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BURNER SAFETY CONTROL APPARATUS FOR AIR HEATERS

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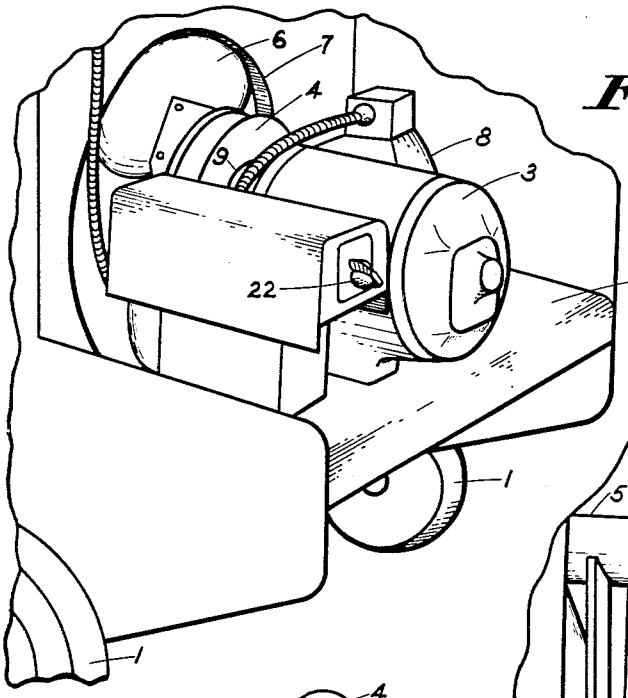



Fig. 1

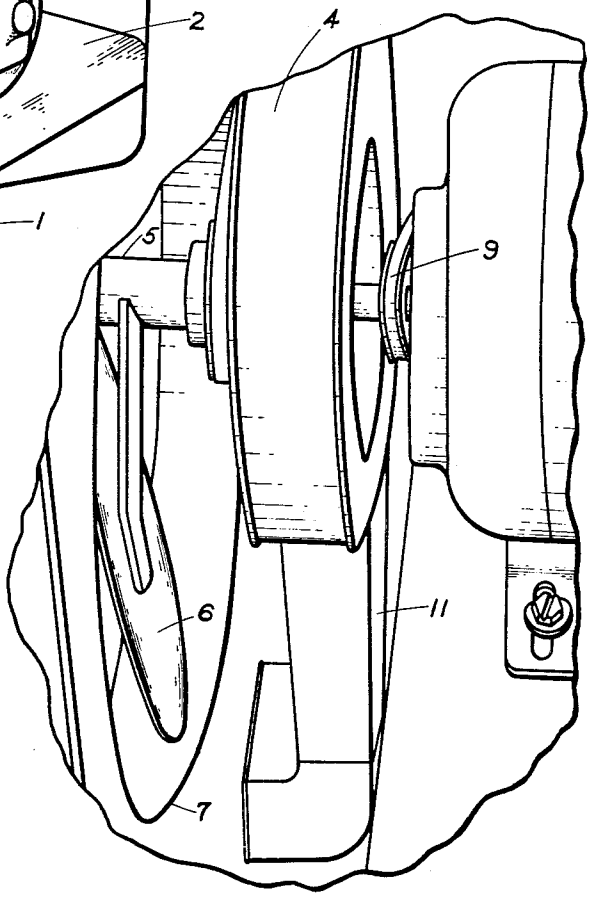



Fig. 2

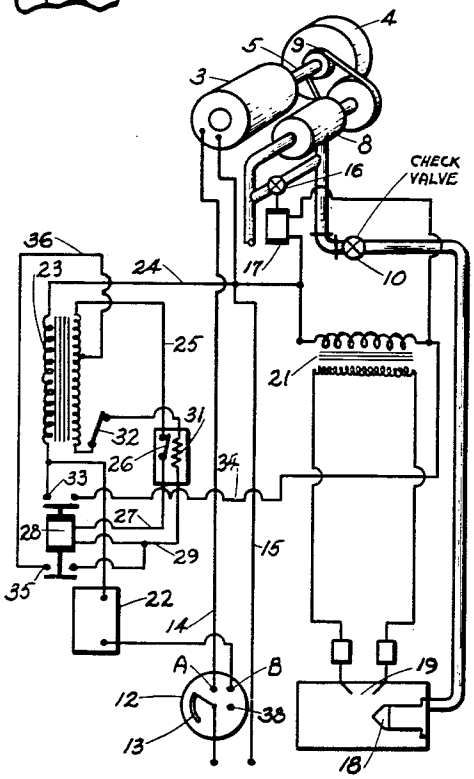



Fig. 3

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# BURNER SAFETY CONTROL APPARATUS FOR AIR HEATERS

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1 Claim. (Cl. 158—28)

The present invention relates to a portable combustion type air heater employing kerosene or similar liquid fuel, and relates in particular to the control mechanism for operating the heater unit.

It is an object of the present invention to provide a scavenging control in an air heater employing an air supply, and ignition and combustion control circuits, whereby the ignition and combustion control circuits may be placed in operation only after a period of operation of the air supply, and on shutting down the heater, the ignition and combustion control circuits may be shut off before the air supply stops.

The invention will be explained in detail in the following description taken in connection with the accompanying drawing illustrating a preferred embodiment of the invention by way of example, and wherein:

Figure 1 is a perspective view of a portion of the heater;

Figure 2 is a perspective view on an enlarged scale of the motor, blower and fan assembly; and

Figure 3 is a diagrammatic view of the invention.

Referring to the drawing, the heater is carried on a chassis supported by a pair of wheels **1** at one end and provided with a foot at the other end. By raising the foot end by means of suitable handles, the heater may be wheeled to any desired location. The wheeled end of the chassis has a platform **2** upon which is mounted the electric motor **3**. A blower housing **4** for combustion air is suitably mounted on the platform, and the motor shaft **5** extending through the housing carries a blower in the housing and a fan **6** for supplying air to be heated by a suitable heat exchanger (not shown). The heater casing has an opening **7** shrouding fan **6** so that the fan forces air through the opening to the heat exchanger in the casing and the heated air discharged at the front end of the casing is conducted by suitable detachable ducts to any desired location. The fuel pump **8** is driven by the motor through a drive pulley **9** and belt (Figure 3) to supply fuel to the burner through a pressure opened valve **10** (Figure 3), and the blower housing **4** has a discharge duct **11** to supply air to the burner to support combustion.

The starting switch **12** has two contacts A and B, and a movable sweep contactor **13**. When this contactor is turned to position A the motor **3** is energized through lead **14** and return lead **15**, and motor **3** drives pump **8**. The pump incorporates a bypass with a relief valve **16** controlled by a solenoid **17** and when valve **16** is open (as when solenoid **17** is deenergized) the pump outlet pressure is not sufficient to open relief valve **10** and fuel does not flow to the burner **18**. However, when bypass valve **16** is closed upon energization of the solenoid **17**, pressure is built up at the pump outlet sufficient to open relief valve **10** to allow flow of fuel to the burner. At the same time if igniter **19** is energized by transformer **21** the fuel will be ignited. It should be observed that the solenoid **17** and transformer **21** are not directly connected to switch contact A so that upon turning the switch to



position A the flow of fuel to the burner is not started, but the motor will drive the fan, which will scavenge the burner chamber. When the contactor **13** is moved to position B, it retains contact at A so that motor **3** continues energized.

A limit control switch **22** is connected between contact B and the primary coil of transformer **23**, the transformer circuit being completed by lead **24** to wire **15**. The secondary circuit of the transformer includes lead **25** to switch **26**, lead **27** to the relay coil **28**, lead **29**, resistance heater **31** and switch **32**. When switch **12** is turned to position B, relay **28** is energized to close switch contacts **33**, thus energizing the ignition transformer **21** through lead **34**. At the same time energization of relay **28** closes switch contacts **35**.

The safety control for the apparatus includes the limit control thermostat switch **22**, and the thermal responsive switches **26** and **32**. Switch **22** is responsive to the temperature of the heated air discharged from the front of the heater casing. Switch **32** is located in the stack where, at the beginning of operation, there will be a predetermined minimum temperature rise, for example, 50°, in one minute. This switch ordinarily is closed, that is, when the stack is cold, and once the minimum temperature rise is attained, it opens and thereafter will not close except upon a shutdown sufficiently long to cause a temperature drop of about 50°. However, this switch is arranged to be closed manually when required.

Switch **26** is closed when cold and is located to be exposed to the heat from element **31**. The flow of current through the operating circuit of relay **28** causes heater **31** to heat switch **26**. If switch **32** remains closed a predetermined minimum time, as for example 90 seconds, the switch **26** is opened by the heat of element **31**, thus opening the operating circuit of the relay **28** to open contacts **33** and deenergize the igniter and solenoid **17**, so that fuel flow to the burner stops. However, should switch **32** be opened by the predetermined stack temperature rise, the operating circuit of relay **28** is opened, but the relay is held in position by a holding circuit at reduced voltage comprising lead **36**, contacts **35**, leads **29**, **27**, switch **26** and lead **25**. The opening of switch **32** deenergizes heater **31** and switch **26** of the holding circuit remains closed. This is the normal operating condition.

However, should the burner fail to ignite, switch **32** remains closed because of the failure of the temperature to rise, and heater **31** causes switch **26** to open, thus opening the circuit of the relay **28** to open contacts **33** and deenergize the igniter at the same time that the fuel is shut off to the burner.

The switch **12**, it will be observed, provides a sequence of operation involving first energization of motor **3** to operate the blower in housing **4** and fan **6**, then turning on the fuel supply to the burner and energizing the igniter. By having the motor **3** operate first, the air will scavenge the combustion chamber at the start. Thereafter the burner is ignited. A stop **38** limits turning of the switch contactor so that the switch must be reversely turned to shut off the burner. Upon reverse turning, the fuel supply is first shut off and then the motor **3** and blowers driven thereby are stopped. Normally there is sufficient manual delay in turning from position A to position B, or in reverse operation from position B to position A, but if desired, the switch may incorporate a conventional automatic delay mechanism.

I claim as my invention:

In an air heater: a fuel burner; a motor; a pump driven by said motor for supplying fuel to said burner; electrically operated means controlling flow of fuel from the pump to the burner; an igniter adjacent the burner; means driven by said motor to supply air to said burner to support combustion; an actuating electric circuit for said igniter and

said electrically operated means; means controlling said circuit including a relay coil having a main operating circuit in which are connected in series an electric heater, a normally closed temperature responsive switch subject to be opened by the heat of said electric heater, and a normally closed combustion responsive switch controlling current flow through said electric heater, said combustion responsive switch being located to be opened by the heat of the burner and upon failure of the burner to ignite allowing a temperature rise of said heater to open said temperature responsive switch to deenergize said relay coil; a holding circuit for said relay coil including said temperature responsive switch, whereby opening of said combustion responsive switch to deenergize the main circuit leaves the holding circuit energized; a main switch having one contact for energizing said motor, and a second contact for energizing said actuating circuit; a movable sweep contactor to successively and thereafter concurrently engage said contacts when operated in one direction to first energize the motor and then energize said actuating circuit; and a stop to limit turning of the contactor, the reverse movement of said main switch acting to serially deenergize said actuating circuit and the motor.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,020,710 | Warner | Nov. 12, 1935 |
| 2,034,311 | Rubel | Mar. 17, 1936 |
| 2,080,580 | Shaw | May 18, 1937 |
| 2,188,565 | Bower | Jan. 30, 1940 |
| 2,427,675 | Holthouse | Sept. 23, 1947 |
| 2,447,373 | Smoot | Aug. 17, 1948 |
| 2,469,271 | Logan | May 3, 1949 |
| 2,575,289 | Nycum et al. | Nov. 13, 1951 |