

[54] **HIGH PRESSURE ELECTRIC FLUID HEATER**

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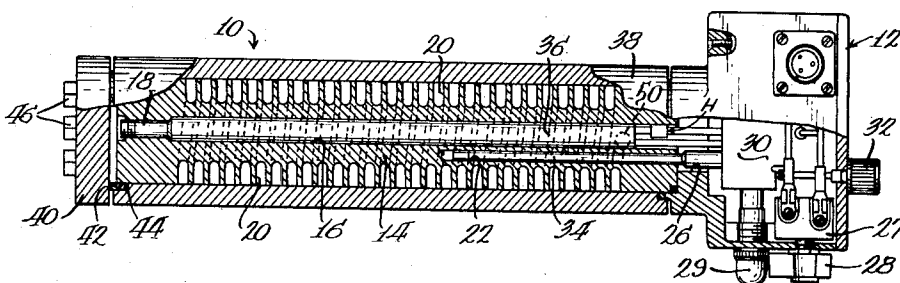
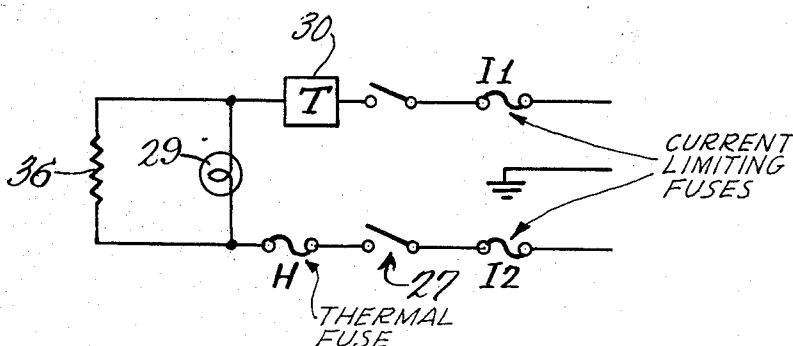
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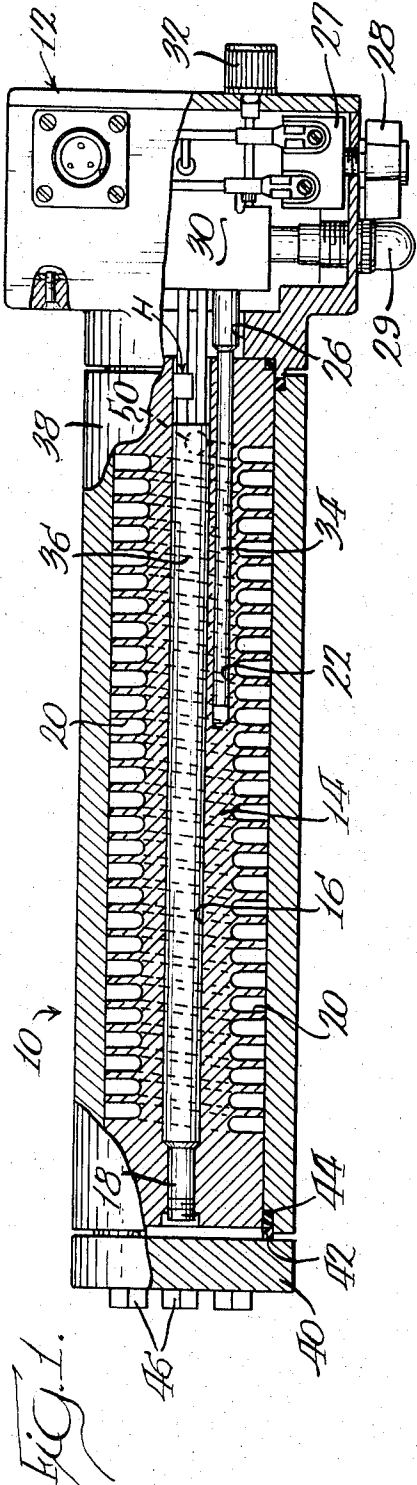
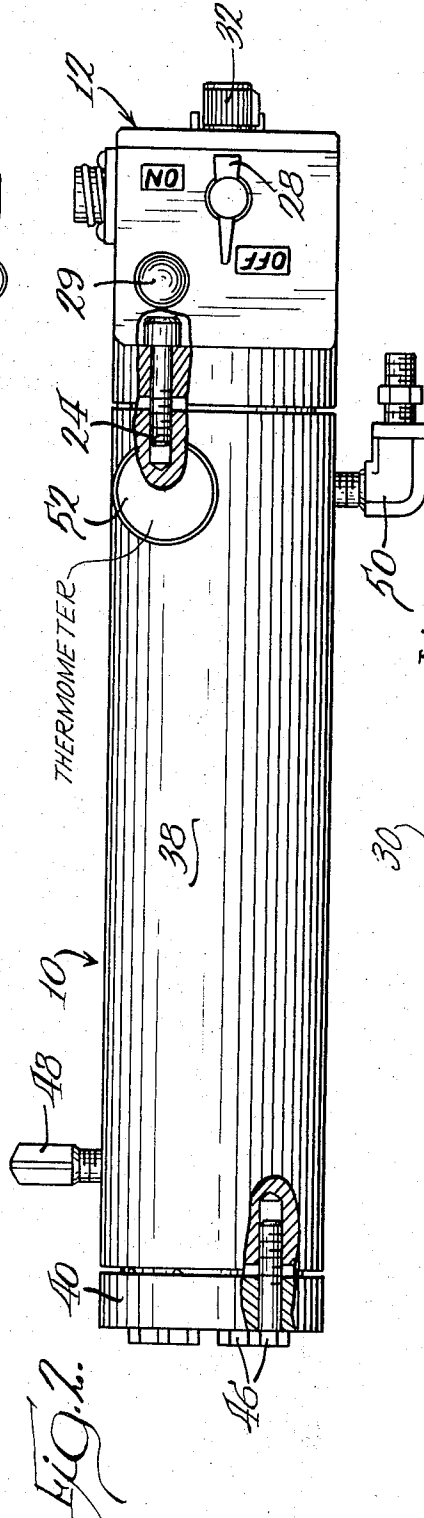
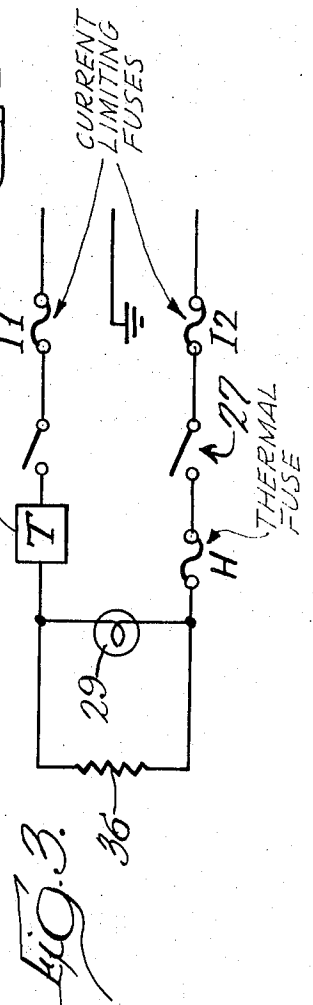
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ABSTRACT

A compact and easily cleaned high pressure heater for paint and the like includes a cylindrical core having a continuous spiral groove in the outer surface. A cylindrical cover having open ends is disposed around and in axially slidable engagement with the core to define with the groove a closed end spiral passageway. A fluid inlet and outlet to the passageway are provided at opposite ends of the cover and the cover is held between a removable end cap secured to one end of the core and a control box attached to the other end thereof. An electric heating element is enclosed in the core and has a pair of leads adapted for connection to a power supply. A thermostat having a sensing element disposed in the core is located in the control box. A current limiting fuse is provided in each of the heater leads and a thermal fuse is provided to protect the heater in the event the thermostat should fail.

1 Claim, 3 Drawing Figures





HIGH PRESSURE ELECTRIC FLUID HEATER

BACKGROUND OF THE INVENTION

In the art of spray painting, it is known to provide a heater between the pump and the spray gun to raise the temperature of the material being sprayed. The use of warm or hot spray materials has several advantages, including lower viscosity for uniform flow of materials, fast drying or curing time, ability to increase solids content, and lower pressures required to generate the desired spray. A minimum spray pressure also results in reductions in overspray and material waste.

Normal operating procedures for heaters of this nature require that the heater be drained and flushed with a suitable solvent immediately after use, in order to prevent coagulation or hardening of the paint within the heater. The danger of coagulation and blockage is particularly severe in a heated passage, even over limited periods of time. Negligence on the part of the operator, power failure or malfunction of any one component of the equipment may result in entrapment and coagulation of paint within the passages of the heater, thereby necessitating disassembly of the heater and reaming of its passages.

Many prior art heaters comprise a length of tube embedded in a heated block, or similar inaccessible passages, which make the removal of coagulated paint difficult if not impossible.

SUMMARY OF THE INVENTION

The present invention contemplates a heater in which the heated passage is constructed in two parts, one part being separable from the other to openly expose the passage and greatly facilitate cleaning. In the preferred embodiment, the first part has a self-contained heating element and an outer surface containing a continuous spiral groove. The second part is slidably fitted over the first part to form a continuous spiral passageway with said groove, the spiral configuration serving to heat the paint uniformly during its passage therethrough.

If the heater passageway should become blocked or clogged with coagulated paint, the second outer part is easily removed from the grooved part to allow for complete and thorough cleaning of the groove. The mechanical force applied during removal of the outer part serves to scrape clean the interior wall of the outer part and the outer surfaces of the inner part.

More specifically, the heater of the invention comprises a cylindrical core, an electrical heating element enclosed by the core and having a pair of leads adapted to be connected to a power supply, a continuous spiral groove in the outer surface of the core, a cylindrical cover having open ends disposed around the core to define a spiral passageway, an inlet and outlet at respective ends of the cover, a control box secured to one end of the core and abutting one end of the cover, a cap removably secured to the other end of the core and holding the cover in abutment with the control box, a pair of current limiting fuses connected in series with respective leads of the heating element, a heat sensitive fuse connected to the heater, and a thermostat.

The heater is also constructed to withstand high pressures in the order of up to 3000 psi to accommodate its use in hydraulic or so-called "airless" spraying or pouring systems, especially for plastics and resins.

Complete safety is assured by the provision of current limiting fuses in both leads to the heater element, a temperature limiting fuses imbedded in the body of the heater, and the thermostat.

Other objects and advantages of the invention will become apparent from the following description.

THE DRAWINGS

FIG. 1 is a vertical longitudinal section of the heater of the invention;

FIG. 2 is a plan view of the heater; and

FIG. 3 is a schematic diagram of the electrical circuit of the heater.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. 1 and 2, the heater assembly is generally of compact, elongate rectangular shape having a heater section 10 with a control box 12 secured at one end thereof. The entire unit may be mounted on its own chassis, or on a pump mechanism, or at a fixed or portable location between the pump and a spray gun.

The heater section 10 comprises an elongate central cylindrical core 14, preferably composed of aluminum. An axial cavity 16 is provided within the core 14, the end of said cavity remote from the control box 12 being closed by a threaded plug 18. The outer cylindrical surface of the core has a spiral or helical groove 20 extending substantially from one end of the core to the other. The core 14 has a second longitudinal axial cavity 22 therein located between the first cavity 16 and the bottom of the groove 20, said second cavity extending from approximately midway of the length of the core to the end thereof adjacent the control box 12. The core 14 and the control box 12 are secured together from within said control box by bolts, such as 24 (FIG. 2), and the control box has an opening 26 sufficiently large to encompass the open ends of the cavities 16 and 22.

The control box 12 and the core 14 comprise an integrated unit in normal use of the heater. The control box 12 contains a power switch 27 operated by an external handle 28, an off-on indicator light 29 and a thermostat 30 which is adjustable by an external knob 32 to regulate the temperature of the heating section. A temperature sensing probe 34 is disposed in the second cavity 22 and leads through the control box opening 26 to the thermostat 30. A resistance heating element 36, having a rating in the order of 2250 watts at is disposed in the first cavity 16 and extends the entire length thereof. The leads of said element extend into the control box through the opening 26 and are connected to a source of electrical current through the power switch 27 and the thermostat 30.

The electrical wiring diagram for the heater is shown in FIG. 3. One lead of the heating element 36 is connected through the thermostat 30 to the switch 27, and the other lead is connected through a thermal fuse H to the switch, the indicator light 29 being connected in parallel with the element 36.

The current limiting fuses I1 and I2 protect the heater from excessive current draw, especially in the event of a short circuit at either end of the 220 volt heater element 36. Specifically, a poor or broken connection at either end of the heater could result in a 110 volt short circuit to ground, and thus a hazardous con-

dition especially in the environment of paints. Also, the heater is frequently combined with an electric pump and one or more additional heaters in a common system, in which event a short circuit could feasibly draw as much as 50 amperes when the remainder of the equipment is not operating but the main system is on. Thus, the two fuses provide complete protection for the heater.

The thermal or heat limiting fuse H is imbedded in the metal body of the heater at a location to immediately sense any condition of excessive heating, such as might result from malfunction of the thermostat, thereby to protect the heater from burning itself out.

The three fuses are preferably of the delay type so as not to respond to a mere surge of current or heat, but promptly to respond to the conditions to be guarded against.

Returning to the physical construction, a body or cover 38 of generally rectangular block form, suitably composed of aluminum, and having an internal cylindrical base is slidably but snugly fitted over the cylindrical surface of the core 14 and is retained thereon by an end cap 40, which is sealed against the cover and core by a follower ring 42 compressing a teflon seal 44 and secured thereto by bolts 46 passing through the cap into the body of the core. The internal cylindrical surface of the cover 38 together with the cylindrical surface and helical groove 20 of the core define a continuous helical passageway around the heated core from one end thereof to the other.

An inlet fitting 48 (FIG. 2) is provided in the side of the cover 38 at the free end of the heating section in communication with one end of the helical groove, said inlet normally being connected to a pump (not shown) for supplying paint or other liquid under pressure. An outlet fitting 50 (FIG. 2) is provided in the side of the cover at the other end of the heating section in communication with the other end of the groove, said outlet being normally connected to a spray or pouring gun or other application device (not shown). A thermometer 52 may also be secured on the cover 38 with a probe extending into the groove to indicate the temperature of the liquid passing therethrough.

An important feature of the present invention is the arrangement of the heating components in a compact

yet safe manner to minimize the danger of explosion. The core 14 surrounds the heating element 36 and is an integrated part of the control box 12, thereby effectively isolating the flow of flammable materials from possible contact with the electrical components.

In operation, paint or other material enters at the inlet 48, flows around the helical passageway where it is uniformly heated to the desired temperature, and the paint then flows out of the outlet to a spray gun or other applicator.

In the event that paint coagulates within the unit, the heater passageway may be cleaned very easily and simply by removing the thermometer 52 and the end cap 40, and then drawing the cover 38 off of the core 14, thereby completely exposing the helical groove 20 and any coagulated material therein.

What is claimed is:

1. A heater for heating fluid materials passing there-through comprising a cylindrical core, an electrical heating element enclosed by said core and having a pair of leads adapted to be connected to a power supply for energizing the heating element, a continuous spiral groove in the outer surface of said core, a cylindrical cover having open ends disposed around and in axially slidable engagement with the cylindrical surface of said core, said cover and said groove defining a closed ended spiral passageway for fluid materials, inlet means in said cover at one end thereof communicating with one end of said passageway, outlet means in said cover at the other end thereof communicating with the other end of said passageway, a control box secured to one end of the core and having an annular abutment facing said cover, a cap removably secured to the other end of said core and covering an open end of said cover, said cover having its other end held in engagement by said cap with said annular abutment and being removable from said core upon removal of said cap, a pair of current limiting fuses connected in series with respective leads of said heating element, temperature responsive fuse means located in heat exchange relationship with said heating element and connected in series with one of said leads, and a thermostat in circuit with the heating element responsive to the temperature of the core.

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