No. 891,743. PATENTED JUNE 23, 1908.

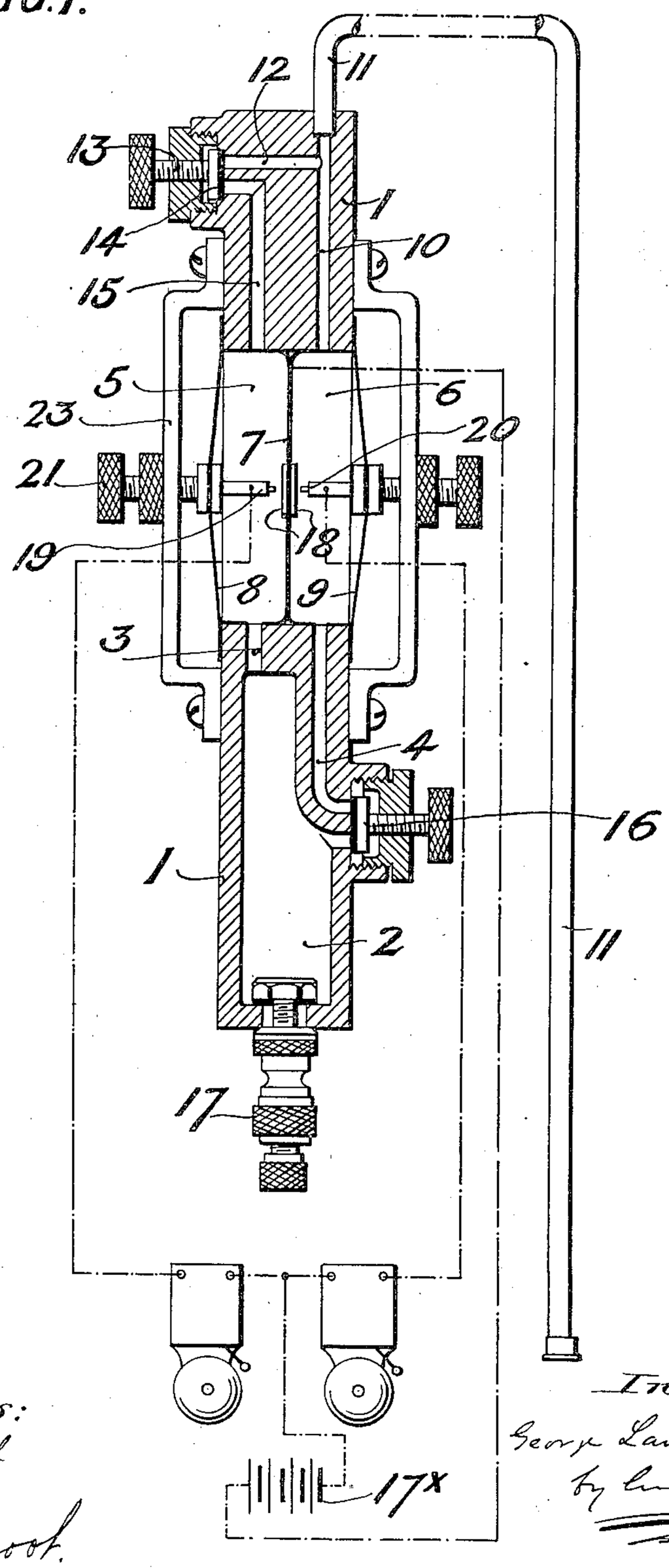
G. L. SMITH.

# FIRE AND TEMPERATURE ALARM OR INDICATOR.

APPLICATION FILED MAR. 19, 1908.

2 SHEETS—SHEET 1.

FIG. 1.

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2 SHEETS—SHEET 2.

FIG. 2.

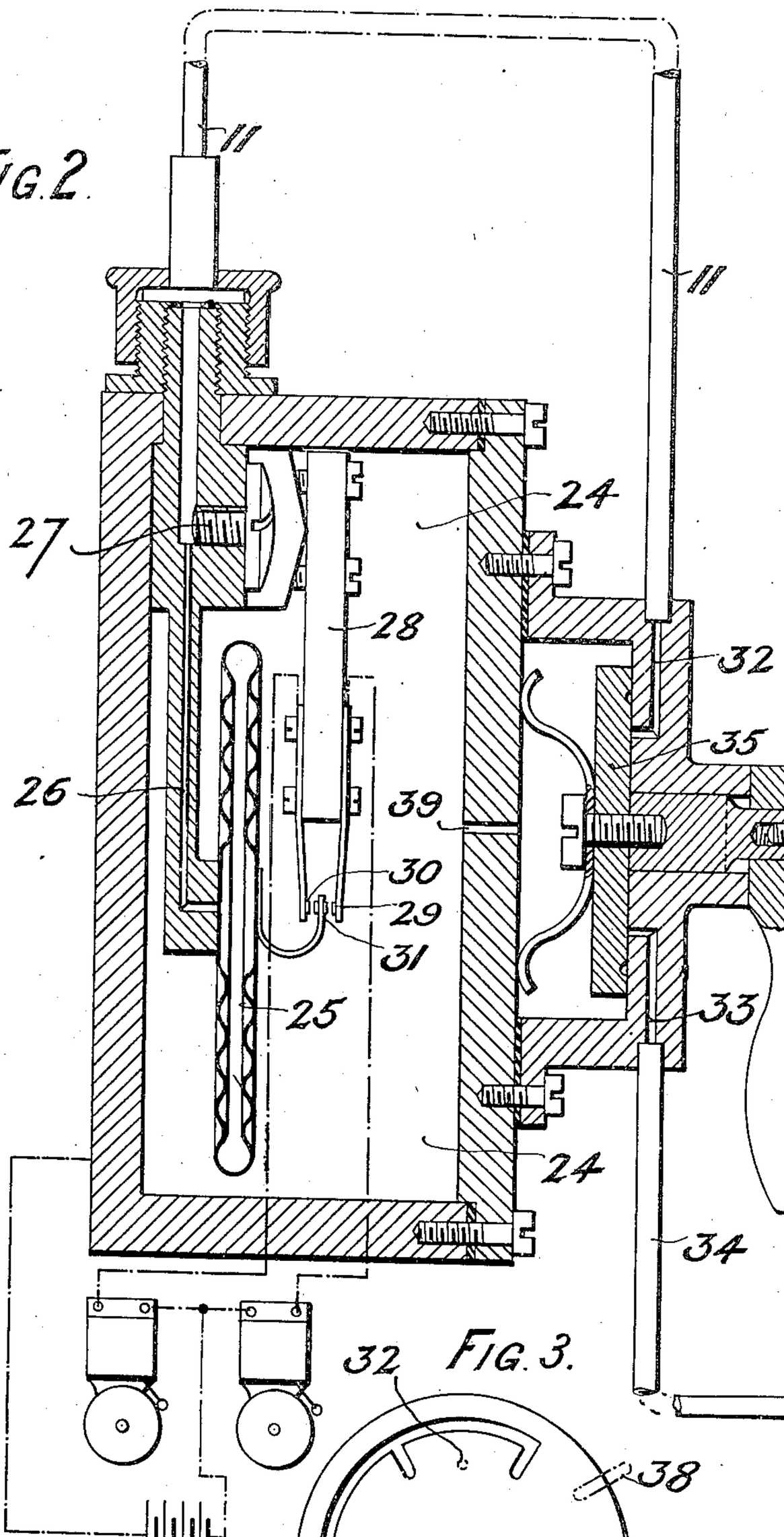
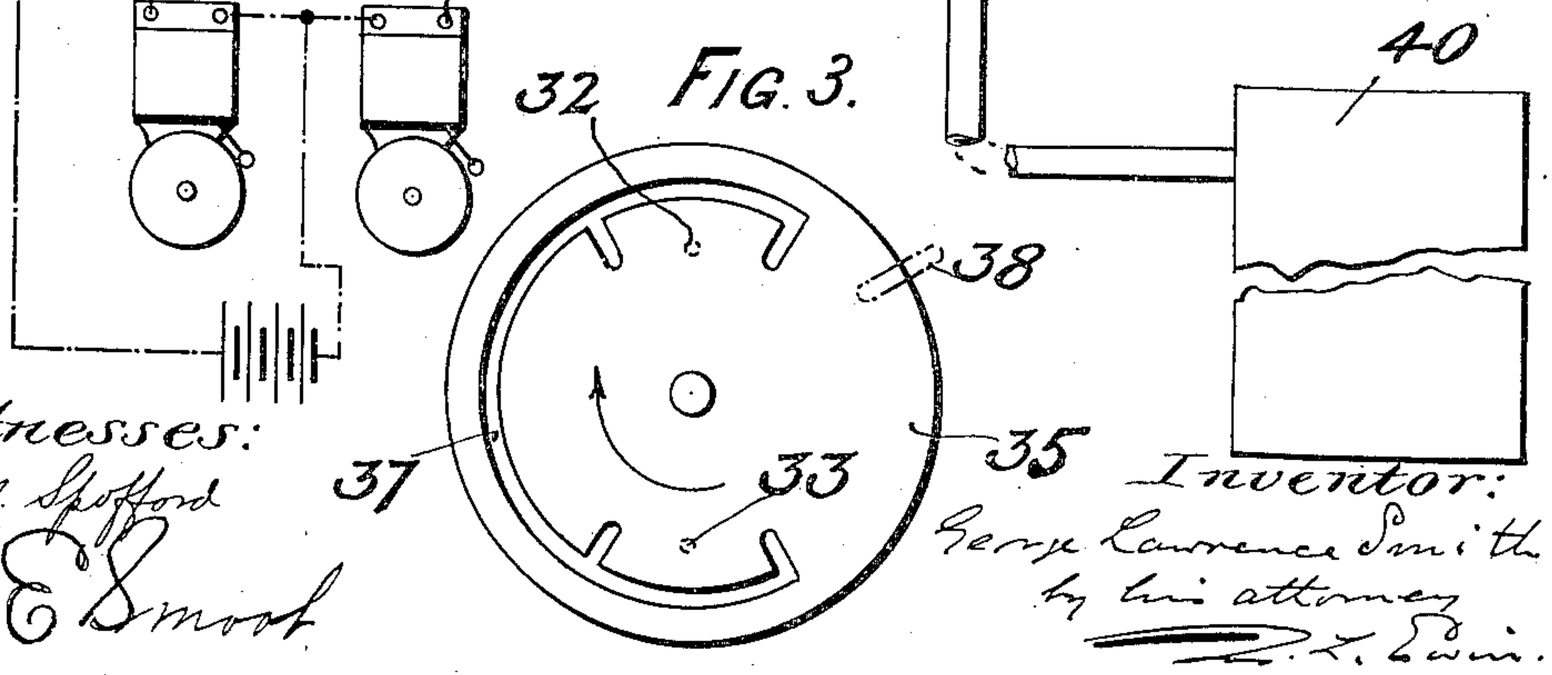



FIG. 3.

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# UNITED STATES PATENT OFFICE.

GEORGE LAWRENCE SMITH, OF ABERDEEN, SCOTLAND.

## FIRE AND TEMPERATURE ALARM OR INDICATOR.

No. 891,743. Specification of Letters Patent. Patented June 23, 1908.

Application filed March 19, 1908. Serial No. 422,147.

*To all whom it may concern:*

Be it known that I, GEORGE LAWRENCE SMITH, a subject of the King of Great Britain, residing at Aberdeen, Scotland, have invented certain new and useful Improvements in Fire and Temperature Alarms or Indicators, and of which the following is a specification.

In the specification of my United States Patent No. 850681 dated 16th April 1907, I have described a fire and temperature alarm or indicator apparatus, operating by pneumatic expansion, and in which a metal tube of small diameter containing air at atmospheric pressure is employed extending through a distance around a place where a sudden rise of temperature is to be indicated, the said tube communicating with a closed expansible chamber at one end, a movement produced in the latter chamber by air expansion due to the sudden rise of temperature being adapted to make or break an electric circuit for the purpose of sounding an alarm; the opposite end of the tube of this apparatus is closed, and an air vent is provided by which the air may pass to or from the tube to the atmosphere upon ordinary variations of temperature, but upon a sudden rise of temperature, the chamber is expanded and operates an alarm.

Now the present invention refers to improvements upon the invention described in my prior patent specification aforesaid, the object being to so construct the apparatus that not only shall an alarm be given upon a sudden and unusual rise of temperature, but in addition to this, the object of the present invention is to provide that another signal shall be given should the small diameter metal tube, extending around the place to be protected, become fractured or broken by accident or otherwise, so that there is a free escape of air therefrom other than by the leak or throttled passage provided. To effect this object, the tube extending around the premises to be protected, is closed at one end and at the other communicates, as in the before-mentioned apparatus, with an expansible chamber; and there is an air vent or leak communicating with the passage of the tube which permits air to pass slowly to and from said tube. The said air vent communicates with a chamber containing air or gas at a pressure differing from that of the atmosphere, and consequently normally the pressure in the pressure chamber is equal to the pressure in the tube by reason of the communicating vent. By reason of this arrangement, upon a sudden and unusual rise of temperature in the place to be protected, the air expands in the metal tube too rapidly to escape by said air vent, and consequently the expansible tube-chamber is expanded, an electric circuit thereby completed, and a fire alarm given, whereas should the metal protecting tube be damaged—say fractured—the pressure air would escape, the expansible tube-chamber would contract, another electric circuit would be completed, and another signal given indicating that the apparatus was not in working order, that is, what I term a "trouble" call would be given.

In the accompanying drawings a simple example of construction is shown at Figure 1 in vertical section, and by the description hereafter given relating to this figure, the working of the apparatus will be readily understood, while Fig. 2 shows, also in vertical section, a preferred form of construction of the apparatus, Fig. 3 being a detail view of a valve employed in the construction at Fig. 2.

Referring to Fig. 1 of the drawings, I provide a body part 1 containing a pressure chamber or reservoir 2 communicating by two passages 3, 4 respectively with two chambers 5, 6. The side walls of the chambers 5, 6 are composed of three flexible diaphragms, *i. e.* a central diaphragm 7 and two outer diaphragms 8, 9, the peripheries of these diaphragms being secured to the body part 1 of the apparatus in any suitable or convenient manner, the drawing being sufficient to render the construction of the apparatus sufficiently clear for persons skilled in the art. One of these chambers 6 communicates, by the passage 10, with the tube 11 which passes around a room or other place to be protected, and the said chamber 6 also communicates, by a passage 12, with what is termed a "leak" in my previous patent specification; the leak consists of a screw 13 having a valve-like head fitted with a porous washer 14, and the valve-like head covers the passage 12 and also covers the passage 15 communicating with the chamber 5. Thus instead of the leak from the tube 11 communicating direct with the atmosphere, it communicates, in this case, with the interior of the chamber 5 which normally contains air (or gas) pressure equal to the air (or gas) pressure in the chamber 6 and in the tube. Beyond this, the chamber 5 can be caused to

communicate with the tube-chamber 6 by means of the passage 4, which is fitted with a valve 16 by which the said passage 4 can be permanently closed when desired. 17 is an air inlet valve of any ordinary or well known construction through which air can be pumped by any suitable force pump into the pressure chamber.

The central flexible diaphragm 7 is connected with one pole of the battery 17×, and has a central contact 18 on each of its sides, one in the tube-chamber 6 and the other in the chamber 5. The outer diaphragm 8 has a contact 19 electrically connected with the fire or alarm circuit, while the outer diaphragm 9 of the tube-chamber 6 has a contact 20 connected with the "trouble" circuit; and beyond this, there are adjustment screws 21 carried by stationary bridges 23 which limit the outward movement of the diaphragms 8 and 9 and which can be brought to act upon the external faces of the outer diaphragms to adjust the contacts which they carry as regards distances from the central diaphragm.

The air is pumped into the pressure reservoir 2 to any desired pressure above atmospheric pressure, and at the same time is admitted by the valve 16 and the by-pass 4 into the tube-chamber 6, so that the pressure in the tube-chamber 6 and in the pressure chamber 5 are equalized, and then the by-pass passage 4 is hermetically closed. When this is done, the central diaphragm 7 will remain in its normal position, and the outer diaphragms 8, 9, will be held distended against their adjustment screws and with their contact points away from the central diaphragm, whereas if no pressure existed in chambers, the outer diaphragm contact points would close onto the central diaphragm.

When an ordinary or gradual rise of temperature occurs in the place through which the tube 11 passes and so pressure is increased in the tube, the air will gradually pass through the leak (which preferably is fitted with a porous washer) and into the pressure chamber, and so the pressure in the pressure chamber and in the tube-chamber would still remain equal and no "call" will be made When the pressure, however, is suddenly increased in the tube by a fire for instance, the air will not pass through the leak sufficiently rapidly, and consequently the central diaphragm will be forced over into contact with the contact pin 19 carried by the diaphragm closing the pressure chamber, and a fire call would be made.

In case of any damage to the apparatus, such for instance as some accident causing a leakage by fracture of the tube, the pressure in the tube chamber would fall rapidly, because the leak by which the tube communicates with the pressure chamber would not supply air fast enough to the tube, and consequently the central diaphragm would move over towards the diaphragm 9 of the tube-chamber 6 owing to the excess of pressure in the pressure chamber, and the "trouble" circuit will be closed and notify that the apparatus was out of order. If such a call was not attended to, the pressure from the pressure chamber 5 would gradually pass away through the leak and escape at the supposed fault in the tubing 11, and then the other outer diaphragm 8 would close down into contact with the central diaphragm and bring the fire circuit also into operation.

In the preferred form of construction shown at Figs. 2 and 3, the pressure chamber 24 is formed by an air-tight closed box which contains an expansible case 25 substantially equivalent to the tube-chamber previously described; this expansible case 25 communicates, by a passage 26, with the tube 11 passing around the room or other place, but otherwise the said expansible case 25 is closed. The passage 26 is also provided with a leak, governed by a screw 27, located within the pressure chamber. Within the said chamber 24 is mounted an adjustable bar 28 of insulating material carrying electrical contacts 29 and 30, and the expansible case 25 carries a contact 31 located between the contacts 29 and 30. The opposite end of the pipe 11 passes to a controlling valve located in any suitable position, as for instance fixed to the pressure chamber as shown. In the casing or frame of this valve there is a passage 32 from the tube 11 to the valve face, and there is also a passage 33 to the valve face communicating with a pipe 34 leading to a reservoir 40 containing pressure air or gas.

The valve illustrated by way of example consists of a revoluble disk 35 operated by a handle 36 connected with the spindle of the disk, and the face of the disk 35 bearing on the valve face is shown at Fig. 3; it is formed with a groove 37, and the positions of the passages 32 and 33 are indicated by dotted lines, while the dotted lines 38 indicate a groove formed in the face of the valve case.

When the handle 36 and disk 35 are in the position shown in the drawings, pressure air cannot pass by way of the passage 33, nor can air escape from the pressure chamber 24, through the valve by way of the communicating passage 39. When the handle 36 is rocked in the direction of the arrow, Fig. 3, pressure air will be permitted to pass by the passage 33 and the groove 37 of the disk 35 to the passage 32 and to the tube 11, and simultaneously by the groove 38 (Fig. 3) in the case, to the pressure chamber 24, so that the air pressure in the tube 11 and in the chamber 24 will be equal, and no movement of the expansible case 25 will take place. The han-

dle 36 is then again brought to the normal position shown in the drawings, closing the passages 32 and 33.

Should a sudden rise of temperature occur, the expansion of air in the tube 11 will then act in the interior of the expansible case 25, and the contact 31 will be brought against the contact 29, and by the electric connections, for instance such as indicated, the fire alarm will be given. On the other hand, should damage happen to the tube 11 and the pressure air escape, the expansible chamber 25 would contract and the electrical contact 31 be brought against the contact 30, and a trouble call be given through the electrical connections indicated. Should there be a gradual rise of temperature, the slow expansion of air in the tube 11 would pass by the leak screw 27 to the pressure chamber 24 and equalize the pressure.

When the handle 33 and the disk are turned in the opposite direction to the arrow (Fig. 3) pressure is then admitted by the passage 33 to the passage 32 only, and thereby to the tube 11, and thus a test alarm can be given in order to definitely ascertain that the apparatus is in perfect working order.

What I claim as my invention and desire to secure by patent is:—

1. In fire and temperature alarms; the combination with a small diameter metal tube closed at one end, an expansible chamber with the interior of which the open end of said tube communicates, said tube having a vent for permitting air to pass slowly to and from said tube and expansible chamber; of a pressure chamber with the interior of which said air vent communicates, the movable diaphragm of said expansible chamber being also located in said pressure chamber, means for supplying air at pressure to said pressure chamber, to said tube and to the interior of said expansible chamber, an electric battery, two electric alarm devices, and electric contacts and connections calculated to complete one electric circuit and sound one alarm device upon the expansion of the expansible chamber by sudden rise of temperature expanding the air in said tube, and to sound the other alarm device upon pressure air escaping from said tube and the interior of said expansible chamber to the outer atmosphere, substantially as set forth.

2. In fire and temperature alarms; the combination with a small diameter metal tube closed at one end, an expansible chamber with the interior of which the open end of said tube communicates, said tube having a vent for permitting air to pass slowly to and from said tube and expansible chamber; of an air-tight pressure chamber within which said expansible chamber and said vent are located, means for supplying air pressure to said pressure chamber and to the interior of said expansible chamber and said tube, said air pressure being normally equalized through said vent, two insulated stationary electric contacts located at a distance apart in said pressure chamber, an electric contact mounted on the movable diaphragm of said expansible chamber and extending between said two stationary contacts, two electrically operated alarm devices, an electric battery, electric connections calculated to operate one of said alarm devices when the expansible chamber is expanded by sudden rise of temperature acting upon the tube causing the electric contact carried by said expansible chamber to contact with one of the stationary contacts, and electric connections to cause the other alarm device to operate when the contact carried by the expansible chamber contacts with the other stationary contact, substantially as set forth.

3. In fire and temperature alarms; the combination with a small diameter metal tube closed at one end, an expansible chamber with the interior of which the open end of said tube communicates, said tube having a vent for permitting air to pass slowly to and from said tube and expansible chamber; of an air-tight pressure chamber within which said vent and expansible chamber are located, means for supplying air at pressure to said pressure chamber and to the interior of said expansible chamber and said tube said air pressure being normally equalized through said vent, two insulated stationary electric contacts located at a distance apart, a bar of insulating material fixed to the walls of said pressure chamber to carry said stationary contacts, an electric contact mounted upon the movable diaphragm of said expansible chamber and extending between said two stationary contacts, two electrically operated alarm devices, an electric battery, an electric conductor connecting one pole of said battery to one pole of each of said alarm devices, an electric conductor from the other pole of one of said alarm devices to one of said stationary contacts, and an electric conductor from the other pole of the second alarm device to the other stationary contact, and an electric conductor from the other pole of said battery to the contact carried by the movable diaphragm of said expansible chamber in order that when said chamber is expanded by the action of heat on said tube, its contact shall make connection with one of said stationary contacts and sound a fire alarm by one of said alarm devices, while when said tube is fractured and said expansible chamber contracts, the contact of the latter shall make connection with the other stationary contact and sound the other alarm device, substantially as set forth.

4. In fire and temperature alarms; the combination with a small diameter metal tube closed at one end, an expansible cham-

ber with the interior of which the open end of said tube communicates, said tube having a vent for permitting air to pass slowly to and from said tube and expansible chamber; of an air-tight pressure chamber within which said expansible chamber and said vent are located, a reservoir for containing air at pressure, a tube connecting said reservoir with said pressure chamber, means for controlling the supply of said pressure air from said reservoir to said pressure chamber, two insulated stationary electric contacts located at a distance apart in said pressure chamber, an electric contact mounted on the movable diaphragm of said expansible chamber and extending between said two stationary contacts, two electrically operated alarm devices, an electric battery, electric connections calculated to operate one of said alarm devices when the expansible chamber is expanded by sudden rise of temperature acting upon the tube causing the electric contact carried by said expansible chamber to contact with one of the stationary contacts, and electric connections to cause the other alarm device to operate when the contact carried by the expansible chamber contacts with the other stationary contact, substantially as set forth.

5. In fire and temperature alarms; the combination with a metal tube of small diameter having a correspondingly small bore containing air and closed at one end, a closed expansible chamber with which the other open end of said tube communicates, said tube having a vent for permitting air to pass slowly to and from the bore of the tube upon a gradual and ordinary variation of temperature, and means for regulating said vent; of an air-tight pressure chamber within which the said expansible chamber and said vent are located, means for supplying air pressure to said pressure chamber and to the interior of said expansible chamber and said tube said air pressure being normally equalized through said vent, two insulated stationary electric contacts located at a distance apart in said pressure chamber, an electric contact mounted on the movable diaphragm of said expansible chamber and extending between said two stationary contacts, two electrically operated alarm devices, an electric battery, electric connections calculated to operate one of said alarm devices when the expansible chamber is expanded by sudden rise of temperature acting upon the tube causing the electric contact carried by the expansible chamber to contact with one of the stationary contacts, and electric connections to cause the other alarm device to operate when the contact carried by the expansible chamber contacts with the other stationary contact, substantially as set forth.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

GEORGE LAWRENCE SMITH.

Witnesses:

WM. SHERMAN CARSON,

ARTHUR J. SMITH.