

July 19, 1960

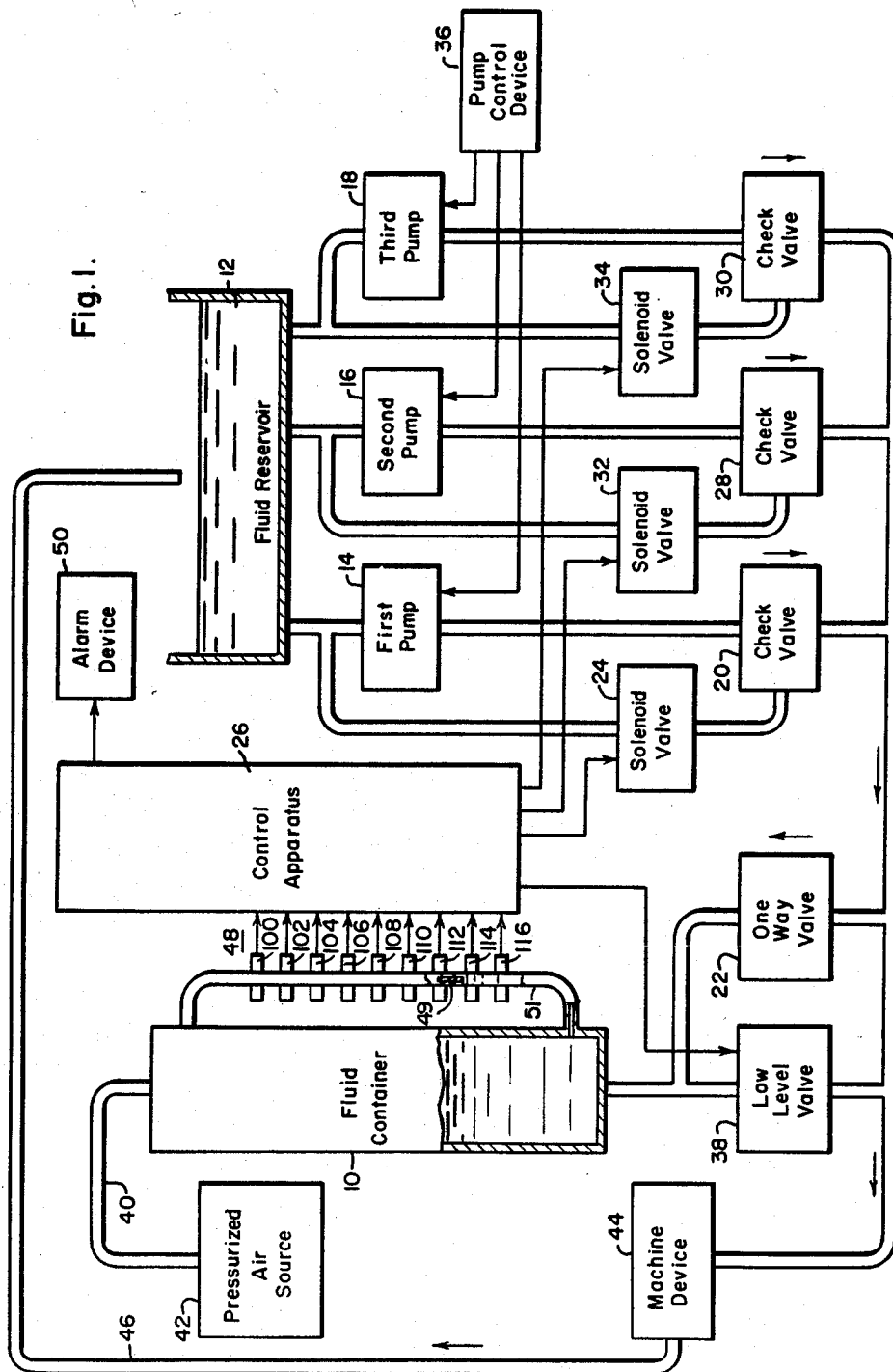
J. W. SMITH ET AL

2,945,445

CONTROL APPARATUS FOR A PUMP DEVICE

Filed Dec. 31, 1957

3 Sheets-Sheet 1



July 19, 1960

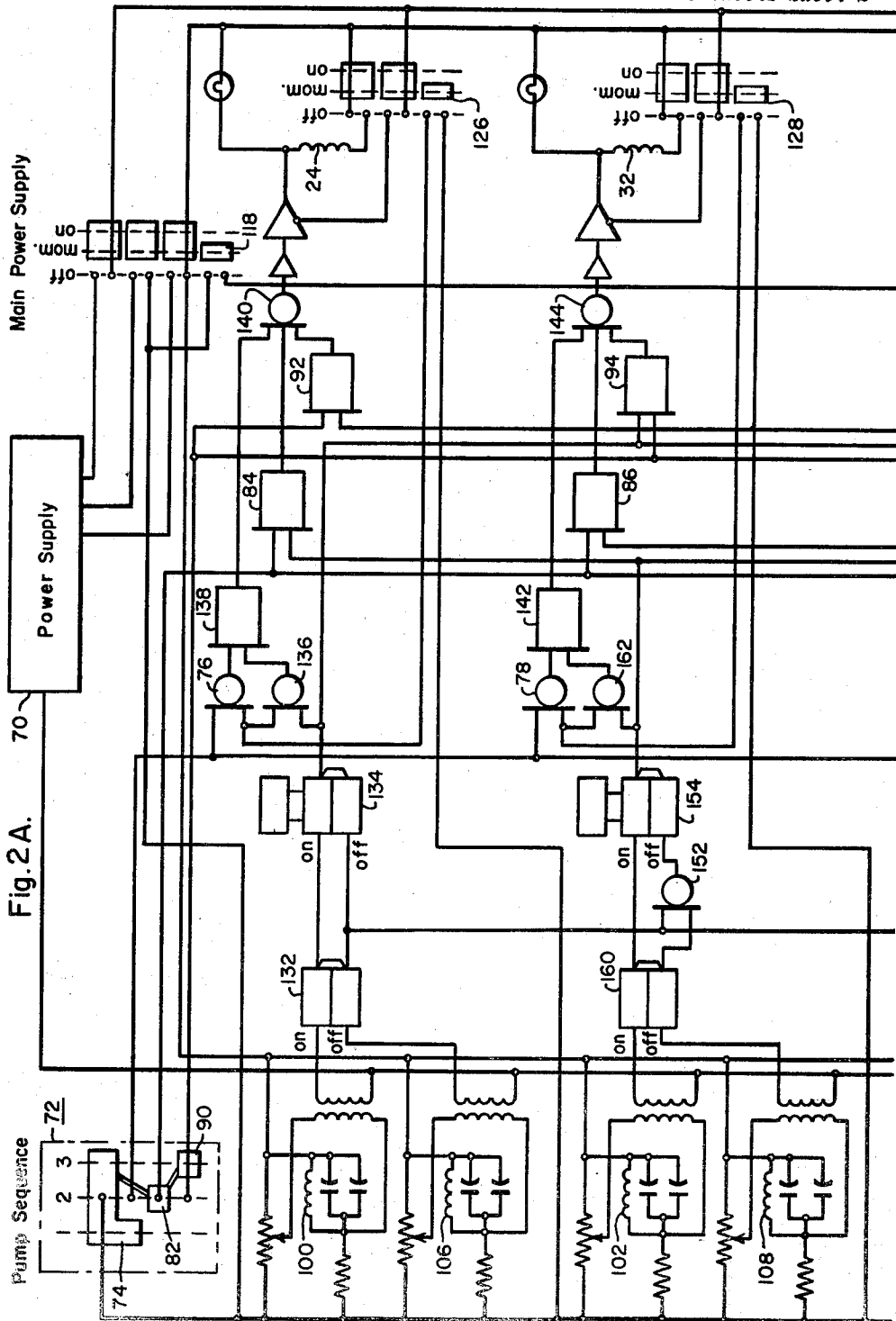
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3 Sheets-Sheet 2



July 19, 1960

J. W. SMITH ET AL

2,945,445

CONTROL APPARATUS FOR A PUMP DEVICE

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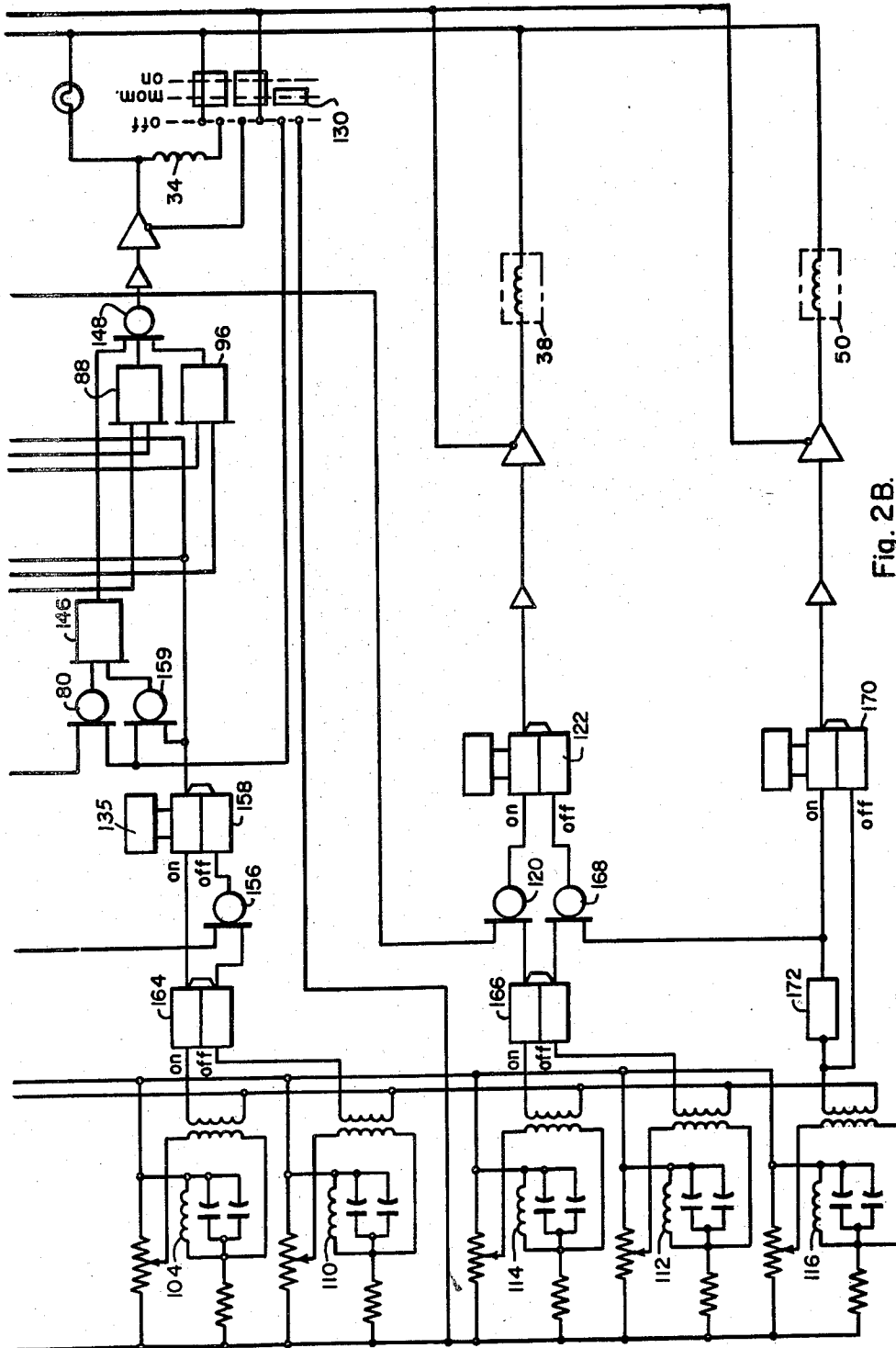


Fig. 2B.

1

2,945,445

CONTROL APPARATUS FOR A PUMP DEVICE

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13 Claims. (Cl. 103—11)

The present invention relates, in general, to control apparatus for one or more pumps, and more particularly to control apparatus for one or more pumps supplying fluid to a fluid container where the fluid or some condition of that fluid within said container may be utilized for controlling the operation of said pump or pumps.

It is an object of the present invention to provide improved control apparatus for one or more pump devices supplying fluid wherein the fluid or some condition of that fluid is utilized to provide a control signal for better controlling the pump or pumps.

It is another object of the present invention to provide improved control apparatus for one or more fluid pumps which control apparatus is more reliable in operation and is more flexible regarding any modifications or changes to be made in the operation of said pumps.

It is a different object of the present invention to provide improved control apparatus for one or more fluid supply devices operative with a fluid container which apparatus senses one or more predetermined conditions of the fluid relative to said container for better controlling the operation of said fluid supply devices.

It is an additional object of the present invention to provide improved control apparatus for one or more fluid supply devices operative to supply fluid to the container member and which apparatus includes one or more fluid condition sensing devices operative with said container to provide one or more control signals for better controlling the operation of said fluid supply devices in accordance with a predetermined selection or scheduling of said fluid supply devices.

It is a further object to provide improved control apparatus for one or more fluid supply devices supplying fluid to a fluid container, which apparatus employs statically operative logic devices to better control the loading and operation of said fluid supply devices as a function of and/or to maintain one or more predetermined operating conditions of said fluid container.

These and other objects and advantages of the present invention will become still more apparent from a study of the following description taken in conjunction with the drawings, wherein:

Figure 1 is a diagrammatic showing of the control apparatus in accordance with the teachings of the present invention; and

Figs. 2A and 2B together provide a schematic showing of the control apparatus in accordance with the present invention, when the bottom of Fig. 2A is connected to the top of Fig. 2B.

In Fig. 1 there is shown a fluid storage member or container 10 operative to receive fluid from a reservoir 12 through a first pump 14, a second pump 16 or a third pump 18. The first pump 14 operates through a check valve 20 and a second check valve 22 to supply fluid from the reservoir 12 to the fluid container 10. A solenoid valve 24 electrically operative by suitable control apparatus 26 is provided to bypass the first pump 14, and is operative to provide a fluid path in parallel to the asso-

2

ciated pump 14 until the solenoid valve is energized to cause it to close, as will be later explained. The second pump 16 is operative to supply fluid through a check valve 28 and the check valve 22 to the fluid container 10.

The third pump 18 is operative to supply fluid through a check valve 30 and the check valve 22 to the fluid container 10. A solenoid valve 32 is connected to bypass the second pump 16 and is electrically controlled by the control apparatus 26 as is a solenoid valve 34 connected to bypass the third pump 18. A pump control device 36 is provided for continuously operating each of the first, second and third pumps during the operation of the control apparatus 26. A low-level valve 38 is controlled by the control apparatus 26 as will be later explained. The fluid container 10 has its uppermost region connected through a conduit 40 to a pressurized air source 42 for controlling the operative pressure within the fluid container 10. The fluid within the fluid container 10 is connected through the low-level valve 38 to a suitable machine device 44, the operation of which is controlled by the fluid from the fluid container 10 with a conduit 46 being connected from the machine device 44 back to the fluid reservoir 12 for carrying the spent fluid back to the reservoir 12. A plurality of fluid condition sensing devices 48 are operative with the fluid container 10 for respectively providing suitable control signals to the control apparatus 26 upon the occurrence of or in accordance with predetermined fluid conditions relative to the fluid container 10 as will be later explained.

In Figs. 2A and 2B, with the bottom of Fig. 2A and top of Fig. 2B joined together, there is shown the control apparatus 26 of Fig. 1 with a suitable power supply 70 being connected through a pump sequence selector switch 72 for providing suitable control signals for determining the operation sequence of the respective pumps. More specifically, when the pump sequence selector switch 72 is in its first position, the switch member 74 is closed to energize one input of a first OR device 76, one input of a second OR device 78 and one input of a third OR device 80. When the pump sequence selector switch is in a second position, its contactor 82 is closed to energize one input of an AND device 84, one input of an AND device 86 and one input of an AND device 88. When the pump sequence selector switch is in its third position, its contactor 90 is closed to energize one input of an AND device 92, one input of an AND device 94 and one input of an AND device 96.

The fluid condition sensing devices 48, as shown in Fig. 1, include a first sensing device 100, a second sensing device 102, a third sensing device 104, a fourth sensing device 106, a fifth sensing device 108, a sixth sensing device 110, a seventh sensing device 112, an eighth sensing device 114 and a ninth sensing device 116. These sensing devices 100 through 116 are diagrammatically shown in Fig. 1. Each of the latter sensing devices 100 through 116 includes a coil member operative with a soft-iron core adjacent said coil member, which core is operative to follow the level of the fluid within the fluid container 10 such that the position of the soft-iron core corresponds to the level of the fluid within the container 10. Thusly, as the level of the fluid varies within the container 10, the position of the soft-iron core varies and when it is adjacent one of the coils 100 through 116, it is operative to remove the output signal from the control circuit including the coil. Thusly, in general all of the fluid position sensing coils give output control signals except the coil within which the coil or soft-iron core or slug is located.

The main power switch includes a momentary contact 118 which is momentarily closed when the main power switch is closed to apply a control signal through an OR device 120 to turn on the Memory device 122

3

and energize the low-level valve 38 by energizing the solenoid for the latter valve 38 to thereby open the low-level valve. Thereafter, the switch member 118 opens to remove the latter-said signal such that the low-level valve 38 is thereafter controlled by the position of the soft-iron core relative to the fluid position indicating coils 100 through 116. A second contact member 126 and a third contact member 128 and a fourth contact member 130 on the main power switch are momentarily closed to operate the pump solenoid valves 24, 32 and 34, respectively, for the purpose of testing them. Thereafter, the contact members 126, 128 and 130 open to deenergize the respective solenoid valves. The output control signal from the bridge circuit including the sensing coil 100 is applied to the ON input of a Memory device 132 which then provides an output signal to the ON input of a second Memory device 134. The latter Memory device 134 is provided with a permanent retentive element 135 to make the Memory device 134 function as a permanent memory as well known to persons skilled in this art. The output signal from the Memory device 134 is applied through an OR device 136 to one input of an AND device 138, the second input of which is energized through the OR device 76 previously mentioned. The output signal from the Memory device 134 also energizes a second input of the AND device 94 previously mentioned and a second input of the AND device 88 are previously mentioned. When both inputs of any of the AND devices are simultaneously energized, that AND device provides an output signal. More specifically, when both inputs of any of the AND devices 138, 84 or 92 are energized, these respective AND devices provide an output signal through the OR device 140 for energizing the control solenoid of the solenoid valve 24 operative to close the parallel bypass of the first pump 14. Similarly, when both inputs are simultaneously energized for any of the respective AND devices 86, 94 and 142, an output signal is provided to the OR device 144 to energize the solenoid valve 32 operative to close the bypass of the second pump 16. Similarly, when both inputs are simultaneously energized for any of the respective AND devices 88, 96 and 146, an output signal is provided to the OR device 148 to energize the solenoid valve 34 for closing the bypassing valve 34 of the third pump 18.

The output signal from the fluid position indicating coil 106 and its associated circuitry is supplied to the OFF control input of the Memory device 132 to turn off said Memory device 132 and to provide a control signal to the OFF input of the Memory device 134. The latter control signal is also applied through the OR device 152 to the OFF control input of a Memory device 154 and through the OR device 156 to the OFF control input of a Memory device 158. The control signal from the coil turns off the signal from the Memory device 134 to deenergize one input of the AND device 138 through the OR device 136 and to deenergize one input of the respective AND devices 94 and 88. The control signal from the coil 102 is applied to the ON input of a Memory device 160 which, in turn, supplies a control signal to the ON input of a Memory device 154 to, in turn, provide a control signal to the OR device 162 to one input of the AND device 142 to, in turn, provide a control signal to the OR device 144 to energize the solenoid valve 32. The output control signal from the Memory device 154 is also applied to one input of the AND device 84 and to one input of the AND device 96.

The control signal from the indicator coil 108 is supplied to the OFF input of the Memory device 160 to turn off the Memory devices 160 and 154. A control signal from the indicator coil 104 is supplied to the ON input of a Memory device 164 to, in turn, provide a control signal to the ON input of a Memory device 158 to apply a control signal to one input of the AND device

4

146 and to one input of the AND device 86 and to one input of the AND device 92. The indicator coil 110 is operative to provide a control signal to the OFF input of the Memory device 164 to turn off said Memory device 164 and the Memory device 158. The OFF output signal from the Memory device 164 is shown connected through the OR device 156 for turning off the Memory device 158. A control signal from the indicator coil 114 is applied to the ON input of a Memory device 166 to, in turn, provide a control signal to the OR device 120 to the ON input of the Memory device 122 for providing an output signal to energize the low-level valve 38. A control signal from the indicator coil 112 is applied to the OFF input of the Memory device 166 to, in turn, provide an OFF control signal to the OR device 168 to the Memory device 122 to terminate the output signal from the Memory device 122. A control signal from the indicator coil 116 is applied to the OFF input of a Memory device 170 and is applied to the input of a NOT device 172 which latter NOT device 172 when the output signal is absent from the indicator coil 116 is operative to provide an output signal to the ON input of the Memory device 170 to energize the alarm device 50.

In the operation of the control apparatus as shown in Figs. 1 and 2A and 2B, and assuming that the fluid container is full of fluid, the float member 49 including the soft-iron core or slug will be positioned at the top of the fluid tube 51 associated with the fluid container 10 and there will be no output signal from the indicator coil 100. At the same time, since the core member is adjacent coil 100, there will be output signals provided from the remainder of the indicating coils 102 through 116. The indicating coil 106 is therefore providing an output signal to the OFF control input of the Memory device 132 to provide an OFF control signal to the OFF control input of the Memory device 134 and through the OR device 152 to the OFF control input of the Memory device 154 and through the OR device 156 to the OFF control input of the Memory device 158. The Memory device 122 is in its ON condition providing an output signal due to the momentary signal from the main power switch contactor 118. The Memory device 170 is off due to the control signal received from the indicator coil 116 and applied to the OFF input of the Memory device 170. This same control signal is applied to the input of the NOT device 172 which, in turn, does not apply a control signal to the ON input of the Memory device 170. The pump sequence selector switch can now be moved into one of its three positions to determine the operating sequence of the illustrated three pumps, and, in addition, the pump control switches for each of the pumps or the respective pumps desired to run are closed. In this regard, due to the pump switch contactors 126, 128 and 130, a momentary signal is applied to each of the solenoid valves 24, 32 and 34, respectively, for the purpose of testing. However, the latter momentary signals terminate when the pump switch is turned to the full ON position.

Due to the operation of the machine device 44 shown in Fig. 1, fluid is removed from the fluid container 10 to cause the fluid level to drop within the fluid container 10 and, thusly, the float member 49 operative with the indicating coils 100 through 116 will change its position to cause the sequential operation of the indicating coil 102 such that it does not provide an output signal and then the indicating coil 104 which does not produce an output signal. This does not change the condition of any of the logic devices in that the Memory devices 160 and 154 responsive to the indicator coil 102 were already in the OFF condition and the Memory devices 164 and 158 responsive to the signal from the indicator coil 104 were already in the OFF condition.

As the machine device 44 continues to remove fluid from the fluid container 10, the level of the fluid within

5

the fluid container 10 will continue to drop until the soft-iron core member is adjacent the indicator coil 106. This removes the output signal from the indicator coil 106 which OFF signal is removed from the OFF input of the Memory device 132.

In this regard, it should be noted that each of the Memory devices as shown in Figs. 2A and 2B are operative such that when only the ON control input is energized by a control signal, that Memory device will provide an output signal. However, when only the OFF control input is so energized or both the OFF control input and the ON control input are simultaneously energized, that Memory device will not provide an output signal.

When the output signal is no longer provided by the indicator coil 106, the output signal from the indicator coil 100 is then operative to turn on the Memory device 132 to, in turn, turn on the Memory device 134 to provide an output signal through the OR device 136 to one input of the AND device 138 and to provide an output signal to one input of the AND device 94 and one input of the AND device 88. Now, depending upon the position of the pump sequence selector switch if, for example, the latter switch is in its first position, the second input of the AND device 138 will be energized through the OR device 76 to energize through the OR device 140 the solenoid valve 24 to bypass the first pump 14.

In this regard, when the solenoid valve 24 is so energized, it closes to allow the output fluid from the first pump to then pass through the check valve 20 and the second check valve 22 to be supplied to the fluid container 10.

If the pump sequence selector switch is in its second position, then the second input of the AND device 88 will be energized to, in turn, provide an output signal through the OR device 148 to close the solenoid valve 34 and allow the fluid output from the third pump 18 to pass through the check valve 30 and the check valve 22 into the fluid container 10.

If, however, the pump sequence selector switch is in its third position, then the second input of the AND device 94 will be energized such that the latter AND device 94 provides an output signal through the OR device 144 to close the solenoid valve 32 and allow the output fluid from the second pump 16 to pass through the check valve 28 and the check valve 22 into the fluid container 10.

In this regard, it should be noted that the check valves 20, 28 and 30 are so operative such that when the solenoid valves 24, 32 and 34 are open, the output fluid from the respective pumps are bypassed back into the fluid reservoir. However, when one or anyone of the solenoid valves is closed, the output fluid from its respective pump then builds up a pressure sufficient to pass through the check valve operative with that particular pump and said output fluid passes into the fluid container 10.

Thusly, the output fluid from one of the pumps as determined by the position setting of the pump sequence selector switch 72 is supplied to the fluid container 10 to restore the level of the fluid which may be water or some other suitable fluid in the fluid container or accumulator 10.

Should the level of the fluid within the fluid container 10 continue to fall due to the operation of the machine device 44, the float and its accompanying soft-iron core passes through the next adjacent indicator coil 108 to terminate the output signal from the latter indicator coil 108 and to allow the output signal provided by the indicator coil 102 to turn on the Memory device 160 to, in turn, turn on the Memory device 154 and provide an output signal through the OR device 162 to one input of the AND device 142 and similarly, to provide a control signal to one input of the AND device 84 and to one input of the AND device 96.

6

Then as previously described, relative to the operation of the pump sequence selector switch, when the latter switch is in its first position to close the contactor 74, a control signal will be supplied through the OR device 78 to the other input of the AND device 142 to provide an output signal through the OR device 144 to close the solenoid valve 32 operative with the second pump 16. However, should the second contactor 82 of the pump sequence selector switch 72 be closed, then the AND device 84 will have both of its inputs energized such that it will provide an output signal through the OR device 140 to close the solenoid valve 24 associated with the first pump 14. However, if the third contactor 90 of the pump sequence selector switch 72 is closed, then a control signal will be supplied to the second input of the AND device 96 such that it provides an output signal through the OR device 148 to close the solenoid valve 34 associated with the third pump 18.

Should the fluid level within the fluid container 10 continue to drop, the soft-iron core member moves into a position adjacent the indicator coil 110 to terminate the output signal from the latter indicator coil 110 to allow the output signal from the indicator coil 104 to turn on the Memory device 164 to, in turn, turn on the Memory device 158 and provide an output signal through the OR device 159 to energize one input of the AND device 146 and to similarly energize one input of the AND device 86 and one input of the AND device 92. Then, depending upon the position of the pump sequence selector switch, the pumps will be sequentially operated. More specifically, in its first position, the contactor 74 will be closed and a control signal will be supplied through the OR device 80 to the second input of the AND device 146 such that the latter AND device 146 provides an output signal through the OR device 148 to close the solenoid valve 34. In its second position with the contactor 82 closed, a control signal will be supplied to the second input of the AND device 86 to cause the latter AND device 86 to provide an output signal through the OR device 104 to close the solenoid valve 32 associated with the second pump 16. In its third position with the contactor 90 closed, a control signal will be supplied to the second input of the AND device 92 to thusly provide an output signal through the OR device 140 to close the solenoid valve 24 associated with the first pump 14. A continuing drop in the fluid level within the fluid container 10 will bring the soft-iron core member into position adjacent the indicator coil 112 to terminate its output signal and allow the output signal from the indicator coil 114 to energize the ON input of the Memory device 166 to provide an output signal through the OR device 120 to the ON input of the Memory device 122 to, in turn, provide an output signal to open the low-level valve 38. It should be noted that the Memory device 122 was already in its ON condition of operation.

A continuing drop in the level of the fluid within the fluid container 10 will move the soft-iron core member into a position adjacent the indicator coil 114 to effectively remove the signal from the indicator coil 114 from the OFF input of the Memory device 166 to, in turn, allow the control signal from the indicator coil 112 to energize the OFF input of the Memory device 166 to turn off the Memory device 166 to, in turn, through the OR device 168 turn off the Memory device 122 and, thusly, remove its output signal to thereby deenergize the low-level valve 38 and allow it to close since the latter low-level valve 38 is held open by the output signal from the Memory device 122.

A further drop in the fluid level within the fluid container 10 will bring the soft-iron core member into a position adjacent the indicator coil 116. This will remove the output signal from the indicator coil 116 from the OFF input of the Memory device 170 and will also remove the input signal from the NOT device 172 to, in turn, allow the latter NOT device 172 to provide an output signal to the ON input of the Memory device

170 to turn the latter device on to provide an output signal to energize the alarm device 50. In addition, the output signal from the NOT device 172 is supplied to the OFF input of the Memory device 122 to provide a second control signal to turn off the Memory device 122 and thusly provide a second effort to deenergize the low-level valve 38.

As the pumps replace the fluid to the fluid container 10, the fluid level begins to rise such that the soft-iron core member moves into a position adjacent the indicator coil 114 and then into a position adjacent the indicator coil 112, which removes the output signal from the indicator coil 112 and allows the output signal from the indicator coil 114 to turn on the Memory device 166 to, in turn, provide a control signal through the OR device 120 to turn on the Memory device 122. The output signal from the Memory device 122 energizes the low-level valve 38 to open the latter valve. As the fluid level within the fluid container 10 continues to rise there is no further response by the control apparatus 26 until the soft-iron core member reaches a position adjacent the indicator coil 104. At this point, the solenoid valve 34 for the third pump 18 is open to bypass the output fluid from the third pump 18 when the soft-iron core member passes a position adjacent the indicator coil 102, the solenoid valve 32 is opened to bypass the output fluid from the second pump 16 and when the soft-iron core member stops in a position adjacent the indicator coil 100, the solenoid valve 24 opens to bypass the output fluid from the first pump 14. In addition, when the soft-iron core member is in a position adjacent the indicator coil 100, the output signal from the indicator coil 106 is effective to turn off the Memory device 132 which provides an output control signal to the OFF input of the Memory device 134 to deenergize the solenoid valve 24 as previously explained and, in addition, the output OFF control signal from the Memory device 132 is applied to the OFF control input of the Memory devices 154 and 158 as a safety measure to make sure that the solenoid valves 32 and 34 for respectively the second pump 16 and the first pump 14 have opened.

It should be noted that due to the retentive elements associated with the Memory devices 134, 154, 158, 122 and 170 that these are permanent Memory units and in the event of a power failure or some other interference with the operation of the control apparatus 26 upon resumption of the power or normal operation, these latter Memory units will resume the same state as existed when the power failed or the interference occurred.

Relative to the bridge circuit including the indicator coils, the bridge circuit is normally in an unbalanced state and provides an output signal in the order of 15 volts. However, when the soft-iron slug is brought into a position adjacent the indicator coil, the inductance of this coil changes and since the indicator coil comprises one leg of the bridge, the bridge now effectively becomes balanced and in this balanced condition has no output signal.

Although the present invention has been described with a certain degree of particularity, it should be understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the scope and spirit of the present invention.

We claim as our invention:

1. In control apparatus for a fluid pump, said pump being operative to supply fluid to a fluid storage member, the combination of a pump control device operatively connected to said pump and operative to provide a first control signal to initiate the operation of said pump, a first fluid sensing device operatively connected to said storage member for producing a second control signal in accordance with a first predetermined fluid condition relative to said storage member, a second fluid sensing device operatively connected to said storage member for

producing a third control signal in accordance with a second predetermined fluid condition relative to said storage member, with said pump control device having an ON control input operative with said first fluid sensing device and responsive to said second control signal for providing said first control signal to initiate the operation of said pump and having an OFF control input operative with said second fluid sensing device and responsive to said third control signal to terminate said first control signal and thereby terminate the operation of said pump.

2. In control apparatus for at least one of a plurality of fluid pumps, said pumps being operative to supply fluid to a fluid storage member, the combination of a pump control device operatively connected to said one pump and operative to provide a first control signal to initiate the operation of said one pump, a fluid sensing device operatively connected to said storage member for producing a second control signal in accordance with a first predetermined fluid condition relative to said storage member, a pump selector control device operative to provide a third control signal for selecting which one of said plurality of pumps is to operate, with said pump control device having a first control input operative with said fluid sensing device and responsive to said second control signal and a second control input operative with said pump selector control device and responsive to said third control signal and being operative such that when said first and second control inputs are simultaneously energized said first control signal will initiate the operation of said one pump.

3. In control apparatus for at least one of a plurality of fluid pumps, said pumps being operative to supply fluid to a fluid container member, the combination of a pump control device operatively connected to at least said one pump and operative to provide a first control signal to initiate the operation of at least said one pump, a first fluid sensing device operatively connected to said member for producing a second control signal in accordance with a first predetermined fluid condition relative to said member, a second fluid sensing device operatively connected to said member for producing a third control signal in accordance with a second predetermined fluid condition relative to said member, with said pump control device having a first control input operatively connected to said first fluid sensing device and responsive to said second control signal for providing said first control signal to initiate the operation of said one pump and having a second control input operatively connected to said second fluid sensing device and responsive to said third control signal to terminate said first control signal and thereby terminate the operation of said one pump.

4. In control apparatus for at least one of a plurality of fluid pumps, said pumps being operative to supply fluid to a fluid container member, the combination of a pump control device operatively connected to at least said one pump and operative to provide a first control signal to initiate the operation of at least said one pump, a first fluid sensing device operatively connected to said member for producing a second control signal in accordance with a first predetermined fluid quantity relative to said member, a second fluid sensing device operatively connected to said member for producing a third control signal in accordance with a second predetermined fluid quantity relative to said member, with said pump control device having a first control input operative with said second fluid sensing device and responsive to said second control signal for providing said first control signal to initiate the operation of said one pump and having a second control input operative with said second fluid sensing device and responsive to said third control signal to terminate said first control signal and thereby terminate the operation of said one pump, with said second predetermined fluid quantity being greater than said first predetermined fluid quantity.

5. In control apparatus for a fluid pump, said pump being operative to supply fluid to a fluid storage member,

9

the combination of a pump control device operatively connected to said pump to provide a first control signal to initiate the operation of said pump, a first fluid control device operatively connected to said storage member for producing a second control signal in accordance with a first predetermined fluid level relative to said storage member, a second fluid control device operatively connected to said storage member for producing a third control signal in accordance with a second predetermined fluid level relative to said storage member, with said pump control device having a first control input operatively connected to said first control device and responsive to said second control signal for providing said first control signal to initiate the operation of said pump and having a second control input operatively connected to said second control device and responsive to said third control signal to terminate said first control signal and thereby terminate the operation of said pump.

6. In control apparatus for a fluid pump, said pump being operative to supply fluid to a fluid container member, the combination of a pump control device operatively connected to said pump and operative to provide a first control signal to initiate the operation of said pump, a first fluid control device operatively connected to said container member for producing a second control signal in accordance with a first predetermined fluid condition relative to said container member, a second fluid control device operatively connected to said container member for producing a third control signal in accordance with a second predetermined fluid condition relative to said container member, with said pump control device having a first ON control input operative with said first control device and responsive to said second control signal for providing said first control signal to initiate the operation of said pump and having a second OFF control input operative with said second control device and responsive to said third control signal to terminate said first control signal and thereby terminate the operation of said pump, with said pump control device being operative in response to both of said second control signal and said third control signal simultaneously to terminate said first control signal and thereby terminate the operation of said pump.

7. In control apparatus for a plurality of fluid pumps, with each of said pumps being operative to supply fluid to a fluid container, the combination of a first pump operation control device having first and second inputs and being operative to produce a first control signal when said first input is energized and being operative to terminate said first control signal when said second input is energized, a first fluid control device operatively connected to said container for producing a second control signal upon the occurrence of a first predetermined fluid condition relative to said container, a second fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a second predetermined fluid condition relative to said container, a pump sequence control device operative to produce a fourth control signal to select the operative sequence of said pumps, with said first input of the first pump operation control device being operative with said first fluid control device and responsive to said second control signal and with said second input being operative with said second fluid control device and responsive to said third control signal, and a second pump operation control device having a pair of inputs and being operatively connected to initiate the operation of one of said pumps when both of the said pair of inputs are energized, with one of the latter said pair of inputs being operative with said first pump operation control device to be energized by said first control signal and the other of the latter inputs being operative with said pump sequence control device to be energized by said fourth control signal to initiate the operation of said one pump.

8. In control apparatus for a plurality of fluid pumps,

10

with each of said pumps being operative to supply fluid to a fluid container, the combination of a first pump operation control device having first and second inputs and being operative to produce a first control signal when said first input is energized and to terminate said first control signal when said second input is energized, a first fluid control device operatively connected to said container for producing a second control signal upon the occurrence of a first predetermined fluid condition, a second fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a second predetermined fluid condition, a pump sequence control device operative to produce a fourth control signal to select the operation of a predetermined one of said pumps, with said first input being operative with said first fluid control device and responsive to said second control signal and said second input being operative with said second fluid control device and responsive to said third control signal, and a second pump operation control device having a pair of inputs and being operatively connected to control the operation of one of said pumps when both of said pair of inputs are energized, with one of said pair of inputs being operative with said first pump control device to be energized by said first control signal and the other of the latter pair of inputs being operative with said pump sequence control device to be energized by said fourth control signal to control the operation of said one pump.

9. In control apparatus for a plurality of fluid pumps, each of said pumps being operative to supply fluid to a fluid container, the combination of a first pump operation control device having first and second control inputs and being operative to produce a first control signal when said first input is energized and to terminate said first control signal when said second input is energized, a first fluid control device operatively connected to said container for producing a second control signal upon the occurrence of a first predetermined fluid condition, a second fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a second predetermined fluid condition, a pump sequence control device operative to produce a fourth control signal to select the operative sequence of said pumps, with said first input being operative with said first fluid control device to be energized by said second control signal and said second input being operative with said second fluid control device to be energized by said third control signal, and a second pump operation control device having a pair of inputs and being operatively connected to one of said pumps to initiate the operation of said one pump when both of said pair of inputs are energized, with one of said pair of inputs being operative with said first pump control device to be energized by said first control signal and the other of the latter pair of inputs being operative with said pump sequence control device to be energized by said fourth control signal to initiate the operation of said one pump.

10. In control apparatus for a plurality of fluid pumps, with each of said pumps being operative to supply fluid to a fluid container, the combination of a Memory device having first and second control inputs and being operative to produce a first control signal when said first input is energized and to terminate said first control signal when said second input is energized, a first fluid control device operatively connected to said container for producing a second control signal upon the occurrence of a first predetermined fluid condition, a second fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a second predetermined fluid condition, a pump sequence control device operative to produce a fourth control signal to select the operative sequence of said pumps, with said first input of the Memory device being operative with said first fluid control device to be energized by said second control signal and with said second input of the Memory device

11

being operative with said second fluid control device to be energized by said third control signal, and an AND device having a pair of inputs and being operatively connected to initiate the operation of one of said pumps when both of said pair of inputs are energized, with one of said pairs of inputs of the AND device being operative with said Memory device to be energized by said first control signal and the other of the latter inputs of the AND device being operative with said pump sequence control device to be energized by said fourth control signal to initiate the operation of said one pump.

11. In control apparatus for a plurality of fluid pumps, with each of said pumps being connected to supply fluid to a fluid container, the combination of a first pump control device having a first pair of control inputs and being operative to produce a first control signal for initiating the operation of a first of said pumps when both of said first pair of inputs are energized, a second pump control device having a second pair of control inputs and being operative to produce a second control signal for initiating the operation of a second of said pumps when both of said second pair of control inputs are energized, a first fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a first predetermined fluid condition, a second fluid control device operatively connected to said container for producing a fourth control signal upon the occurrence of a second predetermined condition, with one of said first pair of inputs of said first pump control device being operative with said first fluid control device and responsive to said third control signal and with one of said second pair of inputs of the second pump control device being operative with said second fluid control device and responsive to said fourth control signal, a pump sequence control device operative to produce a sequence control signal to select the operation of a particular one of said pumps, with said pump sequence control device being connected to one of said first and second pump control devices to energize with said sequence control signal the other of said inputs of said one pump control device to allow thereby the operation initiation of the pump controlled by said one pump control device.

12. In control apparatus for a plurality of fluid pumps, with each of said pumps being connected to supply fluid to a fluid container, the combination of a first AND pump control device having a first pair of control inputs and being operative to produce a first control signal for initiating the operation of a first of said pumps when both of said first pair of inputs are energized, a second AND pump control device having a second pair of control inputs and being operative to produce a second control signal for initiating the operation of a second of said pumps when both of said second pair of control inputs are energized, a first fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a first predetermined con-

12

dition, a second fluid control device operatively connected to said container for producing a fourth control signal upon the occurrence of a second predetermined fluid condition, with one of said first pair of inputs of said first AND device being operative with said first fluid control device to be responsive to said third control signal and with one of said second pair of inputs of the second AND device being operative with said second fluid control device to be responsive to said fourth control signal, a pump sequence control switch operative to produce a sequence control signal to select the operation of a particular one of said pumps, with said pump sequence control switch being connected to one of said first and second AND devices to energize with said sequence control signal the other of said inputs of said one AND device to allow thereby the operation initiation of the pump controlled by said one AND device.

13. In control apparatus for a fluid pump, with said pump being connected to supply fluid to a fluid container, the combination of a first pump control device having a first pair of control inputs and being operative to produce a first control signal for initiating the operation of said pump when both of said first pair of inputs are energized, a second pump control device having a second pair of control inputs and being operative to produce a second control signal for initiating the operation of said pump when both of said second pair of control inputs are energized, a first fluid control device operatively connected to said container for producing a third control signal upon the occurrence of a first predetermined fluid condition, a second fluid control device operatively connected to said container for producing a fourth control signal upon the occurrence of a second predetermined fluid condition, a pump sequence control device operative to produce a sequence control signal and having a first position operative with said first pump control device and where said sequence control signal is supplied to one of said first pair of inputs and having a second position operative with said second pump control device and where said sequence control signal is supplied to one of said second pair of inputs, with the other of said first pair of inputs being operative with said first fluid control device and responsive to said third control signal and with the other of said second pair of inputs being operative with said second fluid control device and responsive to said fourth control signal, with said pump sequence control device being operative to energize with said sequence control signal a particular one of said pump control devices to allow thereby the operation initiation of the pump controlled by said one pump control device.

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