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HEAT DETECTOR

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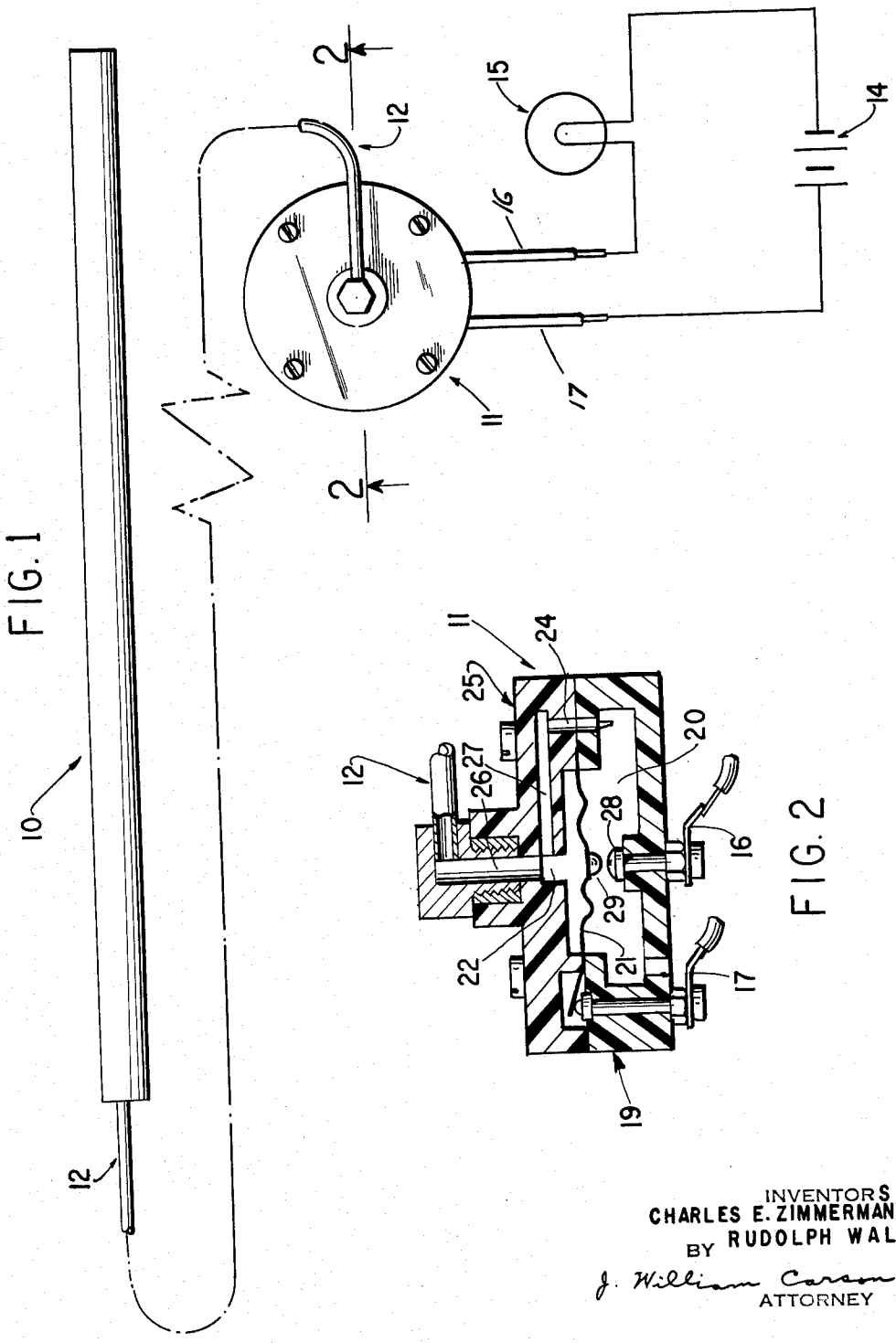


FIG. 1

FIG. 2

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HEAT DETECTOR

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The present invention relates to heat detectors, and, more particularly, to an improved heat detector of the type which responds to an increase of the pressure of air in a heat sensing tube due to a small instantaneous increase in the temperature of air within a space such as an air duct or a cabinet or receptacle for housing equipment or materials inherently capable of becoming overheated.

Accordingly, an object of the present invention is to provide such a heat detector which is extremely sensitive to a small instantaneous increase in temperature and yet is reliable in operation.

Another object is to provide such a heat detector which is unaffected by a gradual increase in temperature due to ambient temperature changes.

A further object is to provide such a heat detector which is simple and economical in construction.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

FIG. 1 is a plan view of a heat detector including a wiring diagram of an alarm network in which the detector is connected.

FIG. 2 is an enlarged sectional view taken along the line 2—2 on FIG. 1.

Referring to the drawing in detail, a heat detector is shown in FIG. 1 which generally comprises a temperature sensing tube 10, filled with air, a pressure responsive switch 11, conduit means such as tubing 12 for connecting the tube in fluid flow communication with the switch, and an alarm network including a source of electrical energy 14 and a lamp 15 connected in series with terminals 16 and 17 (FIG. 2) of the switch.

While a lamp has been shown herein for simple illustration of an alarm device, it will be understood that the network may also include audible alarm means and may provide for the operation of switches adapted to shut down the equipment and/or effect the release of fire extinguishing or cooling media.

The tube 10 is constructed of thin metal which is highly heat conductive such as copper, and preferably is darkened on its exterior surface to increase its capability of absorbing heat. The tube has a wall thickness of 0.003 inch but is rigid to provide it with a fixed volume, and is completely sealed except for an opening at one end in which the tubing 12 is sealed.

It has been discovered that optimum sensitivity is obtained with a tube having a length of about 17 inches and an inner diameter of about 0.75 inch to provide a volume of about 7.5 cubic inches, and that, as the diameter is increased or decreased, the sensitivity decreases. Such a tube is capable of producing an increase in pressure of the air therein in excess of about 0.5 inch of water upon a substantially instantaneous increase in temperature of about 0.5° F. For example, such a tube will produce a pressure of about 0.5 inches of water in about 3 seconds

in response to an instantaneous increase in temperature of about 0.5° F.

It has also been discovered that a 17 inch tube 10 may be constructed in two or more tube sections having a diameter of 0.75 inch and being connected in series by tubing 12 to provide tube means at various locations within equipment sought to be protected, the combined volume of the sections being about 7.5 cubic inches for maximum sensitivity.

It has further been discovered that a tube shorter than 17 inches and having a diameter of about 0.75 inch can be utilized advantageously where a slightly lesser sensitivity can be tolerated.

The pressure switch 11, as shown in FIG. 2, comprises a base 19 formed with a chamber 20, a pressure sensitive diaphragm 21 dividing the chamber into two sides one of which has an inlet 22, a vent or breather valve 24 for bypassing the diaphragm and equalizing the pressure at both sides thereof, an inlet fixture 25 having an opening 26 extending to the inlet 22 and in air-tight connection with the tubing 12 and having a passageway 27 for establishing fluid flow communication between the opening 26 and the vent 24, and a pair of normally open or spaced apart switch contacts 28 and 29, one on the diaphragm and one being fixed and respectively connected to the terminals 16 and 17.

The tubing 12 has a small bore (0.050 inch diameter) and is of minimum length (about 2 feet), and the upper portion or inlet side of the chamber has a small volume, whereby the volume of the tube 10 is much greater than the combined volume of the tubing (0.05 cu. in.) and the inlet side of the chamber (0.20 cu. in.). The portion of the base providing the chamber is constructed of relatively poor heat conductive materials such as plastic resin, whereby the small volume of air confined therein does not sense changes in temperature as rapidly as the tube 10 and thus does not affect the sensitivity of the tube 10. Preferably, the volume of the tube 10 is at least twenty times greater than the combined volume of the tubing and the upper chamber portion.

In operation, the tube 10 senses the temperature of the air in the space within which the tube is mounted. Should this temperature increase, the pressure of the air in the tube 10 increases and acts on the diaphragm 21. Since a slow increase in temperature due to a rise in temperature of the atmospheric air during the daytime is not to be detected, the vent 24 is constructed and arranged to equalize the pressure on both sides of the diaphragm when the rate of increase in pressure is about 0.5 inch of water in about one minute. This rate corresponds to about a 2° F. rise in temperature per minute which greatly exceeds the rate at which the atmospheric temperature rises.

However, should the pressure acting on the diaphragm increase substantially instantaneously about 0.3 to 0.7 inch of water, the diaphragm by reason of its construction and arrangement is operated to cause the switch contacts to engage and actuate the alarm network.

A heat detector in accordance with the present invention having the preferred dimensions was placed above electronic equipment in a cabinet normally having an air temperature therein of 85° F., and an overheat condition was simulated by two 2 watt resistors connected in parallel across a 45 volt source. When the resistors were energized, the temperature of the air ambient to the tube 10 increased less than 1° F., but the pressure switch 11 responded in about five seconds, thereby indicating that the heat detector is extremely sensitive to very small temperature changes.

From the foregoing description, it will be seen that the present invention provides an improved heat detector which is simple, practical and reliable.

As various changes may be made in the form, construc-

tion and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

A heat detector for rapidly responding to a relatively small instantaneous increase in the temperature of air within a space, said detector comprising sealed elongate highly heat conductive tube means for containing air and adapted to be mounted in the space where the increase in temperature is to be detected, said tube means having an inner diameter of about 0.75 inch and having a volume of about 7.5 cubic inches and being capable of producing an increase in pressure of the air therein at a rate of about 0.5 inch of water in about 3 seconds upon a substantially instantaneous increase in temperature of about 0.5° F. of the air ambient to said tube means, said tube means having a wall thickness of about 0.003 inch and being sufficiently rigid to provide it with a fixed volume and the outer surface of said tube means being darkened to increase the heat absorbing capacity of it, a chamber having a vent constructed and arranged to relieve an increase in pressure of about 0.5 inch of water in about one minute, small bore conduit means connecting said tube means to said chamber in fluid flow communication, the volume of said tube means being at least twenty times as great as the combined volume of said chamber and said conduit means and said chamber and said conduit means being constructed of low heat conductive material, a pressure responsive diaphragm in said chamber constructed and arranged to be operated by a substantially instantaneous increase in pressure of the air within said chamber of about 0.3 to 0.7 inch of water, and switch means operable by said diaphragm.

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