Nov. 19, 1968 P. A. MEDICKS ET AL 3,411,375

ROTARY SWITCH HAVING TORSION BAR TYPE RETURN SPRING

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Fig. 1

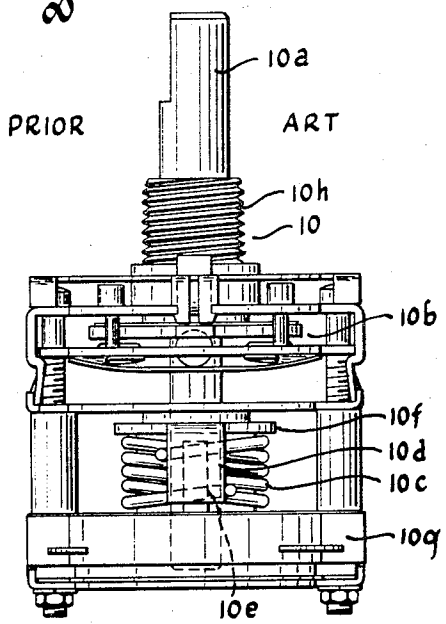


Fig. 2

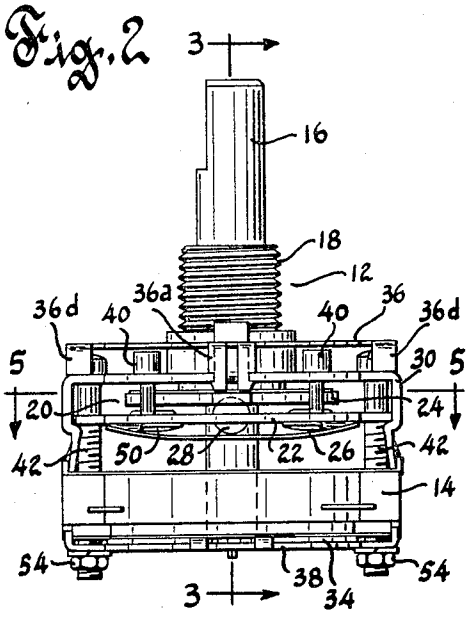


Fig. 3

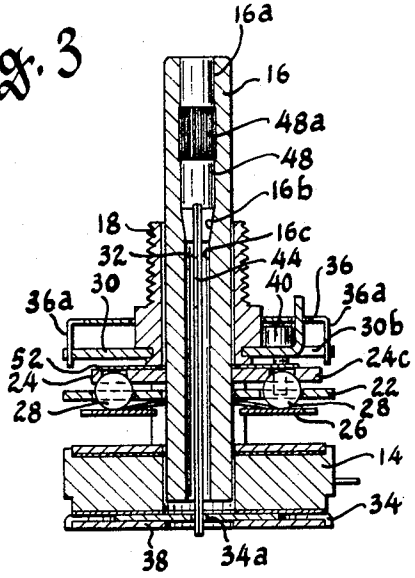


Fig. 4

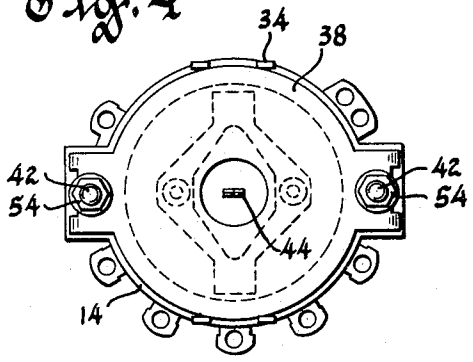
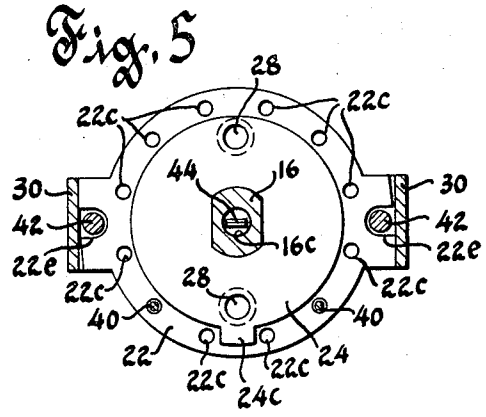


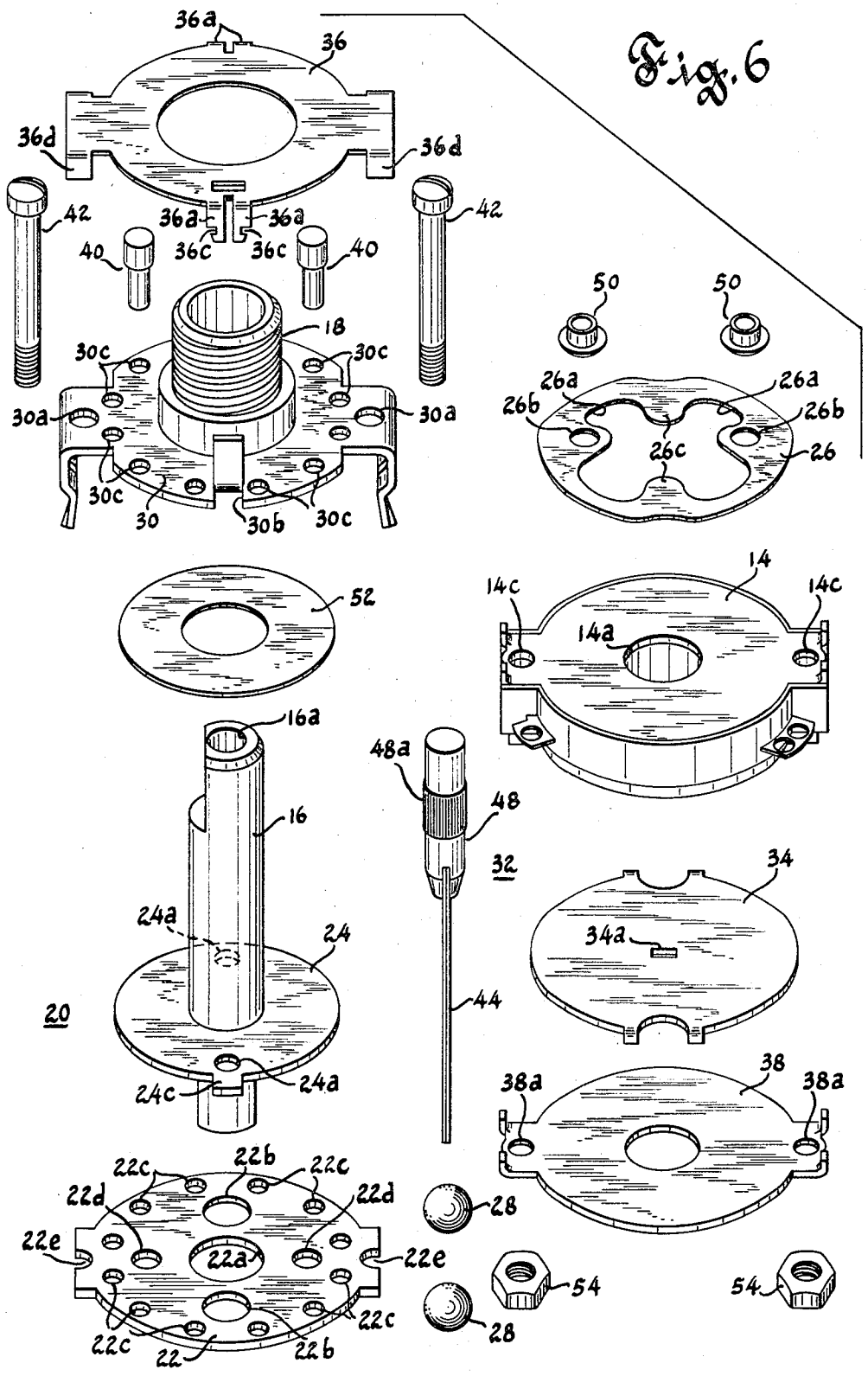
Fig. 5



ROTARY SWITCH HAVING TORSION BAR TYPE RETURN SPRING

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Fig. 6



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ROTARY SWITCH HAVING TORSION BAR TYPE RETURN SPRING

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4 Claims. (Cl. 74—504)

ABSTRACT OF THE DISCLOSURE

A rotary switch operating mechanism having a torsion bar type return spring, secured at one end in a bore in a rotary operating shaft, and non-rotatably secured at its other end to the switch frame to afford return of the operating shaft to normal position following rotation thereof to one or more switch operating positions.

This invention relates to a novel form of torsion bar spring return mechanism for rotary switches of the two or more position momentary type.

Rotary switches of the momentary type as heretofore constructed have utilized helically coiled twist springs to effect return of the operating shaft from either side, or both sides of a center or "off" position depending upon the number of switching units or switch decks used. Helically coiled return springs have required a number of coil turns and the overall length of the switch must in part accommodate the length of the return spring. With increasing demand for the number of switch units that can be mounted behind a mounting panel, it is desirable that some means be provided to effect the shaft return not requiring the considerable overall length of the usual helical coil springs. It is therefore an object of the present invention to provide a novel form of torsion return spring which markedly reduces the space required behind the mounting panel for the complete switch mechanism.

Another object of the invention is to provide an improved form of three position momentary rotary switch embodying the invention.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate a preferred embodiment of the invention that will be hereinafter described in detail in connection with the accompanying drawings. It is to be understood that the preferred embodiment disclosed is susceptible of modifications with respect to details without departing from the scope of the appended claims.

FIGURE 1 is a side elevational view of a rotary switch of the three position momentary contact type constructed in accordance with prior art practices;

FIG. 2 is a side elevational view of a rotary switch of the aforementioned type constructed in accordance with the present invention;

FIG. 3 is a lateral section taken along line 3—3 of FIG. 2;

FIG. 4 is a bottom plan view;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 2; and

FIG. 6 is an exploded view in isometric perspective showing the various parts of the switch of the present invention.

Referring to FIG. 1, it shows a rotary momentary switch **10** having a rotary operating shaft **10***a*, a ball position detent mechanism, generally designated **10***b*, and a helical twist return spring **10***c*. It may be assumed that switch **10** is of the three position, center "off" type having commutating positions on either side of the center position. The ends of the spring **10***c* bear against an upstanding post **10***e* on opposite side thereof and also against a downturned tab **10***d* of a rotor plate **10***f* which is keyed to a portion of the shaft **10***a*.

Let it be assumed that the shaft **10***a* is turned to the left as shown in FIG. 1. In that case the tab **10***d* will move the left-handmost end of spring **10***c* to the left and thereby cause an increase in spring tension. When rotor **10***f* is released after obtaining an operating position, the energy stored in spring **10***c* will return rotor **10***f* to the position depicted in FIG. 1. Likewise, when rotor **10***f* is rotated to the right as shown in FIG. 1. The right-hand or lower-most end of spring **10***c* will be moved by the tab **10***d* to the right to compress spring **10***c* as aforementioned and when released rotor **10***f* will rotate to the left to bring the rotary shaft back to the position depicted in FIG. 1. Although not shown, it may be assumed that contacts contained in the switch deck **10***g* are appropriately commutated in either of the aforementioned operating positions. It will be seen that the spring **10***c* has a number of coil turns and encompasses a considerable overall portion of the total length of the switch **10** below the threaded one-hole mounting boss **10***h*.

The switch **12** embodying the present invention, shown in FIGS. 2 through 6 comprises a switch deck **14**, a rotary operating shaft **16**, a combination shaft bearing support and threaded one-hole mounting bushing **18**, a position detent mechanism, generally designated **20** and comprising a ball cage plate **22**, a ball detent plate **24**, detent disc spring **26** and a pair of detent balls **28**. Switch **12** further comprises an upper stop pin retaining plate **30** to which the member **18** is mounted by spinning over the bottom surface, a torsion spring assembly generally designated **32**, a torsion spring anchor plate **34**, upper and lower cover plates **36** and **38**, stop pins **40** and switch assembly screws **42**.

As shown in FIG. 3, rotor shaft **16** is provided with an axial bore which at its upper end is provided with a portion **16***a* which merges through a frusto-conical tapered portion **16***b* to a portion **16***c* of reduced diameter. A torsion spring assembly **32** comprises a pair of like torsion leaf springs **44**, preferably formed of a spring steel, and a plug-like clamp member **48** which has a frusto-conical tapered end and a transverse slot formed therein. The springs **44** are inserted in the aforementioned slotted end of member **48** and the assembly inserted into the end of the large portion of the bore in rotor **16** and forced downwardly therein with the serrated portion **48***a* of a member **48** having an interference with the inner side walls of the portions **16***a* and **16***b* of the rotor **16**. The walls of slot surrounding the springs are to tightly clamp them in the end of member **48**. The springs **44** at their lower ends extend beyond the lower end of rotor shaft **16** and are anchored against rotation in a rectangular slot **34***a* of complemental dimensions formed in anchor plate **34**.

Shaft **16** over the lower half of its length is provided with flats on opposite sides thereof and extends through a complementally formed opening in a rotary contactor **14***a* within the switch deck **14**. The detent disc spring **26** is provided with a clover leaf like cutout portion **26***a* and a pair of circular openings **26***b* which are concentric with openings **22***d* formed in ball cage plate **22**. Rivets **50** are inserted through the alined openings in the spring plate **26** and ball cage plate **22** to secure the former to the latter. Shaft **16** extends through a centrally located opening **22***a* in plate **22** and plate **22** has a number of openings **22***c* spaced at equal rotary angles about the center and are concentric with corresponding openings in stop pin retaining plate **30**.

Detent balls **28** fit within openings **22***b* in plate **22** and at the lower ends engage the spring plate **26** at tabs **26***c*. Detent plate **24** is suitably keyed on the lower half of rotor shaft **16** and is provided with openings **24***a* concentric with, but smaller in diameter than the openings **22***b* in ball cage plate **23**. The upper portions of the balls **28** in the center position of the detent engage within openings **24***a*. A thrust-washer **52** fits about shaft **16** and between bushing **18** and ball detent plate **24**.

The assembly comprising member **18** and stop pin retaining plate **30** fit about the shaft **16** and the screws **42** penetrate openings **30***a* in plate **30** down through alined notches **22***e* in plate **22**, through openings **14***c* in the switch deck **14**, and through openings **38***a* in the lower bottom cover plate **38**. Nuts **54** take onto the threaded ends of the screws **42** and thereby hold the assembly together. The upper plate **36** has downwardly depending split tangs **36***a* on opposite sides thereof which are adapted to fit into notches **30***b* formed in plate **30** and have notches **36***c* formed therein which engage with the edges of the notches **30***b* to hold the cover plate in place. Extensions **36***d* have downwardly depending arms on both sides that overlie the heads of the screws **42**.

With the upper cover plate **36** removed, the stop pins **40** may be inverted in any of the openings **30***c* formed in plate **30** and have portions that fit within the openings **22***c* in plate **22**. This removability of the pins **40** permits adjustment of the angle of rotation of the rotary shaft **16**. In the embodiments shown in FIGS. 2 through 6 the pins **40** are spaced suitably to provide a rotation of shaft **16** approximately 30 degrees either side of center position. It will be noted that the rotor plate **24** is provided with a tab **24***c* which engages with the pins **40** at the end of the angular rotation.

It will be apparent that if rotor shaft **16** is rotated in either direction from its normal or center position, torsion springs **44** will be helically twisted along a longitudinal axis running through the center of the opening **34***a* and the center of the aforementioned slot in member **48**. In so twisting, energy will be stored in the springs **44** which will provide a shaft position restoring force when shaft **16** is released. The aforedescribed ball detent mechanism, of course, provides a definite position "feel" or indication.

While only one switch deck **14** has been shown in the disclosed embodiment, it will be appreciated that the use of the present invention is not limited to rotary switches having a single deck. More than one switch deck can be used if the size and restoring force provided by springs **44** are appropriately selected.

We claim:

1. In a rotary switch, in combination, a switch operating shaft having an axial bore therein, means affording rotatable bearing support for said shaft, torsion bar spring means nonrotatably anchored at one end in the bore of said shaft, and support means spaced from the first mentioned means in which the other end of said spring means is anchored, said shaft upon rotation from a given position effecting axial helical twisting of said spring means to provide shaft return rotation to said given position upon release thereof.

2. The combination according to claim **1**, wherein said torsion bar spring means comprises at least two, elongated, flat spring members which are positioned and secured at corresponding ends within the bore of said shaft to rotate therewith, and which are anchored at their opposite corresponding ends by said means spaced from the first mentioned means.

3. The combination according to claim **2**, wherein said torsion bar spring means also comprises a member nonrotatably seated within the bore of said shaft and having a slotted end within which said spring members are secured at their first mentioned corresponding ends.

4. The combination according to claim **3** wherein said means spaced from the first mentioned means comprises a member having an opening alined with and complementally formed to accommodate and hold the opposite corresponding ends of said spring members fixed.

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