ABSTRACT

An apparatus for casting under pressure wherein the mold parts are connected to relatively telescoping chamber walls, at least one of which can be actuated by a fluid-responsive device, e.g. a hydraulic cylinder, to ensure tight closure of the mold.

3 Claims, 1 Drawing Figure
MACHINE FOR CASTING UNDER PRESSURE

CROSS-REFERENCE TO U.S. PATENTS

Casting utilizing fluid pressure differentials is disclosed in the commonly assigned U.S. Pat. Nos. 3,532,154 and 3,693,698.

FIELD OF THE INVENTION

The present invention relates to an apparatus for casting under pressure and, more particularly, to a system for casting high-volatility metals and other materials, e.g., synthetic resins, and substances which decompose at low pressures and at melting temperatures in a mold under counterpressure.

BACKGROUND OF THE INVENTION

The principle of casting a flowable material, e.g., a molten metal, under a counterpressure has been proposed heretofore in order to reduce the tendency of the flowable substance to volatile or decompose. In such cases, the molten substance is forced into a mold which is vented to a space at superatmospheric pressure. In such systems it has been particularly difficult to maintain the mold in a closed condition.

In known machines of this type, the mold is located in a chamber which should be easily opened and closed for extracting the castings and which must be closed by a force exceeding that generated by the counterpressure against which the metal or other substance is cast in the mold. Usually this increased force cannot be produced by the low-power actuating elements used for opening and closing the chamber and a special locking device may be required for the two parts of the mold. This device must provide a sealing of the mold halves together at their parting surfaces and be capable of absorbing the force generated by a large number of movable mechanically and thermally stressed members. Moreover, strict coordination is required between the action of the locking device and the remaining parts of the machine to avoid the buildup of pressure within the machine before the locking process is completed and to unlock the machine before the pressure has been fully relieved. The reliability and safety of the operation of the machine depends on such coordination. In order to provide such coordination, the complexity of the mechanism has been increased and casting machines have been provided heretofore with automatic elements which inherently increase operations auxiliary to the casting step and increase the duration of each casting cycle to the detriment of productivity of the apparatus.

OBJECTS OF THE INVENTION

It is a general object of the invention to avoid the aforementioned drawbacks and disadvantages of prior art machines and apparatus for casting with gas counterpressure, and to provide a considerable simplification of the design with a concomitant acceleration of the process, increased reliability, and enhanced safety.

It is another object of the invention to provide means for automatically locking a chamber and mold of a casting apparatus for the purposes described so that mechanical locking devices and similar mechanisms for synchronizing their operation are rendered superfluous.

Still another object of the invention is to provide an improved apparatus for the counterpressure casting of molten metals and high-volatility nonmetallic substances which may be thermally decomposable as described in the application and patent mentioned earlier.

Still another object of this invention is to provide an improved apparatus for counterpressure casting which extends the principles of the aforementioned application.

SUMMARY OF THE INVENTION

These objects and others which will become apparent hereinafter are attained, in accordance with the present invention, in a counterpressure casting system in which the compressed gas against the pressure of which the molten substance is forced into the mold, is used in whole or in part for locking the chamber and the mold parts together.

According to an important feature of the invention, the objects set forth above are attained by using a chamber receiving the mold which consists of two generally cylindrical enclosures telescopically movable with respect to one another, one of the enclosures being rigidly connected to the body of the machine while the other may be raised and lowered by an actuating mechanism, preferably together with the other mold half in order simultaneously to permit the closure of the chamber and the mold.

The movable enclosure has a diameter smaller than the diameter of the outer enclosure in which it moves in such manner that the compressed gas delivered to the closed chamber produces of itself the necessary closing force in accordance with the difference between the diameters of the two enclosures. In other words the movable enclosure constitutes a differential piston which is displaced and retained, in part, by the gas pressure within the chamber.

DESCRIPTION OF THE DRAWING

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description reference being made to the accompanying drawing in which the sole FIGURE is a diagrammatic vertical cross-section of a counterpressure casting apparatus according to the invention.

SPECIFIC DESCRIPTION

In the drawing, there is shown a horizontal and movable plate 1 forming an upper support and mounted upon a plurality of posts 10 angularly spaced about the axis A of the machine. Attached rigidly to the upper plate is a hydraulic cylinder 2 whose piston rod 2a is connected to an upper mold half 6 cooperating with a lower mold half 11 mounted upon another stationary plate 12 carried by a cylindrical outer wall 13 forming an enclosure or a mass 14 of thermally insulating material. A chamber 15 within this mass is provided with a pedestal 16 on which is supported a molten metal ladle or crucible 17 containing a bath 18 of the molten material to be cast.

A syphon tube 19, also referred to as a riser, penetrates into the bath toward the base thereof and opens into the lower mold half 11. The mold chamber is defined by a fixed enclosure mounted upon the plate 1 and depending therefrom, while being of generally cylindrical configuration with an inwardly extending frustoconical lip 3a. The latter supports a rubber sealing ring 4 upon which an out-
wardly turned lip 5a of the lower movable enclosure 5
may come to rest. The latter is vertically shiftable in
enclosure 3 and thus is telescopically movable relative
thereto. An inwardly extending flange 5b of the mov-
able enclosure 5 is bolted at 5c to an outwardly extend-
ing flange 6a to the mold which is provided with ver-
tically movable ejector pins 6b adapted to engage stops
1a depending from the plate 1 in a fully elevated posi-
tion of the mold half 6. The flanges 6a and 5b define a
mold compartment 7 which is at a pressure different
from the pressure in the chamber 20 thereabove as will
be apparent hereinafter and is also different from the
pressure in chamber 9 above the bath 18. The movable
enclosure 5, moreover, has an inwardly extending seal-
ing lip 5d adapted to rest upon a rubber sealing ring 8
which, in turn, is seated against a frustoconic 21a of the
upwardly extending stationary apron 21 rising from
plate 12. The portion of the movable enclosure 5 ex-
posed to gas pressure in chamber 20 has a diameter D,
which is in excess of the diameter D1 of the portion of
the movable enclosure in chamber 7. Pressure may be
supplied by a compressor represented generally at 22
to chamber 20 via a valve 23, to chamber 7 via a valve
24 and to chamber 9 via a valve 25.
In operation, the piston rod 2a may be elevated to
raise the mold half 6 and enclosure 5 until ejectors 6b
release the previous workpiece, the lowered end of en-
closure 5 being lifted from the apron 21 to allow re-
moval of this cast body. When the mold is then closed
by reverse operation of the cylinder, chamber 7 and
chamber 9 may be pressurized with gas at a differential
such that the molten material from bath 18 is driven
upwardly through the tube 19 into the mold. Because
of the differential piston effect, the pressure in cham-
ber 7 which exceeds ambient pressure acts to retain the
mold in its locked position without any additional
means. This pressure may be increased by allowing the
pressure in chamber 20 to equal that in chamber 7 or
applying a higher pressure in chamber 20. After the
mold has been filled, the cycle is repeated and the pres-
sure relieved, e.g. through an venting valve 26.
We claim:
1. An apparatus for casting under counter pressure
comprising a mold having at least one movable mold
part; means communicating with said mold for supply-
ing a molten substance thereto; means forming a mold
chamber communicating with said mold and a further
chamber adapted to sustain a gas pressure above said
substance; means for differentially pressurizing said
chambers to drive said substance into said mold; and an
actuating mechanism for opening and closing said mold
and connected to said movable mold member, said
mold chamber comprising two telescopically movable
enclosures including a stationary enclosure and a mov-
able enclosure, said movable enclosure having effective
piston surfaces of different diameters at its opposite
ends and exposed to the pressures in said chambers to
constitute a differential piston retaining said mold
chamber closed upon differential pressurization of said
chambers, said movable mold member being con-
ected to said movable enclosure and displaceable
therewith.
2. The apparatus defined in claim 1, further compris-
ing a stationary horizontal support disposed above said
mold, said actuating mechanism being mounted on said
support and including a hydraulic cylinder and piston
arrangement connected to said movable mold member,
said stationary enclosure being fixed to and depending
from said support, said movable enclosure being tele-
scopically received in said stationary enclosure, said
mold comprising a lower stationary mold half fixed
with respect to said support, and an upper movable
mold half connected to said movable enclosure, said
means for supplying said substance to said mold includ-
ing a riser tube depending from said stationary mold
half and a vessel containing a bath of said substance be-
neath said mold, said riser tube extending into said bath
in said vessel, said means for pressurizing said cham-
bers including a source of compressed gas, a chamber
receiving said vessel and connected to said source and
valve means between said source, said mold chamber
and said chamber receiving said vessel.
3. The apparatus defined in claim 2, further compris-
ing a rubber sealing ring between said enclosures.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,788,790 Dated 29 January 1974

Inventor(s) Anguel Tonchev BALEVSKY et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading, line 73 read the Assignee's name as:

-- INSTITUT PO METALOZNAIE I TECHNOLOGIA NA METALITE,
Sofia, Bulgaria -- .

Signed and sealed this 3rd day of September 1974.

(SEAL)
Attest:

McCoy M. Gibson, Jr. C. Marshall Dann
Attesting Officer Commissioner of Patents