United States Patent

Farrell

[15] **3,671,693**

[45] **June 20, 1972**

[54] ROCKER SWITCH

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[22] Filed: **May 28, 1971**

[21] Appl. No.: **147,819**

[52] **U.S. Cl.** ..... **200/67 G**
[51] **Int. Cl.** **H01h 13/28**
[58] **Field of Search** ..... 200/67 G, 68

[56] **References Cited**

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Primary Examiner—David Smith, Jr.

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[57] **ABSTRACT**

A switch construction comprising a base carrying at least two stationary contacts with a movable contact arm being disposed over said base for engaging the stationary contacts. A spring is positioned on the contact arm, and this spring includes downwardly depending end portions connected to the ends of the arm and a central portion spanning the arm. A star wheel is located within a rocker used for operating the switch. One point of the star wheel engages the spring, and an opposite point engages the rocker. Additional intermediate points of the star wheel alternately engage interior wall portions defined by the rocker. The structural combination provides an easily assembled and highly effective over-center rocker switch.

8 Claims, 5 Drawing Figures

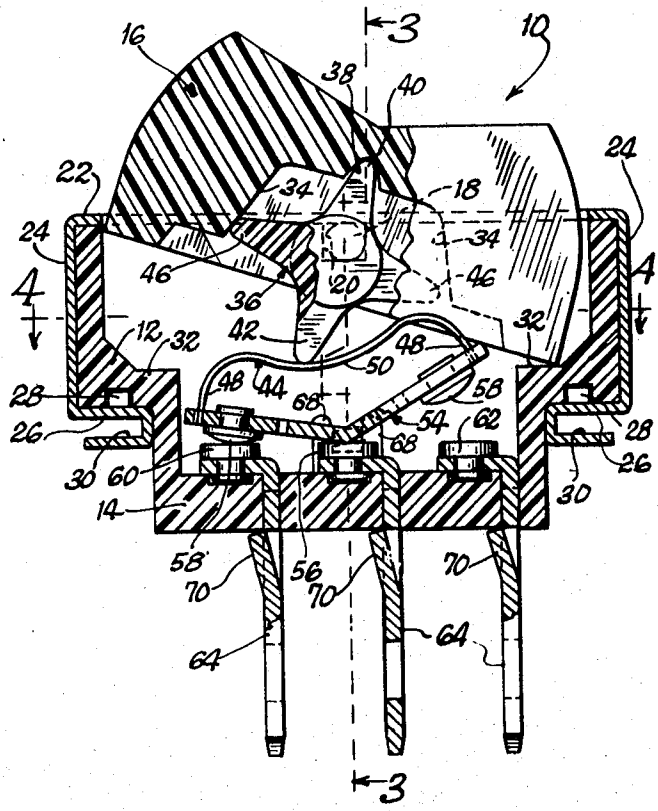


FIG. 1

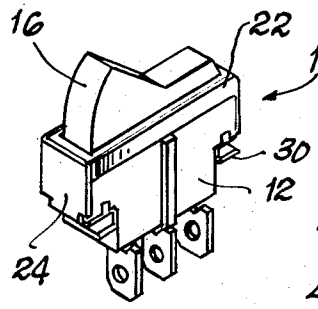


FIG. 2

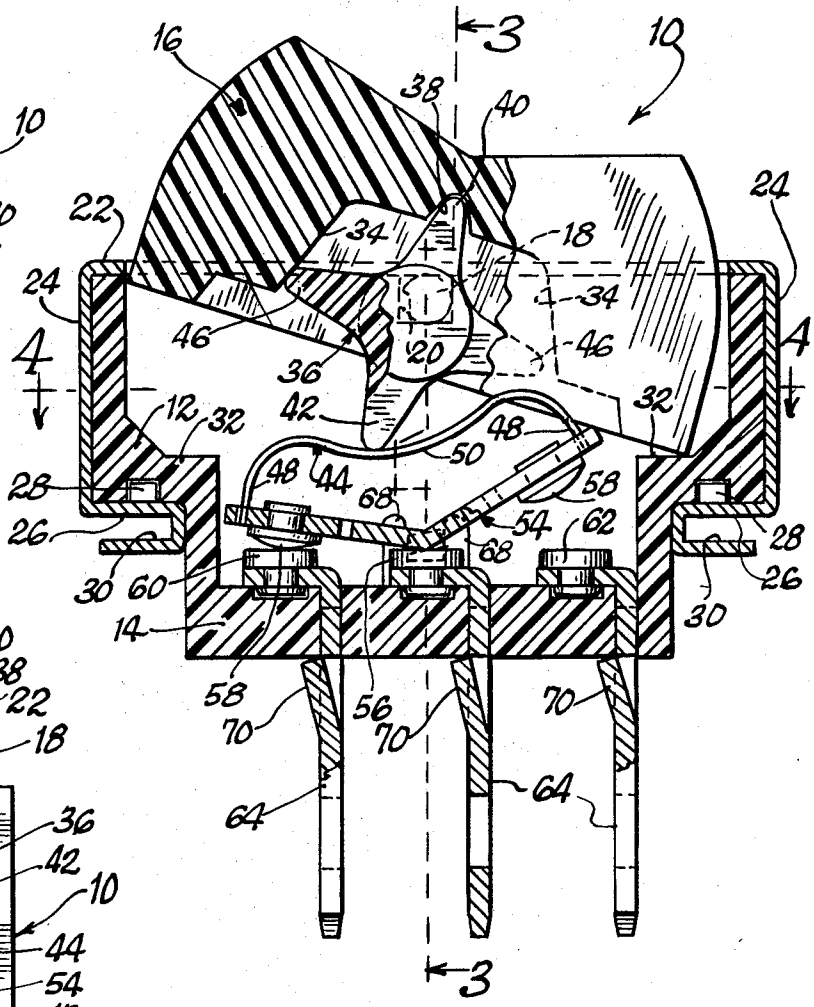


FIG. 3

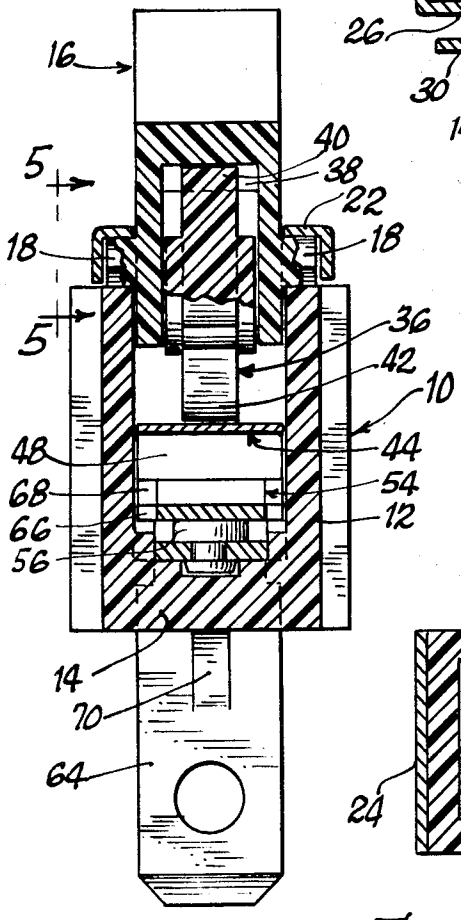


FIG. 4

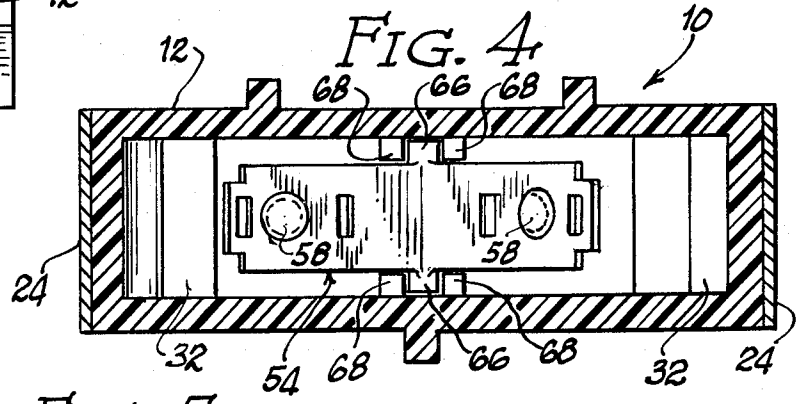
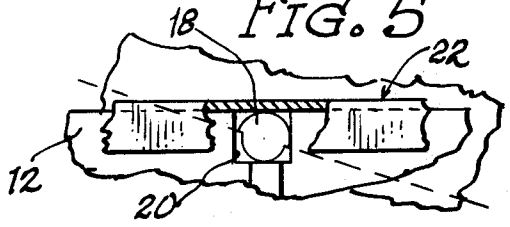


FIG. 5



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ROCKER SWITCH

This invention relates to an improved switch construction. The invention is particularly concerned with a rocker switch which includes a spring action whereby making and breaking of the switch contacts can be carried out in a highly efficient manner.

In many currently employed electrical circuits, very high standards are required for switches to be utilized in the circuits. The switches must be structurally reliable so that they can undergo many operating cycles. Very rapid switch operation during making and breaking is essential in order to eliminate damaging arcing. The switches should also be "-tease-proof" from a practical standpoint since many circuits cannot tolerate even minor changes in resistance which might occur when switch contacts are partially or gradually separated.

Contamination of contact surfaces must also be minimized since even minor amounts of contamination can disrupt circuit operations, for example, by increasing the resistance between the contacts. All of the aforementioned problems are magnified where switches must be produced on a miniature scale. Thus, size limitations are introduced in many applications which require the use of very small components, and which, therefore, create mechanical and electrical problems in switches of ordinary design.

It is a general object of this invention to provide an improved switch construction which overcomes problems which characterize switches employed in relatively sophisticated electrical circuits.

It is a further object of this invention to provide a switch construction which is formed of a relatively few uncomplicated parts and which can be easily assembled whereby the desirable operating characteristics of ths switch can be secured on an inexpensive basis.

It is an additional object of this invention to provide a switch construction of the type referred to in the foregoing objects which can be produced on miniature scale whereby the switch can be utilized in applications involving space limitations.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of the invention are shown in the accompanying drawings in which:

FIG. 1 is a perspective view of a switch construction characterized by the features of this invention;

FIG. 2 is an enlarged vertical sectional view of the switch construction;

FIG. 3 is a cross-sectional view of the switch construction taken about the line 3—3 of FIG. 2;

FIG. 4 is a horizontal sectional view of the construction taken about the line 4—4 of FIG. 2; and,

FIG. 5 is a fragmentary view, partly cut away, taken about the line 5—5 of FIG. 3.

The switch construction of this invention generally comprises a base for mounting at least two stationary contacts, and means for supporting a movable contact arm. The contact arm is adapted to pivot whereby one or more contact areas on the arm will move into and out of engagement with the stationary contacts.

A spring member is connected to the movable contact arm. A midportion of this spring member spans the contact arm with the ends of the spring member engaging the contact arm on opposite sides of its pivot axis. A rocker is provided for moving the contact arm between switch positions, and a star wheel is interposed between the spring member and the rocker for purposes of transmitting movements of the rocker to the contact arm.

The star wheel includes oppositely disposed points, one of which engages the midsection of the spring with the other engaging the rocker. The construction is dimensioned so that the star wheel will normally depress the spring toward the base. The rocker defines a cavity for receiving the star wheel, and interior walls of the cavity are adapted to be engaged by other points of the star wheel. In operation, only one point of the star wheel can engage a wall at a time.

Actuation of the switch by means of the rocker initially operates to cause further depression of the spring member by the star wheel. Thus, in the initial stages of operation, the engagement of contact members is maintained. As movement of the rocker continues, however, the points of the star wheel are shifted to opposite sides of a line extending through the pivot axis of the contact arm. This results in an over-center action which provides rapid disconnect of mating contacts and, in some switch designs, rapid making of other contacts.

The accompanying drawing illustrates a switch construction **10** which is characterized by the features of this invention. This switch construction comprises a molded body portion **12** including a base **14**. The interior of the body portion is open to serve as a means for receiving various switch components.

The components include a rocker member **16** having a pair of trunnions **18** formed integrally therewith. These trunnions are adapted to be received within notched areas **20** formed in each side wall of the body portion **12**. A cap member **22** is secured over the top of the body portion **12** by means of downwardly extending wing portions **24**. These wing portions include inturned latching portions **26**, each having mounting tabs **28** formed thereon. The channels **30** defined by these inturned portions provide a means for mounting the entire switch assembly between opposing members which may be received within the channels.

The cap **22** extends over the notches **20** whereby the trunnions **18** can be maintained in position. In this position, the rocker **16** will pivot as suggested in FIG. 3 with the wall portions **32** of the molded body **12** determining the extent of allowable pivotal movement.

The rocker defines an open interior which includes opposed side walls **34**. A star wheel **36** is mounted within the rocker, and a recess **38** defined by the rocker receives one point **40** of this star wheel. The oppositely disposed point **42** of the star wheel is engaged with a spring **44**. The intermediate points **46** of the star wheel are located for alternately engaging one of the interior walls **34**.

The spring **44** is in the shape of an inverted U and includes downwardly extending legs **48** and a base section **50**. The point **42** of the star wheel slideably engages this base section of the spring whereby the spring serves to provide a surface for pivoting the star wheel and also a surface for sliding movement of the star wheel point.

The legs **48** of the spring are connected to a pivotally mounted contact arm **54**. This arm has a V-shaped configuration with the apex of the V bearing on a first stationary contact **56**. The ends of the contact arm each carry movable contacts **58**. In the position of the switch illustrated, the movable contact **58** engages a second stationary contact **60** while the movable contact **58** is in the open position relative to stationary contact **62**. Each of the stationary contacts has a terminal member **64** attached thereto. These terminal members may be of the type requiring the attachment of an electrical lead or they may be designed for insertion in a printed circuit board.

In the use of a switch construction of the type illustrated, the rocker **16** is depressed in order to pivot the rocker about the axis extending through the trunnions **18**. As this pivoting action occurs, the spring **44** resists downward pressure applied by the star wheel. In constructing the switch, it is preferred that at least some downward pressure be applied by the star wheel to the spring **44** even in the normal position of the switch illustrated. By providing this condition, and by further depressing the spring during pivoting of the rocker, energy is stored in the system which will be released to advantage.

Continued pivoting movement eventually brings the star wheel points to alignment with a line extending vertically, upwardly from the pivot axis of the contact arm **54**. When this occurs, there will be maximum depression of the spring **44**.

As best shown in FIG. 4, the contact arm **54** includes a pair of outwardly extending side tabs **66** which are received in openings defined between the walls **68** formed in the molded body **12**. These walls limit movement of the contact arm lengthwise of the construction and, therefore, the star wheel

point 42 must slide along the surface of the spring 44 in order to achieve the condition described.

As continued rocker movement takes place, the points of the star wheel shift to opposite sides of a vertical line extending upwardly from the pivot axis of the arm 54. When this occurs, a rapid disconnect of previously engaged contacts will result. This rapid movement is developed because of the stored energy in the spring 44. It will be apparent when considering the described operation that the initial movement of the rocker actually increases the contact pressure whereas continued movement of the rocker will quickly release the pressure whereby problems such as arcing can be substantially eliminated.

The design of the star wheel and rocker play an important role in achieving the results described. The star wheel is not connected to the rocker except through engagement of the points of the star wheel within the bearing recess 38 and against the walls 34. Because of this, the star wheel will shift relative to the pivot axis of the rocker during each switching operation. The degree of shifting movement is determined by the spacing between the arms 46 and the adjacent walls 34 when an arm is out of contact with an adjacent wall. By providing the shifting movement of the star wheel, the overcenter action of the spring is made possible since the shifting movement is necessary in order to initiate the rapid disconnect movement.

The illustrated construction is preferably manufactured so that some wiping action will occur between the mating contacts. This wiping action is accomplished by making the spacing between the wall members 68 greater than the width of the tabs 66. During each operating cycle, the position of the mating contacts will shift by an amount equal to this size difference whereby wiping between these mating contacts will result.

The illustrated switch can be varied in many respects to provide arrangements for different applications. For example, one of the stationary contacts 62 could be eliminated whereby a simple "open and close" switch will be provided. In addition, either or both of the contacts 60 and 62 could be replaced with a pair of spaced apart contacts, and the respective movable contacts 58 could be replaced by means for bridging the spaced contacts. With that arrangement, the common terminal connected to the contact 56 would not be required.

In the manufacture of the illustrated construction, all parts can be easily assembled which is of great value where large numbers of switches are required. The assembly operations first involve snapping of the terminals in place which is accomplished by forcing the terminals through openings provided in the molded body 12. The bent-out portions 70 of these terminals are sufficiently resilient so that they can be forced through these openings and will then move to the positions shown for locking the terminals in place.

The assembly comprising the spring 44 and arm 54 is then located in position by simply placing the tabs 66 between the walls 68. The star wheel and rocker are first assembled and then located in position by placing the trunnions 18 in the notches 20. A slight downward pressure is maintained on the rocker until the cap member 22 is located in position. The portions 24 of the cap member are preferably of spring material so that the cap member can simply be snapped into place.

It will be understood that various changes and modifications may be made in the above described construction which provide the characteristics of this invention without departing from the spirit thereof.

That which is claimed is:

1. In a switch construction comprising a base, at least two stationary contacts mounted on said base, a pivotally movable contact arm, at least one contact area defined by said arm for movement into and out of engagement with said stationary contacts, a spring defining ends engaging said arm on opposite sides of the pivot axis of the arm and having a main body portion spanning said arm, a star wheel having a first point engaging said body portion, a rocker defining a bearing area for engaging a second point of said star wheel, said second point being disposed opposite said first point, said points of said star wheel being located on opposite sides of a line extending through said pivot axis, said bearing area of said rocker being located relative to said base so that the star wheel normally depresses said spring body portion in the direction of said base, a pair of interior walls defined by said rocker on opposite sides of said star wheel, additional star wheel points located for engagement with said walls, said walls being spaced so that only one of said additional points can engage a wall at any time, pivoting movement of said rocker being adapted to cause said star wheel to initially depress said spring further in the direction of said base to thereby increase the pressure of said contact area on a stationary contact, and continued pivoting movement shifting said first and second points of said star wheel to the opposite sides of said line to thereby rapidly pivot said contact arm thereby breaking engagement between said contact area and said stationary contact.

2. A construction in accordance with claim 1 wherein said arm is conductive, said stationary contacts being located whereby one contact is maintained in engagement with said arm during all positions of the arm with said contact area being moved into an out of engagement with the other stationary contact.

3. A construction in accordance with claim 2 wherein said arm comprises a V-shaped member, the apex of said arm bearing against said one stationary contact, said one stationary contact providing a pivot area for said arm.

4. A construction in accordance with claim 3 wherein the apex of said arm is free to move relative to said one contact area whereby wiping of said arm against said stationary contact area will occur during switching operations.

5. A construction in accordance with claim 3 wherein said spring comprises a band in the shape of an inverted U, the legs of said band depending downwardly for attachment to the ends of said arm.

6. A construction in accordance with claim 3 wherein stationary contacts are located on said base for engagement with each end of said arm.

7. A construction in accordance with claim 1 wherein said rocker defines an interior cavity, said star wheel being disposed within said cavity, and a housing including said base for enclosing the construction with the exception of an exposed portion of said rocker for actuation of the switch and terminal portions connected to said stationary contacts for connecting the switch in an electrical circuit.

8. A construction in accordance with claim 7 wherein said star wheel is free of attachment within said housing whereby the additional star wheel points alternately engage the respective walls, depending upon the position of the switch.

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