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SWITCH-ACTUATING MECHANISM

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Fig. 1.

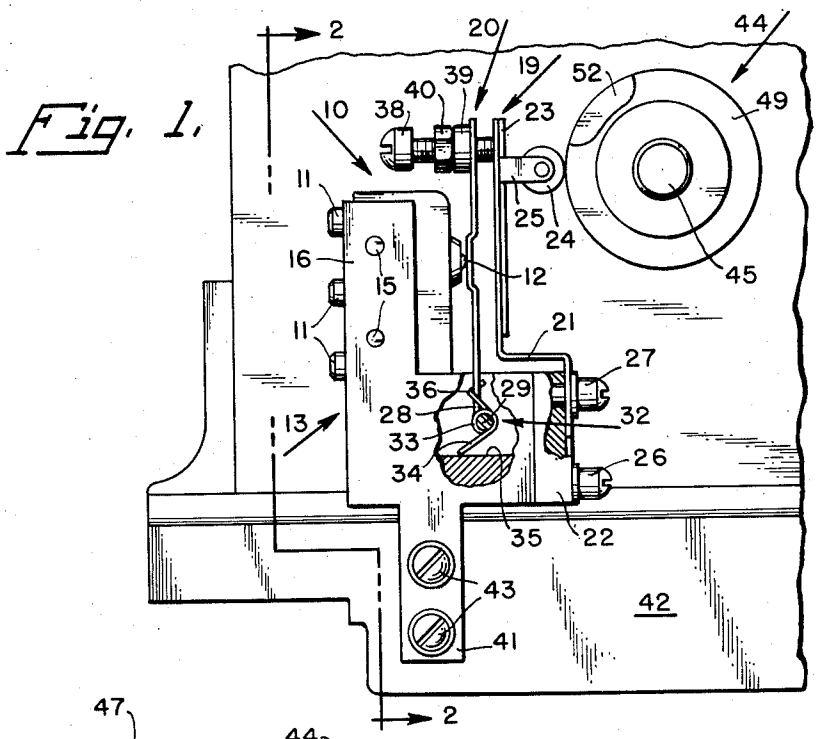
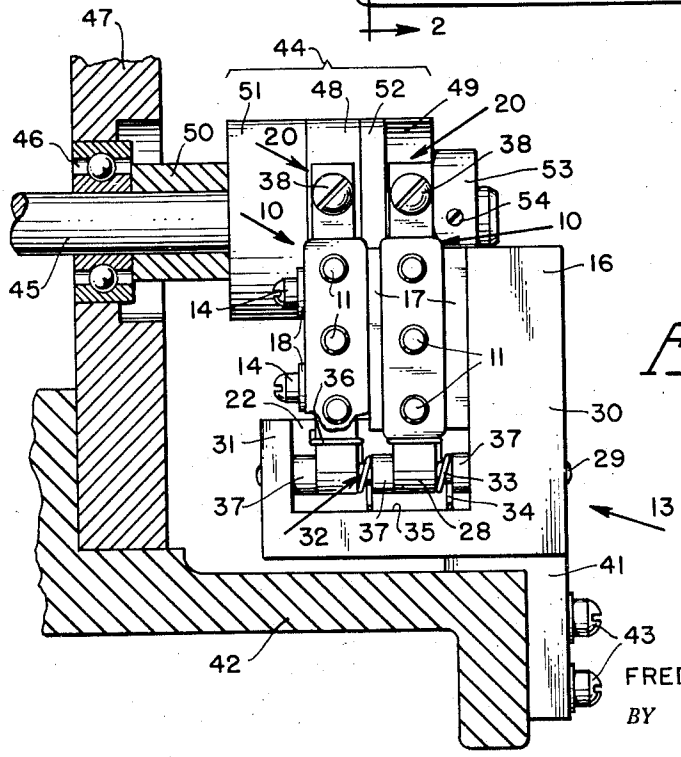


Fig. 2.



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SWITCH-ACTUATING MECHANISM

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5 Claims. (Cl. 200—31)

This invention relates to switch mechanisms and more particularly to an improved switch mechanism of the rotary cam operated type.

Switch mechanisms of the particular class to which the present invention relates usually comprise a row of several switches of over-center snap-action type and a multi-section rotary cam assembly, together with cam-followers which actuate the several switches in accordance with the particular time-contour characteristics of the rotary cams. Means are often provided for adjusting the make-break throws as imparted by the switch mechanism, and for variably positioning and locking the cams so that their angular relationship can be pre-set to precisely time and properly sequence the actuation of the several switches, and prior art switch mechanisms are generally satisfactory in these respects in usual applications. It has been found, however, that conventional switch mechanisms of the above-described character, when employed in ordnance equipment subject to shock and vibration during operation, are vulnerable to the extent that such environments may cause the switches to be spuriously actuated by the cam-followers with resultant malfunction or improper operation of the said ordnance equipment.

It is therefore the principal object of the present invention to provide a rotary cam-operated switch mechanism having essentially positive and reliable actuation characteristics in adverse shock and vibration environments.

A further object is to provide a switch mechanism in which shock and vibration forces, tending to displace and therefore operate the switch actuator, are resiliently opposed and defeated.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a side elevational view of a switch mechanism embodying the present invention, certain parts broken away to show the construction more clearly; and

Fig. 2 is a front elevational view taken along section line 2—2 of Fig. 1 to provide a better understanding of the switch mechanism assembly.

The invention will be described in connection with a particular embodiment shown as having two switches actuated by a like number of rotary cams. It will be understood, however, that the present invention is applicable to assemblies having any number of switches and cams. Considered from a broad standpoint, the invention contemplates a mechanism comprising one or more cams which, through followers that are restricted in displacement inherently and by auxiliary resilient elements, act upon control elements of one or more switches in accordance with the contour time characteristics of said cams.

Referring now to Figs. 1 and 2, the switch assembly comprises one or more switches **10** of over-center snap-action type, each having connection terminals **11** leading

to various contacts within the switch, and a plunger element **12** which, when depressed, opens the normally-closed contacts and/or closes the normally-open contacts. Such switches, which are now conventional per se, such as the so-called "Micro" variety which are used extensively because of compactness and other attributes, are generally quite sensitive in the respects that they may require only small operating forces, say of the order of one ounce, and actuation by plunger element displacements which may be minute, say of the order of a few hundredths of an inch. These switches are normally enclosed in a molded plastic case of configuration substantially as here illustrated, thus entirely sealed except for the small clearance necessary to accommodate movement of the plunger element **12**. The switches **10** are mounted upon a bracket **13** by means of machine screws **14** which extend through apertures (not shown) provided in the casings of switches **10** and into threaded holes **15** which are provided in a thickened supporting arm **16** of the bracket, as shown. Spacers **17** serve to align and center the plunger elements laterally with respect to the cam-followers and associated actuating elements later described. Lock-washers **18** may be employed as shown to assist in maintaining switches **10** securely affixed to the bracket and therefore in fixed relationship to the said actuating elements. Also supported by bracket **13** are cam-follower arms **19** and switch-actuators **20**, the latter being disposed between the cam-follower arms **19** and the switch plunger elements **12**. Cam-follower arms **19** are of laminated structure, each comprising an elongated leaf **21** secured at its lower end to a cross-piece **22** mounted upon the bracket, and a roller support **23** which may be secured to the upper stretch of leaf **21** by spot welding at its extremities. A roller **24** designed for cam-following is journaled for rotation, upon roller support **23**, between two fingers **25** (of which one is visible, the other in frontal alignment therewith in Fig. 1) which are conveniently made an integral part of the roller support as illustrated. Cross-piece **22** is here shown as a separable part of bracket **13**, secured thereto by means of machine screws **26** of which only one is visible in Fig. 1. The cam-follower arms are secured to cross-piece **22** in alignment with switches **10** to confront their plunger elements **12**. An elongated aperture (not shown), at the lower end of cam-follower arm **19**, accepts fastening screw **27** and permits adjustment of roller height relative to the corresponding cam axis. Switch-actuators **20** are similarly of elongated configuration, having a bore formed at the lowermost end **28**, by means of an integral convolution, so that the actuator may be actuated for pivotal movement upon a rod **29** as shown. The ends of rod **29** may be held by press fit in opposed walls **30**, **31** of bracket **13**, in such location that rod **29** is disposed between the cam follower arms **19** and the row of switches **10** and in parallel relation thereto. Each of the switch-actuators **20** is resiliently urged toward its cam-follower arm **19** by means of a wire spring **32** having a convolution **33** intermediate of its length, which enables the spring to be accepted by and mounted upon rod **29**, a leg **34** disposed to bear against floor **35** of the bracket **13**, as a spring stop means, and an arm **36** conformably bent to bear against the switch-actuator **20** along a line beyond rod **29**. Also mounted upon rod **29** are spacers **37** which serve to position and maintain the switch-actuators in confronting alignment with the switches **10**.

Switch-actuator **20** further carries an adjusting screw **38** having threaded engagement with and extending through a boss **39** and through a registering aperture in the upper end of the switch-actuator **20** to which boss **39** is secured. A nut **40** is provided as shown for adjustment locking purposes.

Bracket **13** is provided with a support member **41** which

is secured to a timer base 42 by means of machine screws 43 as shown. All of the switch mechanism elements are carried by bracket 13, except for the rotary cam assembly 44, the latter being supported upon a shaft 45, journaled by bearing 46 provided in a side member 47 which is secured to the timer base 42. Shaft 45, adapted to be rotated by an electrical timer motor including a gear reduction unit (not shown) and held against longitudinal displacement by any conventional means, carries rotary disc-like cams here shown as two in number, designated 48 and 49, each having a peripheral contour including suitably proportioned fall, inner dwell, rise and outer dwell portions to yield desired time displacement characteristics of associated follower elements. The member 50 which is secured to shaft 45 in the particular embodiment here illustrated has no direct bearing upon the present invention and may therefore be regarded simply as a spacer element which, together with spacing collars 51 and 52, suitably position the cams 48, 49 along the shaft so that they properly confront their respective rollers 24. The assembly of cams and spacers is held together by means of a circular nut 53 which may be held to shaft 45 by one or more set screws 54 as indicated. The cam assembly also includes means, such as spline elements (not shown), which maintain the rotary cams in a predetermined angular relationship upon the shaft.

In the above-described switch mechnism, assuming an angular position of shaft 45 at which roller 24 is in an inner dwell portion of cam 48 so that switch 10 is in a released condition, depression of plunger element 12 by spurious actuating forces is resisted by the mechanical restraint afforded by the combination of switch-actuator 20, tensioned by means of wire spring 32, and cam-follower arm 19, having restricted angular movement and which also is acted upon by wire spring 32 through the intermediary of screw 38. Screw 38 further enables adjustment of the on-off action of plunger element 12 relative to cam rotation. In this respect, one desirable type of adjustment, readily obtainable, causes switch operation (in going from inner to outer dwell) and switch release (in going from outer to inner dwell) to be effected by equal radial displacements of the cam roller.

It will be understood that the present invention, while of particular importance in connection with switches of over-center snap-action type as here described, is also fully applicable for use in connection with switches of other types, and that other modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a rotary-cam switch-actuating mechanism comprising an electrical switch having a control element and adapted to be operated by displacement of said control element, a rotatable shaft carrying a rotary cam, and cam-follower means supported in operative relation to said rotary cam, wherein said rotary cam is adapted upon rotation to provide displacements of said cam-follower means of magnitude suitable for operation of said control element, in combination, a switch-actuator member supported in confronting relationship to said switch control element for imparting switch-actuating displacements thereto, means providing an adjustable displacement-link between said switch-actuator member and said cam-follower means, spring means acting upon and urging said switch-actuator member in a direction to maintain said cam-follower means in operative engagement with said rotary cam, and means supporting said electrical switch with its control element in contact with and in position tc be operated by displacement of said switch-actuator member.

2. A rotary-cam switch-actuating mechanism as defined in claim 1, wherein said electrical switch is of over-center snap-action type controllable by a spring-return plunger element.

3. A rotary-cam switch-actuating mechanism as defined in claim 1, wherein said cam-follower means comprises an elongated leaf structure supported at one end thereof and carrying a cam-following element at the other end thereof.

4. A rotary-cam switch-actuating mechanism as defined in claim 1, wherein said switch-actuator member comprises an elongated element pivoted at one end thereof, carrying said adjustable displacement-link at the other end thereof, and wherein the portion of said switch-actuator member bearing against said switch control element lies intermediate said two ends.

5. A rotary-cam switch-actuating mechanism as defined in claim 1, wherein said adjustable displacement link is a screw element threadedly engaged with said switch-actuator member and having an end thereof in contact against said cam-follower means.

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