United States Patent Office 2,856,368
Patented Oct. 14, 1958

2,856,368

RESISTANCE MATERIAL FOR FIRE DETECTOR ELEMENT

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No Drawing. Application October 26, 1954
Serial No. 464,906

4 Claims. (Cl. 252—519)

The present invention relates to fire detector elements, and, more particularly, to a core composed of a resistance material adapted to be utilized in connection with such elements.

The invention is concerned with fire detector elements comprising two or more spaced apart conductors of electricity having therebetween a core composition of such a resistance at normal temperatures that, in effect, it insulates the conductors, and of such a resistance at a predetermined higher temperature that it becomes a conductor of electricity between the conductors and enables sufficient current to pass through the conductors to operate a device for controlling a fire alarm and/or fire extinguishing circuit. For example, as shown in United States Letters Patent No. 2,586,252, the elements may be in the form of a cable-like structure adapted to be placed in a space where a fire is to be detected. This structure comprises a metallic tube through which electrically conductive wires extend which are separated from each other and the tube by a suitable core composition of the foregoing character.

More specifically, the present invention is primarily concerned with improving this resistance material in a manner to more accurately predetermine the temperature at which the composition is rendered conductive in response to the heat of a fire whereby current can flow through the conductors to operate an electrical device.

Accordingly, an object of the present invention is to provide an improved core composition of the character indicated herein.

Another object is to provide such a composition which becomes electrically conductive practically instantaneously when heated to a predetermined temperature.

A further object is to provide such a composition which is economical to prepare, is reliable in operation, and is fully adapted for repeated use without change in its responsive characteristic.

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.

In accordance with the present invention, it has been found that the foregoing objects can be accomplished by utilizing a core composition, comprising manganese dioxide, magnetic iron oxide (Fe_3O_4), nepheline syenite ($K_2O.3NaO_2.4A1_2O_3.9SiO_2$), zirconium silicate, a frit and an inert ceramic body.

The manganese dioxide, iron oxide, nepheline syenite and zirconium silicate may be of a chemically pure or technical grade.

The frit may be any of the well known frits described in the literature which are generally utilized in providing the so-called enamel base coating on metallic kitchenware and the like. This frit, when used in a sufficient amount, serves as a body or carrier for the manganese

dioxide and iron oxide to place the composition in glass phase but its chemical composition does not materially affect the electrical properties of the composition about to be described.

By way of example such a frit may be prepared by melting, solidifying and grinding a mixture comprising

	Percent by weight
Feldspar	32.0
Flint	11.5
Borax	37.5
Soda ash	6.0
Sodium nitrate	4.0
Fluorspar	9.0

Twenty-five parts by weight of this frit are then combined with seventy-five parts by weight of a mixture consisting of 90% steatite and 10% flour.

The manganese dioxide, iron oxide, nepheline syenite, zirconium silicate frit, steatite and flour are dry blended, and sufficient water is added to make the mixture plastic. The plastic mass is then extruded onto the wires and is baked at about 2,000° F. to fuse the same to the wires as the water is driven off and the flour burned out.

It has been discovered that the proportions of manganese dioxide and iron oxide can be varied somewhat to produce a core which becomes conductive at a predetermined temperature within a given range of temperatures. For example, a mixture of about 40 parts by weight may consist of between 20 and 32 parts by weight of manganese dioxide and between 20 and 8 parts by weight of iron oxide to which about 12.5 parts of frit, 33.75 parts of steatite, 3.75 parts flour, 10 parts of nepheline syenite and 4 parts of zirconium silicate have been added, all on a weight basis produces cores which become conductive at temperatures between about 370° and 470° F. The iron oxide further serves to stabilize the manganesse dioxide to maintain the response temperature substantially constant.

It is believed that the mixture of zirconium silicate and nepheline syenite acts as a fluxing agent to provide for good adherence of the core composition to the wires, gives the core composition a high structural strength, particularly high green strength, and gives the core composition a high initial resistance which drops sharply at the predetermined temperature to render the composition conductive. The nepheline syenite serves the additional function of lowering the fluxing temperature, whereby decomposition of the manganese and iron oxides is prevented.

The following examples illustrate specific core compositions in accordance with the present invention.

Example I

	Parts by weight
Manganese dioxide	20
Iron oxide	20
Frit	12.5
Steatite	33.75
Flour	3.75
Nepheline syenite	10
Zirconium silicate	4

A composition was produced from these materials and applied to two wire temperature sensing elements in the foregoing described manner. The wires were composed of "Inconel," and had a length of ten feet and a diameter of .010 inch. This core had a diameter of .058 inch, and the wires were disposed therein parallel relation about .010 inch apart throughout their length. These sensing elements had a resistance of above one million ohms at 70° F. which dropped sharply to about 5,000 ohms when the core composition was heated to 370° F. thereby enabling sufficient direct current or alternating current to

flow through the wires to effect operation of an electrical device for giving an indication that the aforementioned temperature condition existed.

Example II

	Parts by weight
Manganese dioxide	32
Iron oxide	8
Frit	12.5
Steatite	33.75
Flour	3.75
Nepheline syenite	10
Zirconium silicate	4

A composition was produced from these materials and embodied in temperature sensing elements in the aforementioned manner, and, upon testing, these sensing elements had a resistance of about 5,000 ohm at 470° F.

From the foregoing description it will be seen that the present invention provides a composition for temperature sensing elements which has desirable physical and electrical properties, and, in particular, has a sharp resistance drop at a selected temperature to give a rapid and reliable indication that such temperature has been detected.

It will be understood that the details and examples hereinbefore set forth are illustrative only and that the invention as broadly described and claimed is in no way limited thereby.

We claim:

1. A resistance material consisting essentially of about 40 parts by weight of a mixture consisting of between 20 and 32 parts by weight of manganese dioxide and between 20 and 8 parts by weight of magnetic iron oxide, about 10 parts by weight of nepheline syenite, about 4 parts by weight of zirconium silicate, about 12.5 parts by weight of a frit and about 33.75 parts by weight of steatite, said material being characterized in that it exhibits a sharp drop in resistance at temperatures between 370° F. and 470° F.

2. A resistance material consisting essentially of about 20 parts by weight of manganese dioxide, about 20 parts by weight of magnetic iron oxide, about 10 parts by weight of nepheline syenite, about 4 parts by weight of zirconium silicate, about 12.5 parts by weight of a frit and about 33.75 parts by weight of steatite, said material being characterized in that it exhibits a sharp drop in resistance at a temperature of about 370° F.

3. A resistance material consisting essentially of about 32 parts by weight of manganese dioxide, about 8 parts by weight of magnetic iron oxide, about 10 parts by weight of nepheline syenite, about 4 parts by weight of zirconium silicate, about 12.5 parts by weight of a frit and about 33.75 parts by weight of steatite, said material being characterized in that it exhibits a sharp drop in resistance at a temperature of about 470° F.

4. A resistance material extrudable as a plastic mass onto electrical conductors and adapted to be fused thereon, said material consisting essentially of about 40 parts by weight of a mixture consisting of between 20 and 32 parts by weight of manganese dioxide and between 20 and 8 parts by weight of magnetic iron oxide, about 10 parts by weight of nepheline syenite, about 4 parts by weight of zirconium silicate, about 12.5 parts by weight of a frit, about 33.75 parts by weight of steatite and about 3.75 parts by weight of flour.

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