

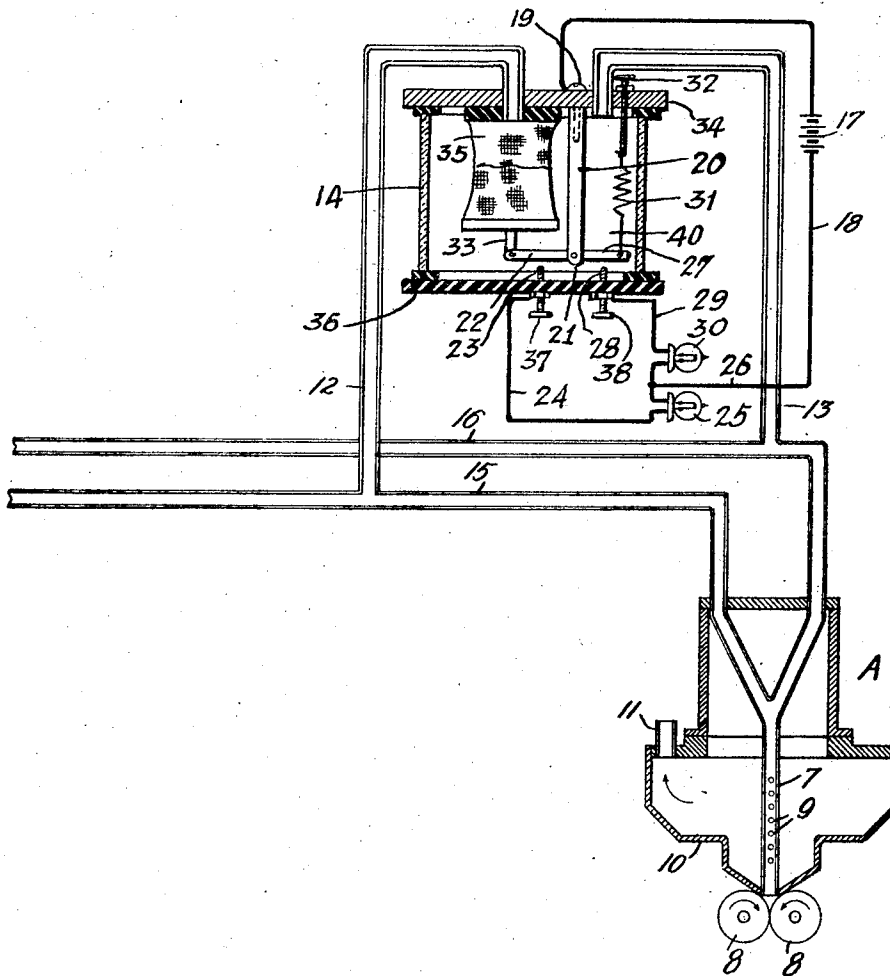
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PNEUMATIC RELAY

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UNITED STATES PATENT OFFICE.

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PNEUMATIC RELAY.

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This invention relates to relays and particularly to pneumatically operated relays, its object being to provide a means for controlling indicator circuits showing the pressure conditions in pneumatic ticket distributing systems.

This invention provides a pneumatic relay that is simple and so constructed as to require almost negligible maintenance after installation. It consists essentially of a bellows enclosed in an airtight chamber, the bellows and chamber each being connected to different points in a pneumatic distributing system. One end of the bellows is free to move to operate electrical contact members controlling signaling circuits. It may be effectively employed with a pneumatic tube ticket distributing system to indicate blockade in the section of the distributing system included between its attached pipes. Other uses dependent upon difference of pressure between two points in a pneumatic system are numerous.

A more complete understanding of the various features in this invention may be had from the accompanying detailed description and drawing wherein the invention is diagrammatically illustrated.

Referring to the drawing, a receiving station A having a pair of tubes 15 and 16 extending from different sending stations (not shown) are illustrated. The tubes 15 and 16 open into a common delivery tube 7, the lower end of which terminates between the soft rubber rollers 8, normally in closed contact, continuous in rotation and which serve to remove a ticket from the delivery tube 7 without admitting air thereto. The tube 7 is perforated near the end as at 9 to relieve the ticket of the high air velocity at the end of its travel. It also extends to within a short distance of the rollers 8 and is located within an airtight casing 10 having a pipe 11 extending therein through which air flowing through the tubes 15, 16 and 7 is exhausted by any suitable means (not shown). Airtight joints are provided where tubes 15 and 16 extend through the casing 10. Any suitable delivery apparatus may be used to facilitate the removal of the tickets from the delivery tube 7, this particular delivery apparatus being shown in a patent to A. F. Dickson, Patent No. 1,065,924. In ticket distributing systems of the type illustrated, the tickets (not shown) are

usually of rectangular form and are bent transversely to form a flap before insertion in the sending tube. The air is exhausted from the tube in advance of the ticket and the resultant higher air pressure at the rear of the ticket acts against the flap to cause the forward movement of the ticket. Under normal conditions the ticket is moved forward until it reaches the bottom of the delivery tube 7 at the desired receiving station where it is seized by the rollers 8 and removed from the tube 7. Tickets occasionally become stuck in the tubes 15 and 16 and although a blocked ticket will often be released within a few moments, it is desirable to indicate the presence of a blockade and in which tube the blockade exists immediately upon the occurrence thereof so that steps may be taken at once to remove the blockade before other tickets become involved therein. To furnish such indication a pneumatic relay 14 is provided for each delivery valve 7 as at A.

The relay 14 comprises an air tight chamber 40 with a bellows 35 within such chamber, one end of which is fastened to the base 34 of the chamber, the other end of the bellows (being free to move) is securely fastened to a round disc in the top of the bellows to which is attached a metal post 33. To the left of the bellows is a post 20 which is rigidly held in vertical position by a screw 19. With the pivot 21 as a fulcrum, the one piece metal bar consisting of a left and right arm 22 and 27, respectively, is in a position to move about the fulcrum 21. The arm 22 is fastened to the post 33 and the arm 27 is attached to the slight spring 31. Spring 31 is adjusted by a screw 32. When the bellows is in its normal working position that is, with the sides partially collapsed, the arms 22 or 27 do not make contact with the contacts 23 or 28. Two circuits with a signal for each one supplied with current from the battery 17 is shown on the figure.

The connecting tube 12 leads from the main tube 15 to the lower part of the bellows and a similar tube 13 leads from the other main tube 16 to the airtight chamber 40. The tubes 15 and 16 are connected respectively to two different points in the pneumatic distributing system so that the vacuum will be slightly different, causing the partially collapsed condition of the bellows. If the points are not located in an exact

manner so that the free end of the bellows is balanced then the spring 31 is employed for adjustment by turning the screw 19.

The operation is as follows: If a blockade occurs in either one of the pneumatic tubes 15 or 16, the difference in pressure causes the operation of the bellows. If the blockade is in tube 15, the air is exhausted from the bellows and it collapses, therefore closing the arm 27 against the contact 28. The closing of this contact establishes a circuit to light a lamp for indicating the blockade and location of the blockade, which may be traced from the positive terminal of the battery 17, conductor 18, screw 19, post 20, arm 27, contact 28 of the terminal 38, conductor 29, lamp 30 and thence to the negative terminal of the battery 17 over the conductor 26. When the air is exhausted from the chamber 40, due to a blockade in the tube 16, the bellows fills out, or in reality, expands, therefore closing the arm 22 against the contact 23. The closing of this contact establishes a circuit which may be traced as follows: From the positive terminal of the battery 17, conductor 18, screw 19, post 20, arm 22, contact 23 of the terminal 37, conductor 24, lamp 25, conductor 26, and thence to the negative terminal of the battery. Lamp 25 lights in this circuit to indicate the blockade and its location as above described. It is of note that the bellows is made of very thin woven material such as the bellows cloth used in player pianos. Furthermore, as illustrated on the drawing, due to the material used and its structure, the bellows is readily collapsible and not merely extensible as is the usual accordion type bellows. In other words, upon a decrease of pressure within the bellows the sides thereof tend to collapse in the center so that a plane therethrough would be of comparatively smaller diameter than the diameter of an end portion. Normally, for a bellows four inches in diameter and four inches long, it has been found that a collapsed condition reducing the diameter about $\frac{1}{2}$ " at the center, gives satisfactory results. Furthermore, it is found that a difference in the pressures within and without the bellows whose equivalent may be measured by a force as low as that represented by $\frac{1}{2}$ " alcohol is sufficient to cause this collapsible condition to occur and operate the lever, controlling the indicating lamps. This is readily explained when it is realized what a comparatively tremendous force a collapsing condition has due to a decrease in pressure within the bellows. This collapsing action, it has been found exerts a force upon the end of the bellows controlling the lever, far greater than that possible with the accordion extensible type bellows where the force is merely the equivalent of the product of the difference in the

pressures within and without the bellows times the area of an end section. Such action is of utmost importance in systems of this kind where the differences in pressure caused by the sticking of a paper ticket in a tube, are very slight.

When the reverse action takes place and the pressure in the bellows is greater than the pressure without it, the force exerted by the bellows per se, will be equal to the product of the difference in pressure times the area of the end section. However, in order that the device be operable for small variations in pressure, the free end of the bellows to which the lever is attached is made of comparatively heavy material such as phenol fibre about $\frac{3}{8}$ " thick. Consequently, this weight downward, in combination with the force due to the difference in pressure, is sufficient to give a result upon the clogging of one tube as satisfactory as that obtained by the aforementioned collapsing condition, when the other tube is effected.

What is claimed is:

1. A pneumatic relay comprising a sealed chamber, a bellows within said chamber mounted in an upright position and constructed to assume a collapsible position when its inner pressure is less than that of said chamber, a support within the chamber for rigidly supporting the bellows at its top, a base for the free end of said bellows made of comparatively heavy material, a lever pivoted at or near its mid-point with one end secured to the bottom of said bellows so that when the pressure within said bellows is less than the pressure within said chamber said lever is moved in one direction by the collapse of the bellows and, when the pressure within said bellows is greater than the pressure within said chamber, said lever is moved in the other direction by the expansion of the bellows and the weight of the base of the bellows, and electrical contacts operated by the movement of said lever to control signals to indicate the position of greatest pressure.

2. A pneumatic relay comprising a sealed chamber, a bellows within said chamber mounted in an upright position and constructed to assume a collapsible position when its inner pressure is less than that of said chamber, a support within the chamber for rigidly supporting the bellows at its top, a base for the free end of said bellows made of comparatively heavy material, a lever pivoted at or near its mid-point with one end secured to the bottom of said bellows so that when the pressure within said bellows is less than the pressure within said chamber said lever is moved in one direction by the collapse of the bellows and, when the pressure within said bellows is greater than the pressure within said chamber, said lever is moved in the other direction by the expansion of the bellows.

sion of the bellows and the weight of the
base of the bellows, electrical contacts oper-
ated by the lever to control signals to indi-
cate the position of greatest pressure, and
5 an adjustable tensioning device within said
chamber cooperating with said lever and
adapted to be controlled without said cham-

ber for normally maintaining all of said
electrical contacts open.

In witness whereof, I hereunto subscribe 10
my name this 5th day of December A. D.,
1923.

EDGAR W. GENT.