United States Patent [19]

McLaughlin

[11] **3,916,128**

[45] **Oct. 28, 1975**

[54] **QUIET SWITCH**

[75] Inventor: **Emmett J. McLaughlin,** Fairfield, Conn.

[73] Assignee: **Westinghouse Electric Corporation,** Pittsburgh, Pa.

[22] Filed: **May 20, 1974**

[21] Appl. No.: **471,734**

[52] **U.S. Cl.** ..... **200/67 A;** 200/288

[51] **Int. Cl.²** **H01H 13/28**

[58] **Field of Search** ..... 200/67 A, 67 G, 68, 288

[56] **References Cited**

UNITED STATES PATENTS

2,648,731	8/1953	Despard	200/67 A
2,669,613	2/1964	Despard	200/67 A
2,725,438	11/1955	Bentley	200/67 A

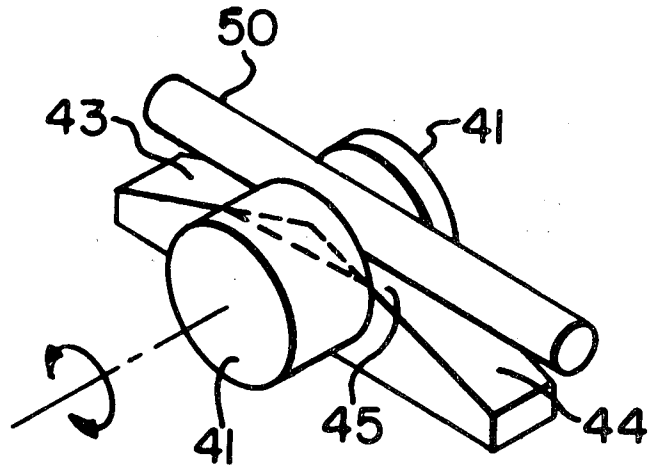
Primary Examiner—David Smith, Jr.

Attorney, Agent, or Firm—G. H. Telfer

[57] **ABSTRACT**

An electric switch is provided with quiet switching action. A resilient rod is disposed between a housing portion and an operating handle portion to substantially reduce the noise generated by the collision of the operating handle portion with the housing. The operating handle portion is provided with planar, stroke-limiting stops which are disposed symmetrically about the axis of rotation of the operating handle. The planar stops compress the resilient rod uniformly as the operating handle rotates to the circuit closed or the circuit open position. The resilient rod has a circular cross section and resists radial deformation substantially linearly.

4 Claims, 4 Drawing Figures



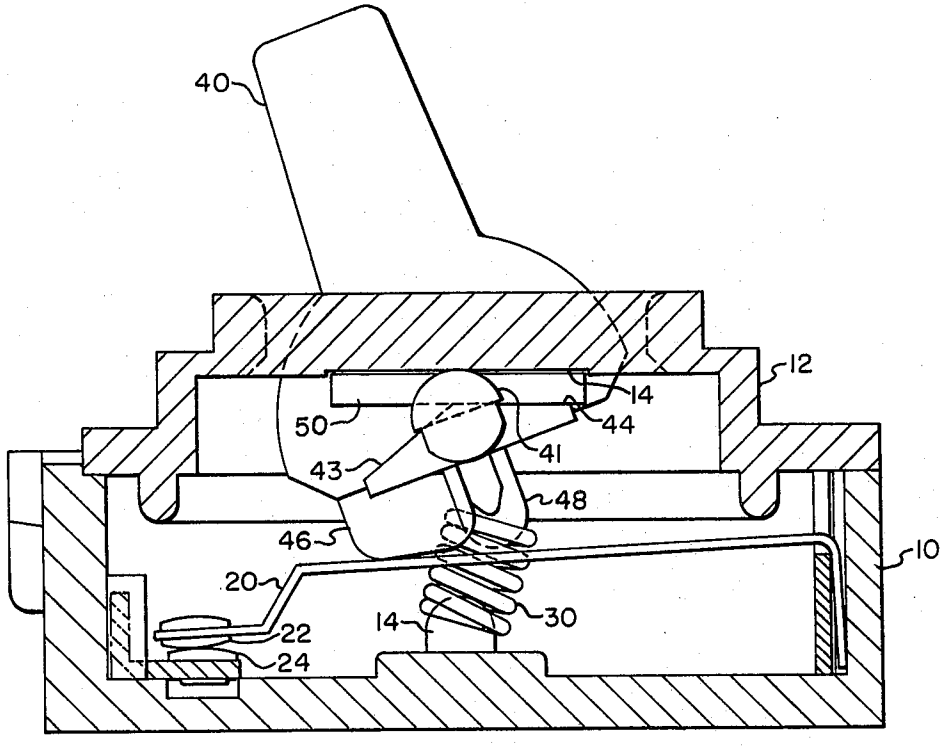


FIG. 1.

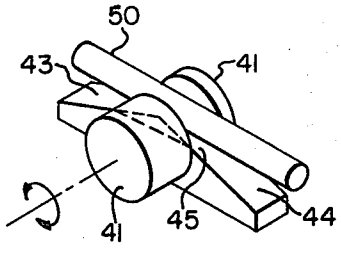


FIG. 3.

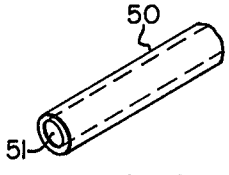


FIG. 4.

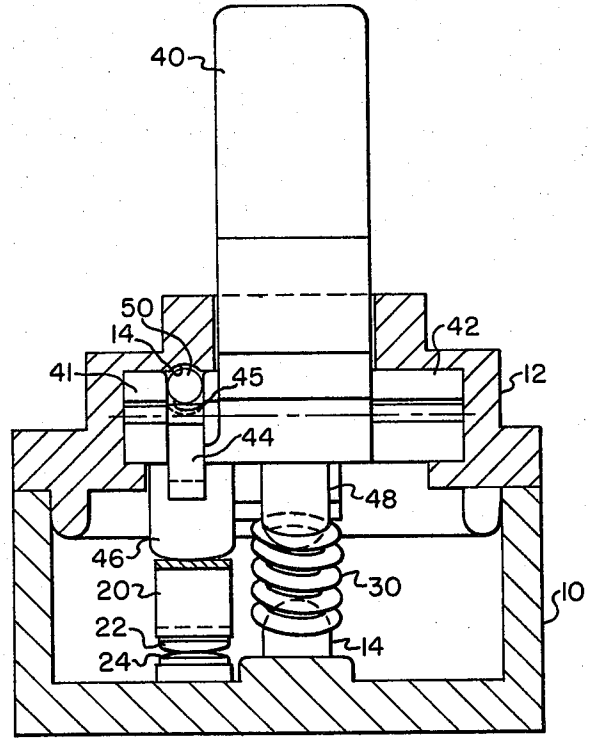


FIG. 2.

QUIET SWITCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electric switches and particularly to lever operated, snap-action electric switches which are designed to operate quietly.

2. Description of the Prior Art

Electric switches of the lever-operated type generally referred to as wall switches are commonly used in the home and in industry. Such switches usually include an overcenter compression spring which affords rapid switching action, sometimes referred to as "snap" action, as the operating lever is moved from one position to another. This rapid switching is desirable in that the switch contacts are forced by the spring pressure to "make" and "break" very quickly, thereby reducing contact arcing. The spring pressure also holds the switch contacts and operating lever in place after the operating lever has been moved to the "on" or the "off" operating position. Further, the resulting noise and vibration generated by the "snap" switching action indicates to the user that positive switching has occurred.

The noise generated by the conventional snap-action switch is, however, relatively loud and is therefore unsuitable for those applications which require a quiet setting. Thus, various shock absorbing devices have been incorporated into snap-action switches to reduce this noise and thereby achieve relatively quiet switching action. For example, Despard U.S. Pat. No. 2,648,731, Aug. 11, 1953, employs a resilient rubber block which is progressively engaged and compressed by a curved wing carried on the operating handle. Keranen U.S. Pat. No. 3,711,669, Jan. 16, 1973, shows a snap-action switch having a pair of resilient rubber discs mounted on either side and near the lower end of a cylindrical extension of the operating handle which cushions the shock when the switch is operated.

Although prior art modifications effectively reduce the noise generated by the snap switching action, manufacture of these devices is difficult because of the unusual construction required. Furthermore, because of the non-linear and non-uniform engagement of the operating handle with the resilient member taught by prior art, the resilient member is subject to "packing" and "gouging" which degrades the effectiveness of the resilient member.

SUMMARY OF THE INVENTION

This invention provides a snap-action switch having quiet switching action. The parts comprising the switch are easily fabricated and assembled. Degradation of the shock absorbing means during operation of the switch is minimized.

In a snap-action switch having an operating handle pivotally mounted upon trunnions journalled within an insulated housing, quiet switching action is obtained by confining a resilient rod member between the housing and a pair of intersecting planar, stroke limiting stops carried by the operating handle. The resilient rod member is cradled within a notched portion of the operating handle trunnion and is held in contact with the housing by the intersecting planar stops. The planar stops intersect upon a line which is parallel to the axis of rotation of the operating handle and are preferably symmetrically disposed about the center line of the operating handle. The intersecting planar stops are grooved at the point of intersection in order to relieve the pressure on the resilient rod member during rotation thereby allowing the operating handle to move freely and rapidly through its center (neutral) position.

In conventional switches, noise is generated when a stroke limiting stop collides against a rigid housing portion. This noise is substantially reduced in the present invention by the resilient rod member which is compressed uniformly along its length by a planar stop. The resilient rod member has a curved cross section which is preferably circular and is formed of a material which resists deformation substantially linearly. The effect of uniform engagement of a planar stop with the resilient rod member combined with the substantially linear resistance to deformation provided by the resilient rod member serve to minimize the "packing" and "gouging" caused by repeated cycling of the switch.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevation view, in section, of a preferred embodiment of the invention, which shows a switch in circuit closed position with a resilient rod uniformly compressed between a housing portion and a planar stop;

FIG. **2** is a side elevation, in section, of the preferred embodiment;

FIG. **3** is a conceptual illustration, in perspective of a resilient rod cradled within a notched portion of an operating handle trunnion; and

FIG. **4** illustrates a second embodiment of an elongated resilient compression member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Throughout the description which follows, like reference characters refer to like elements on all figures of the drawings.

A preferred embodiment of the present invention is illustrated in FIG. **1** and FIG. **2** which shows a lever operated, single-pole, single-throw snap-action electric switch in circuit closed position. Conventional switching elements including a movable electrical contact **22** and a stationary electrical contact **24**, a coil spring **30**, and an operating handle **40** are contained within an insulated housing **10** which is molded from suitable insulating material. The housing **10** is enclosed by a cover frame **12** and is adapted to fit within a conventional mounting yoke, not illustrated.

The operating handle **40** is pivotally mounted upon first and second trunnions **41** and **42** which are journalled within the union of the housing **10** with the cover frame **12.** The handle **40** carries a spring operating arm **48** and a contact operating portion **46**, both of which extend below the axis of rotation. The trunnions **41** and **42**, spring operating arm **48**, and contact operating portion **46** preferably are integrally formed with the operating handle **40** and may be molded from suitable insulating material.

A coiled over-center spring **30** is compressed between the spring operating arm **48** and a spring holding stud **14** and pushes the operating handle **40** in the direction of rotation as the operating handle **40** is moved from one position to another. The operating handle **40** is movable to a first "on" position wherein the contact operating portion **46** depresses a resilient contact arm **20** which carries the movable electrical contact **22** into

circuit closed connection with the stationary electrical contact **24**, and movable to a second "off" position wherein the contact operating portion **46** is rotated away from the resilient contact arm **20**, thereby causing the movable electrical contact **22** to become electrically disconnected from the stationary electrical contact **24**. Pressure from the over-center coil spring **30** holds the operating handle **40** in place after the switching action is completed.

Referring now to FIGS. **1** and **3**, first and second planar stops **43** and **44** are carried on the first trunnion **41** to limit the rotation of the operating handle **40**, and may be integrally formed therewith. The planar surfaces of the stops **43** and **44** intersect upon a line which is parallel to the axis of rotation of the first trunnion **41** and are disposed symmetrically about the center-line of the operating handle **40**. A recess **45** defined by a notched portion of the trunnion **41** and the intersecting stops **43** and **44** form a cradle which holds a resilient rod member **50** in contact with the cover frame **12**. The intersecting planar stops **43** and **44** are grooved at the point of intersection in order to relieve the pressure on the resilient rod member **50** during rotation thereby allowing the operating handle **40** to move freely and rapidly through its center (neutral) position. The underside of cover frame **12** is provided with a grooved portion **14** which receives and further confines the resilient rod member **50**.

Referring again to FIG. **1**, the first and second planar stops **43** and **44** compress the resilient rod member **50** uniformly against the grooved portion **14** as the operating handle **40** rotates to the first "on" position or to the second "off" position, respectively. The surface of planar stop **44** is resting in a plane parallel to the cover frame **12** when it is brought into compressive engagement with the resilient rod member **50**. The force of compression is distributed uniformly along the length of the engaged portion of the resilient rod member **50** which serves to reduce gouging thereof.

The resilient rod member **50** shown in FIGS. **1**, **2**, and **3** is a solid resilient rod having a generally circular cross section preferably formed of .062 inch diameter neoprene rubber, but material other than neoprene may be used to good advantage. In order to minimize packing of the resilient material, the material selected should resist radial deformation substantially linearly, and should be formed with a curved cross section. The rubber rod **50** cushions the vibration and suppresses the noise generated as the snap-action spring **30** forces the operating handle **40** against the cover frame **12** so that the switching action is substantially noiseless.

An alternate embodiment of the resilient rod member **50** illustrated in FIG. **4** comprises a resilient rod having a circular cross section and having a circular opening **51** extending coaxially therethrough. The circular opening **51** renders the resilient rod member **50** more pliable than the solid rod embodiment of FIGS. **1**, **2** and **3**. In either embodiment, the length of the resilient rod member **50** should equal or slightly exceed the combined length of the intersecting planar stops **43** and **44**, but should be a little shorter than the grooved portion **14** of cover frame **12** to allow for slight axial expansion as it is compressed.

While there has been shown and described what is at present considered to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the art. It is not desired, therefore, that the invention be limited to the specific arrangement shown and described.

What we claim is:

1. An electric switch comprising:

a housing;

a first electrical contact supported by said housing;

a resilient arm supported by said housing;

a second electrical contact carried on said resilient arm and disposed to engage said first electrical contact;

an operating handle pivotally mounted in said housing, said operating handle having a cam surface projecting away from the axis of rotation and having first and second shoulder portions each having planar surfaces which intersect upon a line which is parallel to the axis of rotation of said operating handle, said shoulder portions being disposed symmetrically about the centerline of said operating handle, said operating handle being movable to a first position wherein said cam surface depresses said resilient arm so that said second electrical contact makes electrical connection with said first electrical contact, said operating handle being movable to a second position wherein said operating handle disengages said resilient arm so that said second electrical contact becomes electrically disconnected from said first electrical contact;

spring means compressed between said operating handle and said housing, said spring means assisting in moving said operating handle in the direction of rotation as said operating handle is rotated to either said first position or to said second position; and

a resilient rod having a circular cross section disposed between said housing and said operating handle, said rod being engaged by said first or said second planar surface of said operating handle and being compressed uniformly between said housing and said planar surface as said operating handle is rotated to said first position or to said second position; said rod being vertically confined between said intersecting planar surfaces and a grooved recess of said housing and being laterally confined within a notched portion of said operating handle; said shoulder portions being transversely grooved through said line of intersection thereby providing an opening for receiving said rod, the resulting vertical confinement imposing no compression upon said rod as said operating handle rotates through its center position.

2. The switch of claim **1**, said resilient rod having an opening extending coaxially therethrough.

3. In combination with an electric switch of the type wherein an operating handle is pivotally mounted within a housing and is movable from a first operating position to a second operating position, and a stopping member carried by said handle is forced against said housing as said handle is moved from one of said positions to the other said position, the improvement which comprises:

a resilient rod having a curved cross section confined between said stopping member and said housing, the diameter of said rod being small as compared with its length, said rod being compressed uniformly along its length by said stopping member as said handle is moved from one of said positions to said other position.

4. The switch of claim 3, said stopping member comprising first and second shoulder portions each having a planar surface for engaging said resilient rod, said planar surfaces of said shoulder portions intersecting along a line which is parallel to the axis of rotation of said operating handle; said shoulder portions being transversely grooved through said line of intersection thereby providing an opening for receiving said rod, said stopping member being disposed adjacent said housing to provide a clearance between said planar surfaces and said housing which is less than the diameter

of said rod when said operating handle is disposed in either of said operating positions, the clearance provided by said grooved opening in said housing being equal to or greater than the diameter of said rod; said rod being uniformly engaged and compressed by one of said planar surfaces as said operating handle is placed in either one of said operating positions, the compression of said rod being relieved as said handle is moved from one of said positions to the other.

* * * * *