Dec. 20, 1955 C. J. ADAMS ET AL 2,728,068

FIRE DETECTOR

Filed May 19, 1949

2 Sheets-Sheet 1

Fig. 1.

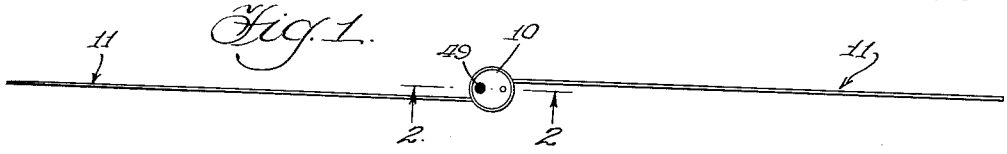


Fig. 2.

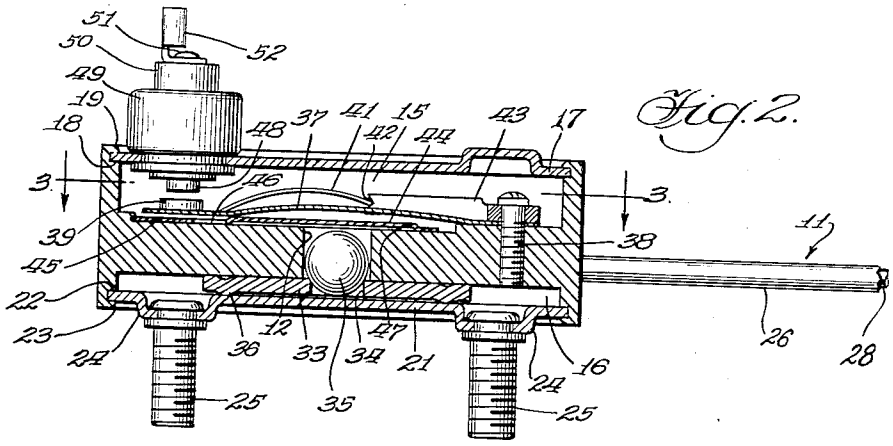
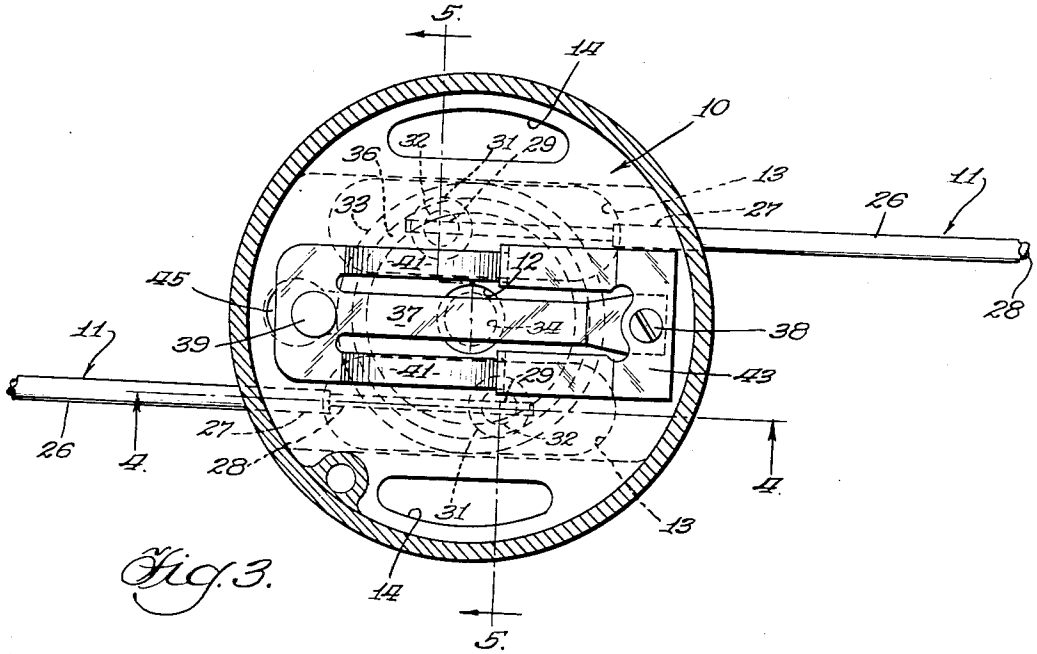


Fig. 3.



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Fig. 4.

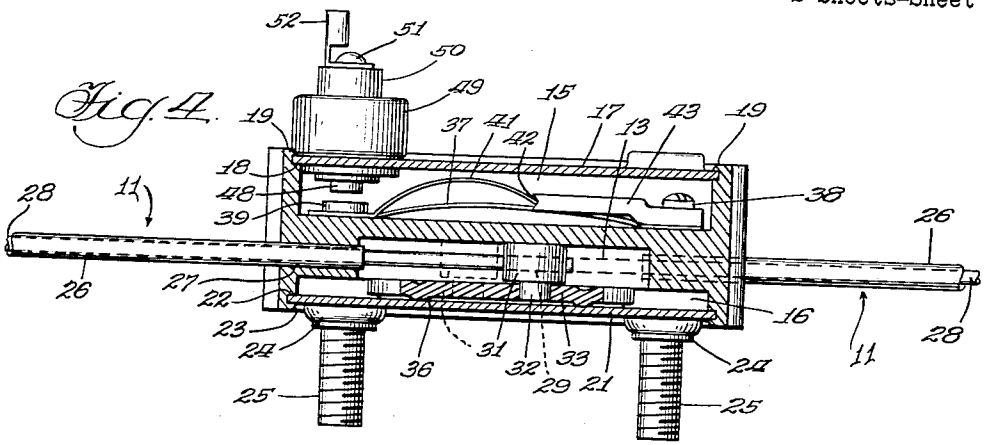


Fig. 5.

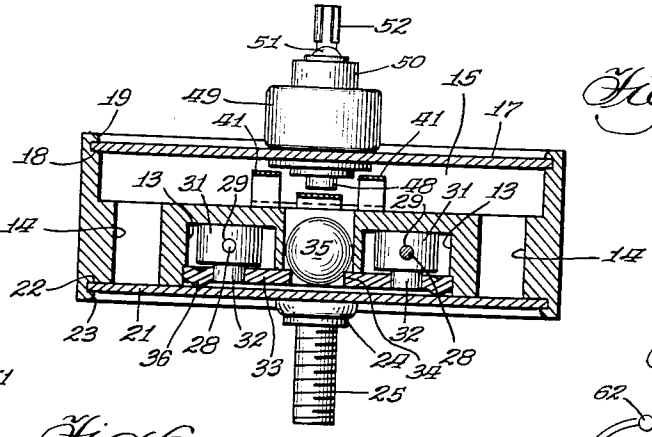


Fig. 6.

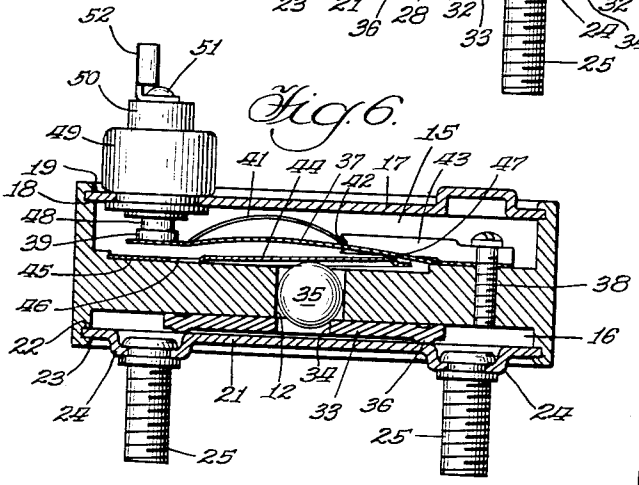


Fig. 7.

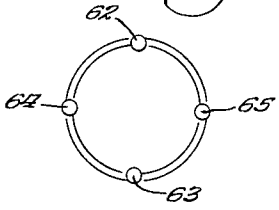
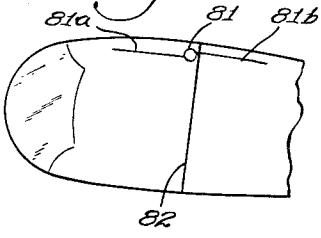


Fig. 9.



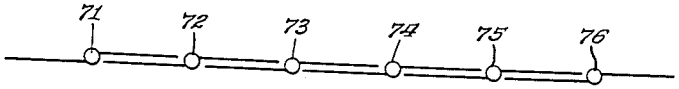


Fig. 8.

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United States Patent Office 2,728,068 Patented Dec. 20, 1955

2,728,068

FIRE DETECTOR

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Application May 19, 1949, Serial No. 94,222

19 Claims. (Cl. 340—227)

The present invention relates to fire directors. The specific form of the invention here disclosed is particularly designed to detect fires in the engine nacelles of aircraft, but the detector is also suited to other uses, as for protection of grain elevators or coal piles against spontaneous combustion, or safeguarding warehouses or other buildings. In any case it is the function of the detector to give an almost instant visual or aural alarm of the outbreak of a fire, and, if desired, to initiate the operation of an automatic fire extinguishing system.

It is the general aim of the invention to provide a reliable, quick acting detector to perform this function. The accomplishment of this aim involves many aspects, however, since to achieve the requisite degree of reliability the detector must operate perfectly in any position, be impervious to forces of acceleration and deceleration, be capable of uniform operation within extremely wide limits of temperature, altitude and humidity, and must be unaffected by continued vibrations, physical shock, or long exposure to all manner of adverse conditions, including corrosion resulting from rain, salt spray, immersion in fuel or oil, as well as exposure to violently blown dust and sand. The problem of providing a satisfactory fire detector, particularly one suited for aircraft use, is further complicated by the requirement that it be able to give an almost instant signal in the event of flame, yet be unaffected even by the extremely wide variations in ambient temperature that may result from abnormal engine operation, so that no false signals will be given. For example, the detector must be capable of giving an instant alarm, yet be free of false signals even during periods of extreme overheating of the engine that may occur under certain conditions of take-off, by direct exposure to the sun in a desert or tropical climate, or even by deliberately exceeding the maximum power rating of the engine during a combat emergency. Notwithstanding this, it is also essential that the same detector, without adjustment, be capable of giving an equally prompt alarm in the event of a fire occurring at the instant of starting the engine in the sub-zero temperatures of the arctic regions. The detector must also be of such design and construction that it is not subject to damage even by temperatures far below those ever encountered even in arctic or antarctic regions, so that the detector mechanism cannot possibly be injured by the operation of carbon dioxide extinguisher systems which may under certain conditions reduce the temperature of parts exposed to the expanding carbon dioxide to temperatures far below climatic extremes.

Many prior devices have been suggested for the purpose of detecting fires, but so far as is known, these have been mere thermostats or temperature rise indicators which are affected by changes in ambient temperature as well as by fire, with the results that they cannot operate satisfactorily over extremely wide ranges of operating temperatures, as may be encountered in aircraft use, for example. This has heretofore posed a very serious problem, particularly with detectors of the "continuous" type that extend uninterruptedly across a specified zone rather

than functioning only at one or more separate points. This is because the widely variable ambient temperatures to which the devices are subjected ordinarily affect the entire length of any continuous detecting unit, while the flame of an actual fire may only influence a small portion of a continuous detector.

It is, therefore, one of the primary objects of the invention to provide a fire detecting device adapted to be mounted in the engine compartment of an aircraft, for example, and capable of giving an almost instant signal if a fire develops in the engine, yet wholly unaffected by ambient temperature changes, so that the time required for response to a flame will remain substantially constant over a range of several hundred degrees in ambient temperature.

Another important object of the invention is to provide a fire detector capable of giving an unfailing signal within a matter of two or three seconds after a fire breaks out, irrespective of the location of the fire within the engine compartment, and at the same time so designed and constructed that it will continue to function even when its parts are heated almost to incandenscence. This means that the detector will continue to function even in the presence of the fire, so that the termination of the detector alarm signal gives a reliable indication that the fire has been extinguished.

A further object of the invention is the provision of a fire detector having the functional characteristics noted and additionally capable of repeated operation even after exposure to fire and to terrific extremes in sub-zero temperatures. The accomplishment of this object means that even if the detector is directly exposed to the flame of an intense fire and then to the expanding gas of a carbon dioxide system used to extinguish the fire, yet the detector will nevertheless be unharmed and in condition for proper operation should a subsequent fire develop.

A further important object of the invention is the provision of a detector capable of the foregoing functions, yet not influenced by acceleration or deceleration; capable of withstanding long continued and violent vibration; substantially impervious to the influences of changes of humidity or the presence of dust or violently driven sand, and not in any manner affected by rain, salt spray, acids, or immersion in fuel or lubricating oil.

A further object of the invention is the provision of a fire detector as above with sensing means of the "continuous" type, having relatively long sensing arms responsive to flame at any point along their entire length, as distinguished from detector systems having only individual points of sensitivity spaced apart from each other.

A still further object of the invention is to provide a fire detector having relatively long, continuous sensing means of extremely small cross section and high physical flexibility, so that the arms may be conveniently coiled within an engine nacelle, for example. The accomplishment of this object means that the detector units may be manufactured as a single standard type, yet be suited for installation in compartments of various sizes, shapes and configurations.

A further object of the invention is the provision of a detector capable of accomplishing the above functions, yet of small, simple, light weight but rugged mechanical construction, requiring no electronic apparatus for its functioning, capable of use with any convenient potential or frequency of power supply, and designed to function without interfering with radio, radar or other electronic equipment carried by the aircraft.

The foregoing objects are accomplished according to the present teachings by detecting fires by a novel method which, instead of utilizing a mere thermostat or temperature rise indicator set for a fixed temperature, contemplates making separate temperature measurements in two

or more zones within a given compartment and comparing the temperatures in each zone. Since any fire, at its outset, is localized and does not envelope the entire compartment, its presence will be indicated by a significant differential existing between the temperatures noted in the different zones measured. In the practical embodiment of the invention here disclosed, these measurements are automatically and continuously made and the comparison is continuously made by a balancing lever, so that the detector may be set to give an instant alarm whenever the difference in measured temperatures of the zones exceeds a selected value.

A fire detector comprising a preferred commercial embodiment of the present teachings is illustrated in the drawings of the specification, wherein:

Figure 1 is a plan view;

Figure 2 is an enlarged cross-sectional view taken substantially on the plane of the line 2—2 of Figure 1;

Figure 3 is a plan sectional view taken substantially on the plane of the line 3—3 of Figure 2;

Figure 4 is a detail sectional view taken substantially on the plane of the line 4—4 of Figure 3;

Figure 5 is a sectional view on the line 5—5 of Figure 3;

Figure 6 is a sectional view similar to Figure 2, showing the movement of the parts in actuating a signal; and

Figures 7, 8 and 9 are diagrammatic illustrations of typical installations of the detector units.

As illustrated, the detector here shown consists of a housing or body portion **10** with a pair of slender temperature sensing arms **11** extending outwardly therefrom. It is contemplated that several of the units may be installed in the zone of possible fire, with the housings **10** mounted at any convenient spaced locations within the zone to be protected. For example, in an aircraft nacelle, the sensing arms may be curved to surround or encircle the engine where they will be instantly exposed to any flame that might develop. The housings **10** are preferably of a corrosion resisting, high temperature metal such as stainless steel. As shown, they are of generally circular shape having a web portion with a center orifice **12**, a pair of elongated slots **13** and recesses **14** between a switch chamber **15** on one side of the web and a differential chamber **16** on the opposite side.

The switch chamber **15** is closed by a circular plate **17** seated against a shoulder **18** in the housing and held by a peripheral edge flange **19** spun over the edge of the plate so as to provide a substantially air-tight switch compartment in which the electrical mechanisms of the unit are housed. The differential housing **16** is closed by a similar circular plate **21** seated on a shoulder **22** of the housing and held in place by a spun flange **23**. As presently manufactured, the plates **17** and **21** are sealed with Glyptal applied to the shoulders and spun flanges, but it will be apparent that, if desired, the unit may be hermetically sealed by brazing, soldering, or otherwise, and in this event it is contemplated that the apertures **14** may be utilized as chambers for silica gel to absorb any traces of moisture within the sealed housing. As shown, the plate **21** has a pair of outwardly extending bosses **24** on which mounting studs **25** are riveted. These may be threaded to facilitate mounting the unit.

The sensing arms **11** of the unit are of bimetallic construction, consisting of a slender exterior tube of metal such as stainless steel, for example, which may be secured within the bores **27** in the wall of the housing **10** by welding or otherwise, so that their inner ends are sealed. The metal of the tubes **26** has a relatively high degree of thermal expansion which greatly exceeds the coefficient of expansion of the alloy wires **28** which extend through each tube. In the commercial embodiment of this invention the wire **28** comprises what is known in the trade as No. 42 Alloy, consisting of 42% nickel and the balance pure iron. The wires **28** are of a diameter a few thousandths of an inch less than the internal diameter of the

tubes **26**. These parts are lubricated for movement of the wires within the tubes by applying a graphite wipe to the wires prior to insertion. The outer extremities of the tubes **26** and the wires **28** are then welded together so that the differing rates of thermal expansion of the two metals will cause the inner ends of the wires to move inwardly or outwardly in response to changes in the temperature to which the sensing arms are subjected.

The inner ends of each of the wires **28** of the sensing arms **11** are secured within bores **29** in the head portions of a pair of operating pins **31** which have reduced end portions **32** fitted into apertures in a floating differential disc **33**. The disc **33** is housed within the differential compartment **16** of the housing of the unit and has a center recess or orifice **34** which normally lies in coaxial relation with the orifice **12** of the housing. A stainless steel ball **35** is positioned in the opening **12** and extends into the orifice **34** of the disc **33**, so that the ball tends to function as a center about which the differential disc **33** can pivot. The lower surface of the disc **33** slides on the inside surface of the lower closure plate **21**, and the disc is preferably provided with an annular shoulder **36** to reduce the area of contact and lessen friction in manner well understood in the art.

The switch housing **15** of the unit serves to house a snap-acting switch consisting of a leaf spring flapper mounted on a screw threaded stud **38** and carrying a contact **39** at its free end. The switch flapper is preferably of thin stainless steel and as shown includes a narrow center strip **37** with a pair of integral arms **41** on each side of the center strip and joined to it at the contact end. These arms are seated in V-notches **42** in a bifurcated yoke **43** carried by the stud **38**. The notches **42** serve as pivot points for the ends of the spring arms **41**, so that when the springs are flexed to the position shown in Figure 2, the center portion **37** of the flapper is in tension and the side portions **41** act as compression elements to hold the contact **39** down, but whenever the center portion **37** of the switch flapper is lifted across center these pivots cause the flapper to snap upwardly.

The switch flapper **37** is arranged to be actuated by the ball **35** which acts through an actuating finger **44** mounted in the switch chamber **15** under the switch flapper. The actuating finger includes a circular head portion **45** staked into a recess in the web of the housing **10**, and a neck portion perforated at **46** to act as a pivot for the slender finger of the actuator. The finger **44** of the actuator is provided with a longitudinal rib to give it considerable rigidity. The actuating finger **44** extends across the bore **12** in which the ball **35** rests, so that in the event the ball **35** is forced upwardly against the lower surface of the actuator strip, the strip will contact the center spring of the switch flapper at the point **47** and lift the flapper spring across the pivots **42**. When this occurs, the flapper will snap upwardly to bring the contact **39** of the switch flapper into engagement with its coacting contact **48**. The contact **48** is carried by the upper plate **17** and is preferably provided with a mounting including a metal bushing **49** riveted into an aperture through the plate with a ceramic insulator **50** housed within the bushing so that a shank of the contact **48** may extend through the insulator and have a head portion **51** riveted over a flange of a terminal lug **52** from which electrical connections may be taken as desired.

In operation the device is not affected by changes of ambient temperature and responds only to a localized fire affecting some point along the sensing arms. This is because the two opposite sensing arms are balanced against each other by a differential mechanism. As shown, this comprises a simple balancing lever in the form of the disc **33** with a recess to receive the ball **35**. Thus, as the arms **11** are exposed to changes in ambient temperature, the different coefficients of expansion of the stainless steel tubes **26** and alloy wires **28** will cause the inner ends of the wires to move inwardly and outwardly, but the only result of this motion will be to rotate the disc **33** a few

degrees in one direction or the other about the ball **35**, which then functions as a pivot for the disc. The sensing arms **11** are quite long, however, preferably each being almost a yard in length so that when the detector is installed in the nacelle of an aircraft engine, by way of example, any fire breaking out in the engine will not affect the entire unit equally but will only affect a portion of one of the arms lying in the fire zone. Should this occur, the increased expansion of the stainless steel tube **26** on the arm extending into the fire will draw the wire **28** outwardly and exert a force on one of the pins **31** which is not balanced by a corresponding movement of the other pin. When this occurs, the upper edges of the recess **34** in the differential disc **33** will exert a camming action on the spherical surface of the ball **35** to move it upwardly against the actuating finger **44**. This finger will bear against the spring flapper of the switch to push it over center. The spring flapper will then snap upwardly to close the contacts **39**—**48** and give the alarm signal.

With this type of construction the sensing arms may be very slender and quite flexible so that the expansion occurs almost instantaneously upon exposure to the flame. This results in an extremely quick response, tests having shown that the unit often gives a response in less than two seconds and never fails to respond in less than an interval of five seconds, even though only a relatively small fraction of the length of one of the arms is exposed to the heat of the flame.

It is also to be noted that since the differential coupling of the opposite sensing arms balance out any variations in ambient temperature, the unit acts in response to a given deviation from ambient temperature rather than at a fixed temperature setting. The differential at which the switch closes may be selected as desired, but should be greater than slight temperature variations that might arise from causes other than fire. Thus, the mechanism is not subject to false signals even under abnormal operating conditions. This is true even though the temperature throughout the entire engine compartment may reach extremely high levels, but the unit is nevertheless capable of instant response if an actual fire breaks out. Similarly, the unit is equally well suited to sounding an alarm in the event that a fire breaks out in the initial starting of an engine even though all of the parts within the nacelle may be at a sub-zero temperature.

The form of a detector here shown is not only capable of uniform operation within extremely wide limits of temperature, altitude, and humidity but is also unaffected by changes in atmospheric pressure. It cannot be harmed by corrosion, nor by exposure to rain, salt spray, or immersion in fuel or oil. It is impervious to exposure to dust, wind, and driven sand. It is not harmed by long continued vibration, nor by forces of violent acceleration or deceleration.

The detector here shown is able to give an almost instant signal in the event of a flame in any portion of the engine compartment, yet terminate the signal promptly when the fire is extinguished. All parts of the unit are capable of withstanding severe extremes in both heat and cold, and as a matter of fact, have by actual test shown themselves capable of withstanding sustained temperatures of 2,000° F. yet retaining their functional ability.

When only a short length of one of the sensing arms is exposed to flame, the movement of the parts is comparatively small, as shown in Figure 6. If the entire length of the arm is exposed, the movement will be correspondingly greater, and may cause the disc **33** to ride under the ball **35** so that the ball rests on the flat surface of the disc. As the sensing arms cool, however, the disc is returned to centered relationship. Thus even extreme movements do not damage the switching mechanism.

The detectors may be mounted in any convenient location and may be used singly or in various arrays to adequately cover a zone to be protected. Normally, the sensing arms will be balanced so that an alarm is sounded if the temperature of one exceeds the other by a selected amount. The installation may be reversed, however, to give an alarm when the temperatures of the two arms approach each other, and when so arranged the device is useful for indicating proper function of pilot lights, etc., which are intended to burn continuously.

In Figure 9 the desired effect is accomplished by mounting a single detector unit with its differential housing **81** at a fire wall or bulkhead **82** that acts as a flame baffle to separate a forward compartment from the rear compartment in such a manner that the forward sensing unit **81***a* and the rear sensing unit **81***b* are isolated from each other. When so isolated, a flame cannot affect the two arms equally, no matter what the location of the flame. In an installation of this character it will be noted that the two arms will be equally affected by normal changes in ambient temperatures such as might occur as a result of external weather conditions or the effects of bright sun on the exterior surface of the aircraft, yet if a fire breaks out in the forward compartment it will affect only the sensing unit **81***a*, and if it breaks out in the aft compartment it will affect only the arm **81***b*. It follows that in either case the baffle **82** prevents the possibility of a flame raising the temperatures of the two differential arms equally and thus makes for the dependable functioning of the system.

If desired, the units may have the temperature sensing arms curved as shown in Figure 7 so that the four detecting units **62**, **63**, **64** and **65** completely encircle the compartment in which a radial engine is mounted, or they may be arranged in a continuous straight line as exemplified by the detectors **71** to **73** in Figure 8. The advantages following employing systems of these types are more fully pointed out in our copending disclosure Serial No. 94,221, filed on even date herewith, now Patent No. 2,563,904.

While we have disclosed what we believe to be a new method of detecting fires and have described a present preferred embodiment of a device for practicing our teachings in this respect, we are aware that numerous variations and modifications may be indulged in without departing from the inventive concept nor sacrificing all of the advantages thereof, and we therefore point out that the scope of the present invention is not limited to the precise form of device here illustrated, but extends equally to any variation or modification thereof coming within the terms of the appended claims.

Having thus described the invention, what we claim as new and desire to protect by United States Letters Patent is:

1. A fire detector comprising a sealed housing having an insulated electrical connection extending into the housing and an electric switch within the housing; a pair of bimetallic temperature sensing arms extending in opposite directions from the housing, each of said temperature sensing arms consisting of a continuous, long, slender tube of metal having a high coefficient of expansion, with a wire of alloy having a low coefficient of expansion extending through the tube and extending into the housing, the tubes of said sensing elements being sealed to the housing and the outer extermities of the tubes and alloy wires being sealed to each other; said alloy wires each being operatively connected to a shiftable differential mechanism comprising a lever, a pivot recess in said lever, and a ball seated in the recess and mechanically interconnected with the electric switch whereby differential expansion of the temperature sensing elements will shift the differential mechanism to actuate the switch.

2. A fire detector comprising a housing with an electric switch; a pair of bimetallic temperature sensing arms extending in different directions from the housing, each of said temperature sensing arms consisting of a continuous, long, slender tube of metal having a high coefficient of expansion, with a wire of alloy having a low coefficient of expansion extending through the tube, the outer extremities of the tubes and alloy wires being joined

to each other, with the alloy wires extending into the housing and operatively connected to a differential mechanism comprising a lever, a pivot recess in said differential mechanism, and a ball seated in the recess and mechanically interconnected with the electric switch whereby differential expansion of the temperature sensing elements will shift the differential mechanism and ball to actuate the switch.

3. A fire detector comprising a housing with an electric switch; a pair of bimetallic temperature sensing arms extending in different and opposite directions from the housing, each of said temperature sensing arms consisting of a long, slender metal tube with a wire extending through the metal having a different coefficient of expansion joined to the tube at the outer end, and extending into the housing; said wires being attached to shiftable pins pivoted to a differential lever; a pivot recess in said differential lever and a pivot comprising a ball shiftably mounted in a bore of the housing with a portion of the ball extending into the pivot recess of the differential lever, with the ball mechanically interconnected with the electric switch whereby differential expansion of the temperature sensing elements will shift the differential lever and ball to actuate the switch.

4. A fire detector comprising a sealed housing having an insulated electrical connection extending through into the housing wall with an electric switch within the housing; a pair of temperature sensing devices extending in different directions from the housing, each of said temperature sensing devices having a shiftable temperature responsive element extending into the housing and operatively connected to a shiftable differential mechanism comprising a lever; a pivot recess in said differential lever and a pivot comprising a ball shiftably mounted in a bore of the housing with a portion of the ball extending into the pivot recess of the differential lever and the opposite side of the ball mechanically interconnected with the electric switch whereby differential movement of the temperature responsive elements of the sensing devices will shift the differential lever and ball to actuate the switch.

5. A fire detector comprising a sealed housing having a switch compartment, a differential compartment, and a central bore extending between said compartments; an insulated electrical connection extending into the switch compartment of the housing wall and an electric switch within the housing; a pair of temperature sensing devices extending to points remote from the housing and spaced apart from each other; each of said sensing devices having a shiftable temperature responsive element extending into the differential chamber of the housing and operatively connected to a shiftable differential lever having a pivot recess carried on a pivot comprising a ball shiftably mounted in the bore extending between the differential compartment and switch compartment of the housing; with a portion of the ball extending into the pivot recess of the differential lever and the opposite side of the ball mechanically interconnected with the electric switch whereby differential movement of the temperature responsive elements of the sensing devices will shift the differential lever and ball to actuate the switch.

6. A fire detector comprising a plurality of continuous bimetallic temperature sensing devices oppositely disposed in end to end relationship extending into zones spaced apart from each other, each of said devices including a shiftable element responsive to variations in temperature, a differential mechanism mechanically interconnecting said shiftable elements whereby movements of said elements are balanced at equal temperatures, cam means responsive to differential movement of said elements, and an electrical switch operated by said cam means to actuate a signal.

7. A fire detector comprising a plurality of temperature sensing devices spaced apart from each other, each of said devices including a shiftable element responsive to variations in temperature, a differential mechanism mechanically interconnecting said shiftable elements whereby movements of said elements are balanced at equal temperatures, cam means responsive to differential movement of said elements, and an electrical switch operated by said cam means to actuate a signal.

8. A fire detector comprising a plurality of temperature sensing devices, each having a shiftable temperature responsive element; together with a mechanical differential mechanism consisting of a floating lever interconnecting said shiftable temperature responsive elements and balancing the movements thereof at equal temperatures of the sensing devices, and means responsive to an increase in the temperature of one of said sensing devices over another to actuate said mechanical differential mechanism to actuate a signal.

9. A fire detector comprising a housing with a plurality of temperature sensing devices, each consisting of a long slender flexible metal tube with one end of the tube secured to said housing, the tube having a shiftable temperature responsive element consisting of a flexible wire extending through the tube, said wire being of metal having a different coefficient of expansion than the tube and joined to the tube at its outer end with the inner end of said wire extending into the housing; together with differential means interconnecting said wires, and responsive to an increase in the temperature of one of said temperature sensing devices over another to actuate a signal.

10. A fire detector comprising a housing with a plurality of elongated continuous temperature sensing devices oppositely disposed in end to end relationship extending into zones spaced apart from each other, together with differential means to compare the temperatures to which said sensing devices are subjected, and means responsive to an increase in the temperature of either one of said sensing devices over the other to actuate a signal.

11. A fire detector comprising a plurality of temperature sensing devices, each of said sensing devices consisting of a relatively long slender flexible metallic tube, the said tubes each having one end thereof secured to the housing and diverging therefrom in different directions together with differential means to compare the temperatures to which said sensing devices are subjected, and means responsive to an increase in the temperature of either one of said sensing devices over the other to actuate a signal.

12. A fire detector comprising a plurality of temperature sensing devices spaced apart from each other, together with a mechanical differential mechanism interconnecting said sensing devices to continuously compare the temperatures to which said devices are subjected, an electrical switch and means responsive to an increase in the temperature of either one of said sensing devices over the other to operate said switch and actuate a signal.

13. A fire detector comprising a plurality of temperature sensing devices oppositely disposed in end to end relationship; each of said sensing devices consisting of a relatively long slender flexible metallic tube, the said tubes each having one end thereof secured to the housing and diverging therefrom in different directions whereby the ends of said tubes are widely spaced apart from each other, together with differential means interconnecting said sensing devices to continuously compare the temperatures to which said sensing devices are subjected, and means responsive to an increase in the temperature of either one of said sensing devices over the other to actuate a signal.

14. The method of detecting fires consisting of mechanically measuring the temperature at two zones spaced apart from each other; mechanically comparing the temperature measurements of said zones, and automatically actuating a signal when the temperature measured in either one of said zones exceeds the temperature measured in the other by a selected amount.

15. A fire detecting device comprising, in combination, a plurality of continuous bimetallic temperature sensing

devices extending into different zones having substantially the same temperature under normal conditions but spaced apart from each other, each of said devices including a shiftable element responsive to variations in temperature; a differential mechanism mechanically interconnecting said shiftable elements whereby movements of said elements are balanced at equal temperatures, means responsive to differential movement of said elements to actuate a signal, and means to isolate the said bimetallic temperature sensing devices from each other, said last named means comprising a fire wall intermediate the ends of said temperature sensing devices.

16. A fire detecting device comprising, in combination, a plurality of continuous bimetallic temperature sensing devices extending into different zones having substantially the same temperature under normal conditions but spaced apart from each other, each of said devices including a shiftable element responsive to variations in temperature; a differential mechanism mechanically interconnecting said shiftable elements whereby movements of said elements are balanced at equal temperatures, means responsive to differential movement of said elements to actuate a signal, and means to isolate the said bimetallic temperature sensing devices from each other.

17. A fire detecting device comprising, in combination, a plurality of temperature sensing devices extending into different zones having substantially the same temperature under normal conditions but spaced apart from each other, differential means to compare the temperatures to which said sensing devices are subjected, means responsive to an increase in the temperature of one of said temperature sensing devices over another to actuate a signal, and means to isolate the said sensing devices from each other; said last named means comprising a fire wall intermediate the ends of said temperature sensing devices.

18. A fire detecting device comprising, in combination, a plurality of temperature sensing devices extending into different zones having substantially the same temperature under normal conditions but spaced apart from each other, differential means to compare the temperatures to which said sensing devices are subjected, means responsive to an increase in the temperature of one of said temperature sensing devices over another to actuate a signal, and means to isolate the said sensing devices from each other.

19. A fire detecting device comprising a fire wall and a plurality of temperature sensing devices, said sensing devices being positioned on opposite sides of the fire wall whereby they are subject to temperatures in different zones having substantially the same temperature under normal conditions; together with differential means to compare the temperatures to which said sensing devices are subjected, and means responsive to an increase in the temperature of one of said sensing devices over another to actuate a signal.

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