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FLUID COOLED, LUBRICATED AND SEALED PISTON MEANS FOR CASTING DEVICES

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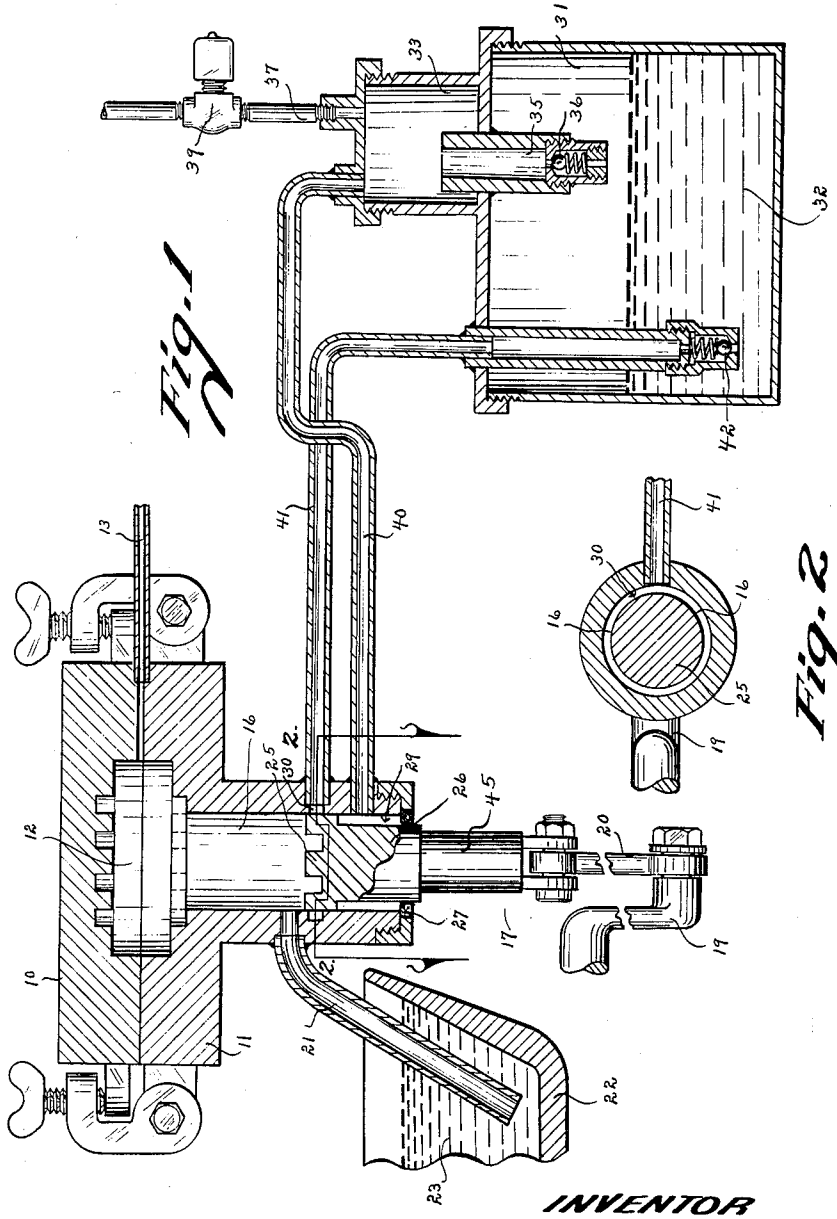


Fig. 1

Fig. 2

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FLUID COOLED, LUBRICATED AND SEALED PISTON MEANS FOR CASTING DEVICES

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This invention relates to casting machines and more particularly to a means for cooling, lubricating and sealing the material injecting means, such as the short piston and cylinder or compression piston and cylinder of a casting device. This is a continuation in part of my application Serial Number 53,704 filed September 2, 1960, now abandoned.

The casting of objects and parts is very old but many apparatus refinements in the art have been made in recent years. Today, it is quite common to produce at least a semi-vacuum condition in the mold cavity prior to the introduction of the molten material. Also, in most such casting equipment, the molten material is pressure forced into the mold cavity by a piston means. The piston may be reciprocatively mounted in a "shot" cylinder, or it may be in the form of at least a part of one side of the mold cavity as shown in FIGURE 1. However, regardless of the function, or design of the cylinder and piston, much difficulty is experienced in the objectionable heating of the piston, the proper lubricating of the piston, and the leakage of the molten material and even air past the piston.

Therefore, one of the principal objects of my invention is to provide a method of and means for lubricating and cooling the injection and/or compressing piston of a casting device.

More specifically the object of my invention is to surround the reciprocating piston means with a changing mote of fluid such as a lubricating oil.

A still further object of this invention is to provide an oil sealed piston means for casting machines.

Still further objects of my invention are to provide a method of and means for conditioning the piston means of a casting machine that is economical in manufacture and durable in use.

These and other objects will be apparent to those skilled in the art.

My invention consists in the construction, arrangements, and combination, of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in my claims, and illustrated in the accompanying drawing, in which:

FIGURE 1 is a side sectional view of a casting machine using my piston conditioned means, and

FIGURE 2 is a cross sectional view of the device taken on line 2—2 of FIGURE 1, and more fully illustrates its construction.

In the drawing I have used the numeral **10** to designate one side of a mold block. The second mold block is generally designated by the numeral **11**. These two blocks are separable for the purpose of discharging the solidified casting but are detachably held together by any suitable means during the actual casting phase. The adjacent faces of the blocks are cut away to provide, when the blocks are secured together, the mold cavity **12**. Communicating with the mold cavity is a conduit **13** adapted to be in communication with a suction producing means (not shown). In the block **11** is formed a relatively large vertical cylinder or passageway **16** communicating with and forming a part of the mold cavity as shown in FIGURE 1. Slidably mounted in this cylindrical portion **16** is a vertical piston ram **17** having its top surface forming at least a portion of the under side of the mold cavity **12**. This member **17** may be power reciprocated by any suitable means. In the drawing I show a powered crank shaft **19** and a connecting rod **20** having one end rotatably mounted on the crank arm **19** and its other end hingedly secured to the bottom of the member **17**. By this arrangement of parts at least a part of one side or face of the mold cavity will be movable. The numeral **21** designated the molten material inlet conduit communicating with the inside of the cylinder **16** at a point between the extreme movement of the piston member **17** in both directions. Therefore, when the piston member **17** is in a lowered position the conduit **21** will communicate directly with the inside of the cylinder **16** but when the piston **17** is elevated in its sliding movement, the point of communication between the conduit **21** and the cylinder **16** will be closed by the side wall of the member **17**. The numeral **22** designates a container having the molten material **23**, and into which the conduit **21** extends.

With the two mold sections **10** and **11** closed together and with the piston ram **17** held in a lowered position, the conduit **13** is opened thereby producing a semi-vacuum within the mold cavity. Due to the minus atmospheric pressure within the mold cavity and the upper end of the cylinder **16**, the molten material **23** will flow into the upper end of the cylinder **16** and mold cavity. After a suitable amount of the molten material has entered the mold the conduit **13** is closed and the piston ram **17** is moved upwardly to its maximum elevated position within the cylinder **16** as shown by broken lines in FIGURE 1. After the pressurized casting has cooled, the two mold halves are separated and the casting taken therefrom.

The casting machine thus far disclosed is one example of an apparatus to which I apply my invention and which I will now describe in detail.

As to the piston **17** I have an enlarged head portion **25** and a reduced rear end portion **26**. The reduced lower or rear end of the piston slidably extends through a close fitting gasket **27** at the lower or rear end of the cylinder **16**, thereby creating a compartment **29** in the lower area of the cylinder and which surrounds the reduced area of the piston below its head **25**. In the cylinder wall and embracing the head **25** when the piston is in a lowered position in the cylinder, is a continuous groove or mote **30**. When the piston is in an elevated position in the cylinder, this mote groove will be in communication with the compartment **29**. The numeral **31** designates an oil supply tank adapted to contain oil or like **32**. On top of the tank **31** is a relatively small oil return tank **33**. The numeral **35** designates a vertical pipe having one end communicating with the inside of the tank **33** above its inside bottom and its other end communicating with the inside of the tank **31**. The top of pipe **35** dwells above the bottom of tank **33**. The numeral **36** designates a one-way valve for preventing fluid in the tank **31** from passing directly into the tank **33**. A vacuum in tank **33** will normally hold valve **36** closed, but an accumulation of oil in the tank will depress the ball-spring component in the valve and the oil will move into tank **31**. The numeral **37** designates a conduit having one end communicating with the inside top of the tank **33** and its other end adapted to be in communication with a

source of suction (not shown). The numeral 39 designates a solenoid valve imposed in the conduit 37. The numeral 40 designates a conduit having one end communicating with the compartment 29 and its other end communicating with the inside of the tank 33. The numeral 41 designates a conduit having one end communicating with the mote grove 30 and its other end communicating with the inside bottom area of the tank 31. The numeral 42 designates a one-way check valve for preventing liquid from returning from the conduit 41 back into the tank 31. The operation of my device is as follows:

Obviously, the movement and position of the piston may be timed or regulated with the normally closed solenoid valve 39. This can be done in several convenient ways. For example, a micro-switch (not shown) in a normally closed position can be held in an open position by the upper portion of crankshaft 19 as viewed in FIGURE 1. The micro-switch can be electrically connected to the solenoid valve 39 and thence to a source of electrical energy. Thus, when the top of the crankshaft 19 moves downwardly from the position shown in FIGURE 1, the micro-switch can move to a closed position to cause solenoid valve 39 to become electrically excited and to open. A vacuum will then be pulling through conduit 37, tank 33 and line 40 until the piston head 25 is lowered and the crankshaft 19 once again opens such a micro-switch to close valve 39.

When the piston 17 moves upwardly, the solenoid valve 39 is opened in the manner described and a vacuum is allowed to pull through conduit 40 as indicated. This initially performs no function until the compartment 29 has moved upwardly to register with mote 30 which serves to connect conduits 40 and 41. This allows the vacuum on conduit 40 to create a suction in conduit 41 (through compartment 29) which opens valve 42 and brings oil from tank 31 into mote 30 through conduit 41. The oil will thence move from the mote 30 into the compartment 29, and thence through the conduit 40 into tank 33. As soon as the extreme lower end portion 45 of piston 17 moves upwardly through gasket 27, the suction on conduit 41 is broken and no more oil is pulled from tank 31. Similarly, all the oil in conduit 40 is pulled into tank 33 and then only atmospheric air moves into the conduit and moves toward tank 33 and valve 39. No oil will move into the top of pipe 55 until the depth of oil in tank 33 achieves the height of the top of the pipe. Thus, the accumulation of oil in tank 33 permits it to cool before moving into tank 31. In addition, the air being pulled through tank 33 during this phase of the operation serves to further cool the oil. When the oil reaches a level in tank 33 to fill pipe 35, the weight of the oil will slightly depress the ball and spring in valve 36, and the cooled fluid will then pass by gravity into tank 31. The tank 33 never becomes full enough of fluid to permit fluid to be pulled towards valve 39 through conduit 37. Normally, one cycle of piston 17 will not create a large enough accumulation of fluid in tank 33 to permit oil to flow through pipe 35 into tank 31.

Some oil will remain by adhesion in the mote 30 and will serve as an oil supply to lubricate the piston 17. Also, before the vacuum is broken in the manner described, the piston 17 will be surrounded by an oil bath in compartment 29. It is seen from the foregoing that the coordination of valve 39 with the remaining components of my device is important only if the vacuum being pulled through conduit 37, tank 33 and line 40 is not continuous. For purposes of efficiency of operating the source of the vacuum, it is desirable to close off the vacuum in line 37 by valve 39 at least during part of the cycle. The vacuum must be pulling at the time that compartment 29 joins conduits 40 and 41, but any arrangement which will close valve 39 or otherwise relieve the vacuum on line 40 after the lower end 45 of the piston 17 breaks the vacuum in compartment 29 will prove satisfactory. As noted above, the pulling of atmospheric air through tank 33 after the vacuum is broken does serve the beneficial result of cooling the oil in the tank. It should be further noted that the pulling of oil from tank 31, through conduit 41, mote 30, compartment 29, conduit 40 and into tank 33 while the vacuum is in effect is an impulse and momentary phenomenon that takes place only once each cycle of piston 17, and which moves only a nominal amount of oil during this brief portion of the cycle.

Some changes may be made in the construction and arrangement of my fluid cooled, lubricated and sealed piston means for casting devices without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim:

1. In combination,
a cylinder,
a reciprocating piston in said cylinder,
a recessed portion in said piston to create a compartment between said piston and the interior of said cylinder,
conduits leading to and from the interior of said cylinder,
said compartment having a size to communicate with said conduits at one portion of said piston's reciprocating path in said cylinder,
means operatively secured to said conduits for circulating a fluid into said cylinder from one conduit and withdrawing said fluid therefrom through said other conduit,
said one of said conduits being connected to a vacuum source, the other of said conduits being connected to a source of fluid,
and means on said piston for exposing said compartment to the atmosphere at one stage of its reciprocal movement.

2. In combination,
a cylinder,
a reciprocating piston in said cylinder,
a recessed portion in said piston to create a compartment between said piston and the interior of said cylinder,
conduits leading to and from the interior of said cylinder,
said compartment having a size to communicate with said conduits at one portion of said piston's reciprocating path in said cylinder,
means operatively secured to said conduits for circulating a fluid into said cylinder from one conduit and withdrawing said fluid therefrom through said other conduit,
one of said conduits being connected to a vacuum source, and the other of said conduits being connected to a source of fluid,
a fluid cooling chamber being imposed in said first-mentioned conduit,
valve means interconnecting said cooling chamber and said source of said fluid, said valve means comprising, a pipe having one end extending above the bottom of said cooling chamber,
and a one way valve element in the bottom thereof yieldably resisting the passage of fluid from said cooling chamber to said source of fluid.

3. In combination,
a cylinder,
a reciprocating piston in said cylinder,
a recessed portion in said piston to create a compartment between said piston and the interior of said cylinder,
conduits leading to and from the interior of said cylinder,
said compartment having a size to communicate with

said conduits at one portion of said piston's reciprocating path in said cylinder,

means operatively secured to said conduits for circulating a fluid into said cylinder from one conduit and withdrawing said fluid therefrom through said other conduit,

said cylinder communicating with a mold cavity between two molded blocks,

and molten liquid intake conduit being in communication with said cylinder.

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