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PORTABLE SELF-CONTAINED PRESSURIZED AIR DEVICE FOR CASTING

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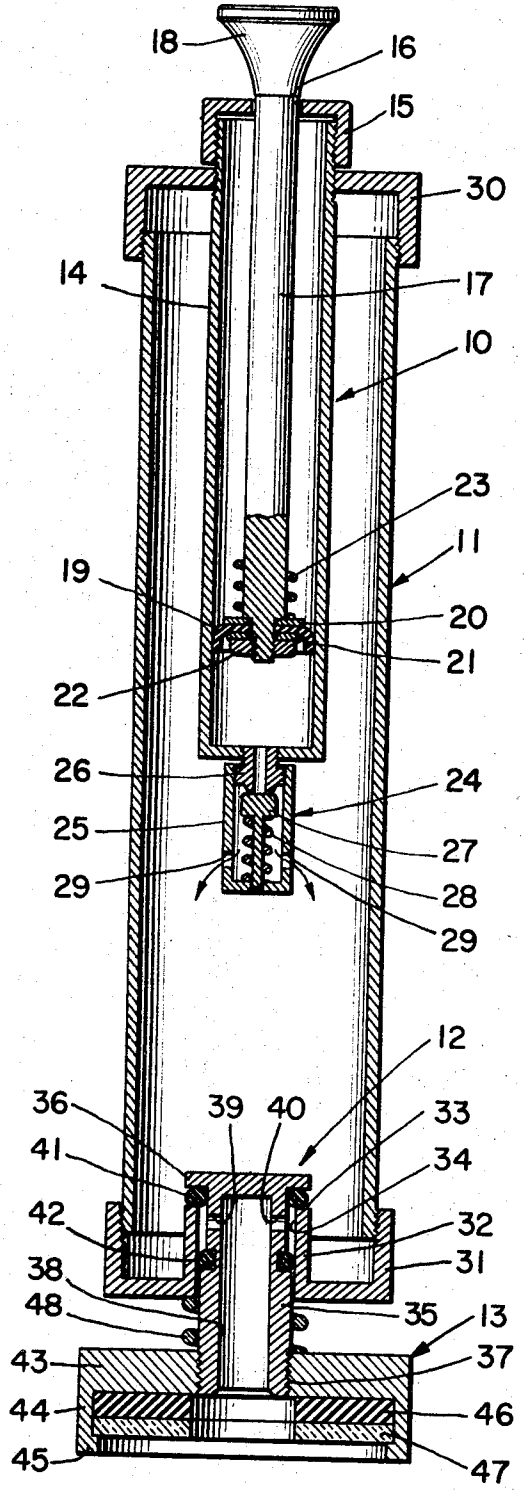


FIG. 1.

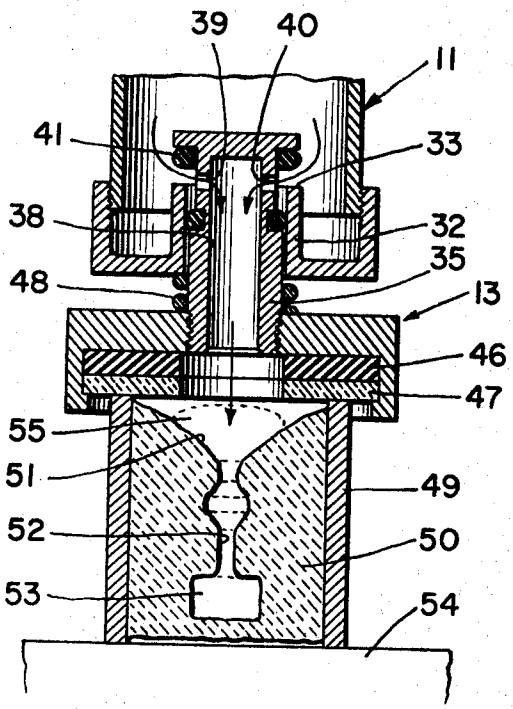


FIG. 2.

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PORTABLE SELF-CONTAINED PRESSURIZED AIR DEVICE FOR CASTING

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ABSTRACT OF THE DISCLOSURE

A portable wholly hand operated casting device is provided for forcing molten metal into a cavity within a mold. The device includes a reservoir with a hand pump mounted thereon for pressurizing the reservoir. The lower end of the reservoir includes a movable valve stem adapted to be engaged by an annular plate incorporating a suitable annular gasket structure for engaging the top end of a mold. Downward pressure exerted manually on the reservoir results in movement of the valve stem to release the pressurized air directly into the top of the mold and thus force the molten metal into the mold cavity.

This invention relates generally to investment or lost wax casting and more particularly to a device for forcing molten metal into a mold during an investment or lost wax casting process.

The art of investment or lost wax casting is old and well known. In its basic aspects, the casting process involves investing a wax or plastic specimen within a mixture of plastic, ground silica, and water—known in the art as the "investment"—contained within a casting ring or flask. The ring is then placed in an oven and heated until the wax or plastic specimen is melted and burned away leaving a mold cavity or void in the investment conforming to the shape of the specimen. Upon removal of the ring from the oven, a metal such as a gold alloy, for example, is melted in a top portion of the ring and is then forced into the mold cavity where the metal hardens into a casting conforming to the shape of the cavity. The investment is then removed from the ring to free the casting for further finishing steps as may be required.

In the above-described process, the step of forcing the molten metal into the mold cavity must be accomplished quickly while the metal is in a molten state and, moreover, must be accomplished in such a manner that the metal completely fills the mold without porosity in the casting itself. Towards this end, various equipment has been used with varying degrees of success. However, this equipment has invariably been complex and expensive such that the costs of the process have been excessive, particularly for the hobbyist or others who used the process on a limited basis.

An example of previously used equipment for forcing the metal into the mold is a high speed centrifuge type machine which receives the mold and molten metal, which then are rotated at high speeds causing the metal to flow into the mold by centrifugal force. The disadvantages of such a system are numerous and include high costs of equipment, operation, and maintenance along with the danger of spraying the operator and equipment with hot molten metal.

Another example involves the use of a source of pressurized air and tubes, valves, and the like for conducting and controlling the flow of pressurized air to a mechanism which is designed to receive the mold and conduct the air into the mold. As with the first mentioned example, this system is complex and expensive and is not

readily portable, which effectively reduces its capabilities and uses, particularly for a hobbyist.

With the foregoing in mind, it is accordingly a primary object of this invention to provide a greatly simplified casting device for quickly and efficiently forcing molten metal into a mold during a casting process.

More particularly, it is an object to provide a unitary portable device for forcing molten metal into a mold, thereby eliminating the need for complex, expensive, and permanently installed equipment heretofore required.

Another object is to provide an improved casting device which is simple and rugged in construction to the end that costs of manufacturing and maintenance are greatly reduced from those involved with equipment heretofore used.

Briefly, these and many other objects and advantages of this invention are attained by providing a unitary casting device including a self-contained source of pressurized air and means for engaging a mold, whereby air may be directed against molten metal on the mold to force the metal into a cavity within the mold.

The casting device includes a generally tubular reservoir and a hand-operated pump mounted thereon for pressurizing the reservoir. The means for engaging the mold includes a pressure head assembly, which is coupled to a valve unit on the reservoir. The pressure head assembly and valve unit are arranged such that when the pressure head assembly is pressed into engagement with the mold, continued downward movement of the reservoir with respect to the pressure head assembly opens the valve unit to direct pressurized air from the reservoir into the mold to thus force the molten metal into the cavity within the mold.

The casting device is lightweight and compact so as to be easily handled by the operator.

A better understanding of the invention will now be had by referring to a preferred embodiment thereof as illustrated in the accompanying drawings, in which:

FIGURE 1 is a sectional view of the casting device in accordance with the invention; and

FIGURE 2 is a fragmentary sectional view of the casting device of FIGURE 1 shown in operational relationship with a mold assembly.

Referring first to FIGURE 1, it will be seen that the casting device generally includes a hand pump assembly **10** mounted on a tubular air reservoir **11**. A pressure release valve assembly **12** is mounted on the reservoir **11** and a pressure head assembly **13** is, in turn, coupled to the valve assembly **12**.

The details of the preferred embodiment of the casting device will now be described. The pump assembly **10** includes a pump cylinder **14** having a threaded cap **15** secured to an end thereof as shown. Defined through the cap **15** is an opening **16** which is adapted to receive a pump rod **17**. The pump rod **17** is provided with an enlarged diameter knob **18** by which the rod may be gripped to be reciprocated within the pump cylinder **14**.

A cup-type piston member **19** made, for example, of leather is secured to the pump rod **17** between a pair of spaced washers **20** and **21**, respectively. The piston **19** and washers **20** and **21** are secured to the pump rod **17** by means of a threaded nut **22**. A coil spring **23** is mounted around the pump rod **17** and serves as a spring cushion against the end cap **15** when the pump rod is drawn upwardly on its upstroke.

Upon actuation of the hand pump assembly **10**, air is transmitted into the air reservoir **11** through a conventional poppet valve assembly **24**. This valve assembly includes a valve casing **25** being threadedly coupled to an air outlet nipple **26** which is, in turn, threadedly coupled to the pump cylinder **14**. A valve member **27** is disposed within the valve casing **25** and is normally biased up-

wardly into engagement with the nipple **26** by means of a coil spring **28**. It will be apparent that upon each upstroke of the rod and piston, air will pass about the periphery of the piston to fill the resulting void in the cylinder **14**. This air may enter the upper portion of the cylinder **14** about the rod opening **16**. Upon each downstroke of the pump rod **17** and piston **19**, the periphery of the piston will flare out into sealing relationship with the cylinder walls and air will be compressed within the pump cylinder **14** and will force the valve member **27** downwardly against the spring **28** to accordingly permit the air to pass into the reservoir **11** through air passages **29** defined in the valve casing **25**. Of course, upon completion of the downstroke, the spring **28**, together with the air pressure within the reservoir **11**, will force the valve member **27** upwardly to close the air outlet nipple **26**.

The above described hand pump assembly **10** is mounted within an end cap **30** which is threadedly coupled to the upper end of the reservoir cylinder **11**. In a somewhat similar manner, the lower end of the reservoir cylinder **11** is threaded to receive a second end cap **31**.

In accordance with an important feature of the invention, the casting device includes a valve assembly **12** (heretofore mentioned) through which pressurized air may be released from the reservoir **11** into a mold or casting assembly to be subsequently described. The end cap **31** is provided with a centrally disposed cylindrical flange **32** which terminates in an annular seating edge **33**. The cylindrical flange **32** defines an opening **34** which is adapted to receive a valve stem **35** which terminates at its upper end in an increased diameter annular flange **36** and at its lower end in a threaded portion **37**.

The valve stem **35** includes a central passage **38** communicating with a pair of diametrically opposed transverse passages **39** and **40** through which pressurized air may pass outwardly from the reservoir **11** in a manner to be subsequently described.

In order to maintain pressurized air within the reservoir **11** until it is desired to release the same, a first O-ring **41** is tightly fitted around the valve stem **35** adjacent to the annular flange **36** and is positioned in sealing engagement with the annular seating edge **33** of the cylindrical flange **32** when the valve assembly **12** is in a closed position shown in FIGURE 1. A second O-ring **42** is secured around the valve stem **35** below the transverse passages **39** and **40** to sealingly engage the cylindrical flange **32** and thereby prevent escape of pressurized air between the valve stem **35** and the flange **32** when the valve assembly **12** is in an open position to be described with reference to FIGURE 2.

A particularly important feature of the invention resides in the provision of a pressure head assembly **13** (heretofore mentioned) which is adapted to engage a mold ring and direct pressurized air from the reservoir **11** into the mold. Towards this end, the pressure head assembly **13** includes an annular plate portion **43** threadedly coupled to the threaded portion **37** of the valve stem **35**. The plate portion **43** includes a cylindrical sidewall portion **44** which terminates at its bottom end in an inturned annular flange **45**. An annular sealing gasket **46** made, for example, of rubber and an annular insulating gasket **47** made, for example, of asbestos are positioned within the cylindrical sidewall portion **44** and are retained in place by the inturned annular flange **45**.

In order to maintain the valve assembly **12** in the closed position illustrated in FIGURE 1, a coil spring **48** is disposed around the valve stem **35** and is interposed between the end cap **31** and the plate portion **43** of the pressure head assembly **13**. The spring **48** acts to bias the valve stem **35** downwardly to thereby compress the O-ring **41** between the annular flange **36** and the seating edge **33**. Accordingly, pressurized air within the reservoir **11** is prevented from escaping through the valve assembly **12**. It will, of course, be apparent that air pressure within the reservoir **11** will aid in maintaining the valve stem assembly **12** in the closed position by acting downwardly against the top of the valve stem **35**.

Referring now to FIGURE 2, the casting device is shown positioned on the top of a cylindrical casting ring **49** which encloses a refractory material **50** which, as above described, may comprise a hardened mixture of plastic, ground silica, and water—known in the art as the "investment." The investment **50** is formed with a conical crater **51** communicating with a downwardly extending passage **52** called a "sprue," which, in turn, communicates with a mold cavity or void **53** shaped to the desired form of the object to be cast therein.

After heating the ring **49** and the enclosed investment **50** in a heating oven, the ring is removed therefrom and placed upon a table or supporting surface **54** and a metal is melted in the crater **51** until it flows or pools into the position shown in dotted lines at **55**.

The surface tension of the molten metal **55** prevents it from flowing downwardly through the sprue **52** into the mold cavity **53**, and, accordingly, the molten metal must be forced to flow quickly into the mold cavity **53** before the metal cools and hardens within the crater **51**.

The foregoing is achieved by the casting device of the invention, the operation of which will now be described. First, the hand pump assembly **10** is actuated to pressurize the reservoir **11**. The device is then placed over the casting ring **49** with the pressure head assembly **13** in contact with the top of the ring **49**. The reservoir **11** is then pushed downwardly with respect to the pressure head assembly causing the valve assembly **12** to open as shown in FIGURE 2. The air within the reservoir then passes through the passages **39** and **40** into the passage **38** and then into the crater **51** where the air pressure forces the molten metal downwardly through the sprue **52** into the mold cavity **53**.

The air pressure is sufficient to force the metal into the cavity quickly before the metal hardens and also insures that the metal completely fills the cavity without porosity in the finished casting.

The insulating gasket **47** serves to prevent transfer of heat from the ring **49** to the pressure head assembly, and the resilient sealing gasket **46** insures that the pressurized air will not escape its path from the pressure head assembly into the ring **49**.

After completion of the above-described casting operation, the casting device is simply lifted off the ring **49** and the spring **48** acts to close the valve assembly **12**, thereby permitting the reservoir to be again pressurized in preparation for subsequent casting operations.

The casting device is uniquely constructed to accommodate casting rings of a variety of diameters and, as is apparent, can be used with rings of any height.

From the foregoing, it is apparent that this invention provides a compact, simplified, and easily handled casting device which may be used in conjunction with a variety of casting rings.

While the invention has been described for use in investment or lost wax casting operations, it will be understood that the invention is not to be thought of as limited to that particular use or to the specific embodiment shown and described.

What is claimed is:

1. A portable unitary hand casting device for forcing molten metal into a mold during a lost wax casting operation, said device comprising:

(a) a tubular reservoir for containing pressurized air, said reservoir including first and second end caps mounted on its opposite ends, respectively;

(b) a tubular hand pump assembly secured through said first end cap for pressurizing said reservoir, said hand pump assembly including a pump rod extending outwardly from said first end cap for actuating said hand pump assembly to pressurize said reservoir;

(c) a pressure release valve stem mounted for in and

out telescopic movement in said second end cap, said second end cap defining an internal valve seat for said valve stem so that when said valve stem is telescoped inwardly, said seat is uncovered to communicate pressure through said valve stem;

(d) a pressure head assembly including an annular plate portion secured to the outer end of said valve stem, said plate portion having:

(1) a cylindrical side wall portion terminating in a reduced diameter annular flange;

(2) an annular resilient gasket positioned within said side wall portion;

(3) an annular insulating gasket interposed between said resilient gasket and said annular flange for engaging and hermetically sealing against the top end of said mold to prevent transfer of heat from said mold to said valve stem and said reservoir means; and

(e) spring means disposed between said annular plate portion and said second end cap for normally biasing said valve stem to a closed seated position,

whereby said casting device may be held solely in the hands and said annular insulating gasket manually positioned over said top end of said mold, manual movement of said reservoir means downwardly with respect to said annular plate portion telescoping said valve stem inwardly in opposition to said spring means to thereby pass pressurized air into said mold.

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