure operative position. The same plate, by engaging with the hold-down flanges on the mold parts, position the assembled mold structure securely against the chill plate on which the mold is positioned and which serves to begin the columnar growth in the alloy as solidifies.

The foregoing and other objects, features and advantages of the present invention will become more apparent in the light of the following detailed description of preferred embodiments thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a plurality of molds held on a chill plate by the hold-down plate.

FIG. 2 is a sectional view along line 2—2 of FIG. 1.

FIG. 3 is a sectional view on a larger scale of the mold and slot of FIG. 2.

FIG. 4 is a sectional view on a larger scale of a modified form of mold.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The device 10 is shown being used to hold a plurality of molds 12 in vertical position on a chill plate 14. The device is in the form of a heavy plate and rests on bottom flanges 16 and 18 on the opposed mating parts 20 and 22 of each mold. The parts 20 and 22 are preformed or molded to mate with each other as described in the above-identified application Ser. No. 416,563 and each part has the bottom flange 16 or 18 which rests on the chill plate. The casting cavity of the mold is open to the chill plate and the bottom of the mold as well as the flanges must make a fluid tight connection with the chill plate to prevent leakage of molten alloy. The mold parts 20 and 22 have edge mating flanges 23 and 24, FIG. 3 which serve to hold the mold portions in proper relation to one another.

The device is shown as holding a plurality of these multi-part molds in position so that all the molds may be filled with molten alloy at one time for the simultaneous production of several articles. The part being cast by way of example is a turbine blade that has a root portion formed in the enlarged portion 25 of the mold adjacent the bottom end, with an airfoil portion 26 extending upwardly from the root. The root is substantially rectangular in cross section and thus the mold parts in this root area may have outer flat surfaces 27 for engagement with the opposite walls 28 and 30 of a mold-receiving slot 32 in the plate or device 10. When the assembled mold in the position shown in FIGS. 1 and 2 and located in the slot the mold parts are securely held in assembled relation adjacent the bottom of the mold. The plate 10 has, as shown, a plurality of such slots around the periphery, one for each assembled mold, although it will be understood that such a plate could serve for holding a single mold is desired. The plate 10 rests on the bottom flanges 16 and 18 of the mold and thus hold the open bottom of the mold securely against the chill plate.

Prior to the use of this hold-down plate the one-piece shell molds were held on the chill plate by hold down clamps that tended to concentrate stresses on the mold in the areas of the clamps thus frequently causing cracking of the mold with resultant leakage of the alloy. This plate distributes the hold-down pressure evenly around the periphery of the mold and on the peripheral flanges with much less possibility of mold damage.

Each multi-part mold may be held together at the top as by the filler cup 34 that fits over the top ends of the mold parts. This subject matter is described and claimed in the copending application of Hayes et al., Ser. No. 499,224.

As shown in FIG. 4, the mold may have more than two parts as shown in FIG. 2. In this arrangement there is a central divider 36 between the opposed mold sides 38 and 40. The blade or other article being cast is made in two parts in the cavities 42 and 44, and these two parts are later suitably bonded together in making the finished article. Here as in FIG. 2, the opposed side walls 28' and 30' of the slot 32' in the plate 10 engage flat surfaces 46 and 48 formed for this purpose on the opposed mold sides 38 and 40 in the root portion. Obviously the slot is made of the appropriate width to receive the assembled mold slidably therein. In use, the several assembled molds are positioned in the respective slots in the hold down plate with the plate in engagement with the top surfaces of the peripheral flanges and with the molds resting on the chill plate. In normal use the assembly shown is placed in a vacuum chamber to heat the mold assembly to a temperature above the melting point of the alloy. The molten alloy, with a few hundred degrees of preheat is then poured into the molds and the solidification process is carried out as described in either U.S. Patent No. 3,260,505. to produce the usual columnar grain, or as in Pearcey U.S. Patent No. 3,494,707 which produces a single crystal crystal, a particular type of columnar grain. Such molds are also usable in casting the so-called eutectics as in Gell U.S. Patent No. 3,567,526 which also have a columnar grain structure.

In the arrangement shown the several slots extend radially of the plate since this positions the mold in such a way that the chord of the blade being cast is substantially radial of the assembly. This has been found to be most effective in obtaining the desired cooling of the cast article when a plurality of articles are cast at once. Obviously these slots will be so arranged as to provide
the most effective columnar grain growth in other mold configurations.

Although the invention has been shown and described with respect to a preferred embodiment thereof, it should be understood by those skilled in the art that various changes and omissions in the form and detail thereof may be made therein without departing from the spirit and the scope of the invention.

I claim:

1. The combination with a multi-part, preformed mold for making castings, said mold being in at least two longitudinal parts and having an open end to rest on a chill plate and also having a peripheral flange at said open end, of a plate having at least one slot therein to hold said mold on the chill plate, said slot being dimensioned to receive the multi-part mold therein and to engage opposite sides thereof such that the parts are held in operative assembled relation, said plate resting on and engaging said peripheral flange to hold the latter against the chill plate.

2. The combination as in claim 1 in which the width of the slot is substantially the thickness of the mold at the portion of the mold engaging the slot.

3. The combination as in claim 1 in which the plate has a plurality of slots arranged around the periphery, to support and hold a plurality of assembled molds at one time.

4. The combination as in claim 3 in which plurality of slots are positioned radially of the plate.

5. A plate for holding at least one multi-part mold in casting position on a chill plate, the mold having a plurality of mold parts adapted to be mated together in assembled relation and a peripheral flange on said mold parts at one end, said plate having a slot therein to receive the multi-part mold slidably therein, the slot being substantially equal in width to the thickness of the mold fitting in the slot, the multi-part mold being positioned in the plate with the peripheral flanges against one surface of the plate and with the plate located above and substantially parallel to the chill plate with the peripheral flanges therebetween.

6. A plate as in claim 5 in which the plate has a plurality of radial slots therein, each receiving an assembled multi-part mold for the simultaneous casting of a plurality of articles.