Jan. 16, 1962 S. J. MESSELT 3,017,513

FIRE DETECTION APPARATUS

Filed Oct. 8, 1959

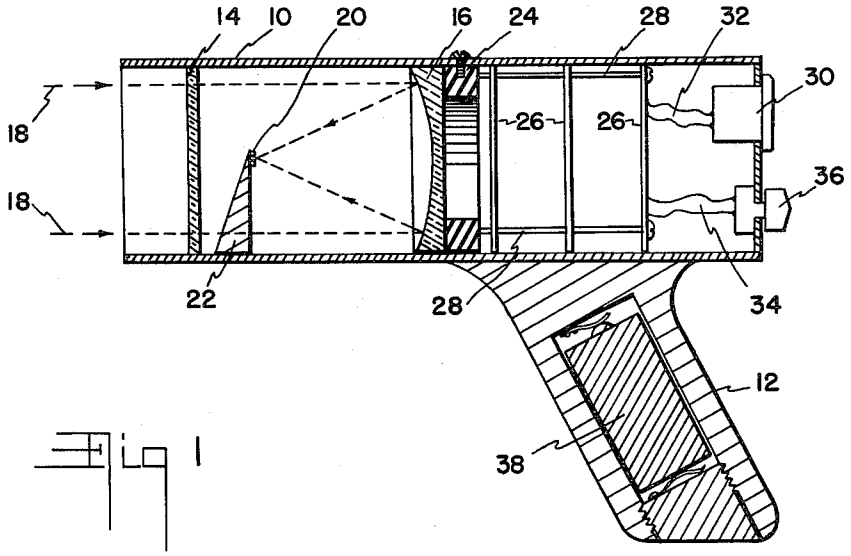

Fig 1

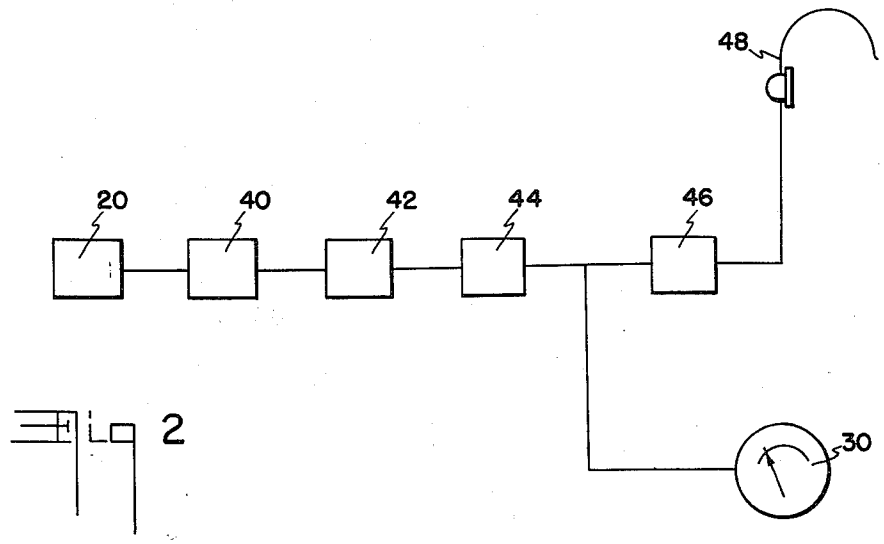

Fig 2

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FIRE DETECTION APPARATUS

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This invention relates to fire detection systems and, more particularly, to a portable, infra-red fire detection apparatus.

Many scientific advances have been made in the field of fire fighting in the past few years. Many of these advances are at least partially nullified, however, by the difficulty of pin-pointing the exact location of hidden blazes. Smoke is one of the major problems of all fire fighters. Smoke fills a building in a matter of moments, obscuring the fire. Not only can the blaze continue its destructive course behind the obscuring screen but extensive water damage may be done in the necessary effort to reach all possible points of combustion.

Furthermore, even the apparent extinguishment of a fire may not result in its eradication. Unseen blazes often remain within walls and partitions. There is little visible indication of the existence of such fires. A fireman may use his hand to locate hot spots on a wall but this is a slow and time consuming procedure. Fires within wall spaces are notoriously rapid spreading. Air spaces act like flues in spreading the blaze from floor to floor.

It will be readily appreciated that firemen investigating burning buildings, carrying protective equipment, working under all sorts of weather conditions and in all types of structures, cannot be burdened with heavy, cumbersome equipment. This is particularly true when haste is imperative.

It is, therefore, the primary object of the present invention to provide a fire detection apparatus.

Other objects of this invention are to provide such an apparatus sensitive to infra-red radiation; having a self-contained power supply; portable and easy to handle by one man; fast acting and reliable; and rugged and adaptable to operation under severe conditions.

The above objects are achieved by providing fire detection apparatus including focusing means adapted to receive and focus radiation from an inspected area and a detector positioned at substantially the focal point of the focusing means. The detector is part of an electronic circuit designed to produce an electrical signal responsive to the radiation. Indicating means are also provided responsive to the electrical signal to disclose the presence of fire in an inspected area.

The manner in which the above objects are attained will be more apparent from the following description taken together with the figures of the attached drawing, wherein

FIG. 1 is a sectional elevational view of a detection apparatus of the invention; and

FIG. 2 is a schematic block diagram of a circuit usable in the present invention.

The apparatus of FIG. 1 includes a tubular barrel member **10** which may be constructed of metal or other suitable material. A pistol grip **12** is provided to afford the user a positive, comfortable grip. A window **14** is enclosed within the barrel near its open end. A paraboloidal mirror **16** is positioned within the barrel to receive rays of entering infra-red radiation **18**. Infra-red detector **20** is positioned on a bracket **22** at the focal point of reflector **16**. A toroidal supporting member **24** is secured within barrel **10** as a support for mirror **16** which is bonded thereto. Member **24** may be of any suitable material but in the illustrated embodiment is of rubber or plastic to provide shock absorbing qualities. The

necessary circuit elements are reduced to printed circuit form and are positioned as members **26** within the barrel by means of supporting screws **28**. A meter **30** for visual observation is mounted at the rear of the apparatus, electrically connected to the circuit by wires **32**. Wires **34** are connected to a calibration knob **36**. The wires interconnecting the detector and the various printed circuit boards are not shown. A battery **38** positioned within a suitable compartment within grip **12** provides the necessary power for operation.

The electrical circuit of the device as illustrated in the block diagram of FIG. 2 includes the detector **20**, preamplifier **40**, amplifier **42**, rectifier **44**, and meter **30**. A variable oscillator **46** may also be provided along with head phones **48** for producing an audible signal especially useful when visibility is limited. As each of the electrical components is of standard construction and well known in the art, it has not been considered necessary to illustrate the circuits in more detailed fashion.

The primary function of window **14** is to maintain cleanliness within barrel **10** and thereby protect the surface of reflector **16**. Window **14**, however, may also be used as a filter, for example, to eliminate visible light which might give erroneous readings.

For the detection of fire sources, a detector responsive to a temperature of approximately 210° F. is required. However, in order to provide some margin of safety and, at the same time, compensate for the insulating qualities of walls and partitions, the apparatus is preferably made sensitive to heat sources of 150° F. In addition, for maximum efficiency, the heat source should be detectable at a distance of ten feet. The energy emitted by a black body radiator at 150° F. is 7×10^{-2} watts/cm.^{2}. By using a three inch paraboloidal reflector to focus the radiation, the available energy at a detector is approximately 1.26×10^{-7} watts.

The detector should be of the uncooled type and have a spectral response within a wavelength band not absorbed by the atmosphere. Examples of usable wavelengths are 3.5 to 4.3μ and 5.0μ. The noise equivalent power of the detector should provide a good signal to noise ratio at 1.26×10^{-7} watts.

Several detectors will satisfy the foregoing requirements—a bolometer, lead selenide, or lead sulfide, to name a few.

Because of the drift problems encountered in the D.C. amplification of detector signals, it is preferable to utilize an A.C. amplifier. In order to do this, the signal must be chopped. In order to eliminate the necessity for a mechanical chopper, the detector may be wired into an A.C. bridge circuit excited by an oscillator. Any of a number of easily portable battery sources may be utilized for a power supply. In the described embodiment, a rechargeable 9 volt mercury battery is employed.

It will now be seen that in order to locate the existence of "hot spots," an operator need only scan an area, such as a wall, by pointing the apparatus in the proper direction. The infra-red energy, guided through barrel **10** and focused on the detector by the reflector, will cause a signal to flow in the electrical circuit. The signal, amplified and impressed on a meter or headphone, will thus give a physical indication of the presence of fire.

It will be apparent that the device of the present invention has wide application in all fields in which the location of heat sources is of importance. It will be further apparent to those skilled in the art that the apparatus of this invention is capable of many variations. The tubular radiation path, for example, is not limited to a construction of circular cross section but may be of any convenient shape such as square, octagonal, or oval. The foregoing description is therefore to be construed as descriptive rather than limiting.

I claim:

Fire detection apparatus comprising a tubular barrel having an infrared permeable window at one end thereof, said window being of substantially disk-like configuration and lying in a plane perpendicular to the longitudinal axis of said barrel; pistol grip means attached to said barrel for supporting the apparatus in a user's hand; paraboloidal reflector means positioned in said barrel to receive the radiation passed by said window and focus said radiation on a finite area between said window and said reflector; detector means selected from the group consisting of lead selenide, lead sulphide, and bolometers positioned to receive the focused radiation, said detector being responsive to radiation wavelengths selected from the group consisting of about 3.5μ to 4.3μ and approximately 5μ; electronic alternating current circuit means within said barrel means for producing an electrical signal responsive to the radiation on said detector; battery means within said pistol grip for supplying electric power to said circuit means; and indicating means responsive to said electric signal to disclose the presence of fire in an inspected area.

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