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THERMOPILE

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Fig. 1

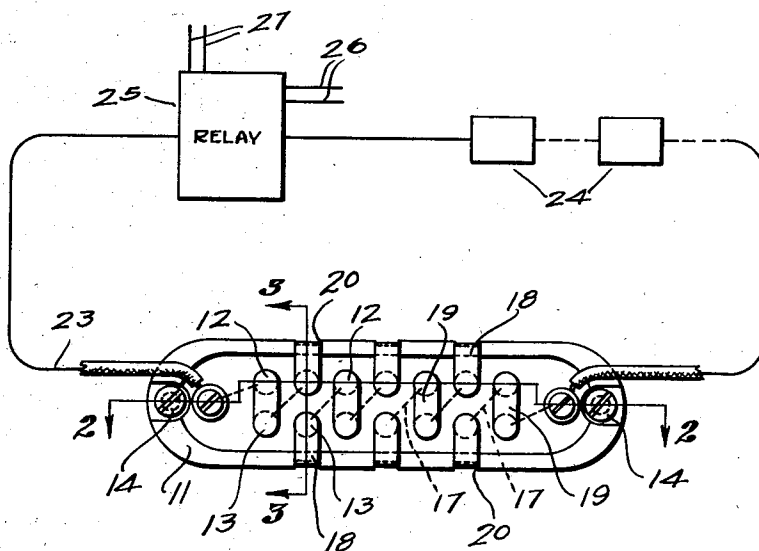


Fig. 2

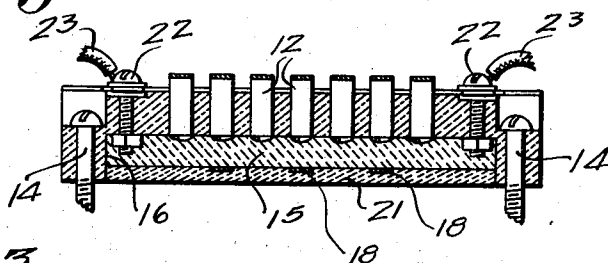
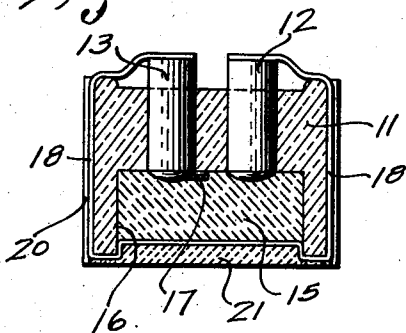


Fig. 3



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THERMOPILE

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This invention relates to a thermopile, and especially to a thermopile that can be used in a fire alarm circuit, to cause operation of the system upon dangerous temperatures being reached.

Such fire alarm systems are now in use; but the thermopiles prior to my invention were apt to give faulty results. With the aid of my invention, this danger is minimized; and it is accordingly one of the objects of my invention to provide a thermopile that is reliable in service.

My invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of my invention. For this purpose I have shown a form in the drawings accompanying and forming part of the present specification. I shall now proceed to describe this form in detail, which illustrates the general principles of my invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of my invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a top plan view of a thermopile incorporating my invention, shown as connected in a relay circuit, said circuit being diagrammatically illustrated;

Fig. 2 is a longitudinal section through the pile; and

Fig. 3 is a section taken along plane 3—3 of Fig. 1.

In general, the pile consists of a support 11 of insulation material, such as porcelain. This base or support has transverse apertures arranged in pairs for the accommodation of a number of pairs of studs 12—13. These studs are made from dissimilar material, one of each pair, such as 12, being made, for example, from bismuth, and the other of the pair, from antimony. The manner in which this dissimilarity is utilized for fire detection will be hereinafter described.

The base 11 can be fastened as by screws 14 to a ceiling or any other locality where the thermopile is to respond to temperature changes. The studs 12—13 are exposed at their upper ends only, and are otherwise

completely embedded, as by the aid of a layer 15 of plastic material, such as plaster of Paris, partially filling a recess 16 in the rear of base 11, and into which recess the studs 12—13 extend. At their bottoms, the pairs of studs are connected together in series as by the soldered transverse connecting wires 17; and the pairs are connected at the tops by either long or short copper strips 18 or 19. The short strips 19 simply extend between the two studs of a pair, and are fastened thereto as by soldering. The long strips 18 however, extend completely around base 11, as indicated in Fig. 3; and preferably are accommodated in shallow grooves 20 in the sides of the base 11. They are furthermore, bent into the recess 16 as clearly shown in Fig. 3, whereby a supplementary layer 21 of plastic insulation can be used to cover up the entire base, to insulate these strips thoroughly from the support or from contiguous parts.

All of the couples 12—13 are thus placed in series. Terminals 22 can be used at each end to connect to the end studs of the series, and wires 23 can be used to connect the series to a relay circuit. Any number of other thermopiles, such as 24, can be included in the same circuit, and properly distributed to safeguard against unusual temperature rises. A relay 25 is arranged to be controlled by the thermopiles, and I shall now explain how the thermopiles cooperate with the relay.

Since one end of each couple 12—13 is embedded in material that passes heat only at a slow rate, and the other end is exposed, sudden temperature changes will cause the exposed ends to have a temperature materially different from that of the embedded ends. Therefore a thermal current will be generated, and relay 25 will be operated to close a circuit 26 leading to a fire alarm system. For gradual changes in temperature, all parts of the thermopile couples will be at about the same temperature, and no material current is induced in the circuit.

If for any reason, the thermocouple circuit should become broken, relay 25 and its associated parts can be so arranged that a

trouble circuit 27 is operated to indicate that the system is not in operative condition.

Usually the thermopile is arranged near the ceiling, with the exposed ends of studs 12-13 pointing downward. Since warmth accumulates near the ceilings, and since heat is also reflected downwardly toward the base of the thermopile, trouble has been experienced in the usual type of thermopile due to the generation of a reverse current, produced by the heating of the embedded ends of the couple, above the temperature of the exposed ends. This reverse current not only causes unnecessary operation of the "trouble" circuit 27, but it also seriously reduces the sensitivity of the whole detector circuit.

In my present form of thermopile this disadvantage is effectively overcome. This is brought about by the use of the strips 18 that encircle the thermopile. As the back heats up, these strips conduct the heat therefrom to the front, exposed ends of rods 12-13 and maintain substantially equal temperatures at both ends. The number of strips 18 that can be used in lieu of the short connections 19 in any thermopile depends upon the particular installation; the intention is to supply enough of them to eliminate all reverse currents. In the pile illustrated, there are three embracing connectors 18 and four short connectors 19; but at times as few as one or two strips 18 need be used; and at other times, as many as six or seven.

The intended use of the thermopile for operating the fire alarm circuit is not interfered with. In case sudden temperature rises affect the open ends of rods 12-13, the layer 15 at the back of the pile prevents uniform heating of the embedded ends, and the pile generates a current. On the other hand, sudden increases in temperature at the back will also be effective for the same purpose, because the layer 21 covering the strips 18 is so thin that the heat can be quickly transferred thereto, whence it is conducted to the exposed ends to cause current generation. Thus the thermopile is selectively sensitive to sudden rises. It is not materially affected by gradual heat changes at the back, even if the degree of heat is greater than at the front.

I claim:

1. In a thermopile, a series of connected thermocouples, means totally embedding one end only of each thermocouple, said means being made from material that is a slow conductor of heat, and means selectively opposing the generation of current by the couples when the degree of heat near the embedded ends is different from that of the open ends, while permitting sudden temperature variations to cause current generation.

2. In a thermopile, a series of connected thermocouples, means totally embedding one end only of each thermocouple, and means whereby only sudden temperature variations

near the open or the embedded ends cause material current generation.

3. The combination as set forth in claim 1, in which the selectively opposing means includes a conductor of heat that serves to connect the exposed ends of at least one set of thermocouples, and that extends around in back of the embedded ends.

4. The combination as set forth in claim 2, in which the means that causes response only to sudden temperature variations includes a heat conductor connecting the exposed ends of at least one thermocouple and that extends around in back of the embedded ends.

5. In a thermopile, a series of connected thermocouples, means totally embedding one end only of each thermocouple, said means being made from material that is a slow conductor of heat, and means preventing the generation of reverse currents in response to the production of a higher but substantially uniform temperature near the embedded ends than near the exposed ends.

6. The combination as set forth in claim 5, in which the preventing means includes a heat conductor extending back of the embedded ends and connected to affect the exposed ends of at least one thermocouple.

7. In a thermopile, a base of slow heat conducting properties, a series of thermocouples having one of their ends exposed and the other end embedded in said base, and means for connecting the thermocouples in series, including a conducting strip for each couple connecting the exposed ends thereof, at least some of said strips being extended around the back of the embedded ends.

In testimony whereof I have hereunto set my hand.

THOMAS A. MOLLARD.