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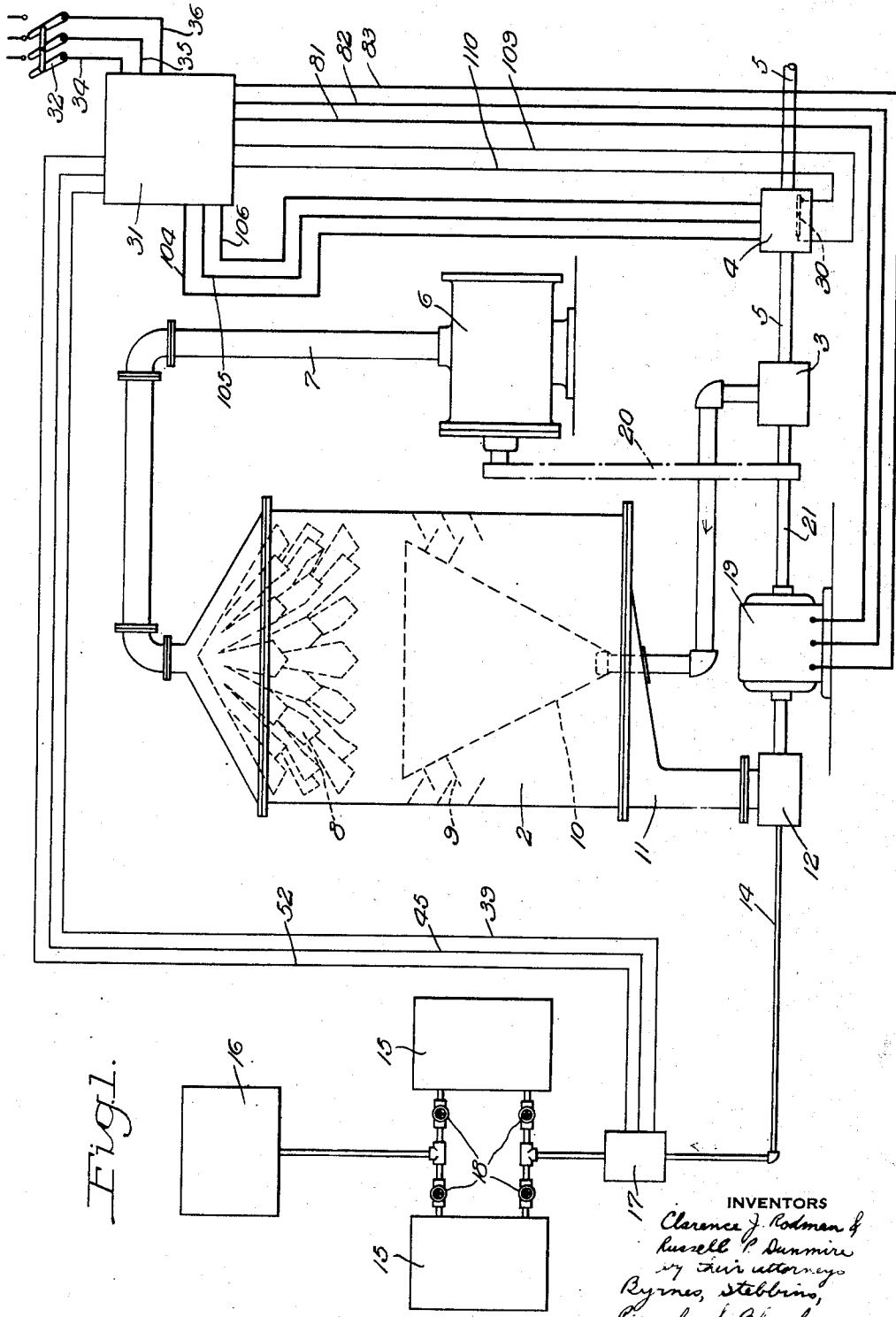
C. J. RODMAN ET AL

1,890,265

LIQUID TREATING APPARATUS

Filed Sept. 28, 1929

2 Sheets-Sheet 1



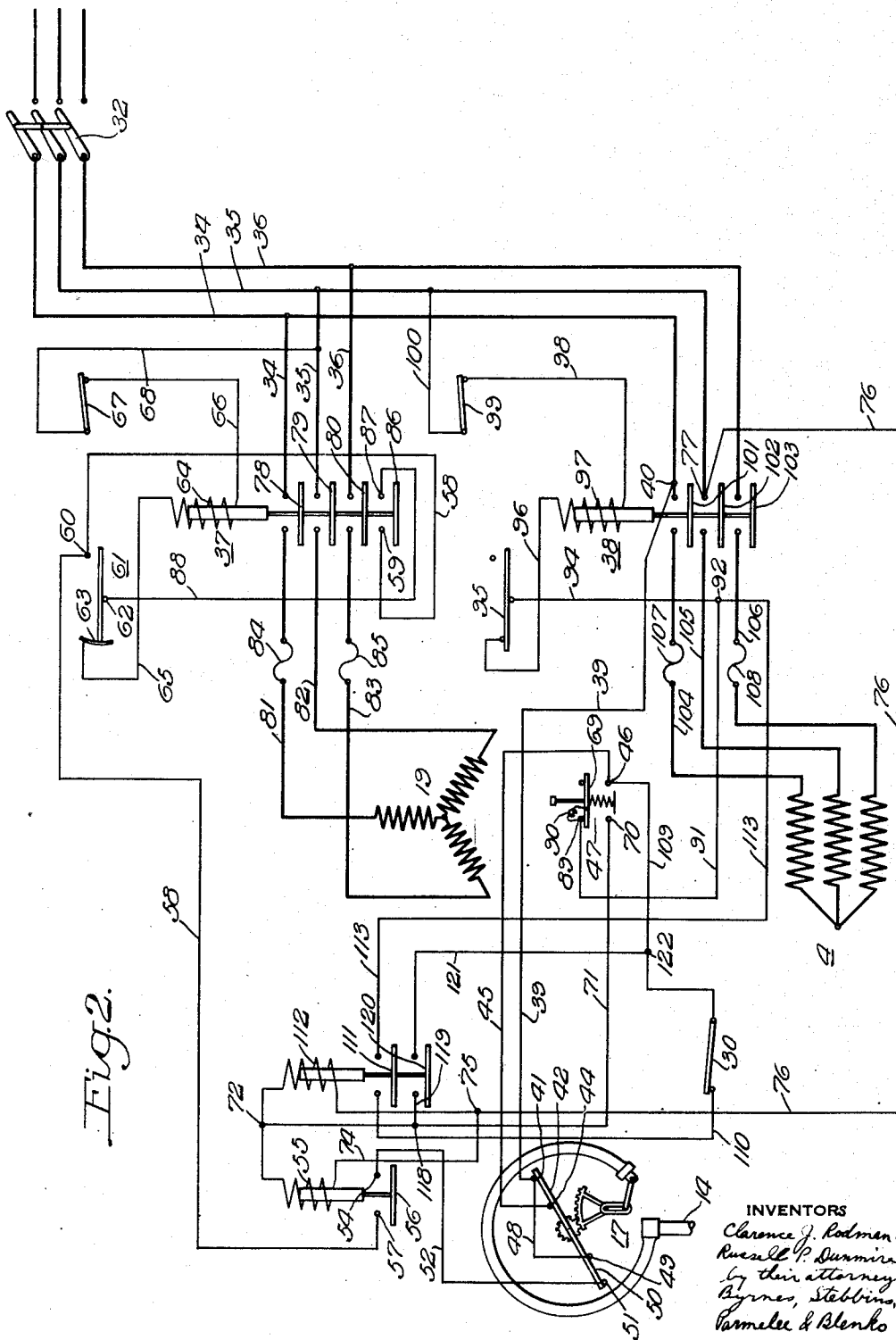
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UNITED STATES PATENT OFFICE

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LIQUID TREATING APPARATUS

Application filed September 28, 1929. Serial No. 395,811.

Our invention relates to liquid treating apparatus and more particularly to an electrical control system for oil purifying apparatus. In our co-pending application Serial No. 373,503 filed June 25, 1929, we have disclosed a method and apparatus for treating liquids and more particularly for treating insulating oils used in electrical apparatus. In the treatment of such liquids, a heater is disposed in a pipe line for warming liquid prior to its being fed under pressure into a vacuum tank for removing certain of the impurities by the shock to the liquid in suddenly passing from a condition of pressure to an atomized spray in a rarefied atmosphere. From the vacuum tank the liquid is passed to a selected one of a plurality of filters through which the liquid is forced under pressure.

By the present invention we provide a system of electrical control in which a driving motor for the several pumps used in the purifying apparatus and the heater are controlled in accordance with the operation of the apparatus. The entire starting operation of the device is under the control of a single switch. If the device is started, the heater and the driving motor for one or more of the pumps are controlled by the pressure of the fluid entering the filters. The heater is energized and de-energized independently of the pump motor or motors in accordance with its own temperature. By controlling the apparatus in accordance with the pressure of fluid entering the filter, excessive filter pressures such as are apt to force impurities through the filtering media or disrupt them are avoided.

The accompanying drawings illustrate a present preferred embodiment of the invention, in which

Figure 1 is a diagrammatical view of circuits and apparatus embodying our invention; and

Figure 2 is a detail electrical wiring diagram showing the control circuits.

Referring to the drawings, liquid to be treated, and particularly insulating oils such as are used in electrical transformers, circuit breakers and the like, is supplied to a vacuum treating tank 2 by a pump 3 through a heater

4 disposed in a connecting pipe line 5. A pump 6 is connected through a pipe line 7 to the top of the vacuum tank 2 for maintaining a desired rarefied pressure therein. Baffles 8 and 9 and a deflecting cone 10 are disposed in the tank 2 for baffling liquid and diverting it to an outlet 11 in the tank 2. The details of the baffles, reflector and the operation thereof are described in our co-pending application Serial No. 373,503 filed June 25, 1929. The treating of liquids by suddenly releasing them from pressure into a condition of vacuum produces a shock which has pronounced advantages in the treating of such liquids, and particularly in purifying electrical insulating oil.

A discharge pump 12 connected to the outlet 11 forces the treated liquid from the tank 2 through a pipe line 14 to one of a plurality of filters 15 which are in turn connected to a storage tank 16. For preventing impurities from being forced through the filters 15 by the pressure of the pump 12 and also to prevent the destruction of the filtering medium itself, a pressure switch 17 is disposed in the pipe line 14 between the pump 12 and a plurality of valves 18. The valves 18 selectively control the admission of fluid to the different filters 15.

A motor 19 is provided for driving the pumps 3, 6 and 12. The pump 6 is connected to the motor 19 through a reduction gearing 20 or a chain drive. Pumps 3 and 12 are directly connected to the motor 19 by a shaft 21. It is to be understood that independent motor drives for the pumps 3, 6 and 12 may be used if desired. A thermostat 30 is provided in the heater 4 for controlling the energization thereof.

Referring to Figure 1, the motor 19, the heater 4, the thermostat 30 and the pressure switch 17 are shown connected to an electrical cabinet 31 by electrical conductors. The cabinet 31 is connected by conductors to a service switch 32. The details of the electrical circuits embodied in and controlled by apparatus in the cabinet 31 are shown in Figure 2.

In Figure 2 the motor 19 is illustrated as a three-phase Y connection and the heater 4 is illustrated as a three-phase Y connected re-

sistor, although it is to be understood that the motor and heater may be operated on a single-phase circuit within the spirit of the invention and the scope of the appended claims. The switch 32 connects supply conductors 34, 35 and 36 to terminals on contactors 37 and 38 for controlling the motor 19 and the heater 4, respectively.

For controlling the energization of the contactors 37 and 38, we provide an initiating circuit which is controlled by the pressure switch 17, so that it is impossible to start either the motor 19 or the heater 4 when the pressure switch is open, thereby insuring proper filtering of the fluid in its movement through the filters 15 by keeping the pressure within a safe working range. The initiating circuit comprises a conductor 39 extending from a terminal 40 on the conductor 34 to a terminal 41 in the pressure switch 17, a moving contact arm 42 of the pressure switch 17, a terminal 44 engaged by the contact arm 42, and through a conductor 45 to terminal 46 on a push button switch 47. From the terminal 41, a jumper connection 48 extends to a terminal 49 which is also in the pressure switch 17. A contact arm 50 in the switch 17 completes a circuit between the terminal 49 and another terminal 51.

The contact arms 42 and 50 of the pressure switch 17 are adapted to move simultaneously, thereby disconnecting the terminals 44 and 51 from the conductor 39 upon the occurrence of excessive pressure in the pipe line 14. A conductor 52 extends from the terminal 51 to a terminal 54 on a relay 55. A front contact member 56 on the relay 55 is adapted to connect the terminal 54 with a terminal 57 from which a conductor 58 extends to a terminal 59 on the contactor 37. The conductor 58 is also provided with a terminal 60 co-operating with a three-point switch 61. As the push button switch 47 and the switch 61 are utilized in starting the motor 19 and as the pressure switch 17 controls the circuits for supplying electrical energy to the switches 47 and 61, it follows that the operation of the motor cannot take place when the pressure switch 17 is open circuited, thereby indicating a condition of excessive pressure in the pipe line 14. Normally the contacts through the pressure switch 17 are closed to energize the conductor 58, and its terminals 59 and 60 together with the conductor 45 and the terminal 46 of the switch 47.

When it is desired to start the motor 19, the switch 61 is placed in position to complete a circuit between the terminal 60 and a terminal 62. When it is desired to start the heater 4 before the motor 19, the starting circuit through the switch 61 need not be completed until after the heater 4 has become heated. The switch 61 also completes a circuit between the terminal 62 and a terminal

63 for energizing the winding 64 of the contactor 37. The circuit extends from the terminal 63 through conductor 65, the winding 64, a conductor 66, a service switch 67 and a conductor 68 to the supply conductor 35. However, the entire circuit between the conductors 34 and 35 is still open at the relay 55.

For energizing the relay 55 to complete the circuit between the terminals 54 and 57, the push button switch 47 is depressed to complete a circuit extending from the terminal 46 through a contact 69 in the switch 47, a terminal 70, a conductor 71, a terminal 72, winding of the relay 55, a conductor 74, a terminal 75 and a conductor 76 to a terminal 77 on the conductor 35. The completion of this circuit energizes the relay 55 to close its contacts which, in turn, completes the circuit for the contactor 37 through the pressure switch 17 and the switch 61 as heretofore described.

Upon the closing of the contactor 37, the conductors 34, 35 and 36 are connected through front contacts 78, 79 and 80 and conductors 81, 82 and 83, respectively, to the windings of the motor 19. Fuses 84 and 85 are preferably placed in the conductors 81 and 83. Upon the closing of the contactor 37, a circuit is completed for maintaining the coil 64 energized independently of the switch 61. This circuit extends from the terminal 59 on the conductor 58 through a front contact 86 on the contactor 37, a terminal 87 and a conductor 88 to the terminal 62. For manually stopping the motor 19, the switch 61 is operated to open the circuit between the terminals 62 and 63 which causes the de-energization of the winding 64 of the contactor 37.

The heater 4 may be energized simultaneously with or previous to the energization of the motor 19 in accordance with the setting of the switch 61. In practice the energization of the heater 4 often takes place previous to the energization of the motor 19. The energization of the heater 4 is also controlled by the push button 47. The closing of the push button switch 47 completes a circuit between the terminal 46 and a terminal 89 in the switch 47 through the contact 69 and a jumper 90. From the terminal 89 the circuit extends through a conductor 91, a terminal 92, a conductor 94, a manually operable switch 95, a conductor 96, a coil 97 of the contactor 38, a conductor 98, a service switch 99 and a conductor 100 to the supply conductor 35. The completion of this circuit closes the contactor 97 for connecting the heater 4 to the conductors 34, 35 and 36 through the front contacts 101, 102, 103 and conductors 104, 105 and 106, respectively. The conductors 104 and 106 are provided with fuses 107 and 108, respectively.

For completing the holding circuit for the contactor 97 independent of the push button

switch 47 and for putting the contactor 97 under control of the thermostat 30, a circuit is completed which extends from the terminal 46 through a conductor 109, the thermostat 30, a conductor 110, a contact 111 on a relay 112, and a conductor 113 to the terminal 92. This circuit bridges the switch 47 between the terminals 46 and 92.

As the circuit contains the thermostat 30, the operation of the contactor is made dependent upon the opening and closing of the thermostat 30. So long as the relay 112 remains energized and the switch 95 closed, the circuit for the contactor 97 may be made and broken by a movement of the thermostat 30 in accordance with the heat of the heater 4. The circuit for the heater 4 may be opened manually by the switch 95 when desired. By opening the switch 99, the heater is rendered inoperative although the motor 19 may operate. Conversely, the opening of the switch 67 while the switch 99 is closed permits the use of the heater without the use of the motor 19.

The relay 112 is connected between the terminals 72 and 75 so that it is energized when the relay 55 is energized. The closing of the relay 112 completes a circuit from a terminal 118 on the conductor 71 through a conductor 119, a front contact 120 on the relay 112, and a conductor 121 to a terminal 122 on the conductor 109. The completion of this circuit bridges the push button switch 47 between the contacts 46 and 70 through the contactor 69. Accordingly, upon the release of push button switch 47, the motor and heater continue to operate unless stopped by the operation of the pressure switch 17 provided the separate control switches and the thermostat 30 are closed.

While we have shown and described the present preferred embodiment of our invention, it is to be understood that it may be otherwise embodied within the spirit of the invention and the scope of the appended claims.

We claim:—

1. A fluid treating device comprising a heater for the fluid, a filter therefor, means for supplying fluid to said heater and filter and means responsive to the pressure of the fluid supplied to the filter for stopping operation of said supply means and said heater.

2. A fluid treating device comprising a heater for the fluid, a filter therefor, means for supplying fluid to said heater and filter, means responsive to the pressure of the fluid supplied to the filter for stopping operation of said supply means and said heater, and means for controlling said heater independently to maintain a definite temperature therein.

3. A liquid treating device comprising a liquid treating chamber, a heater for liquid, a filter, a connecting conduit between said

chamber and filter, a pressure operated switch connected thereto, a pump, an operating motor therefor, and means controlled by said pressure switch for preventing operation of said motor and heater, and independent means for controlling said heater to maintain a definite temperature therein.

4. A liquid treating device comprising a tank, liquid supply therefor, a pump for supplying liquid from said tank under pressure to a filter, a motor for actuating the pump, a heater connected between the tank and its supply means for treating liquid moving to said tank, a pressure operated switch disposed on the discharge side of said pump, and means controlled thereby for de-energizing said motor and heater on the occurrence of excessive pressure in said filter and means for controlling the heater in accordance with its temperature.

5. A liquid treating device comprising a tank, a pump for delivering liquid from the tank to a filter, means for supplying liquid to the tank, a heater in the inlet to the tank, and a switch controlled in accordance with the pressure at the discharge end of said pump, for controlling said pump and heater.

6. A liquid treating device comprising a treating tank, a pump associated with said tank for delivering liquid from said tank, a heater for liquid traversing said tank, means for energizing said motor and heater, and a normally closed pressure operated switch associated with said pump for rendering said means ineffective upon conditions of excessive pressure on the discharge side of said pump.

7. A liquid treating device including a heater and a motor driven pump, a starting switch therefor, means actuated by the discharge pressure of the pump for rendering said starting switch ineffective, and a thermostat for further controlling said heater.

8. A liquid treating device comprising a heater for liquid, a chamber for subjecting heated liquid to a reduced pressure, a filter, a pump for transferring liquid from said chamber to said filter, a pressure operated switch connected between said chamber and filter responsive to the back pressure of said filter, for controlling the energization of said motor and heater, and means for independently controlling the energization of said heater in accordance with its temperature.

9. A liquid treating device comprising a heater for liquid to be treated, a treating chamber connected thereto, motor actuated means for controlling the pressure in said chamber, a filter, a pump for conveying liquid from said chamber to said filter, motor operated actuating means for the pump, means responsive to the back pressure on said filter for controlling the energization of the motor means cooperating with said chamber, pump, and heater, and means for independently controlling said heater in accordance

with its temperature, said pressure responsive means serving when operated to render said independent controlling means ineffective upon occurrence of excessive back pressures on said filter.

5 10. In a fluid treating system, a fluid heater on the supply side thereof, a pump and a filter on the discharge side, means for operating said heater and pump, means responsive to
10 the pressure in the filter for rendering the pump and heater ineffective, and independent control means for the heater responsive to the temperature therein.

11. In a fluid treating system, a fluid heater
15 on the supply side thereof, a pump and a filter on the discharge side, operation initiating means common to the heater and pump, and means for rendering the heater alone ineffective.

20 12. In a fluid treating system, a fluid heater on the supply side thereof, a pump and a filter on the discharge side, operation initiating means common to the heater and pump,
25 means for rendering the heater alone ineffective, and means for de-energizing the heater and stopping the pump when the discharge pressure of the latter exceeds a certain value.

13. In a fluid treating system, a fluid heater on the supply side thereof, a pump and a filter
30 on the discharge side, means for simultaneously rendering said heater and pump effective, means for simultaneously rendering them both ineffective, and independent means for controlling said heater.

35 14. In a fluid treating system, a fluid heater on the supply side thereof, a pump and a filter on the discharge side, control means for the heater and pump responsive to the pressure in
40 the filter, and thermostatic control means for the heater.

In testimony whereof we have hereunto set our hands.

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