July 16, 1957 W. C. MESSICK 2,799,239

TEMPERATURE RESPONSIVE ALARM DEVICE

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Fig. 1.

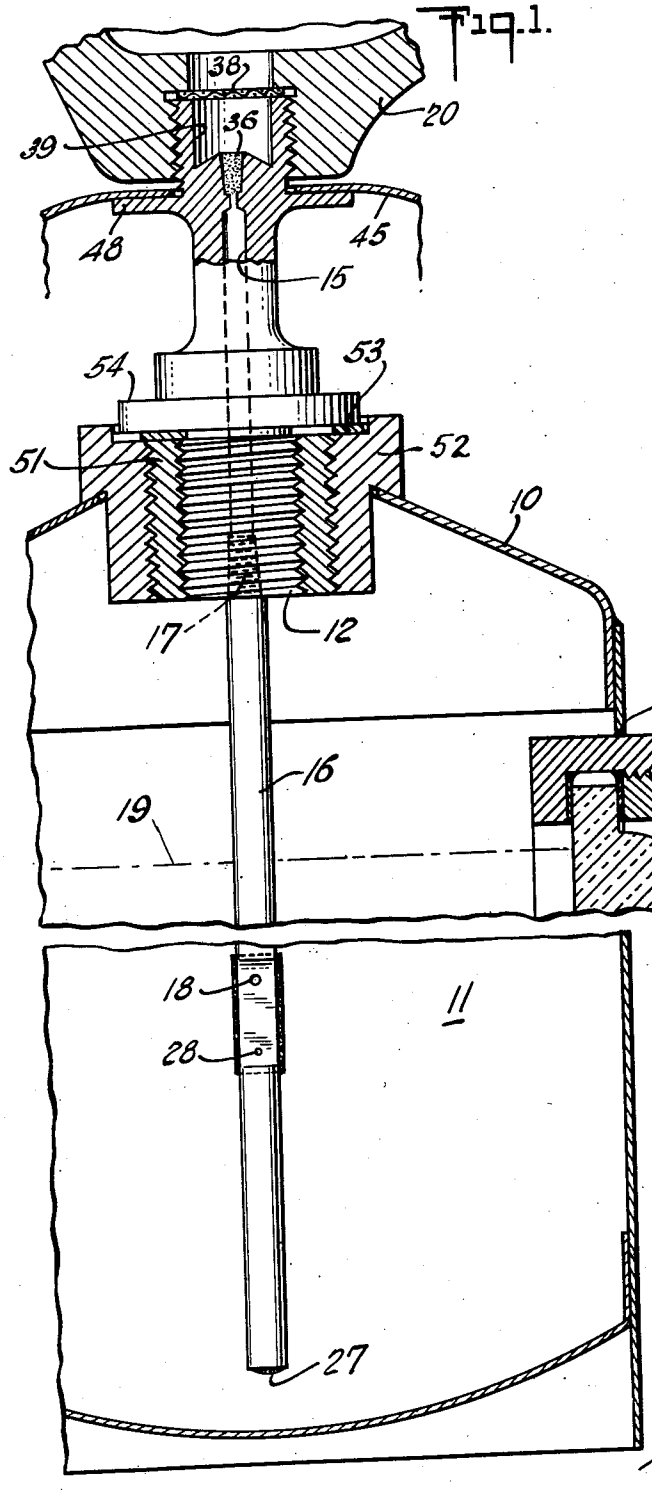
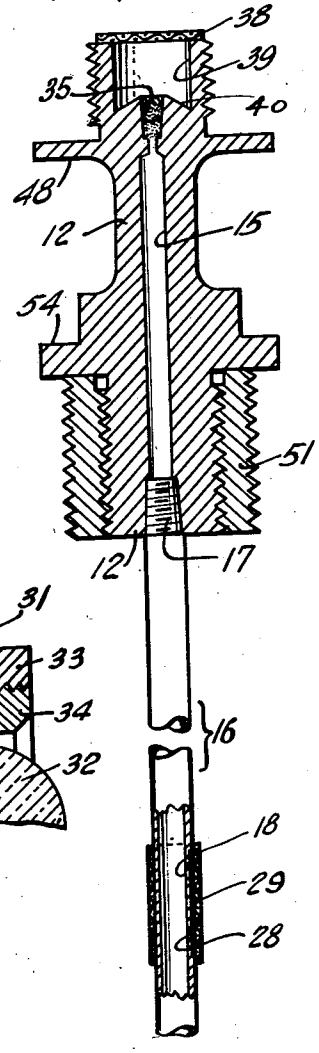


Fig. 2.



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Fig. 3.

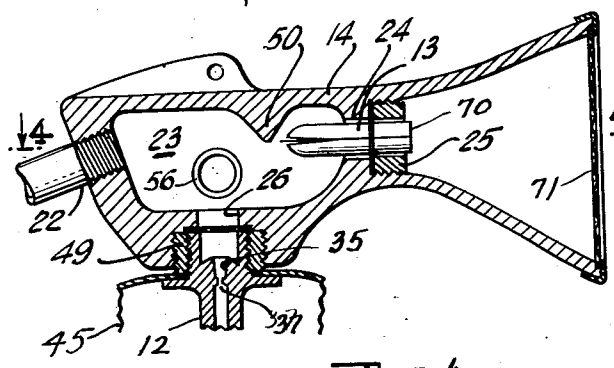


Fig. 5.

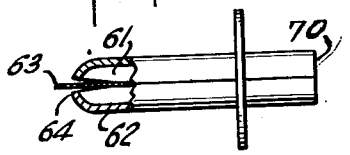


Fig. 6.

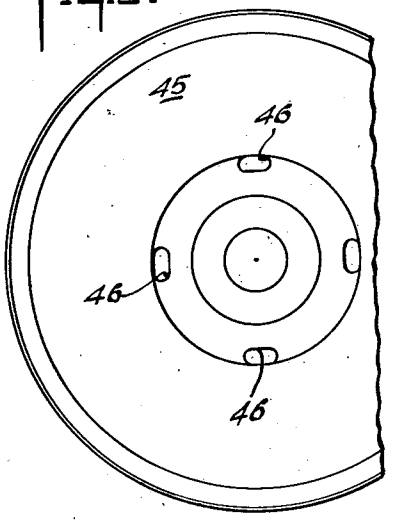


Fig. 4.

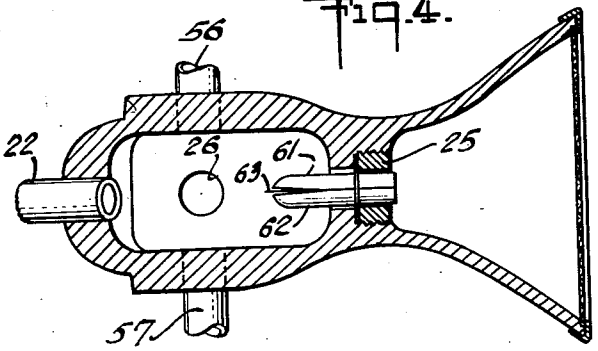
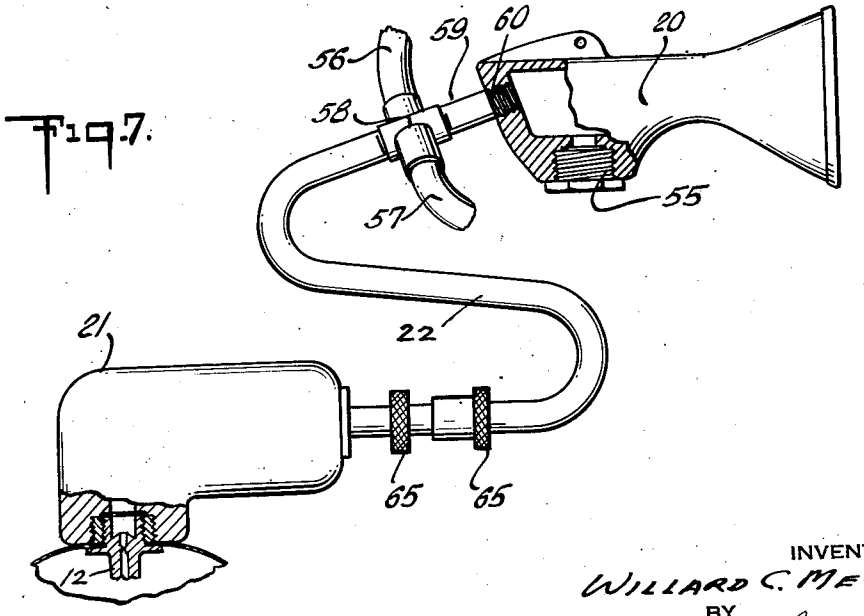


Fig. 7.



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TEMPERATURE RESPONSIVE ALARM DEVICE

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9 Claims. (Cl. 116—106)

This invention relates to alarm devices, and is more particularly directed to the provision of a temperature responsive alarm device which will serve as an automatic detector, for example, of an ambient temperature change beyond that at which said device is set to be operative. The device is highly useful as an automatic, self-contained, thermally actuated single or multiple station, fire detector system which will automatically actuate an audible signal or other alarm and maintain the same persistently for a considerable period of time. The device incorporates novel structural features which insure the instantaneous operation thereof at the desired predetermined temperature change to actuate an alarm for a protracted period, for example, on the occurrence of a fire, and is so designed that a plurality of alarm units, such as horns may be coupled to a single cylinder of the device if desired so as to sound the alarm at a number of different stations, or a single alarm unit, such as the horn of the device, may be coupled to a plurality of cylinders located at different stations so as to sound the alarm upon the occurrence of a fire at any of the stations.

These and other advantageous objects, which will appear from the drawings and from the description hereinafter, are accomplished by the structure of my invention, of which an embodiment is illustrated in the drawings. It will be apparent, from a consideration of said drawings and the following description, that the invention may be embodied in other forms suggested thereby, and such other forms as come within the scope of the appended claims are to be considered within the scope and purview of the instant invention.

In the drawings:

Fig. 1 is a fragmentary, sectional, elevational view of a temperature responsive alarm device embodying my invention,

Fig. 2 is a vertical sectional view of an elongated fitting member used in carrying out the invention.

Fig. 3 is a vertical sectional view of a signal housing unit which may be used in carrying out the invention, showing, fragmentarily, parts to which the same may be connected,

Fig. 4 is a fragmentary horizontal sectional view, taken on line 4—4 of Fig. 3.

Fig. 5 is an enlarged elevational view of a reed unit which may be used in device,

Fig. 6 is a top plan view of a heat collecting plate which may be used in carrying out the invention, and

Fig. 7 is a fragmentary, schematic view, showing the manner in which, pursuant to the invention, a single cylinder casing, disposed at a given station may be coupled to horns disposed at the same and remote stations.

In the drawings, the temperature responsive alarm device of this invention is shown to comprise a casing **10** to be filled with and to releasably store a medium **11** under pressure, and an elongated fitting member **12** secured to the casing through which the medium **11** may be discharged on opening of the valve responsive to a critical

change in ambient temperature, to actuate an alarm, such as the vibratory reed **13** in the signal housing **14**. Medium **11** is preferably a pressure fluid medium of a type suitable for the purpose such as "Genetron" (CCl_3F) or "Genetron 12" (CCl_2F_2) (dichloro-difluoro-methane). The elongated fitting member **12** through which the medium **11** is to flow is provided with a bore **15** therethrough and a hollow tube **16** is secured to the lower end of the member **12** opening **15**, as indicated at **17** in Figs. 1 and 2, so as to form, in effect, an extension thereof. Tube **16** is hollow (Fig. 2) and is provided with a radial opening **18** disposed below the normal level **19** of the medium **11** in the casing, for passage of the medium through the valve on opening the member **12**. The latter is provided with heat sensitive means (such as **36**, Fig. 1) closing the upper end of the opening **15** thereof.

The member **12** connects the casing **10** with a signal device such as the housing **20**, either directly, as in Fig. 1, or through the medium of intermediate members such as bracket **21** secured to elongated fitting member **12** and connector **22** coupled thereto shown in Fig. 7. The housing has a chamber **23** with which the fitting bore **15** communicates and has a second opening, **24**, in which the reed **13** is secured by any suitable means such as the ring **25**. The housing is provided with an aperture **26** in registry with and preferably of larger diameter than the bore **15** of the elongated fitting member **12**. The outer end of the horn may have a protective screen **71** (Fig. 3). The upper end of the bore **15** of member **12** is normally closed by heat sensitive means **36** such that the medium **11** will be discharged automatically on occurrence of a predetermined ambient temperature change, for example, such as would be brought about a fire. The lower end of the hollow tube **16** is closed as at **27**; said tube may be provided with a second aperture, **28**, below the aperture **18**. Both of said apertures may be covered by a screen **29** to preclude contamination.

The casing **10** may be provided with an opening **31** (Fig. 1) in registry with the normal level **19** of the medium **11** in said casing, and said opening **31** has a light-permeable window **32** secured thereto by suitable means such as **33–34**.

The upper end (Fig. 3) of the bore **15** in the member **12** is preferably formed downwardly tapered (as indicated at **35** in Figs. 2 and 3) and is normally closed by a heat sensitive plug **36**, which at normal temperatures will maintain the upper end of the bore **15** sealed, but, on occurrence of a predetermined ambient temperature, as for example, one attained on occurrence of a fire, will become loose and will be ejected from its seat **35**.

The plug **36** may be made of eutectic metal; the device of this invention is through the medium of plate **45** so designed as below more fully explained that ambient heat is concentrated on and immediately carried to the plug seat **35**, the external faces of the plug being first heated, begin to change from their solid state; pressure being exerted on the plug from the constricted lower end **37** (Fig. 3) of plug seat **35**, the plug is ejected as a unit. The plug **36** may be made of fusible metal, the tapered plug seat **35** of the bore **15** being initially filled therewith and thereby sealed while the ambient temperature is less than the one at which the plug will be ejected as above noted.

Means are provided for checking the plug when it is so ejected, to prevent its entry into the chamber **23**. As shown in Figs. 1 and 2, said means may comprise a screen **38** positioned over the enlarged recess **39** at the end of the elongated fitting member **12**. The recess **39** is provided with a lower wall which is downwardly outwardly sloping as indicated at **40** (Fig. 2). As the plug **36** is ejected from its tapered seat **35** it will strike the screen **38** and drop down to a position on the sloping lower wall **40**, where it will not interfere with the discharge of the gases

discharged from the casing **10** into the chamber **23** of the housing **14**.

A heat collecting plate **45** (Figs. 1, 3, 6) preferably of arcuate cross section is secured directly to the valve body **12** in the line with the plug seat **35** to collect heat and directly transmit it to the plug **36**. The plate **45** may be provided with air vents **46** (Fig. 6) to prevent the accumulation of stale air. The plate **35** is mounted intermediate a flat body portion **48** which may be in the form of an enlarged fin or body **12** for better heat contact with the plate, and a heat insulating ring **49** intermediate the upper end of the valve body **12** and the housing. A portion **50** of the housing is disposed inwardly of the chamber **23** therein so as to act as a baffle in cases such as shown in Figs. 3 and 7 wherein the point at which pressure line (**22**) opens into chamber **23** would otherwise be in direct line with the reed **13**; baffle **50** deflects the gas, so that, in such cases, it will take an indirect course to the reed; this arrangement is efficient and practical.

The member **12** may be thermally insulated from the casing **10** by an insulating ring **51** disposed within an internally threaded open collar or socket **52** fixed to the casing, as shown in Fig. 1; a further insulating washer **53** (Fig. 1) may be positioned between a flange **54** formed on the valve **12** and the ring **52**.

The housing **20** may be directly connected to the valve body, as in Figs. 1 and 2, or may be indirectly connected thereto through intermediaries **21** and **22** as above described, and shown in Fig. 7, where, for example, it is desired that a plurality of casings **10** and associated parts be connected to a single housing **20**. In such case the aperture **26** for the horn may be closed by a plug **55**, and lines **56**, **57**, **22**, connected to the horn at one end and to casings **10** (not shown) at the other end. Lines **56**, **57** and **22** may be straight, curved or bent, as conditions require, and may be coupled to the single housing such as **20** by cross coupler **58**, which may be in turn connected to the housing **20** as by a tube **59** secured to an aperture **60** in the horn, or as shown in Fig. 4, the lines **22**, **56** and **57** might be connected directly to apertures located at different parts of the horn. The same arrangement might be used to connect a single cylinder to a plurality of housings at different stations.

The reed **13** consists of two shells or halves **61**, **62**, Fig. 5, with a single reed **63** secured intermediate the same and adapted to vibrate in an opening **64** at the upper ends of the reed shells **61**, **62**. The reed shells **61**, **62** are, at their upper ends tapered away from the reed, to define the mention-opening **64**. The central reed **63** will not lock when subjected to excess pressure as it will be constantly released under pressure. The improved reed of this invention as described vibrates against two shells, increasing the sound level and protecting the reed from taking a "set" or locking in the event of excess pressure. The back **70** of the reed may be coated with a silicone grease film which will seal and protect the reed and the chamber **23** of the single housing against corrosion; a volume of gas will accumulate in the chamber **23** of the single housing for the purpose of starting the reed vibrating before pressure is sufficient to break the silicone grease film **70**.

The plug **36** retained the liquid and gas in cylinder casing **10** within 11° F. of its operating temperature as required by Underwriters Laboratory rules and has an instant response to the desired release temperature such as 136° F. of heat. The plug is expelled as a solid, which eliminates any possibility of liquid metal being carried into the chamber **23** and solidifying on the reed. The hollow tube **16** may be made of brass, ⅛ inch in diameter and 5¼ inches long; its function is to provide a flow of the liquid and gas medium **11** with which the casing **10** is filled into the member **12** in a matter of seconds on clearing opening **15** of plug **36**. The orifice **18** of the tube is preferably .020 inch in diameter and located ½ inch below the level **19** of the liquid in the casing **10**.

When the metal plug **36** is expelled, the liquid **11** is shot into the single housing casing **23** and said liquid gasifies instantly, providing the desired pressure to sound the alarm. This pressure would instantly fill the tubing **22**, **56**, **57** in a case of an installation such as in Fig. 7.

The reed **63** requires far less pressure to maintain its continued vibration than in the initiation of its vibration. As above noted, the silicone grease film serves two purposes—it seals chamber **23** and it requires a build-up of pressure in the chamber to start reed **63** vibrating. When plug **36** is ejected from its seat **35** there is an initial surge of the liquid **11** into chamber **23**, Fig. 3, or tubing **22**, Fig. 7, until the level of the first aperture **18** in the tube **16** is reached. This initially surging liquid gasifies before reaching the reed and surges through the reed in a burst, providing the initial surge to set the reed vibrating; the liquid flow stops and only gas passes through aperture **18** after the liquid level in casing **10** drops below aperture **18** in tube **16**. The aperture **18** permits sufficient gas flow to keep the reed **63** operating due to the large expansion area created as the liquid fluid **11** drops. The second aperture **28** is preferably .004 inch in diameter and is placed about ¼ inch below the first aperture **18**; it permits additional flow of gas when the liquid level drops. The liquid flowing through the aperture **28** gasifies in the tubing **16** before it reaches the single housing head **23**. The light permeable window **32** may be a convex glass eye; a color dye which is compatible with the liquid **11** may be mixed with the liquid, so that the liquid level **19** will be readily visible through eye **32**. If leakage occurs, the eye **32** will lose its color when two ounces of liquid **11** have been lost (assuming the relative proportion of parts shown in Fig. 1 of the original drawings of the application). This eliminates the necessity for periodic weighing of the casing **10** to check against leakage. A hanger may be provided for suspending the casing **10** from a wall. The fin **48** distributes heat evenly. The tubing **22**, **56**, **57** may convey the gas flowing through casing **10** to remote signal housings; such remote horns have been so operated at five hundred feet from the casing **10**; there appears to be no reasonable distance limitation.

Thus a single casing **10** in a basement for example, may be connected to signal housing at different floor levels of a home. In commercial installations, for example, a casing **10** in a warehouse may be connected to a signal housing in a remote other building, such as an office or guard's room.

The tubing may be joined together with compression fittings or the like, **65**, **66** (Fig. 7). As many cylinders as desired may be attached to one line of tubing in the arrangement shown in Fig. 7.

The operation of the device of this invention, following ejection of plug **36** from its seat **35**, appears to be as follows: The level (**19**) of the liquid **11** being higher than the first aperture **18**, there will be an initial surge of liquid through aperture **18** and tube **16** and thence into chamber **23** (in the case of the Fig. 1 form of the invention) or into the tubing **22** (in the case of the Fig. 7 form of the invention) the liquid flowing several times faster than gas to provide an initial liquid or mist surge to initiate vibration of reed **13** and thus sounding the alarm. When the liquid level **19** drops below the aperture **18** apparently the liquid gasifies and will flow through and out of the tube **16**. The tube **16**, being in direct contact with the member **12**, which may be of brass or similar material of good heat conducting properties, and the interior wall of the casing both heated by the ambient temperature agitate and gasify the liquid. The second aperture **28** is preferably made so small that it will not normally enable liquid to flow therethrough until the liquid level falls to the point of registry with said second aperture **28**, whereupon, and only for the very short time that the liquid is at that level, some liquid will flow into and through the tube **16** to provide a second surge or "pick

up" to again set the reed **13** vibrating rapidly; from then until all of the remaining liquid **11** has gasified and been completely expelled through tube **16** against the reed **13**, the reed will continue to vibrate and sound the alarm. More than two of such apertures (**18**, **28**) may be provided, the third, etc. apertures operating to "pick up" or provide a surge to set the reed vibrating as the liquid level **19** registers therewith, then followed by gas to continue the reed vibrating. The device of this invention is operative either in the normal upright position thereof as shown in the drawings (it may be secured to a ceiling or wall by suitable means in that position) or inverted 180° from that position, or at any intermediate angle—a feature not possible with devices of the prior art which are operative in one position only, and which might well be rendered inoperative by the very means which precipitate a fire. The device is basically fool-proof, being free of reliance on mechanical movement which might result in jamming or mechanical failure at the critical time.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a temperature responsive alarm device having a casing to store a pressure medium, an elongated fitting having a bore therethrough, means securing said fitting to said casing so as to extend exposed therefrom, heat-sensitive means in the so-exposed portion of said fitting normally closing said bore through the member but opening said bore when heated to predetermined temperature, an elongated tube secured, at one end, to the elongated fitting and depending interiorly of the casing, said tube being closed at its lower end interiorly of the casing, and having an opening in the wall of the tube connecting the interior thereof with the interior of the casing, for passage of the medium in the casing through the tube and into the bore of the fitting, and a signal device secured to said fitting, whereby, when, responsive to ambient temperature change to said predetermined temperature, the heat sensitive means in the bore of the fitting is moved clear of said bore, the medium in the casing will flow through the opening in the wall of the tube, through the tube, and through the bore of said fitting to actuate said signal device.

2. In an alarm device as set forth in claim 1, said pressure medium extending to a given normal level in the casing, said opening in the wall of the tube being disposed below said normal level.

3. In an alarm device as set forth in claim 1, said tube being provided with a second opening in the wall of the tube spaced from the first mentioned opening.

4. In an alarm device as set forth in claim 1, said casing having an opening in the wall thereof in registry with the normal level of the medium in the casing, and light-permeable means in said opening to provide a visual check as to the level of said medium.

5. In an alarm device as set forth in claim 1, said heat sensitive means closing the bore through the fitting comprising a plug of normally solid state filling the upper end of the bore and made of heat sensitive material, so as to become peripherally separated from said bore, and ejected therefrom, responsive to the pressure in the casing, on occurrence of said predetermined change in said ambient temperature and interception means positioned in the path of ejection of said plug.

6. In an alarm device as set forth in claim 1, said signal device being so secured to the fitting by a tube secured at one end to the signal device, and means to connect the opposite end of said tube to said fitting.

7. In an alarm device as set forth in claim 1, said signal device including a housing connected at opposite ends to the fitting and to a signal element, said housing having a chamber therein, and a baffle extended inwardly into the chamber so as to interrupt the medium in its passage through the chamber.

8. In an alarm device as set forth in claim 1, said signal device including a signal element and means for connection of said element with other casings in a system utilizing more than one casing.

9. In an alarm device as set forth in claim 1, a screen intermediate the signal device and the bore of the fitting.

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