Feb. 19, 1957 R. T. CORNELIUS 2,782,272

SWITCH MECHANISMS

Filed May 7, 1953

FIG. 2

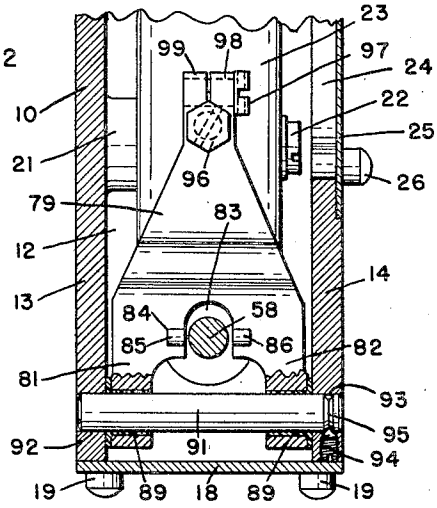
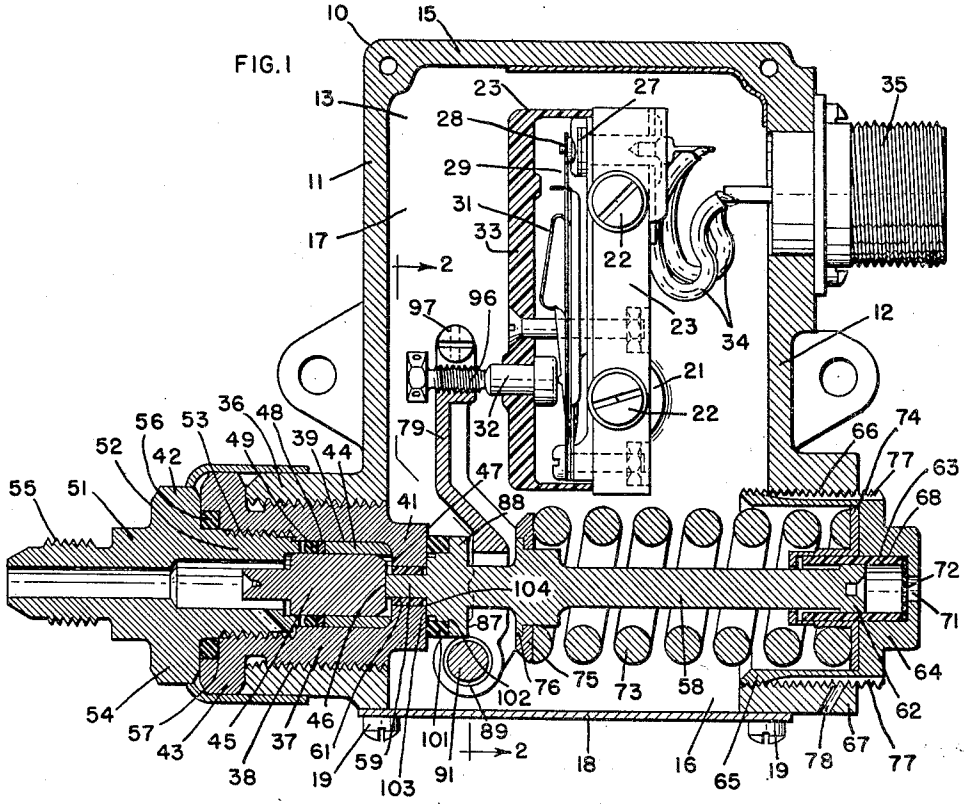


FIG. 1



INVENTOR

RICHARD T. CORNELIUS

BY Caswell & Lagaard

ATTORNEYS

United States Patent Office 2,782,272 Patented Feb. 19, 1957

2,782,272

SWITCH MECHANISMS

Richard T. Cornelius, Minneapolis, Minn.

Application May 7, 1953, Serial No. 353,584

7 Claims. (Cl. 200—82)

The herein described invention relates to fluid pressure operated switch mechanisms and has for an object to provide a mechanism capable of operating on high pressure and high over pressure.

Another object of the invention resides in providing a switch mechanism utilizing a case having a switch therein and supporting a cylinder with a piston slidably mounted in the same, said piston being subject to the pressure of the fluid and in further providing a mechanism in which the travel of the piston is relatively small.

Another object of the invention resides in providing a plunger having a stem engaging the end of the piston and operated thereby and in providing a spring engaging said plunger and urging the same into engagement with the piston.

An object of the invention resides in providing an end wall for the cylinder and in constructing the plunger with a stem extending through the end wall and engaging the piston.

Another object of the invention resides in providing a bushing in the end wall constructed of polymerized tetrafluoro ethylene and guiding said plunger for reciprocating movement in the direction of movement of said piston.

An object of the invention resides in constructing said end wall with stops on opposite faces thereof and said piston with an end engaging one of said stops and said plunger with a shoulder engaging the other of said stops for limiting the movement of said plunger and piston.

Another object of the invention resides in constructing the plunger with a flange formed with a shoulder thereon and in providing a lever pivoted to the case and having a fulcrum engaging said shoulder and causing movement of said switch upon operation of the plunger.

A feature of the invention resides in constructing said lever with spaced legs straddling said plunger and a fulcrum having two parts, one on each of said legs and engaging said shoulder, said lever serving to operate the switch upon movement of the fulcrum.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is a longitudinal sectional view of a fluid pressure operated switch mechanism illustrating an embodiment of the invention and taken substantially through the center of the same.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1.

In the drawings a case has been shown in which is mounted a switch comprising a fixed contact and a movable contact operated by a movable button. Below the switch and formed on the case is a boss in which is screwed an insert having a bore. In this bore is mounted a liner forming a cylinder and in the cylinder is a slidable piston. A fitting connected to the insert conducts fluid under pressure into the cylinder to urge movement of the piston toward the end of the cylinder. At one end of the cylinder is provided a wall and on the inner side of the wall is a stop adapted to be engaged by the piston to

limit the movement thereof. Disposed within the case and in axial alignment with the piston is a plunger. This plunger has at one end a stem slidably received in a bushing mounted in the end wall of the insert and the said stem is adapted to be engaged by the end of the piston whereby the plunger is moved by the action of the piston. The other end of the plunger has a portion which is slidably mounted in another bushing fixed relative to the case. Both of these bushings are constructed of polymerized tetrafluoro ethylene. A compression coil spring acting at one end against a part fixed relative to the case acts against another part mounted on the plunger and urges the stem into engagement with the piston. A lever disposed within the case is pivoted to the case and has two legs straddling the plunger. This lever has a fulcrum, parts of which are disposed on said legs, and which engages a shoulder formed on a flange on the plunger. The said lever engages the button of the switch and serves to operate the same as the lever is moved by the motion of the plunger.

The invention consists of a case 10 comprising end walls 11 and 12, side walls 13 and 14, and a top 15. These parts may be made as a casing if desired. The lowermost portion of the case is provided with an opening 16 through which access may be had to the chamber 17 within the same. The opening 16 is closed by means of a cover 18 which is held attached to the case by screws 19 extending through said cover and screwed into the walls of the case. The wall 14 of case 10 has an opening 24 which is closed by means of a cover 25. This cover is attached to the wall 14 by means of screws 26 in the same manner as the cover 18.

Formed on the side wall 13 of the case are bosses 21, Fig. 2, which are threaded to receive screws 22. These screws extend through a switch 23 and attach the switch to the case proper. The switch 23 includes a fixed contact 27 and a movable contact 28 mounted on a swinging arm 29. The arm 29 is operated by means of an overcenter spring lever 31 which is adapted to be actuated by a button 32. The entire switch is mounted in a housing 33 and the button 32 is slidable and projects outwardly beyond said housing. A switch in which the moving part travels an extremely short distance is employed and one in which the contact 28 is moved into and out of engagement with the contacts 27 through a snap action. However, such switches being well known in the art, switch 23 has not been described in detail, and any suitable construction may be used for the purpose. The contacts 27 and 28 are connected by means of conductors 34 to suitable terminals in an electrical fitting 35 attached to the wall 12 of case 10. Suitable connections may be made with these terminals and attached to the fitting 35 whereby the switch may be connected to any suitable circuit with which it is to be used.

The wall 11 has formed on it a boss 36 which is bored and threaded as indicated at 38 to receive an insert 37. The insert 37 is constructed with a bore 39 situated centrally of the same and which is partially closed at one end by means of an end wall 41 formed on the end of said insert. This wall projects inwardly into the chamber 17 in the case 10. The insert 37 is constructed with a head 42 having a hexagonal wrench engaging portion 43. This head butts up against the end of the boss 36 and forms a fluid-tight connection therewith. Received within the bore 39 in insert 37 is a liner 44 which serves as a cylinder and in which is slidably mounted a piston 45. Piston 45 has an end 46 which is adapted to engage a stop 47 formed by the inner surface of the end wall 41. Disposed within the bore 39 and encircling piston 45 is a back-up washer 48 and an O-ring 49. This construction forms a fluid-tight joint between the piston 45 and the insert 37. Attached to the end of the insert 37 is a

tube fitting 51 adapted to be connected to a tube leading from the source of fluid used to operate the switch. The fitting 51 has a shank 52 which is threaded to screw into threads 53 in the insert 37. This fitting has a hexagonal head 54 by means of which the same may be screwed in position and terminates in a threaded portion 55 adapted to be connected to the tube with which it is associated. An O-ring 56 encircling the shank 52 of fitting 51 and received in an annular recess 57 in insert 37 maintains a tight joint between said fitting and insert.

Disposed within the chamber 17 of case 10 and at the lowermost portion of the same is a plunger 58. This plunger is formed at one end with a stem 59 which is slidably mounted in a bushing 61 received in the end wall 41 of insert 37. This stem extends completely through said end wall and is engaged by the piston 45. The other end of the plunger 58 is provided with a portion 62 which is slidably mounted in another bushing 63 and which is of greater diameter than the adjoining portion to form an enlargement at the end of the same. This bushing is carried by a threaded sleeve 65 formed on a cap 64. The said sleeve is screwed into a threaded hole 66 formed in a boss 67 issuing outwardly from wall 12 of case 10. The cap 64 has a bore 68 in the same and in which the bushing 63 is mounted. An opening 71 is formed in the cap 64 and which is covered by a screen 72. By means of this construction air may enter and leave the interior of the bushing 63 as the portion 62 of the plunger 58 travels. The plunger 58 is urged in the direction of the piston 45 by means of a compression coil spring 73. This spring is seated at one end against a spring seat 74 mounted on the cap 64 and encircling the bushing 63. The other end of this spring is seated against a washer 75 encircling the plunger 58 and reacting against a flange 76 formed on said plunger. The pressure exerted by the spring 73 may be varied as required by screwing the cap 64 in the threaded hole 66 of boss 68. The cap 64 may be held locked in position by means of a key, not shown in the drawings, and which is adapted to extend through one of a number of keyways 77 formed in the sleeve 65 and through an opening 78 in the boss 68.

For the purpose of operating the switch 23, a lever 79 is employed. This lever has two spaced legs 81 and 82 which straddle the plunger 58 and which provide an opening 83 between the same and through which the said plunger extends. On the legs 81 and 82 of said lever is formed a fulcrum indicated in its entirety by the reference numeral 84, and which has two parts 85 and 86 extending outwardly therefrom and disposed one on each of said legs. This fulcrum is adapted to engage a shoulder 87 formed on a flange 88 extending outwardly from the plunger 58. The legs 81 and 82 of the lever 79 are bored to receive bushings 89 and which are rotatably mounted on a shaft 91 secured to the walls 13 and 14 of the case 10. This shaft extends through holes 92 and 93 in the said walls and a set screw 94 screwed into the wall 14 engages in a groove 95 in one end of the shaft 91 and holds the same properly mounted. The bushings 61 and 63 and the bushings 89 are all constructed of polymerized tetrafluoro ethylene whereby lubrication of the parts becomes unnecessary. An adjusting screw 96 is threaded in the free end of the arm 79 and engages the button 32. A lock screw 97 extends through an ear 98 on the lever 79 and is screwed into another ear 99 in said lever. These ears are disposed adjacent the lock screw 97 and serve to clamp the same from movement.

The movement of the plunger 58 is extremely limited and to prevent the entry of dust from the chamber 17 in case 10 and into the cylinder 44, a sleeve or gasket 101 of flexible material such as rubber or the like is employed. This sleeve is received within an annular rabbet 102 in the flange 88 of plunger 58 and closely fits against this flange and against the outer surface 103 of the end wall 41. This surface forms a stop against which a shoulder 104 on flange 88 may abut. The sleeve 101 is of a length slightly greater than the distance of travel of the plunger 58 so that the said sleeve is always under compression. The said sleeve is sufficiently resilient so that the space between the flange 88 and the end wall 41 is always closed thereby preventing dust or foreign material from entering the cylinder 44. Sleeve 101 is constructed of silicone rubber which is water repellant and not affected by frost.

The operation of the invention is as follows: Cap 64 is adjusted until the spring pressure of the spring 73 is sufficiently great to give the desired pressure at which the switch 23 is to be operated. Stem 59 is urged by spring 73 away from the lever 79 as viewed in Fig. 1 and in opposition of the pressure of the fluid entering cylinder 44. When the pressure of the fluid rises sufficiently in said cylinder, the piston 45 is moved to the right, and the lever 79 through contact of the fulcrum 84 the flange 88 moves the button 32 inwardly and closes the switch 23. Switch 23 being a snap action switch rapidly opens or closes as the case may be and makes or breaks the current through the circuit being controlled by the switch. The plunger 58 slides in the bushings 63 and 61 and is guided for movement thereby in the same direction as piston 45. When the pressure drops the action is reversed and the switch opens.

The advantages of the invention are manifest. The travel of the plunger is very slight and the space between the plunger and the case can be closed to prevent the entry of dust or frost into the cylinder by the use of the resilient sleeve disposed between the same. By adopting bearings constructed of polymerized tetrafluoro ethylene, the friction of the moving parts is a minimum and at the same time no lubrication on the moving parts is required. Also binding due to frost is eliminated. By arranging the parts as shown, the end wall of the insert provides stops for limiting the movement of the plunger and the piston and confines the movement of the lever 79 sufficiently to just open and close the switch 23. With the invention, extremely high pressures may be regulated and the amount of over pressure does not effect the operation of the device.

Changes in the specific form of the invention, as herein described, may be made within the scope of what is claimed without departing from the spirit of the invention.

Having described the invention, what is claimed as new and desired to be protected by Letters Patent is:

1. In a fluid pressure operated switch mechanism, a case, an insert mounted in said case and having an annular wall and an end wall, means forming a cylinder in said annular wall, said end wall providing a surface within said cylinder extending inwardly of said cylinder to form a stop, a piston slidable in said cylinder and engageable with said stop, a fitting carried by said case and conducting fluid into said cylinder to urge said piston against said stop, a plunger disposed within said case in coaxial alignment with said piston, guide means carried by said case and guiding one end of said plunger for axial movement in said case, a stem on the other end of said plunger, guide means carried by said insert and receiving said stem to further guide said plunger for reciprocating movement, said piston engaging said stem and urging said plunger for movement away from said fitting, a compression coil spring acting between a part fixed relative to said case and said plunger and resisting movement of said plunger by said piston, said end wall providing another surface within said case encircling said plunger and forming a second stop, means forming a shoulder on said plunger engageable with said second stop and a switch operated by said plunger.

2. In a fluid pressure operated switch mechanism, a case, an insert mounted in said case and having an annular wall and an end wall, means forming a cylinder in said annular wall, said end wall providing a surface within said cylinder extending inwardly of said cylinder to form

a stop, a piston slidable in said cylinder and engageable with said stop, a fitting carried by said case and conducting fluid into said cylinder to urge said piston against said stop, a plunger disposed within said case in coaxial alignment with said piston, guide means carried by said case and guiding one end of said plunger for axial movement in said case, a stem on the other end of said plunger, guide means carried by said insert and receiving said stem to further guide said plunger for reciprocating movement, said piston engaging said stem and urging said plunger for movement away from said fitting, a compression coil spring acting between a part fixed relative to said case and said plunger and resisting movement of said plunger by said piston, said end wall providing another surface within said case encircling said plunger and forming a second stop, means forming a shoulder on said plunger engageable with said second stop, a switch operated by said plunger, the distance between the portion of said piston engageable with said first stop and the shoulder on said plunger engageable with said second stop being substantially equal to the distance between said stop plus the length of travel of said plunger necessary to operate said switch.

3. In a fluid pressure operated switch mechanism, a case, a switch within said case, means carried by said case and providing a cylinder, a piston in said cylinder, means for conducting a fluid under pressure to said cylinder, a plunger disposed in axial alignment with said piston and having at one end a stem engaging said piston, a bushing constructed of polymerized tetrafluoro ethylene carried by said case and receiving one end of said stem, a similar bushing carried by said case and receiving the other end of said plunger, said bushings guiding said plunger for movement in the direction of movement of said piston, resilient means acting between said plunger and a part fixed relative to said case and urging said plunger and piston for movement in opposition to the movement produced by the pressure in said cylinder and means acting between said plunger and switch for operating said switch upon movement of said plunger.

4. In a fluid pressure operated switch mechanism, a case, a switch within said case, means carried by said case and providing a cylinder, a piston in said cylinder, means for conducting a fluid under pressure to said cylinder, a plunger disposed in axial alignment with said piston and having at one end a stem engaging said piston, a bushing constructed of polymerized tetrafluoro ethylene carried by said case and receiving said stem, a similar bushing carried by said case and receiving the other end of said plunger, said bushings guiding said plunger for movement in the direction of movement of said piston, resilient means acting between said plunger and a part fixed relative to said case and urging said plunger and piston for movement in opposition to the movement produced by the pressure in said cylinder, means acting between said plunger and switch for operating said switch upon movement of said plunger and a sleeve of resilient material interposed between a part on said plunger and a part fixed relative to said case and being compressible to the extent of the movement of said plunger and being of a length substantially equal to the maximum distance between said parts.

5. In a fluid pressure operated switch mechanism, a case, a switch within said case, means carried by said case and providing a cylinder, a piston in said cylinder, means for conducting a fluid under pressure to said cylinder, a plunger disposed in axial alignment with said piston and having at one end a stem engaging said piston, a bushing carried by said case and receiving said stem, a similar bushing carried by said case and receiving the other end of said plunger, said bushings guiding said plunger for movement in the direction of movement of said piston, resilient means acting between said plunger and a part fixed relative to said case and urging said plunger and piston for movement in opposition to the movement produced by the pressure in said cylinder, means acting between said plunger and switch for operating said switch upon movement of said plunger and a sleeve of resilient material interposed between a part on said plunger and a part fixed relative to said case and being compressible to the extent of the movement of said plunger and being of a length substantially equal to the maximum distance between said parts.

6. In a fluid pressure operated switch mechanism, a case, a switch within said case and having a movable member, a plunger within said case, guide means in said case engaging said plunger and guiding said plunger for reciprocating movement, a lever within said case, pivot means in said case for guiding said lever for swinging movement, said lever having an arm engaging the movable member of said switch and upon movement operating said switch, means forming a shoulder on said plunger, a fulcrum on said lever engaging said shoulder, resilient means acting between a part fixed relative to said case and said plunger and urging said shoulder for movement in one direction, means forming a second shoulder on said plunger and facing in the opposite direction from said first named shoulder, a stop in said case engageable with said second shoulder, fluid pressure responsive means carried by said case and engaging said plunger to move the same in a manner such that said second shoulder travels in a direction away from said stop to operate the switch and a compressible gasket between said plunger and said case and encircling said second shoulder and engaging said stop and plunger, said gasket remaining in engagement with said stop and said plunger throughout the movement of said plunger to close the space between said plunger and fluid pressure responsive means to prevent entry of dust or frost from the interior of said case and into said fluid pressure responsive means.

7. In a fluid pressure operated switch mechanism, a case, a switch within said case, means carried by said case and providing a cylinder, a piston in said cylinder, means for conducting a fluid under pressure to said cylinder, a plunger disposed in axial alignment with said piston and having at one end a stem engaging said piston, a bushing constructed of polymerized tetrafluoro ethylene carried by said case and receiving one end of said stem, said plunger being reduced in diameter adjacent said end of the stem to form an enlargement slidable along said bushing, said enlargement being shorter than said bushing and remaining at all times within said bushing, a similar bushing carried by said case and receiving the other end of said plunger, said bushings guiding said plunger for movement in the direction of movement of said piston, resilient means acting between said plunger and a part fixed relative to said case and urging said plunger and piston for movement in opposition to the movement produced by the pressure in said cylinder and means acting between said plunger and switch for operating said switch upon movement of said plunger.

References Cited in the file of this patent

UNITED STATES PATENTS

1,264,422	Moard	Apr. 30, 1918
2,033,417	Dezotell	Mar. 10, 1936
2,072,984	Haskins	Mar. 9, 1937
2,404,843	Huber	July 30, 1946
2,429,440	White	Oct. 21, 1947
2,435,143	Knauth	July 27, 1948
2,492,261	Bordelon	Dec. 27, 1949
2,507,065	Trautman	May 9, 1950
2,529,688	Grupp	Nov. 14, 1950

FOREIGN PATENTS

657,080	Great Britain	Sept. 12, 1951