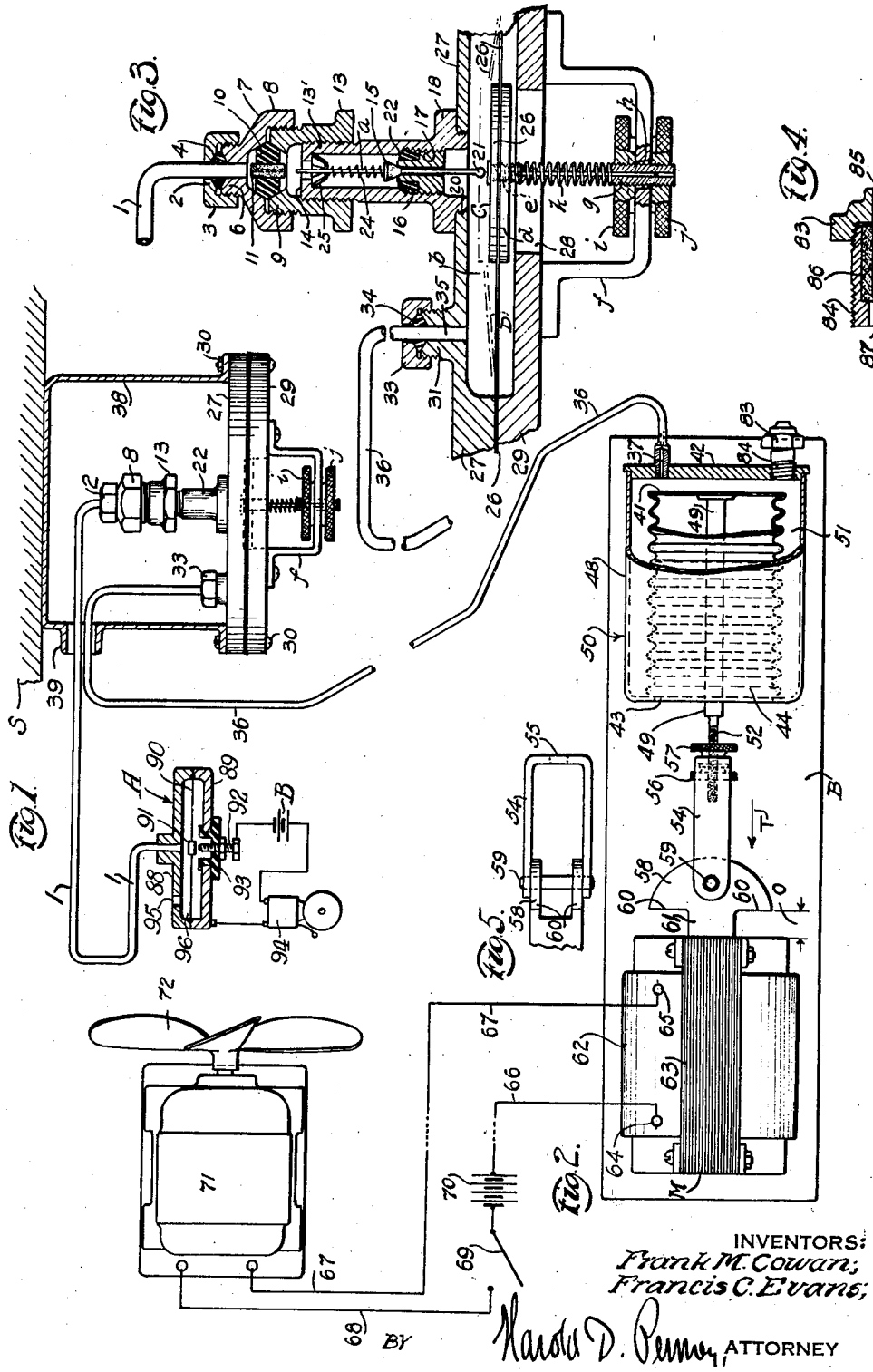
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AUTOMATIC COMPENSATION MEANS FOR AEROTUBE FIRE ALARM SYSTEMS

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AUTOMATIC COMPENSATION MEANS FOR AEROTUBE FIRE ALARM SYSTEMS

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The present invention relates to an improvement in apparatus for controlling fire alarm systems, and more particularly relates to controlling operative fire alarm systems of the heat sensitive expansive fluid, tube type, hereinafter to be denoted as aero-tube systems.

Many systems of this kind operate to cause an alarm when the rate of rise of the temperature exceeds a predetermined maximum rate, as in case of a dangerous fire. Where blower heater devices are used, the rate of rise, on the starting up of said device, may be great enough to cause a false alarm.

Therefore, an object of the present invention is to provide means for automatically preventing the false alarm during the intentional rapid raising of the temperature.

Another object of the invention is to provide means for automatically changing the alarm system so that it will not cause an alarm when the normal rate of rise for which the system is set is reached, but will automatically change to send an alarm only when a predetermined higher rate of rise is reached.

Another object of the invention is to automatically restore the system, after a predetermined time, to operate again on the normal rate of rise.

Aero-tube systems for fire alarm signalling are usually set to operate on an expansion pressure of about 1.04 ounces per square inch, the detector being set at an alarm point for permitting a temperature rise of about ten degrees a minute; if the temperature in the protected area rises faster than this the fire alarm is operated. It is understood that the detector may be set to any desired degree of rate-of-rise and the figures herein given are only by way of illustration.

Due to recent introduction of a new room heating and heat dispersion apparatus known as the blower-heater system wherein a motor driven fan, or blower, drives and disperses a large volume of heated air into a room from an air heating source, trouble from false alarms in aero-tube protected areas has been encountered, for the reason that such heater-blowers deliver such increased volumes of heat as to exceed the normal rate-of-rise of the aero-tube system and therefore the detector sends in an alarm.

The present device is so designed that extraction of a volume of air from the aero-tube system which is substantially equivalent to the expanded air therein prevents the detector from sending in an alarm by reason of the pressure in the aero-system being maintained substantially constant over the period of rapid room temperature change. After the first rush of heated air the aero-tube system gradually adjusts back to normal rate-of-rise control of the detectors and is ready to deliver true fire alarm signals.

The foregoing and other features of advantage will be apprehended as the description herein proceeds and it is obvious that modifications may be made in the herein apparatus without departing from the spirit hereof or the scope of the appended claims.

The drawing herein is illustrative of the instant invention in detail but is purely diagrammatic in such portions of the coacting apparatus as are old in the aero-tube signalling systems.

In the drawing,

Fig. 1 is a side elevation of the diaphragm valve with its protective outer housing cut away to better show the interior portions, including a conventional detector alarm means, shown in section and connected to an aero-tube.

Fig. 2 is a plan view of a heated air dispersing motor and a base having the solenoid actuated aero-tube system suction device mounted thereon;

Fig. 3 is an enlarged sectional view of the diaphragm valve showing its interior construction and operation under suction;

Fig. 4 is an enlarged sectional view of the vent of the suction device; and

Fig. 5 is a fragmentary side view of the bracket connecting the solenoid plunger and the suction device.

The protective aero-tube 1 and the connected conventional alarm means, generally denoted by A, is shown in Fig. 1. The alarm means is connected at a suitable point into the aero-tube and comprises a housing 88—89, enclosing a flexible diaphragm 90 which carries thereon a conductor contact button 91. Beneath said button 91 is located an adjustable contact screw 92 which is threadedly mounted in an insulator bushing 93, the latter being suitably mounted in said housing 89.

The housing of the diaphragm and the contact screw 92 are connected into a normally open alarm circuit including a battery B and an audible, electrically operated signal 94. The upper chamber 96 of the housing is vented as at 95, so that the aero-tube system can breathe.

A sudden rise in air pressure in the aero-tube system causes the diaphragm 90 to flex downwardly, closing the alarm circuit and causing the alarm to sound.

In Fig. 3 is shown a diaphragm actuated valve into the top of which, as at 2, is connected the open end of aero-tube 1, the tube end being tightly compressed, preferably, by a rubber packing 4, which is itself compressed by packing or compression nut 3 in the angled seat of threaded end of upper extension 6.

Extension 6—7—8 may be in a single piece as shown and it has at its lower end a packing nut extension 8 which is threadedly engaged with threaded nipple 9, said nipple and extension having associate angled packing seats therein to compress a rubber packing 10, which in turn holds a replaceable tubular air restrictor 11, the port of which may be of any desired diameter in accord with the desired volumetric air flow therethrough, in point of time.

The nipple 9 has a lower flared wrench receiving portion 13 and is threaded to receive therein the threaded end 13′ of a tire valve-core holding nipple 22, said core, generally denoted by *a*, being mounted therein upside down, so as to pass air from the upper diaphragm chamber *b* to the aero-tube 1, but to seal itself against air passing downwardly from said aero-tube 1.

The upper end of the bore of nipple 22 may be made smaller as at 14, to form an annular ledge, against which the foot 25 of the core may rest, thereby to form an abutment for said foot under compressive action of the valve spring 24, as it is compressed by the valve seat 15—16 as it is screwed by its threaded outlet 17.

The lower end of nipple 22 is flanged as at 18 and by the lower threaded end is screwed firmly to the top face 27 of the diaphragm housing in threaded bore 20. In this position the relief valve plunger 21 is held in the upper chamber *b* of the diaphragm housing and adjacent the face of the diaphragm, generally denoted by 26, which is held clamped between the outer edges of the upper and lower housing sections 27 and 29, respectively, by means of screws 30—30, Fig. 1. The central portion of the diaphragm is clamped by two opposing discs *c—d*, fixed together at their centers with a fastening *e*.

The lower housing section 29 has an opening 28 permitting free movement of the diaphragm.

As shown in Figs. 1 and 3, especially the latter, the lower face of housing section 29 has mounted thereon a bracket *f* which slidably supports therein a threaded bushing *g*, through a non-threaded bore *h* and said threaded bushing is held in operative, adjustable relation in said bracket by a pair of threaded nuts *i* and *j*, the adjustment of which moves the bushing *g* up or down to increase or decrease the tension of the spring *k* which is affixed between the diaphragm fastening *e* and the threaded end of bushing *g*, thus to bias the diaphragm to adjust it for action under various tensions or pressures as required.

It will be noted that a continuous air conducting passage is formed from the aero-tube system to the upper chamber *b* of the diaphragm housing which is controlled to be normally cut off by the valve 15 and volumetric air flow is constrained by the restrictor 11. Thus, normal changes in the rate-of-rise pressure in the aero-tube system do not get to the diaphragm.

The upper face of the top housing section 27 at one side, Fig. 3, is provided with a threaded nipple 31 which coacts with a threaded compressor nut 33 both the nipple and the nut having angled seats in which to receive and compress a rubber packing 34 about the open end 35 of a suction tube 36, to form a leak proof joint.

The tube 36, being broken for convenience, extends to the head 42 of the air extractor, generally denoted by 50, as shown in Figs. 1 and 2.

The connection of tube 36 to the extractor head 42 may be of any suitable nature and must be air tight.

In Fig. 1, the valved nipple 22 of Fig. 3 is shown slightly reduced in size and the attached tubing and upper portion of the nipple 22 is enclosed in a housing 38, which housing is shown in transverse section and which may be affixed to a support S in any suitable manner. Any other mounting may be used.

The aero-tube 1 goes to the protected area from the open housing boss 39, the second or suction tube 36 being run in the direction of and coupled to the head 42 by a tube connection 37 as shown in Figs. 1—2.

The suction device generally denoted by 50, Fig. 2, comprises the head 42, which is fixedly mounted to a base plate B, said head mounting a cylindrical, tubular extension 48 in an airtight fit, the extension 48, in turn having its opposite open end 43 connected to the open end of a metallic Sylphon bellows 44, the opposite end of said bellows being closed by an integral head 41.

The head 41 mounts a piston or bellows shaft 49 which extends rearwardly through the open end 43 of bellows 44 and is connected to a U-shaped yoke 54 by having its reduced threaded end 52 passed through unthreaded bore 55 in the closed end of said yoke. Two adjusting nuts 56—57 spanning the closed end of the yoke are mounted upon said threaded end 52 and permit of adjustment between said rod 49, the yoke 54 and its connections, when setting up the apparatus. This adjustment may be also utilized to vary the maximum change in volumetric capacity of the air chamber 51 formed by bellows 44, when collapsed, and outer cylinder 48, by extending or contracting the bellows, thus varying, also, the stroke *o*, Fig. 2, of the solenoid plunger 61.

The yoke 54, at its open end is connected to the stop head 58 of solenoid plunger 61 which is reciprocably mounted in the core of a magnet M by a cross pin 59, Figs. 2 and 5. The stop head 58 has ears 60—60 provided thereon to act as stop members and abut against the adjacent magnet face when the plunger is magnetically drawn backward in the direction of the arrow T, Fig. 2.

The magnet is of known construction and comprises a solenoid 62 having a central hollow core, and a magnet frame 63. The magnet is also fixed on base plate B, with its plunger and core in substantial alinement with the axis of rod 49.

The two terminals 64—65 of the magnet are connected into a circuit which includes a current source 70, connected to terminal 64 by wiring 66 and a normally open switch 69, the latter connecting one terminal of an electric motor 71 by wire 68.

The other terminal of motor 71 is connected by wiring 67 to magnet terminal 65. The motor 71 mounts a fan 72 thereon, and when operating, the motor driven fan operates to propel heated air from an air heating source, not shown, into the protected room area.

The head 42, of the suction device, has provided thereon, in an air tight manner, a relief vent, which, as disclosed in Fig. 4, may be in

the form of a chambered nipple the threaded end 84 of which is screwed into said head with its duct 87 in communication with the air chamber 51 of the suction device.

The interior of the nipple has mounted therein a porous leakage plug 86 which is held in operative position by a threaded vent cap 83, the vent 85, of which is open to atmosphere. The plug 86 may be changed to increase or decrease the air venting speed from chamber 51.

The operation of the device is as follows:

The switch 69, Fig. 2, may be a thermostatic or a manual switch. When switch 69 is closed, the motor fan operates to drive heated air into the protected area and simultaneously magnet M is operated to draw plunger 61 rearwardly in the direction of arrow T. This action contracts bellows 44 causing air to be sucked from the upper chamber *b* over diaphragm 26 through tubing 35, 36 and 37 whereby the diaphragm 26 moves upwardly as shown dotted at D, Fig. 3, to contact with the end 21 of the air valve and lift check valve 15 from its seat, whereupon the suction action of the bellows removes sufficient air from the protective aero-tube system to prevent it from sending an alarm.

Thus, it will be noted that the sudden rise of temperature caused by the operation of the fan, which increases the air pressure in the aero-tube system is negatived by the simultaneous withdrawal of air from the aero-tube system and after this is done the aero-tube system gradually equalizes to the new temperature conditions through the breather vent 95 in the detector alarm system A, the diaphragm 26 is restored to valve closing position cutting off the aero-tube system from the diaphragm, and the aero-tube system is then in alarm sending condition under its altered temperature conditions.

It is understood that so long as the motor 71 operates to move heated air into the protected area, the bellows is held contracted by the magnet M. As soon as the motor circuit is broken, the plunger 61 under recovery action of the resilient bellows 44 is restored to its initial offset position, ready for a repetition of the cycle.

As the motor-magnet circuit is opened the plunger 61 and bellows 44 are restored gradually to initial position by the gradual venting of air in bellows chamber 51 through the controlling porous restrictive vent 86, the diaphragm 26 being lowered, and the valve 15 closed during this restoration.

The speed of restoration of the bellows 44 and its connections 61—54—49 is controlled by the porous vent 86 and this may be varied by replacement of the vent 86 with a porous vent member of greater or lesser venting capacity as circumstances require and indicate. This latter feature is of importance as the vent 86 should not act too freely as it would prevent the instant action of the bellows on the air extraction line 36.

It will be noted that, due to the structure herein disclosed, that at no time is the aero-tube system I disabled against actuating the detectors to send an alarm, because, at any degree of temperature the fixed rate-of-rise is set, and in any additional air adjustment in the aero-tube system by reason of a falling temperature or a greater than the set rate-of-rise increase in room temperature, the set rate-of-rise in the aero-tube system is constant. In the event that room temperature has reached the desired degree, and the blower heater is shut off and the room commences to cool off the aero-tube system adjusts itself, through the usual vent of the aero-tube system and the vent 85, to the changed temperature, but is ready at any temperature to become active. Thus the present system maintains its set rate-of-rise during normal rising or falling temperature changes.

From the foregoing description of the valve, it will be noted that it acts as a check valve, to open or close communication between the aero-tube system and the bellows actuating system, but it acts reversely to the usual, known check valve structures, in that it closes when air pressures are created above the valve 15 in the aero-tube system, which may be called the upstream or inlet side, and the valve 15 is opened by downward suction created by the expanding suction action of the bellows 44, upon what may be called the downstream or outlet side. In other words the upstream or inlet side of the structure is that portion of the ducts or tubing above the valve and the downstream or outlet side of the structure is that portion of the structure which is below the valve, as viewed in Figs. 1 and 3, where the complete valve is shown in normal operative position. This valve can also be operated in the reverse position to that shown in Figs. 1 and 3.

No claim is made herein to the broad concept of compensating means for a fire detecting system arranged to prevent false alarms without rendering the system inoperative, this subject matter being claimed broadly in our copending application, Serial No. 164,286.

What we claim is:

1. The combination, with the aero tube of an aero alarm system adapted to operate an alarm when the rate of pressure rise in the tube exceeds a predetermined rate, of a heater blower system adapted to cause in said tube a rate of rise exceeding said predetermined rate; a normally closed valve closing said tube; a diaphragm chamber having a wall composed of a flexible diaphragm means for opening said valve on movement of the diaphragm when air pressure in the chamber is reduced; a suction device communicating with said housing; and electric circuit means having a circuit adapted to be closed for operating said heater system and including in said circuit an electro-magnetic operating means for operating the suction device for drawing air from the diaphragm housing for opening said valve and then drawing air from the tube.

2. The combination, with the aero tube of an aero alarm system adapted to operate an alarm when the rate of pressure-rise in the tube exceeds a predetermined rate, a heater blower system adapted to cause in said tube a rate of rise exceeding said predetermined rate and electric circuit means having a circuit adapted to be closed for operating said heater system, of a normally closed valve closing said tube and adapted to be opened to relieve pressure in the tube; a diaphragm chamber having a wall composed of a flexible diaphragm means for opening said valve on movement of the diaphragm when air pressure in the chamber is reduced; a suction device communicating with said housing; an electro-magnetic operating means interposed in said circuit for operating the suction device when the circuit is closed for drawing air from the diaphragm housing for opening said valve; said suction device having a slow venting device for equalizing exterior and interior pressures after a predetermined time to allow said valve to close.

3. A device for combination with the aero tube

of an aero alarm system adapted to operate an alarm when the rate of pressure-rise in the tube exceeds a predetermined rate, a heater blower system adapted to cause in said tube a rate of rise exceeding said predetermined rate; and electric circuit means having a circuit adapted to be closed for operating said heater system; said device comprising a normally closed valve adapted to be connected for closing said tube and adapted to be opened to relieve pressure in the tube; a diaphragm chamber having a wall composed of a flexible diaphragm means for opening said valve on movement of the diaphragm when air pressure in the chamber is reduced; a suction device communicating with said housing; and an electro-magnetic operating means adapted to be included in said circuit for operating the suction device when the circuit is closed for drawing air from the diaphragm housing for opening said valve; said suction device having a slow venting device for equalizing exterior and interior pressures after a predetermined time to allow said valve to close.

4. In combination, a pressure tube; a normally closed valve closing said tube and adapted to be opened to relieve pressure in the tube; a diaphragm chamber having a wall composed of a flexible diaphragm means for opening said valve on movement of the diaphragm when air pressure in the chamber is reduced; a suction device communicating with said housing; and an electric circuit means having a circuit adapted to be closed and including in said circuit an electro-magnetic operating means for operating the suction device when the circuit is closed for drawing air from the diaphragm housing for opening said valve; said suction device having a slow venting device for equalizing exterior and interior pressures after a predetermined time to allow said valve to close.

5. The combination, with the aero-tube of an aero system adapted to operate a translating means when the rate of pressure-change in the tube exceeds a predetermined rate, of a temperature changing system adapted to cause in said tube a rate of change exceeding said predetermined rate; a chamber communicating with the tube; a normally closed valve between said tube and chamber; a device communicating with said chamber for changing the pressure therein; means to open the valve when air-pressure in the chamber is thus changed; and means for operating said temperature change system including means for operating said device.

6. In a combination as in claim 5, means to return the pressure in said chamber to normal to allow said valve to close.

7. In a combination as in claim 5, an air restrictor for restricting the passage of air through said valve.

8. The combination, with the aero-tube of an aero system adapted to operate a translating means when the rate of pressure rise in the tube exceeds a predetermined rate, of a temperature changing system adapted to cause in said tube a rate of rise exceeding said predetermined rate; a chamber communicating with the tube; a normally closed valve between said tube and chamber; means to open the valve when air is withdrawn from the chamber; a suction device communicating with said chamber for withdrawing air therefrom to open the valve and from the tube after the valve is opened; means for operating said temperature change system including means for operating said device.

9. In a combination as in claim 8, a slow venting device to allow air to return to said chamber to allow said valve to close.

10. The combination, with the aero-tube of an aero system adapted to operate a translating means when the rate of pressure change in the tube exceeds a predetermined rate, of a temperature changing system adapted to cause in said tube a rate of change exceeding said predetermined rate; a normally closed valve adapted when opened to allow the passage therethrough of air from said tube; a chamber; means to open the valve when air in the chamber is changed; a pressure changing device communicating with said chamber for changing pressure therein to open the valve; and means for operating said temperature change system including means for operating said device.

11. The combination, with an aero-tube fire alarm system, comprising a normally closed valve, an aero-tube, one end thereof being connected to said normally closed valve, a suction actuated diaphragm adjacent said valve and being normally unflexed, a heater blower system for causing a rate of temperature rise in said aero-tube fire alarm system at least equal to the rate of rise necessary to operate the alarm, means operated by the operation of the heater-blower to flex said diaphragm and open said valve to create a suction in said aero-tube, when the heater-blower is in operation and means in connection with said diaphragm flexing means for operating to unflex said diaphragm and to close said valve when the heater-blower ceases operating, and to restore normal conditions in said aero-tube system.

12. The combination as set forth in claim 11, in which the normally closed valve comprises a chambered housing provided with a flexible diaphragm therein, one side of said diaphragm being open to atmosphere, the other side thereof being closed to the atmosphere, a tubular connection from said closed side of said diaphragm to a suction device, whereby suction flexes said diaphragm on said closed side away from said atmospheric side, said valve having an open duct connection into an aero-tube system on the closed side of said diaphragm, a valve seat between said open duct connection and the closed side of said diaphragm, a normally closed and constrained valve on said seat, closing said closed side of said diaphragm from said aero-duct connection, and means connected to said valve and normally in operative contact with the closed side of said diaphragm, whereby when suction is created on the closed side of said diaphragm the diaphragm is flexed out of normal to unseat said valve, thereby to extract air from said aero-tube system and means connected to the atmospheric side of said diaphragm for biasing the tension of the unflexed diaphragm to adjust the same to any desired degree of flexing displacement.

13. The combination, as set forth in claim 11, in which the valve is of the diaphragm operated type and includes a diaphragm, a normally closed valve member ordinarily restrained upon its valve seat, means operatively connecting the valve member to the diaphragm whereby the diaphragm, when suction is applied thereto, opens said valve member from its seat and means normally restraining said valve in its closed position upon its seat, to resist application of pressure upon said valve.

14. In a fire detecting system, an enclosure, an aero-tube arranged therein to supervise tempera-

ture changes and adapted to operate after a predetermined increase in pressure in said aero-tube system, signal means controlled by said aero-tube, a heat source adjacent said aero-tube system, an air extracting means connected to said aero-tube and means for simultaneously controlling said heat source and air extracting means whereby air will be extracted from said aero-tube when said heat source is active to compensate the pressure changes and thereby prevent a false alarm.

15. In a signalling system, an enclosure, an aero-tube system for supervising changes in temperature in said enclosure, signal means controlled by said aero-tube, a heat source adjacent said aero-tube system, an electrical circuit for controlling said heat source, a bellows controlled by said electrical circuit and connected to said aero-tube system for extracting air from said aero-tube when said heat source is active to thereby prevent a false alarm.

16. In a signalling system, an enclosure, an aero-tube system for supervising changes in temperature in said enclosure, signal means controlled by said aero-tube, a heat source adjacent said aero-tube, an electrical circuit for controlling said heat source, a bellows connected to said aero-tube for extracting air therefrom, and a magnetic means controlled by said electrical circuit for expanding said bellows whereby said bellows will extract air from said aero-tube system when said electrical circuit is closed.

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