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PRESSURE SWITCH

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Fig. 1

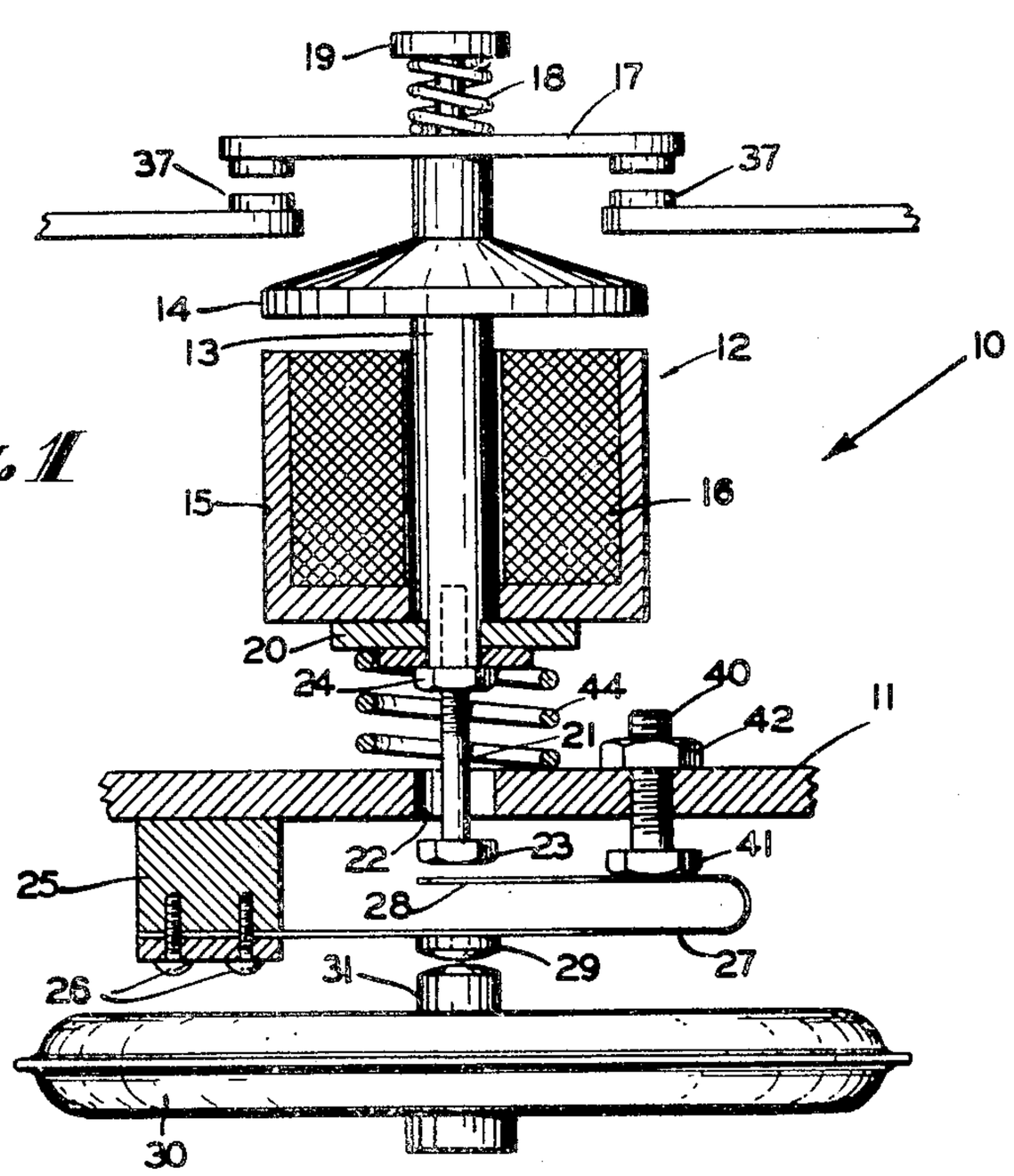
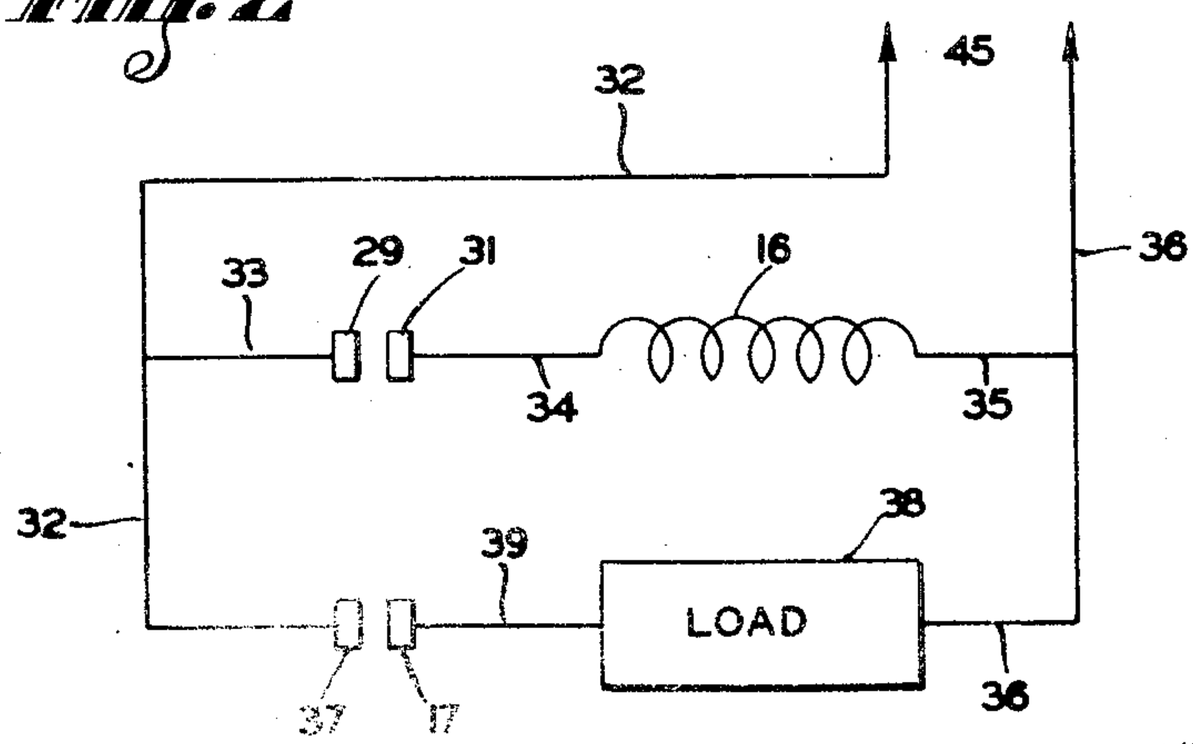


Fig. 2



INVENTOR
RICHARD SHAW, JR.
BY
ATTORNEY

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PRESSURE SWITCH

Richard Shaw, Jr., Bergenfield, N. J., assignor to Bendix Aviation Corporation, Teterboro, N. J., a corporation of Delaware

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This invention relates to a switch arrangement, and more particularly to a switch which will be actuated at predetermined values of pressure by the operation of a pressure responsive member.

An object of my present invention is to provide a switch which will be actuated upon operation of a pressure responsive member when the pressure acting upon said member reaches a predetermined value, and which will be restored to its initial condition when the actuating pressure returns to a second predetermined value.

Another object of my invention is to provide a switch arrangement of the character described in which the pressure value at which the switch is actuated may be readily adjusted to other predetermined pressure values.

A further object of the present invention is to provide a switch arrangement of the character described in which the pressure value at which the switch is returned to initial condition after actuation thereof, may be readily adjusted to other predetermined pressure values.

Still a further object of my invention is to provide a switch arrangement of the character described in which the pressure lag in circuit operation may be varied.

Still another object of the invention is to provide a highly compact and rugged switch arrangement of the character described which shall be automatic and positive in its operation, relatively inexpensive to manufacture, which shall have a large variety of applications and yet be practical and efficient to a high degree in use.

Other objects of this invention will in part be obvious, and in part hereinafter pointed out.

The invention accordingly consists in the features of construction, combinations of elements and arrangement of parts which will be exemplified in the construction hereinafter described, and of which the scope of application will be indicated in the appended claims.

In the accompanying drawings in which one of the various possible illustrative embodiments of this invention is shown,

Figure 1 is a side view, portions of which are in elevation, other portions in cross section, of a switch arrangement embodying the invention, while

Figure 2 is a wiring diagram showing the electrical connections for said switch arrangement.

The switch arrangement herein provided comprises a solenoid adapted to be energized upon actuation of a pair of control contacts by the expansion and/or contraction of a pressure responsive member, or aneroid. Energization of the solenoid will actuate a second pair of contacts to control the operation of the electrical circuit in which they are connected.

The control contacts actuated by the aneroid comprise a contact movable upon the expansion

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and/or contraction of the aneroid due to pressure changes, and a spring mounted contact adapted to be engaged by the aneroid contact. The spring mounting of the second contact is such that upon energization of the solenoid by the actuation of the control contacts, the movable core of the solenoid will increase the pressure upon the spring mounting. Thus, the control contacts may be held in engagement to maintain the solenoid energized even though the pressure affecting the aneroid has changed sufficiently to permit the opening of the closed contacts under normal conditions.

A pressure lag is thus provided which permits the switch arrangement to control an electrical circuit between two predetermined pressures, the pressure at which the solenoid controlled contacts are actuated, and a second predetermined pressure value at which the solenoid contacts return to their initial condition.

In the embodiment hereinafter described, the aneroid upon expanding due to a decrease in ambient pressure will close the control contacts to energize the solenoid. The core of the solenoid will abut against the spring supporting one of the control contacts, increasing the pressure of the contacts. A further decrease in ambient pressure will not change the condition of the closed contacts. However, upon an increase in ambient pressure affecting the aneroid, the aneroid will contract until a point is reached when the control contacts are opened. The pressure at which the control contacts will open will be a higher pressure than that at which the contacts first closed. This is due to the bias of the resilient mounting by the solenoid core.

Referring now in detail to the drawings, 10 designates a switch arrangement embodying the present invention. The switch arrangement comprises a support plate 11 in a sealed casing (not shown) having a pressure connection through which the controlling pressure is applied to the interior of the casing. Fixed to said plate in a suitable manner is a solenoid 12 comprising a core structure 13 and an armature 14, said core being slidably received within a coil frame 15 supporting a coil 16. The upper end of the core 13 is provided with a pair of movable contacts 17, resiliently mounted to said core as by spring 18 and cap 19 and adapted to engage stationary contacts 37 upon energization of the coil 16.

The lower end of said core 13 is provided with bottoming plates 20. Threaded into the lower end of the core 13 is a threaded rod 21, the lower end of said rod extending through an aperture 22 in the mounting plate 11. Fixed to the lower end of the threaded rod 21 is a cap 23 made of insulating material, the purposes of which will be more fully described hereinafter. A return spring 44 abutting the bottoming plates 20 and the upper

surface of support 11 will return the core to the position shown upon de-energization of the coil 16.

Depending from the plate 11 is a contact supporting block 25 made of insulation material. Fixed to said block, as by screws 26, is a leaf spring 27 bent into U form, the upper portion 28 of which is adapted to be engaged by the insulation cap 23. A control contact 29 is fixed to the under side of the leaf spring 27 at its center and in line with the core 13 and cap 23.

Fixed in a suitable manner beneath the platform 11 and within the casing, is a pressure responsive member, or aneroid, 30. Fixed to the top of said member, and insulated therefrom is an electrical contact 31 in alignment with and adapted to engage the electrical contact 29. A decrease in pressure within the casing will cause the aneroid to expand, bringing the contact 31 into engagement with the spring mounted contact 29. An increase in pressure will contract the aneroid to disengage the two contacts.

Referring now to Figure 2 of the drawings, the expansion of the pressure responsive member 30 will cause the contact 31 to engage the contact 29. Closure of the contacts 29, 31 will energize the solenoid coil 16 by the following circuit:

Through wire 32 connected to one side of a source of electrical energy 45, wire 33, the contacts 29, 31 and wire 34, through coil 16, wire 35 and thence through wire 36 connected to the other side of the source of electrical energy.

Energization of the solenoid 12 will cause an attraction of the armature 14 moving the core 13 downwardly. Movement of the core 13 will cause the movable contacts 17 resiliently mounted thereon to engage the stationary contacts 37 associated therewith. Closure of the contacts 17, 37 will complete an electrical circuit through a load 38, herein shown in block outline, but which may be any piece of electrical equipment to be controlled. The completed electrical circuit is through wire 32, contacts 17, 37, wire 39, through the load 38, and thence through the wire 36.

The downward movement of the core 13 will cause the insulated cap 23 to abut against the upper portion 28 of the leaf spring 27 flexing the same downwardly toward the aneroid 30. The increase in bias of the spring 27 will tend to maintain the contacts 29, 31 in engagement as the pressure responsive member 30 contracts due to an increase in pressure. The contacts will become disengaged at a higher pressure than that at which the contacts first closed. There is thus provided a pressure lag between the predetermined pressure value at which the load contacts are closed and at the predetermined pressure value at which the contacts again open.

Means are now provided to adjust the pressure value at which the load contacts 17, 37 are first closed and the pressure value at which they will open.

To this end, a threaded rod 40 is supported in the mounting plate 11, the lower portion of said rod being provided with a cap 41 made of insulating material. The cap 41 is adapted to abut against the upper portion 28 of the leaf spring 27. The length of the threaded rod 40 may be adjusted by means of a lock nut 42. The pressure upon the spring 27 may be varied by loosening the nut 42 and rotating the rod 40 until the proper length is attained and then tightening the same in place by means of the nut 42. The pressure upon the spring 27 will flex said spring about its support 25, increasing or decreasing the travel

required of the contact 31 to engage the spring mounted contact 29. Thus, the pressure at which the contacts 29, 31 are engaged may be varied to any desired predetermined value of pressure.

In furtherance of these ends, the length of threaded rod 21 may also be adjusted by means of a lock nut 24 threaded thereon, in a similar manner. The rod 21 may be adjusted by loosening the lock nut 24, screwing rod 21 until a proper length is attained, and then securing the rod by tightening the lock nut.

The travel of the solenoid core 13 being always the same, the degree with which spring 27 is flexed upon energization of the solenoid will depend upon the length of the rod 21. The longer the length of the rod, the greater will be the bias of the spring, thus increasing the pressure value at which the control contacts will open. A greater pressure lag will thus be obtained. A shorter length of rod 21 will bring the pressure value at which the contacts open closer to that at which the contacts first close, thus decreasing the pressure lag obtained.

It will be apparent to those skilled in the art, that the pressure responsive member 30 may be actuated by predetermined pressure differentials. The interior of said member instead of being evacuated, may be connected by an appropriate pressure line to one pressure source, while the exterior of said member subjected to another pressure source. In the use of the herein described pressure switch to control aircraft equipment, the interior of member 30 may be readily connected to the dynamic pressure line of a Pitot tube while the interior of the pressure tight casing in which the member is mounted may be connected to static pressure line of the Pitot tube, or vice versa.

Thus in the appended claims, the term "predetermined pressure," or its equivalent, will include the predetermined pressure affecting an evacuated member 30, and the predetermined differential in pressures of the interior and exterior of said member.

It will thus be seen that there is provided a switch arrangement in which the various objects are attained and which is well adapted to meet the requirements of practical use.

As various possible embodiments may be made of the invention set forth above, and as various changes may be made in the embodiment illustrated, it is to be understood that all matter set forth herein or shown in the accompanying drawings is to be interpreted as illustrative rather than in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressures, a pair of contacts adapted to be actuated by said member at a predetermined pressure value, a second pair of contacts, means adapted to actuate said last contacts upon actuation of said first contacts, resilient means associated with said first contacts, and means included in said actuating means to bias said resilient means to hold said first contacts actuated until a second predetermined pressure affects said member to restore said first contacts to their initial condition, whereupon said actuating means will restore said second contacts to their initial condition.

2. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressures, a pair of contacts

adapted to be actuated by said member at a predetermined pressure value, a second pair of contacts, a solenoid adapted to be energized upon actuation of said first contacts to actuate said second contacts, and resilient means associated with said first contacts, said last means being biased by the core of said solenoid upon energization thereof to hold said first contacts actuated until a second predetermined pressure affects said member to restore said first contacts to their initial condition to de-energize said solenoid.

3. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressures, a pair of contacts adapted to be actuated by said member at a predetermined pressure value, a second pair of contacts, a solenoid adapted to be energized upon actuation of said first contacts to actuate said second contacts, resilient means associated with said first contacts, said last means being biased by the core of said solenoid upon energization thereof to hold said first contacts actuated until a second predetermined pressure affects said member to restore said first contacts to their initial condition to de-energize said solenoid, and means for biasing said resilient means to adjust the pressure value at which said first contacts are actuated by said member.

4. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressures, a pair of contacts adapted to be actuated by said member at a predetermined pressure value, a second pair of contacts, a solenoid adapted to be energized upon actuation of said first contacts to actuate said second contacts, resilient means associated with said first contacts, said last means being biased by the core of said solenoid upon energization thereof to hold said first contacts actuated until a second predetermined pressure affects said member to restore said first contacts to their initial condition to de-energize said solenoid, means for biasing said resilient means to adjust the pressure value at which said first contacts are actuated by said member, and means associated with said solenoid for varying the bias on said resilient means upon energization of said solenoid to adjust the pressure value at which said first contacts are restored to initial condition.

5. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressure values, a contact movable therewith, a second contact adapted to be engaged by said first contact upon expansion of said member when a predetermined pressure affects said member, a resilient mounting for said second contact, a solenoid adapted to be energized upon engagement of said first and second contacts, a member on the core of said solenoid adapted to bias said resilient means upon energization of said solenoid to hold said first and second contacts engaged until a second predetermined pressure contracts said member to disengage said first contact from said second contact, and a set of contacts adapted to be closed upon energization of said solenoid.

6. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressure values, a contact movable therewith, a second contact adapted to be engaged by said first contact upon expansion of said member when a predetermined pressure affects said member, a resilient mounting for said second contact, a solenoid adapted to be energized upon engagement of said first and second contacts, a member on the core of said solenoid adapted to bias said resilient means upon energization of said solenoid to hold said first and second contacts engaged until a second predetermined pressure contracts said member to disengage said first contact from said second contact, a set of contacts adapted to be closed upon energization of said solenoid, and means for biasing said resilient means to vary the distance of travel of said first contact to adjust the pressure at which said first and second contacts are engaged.

7. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressure values, a contact movable therewith, a second contact adapted to be engaged by said first contact upon expansion of said member when a predetermined pressure affects said member, a resilient mounting for said second contact, a solenoid adapted to be energized upon engagement of said first and second contacts, a member on the core of said solenoid adapted to bias said resilient means upon energization of said solenoid to hold said first and second contacts engaged until a second predetermined pressure contracts said member to disengage said first contact from said second contact, a set of contacts adapted to be closed upon energization of said solenoid, means for biasing said resilient means to vary the distance of travel of said first contact to adjust the pressure at which said first and second contacts are engaged, and means for adjusting the length of said core member to vary the bias on said resilient means by said member upon energization of said solenoid to adjust the pressure value at which said first and second contacts are disengaged.

8. A pressure switch comprising, a pressure responsive member adapted to expand and contract under varying pressures, a contact movable therewith, a second contact adapted to be engaged by said first contact upon expansion of said member when a predetermined pressure affects said member, a resilient mounting for said second contact, a rod adjustable in length abutting said mounting for varying the pressure value at which said first contact engages said second contact, a solenoid adapted to be energized upon engagement of said first and second contacts, a rod adjustable in length on the core of said solenoid adapted to abut the resilient mounting of said second contact to hold said first and second contacts engaged until a second pressure determined by the length of said second rod contracts said member to disengage said first contact from said second contact, and a switch actuated upon the energization of said solenoid.

RICHARD SHAW, JR.

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