

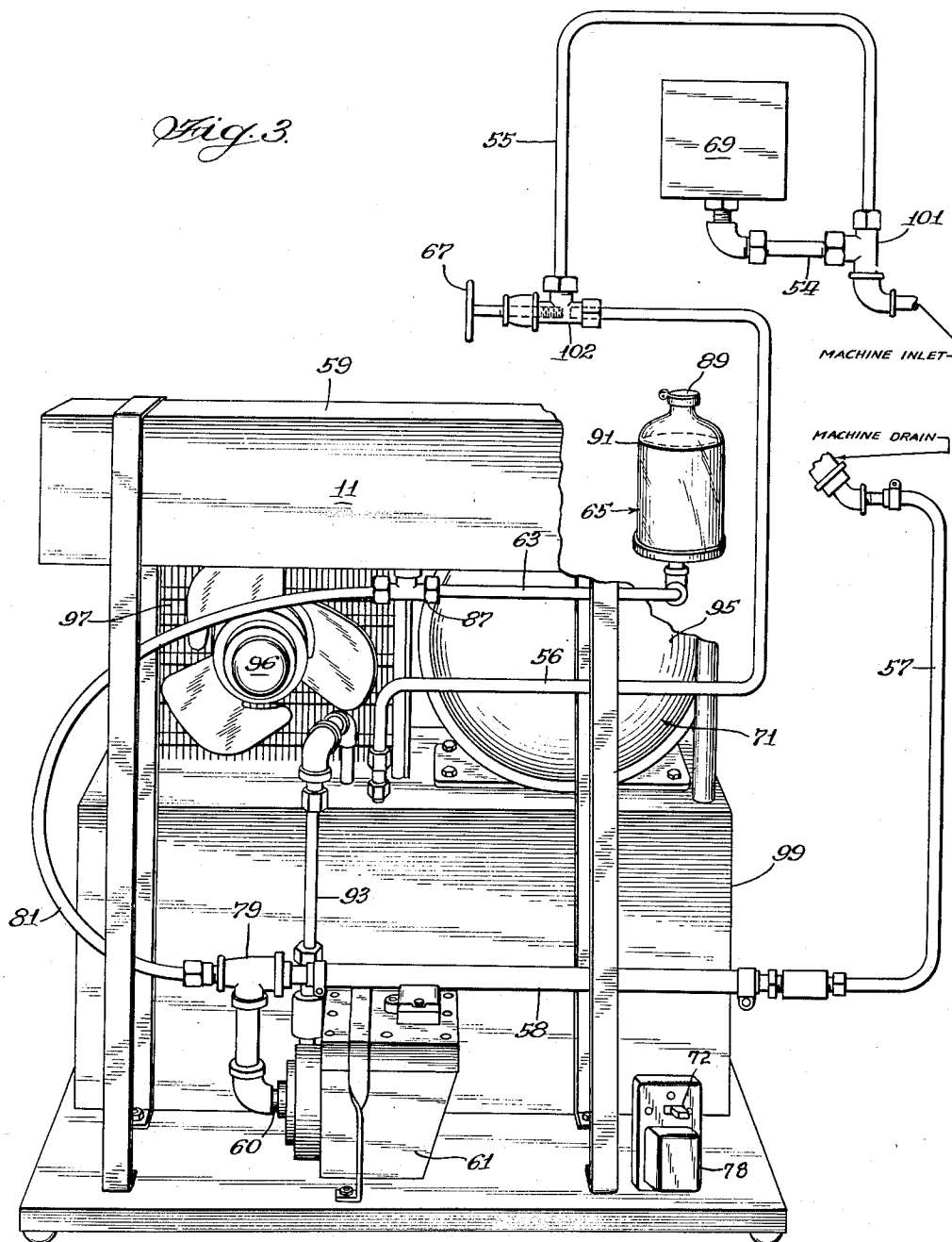
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3 Sheets-Sheet 2



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COOLING SYSTEM

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3 Sheets-Sheet 3

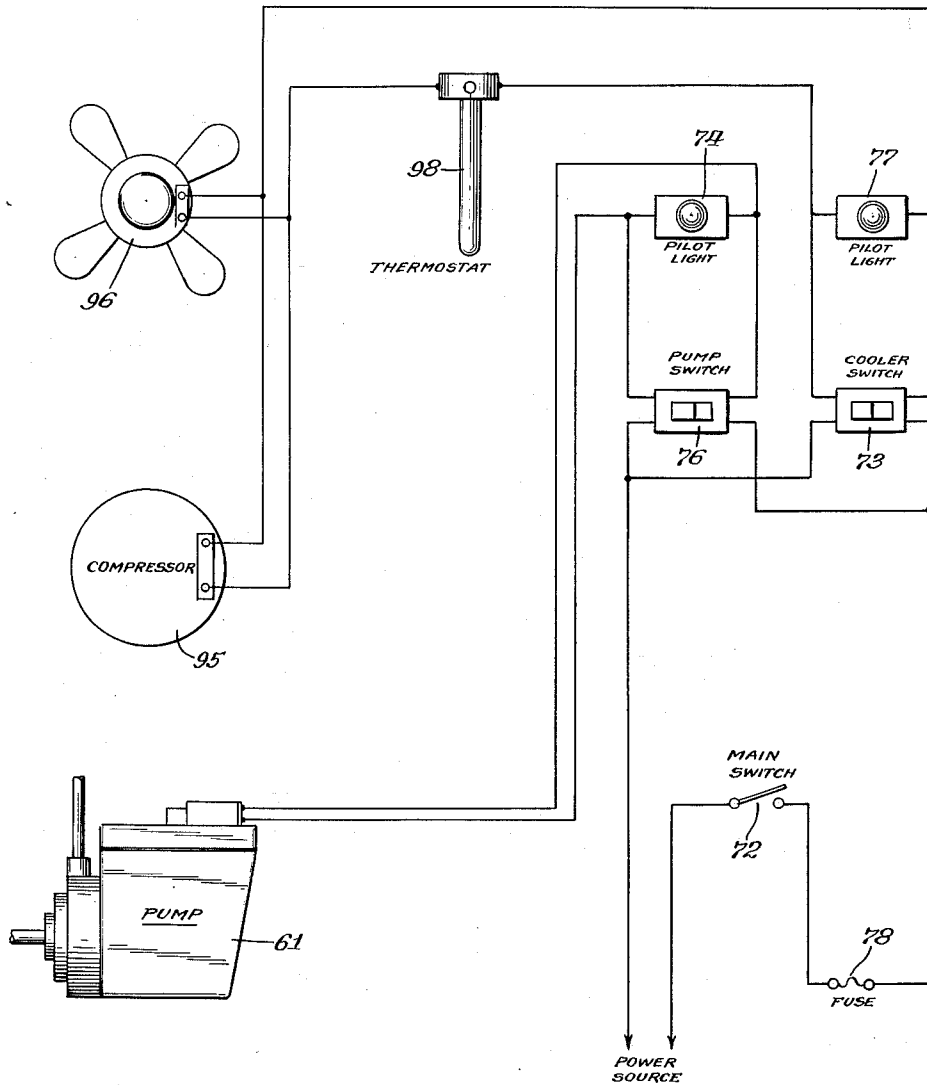


Fig. 5.

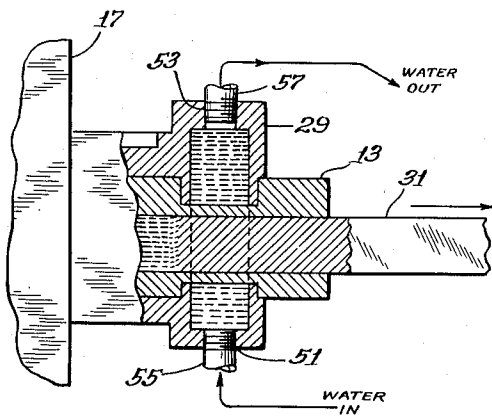


Fig. 4.

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COOLING SYSTEM

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1 Claim. (Cl. 257—306)

The present invention relates to a cooling system and more particularly to a closed circuit type of liquid cooling system which has particular utility in machine installations.

In many manufacturing processes, it is necessary to provide a stream of liquid coolant. For example, in the forming of slugs, rules and base casters used in the printing industry, a stream of molten metal is passed into a mold and is removed as solid metal at the outlet of the mold. A stream of cooling liquid is passed around the mold to remove heat so as to solidify the metal.

Many types of liquids can be used as liquid coolant. Among the liquid coolant that may be used are alcohol, dowerm, ethylene glycol, mercury, carbon tetra-chloride, and water. Since water is the most commonly known coolant, it will be used as an example of a liquid coolant in the following explanation. However, any of the other liquid coolants could equally well have been used for explanation purposes.

If water is used as a coolant, it might be possible to take the water from a substantially unlimited supply such as a lake and to pass the water directly to the place where the cooling is desired. The water, after serving its purpose as a coolant, may then be dumped into a nearby watercourse. This is called an open circuit type of cooling. Another type of cooling which is frequently used is the closed circuit type of cooling, in which the coolant liquid is recirculated for use.

A closed type or recirculating type of cooling system has many advantages over the type of system in which a fresh supply of cooling liquid is continuously used. One of the advantage is that it substantially decreases the amount of water needed. This is of considerable importance where water is in short supply or where the cost of the water is rather high. Also, water frequently has a high mineral content and it is necessary to treat this water so that undesirable mineral deposits will not be formed in the various channels in the piping and heat exchange elements which are associated with the usual cooling system. This water treatment frequently is very costly and must be continuous in a system wherein fresh water is continuously brought in. However, in closed circuit types of systems pure water may be used or the water need be treated only once to remove the minerals.

From the above advantage, one can see that a closed circuit cooling unit would be desirable. Because of the lack of space in manufacturing buildings, this unit should be as compact as possible. Also, for ease of operation and maintenance, the unit should be self-contained and easily tied into a machine. Adequate safety controls should be provided with the unit. The present invention has all of these features which have previously been unavailable.

The main object of the present invention is to provide a self-contained cooling system which furnishes a stream of liquid to an object to be cooled. A further object of the invention is to provide a cooling system having novel

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means for maintaining the quantity of coolant within the system relatively constant. Another object of the present invention is to provide a cooling system having a novel means for making inoperative various parts of the equipment dependent on the cooling system in the event that there is a failure in the supply of the cooling liquid.

Other objects and advantages of the present system will be readily apparent as the description of the invention progresses.

In the drawings:

Figure 1 is a front perspective view showing a cooling system formed in accordance with the present invention, connected to a machine used for casting strip material, part of the machine being cut away to show portions of the safety control for the machine;

Figure 2 is a fragmentary, rear perspective view of the machine and cooling system of Figure 1, showing the connection between the casting machine and the cooling system;

Figure 3 is an enlarged, rear perspective view of the cooling system shown in Figure 1, with the cover removed and a portion cut away for purposes of clarity;

Figure 4 is an enlarged, fragmentary sectional view of the mold used with the casting of machine shown in Figure 1 and

Figure 5 is a schematic wiring diagram of the cooling system.

As previously indicated, the cooling system in accordance with this invention can be used with any machine which requires a source of liquid coolant. Figure 1 shows the cooling system 11 being used to cool a mold 13 in a casting machine 15.

The casting machine 15 includes a table-like frame structure 16, on which is mounted an electrically heated crucible 17 which is thoroughly insulated to insure uniform and economical heating. The crucible 17 has a hinged cover 19 provided thereon. Lead or other low melting point metal is placed within the crucible, and the heater switch on a front panel 23, which connects the heaters of the crucible 17 with a source of electrical energy (not shown); is turned on to heat the metal to a molten state. The crucible is provided with a thermostat 25, which is connected into the electrical system heating the crucible 17, so as to automatically maintain a predetermined temperature of the metal in the crucible 17. The molten metal flows out of the crucible 17 and passes through the mold 13 which is surrounded by a water jacket 29. A stream of cooling water passes through the water jacket 29 from the cooling system 11 and as the molten metal passes through the cooled mold 13, the metal solidifies and takes on the shape of the outline of the mold 13. The mold being used is of such shape that the metal exits as a rectangular strip 31, but any other shape of mold could be used.

The metal strip or bar 31 is pulled therefrom by a pulling mechanism 33. The pulling mechanism 33 is provided with suitable adjustments (not shown) so that strips of various thicknesses may be clamped and pulled from the mold 13. The pulling mechanism 33 reciprocates from left to right on the machine. When the mechanism 33 is at the left position, the mechanism 33 clamps on the bar 31 and begins movement to the right, thereby pulling the metal bar 31 out of the mold 13.

It can be seen that it is very important for the cooling system to be very reliable, since, if the cooling system failed and no precautions are taken, the molten metal would pour out of the mold 13, which might cause serious damage to the machine and harm the operator.

The metal strip 31 is pulled to the right by the pulling mechanism until a predetermined length of strip 31 is extending from the mold, at which time a cutting mech-

anism 35 cuts the metal strip 31 into a predetermined length. A stacking mechanism 37, which includes two endless chains 39, moves the cut length of the strip off to one side in a direction perpendicular to the longitudinal axis of the strip and stacks the metal strips on a table-like portion 41 of the casting machine 15.

A motor 43, which is mounted on a lower portion of the frame 16, provides the pulling mechanism 33, the cutting mechanism 35 and the stacking mechanism 37 with the necessary power through a pulley system. Electrical power to the motor 43 is furnished through the electrical conduit 45.

The casting machine 15 is not described in greater detail since it is believed that the present invention may be clearly understood without further description of the casting machine 15.

The water jacket 29 for cooling the mold 13 has an inlet opening 51 and an outlet opening 53. A stream of cooling water is introduced into the inlet opening 51 through an inlet hose 55 and the water exits from the water jacket 29 through an outlet hose 57 which is connected to the outlet opening 53.

Figures 1 and 2 show the casting machine 15 equipped with a two-way valve 52 in the inlet hose 55 and a sight glass 66 in the outlet hose 57. These features allow the operator to regulate the flow of cooling water, as a result of the visual determination of the amount of water flowing through the mold.

Mounted on the casting machine 15 is a pressure-sensitive device 69 which is operated by a predetermined inlet cooling water pressure. The pressure-sensitive device 69 is connected to the inlet hose 55 at T 101 through a hose 54. This pressure-sensitive device 69 is preferably a device which may be set so as to disconnect the power to the machine and operate a warning device, such as an alarm, a light, etc. In the illustrated embodiment, the pressure-sensitive device 69 is connected into the electrical system of the casting machine 15 so as to turn off the power which operates the various parts of the casting machine 15, such as the heating means for the crucible 17, the pulling mechanism 33, cutting mechanism 35 and stacking mechanism 37. Therefore, if for one reason or another the water pressure in the inlet hose 55 drops below a predetermined value, the pressure-sensitive device 69 will shut off the current to the machine and thereby prevent the possibility of molten metal spilling out of the mold 13.

The stream of cooling water is furnished by the cooling system 11. This cooling system 11 includes a make-up water supply tank 59, a fluid pump 61, a fluid level indicator 65, a thermometer 67 and a cooling unit 71.

The return stream of water in the outlet hose 57 passes through the conduit 58 and enters the suction side 60 of the pump 61. A conventional centrifugal pump may be used as the fluid pump 61. Also connected to the upstream side of the pump 61 is a make-up water supply conduit 81 which leads from a T 79 to the bottom of the make-up water supply tank 59.

It is, of course, important that the cooling system have a sufficient amount of water therein at all times so that there is no failure in the supply of cooling water to the water jacket 29. To accomplish this, a make-up water supply tank 59 is provided in the cooling system. It is necessary to supply make-up water into the cooling system because of evaporative losses in the system.

It is, of course, preferred that the level in the make-up water supply tank 59 be kept somewhat above the bottom of the tank, and it is preferable to have some means for readily indicating the level of water in the tank. A means of introducing water to the supply tank 59 and indicating the level of the water in the tank 59 is provided by a fluid level indicator 65 having a hinged cover 89. The bottom of the level indicator 65 is connected to the bottom of the tank 59 through a conduit and T 87, positioned under the tank, thereby establishing fluid com-

munication between the make-up water supply tank 59 and the indicator 65. Generally, the indicator 65 is of glass construction. The top of the level indicator 65 is somewhat above the level of the top of the tank 59, and the bottom of the level indicator 65 extends to substantially the level of the bottom of the supply tank 59. Since the supply tank 59 and level indicator 65 are in fluid communication with each other, the level of water in the level indicator 65 indicates the level of water in the supply tank 59. A mark 91 is preferably made on the bottle 65 near the upper end thereof to indicate the desired upper level of water. Water is added to the system to the height of the mark 91 when the cooling system is inoperative, since during operation, the level in the supply tank 59 will drop. Normally, only a small amount of water need be added to the system per day and this may be conveniently done before starting up the day's operation.

The discharge conduit 93 from the water pump 61 leads directly into a storage tank 99 of the cooling unit 71. This cooling unit 71 is a conventional cooling unit which may include an enclosed compressor unit 95, fan 96, condenser coils 97, evaporator coils (not shown), thermostat 98 (Fig. 5) and storage tank 99. The storage tank 99 is used to store cooled water and also to house the evaporator coils (not shown). It is apparent that the size of the cooling unit depends upon the amount of water passing through the cooling unit and the desired reduction in the temperature of the incoming water.

Cooled water is discharged from the upper part of the storage tank 99 through a conduit 56 into a T 102. One branch of the T 102 has the thermometer 67 inserted therein to measure the inlet water temperature. This thermometer 67 is conveniently mounted so that it can be viewed by the operator from the front of the cooling system.

The other branch of the T 102 is connected to the inlet hose 55, which in turn is connected to the water jacket 29, completing the closed circuit.

Two electrical on-off switches with their associated pilot lights are mounted on the front of the cooling system. The pump switch 76 connects power to the water pump 61. When this pump switch 76 is closed, pump pilot light 74 will be lit. The cooling unit switch 73 connects power to the fan motor 96 and the compressor unit 95. The adjustable thermostat 98, which is located in the storage tank 99 maintains the temperature in the storage tank 99 at a desired value by controlling the operation of the compressor 95 and the motor 96. Cooling unit pilot light 77 indicates whether or not the cooling unit switch is closed. A main on-off switch 72 and a conventional fuse 78 are located at the rear of the cooling system 11.

Although in the above embodiment of the invention the cooling system is cooling only one machine, it is apparent that by placing T's in the inlet hose 55 and the outlet hose 57 that more than one machine could be cooled by the same cooling system.

By the present invention a novel, compact and highly reliable, self-contained cooling system is provided. Although the cooling system is described with respect to a particular embodiment, it will be apparent to those skilled in the art that other embodiments might readily be made without departing from the principles of the invention.

Various features of the present invention which are believed to be new are set forth in the accompanying claim.

I claim:

A cooling system for an electrically operated metal casting machine and which includes a jacketed mold to be cooled, said jacket including an inlet port and an outlet port, said system comprising a closed tank, liquid coolant in said tank, cooling means for said coolant in said tank, a conduit connecting the interior of said tank to the inlet port of the jacket on the mold a pump having an outlet port and an inlet port, a conduit connecting the

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outlet of the jacket on the mold to the inlet port of said pump, a conduit connecting the outlet of said pump to the interior of said tank, means for operating said pump continuously while said casting machine is in operation to pump coolant from the outlet port of the jacket to said tank under pressure whereupon it flows to the inlet of the jacket on the mold, a pressure sensitive means in communication with the coolant in said conduit connecting said tank and the jacket inlet operable to disconnect electrical current to said casting machine when the coolant pressure in the conduit associated therewith falls below a predetermined pressure, a coolant make-up tank containing coolant at atmospheric pressure, and a conduit

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connected to the inlet of said pump whereby coolant is automatically drawn into the circulating coolant stream as required.

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