Aug. 18, 1964 G. E. GRIGGS 3,145,278

COMBINED LINEAR AND ROTARY ACTUATOR MEANS FOR SWITCH

Filed July 1, 1960

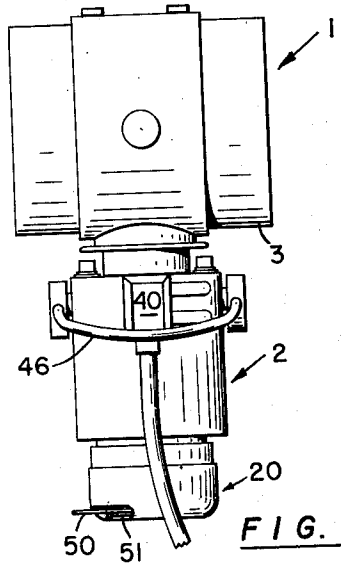


FIG. 1

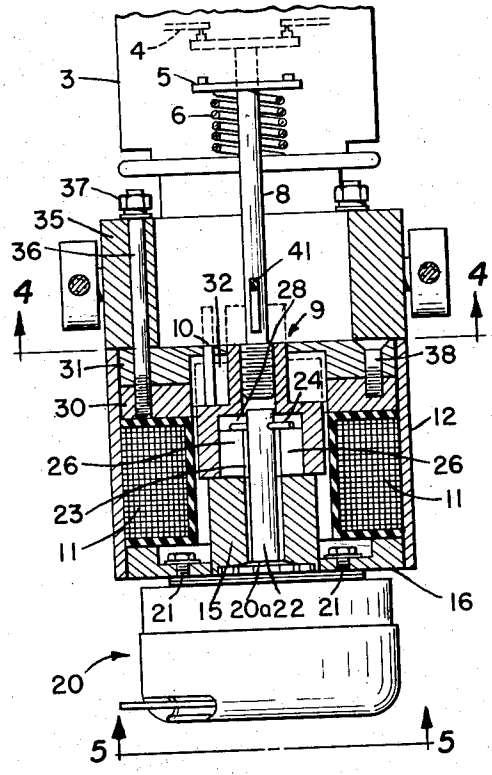


FIG. 2

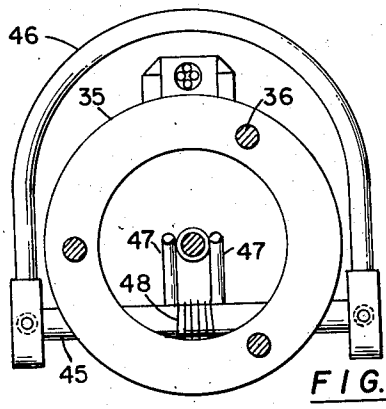


FIG. 4

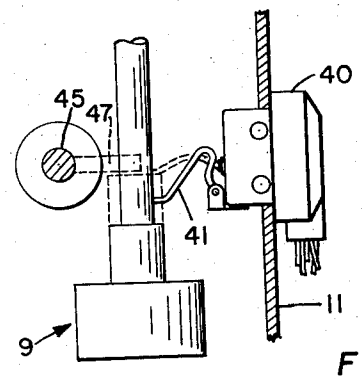


FIG. 3

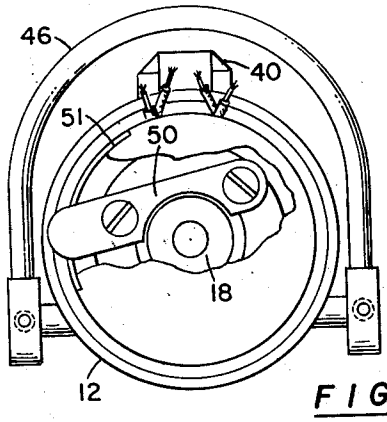


FIG. 5

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COMBINED LINEAR AND ROTARY ACTUATOR MEANS FOR SWITCH

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The invention relates to an electro-mechanical mechanism for actuating a member adapted to be moved between two positions. More particularly the invention is adapted for use in actuating coaxial switches and lends itself especially to actuation of conventional vacuum switches. The preferred embodiment of the invention will be described in connection with actuation of a vacuum coaxial switch but it will be apparent that it is applicable to other devices requiring a similar type of movement such as valves, interlocks, positioners, indexers and the like.

The main object of the invention is therefore the provision of a novel electro-mechanical actuator which is fast acting and extremely positive and fool-proof in operation.

Another object of the invention is the provision of an electro-mechanical mechanism that includes a latching means for holding a member in one of two positions, and which may be disengaged to permit reversal of movement of the member.

Still another object of the invention is the provision of an electro-mechanical mechanism for operating a device such as a switch and which mechanism may be operated manually when power is not available. Yet another object of the invention is the provision of an electro-mechanical actuator for a vacuum switch which employs a solenoid actuated bayonet latch or lock for holding the movable switch contact in either open or closed as desired.

Another object of the invention is the provision of an actuator for a vacuum switch which lends itself to miniaturization of the switch and actuator assembly.

Other objects will be brought out in the following description of the invention. I do not limit myself to the showing made by said description and drawings, since I may use variant forms of the invention within the scope of the appended claims.

Referring to the drawings:

FIG. 1 is a side elevation of a vacuum switch and actuator assembly showing the preferred embodiment of the invention as applied to such an assembly;

FIG. 2 is an enlarged longitudinal section through the device of FIG. 1;

FIG. 3 is a fragmentary longitudinal section of the device of FIG. 1 but in a plane at right angles to FIG. 2;

FIG. 4 is a cross section of the device of FIG. 1 as taken along lines 4—4 of FIG. 2;

FIG. 5 is an end elevation of the device of FIG. 1 with portions of the housing broken away to show the manually operative means for rotating the rotary solenoid armature.

With reference first to FIG. 1 the preferred form of the invention will be described with reference to a conventional vacuum switch generally designated 1 and an actuator therefor generally designated 2. The particular form of the vacuum switch is not critical, but preferably includes an envelope 3 secured to the actuator 2 and including fixed contact 4 (FIG. 2), which is adapted to be engaged by a movable contact 5. In the example shown a compression spring 6 is employed to urge the contact 5 into engagement with contact 4 for closing the circuit but it will be apparent that the contacts may

be opened by a spring and closed by the actuator to be described.

The movable contact 5 is secured to one end of a contact support rod 8 which is secured at its opposite end within a solenoid armature or plunger generally designated 9. The plunger 9 is provided with a guide pin 10 laterally displaced from the axis of the plunger which is slidably but non-rotatably supported within the central opening of a solenoid coil 11 which in turn is supported in a cylindrical housing 12. At this point it may be noted that in the embodiment illustrated the support shaft 8 is normally urged upwardly so that normally the plunger 9 occupies the dotted line position; when solenoid coil 11 is energised, the plunger 9 is pulled from the dotted line position of FIG. 2 to the full line position shown at which position it is stopped by a boss 15 on a circular pole piece 16.

The circular pole piece 16 is press fitted within housing 12; and acts as an end plate for the housing to retain coil 11, as well as developing the magnetic attraction for applying torque to an armature 18 of a rotary solenoid generally designated 20. The rotary solenoid 20 is conventional and includes a clock-type coil spring 21*a* interposed between the rotary solenoid housing and armature 18 for rotating it in one direction and a magnetic coil cooperating with pole piece 16 for rotating it in the opposite direction. Rotary solenoid 20 may be secured to pole piece 16 by screws 21.

Integral with armature 18 of the rotary solenoid 20 is a shaft 22 which extends through boss 15 and into the axially extending central opening 23 formed in plunger 9. At its free end the shaft 22 is provided with a diametrically extending hole to receive therethrough a cross pin 24. During axial translation of plunger 9, the opposite ends of pin 24 which extend beyond shaft 22 are received within diametrically opposed axially extending slots 26 formed in plunger 9, thus preventing rotation of the shaft 22 by spring 20*a*. However when plunger 9 is in its retracted position shown in full lines in FIG. 2, armature and shaft 22 are adapted to be rotated out of alignment with axially extending slots 26 by the spring 20*a* in rotary solenoid 20 so as to swing the opposite ends of cross pin 24 into circumferentially extending grooves 28 formed in plunger 9 as seen in FIG. 2. In this position it will be apparent that plunger 9 is held down by the cross-pin against the force exerted by spring 6 tending to close contacts 4 and 5; and coil 11 of the linear solenoid may then be deenergized.

When it is desired to close the vacuum switch 3, it is merely necessary to release the latched plunger 9 by energizing the rotary solenoid 20 to rotate its armature and shaft 22 to disengage pin 24 from grooves 28 and realign the pin with axially extending slots 26.

An annular end plate 30 is press-fitted within housing 12; and a plunger stop 31 is provided on top of plate 30. This stop 31 is provided with a recessed shoulder 32 which is adapted to engage and arrest movement of plunger 9 under the urge of spring 6. Positioned on plunger stop 31 is an annular mounting collar 35 which is connected to end plate 30 by means of through bolts 36 and nuts 37. Prior to mounting collar 35 on end plate 30, the plunger stop 31 may be secured to the plate by means of screws 38.

Secured to mounting collar 35 is a switch housing 40 containing two switches actuated by switch arm 41, adapted to be engaged by plunger 9 as the latter is spring-urged to contact closing position (FIG. 3). In this manner both solenoids may be connected through the switches in housing 40 to a source of power so that automatic reenergization may occur when movement in each direction has been accomplished.

In order to permit manual actuation of the plunger 9

a shaft 45 is passed through holes in collar 35 as best seen in FIG. 4; and is rotatably supported therein. To actuate shaft 45 a manually manipulatable bail 46 is secured to said shaft so that it substantially surrounds the collar 35. Secured to shaft 45 and extending radially outwardly therefrom are a pair of pins 47 which are adapted to engage plunger 9 (FIG. 3) for urging the latter to contact open position as bail 46 is urged toward the rotary solenoid. Pins 47 are yieldably urged toward plunger 9 by a torsion spring 48 which of course causes bail 46 to follow plunger 9. When it is desired to open the contacts manually it is merely necessary to urge bail 46 toward the rotary solenoid thus retracting plunger 9 against the force of spring 6 until cross-pin 24 aligns itself with circumferential grooves 28. At this point spring 20*a* rotates the shaft 22 to engage the cross-pin with grooves 28, and it may be noted that bail 46 serves as a visual indication of the condition of the switch, that is, whether it is open or closed.

Plunger 9 may also be manually unlatched from its retracted position. This is achieved by means of an arm 50 (FIGURES 1, 2, and 5) secured to armature 18 of the rotary solenoid 20. Arm 50 projects outwardly through a suitable opening 51 (FIG. 1) in the rotary solenoid housing so as to be accessible for manual actuation to rotate the armature 18 and shaft 22 against the force of spring 20*a* so as to release the cross-pin from the grooves 28.

It will be apparent that the above described structure provides an effective means for actuating vacuum switches so that no power is required to hold the contacts in either open or closed position.

I claim:

1. A mechanism for actuating a switch having a movable contact supported for movement along a line of action between a closed position and an open position and vice versa, comprising; a contact support for so supporting said movable contact, a linear solenoid for translating said support along said line of action from one of said positions to the other, a latch including a rotatable shaft having means thereon movable from a non-latching position when the contact support is in said one of said positions to a latching position when the contact support is in said other position for holding said support in said other position, and a rotary solenoid for actuating said latch to release said support from said other position.

2. A mechanism for actuating a switch having a movable contact supported for movement along a line of action between a closed position and an open position and vice versa, comprising: a contact support including a longitudinal slot and a circumferential slot for so supporting said movable contact, metallic coil spring means for urging said support along said line of action to one of said positions, a linear solenoid for translating said support along said line of action to the other of said positions, a latch including a pin extending transverse to said line of action of said support and operatively connected with said support through said longitudinal slot, and a rotary solenoid including a spring for actuating said latch to engage said pin in said circumferential slot to hold said support in said other position.

3. A mechanism for actuating a switch having a movable contact supported for movement along a line of action between a closed position and an open position and vice versa, comprising: a contact support for so supporting said movable contact, means urging said support to one of said positions, a linear solenoid for translating said support to the other of said positions against the force exerted by said means urging said support to said one of said positions, a spring-pressed latch operatively associated with said support to automatically latch the support in said other position substantially simultaneously with de-energization of the linear solenoid, and a rotary solenoid for actuating said latch to release said support from said other position, said rotary solenoid being operative to cock the spring-pressed latch to disengage said latch to permit said means to return said support to said one position while said linear solenoid is deenergized.

4. A mechanism for actuating a member adapted to be moved along a given line of action from one position to another comprising: a linear solenoid operatively associated with said member for moving the same along said given line of action from one position to another, a latch element including a pin extending transverse to said line of action and rotatable about said line of action as an axis so as to engage said member to hold said member in said other position, and a rotary solenoid associated with said latch for actuating the same to release said member.

5. A mechanism for actuating a switch having a movable contact supported for movement along a line of action between a closed position and an open position and vice versa, comprising: a contact support for so supporting said movable contact, means for urging said support to one of said positions, a linear solenoid for translating said support to the other of said positions, a latch operatively connected with said support, spring means for actuating said latch for holding said support in said other position, and rotary solenoid means opposing said spring means for disengaging said latch to release said support.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,145,278 August 18, 1964

Glenn E. Griggs

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 70, for "reenergization" read -- deenergization --.

Signed and sealed this 21st day of September 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

UNITED STATES PATENT OFFICE

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