SWITCH MOUNTING ARRANGEMENT
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The present invention relates to heat-responsive switches and more particularly relates to mounting arrangements to improve the effectiveness and reliability of heat-responsive switches adapted for use in portable air heating devices.

Previous air heating devices have included thermal responsive switches at various locations in the air flow path to sense the temperature of the air passing through the heat exchanger and control selected elements of the heating device in response to the temperature sensed by the switch. In some applications, particularly where the switches are mounted adjacent a heat exchanger, combustion chamber or on a cold surface, such heat-responsive devices have not operated in response to the actual average temperature of the air stream flowing through the heating device and the operation has been unsatisfactory.

In accordance with the present invention, an arrangement is provided whereby a temperature-responsive switch can be mounted at any selected location in the air stream in a portable heater and the switch will operate satisfactorily in response to the changes in the temperature of the air stream regardless of the proximity to the combustion chamber, heat exchanger means or other elements of the air heating device. Furthermore, it has been recognized that the new, advantageous, and inexpensive switch mounting arrangement in accordance with the present invention provides means to assure that the temperature sensed by the switch is the actual average temperature of the air stream passing the switch.

Various other features of the present invention will become obvious to one skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides an improved mounting arrangement for a temperature responsive switch in an air heater comprising: thermal isolating means fixed to a wall of the air heating device which defines at least a part of an air flow path through the heater; heat conductive fins means having a first portion mounted in insulated relation with the wall by means of the thermal isolating means, and a second portion extending transversely into the air stream flowing past the wall; and heat responsive switch means mounted in insulated relation with the wall and contacting the first portion of the fins means in contiguous heat-conductive relation.

It is to be understood that various changes can be made in the arrangement, form, and construction of the apparatus disclosed herein without departing from the scope or spirit of the present invention.

Referring now to the drawings:
FIGURE 1 shows a view, partly in section, of an example of a portable heater having a switch mounting arrangement in accordance with the present invention; FIGURE 2 is an enlarged view taken along a plane passing through line 2—2 of FIGURE 1; and
FIGURE 3 is a view taken along a plane passing through line 3—3 of FIGURE 2.

The switch mounting arrangement in accordance with the present invention can be used in a portable air heater and the portable heater shown in FIGURE 1 includes a temperature responsive switch 16 mounted in air passage 7. Switch 16 can be mounted at a selected location in the portable heater to control the operation of selected elements of the heater, for example, safety devices which terminate operation of the heater upon the occurrence of selected conditions.

In the example of the air heater shown in FIGURE 1, air is drawn into the heater through an air inlet 17 by fan 6 driven by motor 9 and a shroud 18 is provided to direct the flow of air. The heater includes combustion chamber 1 defined by an outer casing 13 and end walls 11 and 23 and a fuel burning combuster 24 to provide a source of heat for the heater. Hot gases generated in combustor burn pass out of combustion chamber 1 through a hot gas conduit 8 into annular heat exchanger 2 and are emitted from heat exchanger 2 by means of vent stack 10. Air to be heated is blown through annular passages 7 and 7a defined between casing 13 of combustion chamber 1 and surface 14 of heat exchanger 2 and casing 19, respectively. The heated air is emitted from outlet 31 of the portable heater to an adjacent space to be heated.

Combustion air for burner 34 is supplied from chamber 20 defined generally by casing 13 and end walls 11 and 25. Such air is supplied to the chamber 20 by fan 6 through an auxiliary combustion air duct (not shown). Fuel can be supplied to combustor 24 by means of a fuel line 21 and electricity is provided by means of electrical wires 22 to ignite the fuel in the combustor 24.

In accordance with the present invention a new and improved temperature sensing arrangement is provided and includes (FIGURE 2) a temperature-responsive heat switch 28 and heat conductive fin 27 fastened to casing 13 by bolts 29. Temperature-responsive switch 28 can be mounted through an aperture 32 of fin 27 and is in contiguous heat-conductive relation with fin 27. A layer 26 of insulating material is provided to separate heat conductive fin 27 and the bottom of switch 28 from casing 13, the base of the switch extending laterally outward to nest between fin 27 and layer 26. In the example of FIGURE 1, switch arrangement 16 is mounted on casing 13 adjacent the combustion air supply chamber 20. In operation of the switch in the location illustrated in the example of the present invention, casing 13 becomes extremely hot in the area adjacent combustion chamber 1 and the heat is conducted to the portion of casing 13 adjacent chamber 20. It is to be noted that if switch 16 were mounted directly on casing 13 instead of an insulating layer 26, heat conducted to switch 28 would increase the temperature of the switch and would accordingly decrease the sensitivity of the switch to changes in temperature of the air stream so operation of the switch would be adversely affected. In accordance with the present invention fin 27 includes a second portion 27a which is directed transversely into the stream of air flowing through passage 7. It has been recognized that fin 27 induces turbulence in the stream of air flowing past casing 13 which mixes the air stream in passage 7 so the temperature of the mixture is the average of the temperatures across passage 7. Fin 27 can advantageously be directed upstream relative to the air flow so that the air stream is mixed downstream to the air and the mixed stream flows over switch 28 to expand switch 28 to the average temperature of the air stream. Moreover, in accordance with the present invention, it has been recognized that fin 27 is heated, or cooled, to the average temperature of the air flowing through passage 7 and switch 28 is heated or cooled accordingly. Because the bottom side of switch 28 is insulated from casing 13, switch 28 is exposed only to the average temperature of the stream of air flowing through passage 7 and the accuracy and operating efficiency of temperature-responsive switch 28 is significantly improved.

It will be noted that switch 28 includes a heat-responsive temperature sensing surface 28a (FIGURE 3) which operates the switch at selected temperature in the air stream and the resulting signal can be transmitted to a
selected control element by suitable means, for example, wire 30. In previous heaters, heat-responsive switches have been used to actuate safety and control devices included within the heater and such switches have been mounted directly to the wall of casing of the heat exchanger, combustion chamber, or the outer casing of the air heater. Such previous arrangements have been unsatisfactory because the switches have been more affected by the condition of environment in which they are mounted than the temperature of the air stream. Such switches, therefore, have not effectively responded to changes in temperature of the air stream flowing past the switch. In some applications such switches have been used to determine undesirable over-heating in certain areas of portable heaters as indicated by unusually high temperature in the air stream and in other applications such switches have been provided to react to subnormal temperatures to indicate the flame has been extinguished in the combustion chamber. Temperature responsive switches mounted in portable air heaters in accordance with the combination of insulating layers and fin arrangements provided by the present invention operate efficiently in either application.

The invention claimed is:

1. An improved mounting arrangement for temperature-responsive switches in an air heater comprising: thermal insulating means joined to a wall of an air flow conduit of an air-heating device; heat-conductive fin means having a first portion connected to said thermal insulating means and said wall means and a second portion extending into the air stream flowing through said conduit past said wall; and heat-responsive switch means joined to said first portion of said fin means in contiguous heat-conductive relation to operate selected elements of said air heater.

2. The apparatus of claim 1 wherein said second portion of said fin means extends into said air stream in an upstream direction relative to the direction of air flow through said conduit from said temperature responsive switch means, where said first portion of said fin means surrounds said switch means and is mounted over a laterally-extending base of said switch, said base means also being mounted on said thermal insulating means.

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