Nov. 17, 1936. H. A. SOVERHILL 2,061,258

SAFETY DEVICE FOR ELECTRIC HEATERS

Filed July 6, 1935

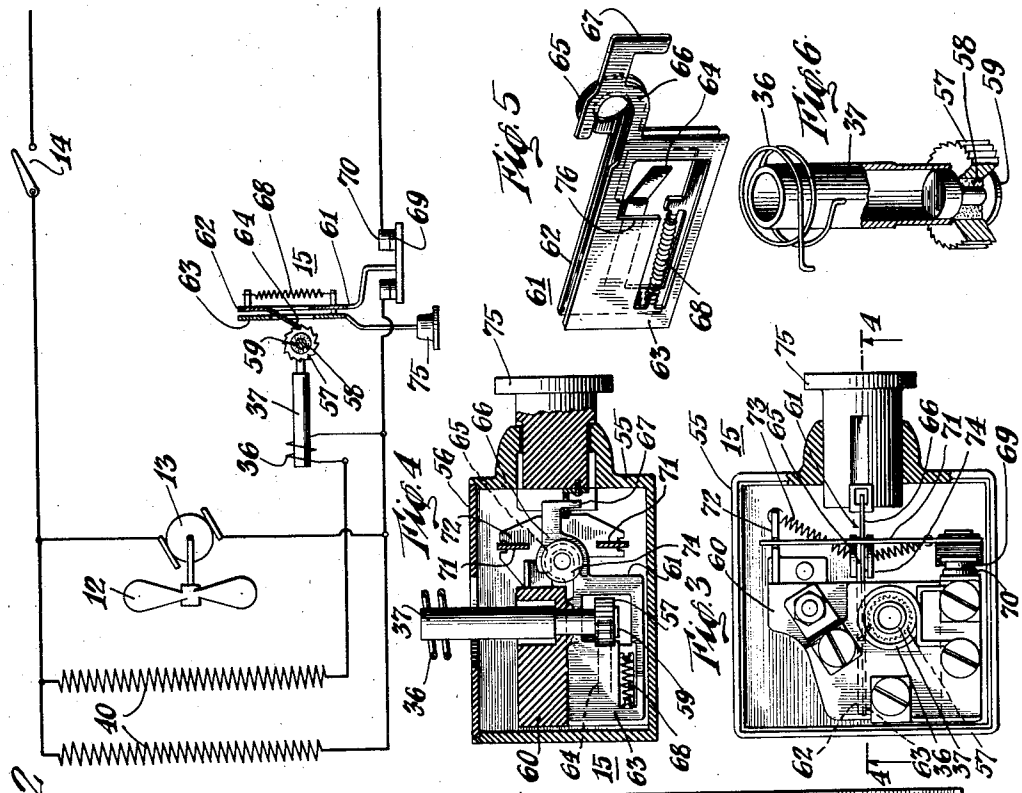

Fig. 2

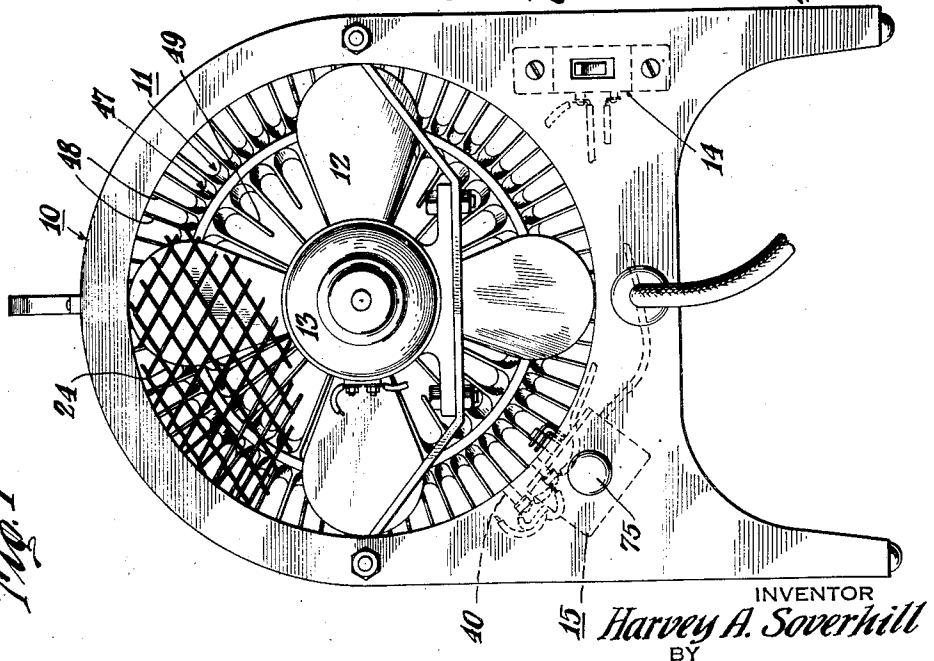

Fig. 1

Fig. 5

Fig. 6

Fig. 4

Fig. 3

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Patented Nov. 17, 1936

2,061,258

UNITED STATES PATENT OFFICE

2,061,258

SAFETY DEVICE FOR ELECTRIC HEATERS

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Application July 6, 1935, Serial No. 30,068

8 Claims. (Cl. 219—39)

The invention relates to electric heaters, and more particularly to safety devices for preventing burning out of such heaters.

The invention relates more particularly to forced draft electric air heaters comprising a grid or other electric heating element for generating heat, a fan for forcing a stream of air through the grid and a motor for driving the fan. If the air stream should fail for any reason, the temperature of the electric grid would rise to such a temperature as to burn itself out if some safety means were not provided.

According to a preferred form of the invention, a safety device is provided comprising a safety heating coil disposed in the current of air generated by the fan. This coil is heated by an electric current, but so long as the forced draft of air remains normal and undiminished, the safety device is kept comparatively cool. If the air draft should fail, the safety heating coil supplies sufficient heat to melt a fusible material permitting a switch in the safety device to release, opening the circuit and removing the electric energy from the heater grid.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof, in which

Fig. 1 is a rear elevation of one type of electric heater to which the safety device of the invention is applied;

Fig. 2 represents somewhat diagrammatically the electric diagram;

Fig. 3 is an open face view, with the cover removed, of the safety device;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a perspective of a slide member; and

Fig. 6 illustrates the manner in which the fusible material is utilized.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawing.

In the drawing accompanying and forming part of this specification, a certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

Referring now to the drawing, and more particularly to Fig. 1, the heater comprises, in general, a hollow casing 10 having a grid 11 mounted in the front of the casing, a fan 12 in back of the grid, a motor 13 in back of the fan and a service switch 14 and safety device 15, both mounted in back of the fan. For a detailed description and illustration of the structure of this heater, attention is directed to copending application Serial No. 30,067, filed July 6, 1935.

The grid 11 has a circular or cylindrical body 47 which has a plurality of outwardly extending radial flanges 48 and a plurality of inwardly extending flanges 49. The body 47 may have incorporated therein one or more individual resistance elements 40 through which electricity flows to generate heat (Fig. 2).

The details of construction of the casing 10, heat generating grid 11, fan 12 and motor 13 are immaterial so far as the safety control is concerned. In the form shown, the fan 12 operates to draw cold air through the rear screen 24 of the casing, discharging this air through the grid 11 where it becomes heated and out through a corresponding screen in the front face of the casing. As illustrated especially in Fig. 2, the safety device 15 is on the suction side of the fan 12.

Referring to Figs. 4 to 6, the safety device 15 comprises an insulating casing 55 having a removable cover 56. The safety device is secured on the inside of the casing 10 to the rear wall thereof with its knob 75 projecting through to the outside of the casing. Disposed within the insulating casing 55 is an insulating body 60 on which the safety mechanism is mounted.

Secured to the insulating body 60 is a heat conducting rod 37 surrounded by the safety heating coil 36, both of these members being disposed in the air stream on the suction side of the fan 12 (see Figs. 1 and 2). The rod 37 has an axle member 59 at its lower end on which is mounted a ratchet wheel 57 with fusible material, such as a special form of solder 58, therebetween.

The insulating knob 75 is slidably mounted within the casing 55 and is connected to a compound slide 61 (Fig. 5) made up of a ratchet plate 62 and a cam plate 63, these plates being slidably mounted within a slot in the insulating

body 60. The ratchet plate 62 has a pawl 64 and an eye 65. The cam plate 63 has a cam portion 76, a U-shaped portion 66 and an angle 67 secured to the knob 75. A coil spring 68 operates between lugs on the plates 62 and 63 normally to hold the cam portion 76 away from the pawl 64.

The safety device has a pair of stationary contacts 70 cooperating with a pair of movable contacts 69 mounted on the end of a forked arm 71 whose ends are disposed in a plate 72 secured to the body 60. The forked arm 71 is held in position by a coil spring 73 whose ends are secured respectively to the arm 71 and plate 72. The spring 73 passes through the collar 74 disposed in the eye 65 and fork 66.

Referring now to Fig. 2, it will be noted that both heaters 40 are under control of the service switch 14 and of the safety device 15. The safety coil 36 is in series with one of the heater elements 40, it being understood that the voltage drop through the coil 36 is substantially negligible.

In operation, so long as the air flow caused by the fan 12 is normal, the coil 36 and rod 37 are kept sufficiently cool to prevent melting of the fusible material 58 in spite of the heat generated by the coil 36. If the air stream should fail either due to motor failure or fan failure, or due to paper either totally or partially clogging the heater grid 11 or intake screen 24, the lack of cooling effect on coil 36 and rod 37 will cause the temperature of rod 37 to increase sufficiently to melt the solder 58. This permits the ratchet wheel 57 to rotate, releasing the pawl 64 and permitting spring 73 to move the slide 61 and pull open the contacts 69 and 70, breaking the circuit to both the motor 13 and heater elements 40. Thus, the current supply is broken before the heater elements can overheat sufficiently to damage themselves.

After the obstruction is removed or the defect otherwise overcome, the knob 75 is pushed inwardly, causing the pawl 64 to engage ratchet wheel 57 which is now in fixed position since the solder 58 has again hardened. It will be noted that the inward motion of knob 75 moves both plates 62 and 63 inwardly together, with the cam portion 76 disengaged from pawl 64.

If it is desired to use the safety device 15 as a service switch, it is only necessary to pull out the knob 75. This action moves plate 63 with respect to plate 62, causing the cam portion 76 to engage pawl 64, removing the latter from the ratchet wheel 57, thus permitting the spring 73 to disengage the contacts 69 and 70.

It will be understood that the safety device may be placed anywhere in the air stream, either in the air stream before it is subjected to the electric heater element or after the air leaves the heater element. The size of the heater wire of coil 36, its length and the distance it projects into the air stream will be governed by conditions, such as the voltage and the kilowatt capacity of the heater. It will be furthermore understood that with large capacity heaters requiring the use of contactors for controlling the current to the heater element 40, the contacts 69 and 70 may be placed in series with the electromagnet on the contactor.

Thus, a safety control has been provided which is simple in construction and efficient in operation. It is self-contained and requires no direct mechanical connection with the heater element. Yet it surely protects the electric heating element from burning out since it responds instantly to failure of normal air supply. So long as the heater is receiving its normal air supply, the heating elements cannot burn out and the safety device is kept sufficiently cool to prevent its operation. The connection of the safety coil 36 in series with one of the heater elements eliminates the necessity for an extra resistance which would otherwise be necessary to cut down the voltage on the coil 36.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In an electric heater, a main heater element, means for establishing a current of air across said main heater element, a small pilot heater subjected to said air current, and means operated by said pilot heater governed by failure of said air current for removing electric power from said main heater element.

2. In an electric heater, a main heater element, an electric fan for establishing a current of air across said main heater element, a small pilot heater, a heat responsive element controlling the supply of electric power to said main heater element, said heat responsive element being subjected to the combined effects of said pilot heater and of said air current.

3. In an electric heater control system, an electric main heater element, an electric fan for discharging a stream of air across said heater element, a safety device comprising a safety heater coil, switch contacts controlling the current to said main heater element, a spring normally tending to open said contacts, a heat conducting rod within said heater coil, a ratchet wheel on said rod, fusible material between said rod and ratchet wheel, a pawl connected to said contacts and engaging said ratchet wheel for resisting said spring, said coil and rod being located in said air stream, said fusible material melting upon failure of said air stream.

4. In an electric heater control system, an electric main heater element, an electric fan for discharging a blast of air across said heater element, a safety device comprising a safety heater, switch contacts controlling the heating current to said main heater element, a spring normally tending to open said contacts, a holding member for resisting said spring, said holding member being normally solid but becoming liquid under abnormal temperatures, said holding member being subjected to heat from said safety heater, said safety device being located in the path of the air stream passing through said heater, said holding member becoming molten upon failure of said air stream, said safety heater being in series with said main heater element.

5. In an electric heater control system, an electric main heater element, an electric fan for discharging a blast of air across said heater element, a safety device comprising a safety heater, switch contacts controlling the heating current to said main heater element, a spring normally tending to open said contacts, a holding member for resisting said spring, said holding member being normally solid but becoming liquid under abnormal temperatures, said holding member being subjected to heat from said safety heater, said safety device being located in the path of the air stream passing through said heater, said hold-

ing member becoming molten upon failure of said air stream.

6. In an electric heater control system, a casing, an electric main heater element therein, an electric fan for blowing a blast of air across said heater element also in said casing, a unitary safety device comprising a housing, switch contacts in said housing for controlling the power supply to said main heater element, a spring normally tending to open said contacts, a heat conducting rod, a pilot heating coil around said rod, a ratchet wheel on said rod, fusible material between said rod and said ratchet wheel, a pawl connected to said contacts and engaging said ratchet wheel, said housing being secured to said casing with said rod and coil in the air stream.

7. In a control system for an electric heater, an electric heater element, an electric fan discharging a stream of air through said heater element, a safety device in said air stream, said safety device comprising a plunger having a movable contact, cooperating stationary contacts bridged by said movable contact, a safety spring normally tending to open said plunger, a ratchet wheel, a support for said ratchet wheel, a normally solid, meltable substance holding said ratchet wheel stationary, a heat conducting rod extending from said ratchet wheel into said air stream, a safety heating coil around said rod, said safety coil being in series with said main heater element, a pawl on said plunger engaging said ratchet wheel to keep the switch closed, a hand-engaging portion on said plunger and means whereby said contacts may be opened by said hand-engaging portion, said meltable substance melting upon failure of the air stream, thereby permitting said spring to open said switch contacts.

8. In an electric heater, a main heater element, means for establishing a current of air across said main heater element, a small pilot heater subjected to said air current, and means operated by said pilot heater governed by failure of said air current for removing electric power from said main heater element, said main heater element and small pilot heater being in series with the electric power.

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