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W. G. HOLMES
FIRE DETECTING CABLE
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Fig. 1

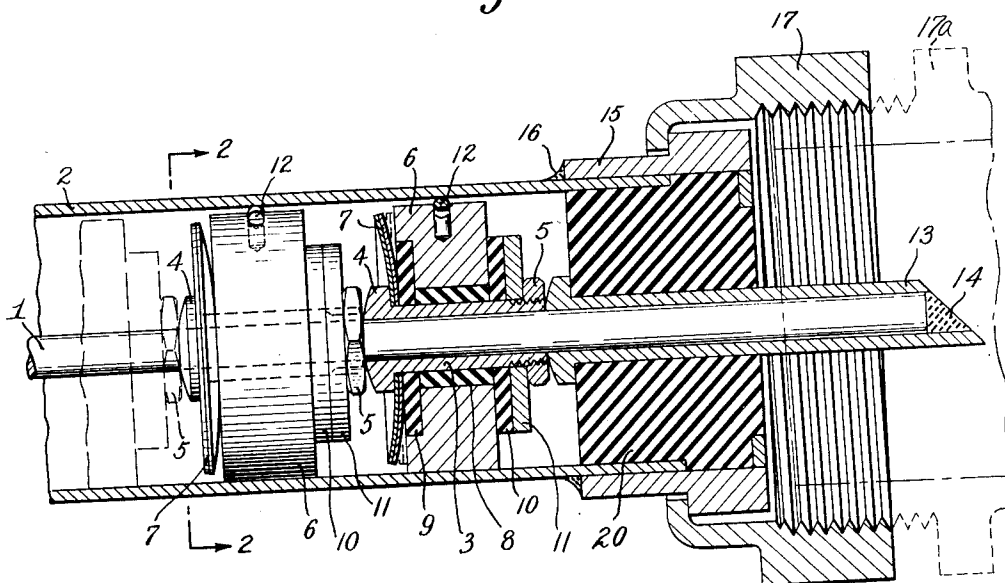


Fig. 2

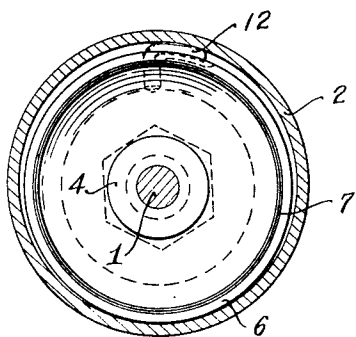
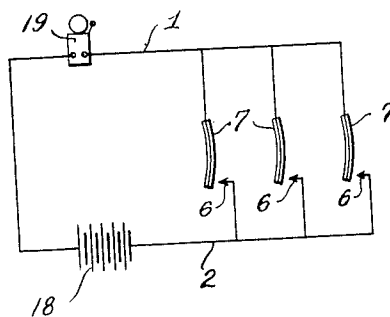


Fig. 3



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FIRE DETECTING CABLE

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9 Claims. (Cl. 200—138)

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1 This invention relates to improvements in fire detectors or heat-sensitive mechanisms of the wire or line type, the sensitivity of which extends along their entire length. The advantages of detectors of this type in comparison with detectors of the unit or spot type have long been recognized; and these advantages have been shown to be of particular importance in connection with the detection and warning of fires on aircraft in flight. Such line or continuous type detectors have heretofore generally been capable of one operation only. Once operated they remain so until replaced; hence they are incapable of showing when the condition which causes them to operate has ceased to exist. On aircraft in flight this self-restoring feature is of particular advantage. If fire occurs in flight and can not be promptly extinguished, an emergency or crash landing is necessary. If on the other hand the fire can be extinguished with reasonable promptness, the aircraft may proceed to a normal landing at the first available field. To know that a fire has been extinguished therefore becomes of very great importance.

Many modern aircraft are equipped with fire extinguishing systems having sufficient extinguishing agents for more than one attack on fire before landing. Thus, even if a fire flashes back or breaks out anew after one attempt at extinguishment, there is still a chance to allay it and avoid a crash landing if the remaining extinguishing agent can be applied at the right time. Again the advantages of a self-restoring detector are apparent.

Aircraft fire detectors now in use are of both the unit and the line or continuous type, the former being generally self-restoring and the latter being generally of the single operation type. Due to the extreme draft conditions on aircraft in flight, unit detectors to be effective have to be placed so close together that they present difficult problems on that account. The line or continuous type detectors used have not only had the disadvantage of not being self-restoring but have also been subject to false alarms.

Objects of the present invention are to overcome the aforesaid difficulties and to produce a detector of the line or continuous type which is simple and economical in construction, which is self-restoring and capable of repeated operation, which is durable and reliable in use, which is highly resistant to vibration such as encountered on aircraft, which is unaffected by gasoline, oils and other agents commonly present on air-

craft, which is positive in action and thoroughly reliable in use, which is responsive to a fire anywhere along its length, which opens and closes quickly and positively, which can be directly incorporated in conventional electrical circuits to actuate signal lights or other alarm signals without special instruments, which can be readily installed and serviced and which is generally superior to fire detectors of the character above referred to.

10 The present invention involves a fire detecting cable comprising inner and outer conductors with a space therebetween and a series of thermostats distributed along the cable in the aforesaid space, each thermostat having terminals electrically connected to the conductors respectively and thermostatic means for electrically interconnecting the terminals, whereby the circuit comprising the conductors is closed by application of heat to the cable and remains closed only so long as heat is applied. Preferably the thermostats are of the snap type and comprise unitary devices with aligned openings so that they may be strung along the inner conductor. In the preferred embodiment each thermostat comprises a conducting sleeve slidably fitted around the inner conductor, two conducting rings surrounding the sleeve and electrically connected to the two conductors respectively, and insulating means between the sleeve and the ring connected to the outer conductor, one of the conducting rings snapping into contact with the other in response to change of temperature, and the sleeve having heads on its opposite ends to hold the rings and insulating means in position, one of the heads preferably being in the form of a nut threaded on the sleeve.

For the purpose of illustration a typical embodiment of the invention is shown in the accompanying drawing in which

40 Fig. 1 is a longitudinal central section through one end of a cable;

Fig. 2 is a section on line 2—2 of Fig. 1; and

Fig. 3 is a diagram illustrating the circuit connections.

The particular embodiment of the invention chosen for the purpose of illustration comprises inner and outer conductors 1 and 2 and a series of thermostats each of which comprises a conducting sleeve 3 having a head 4 on one end and a nut 5 threaded on the other end, a conducting ring 6 electrically connected to the outer conductor, a thermostatic ring 7 in conducting relationship with the sleeve 4, an insulating sleeve 8,

two insulating rings 9 and 10 and a conducting ring 11 between the nut 5 and the ring 10. To insure good conducting relationship between the conductor 2 and the ring 6 one or more conducting spring pieces 12 may be set in recesses in the periphery of the ring 6. Whether or not the springs 12 are provided, the outer conductor 2 is preferably drawn tightly around the rings 6. Good electrical contact may be established between the inner conductor 1 and the sleeve 3 in various ways, as by providing the respective parts with a contact surface such as silver or palladium, welding the respective parts together after assembly, assembling while the sleeve is expanded with heat, or using for the inner conductor spring wire having a marked inherent curvature.

While any suitable construction may be provided at the end of the cable, the construction is preferably adapted to fit a standard terminal. As illustrated in Fig. 1 it comprises a sleeve 13 fitted over the inner conductor and connected thereto by means of solder 14, a ring of insulation 20 between the inner and outer conductors, a sleeve 15 soldered to the outer conductor at 16 and a ring 17 having a shoulder engageable with the shoulder on the ring 15 and having internal threads or engagement with a male connector 17a.

To assemble the parts the unitary thermostatic devices are first threaded on the inner conductor 1, then the outer conductor 2 is drawn tightly over the rings 6 and the end parts 13 to 20 are applied. The nuts 5 may be tightened either before or after the devices are threaded on the conductor 1, and the threaded ends of sleeves 3 may be tapered so that the sleeves are pinched against the inner conductor when the nuts are tightened. The thermostatic units may be mounted on the inner conductor in contact with each other as shown in Fig. 1 or they may be mounted in spaced relationship. In either case the ends of the sleeves 3 are preferably rounded to facilitate flexing of the cable without stretching the outer conductor unduly.

In use the periphery of the ring 7 snaps into engagement with the end of ring 6 in response to change of temperature. While the thermostatic disks 7 may be constructed to close circuit in response to decrease of temperature they are preferably constructed so as to snap into contact with the ring 6 in response to heat. In the diagram of Fig. 3 the thermostatic disks 7 are indicated diagrammatically at 7, the larger conducting rings at 6, the inner and outer conductors at 1 and 2, the source of current at 18 and a signal device at 19. As will be evident from Fig. 3 the signal circuit may be closed in response to any one of the thermostats along the length of the cable in response to heat and then opened again when the temperature falls again.

It will be understood that instead of ring 7 different switching elements of similar function, so far as the purpose of the invention is concerned, can be used, for example bimetallic star-shaped elements which do not necessarily have to operate on the snap action principle.

In addition to the aforesaid advantages, this cable can stand considerable hammering without damage and no endwise pressure is necessary because the thermostatic elements do not need to be held in contact with each other. By sealing the ends of the outer conductor internal corrosion may readily be prevented.

It should be understood that the present disclosure is for the purpose of illustration only and

that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A fire detecting cable comprising inner and outer conductors with a space therebetween, and a series of switches distributed along the cable in said space, each switch having terminals electrically connected to said conductors respectively and also having thermostatic means responsive to heat for electrically interconnecting the terminals, whereby the circuit comprising said conductors is closed by application of heat to the cable and remains closed only so long as heat is applied.

2. A fire detecting cable comprising inner and outer conductors with a space therebetween, and a series of switches distributed along the cable in said space, the switches comprising unitary devices enclosed by the outer conductor with aligned openings for said inner conductor, each switch having terminals electrically connected to said conductors respectively and also having thermostatic means responsive to heat for electrically interconnecting the terminals, whereby the circuit comprising said conductors is closed by application of heat to the cable and remains closed only so long as heat is applied.

3. A fire detecting cable comprising inner and outer coaxial conductors with a space therebetween and a series of switches distributed along the cable in said space, each switch comprising two conducting rings surrounding the inner conductor and electrically connected to the two conductors respectively, one of the conducting rings being made of thermostatic material and snapping into contact with the other in response to heat, whereby the circuit comprising said conductors is closed by application of heat to the cable and remains closed only so long as heat is applied.

4. A fire detecting cable comprising inner and outer coaxial conductors with a space therebetween and a series of switches distributed along the cable in said space, the switches comprising unitary devices with aligned openings for said inner conductor, each switch comprising two conducting rings surrounding the inner conductor and electrically connected to the two conductors respectively, one of the conducting rings being made of thermostatic material and snapping into contact with the other in response to heat, whereby the circuit comprising said conductors is closed by application of heat to the cable and remains closed only so long as heat is applied.

5. A fire detecting cable comprising inner and outer coaxial conductors with a space therebetween and a series of switches distributed along the cable in said space, the switches comprising unitary devices with aligned openings for said inner conductor, each switch comprising a conducting sleeve slidably fitting around said inner conductor, two conducting rings surrounding the sleeve and electrically connected to the two conductors respectively, and insulating means between said sleeve and the ring connected to the outer conductor, one of the conducting rings being made of thermostatic material and snapping into contact with the other in response to change of temperature.

6. A fire detecting cable comprising inner and outer coaxial conductors with a space therebetween and a series of switches distributed along the cable in said space, the switches comprising unitary devices with aligned openings for said

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inner conductor, each switch comprising a conducting sleeve slidably fitting around said inner conductor, two conducting rings surrounding the sleeve and electrically connected to the two conductors respectively, and insulating means between said sleeve and the ring connected to the outer conductor, one of the conducting rings being made of thermostatic material and snapping into contact with the other in response to change of temperature, said sleeve having heads on its opposite ends to hold said rings and insulating means in position.

7. A fire detecting device comprising a conducting sleeve having an axial opening extending therethrough, a conductor in said opening, two conducting rings surrounding the sleeve, one of the rings being larger than the other, and insulating means between said sleeve and the larger ring, the smaller ring being made of thermostatic material and snapping into contact with the larger ring in response to change of temperature.

8. A fire detecting device comprising a conducting sleeve having an axial opening extending therethrough, a conductor in said opening, two conducting rings surrounding the sleeve, one of the rings being larger than the other, and insulating means between said sleeve and the larger ring, the smaller ring being made of thermo-

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static material and snapping into contact with the larger ring in response to change of temperature, said sleeve having heads on its opposite ends to hold said rings and insulating means in position.

9. A fire detecting cable comprising inner and outer coaxial conductors with a space therebetween and a series of switches distributed along the cable in said space, each switch comprising two conducting rings surrounding the inner conductor and electrically connected to the two conductors respectively, one of the conducting rings being made of thermostatic material and moving into contact with the other in response to heat, whereby the circuit comprising said conductors is closed by application of heat to the cable and remains closed only so long as heat is applied.

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