April 10, 1928. 1,665,381

J. SIDDALL ET AL

AUTOMATIC FIRE ALARM

Filed Nov. 10, 1921 2 Sheets-Sheet 1

Fig. 1.

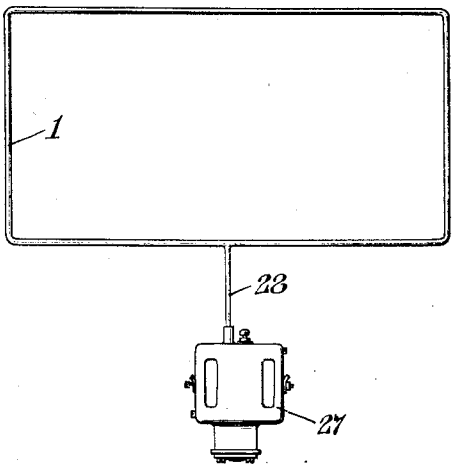


Fig. 2.

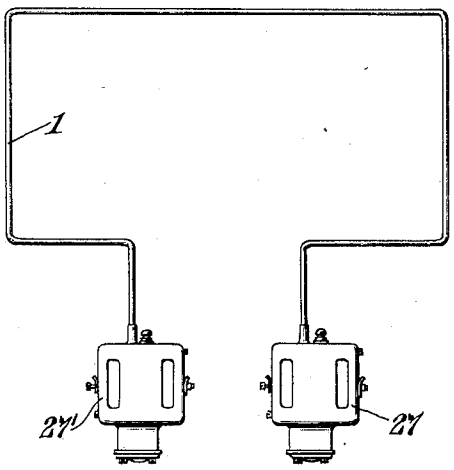


Fig. 4.

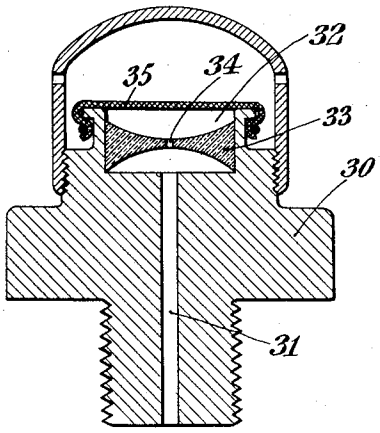


Fig. 5.

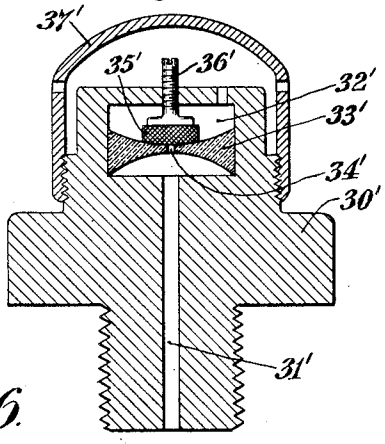
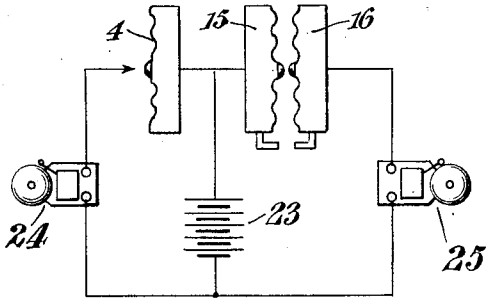


Fig. 6.



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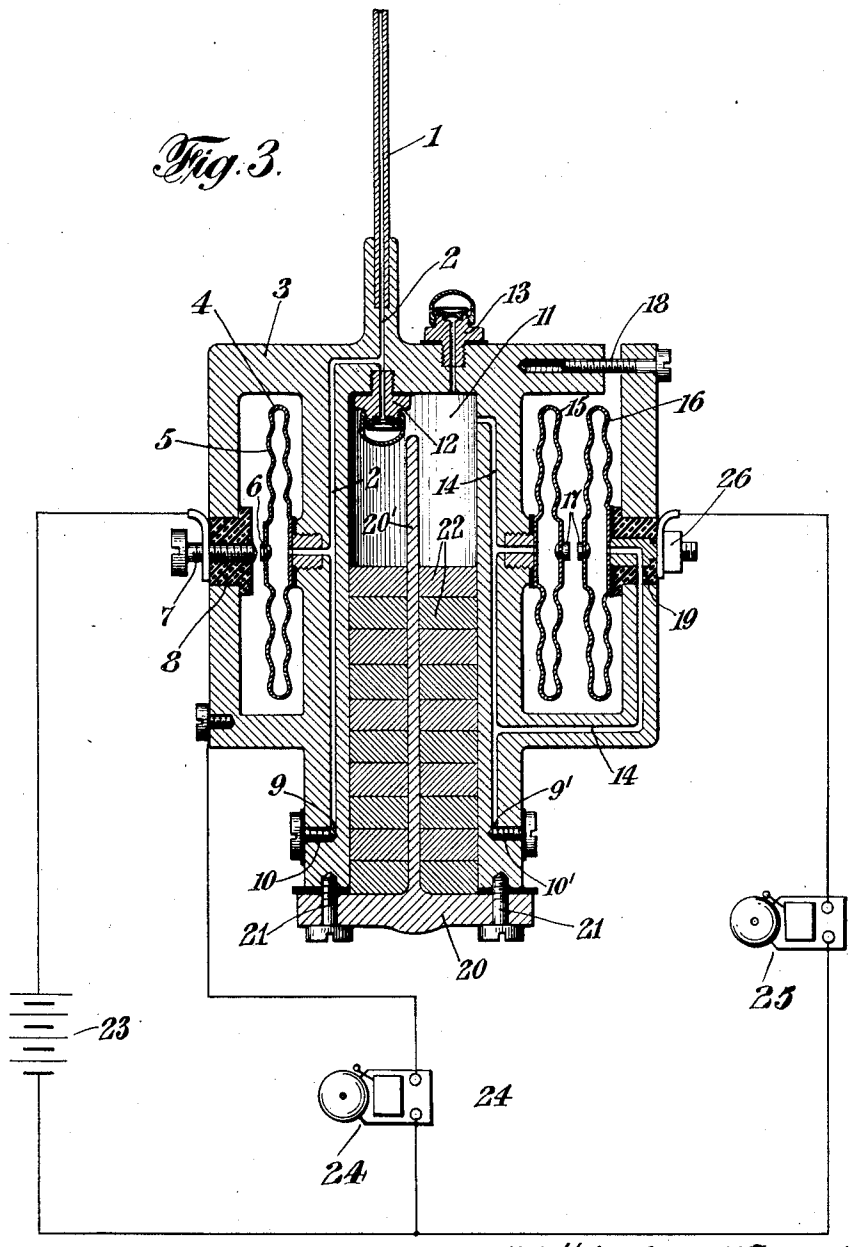
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Fig. 3.



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Patented Apr. 10, 1928. 1,665,381

UNITED STATES PATENT OFFICE.

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AUTOMATIC FIRE ALARM.

Application filed November 10, 1921. Serial No. 514,168.

Our invention relates to improvements in automatic fire alarms. It has for its object, the providing in fire alarms of the character hereinafter described, of the addition of a premature or heat signal which will automatically give notice of any unusual increase in temperature throughout the area to be protected, but will not set off the main fire alarm unless the unusual condition continues or increases; the prevention of unnecessary fire alarms due merely to local conditions; the providing of such an alarm system with means for regulation or adjustment so that it can readily be adapted to the particular use to which the alarm may be put; and in general to improve the effectiveness of such fire alarms.

Where the term "heat" appears in the specification and claims this term is used to denote a condition of heat less than a fire condition, and "heat alarm" is an alarm indicating that there is an unusual condition of heat but which will not turn in a general fire alarm.

Figs. 1 and 2 show in outline two different methods in which our fire alarm devices may be employed. It is to be understood throughout this specification and the accompanying claims that the devices may be employed in the manner covered by both of the arrangements shown in these figures and by any other suitable arrangement. Fig. 3 is a detailed drawing and plan in section of the preferred form of our pressure responsive means with an indication of the arrangement of signaling means which we have found most advantageous. Figs. 4 and 5 show in detailed enlargement a cross section view of two different forms of leak which we have found very efficient and which include the use of a jewel to form a restricted passage. Fig. 6 shows another plan for wiring the signaling means connected with our devices. In the following paragraphs and in the drawings we describe and show our devices as used in their preferred form but our invention is not limited to the particular form shown. Our invention consists in the novel devices herein shown and described.

In Fig. 1, hollow metal tubing 1 is extended throughout the area to be protected, both ends of which are either run directly into the pressure responsive means 27 or are as shown in the drawing connected therewith by a passage 28. In Fig. 2, another means of arranging the hollow tubing is shown, such tubing being extended through the area to be protected and connected at both ends with separate and independent pressure responsive means 27 and 27'. It is not necessary to connect both ends of the tubing with a pressure responsive means but it is advantageous to do so, as then a fire occurring on either side of a breakage or stoppage will operate to set off the alarm. The arrangement shown in Fig. 1 is perhaps a little more sensitive than Fig. 2, but both operate successfully.

Referring to Figure 3 the hollow metal tubing 1, which is run through the area to be protected is connected with the pressure responsive means and the air passage in the tubing is continued by a passage 2 located in the metal body 3. The passage 2 is continued and connects with the interior of a diaphragm piece 4 located in an open chamber in the body. One side 5 of the piece 4 operates as a diaphragm and expands upon a slight increase in pressure. The diaphragm bears a contact piece 6 and is adapted to make a contact with adjustable screw 7 which is surrounded by insulation 8. The passage 2 has an extension connected with an outlet at 9. This outlet is normally closed by screw 10, but may be used for testing purposes. Another branch of passage 2 leads into pressure chamber 11. A delaying leak 12 permits only a slow passage of pressure from the tubing 1 and the passage 2 into the pressure chamber 11. The detail of the construction of this delaying leak is more fully described hereinafter. Another leak 13 is screwed into the metal body 3 and serves to permit slow passage of pressure from the pressure chamber into the atmosphere and vice versa. Leak 13 should afford a more restricted passage of air than does leak 12 and the ratio of the size of its restricted passage should be approximately 1:2. Passage 14 connects the pressure chamber 11 with the interior of diaphragm pieces 15 and 16, which are located in another open chamber in the metal body. Contacts 17 are located on sides of these diaphragm pieces. The size of the chamber in which these diaphragm pieces are located and the adjustment of the contact between

them may be regulated by screw 18. An insulator 19 insulates the contact on diaphragm piece 16 from the metal body. Passage 14 has an extension with an outlet at 9' which is closed by screw 10'. This outlet may be used for testing purposes. Pressure chamber 11 is provided with a removable head 20 held in place by screws 21. The removable head also operates as a disc holder. It has a prong 20' extending into the chamber upon which discs 22 may be placed. Pressure chamber 11 should preferably be made of round construction and the discs 22 should fit snugly therein. The addition of discs as can readily be seen will restrict the capacity of pressure chamber 11. The metal body portion 3 serves as an electric ground between the contacts except where insulated.

We have shown in Fig. 3 the preferred manner in which we wire our signalling devices. Any other method of wiring may be used, such as is shown in Fig. 6, or otherwise. The novel method of wiring which we illustrate in Fig. 3 has many distinct advantages and we preferably use it in our system and it is a part of the novel devices we are herein describing and for which we are seeking a patent. In this method we connect one pole of a battery 23 or other source of electrical supply with adjustable screw 7 and the other pole with a preliminary or premature heat signal device 24 and also with a general fire alarm device 25. The heat signal device which operates in the system to give notice of any unusual change in local conditions, which ordinarily are not of a serious character, is grounded from the other side upon metal body 3. The general alarm device is connected from its other side to an extension 26 of diaphragm piece 16, which is insulated from the metal body. Thus the electrical circuit including the premature heat alarm device 24 will be closed when the contact at 6 is made, and the circuit including the general alarm device will be closed when both the contacts at 6 and 17 are made.

Our fire alarm operates as follows: The increase in temperature in the protected area affects the hollow tubing run through that area and increases the air pressure in said tubing. This pressure is transmitted into the pressure responsive means above described and is first carried into diaphragm piece 4. If the increase in temperature in the protected area occurs through normal or ordinary increases in temperature, a very slow increase in pressure in the tubing may leak out into the atmosphere through leaks 12 and 13 without affecting any of the diaphragms. The pressure in the tubing is kept the same as the atmospheric pressure by means of these leaks. An unusual increase in temperature in the protected area even though local, and of very short continuance, will not be compensated for by leaks 12 and 13 but will expand diaphragm piece 4, while making contact with screw 7. The electrical circuit running through the battery and the premature or heat alarm 24 will then be closed and that signal will be set off indicating that there is some local disturbance in the protected area which may need investigation. Signal 24 will not operate as a general fire alarm. The increased pressure in the tubing, on account of delaying leak 12, will only slowly flow into chamber 11. Leak 13 affords an opportunity for the air pressure in chamber 11 to escape into the atmosphere. This leak is composed of a more restricted passage than leak 12 and a gradual increase in the pressure in chamber 11 will be allowed to escape through 13. If the local heat condition continues in the protected area or if a general or violent rise in temperature occurs there, the pressure in the tubing is banked up in chamber 11. This chamber being connected with diaphragm pieces 15 and 16 expands the same and contacts 17 are brought together. As shown in our drawings we have the contacts made by the expansion of the diaphragm piece and the outward operation of the diaphragm making an external contact. In all these cases it is possible to make the contact in other manners well-known in the electrical art without departing from our invention. Contact is made between diaphragm piece 15 and 16 by the relative motion of their parts with respect to one another. In the drawing we have shown the contact made externally by mutual approach of the respective sides of said diaphragm pieces towards each other. Each diaphragm, mutually moving towards one another, will only have to move a part of the distance. It can be seen that this contact therefore is very delicate and contact will be made if there is an increase in pressure in chamber 11 not relieved by leak 13. The contacts made at 6 and at 17 close the circuit containing the battery and the general fire alarm 25. Upon an increase in pressure in the protected area our device therefore will operate a premature heat signal and if the increase in temperature is of a serious character will then operate independently the general alarm. Another feature of this arrangement is that if after the heat alarm has been operated, and sufficient air pressure has passed into chamber 11 to make contact at 17, if the temperature in the protected area suddenly drops away, contact between diaphragm piece 6 and screw 7 will be broken and no general alarm will be operated even though the pressure in chamber 11 subsequently closes the contact at 17. I have provided means for testing the system by applying pressure gauges at 9 and 9'. The delicacy of the device may be regulated by the capacity of chamber 11. If the ca-

pacity of the chamber is large, the alarm will be set off relatively slowly, while if this chamber is smaller, the system will be more sensitive. By means of the removable disc holder 20 and the use of discs 22, the capacity of chamber 11 may be readily regulated to adapt the device to the particular use to which it is to be put. The contact at 6 is adjustable by means of screw 7 and the contact at 17 is likewise adjustable by means of screw 18.

In Fig. 4 we have shown in detailed cross-section a preferred form of leak which we employ advantageously in our alarms. By means of the use of a jewel in the leak, we are able to make a leak which will permit a very slow passage of air and yet which will be of substantially uniform capacity with other leaks similarly made. Our leak is composed of a metal jewel holder 30 having a passage in the center 31 opening into an enlarged space 32. In this space we place a jewel 33 preferably a sapphire, having its opposite faces concave as shown. The jewel should be ground from both sides to this shape until the jewel is very narrow at the center of the concave faces. A restricted passage 34 may then readily be bored through the narrow portion of the jewel at the centre of the concave face. If a steel drill is used we have found that a very small hole can be obtained, but one that is of a definite size. The jewel is cemented into the enlarged space in the metal holder as shown. A porous fabric dust shield 35 is placed over the enlargement in which the jewel is contained with the result that air can freely pass to and fro from the jewel but the latter is protected from the dust. A cap with air holes is then secrewed over the devices. In Fig. 5 we show another preferred form of jeweled leak. This leak is composed of a metal jewel holder 30′ having a passage 31′ leading into an enlarged space 32′. A jewel 33′ of a similar shape is cemented therein with a restricted passage 34′. Over the top of this passage is placed a porus piece 35′ held in place by screw 36′, with a cover 37′. This leak may be adjusted by means of screw 36′.

In Fig. 6, we have outlined a different plan for wiring the premature heat signal and the general alarm. This method of wiring will possess all the advantage of the one shown in Fig. 3, except that the breaking of the contact by heat diaphragm piece 4 will not prevent a contact made at 17 from operating the general alarm 25. It is to be understood that our novel devices may be used, however, in connection with a wiring arrangement such as shown in this figure or in any other suitable wiring arrangement, and we do not limit them to the wiring shown in Fig. 3.

In our alarms we have separate operating devices for the premature or heat signal and separate devices to operate the fire alarm, both of these operating devices being actuated directly and independently from the increased pressure in the tubing due to the increased temperature in the protected area. As a consequence of this arrangement we are able to secure alarms which will operate more directly, positively and effectively than any now used in the art.

Moreover in our apparatus the heat signal will be operated from an increase in pressure in the tubing and the fire signal will be operated if that pressure in the tubing continues for a certain length of time. The fire signal is operated by a mere continuation of the same pressure in the tube as operates the heat signal. If the increased pressure be sufficient it will first operate the heat signal and then without any further increase will operate the fire signal. The fire signal will of course, also operate if the pressure increases as well as merely when the initial pressure continues. The sensitiveness of the alarm is adjustable and it is possible for the apparatus to be so arranged that the heat signal will go off on a very slight increase of pressure in the tubing which increased pressure even if it continued indefinitely would not necessarily operate the fire signal. But if the initial increased pressure in the tubing be ultimately sufficient to operate the fire signal, it will first operate the heat signal and then its continuation will operate the fire signal with or without any further increase.

What we claim as new and desire to secure by Letters Patent is:

1. In a pressure fire alarm system having pressure transmitting apparatus located in the area to be protected, the combination of heat signaling means, fire alarm signaling means, and means operating on a certain increase in pressure in said pressure transmitting apparatus for operating said heat signaling means and on a continuation of substantially the same pressure for operating the fire alarm signaling means.

2. In a pressure fire alarm system having pressure transmitting apparatus located in the area to be protected, the combination of heat signaling means, fire alarm signaling means, and means operating on a certain increase in pressure in said pressure transmitting apparatus for operating said heat signaling means and independently actuated means operating on a continuation of substantially the same pressure for operating the fire alarm signaling means.

3. In a pressure fire alarm system having pressure transmitting apparatus located in the area to be protected, the combination of heat signaling means, fire alarm signaling means, and means operating on a certain increase in pressure in said pressure transmit-

ting apparatus for operating said heat signaling means, and on a continuation of substantially the same pressure or an increase in said pressure for operating the fire alarm signaling means, said means operating said fire alarm signaling means more quickly after said heat signaling means has been operated when the pressure is increased.

4. In a pressure fire alarm system having tubing located through the area to be protected, the combination of preliminary signaling means connected directly with said tubing, a pressure chamber, means connecting said tubing and said chamber but permitting only a slow passage of pressure from said tubing to said chamber, and a fire signal operated from said pressure chamber.

5. In a pressure fire alarm system having tubing through the area to be protected, the combination of a contact making diaphragm connected with said tubing, electrical signaling means operated by said contact, a pressure chamber, a delaying leak between said tubing and said pressure chamber, a contact making diaphragm connected with said pressure chamber, a fire signal electrically operated by the said contact and a more restricted delaying leak as an outlet from said chamber.

6. In a pressure fire alarm system having tubing located through the area to be protected, the combination of a pressure chamber, a delaying leak located between said tubing and said chamber, a contact making diaphragm operated by the pressure in said chamber, electrical fire signaling means operated by the making or breaking of the contact, and a more restricted leak from said chamber to the atmosphere.

7. In a pressure fire alarm system, the combination of a pressure chamber, a disc holder therein adapted to receive and hold discs and vary thereby the capacity of said pressure chamber, a contact making diaphragm connected with said pressure chamber and electrical signaling means operated by the making or breaking of the contact.

8. In a pressure fire alarm system having means responsive to an increase in pressure in the area protected by said system, the combination of a heat alarm, a fire alarm, said means adapted to operate said heat alarm upon a slight increase in pressure and to operate independently said fire alarm upon a continuation in said increased pressure, said means preventing the operation of said fire alarm if said increased pressure drops off.

9. In a pressure fire alarm system having tubing located through the area to be protected, the combination of a pressure responsive means connected with said tubing, a pressure chamber, a delaying leak located between said tubing and said pressure chamber, a second pressure responsive means connected with said chamber, a heat alarm electrically operated, a source of electrical supply, an electrical circuit including said heat alarm and said source of electrical supply, said circuit being closed by the action of said first mentioned pressure responsive means, a fire alarm electrically operated, an electrical circuit including said fire alarm and said source of electrical supply, said circuit being closed by the combined action of said first mentioned pressure means and said second pressure responsive means.

10. In a fire alarm system having responsive means actuated by slight increases in temperature in the system, the combination of a responsive means actuated by a continuation of said increased temperature, a heat alarm, a fire alarm, electrical means to operate said alarms, said means comprising a source of electrical supply, an electrical circuit including said source of electrical supply and said heat alarm, said circuit being closed by the action of said first mentioned responsive means, and an electrical circuit including said source of electrical supply and said fire alarm, said circuit being closed only by the action of both of said responsive means.

11. In a pressure fire alarm system a leak adapted to permit the slow passage of pressure there through, said leak being composed of a jewel having a small hole located therein.

12. In a pressure fire alarm system, a leak composed of a sapphire jewel with opposite concave faces, and a small hole passing through the jewel at the centre of the concave faces.

13. In a pressure fire alarm system having tubing located through the area to be protected, the combination of a pressure chamber and a delaying leak located between said tubing and said chamber, said leak being composed of a jewel with opposite concave faces, and a small hole passing through the jewel at the centre of the concave faces.

14. In a pressure fire alarm system having tubing located through the area to be protected, combination of a pressure chamber, a delaying leak located between said tubing and said chamber, and another leak permitting the slow escape of pressure from said chamber, each of said leaks being composed of a jewel having a small hole located therein, said second mentioned leak being adapted to permit a more restricted passage of pressure than said first mentioned leak.

15. In a pressure fire alarm system having tubing located through the area to be protected, the combination of a pressure chamber, a delaying leak located between said tubing and said chamber, said leak being composed of a jewel having a small hole located therein, and another leak permitting a slow escape of pressure from said chamber,

said second mentioned leak being adapted to permit a more restricted passage of pressure than said first mentioned leak.

16. In a pressure fire alarm system having tubing located through the area to be protected, the combination of pressure responsive means, a delaying leak between said tubing and said pressure responsive means, said leak being composed of a jewel having opposite concave faces with a small hole passing through the jewel at the centre of the concave faces, and signaling means operated by said pressure responsive means.

17. In a pressure fire alarm system a leak composed of a body portion having an air passage, a jewel with opposite concave faces, a small hole passing through the jewel at the center of the concave faces, and means for adjusting the amount of air permitted to pass through said hole.

18. A pressure fire alarm system comprising tubing located through the area to be protected, a pressure chamber of materially greater capacity per unit of length than said tubing, said tubing being in communication with said pressure chamber through a restricted orifice, a signal and fluid operated signal control means communicating with said chamber through another orifice, said means being subject to the pressure in said chamber and responsive to increase of pressure therein to operate said signal, said system having a vent to atmosphere.

19. A pressure fire alarm system comprising tubing located through the area to be protected, a pressure chamber of materially greater capacity per unit of length than said tubing, said tubing being in communication with said pressure chamber through a restricted orifice, a signal, fluid operated signal control means communicating with said chamber through another orifice, said means being subject to the pressure in said chamber and responsive to increase of pressure therein to operate said signal, and means for varying the capacity of said chamber, said system having a vent to atmosphere.

In testimony whereof, we have signed our names to this specification.

JOSEPH SIDDALL.
WILLIAM HENRY SIDDALL.