March 30, 1937. G. B. SAYRE 2,075,305

DIAPHRAGM CONTROLLED SWITCH

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FIG. 1.

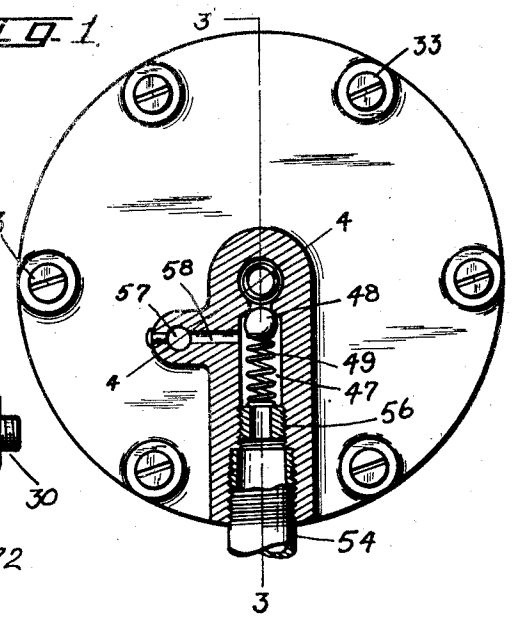
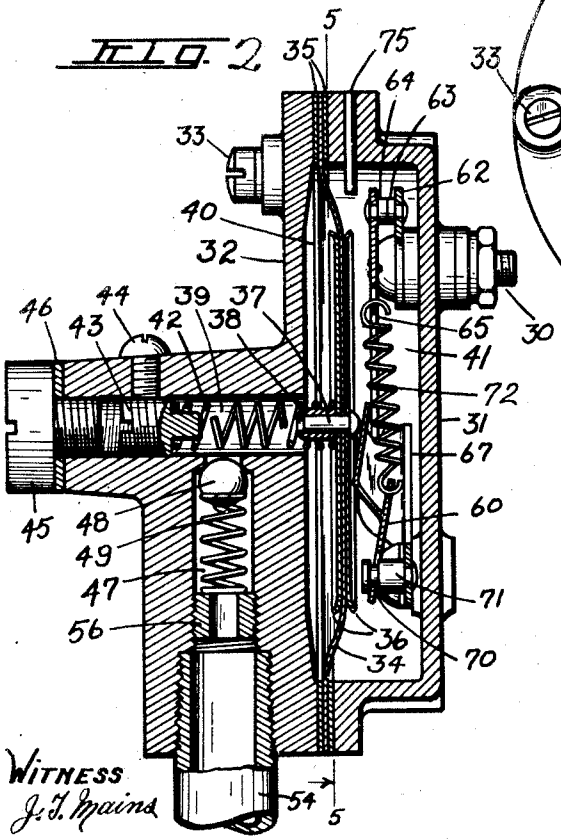


FIG. 2.



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Fig. 3.

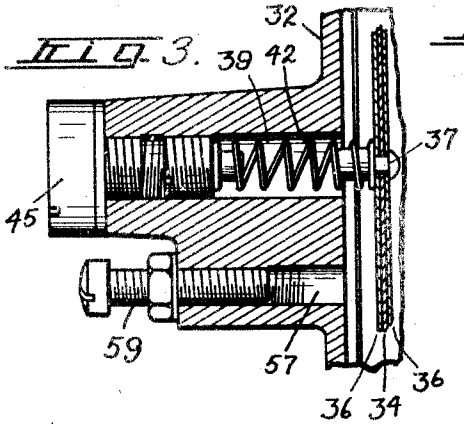


Fig. 4.

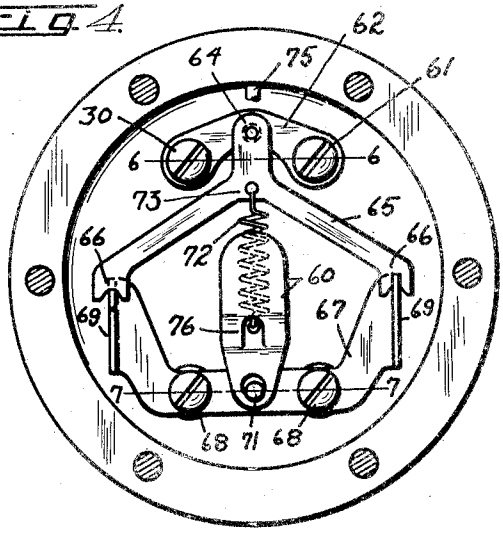


Fig. 5.

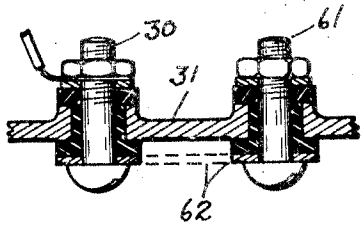


Fig. 6.

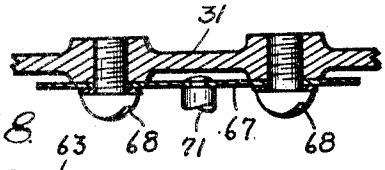


Fig. 7

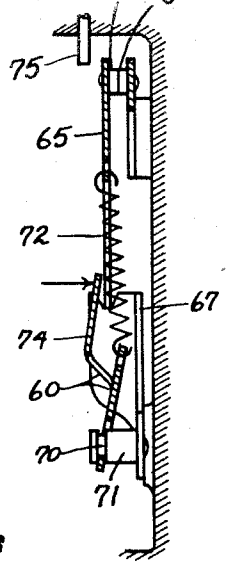
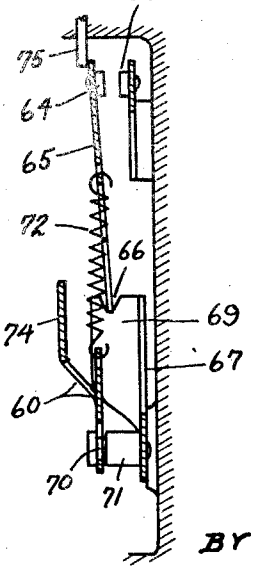


Fig. 8.



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UNITED STATES PATENT OFFICE

2,075,305

DIAPHRAGM CONTROLLED SWITCH

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Application November 20, 1931, Serial No. 576,319

6 Claims. (Cl. 200—83)

This invention relates to a diaphragm controlled switch.

One of the objects of the invention is to provide a switch actuated by a flexible diaphragm operable by sub-atmospheric pressure.

Another object of the invention is to provide a suction operated switch including a movable diaphragm actuated by suction for changing the position of a plurality of electrical contacts in order to control the energization of electrical circuits.

Other objects and advantages relate to the details of the structure, form and arrangement of the apparatus, all as will more fully appear from the following description taken in connection with the accompanying drawings, in which:—

Figure 1 is a plan view, partly in section, of the diaphragm controlled switch which is operated in accordance with engine conditions, in this instance, used as a sub-atmospheric pressure controlled switch.

Figure 2 is a sectional view taken along line 3—3 of Figure 1.

Figure 3 is an enlarged sectional view taken along line 4—4 of Figure 1.

Figure 4 is a sectional view taken along line 5—5 of Figure 2.

Figure 5 is a sectional view taken along line 6—6 of Figure 4.

Figure 6 is a sectional view taken along line 7—7 of Figure 4.

Figure 7 is a sectional diagrammatic view showing the electrical switching mechanism in its closed position.

Figure 8 is a sectional diagrammatic view showing the electrical switching mechanism in its open position.

The diaphragm controlled switch of the invention is particularly adapted to be used in connection with internal combustion engines and an embodiment of the invention is more specifically illustrated in Figures 1 to 8. In the preferred form, it comprises a cylindrical body 31 provided with a removable head 32 secured, in this instance thereto, by means of screws 33. Clamped between head 32 and cylinder 31 and sealed by gaskets 35 is a flexible diaphragm 34 of suitable material, as leather, rubber or materials known as fabrikoid composition, dividing the interior of the cylinder into two chambers 40 and 41.

In order to have the central portion of diaphragm 34 move in a positive and substantially parallel relation with respect to head 32, the diaphragm is stiffened by two co-axial circular disks 36 placed one on each side thereof and clamped in position by means of a pin 37 passing centrally through the disks and diaphragm and frictionally engaging a sleeve or collar 38. Head 32 of the diaphragm controlled switch is provided with a passage or port 39 connecting with chamber 40. The other end of passage 39 may be threaded to accommodate an adjusting screw 43 having its forward end reduced to engage one end of coil spring 42. The other end of spring 42 fits snugly over sleeve 38 thereby urging diaphragm 34 away from head 32.

An external screw 44 provides means for locking screw 43 after the desired adjustment of the tension of spring 42 has been made. Passage 39 may be sealed by means of a screw 45 and gasket 46. At right angles to passage 39 and connected therewith is a second passage 47 leading to the exterior of head 32.

The outer end of passage 47 is provided with internal threads for receiving a conducting pipe 54 which may be connected to the intake manifold of an engine. Passage 47 is slightly restricted at the junction point with passage 39 in order to provide a seat for ball valve 48 actuated by spring 49 which is, in turn, retained by an externally threaded collar 56 threaded into passage 47.

Passage 47 is normally closed, but as soon as a slight sub-atmospheric pressure is produced in the engine manifold, check valve 48 opens against the tension of spring 49 and air is withdrawn from chamber 40 through passage 39 thereby causing diaphragm 34 to move toward head 32 against the tension of spring 42. A bleed passage is provided around ball valve 48 comprising a passage 57 parallel to passage 39 extending to chamber 40 and a passage 58 at right angles to passages 47 and 57 and also connecting the same.

Passage 57 extends to the exterior of head 32 and is internally threaded to receive an adjusting screw 59 which, when screwed in or out, will regulate the opening between passages 57 and 58 and thereby, the rate of bleeding of chamber 40. Check valve 48 also provides protection for the sensitive diaphragm 34 against excessive pressure that may be set up in the intake manifold due to a back fire of an engine.

Within chamber 41 is located a snap switch controlled by the action of pin 37 in diaphragm 34 against a switch-actuating arm 60. Terminal 30 may be in the form of a bolt insulated from cylinder 31, as shown in Figure 5. A second bolt 61 similarly insulated, may be used in conjunction with terminal 30 for supporting a bridg-

ing member or contact carrier 62 upon which is mounted switch contact 63.

Contact 64 is carried by a Y-shaped switch arm 65. The extremities of the two symmetrical arms of switch arm 65 are provided with notches, as shown at 66. A U-shaped bracket 67 having its lateral ends bent at right angles to form projecting support 69 may be secured to the fixed head of cylinder 31 by screws 68, as shown in Figures 4 and 6.

The projecting supports 69 may be notched at their upper ends to receive the notched end 66 of switch arm 65 thereby providing a support that will permit the rocking of the switch arm 65. Switch actuating arm 60 may be seated at its lower end in an annular groove 70 formed near one end of post 71 mounted on U-shaped bracket 67, as shown.

A coil spring 72 is suspended from hole 73 in arm 65 to an opening 76 in arm 60. This spring maintains arm 65 in tight relation with the notched seats at 66 and in brackets 69. This spring also provides the necessary tension for the snap action in opening and closing contacts 63 and 64.

The opening and closing of contacts 63 and 64 is effected by the movement of actuating arm 60. It will be noted that arm 60 is provided with an offset portion 74 adapted to contact with pin 37 in diaphragm 34.

Figure 7 shows the switch in the closed position. The force of pin 37 on portion 74 of arm 60 is indicated by an arrow which shows that spring 42 is urging diaphragm 34 against arm 60 to effect a closing of contacts 63 and 64. Arm 60 pivots in groove 70 on post 71 thereby moving coil spring 72 to the right until the line of tension of the spring crosses to the right of the plane of switch arm 65. When this position is reached, switch arm 65 will snap sharply to the right, closing contacts 63 and 64. Now, when a partial vacuum is created in the engine intake manifold, diaphragm 34 will be drawn against the tension of spring 42 allowing lever 60 and coil spring 72 to return to their normal position, as shown in Figure 8. In so doing, the line of tension in spring 72 moves to the left past the plane of switch arm 65 and the latter snaps to the left separating contacts 63 and 64.

A stop member 75 secured to the wall of cylinder 31 limits the movement of switch arm 65 away from contact 63. It will be noted that contact 63 is carried by a member 62 which is insulated from cylinder 31. Contact 64 is carried by switch arm 65 which is directly in contact with bracket 67, the latter being grounded to the fixed head of cylinder 31.

When contacts 63 and 64 are closed, the electrical circuit is completed from terminal 30 to ground through the switch casing by way of the intake manifold of an engine.

If, for any reason, the engine should stall with the ignition on after the manifold reaches atmospheric pressure, air will bleed into chamber 40 through passages 58 and 57 which is restricted to the desired extent by adjusting screw 59. This restriction, caused by screw 59, is so proportioned that the engine will cease rocking before contacts 63 and 64 close under the actuation of spring 42. However, when the engine stops, spring 42 urges diaphragm 34 against actuating arm 60 which causes contacts 63 and 64 to close.

It will be apparent that the diaphragm controlled switch may be operated by and in accordance with internal combustion engine conditions, and although I have shown and described a vacuum operated diaphragm controlled switch, it will be apparent that such diaphragm controlled switch can be operated in various ways as, for instance, by oil pressure in the engine system, circulation of water in the cooling system, suction of air in the carburetor, suction produced by a separate vacuum pump driven from the engine, flow of gasoline to the carburetor, rotary motion produced by the crank shaft, air produced by the fan, pressure existing in the exhaust system or any combination of one or more of the above, and although I have shown and described a particular circuit arrangement and particular construction or relation, I do not desire to restrict myself to the details of form, construction or arrangement, as various changes and modifications may be made, without departing from the spirit of this invention as set forth in the appended claims.

I claim:

1. A diaphragm controlled switch comprising a casing, a removable head therefor, a flexible diaphragm retained between said head and said casing providing a suction chamber between said head and said diaphragm, a snap switch within said casing, a suction passage communicating from said suction chamber to the intake manifold of the engine for evacuating said chamber whereby said diaphragm is drawn toward said head, an adjustable member coacting with said diaphragm for opposing its movement toward said head, a check valve within said passage for sealing the same as soon as the engine stops, a bleed passage around said check valve, means accessible from the exterior of said casing for adjusting said bleed passage for setting the time interval for the return of said diaphragm to its normal position.

2. A diaphragm controlled switch comprising a cylindrical casing, a removable head therefor, a flexible diaphragm retained between said head and said casing providing a suction chamber between said head and said diaphragm, a snap switch within said casing having an actuating lever for opening and closing the switch contacts, a suction passage communicating from said suction chamber to the intake manifold of the engine for evacuating said chamber whereby said diaphragm is drawn towards said head, a resilient member located between said diaphragm and said casing for opposing movement of said diaphragm, means to adjust the tension of said resilient member, a check valve within said passage for sealing the same as soon as the engine stops, an adjustable bleed passage around said check valve for accurately setting the time interval for the return of said diaphragm to its normal position, said actuating lever being in contact with said diaphragm to open and close said switch in accordance with said movement of said diaphragm.

3. A diaphragm controlled switch comprising a casing, a removable head therefor, a flexible diaphragm retained between said casing and said head providing a suction chamber between said head and said diaphragm, a switch within said casing, an actuating lever therefor, resilient means for normally maintaining said diaphragm in contact with said actuating lever to maintain said switch in the closed position, means for adjusting said resilient means, a suction passage for subjecting the space between said diaphragm and said head to a sub-atmospheric pressure for withdrawing said diaphragm against said resilient means to effect an opening of said switch, a check

valve within said passage for sealing the same as soon as the pressure increases, and an adjustable bleed passage around said check valve for accurately setting the time interval for the return of said diaphragm to its normal position for closing said switch.

4. A diaphragm controlled switch comprising a cylindrical casing, a removable head therefor, a flexible diaphragm retained between said casing and said head, a snap switch within said casing, an actuating lever therefor, spring means for normally maintaining said diaphragm in contact with said actuating lever to maintain said switch in the closed position, means to adjust the tension of said spring means, means to lock in position said adjusting means, said head being provided with a passageway for subjecting the space between said diaphragm and said head to a sub-atmospheric pressure for withdrawing said diaphragm against said spring means to effect an opening of said switch, a check valve within said passageway for closing the same when the sub-atmospheric pressure is removed, and an adjustable bleed passage around said check valve to permit said diaphragm to return to its normal spring-pressed position after a predetermined time interval upon removal of said sub-atmospheric pressure.

5. A diaphragm controlled switch comprising a casing, a snap switch having two contacts within said casing, one of said contacts being insulated from and secured to said casing, the other contact being mounted on a rocking switch arm, a switch actuating lever resiliently connected to said switch arm, a diaphragm within said casing, a spring member between said diaphragm and said casing for urging said diaphragm in contact with said switch actuating lever, said spring member also acting to oppose movement of said diaphragm toward or away from said casing, and means accessible from the exterior of said casing for adjusting said spring member.

6. A diaphragm controlled switch comprising a casing, a snap switch within said casing comprising two contacts, one of which is insulatingly mounted to said casing, a rocking switch arm for carrying the other switch contact and having two diverging extensions, the extremities of which are provided with notches, a support member secured to said casing having two spaced notches, the planes of which are at right angles to and are adapted to respectively operatively engage the notches on said switch arm extensions, a switch actuating lever resiliently connected between said support member and said switch arm for actuating the latter and for maintaining it seated in the notch support, a diaphragm within said casing normally spring-pressed to contact with said switch-actuating lever to maintain said switch contacts closed, said diaphragm dividing said casing into two chambers, one of which is a suction chamber and the other a chamber for retaining said switch, a suction passage communicating from said suction chamber to the intake manifold of the engine for evacuating said chamber whereby said diaphragm is withdrawn from said actuating lever, a check valve within said passage for sealing the same as soon as the engine stops, a bleed passage around said check valve and means accessible from the exterior of said casing for accurately setting the time interval for the return of said diaphragm to its normal position for closing said contacts.

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