United States Patent [19]

Patycola

[11] **3,756,221**

[45] **Sept. 4, 1973**

[54] **CONTROL APPARATUS FOR GAS BURNERS**

[76] Inventor: **Edward A. Patycola,** 22425 Audrey Ave., Warren, Mich. 48091

[22] Filed: **Sept. 14, 1972**

[21] Appl. No.: **288,898**

[52] **U.S. Cl.** ..... **126/360 R,** 431/90

[51] **Int. Cl.** **F24h 1/24**

[58] **Field of Search** ..... 431/90; 126/360 R, 126/360 A

[56] **References Cited**

UNITED STATES PATENTS

3,421,496	1/1969	Gething	126/360 R
3,568,658	3/1971	Brock	126/360 A
3,592,574	7/1971	Zenkner	431/90
3,676,042	7/1972	Osborne	431/90

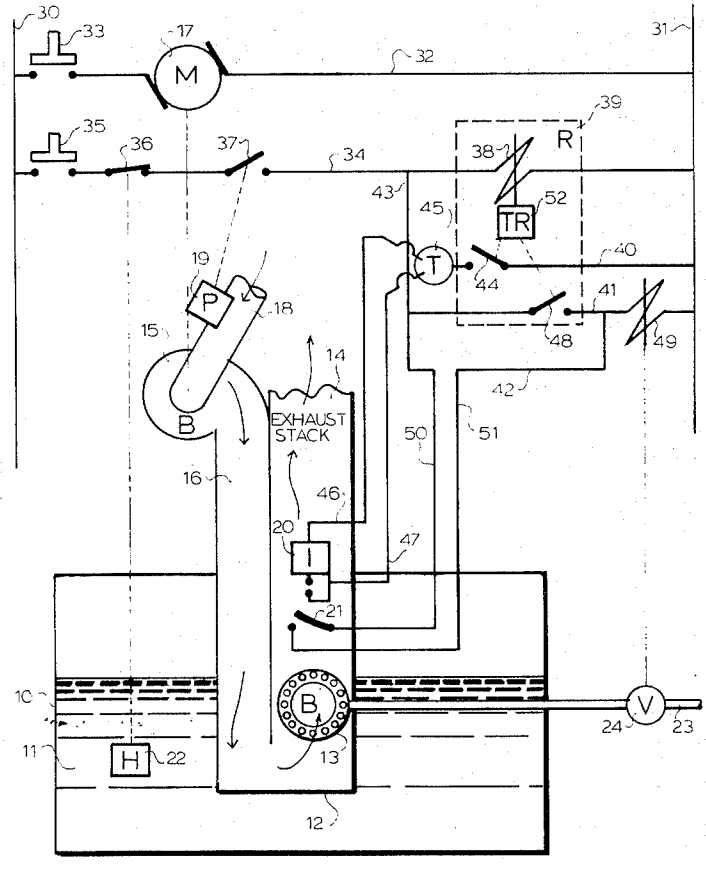
Primary Examiner—Edward G. Favors

Attorney—William T. Sevald

[57] **ABSTRACT**

An apparatus for automatically controlling the gas burner of an emersion heater by igniting, extinguishing, and re-igniting the flame of a gas burner in response to the temperature of the liquid or mass being heated wherein closing the circuit is rendered subject to the actual operation of a blower exhausting unburned gas products from the heater and wherein the operator controls the initial igniting sequence via a manual switch. Upon the operator closing the manual switch in the control circuit, a relay is energized closing contacts, energizing an igniter and a solenoid gas valve to supply gas and to ignite a flame. A time release head on the relay opens the contacts after a short time period. The operator opens and closes the manual switch until a flame is established leaving the manual switch closed when a flame is established, whereupon a thermocouple in the liquid mass operates the control circuit de-energizing the relay coil allowing it to re-set when the desired temperature is reached and then re-energizing the relay coil to energize the flame igniter and gas valve when heat is to be re-supplied upon the temperature of the mass dropping.

1 Claim, 4 Drawing Figures



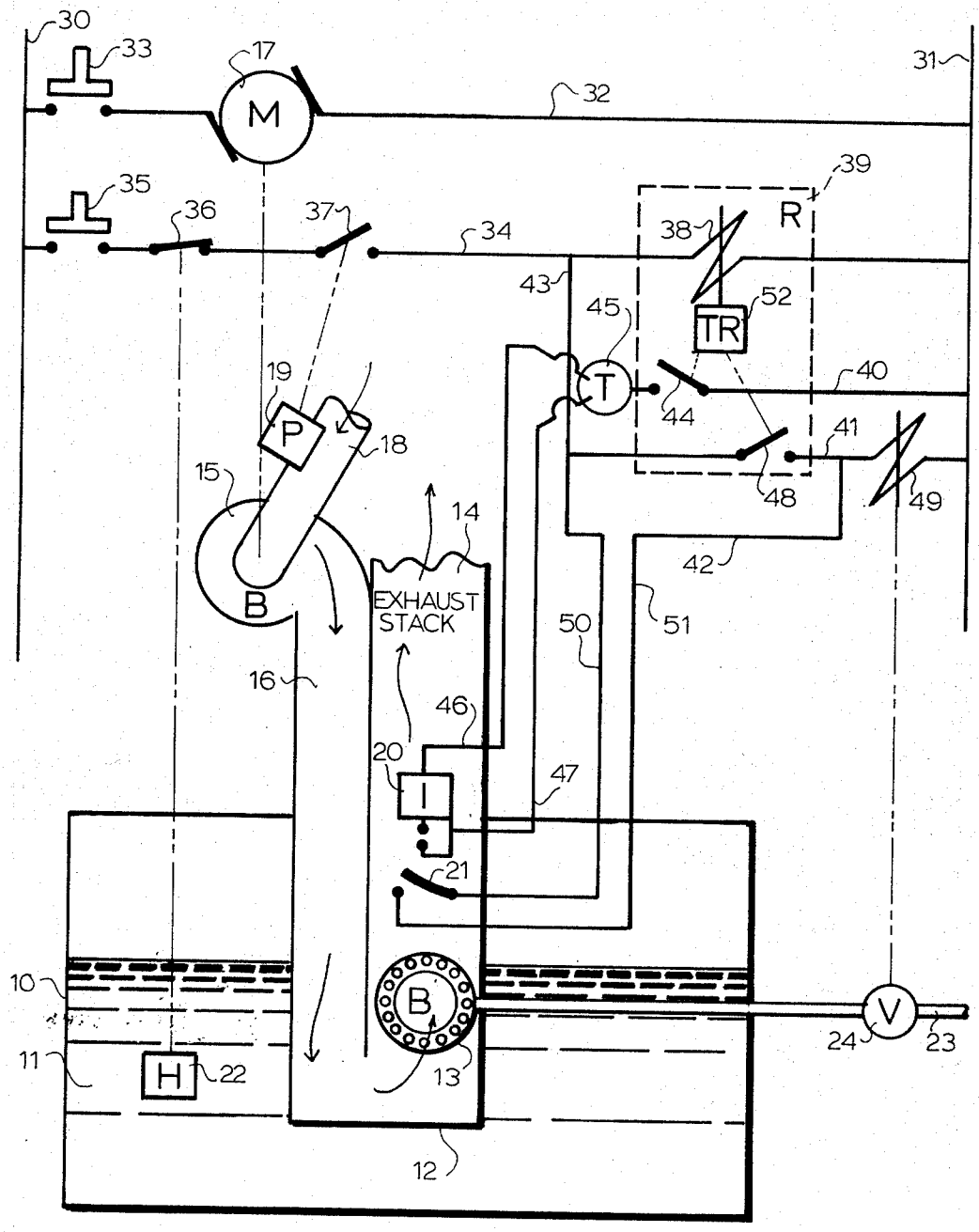

30
33
17
M
31
32
35
36
37
34
39
R
38
43
45
52
TR
T
40
44
41
19
P
18
15
48
49
14
B
EXHAUST STACK
42
50
51
16
46
20
I
47
21
10
B
V
24
23
11
H
22
13
12

Fig.1

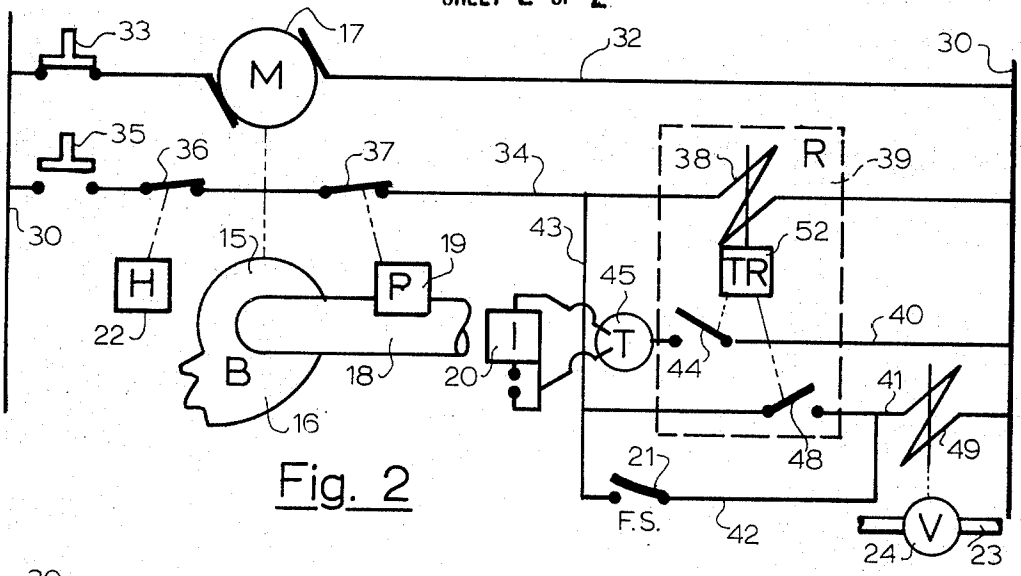


Fig. 2

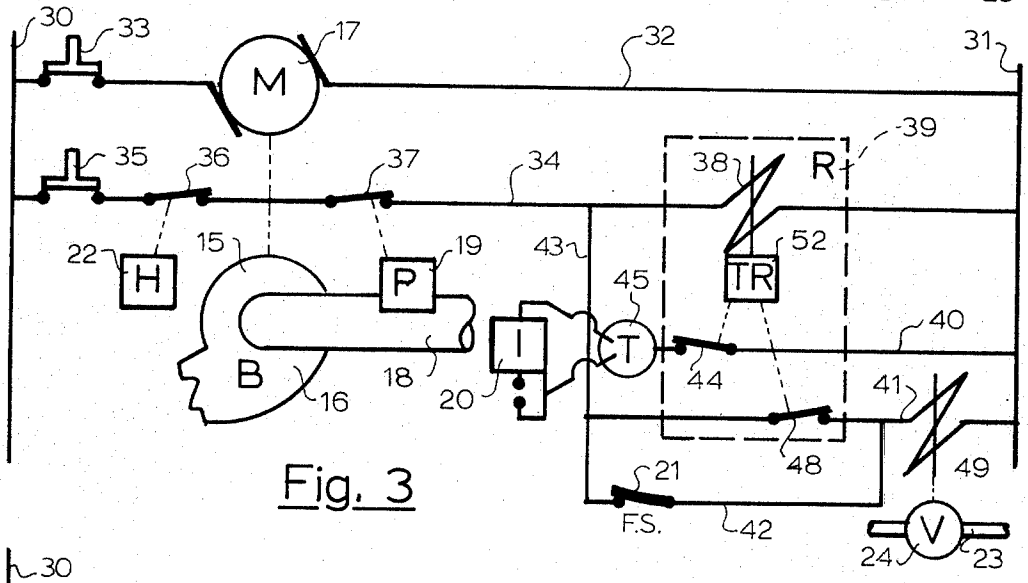


Fig. 3

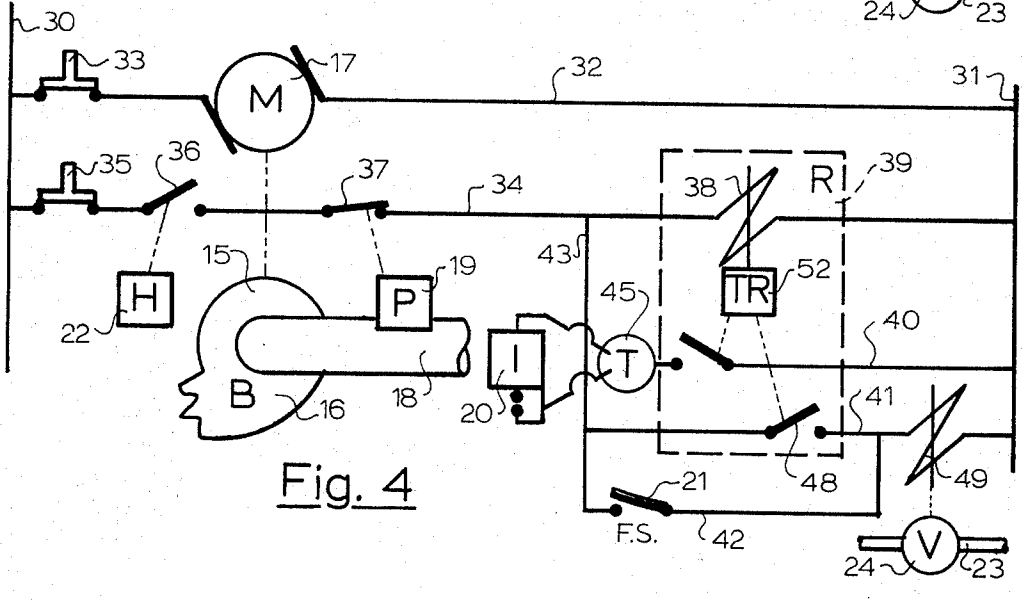


Fig. 4

CONTROL APPARATUS FOR GAS BURNERS

Edward A. Patycola, a citizen of the United States of America, residing at 22425 Audrey Avenue, Warren, Macomb County, Michigan 48091, is the applicant herein for Letters Patent of the United States of America for an apparatus for automatically controlling the gas-burner of an emersion heater.

Control apparatus has been used heretofore to operate emersion heaters, however, the several devices of the prior art have not proven entirely satisfactory in that they are complicated in design and construction, expensive to manufacture, difficult to integrate with other equipment, and not suitably reliable in commercial use.

With the foregoing in view, the primary object of the invention is to provide an apparatus for controlling emersion heaters which is simple in design and construction, inexpensive to manufacture, easy to integrate with other equipment, and very reliable in commercial use.

An object of the invention is to provide control apparatus having a relay equipped with a time release head so that upon energizing the coil of the relay, the normally open contacts are held in for a relatively short time, such as two seconds, with the contacts closing sub-circuits to an electric spark igniter and a solenoid operated gas valve to ignite the burner.

An object of the invention is to provide a flame-sensor switch in a shunt circuit around the relay to the gas valve to hold the valve open after the flame ignites and the time release head allows the relay contacts to open.

An object of the invention is to provide a thermostatically controlled switch responsive to the temperature of the mass which acts in the control circuit to energize the relay to ignite a flame, to de-energize the relay to allow it to re-set, to open the circuit to extinguish a flame, and to again energize the relay to re-light a flame automatically.

These and other objects of the invention will become apparent by reference to the following description of a control apparatus embodying the invention taken in connection with the accompanying drawings, in which:

FIG. 1 is a schematic showing of the control apparatus integrated with a tank containing a liquid mass and an emersion heater showing the various components diagrammatically and showing the system at rest.

FIG. 2 is a view similar to FIG. 1, but with the tank and heater deleted, showing the blower circuit closed developing low pressure to close the pressure sensitive switch in the control circuit.

FIG. 3 is a view similar to FIG. 2, showing the control circuit closed, the relay energized, and all switches closed, illustrating the flame ignition and burning sequences; and

FIG. 4 is a view similar to FIG. 2, with the thermostatically controlled switch in the control circuit open upon the liquid mass being heated to the desired temperature.

Referring now to the drawings wherein like numerals refer to like and corresponding parts throughout the several views, the control apparatus and environment comprises a tank **10** containing a liquid or mass **11**. An emersion gas heater **12** lies in the liquid or mass **11**. A burner **13** in the heater **12** exhausts through a stack **14**. A blower **15** supplies air to the burner **13** through a supply duct **16**. A motor **17** drives the blower **15**. An

intake duct **18** feeds air to the blower **15**. A pressure sensitive device **19** lies in the intake duct **18**. An electric spark igniter **20** and a flame sensor thermocouple **21** lie adjacent the burner **13**. A heat sensitive diaphragm **22** lies in the tank **10**. A gas pipe **23** leads to the blower **13**. A valve **24** controls gas flow in the pipe **23** to the burner **13**.

Electric supply lines **30** and **31** supply power to the apparatus. A circuit **32** between the lines **30** and **31** includes a motor **17**. A manual on-off switch **33** in the motor circuit **32** controls the motor **17** and the blower **15**.

A control circuit **34** lies between the supply lines **30** and **31**. A manual on-off switch **35**, a switch **36** operated by the diaphragm **22**, a switch **37** operated by the pressure sensitive device **19**, and a coil **38** of a relay **39** all lie in the control circuit **34**. A sub-circuit **40**, a sub-circuit **41**, and a shunt circuit **42** have a common side **43** leading to the supply line **30** via the control circuit **34** and have their other sides leading to the supply line **31**. Sub-circuit **40** is controlled by a relay contact **44** and includes a transformer **45** connected to the igniter **20** by wires **46** and **47** or by a single wire and suitable ground connections. Sub-circuit **41** is controlled by a relay contact **48** and includes a solenoid connected to the gas valve **24**. The shunt circuit **42** leads around the contact **48** of sub-circuit **41** to the solenoid **49** and includes the flame sensitive thermocouple or by-metal switch **21** via the wires **50** and **51**. A time release head **52** is directly actuated by the coil **38** of the relay **39** and holds the contacts **44** and **48** closed for a short time, such as 1 to 10 seconds, and then allows the contacts to open although the coil is still energized. Upon the coil **38** being de-energized, the relay **39** and the time release head **52** are re-set so as to be capable of again closing the contacts **44** and **48** upon the coil **38** being re-energized.

With the system at rest, FIG. **1**, the circuits are de-energized and all switches are open except the normally closed temperature switch **36** in the control circuit **34**. This switch **36** is closed due to the fact that the liquid or mass **11** is below desired operating temperature and the heat sensitive diaphragm **22** is not subjected to a high enough temperature to move the temperature switch **36** to its open position.

To prepare to ignite the burner **13**, the operator closes the switch **33** in the motor circuit **32** energizing the motor **17** which drives the blower **15** creating a low pressure in the duct **18** causing the pressure sensitive device **19** to close the switch **37** in the control circuit **34** as shown in FIG. **2**. Should the blower **15** stop operation for any reason, the switch **37** opens shutting down the system.

To initiate burning, FIG. **3**, the operator closes the manual switch **35** in the control circuit **34** energizing the coil **38** of the relay **39** actuating the time release head **52** to close contacts **44** in sub-circuit **40** powering the transformer **45** causing the igniter **20** to provide ignition spark and also to close the contact **48** energizing the solenoid **49** to open the gas valve **24** in the gas pipe **23** to furnish gas to the burner **13** in the presence of the ignition spark from the igniter **20** whereupon a flame is established causing the flame sensor switch **21** to close completing the shunt circuit **42** to the solenoid **49** holding the gas valve **24** open. The time release head **52** then opens the contacts **44** and **48**.

Upon the ignited burner **13** heating the mass to the desired temperature, FIG. **4**, the heat sensitive diaphragm **22** opens the switch **36** in the control circuit **34** de-energizing the solenoid **49** allowing the gas valve **24** to close shutting off gas supply and the flame goes out, the flame sensor switch **21** opens, and the relay **39** resets.

Upon the liquid or mass **11** losing heat and coming to a temperature below that desired, the heat sensitive diaphragm **22** closes the temperature switch **36** closing the control circuit **34** as seen in FIG. **3**, and the relay coil **38** is again energized to actuate the time release head **52** to close the contacts **44** and **48** which again ignites the flame at the burner **13** and the flame sensitive switch **21** closes the shunt circuit **42** maintaining power to the solenoid **49** to hold the gas valve **24** open maintaining gas supply to the burner **13** and the flame continues until the temperature of the liquid or mass rises to the desired temperature whereupon the heat sensitive diaphragm **22** opens the temperature switch **36** and the flame is extinguished as previously described.

The cycle thus continues automatically so that upon the temperature of the mass **11** dropping, the switch **36** closes igniting the flame which continues until the temperature of the mass rises to the desired temperature whereupon the switch **36** opens extinguishing the flame as previously described. Thus the switch **36** is closed and opened sequentially reactively to the temperature of the mass **11** to maintain the heat of the mass at the desired temperature.

To shut down the system, the operator opens the switch **35** de-energizing the control circuit **34** and opens the switch **33** de-energizing the motor circuit **32.**

Should a flame not ignite immediately upon initiation of burning, the operator opens and closes the switch **35** until a flame is established. Should a flame not ignite during the automatic cycling, the operator then opens and closes the switch **35** as necessary to ignite and establish the flame.

The system has been tested in commercial use in a plating plant and has been found to be far more satisfactory and reliable than more complicated and sophisticated systems previously known.

The scope of protection of the invention is defined in the appended claims.

I claim:

1. A system for automatically controlling the gas burner of an emersion heater to maintain the heat level of a liquid-mass at a desired temperature automatically in a tank containing the liquid-mass equipped with an emersion heater, a gas burner in the heater, a gas supply pipe leading to the burner, a normally closed gas valve in the pipe, a blower for flowing air through the heater to supply oxygen and to remove unburned gas and the products of burned gas, an electric motor driving the blower, a motor circuit powering the motor, and an on-off switch in the motor circuit for controlling the motor to activate and de-activate the blower with the blower having a low air pressure area when operating to force air-flow through said heater;

said system comprising:

an air pressure sensitive device connected with said low air pressure area of the blower,

a burner control circuit,

a normally open air flow switch in said control circuit operably connected to said pressure sensitive device;

an electric spark igniter at the burner,

a normally open flame sensor switch at the burner closing in the presence of a flame,

a solenoid on the gas valve for opening the gas valve to supply gas to the burner;

said pressure sensitive device closing said air flow switch during low pressure conditions during operation of the blower and allowing said air flow switch to open upon the blower not operating,

a normally closed liquid-mass temperature switch in said control circuit,

a mass temperature sensitive apparatus in the tank connected to said temperature switch to open said temperature switch when the mass is at a desired temperature and to close said temperature switch when the mass is below the desired temperature,

a relay having a coil in said control circuit,

said relay having first and second paired normally open contacts,

a time release head on said relay holding said contacts closed for a relatively short time when said coil is energized and then allowing said contacts to open,

a first sub-circuit on said control circuit including said first contacts of said relay and said igniter,

a second sub-circuit on said control circuit including said second contacts of said relay and said solenoid operating said gas valve,

a shunt circuit on said control circuit including said flame sensor switch and said solenoid operating said gas valve, and

a manual switch in said control circuit for closing and opening said control circuit;

upon operation of the blower said air flow switch closing rendering said control circuit operable by said manual switch,

in initially establishing a flame with the blower operating and said air flow switch closed, the operator closes said manual switch in said control circuit energizing said coil of said relay closing said first and second relay contacts for a relatively short time period via said timing head to energize said igniter and to energize said solenoid to open said gas valve,

upon a flame igniting said flame sensor switch closes said shunt circuit and maintains said gas valve solenoid energized and said gas valve open maintaining gas supply to the flame to heat the liquid-mass after said time release head allows said relay contacts to open;

upon a flame maintaining and heating the liquid-mass to the desired temperature, said temperature sensitive apparatus opens said temperature switch opening said control circuit and de-energizing said solenoid whereupon the gas valve closes and de-energizes said coil of said relay allowing said relay to re-set;

subsequently upon the heat of the mass dropping below the desired temperature, said temperature sensitive apparatus closes said temperature switch to close said control circuit to re-energize said relay whereupon said flame ignition sequence occurs igniting a flame and said flame sensor closes said shunt circuit maintaining said solenoid energized and the gas valve open maintaining the flame;

said foregoing sequences controlled by said heat sensitive apparatus repeating automatically in a cycle to maintain the mass at the desired temperature.

* * * * *