

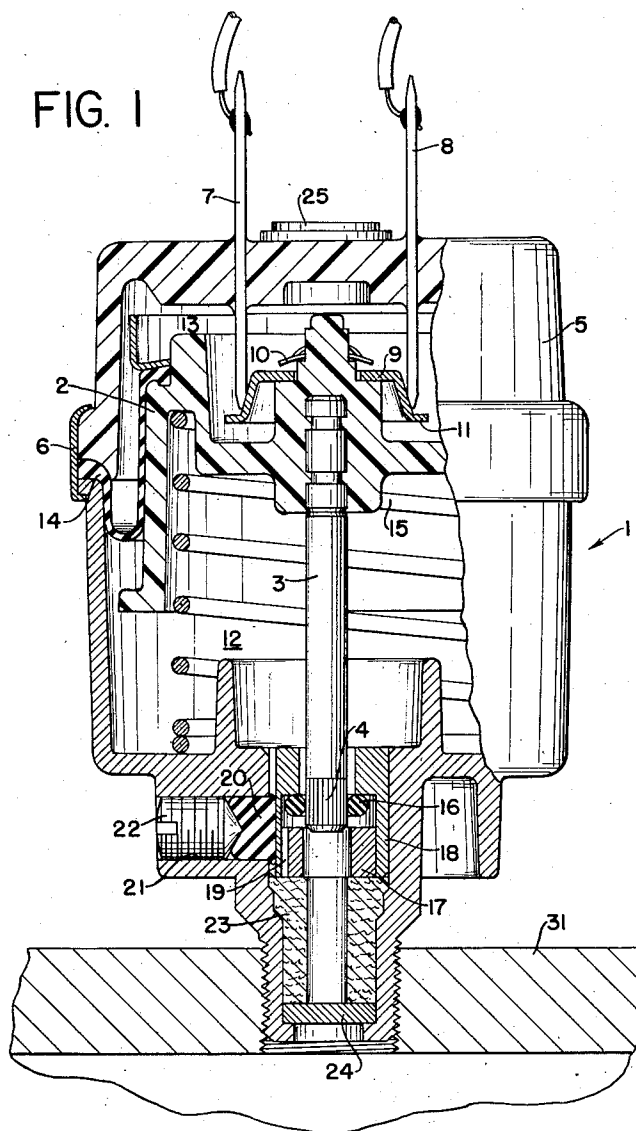
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C. B. SMITH
VACUUM OPERATED SWITCH

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2 Sheets-Sheet 1



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FIG. 2

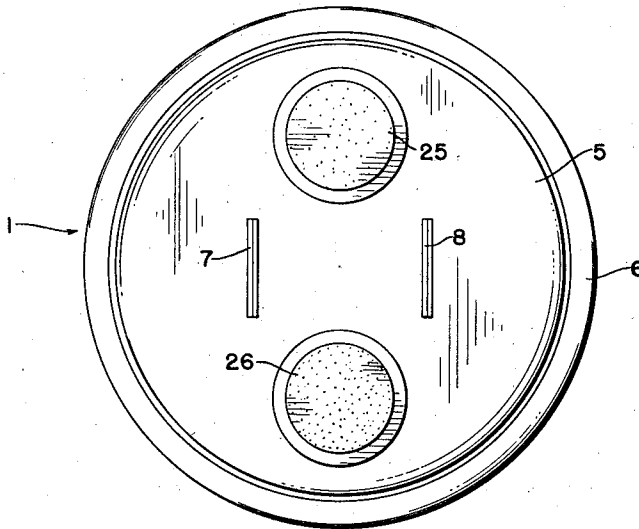
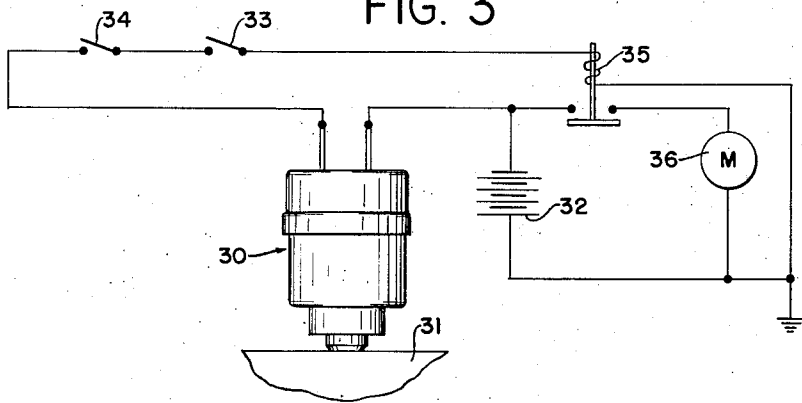


FIG. 3



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VACUUM OPERATED SWITCH

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This invention relates generally to a pressure operated switch and more particularly to a switch operated by a pressure differential existing between a partial vacuum and atmospheric pressure. This pressure operated switch is particularly adaptable for use in the electrical system of an automobile having an automatic transmission to provide an automatic closure of the starting circuit when the engine of the automobile is stalled and when the transmission is in neutral.

A commonplace problem existing in automobiles having automatic transmissions is that in heavy traffic the engine often stalls so that in order to re-start the engine, the transmission lever must first be brought to neutral and the starter button depressed or ignition key turned sufficiently to close the starting circuit. During heavy traffic and particularly among novice drivers, the re-starting procedure of the engine becomes difficult. I propose to make the starting procedure in the event of an inadvertent stall of the engine easier by providing means which will start the engine automatically when the gear shift is put in neutral and which will eliminate the necessity of depressing a starter button or turning the ignition key to close the starting circuit.

I further propose to provide for a new type of electrical switch which will overcome the disadvantages of arcing and subsequent pitting of the electrical contacts. Broadly I propose to include in an electrical system of an automobile, a pressure operated switch which will close the starting circuit of an automobile when the ignition switch is "on" and when the gear shift lever is in a neutral position and which will break the circuit when the engine is running. I provide for a piston movable in a cylinder and which defines with the cylinder a pressure or vacuum chamber and a contact chamber. The piston has a conductor mounted on one end for completing an electrical circuit between two contacts mounted at one end of the cylinder and extending into the contact chamber. The vacuum chamber is connected to the intake manifold of the engine so that when the engine is running, less pressure will exist in the pressure chamber of the switch than in the contact chamber. The resulting pressure differential will cause the piston to move towards the portion of the cylinder defining the vacuum chamber to break the electrical circuit between the contacts to thus break the starting circuit. A spring biases the piston toward the contacts to close the circuit when the engine is not running.

Further, I provide for a check valve to be inserted between the vacuum chamber and the intake manifold so that air may be quickly exhausted from the vacuum chamber when the engine is running and, when the engine is not running, will prevent flow of air back into the vacuum chamber. Around this check valve I provide a metering or bleed passage by which air may bleed back into the vacuum chamber when the check valve is closed and when the engine is not operating.

I provide also for a novel conductor which may overcome the disadvantageous effects of arcing when coming

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into engagement with the electrical contacts. This conductor comprises a conical cup shape chamber made of an electrical conducting material having a flared edge. The conductor is adapted to come into engagement with the contacts so that the contacts will initially engage the conical side walls of the cup shape member. As the piston carrying the conductor moves further towards the contacts, the contacts will finally engage the flared edge of the cup. By this means a wiping action is achieved between the contacts and the conductor so that a good electrical contact is achieved and arcing along with resultant pitting is minimized.

Referring to the drawings in which a preferred embodiment of my invention is illustrated,

Fig. 1 is a sectional view of a pressure operated electrical switch adapted to be used in the starting circuit of an automobile;

Fig. 2 is an end view of the electrical switch of Fig. 1, and

Fig. 3 is a schematic illustration of my novel starting switch as applied to a typical starting circuit of an automobile.

Referring to the figures in greater detail, 1 is a body of a starting switch made out of an easily cast material such as aluminum. A piston 2 also made of a molded material is movably mounted in body 1 and has connected therewith a rod 3 having a serrated end 4. A cap 5 is mounted on the end of the body 1 by means of a closing ring 6. Contacts 7 and 8 are embedded in cap 5 and are adapted to connect with the starting circuit of an automobile as explained more completely hereafter.

A cup shape conductor 9 is loosely mounted on the end of piston 2 by means of retainer 10. Conductor 9 is conical shaped so that when the piston 2 moves toward the contacts 7 and 8 the conductor will initially engage the conical portion of the cup and when the piston moves completely toward the contacts, the flared portion 11 of the conductor will engage the contacts. Thus it is seen that as the conductor engages the contacts, there will be a wiping motion between the conductor and contacts which will wipe away the corrosive oxides formed by arcing and so improve electrical conductivity between the parts and will at the same time reduce arcing. Conductor 9 is self aligning with respect to contacts 7 and 8 since it is loosely mounted on the end of piston 2. This will insure positive engagement of the contacts with the conductor without the use of precision machined parts.

The piston 2 defines with the cylinder and cap a pressure chamber 12 and a contact chamber 13. The chambers are separated by means of a bellows 14 so that there may be no leakage of air from one chamber to the other and which obviates the necessity of an accurate fit of the piston in the cylinder. A spring 15 biases the piston toward the contacts when pressure in both chambers is substantially equal.

A check valve comprising an O ring 16, a valve collar 17 and a valve body 18 is provided at one end of the vacuum chamber to restrict the flow of air in one direction while allowing unrestricted flow in the opposite direction. It is seen that when the piston moves up as shown in Fig. 1 under the influence of spring 15, the O ring 16 will be pushed over the serrated portion 4 of the rod 3 by contact with valve body 18. When a negative pressure exists in the pressure chamber, air will be drawn quickly out of the pressure chamber 12. The differential then existing between the pressure chamber and the atmospheric pressure in the contact chamber will force the piston 2 to move down as shown in Fig. 1 against the force of the spring 15. This movement of the piston down will cause the O ring 16 to come in contact with the valve collar 17 and to slide over to the smooth portion of the rod 3

to prevent any further passage of gas through the check valve.

A bleed or metering passage 19 by-passes the check valve to allow pressure to seep back into the pressure chamber when the engine is stalled and when the pressure in the intake manifold rises to atmospheric. A regulating device is included in the bleed passage which comprises a rubber ball 20 fitted into a tapped hole 21. The rubber ball is forced into the passage way to restrict it by means of a set screw 22. It is seen that as the set screw is screwed further into the tapped hole 21, it will force the rubber ball to further restrict passage-way 19 and so regulate the passage of air or the fluid through it. By this means, the time of closure of the starting circuit may be regulated to insure that the engine will not be moving when the circuit closes and so prevent damage to the ring starting gear.

A felt filter 23 filters passage of air from the intake manifold through the bleed passage. This filter may be treated with a water repellant substance so as to obliterate or minimize moisture in the pressure chamber which might turn to ice and so prevent operation of the switch.

A filter 24 prevents dirt from entering the intake manifold into the switch which might block passage-way 19 or the check valve. Filters 25 and 26 are provided in the cap 5 in order to filter dirt from the atmospheric air entering the contact chamber.

Referring to Fig. 3, there is illustrated schematically an electrical diagram in which my novel starting switch is included. The switch denoted generally by 30 is connected to a source of vacuum pressure 31 such as the intake manifold of an automobile. The electrical circuit is further provided with a source of electrical current such as a battery 32, an ignition switch 33 and a switch 34 which is connected to the gear shift of the automobile. Switch 34 is so constructed that the switch will be closed only when the gear shift of an automobile having an automatic transmission is in a neutral position. A relay 35 is provided to connect and close the circuit connecting the starter motor 36 with the battery 32.

It is thus seen that when ignition switch 33 is closed and switch 34 is closed by the gear shift being in neutral and when the engine is stalled, an electrical circuit will be completed so as to operate relay 35. This in turn will complete the circuit between the starting motor 36 and the battery 32 so causing the starting motor to start the engine.

When the engine is started a negative pressure will be built up in the intake manifold so as to move the piston in my novel switch and break contact with the starting circuit. When the starting circuit has been broken, relay 35 will open to cause a break in the circuit connecting the starting motor and the battery.

If the engine stalls, then atmospheric air will bleed back through passage 19 to allow spring 15 to again move the piston so that the conductor completes the circuit between the contacts. The time for this build up of pressure to atmospheric in the pressure chamber will be such as will insure that the engine is stopped moving before the starting circuit is closed.

While I have shown my novel pressure switch in an automobile electrical circuit, it is obvious that a switch may be used in any system in which there may exist a pressure differential and where it is desired to have a positive acting switch with a minimum of arcing between contacts.

It is thought that the invention and its many attendant advantages will be understood from the foregoing de-

scription and that it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the scope of the invention.

I claim:

1. A pressure operated electrical switch comprising a cylinder, a reciprocally movable piston in said cylinder defining therewith a pressure chamber and a contact chamber, electrical contacts extending through said cylinder into said contact chamber, conductor means mounted on the end of said piston adapted to engage said contacts at one extreme limit of reciprocal travel of said piston, means biasing said piston toward said contacts, passage means connecting said pressure chamber to a source of pressure fluid, check valve means inserted in said passage means for preventing flow of pressure fluid from said source to said pressure chamber when said contacts are out of engagement with said conductor, and adjustable bleed means by-passing said check valve for allowing fluid to meter from said source to said pressure chamber; said adjustable bleed means comprising a conduit extending between said pressure chamber and source, a tapped hole extending through said cylinder into said conduit, a pliable substance at the bottom of said tapped hole partially restricting said conduit and an adjustable screw in said tapped hole for regulating the restriction of said conduit by said pliable substance.

2. A pressure operated electric switch comprising a cylinder, a reciprocally movable piston in said cylinder defining therewith a pressure chamber and a contact chamber, electric contacts extending through said cylinder into said contact chamber, conductor means mounted on the end of said piston adapted to engage said contacts at one extreme limit of reciprocal travel of said piston, means biasing said piston towards said contacts, passage means connecting said pressure chamber to a source of pressure fluid, and check valve means inserted in said passage means for preventing flow of pressure fluid from said source to said pressure chamber when said contacts are out of engagement with said conductor; said check valve means comprising a rod serrated at one end and connected at its other end to said piston, a collar adapted to closely surround said rod, a valve body spaced on said collar and closely surrounding said rod, an "O" shaped ring slidably mounted on said rod so that said "O" ring engages said serrated portion of said rod and said body when said conductor engages said contacts at one limit of reciprocal travel of said piston and engages an unserrated portion of said rod and said collar when said piston is at an opposite extreme limit of reciprocal travel.

3. A pressure operated electrical switch according to claim 2 wherein said conductor is loosely mounted on said piston in order that it may be self aligning when in engagement with said contacts.

References Cited in the file of this patent

UNITED STATES PATENTS

586,561	Mosher	July 20, 1897
1,852,818	Miscera	Apr. 5, 1932
1,964,155	Hobbs	June 26, 1934
2,045,274	Kundig	June 23, 1936
2,125,379	Kearney	Aug. 2, 1938
2,208,884	Herbster	July 23, 1940
2,258,427	Smith	Oct. 7, 1941
2,584,478	Lindenmuth	Feb. 5, 1952
2,620,630	Bitzer	Dec. 9, 1952
2,705,123	Hieger	Mar. 29, 1955