Sept. 17, 1968 J. H. GAINES ETAL 3,402,374

ELECTRICAL RELAY SWITCH ACTUATOR

Filed July 26, 1966

FIG. 1.

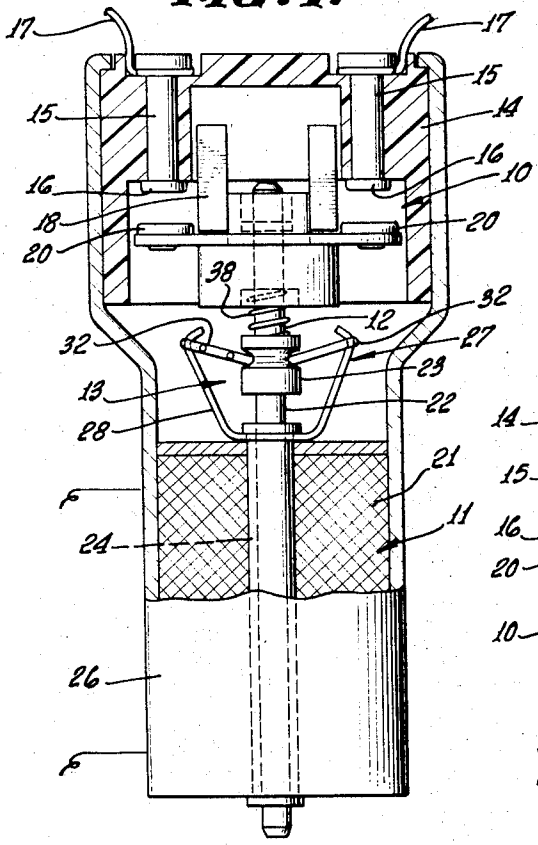


FIG. 2.

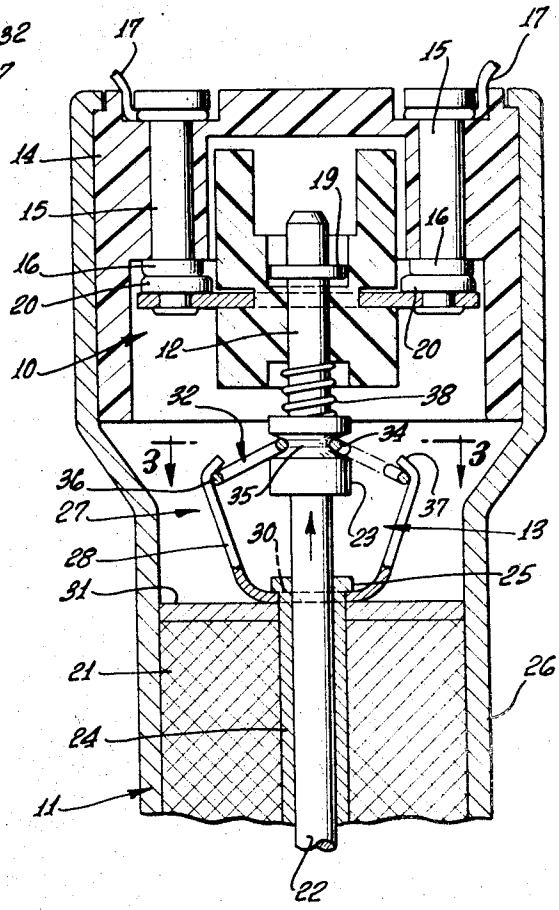
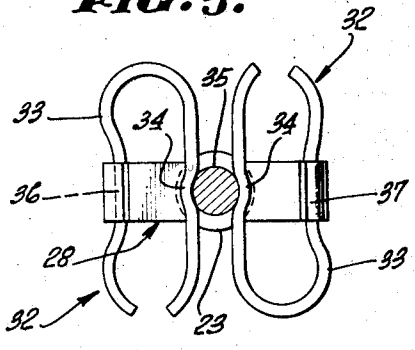


FIG. 3.



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3,402,374

ELECTRICAL RELAY SWITCH ACTUATOR

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ABSTRACT OF THE DISCLOSURE

A positively acting relay switch device having its actuator interpositioned between a solenoid motor and the switch, the actuator being characterized as a stationarily positioned assemblage of outer spring arms and spring toggle elements interposed between the arms and a solenoid core stem so that beyond toggle centered condition the spring assembly displaces the stem by snap action to open and close the switch.

This invention has to do generally with electrical relay switches and their actuation between open and closed positions by the type of motors, e.g. solenoids, customarily employed, and is directed particularly to such switch and motor combinations employing an improved snap-type actuator interposed between the switch and motor and functioning to assure desirably quick closing and opening of the switch contacts.

In the specific preferred embodiment, the invention is employed for the instantaneously rapid transmission of reciprocal movements to a rod or stem interconnection between the switch and a magnetic solenoid armature or core.

The invention has for its general object to provide a simple and low cost toggle-type actuator characterized by its spring qualities and reduction to parts capable of simple and low cost manufacture and assembly.

In its more particular objectives the invention contemplates an actuator so characterized, comprising the combination of a simply formed radially sprung carrier or holder, and toggle means retained by and interposed between the carrier and switch actuating stem so that upon reciprocation of the latter the interposed toggle means deflects to each side of an over-center position and in so doing imparts instantaneous switch opening or closing movements to the stem.

A further feature and object of the invention is the provision of interposed toggle means in the form of spring elements thus rendering the actuator assembly, including both the carrier and toggle elements resiliently deflectable in resisting and urging movements of the relay stem within its travel range.

More specifically the invention contemplates formation of the carrier as a pair of resilient arms at opposite sides of the stem and receiving between them a pair of return bend spring toggle links retained in position simply by their accommodation within essentially recessed configurations of the carrier arms and stem.

All the features and objects of the invention as well as the details of an illustrative embodiment will be understood more fully from the following description of the accompanying drawing, in which:

FIG. 1 is a view taken generally in longitudinal or axial section through the relay, actuator and solenoid with the switch contacts in open position;

FIG. 2 is an enlarged fragmentary view similar to FIG. 1 showing the relay switch in closed position; and

FIG. 3 is an enlarged plan view of the actuator taken from line 3—3 of FIG. 2.

FIGS. 1 and 2 illustrate the general combination of a relay switch 10 which may correspond to any of various known types and designs, a motor 11 operable to reciprocate a stem 12 connected to the relay switch, and a snap-type actuator 13 operable to produce instantaneous opening and closing of the relay as will appear.

The switch 10 comprises a suitable insulative body structure 14 containing conductors 15 having contact terminals 16 in open or closed circuit with the leads 17. Internally the switch structure includes an insulative carrier 18 which receives the upper extent of stem 12, the latter being axially movable within the holder against the resistance of coil spring 38 and to a limiting position determined by the stem collet 19. The carrier 18 mounts a pair of contacts 20 engageable with and releasable from the stationary contact 16 upon reciprocation of the stem 12.

The motor 11 may consist essentially of a usual solenoid having a body or coil section 21 and a reciprocable rod-like magnetic core 22 connected to the stem 12 by coupling 23. The core 22 extends through a magnetic sleeve 24 flanged at 25 for retention of the later described spring carrier. The relay switch and solenoid structures are shown to be accommodated in axially fixed relation within a common housing 26.

The invention is more particularly concerned with the actuator 13 which is shown to comprise a carrier or holder generally indicated at 27 and consisting of a pair of upwardly divergent spring metal arms 28 secured to the stationary solenoid housing as by forming the arms integrally with an annular base portion 30 clamped about sleeve 24 between flange 25 and the top 31 of the solenoid structure. The spring arms 28 are resistant to spreading outwardly from the FIG. 1 and FIG. 2 positions illustrated, and thus contribute to the toggle action of the toggle means 32 interposed between the arms and coupling 23.

As more particularly shown in FIG. 3, such toggle means is shown to comprise a pair of metallic springs 33 having the essentially U-shaped or return bend configurations illustrated, the inner arms of the springs being bent at 34 for seating and confinement within an annular recess 35 in the coupling 23. The outer spring extents are shown to have essentially straight intermediate portions 36 for engagement and retention within the arms 28 at the location of their inwardly bent terminals 37. The wire-like toggle springs are interchangeable and preferably are relatively reversed as to their bends in order to contribute to balanced resistance to deflection.

Assuming the switch 10 to be in its FIG. 1 open position, upward displacement of the rod 12 against the resistance of coil spring 38 initially displaces the spring links 33 to an over-center position of alinement transversely of the stem, with resultant outward resilient deflection of the arms 28 accompanied by degrees of deflection together of the toggle spring arms, the springing energy of course being supplied by the solenoid. Upon continued stem movement beyond the over-center position, the contractive thrusts of the arms 28 and expensions of the toggle springs combine to produce instantaneous throw of the stem to engage the contacts 16 and 20 with corresponding immediacy. Upon reverse energization of the solenoid and actuation of the stem, the carrier and toggle springs similarly respond so that upon down travel of the stem past the over-center position, the spring assembly operates to suddenly disengage the contacts 16 and 20.

We claim:

1. In combination: a relay switch, a solenoid motor including a body containing a relatively reciprocating core stem connected to the switch and operable to open and close the switch by the stem reciprocations, and a snap

actuator mounted in fixed relation to the solenoid body and including spring means engaging the stem in toggle relation therewith and deflectable radially thereof by reciprocations of the stem whereby the spring means is reversely actuable to and beyond over-center condition to produce sudden actuation of the stem and switch.

2. The combination of claim 1, in which said spring means comprises outer spring means mounted to the solenoid body and radially and resiliently resistant to deflection outwardly from the stem, and toggle elements interposed between said outer spring means and the stem.

3. The combination of claim 2, in which said toggle elements are springs deflectable radially of the stem.

4. The combination of claim 2, in which said outer spring means comprises radially deflectable spring arms diverging from fixed mounting to the solenoid body about the stem.

5. The combination of claim 4, in which said toggle elments are a pair of opposed reversely bent spring wires

each confined individually within a stem recess and one of said arms.

6. The combination of claim 5, in which said arms are terminally bent toward the stem and retain straight intermediate extents of said spring wires.

7. The combination of claim 4, in which said solenoid body contains a magnetic sleeve containing the core stem and having a flange holding said arms to the solenoid body.

References Cited

UNITED STATES PATENTS

2,967,218	1/1961	Dorsee	200—76
3,242,282	3/1966	Suzuki	200—76
3,242,283	3/1966	Clements	335—188

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