Jan. 9, 1951 J. G. MEJEAN 2,537,474

DIFFERENTIAL PRESSURE CONTROLLED SWITCH

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Fig. 2.

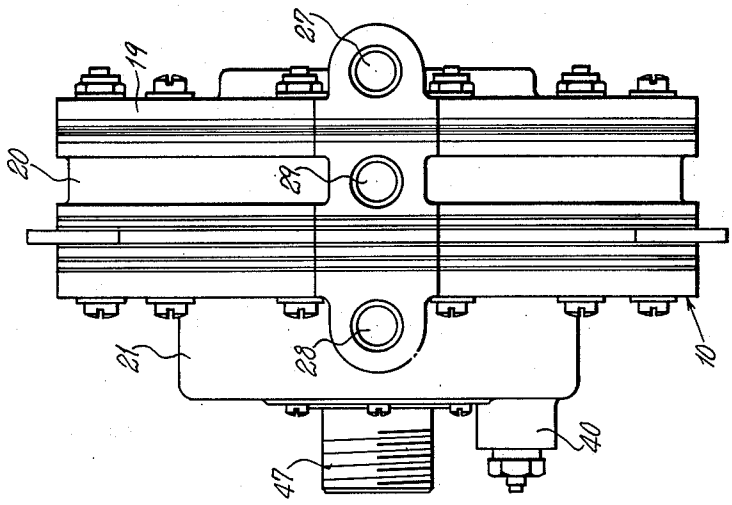
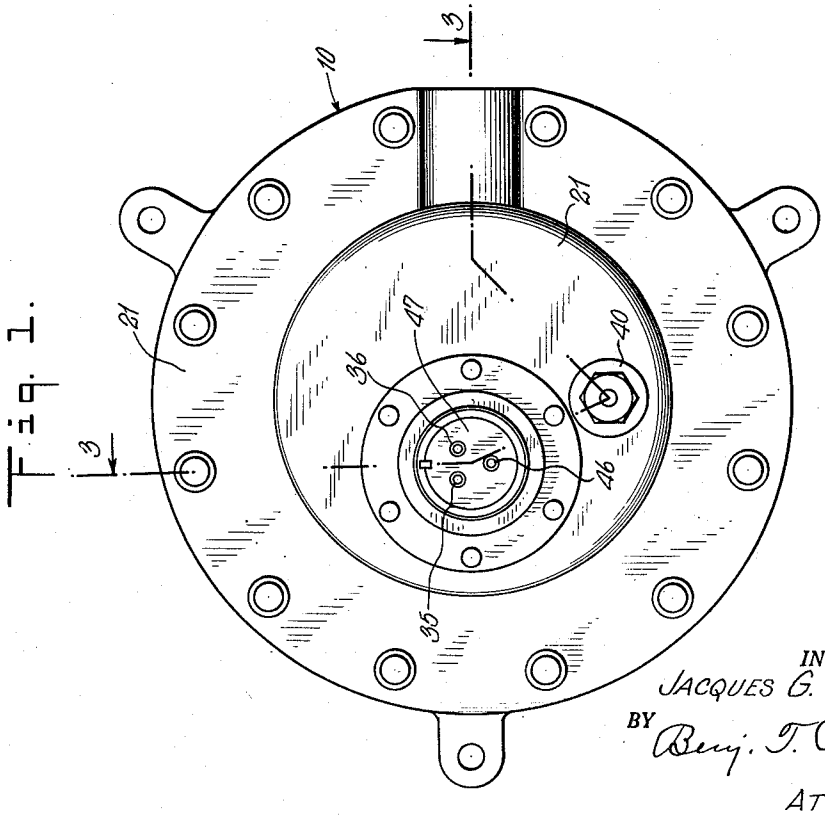


Fig. 1.



INVENTOR.
JACQUES G. MEJEAN
BY Benj. T. Rauber
ATTORNEY

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Fig. 4

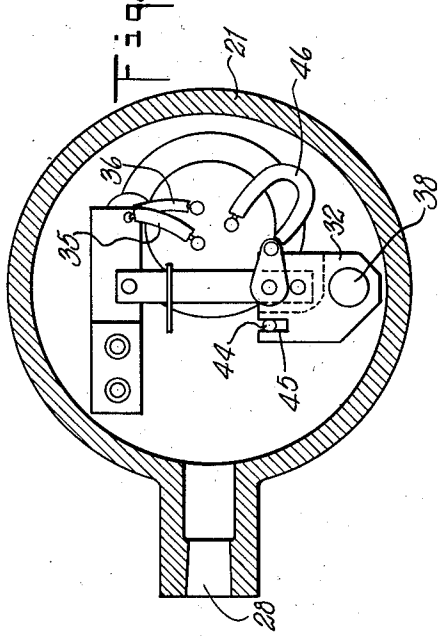


Fig. 5

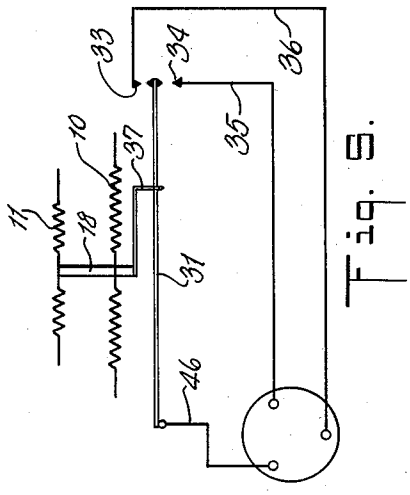
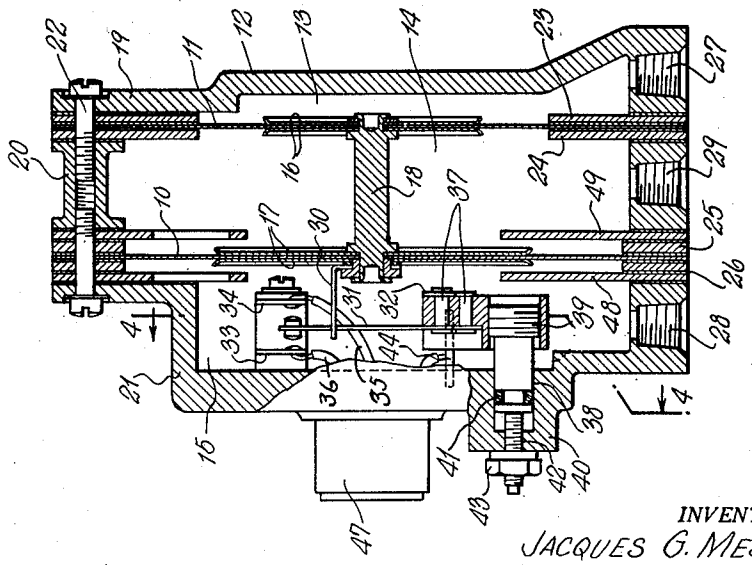


Fig. 3



INVENTOR.
JACQUES G. MEJEAN
BY
Benj. T. Rauber
ATTORNEY

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UNITED STATES PATENT OFFICE

2,537,474

DIFFERENTIAL PRESSURE CONTROLLED SWITCH

Jacques G. Mejean, Greenwich, Conn., assignor to The Aerotec Corporation, Greenwich, Conn., a corporation of Connecticut

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4 Claims. (Cl. 200—83)

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My present invention relates to apparatus controlled by pressure differences for the regulation or control of mechanism.

In my invention gases or fluids of different pressure are so balanced as to maintain a control element, such as an electric switch, in a neutral position for differences of pressure and to move it to actuating position in one direction or another upon changes in the relative pressures.

For this purpose my invention provides a pair of diaphragms of different effective areas, the smaller of which is exposed or subjected to the medium of higher pressure, and the larger of which is subjected to the medium of lower pressure, the diaphragms being separated but connected to move as a unit.

One of the diaphragms is connected to an actuating or control mechanism, as a switch, swinging or pivoted between electric contacts and preferably within the lower pressure medium so that with the movement of the diaphragms the switch or element is moved in one direction or the other.

Means are provided for adjusting the base or support of the movable switch element so that a very fine adjustment may be attained. This is preferably done by means of a differential screw extendng through the wall of the enclosing case into the chamber containing the low pressure fluid.

The various features of my invention are illustrated, by way of example, in the accompanying drawings in which

Fig. 1 is a plan, and Fig. 2 a side elevation of an apparatus embodying a preferred form of the invention;

Fig. 3 is a section of the apparatus taken on line 3—3 of Fig. 1;

Fig. 4 is a section on a smaller scale taken on line 4—4 of Fig. 3, and

Fig. 5 is a diagrammatic illustration of the wiring of a circuit embodying the invention.

In the embodiment of the invention illustrated in the accompanying drawings, a pair of diaphragms 10 and 11 are mounted in spaced position within an enclosing case 12 in such manner as to separate the case into a high pressure chamber 13 an intermediate chamber 14 and a low pressure chamber 15. The diaphragm 11 may be provided with rigid centrally disposed plates 16 and the diaphragm 10 may be similarly provided with rigid centrally disposed plates 17.

The plates 16 and 17 are connected by means

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of a spanning element or rod 18 which holds the diaphragms in fixed spaced relation at their centers.

The case 12 may be made in three parts, 19, 20 and 21, between which the diaphragms 10 and 11 are clamped and held by means of bolts 22 which clamp the elements of the case tightly together with spaces between the elements and diaphragms being sealed tight against air, gas or other fluids.

Interposed between the diaphragm 11 and the case elements 19 and 20 are rigid rings 23 and 24 on opposite sides of the diaphragm which limit or reduce the effective area of the diaphragm to the area within these rings. The effective force acting on the diaphragm will, therefore, be the product of the pressure of the gas and the area of the diaphragm.

Spacing rings 25 and 26 may similarly be provided on the opposite sides of the peripheral part of the diaphragm 10, the inner peripheral diameter of the rings 25 and 26 being greater than that of the rings 23 and 24 so that the effective area of the diaphragm 10 will be greater than that of the diaphragm 11 and the pressure of the gas required to balance the gas pressure in the chamber 13 will consequently be much less.

The chambers 13 and 15 are provided with openings 27 and 28 through which connection may be made to the different sources of pressure.

The intermediate chamber 14 is also provided with an outlet 29 which may be open to the atmosphere or be connected to a source of uniform pressure, preferably intermediate that of the pressures in the chambers 13 and 15.

It will be evident that the diaphragms 10 and 11 and the connecting element 18 will be in mid position and balanced when there is a certain pressure differential between the chambers 13 and 15, and that when this differential changes the diaphragms will be moved as a unit in one direction or the other.

The movement of the diaphragms is transmitted through a connecting stem or link 30 to a movable control element, such as a switch arm 31 pivoted on a stationary support 32 and movable between a pair of fixed electrical contact terminals 33 and 34.

The terminals 33 and 34 are connected by means of conductors 35 and 36 to suitable actuating or control mechanisms.

The supporting base for the switch arm 31 may comprise a block of suitable material, such as

an insulating compound, to which the switch arm 31, which may be a leaf spring, is secured by suitable screws or rivets 37.

The supporting block 32 is mounted on the wall of the case by means of a stem 38 threaded as at 39 into an opening in the block 32 and extending through and rotatable in a projection 40 on the wall of the case.

The stem 38 is provided with an annular groove to form a resilient sealing ring 41. And beyond this sealing ring is a second threaded length 42 threaded in and extending to the exterior of the projection 40. The threads 42 and 39 are inclined in the same direction but of different pitch so as to give a reduced movement to the block 32.

The block 32 is kept from rotation about the stem 38 by means of a pin 44 fixed on the case 12 and engaging a slot 45 as shown in Fig. 4. The switch arm 31 is connected by means of a conductor 46 in a suitable electric circuit. The conductors 35, 36 and 46 pass out of the low pressure compartment 15 through a fitting 47 in which they are sealed fluid-tight even at relatively high temperatures.

The manner of operating the control apparatus is illustrated by way of example in Fig. 5 in which the reference numerals correspond to those in Fig. 3.

It will be apparent that as the movable switch element 31 contacts with the terminal 33 or 34 it will close a circuit to the wires 35 and 36 passing to an actuating element not shown.

To prevent excessive movement of the diaphragm a pair of spaced stop rings 48 and 49 are provided on opposite sides of the diaphragm 10.

Through the above invention, therefore, a control element may be actuated by mediums of different pressure to remain in mid or neutral position for a predetermined pressure difference, but to swing to one control element or the other as this pressure differential changes.

In use it is sometimes advantageous to connect the intermediate chamber 14 to a zone where pressures are near the value of the pressures transmitted to the chambers 13 and 15 so as to have a small differential pressure across the diaphragm even though high absolute pressure conditions exist.

Having described my invention, what I claim is:

1. Differential pressure controlled apparatus which comprises a case, a diaphragm separating a part of said case into a chamber for higher pressure, a diaphragm of larger area separating a part of said case into a chamber for lower pressures and spaced from the first mentioned diaphragm to form an intermediate chamber, said chamber for higher pressures and said chamber for lower pressures each having an outlet, a pair of spaced electric contact terminals in one of said pressure chambers, a swinging contact in said chamber to swing from one of said spaced contacts to the other, a connector connecting said diaphragm in fixed spaced position, a connector connecting said diaphragms to actuate said swinging switch, a support for said swinging contact and means operable through the wall of said case to adjust the position of said support relative to said spaced contacts.

2. The apparatus of claim 1 in which said adjusting means comprises a screw connection extending through and threaded in the wall of said case and threaded into the support of said swinging contact with a pitch different from that in the wall of said case.

3. The apparatus of claim 1 in which said case is formed of an intermediate annular element and a pair of end elements and in which said diaphragms are secured between said elements.

4. The apparatus of claim 1 in which spaced stop rings are provided on opposite sides of one of said diaphragms.

JACQUES G. MEJEAN.

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