United States Patent

Weisenburger

[15] **3,660,789**

[45] **May 2, 1972**

[54] ROTARY REED SWITCH

[72] Inventor: **Lawrence P. Weisenburger,** Ottsville, Pa.

[73] Assignee: **Thomas & Betts Corporation,** Elizabeth, N.J.

[22] Filed: **Apr. 19, 1971**

[21] Appl. No.: **135,281**

[52] **U.S. Cl.** **335/206**

[51] **Int. Cl.** **H01h 19/04,** H01h 51/28

[58] **Field of Search** 335/205, 206, 207, 153

[56] **References Cited**

UNITED STATES PATENTS

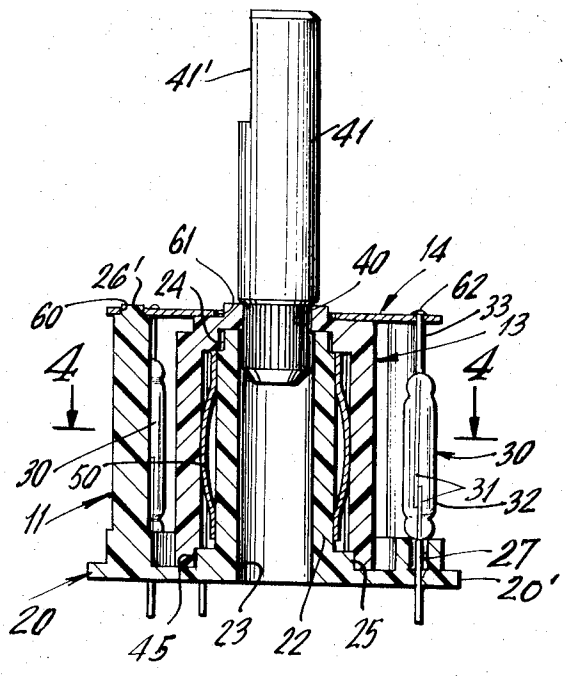
3,151,226	9/1964	Jones et al.	335/206
3,162,738	12/1964	Abramson et al.	335/206

Primary Examiner—Bernard A. Gilheany
Assistant Examiner—R. N. Envall, Jr.
Attorney—Thomas M. Marshall

[57] **ABSTRACT**

A rotary reed switch includes an integral support structure having a central elongated rotor support about which is arranged an array of reed switches, with a rotor being mounted on the rotor support. A magnet is mounted on the rotor and is operative to selectively actuate the individual reed switches as the rotor is rotated on the central rotor support.

11 Claims, 4 Drawing Figures



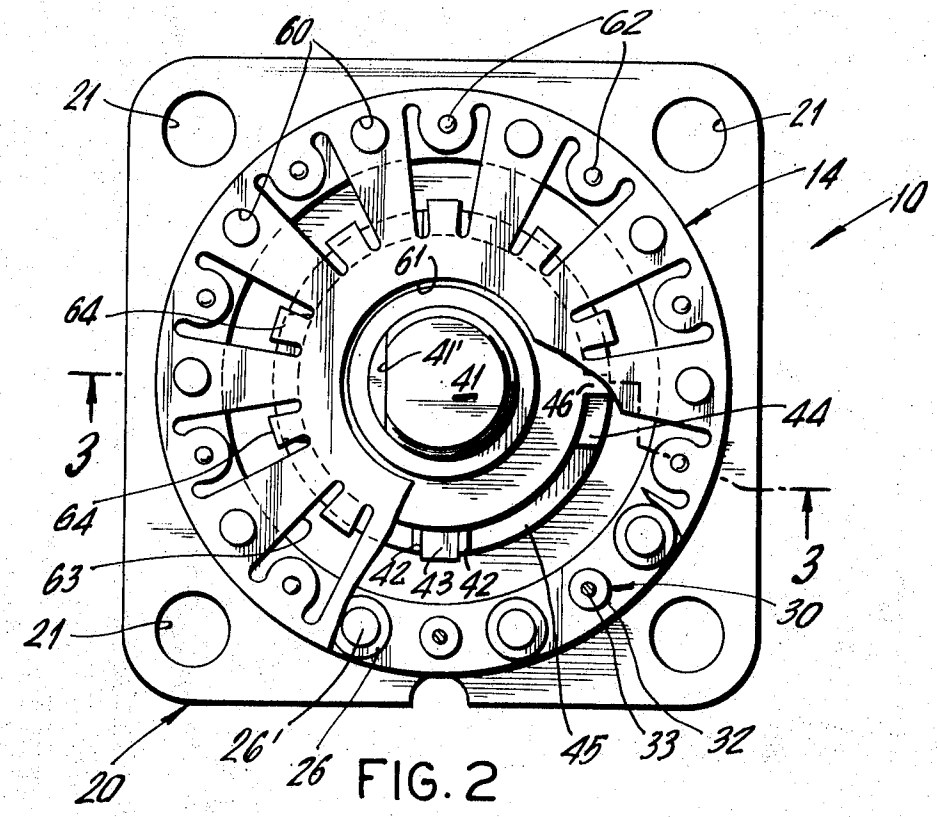


FIG. 2

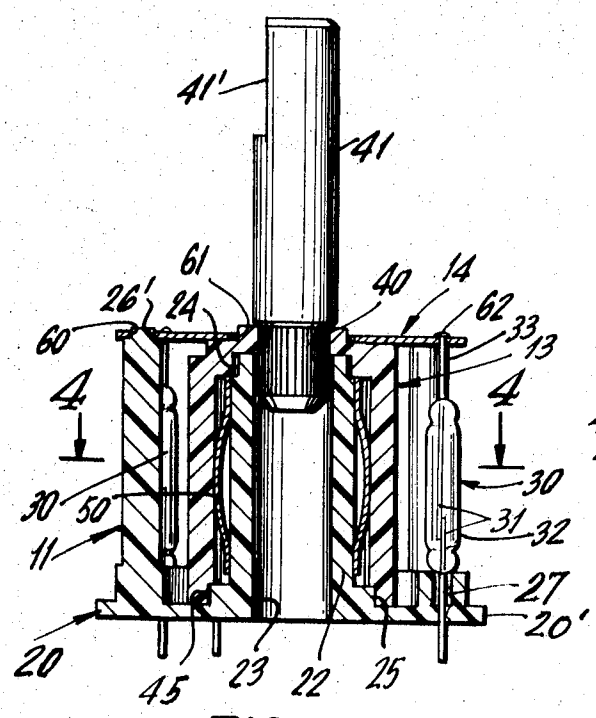


FIG. 3

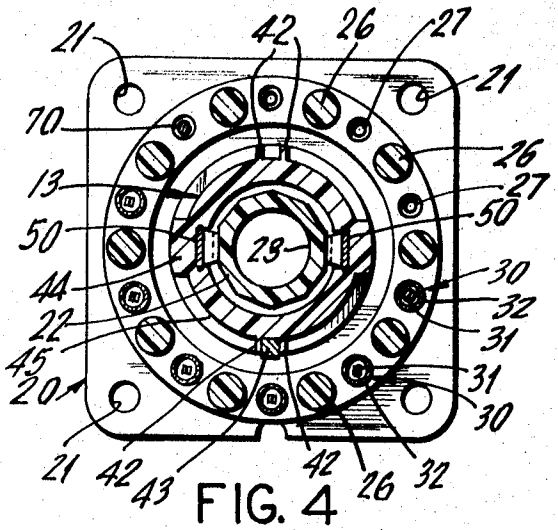


FIG. 4

INVENTOR.
LAWRENCE P. WEISENBURGER
BY

Thomas M. Marshall
ATTORNEY

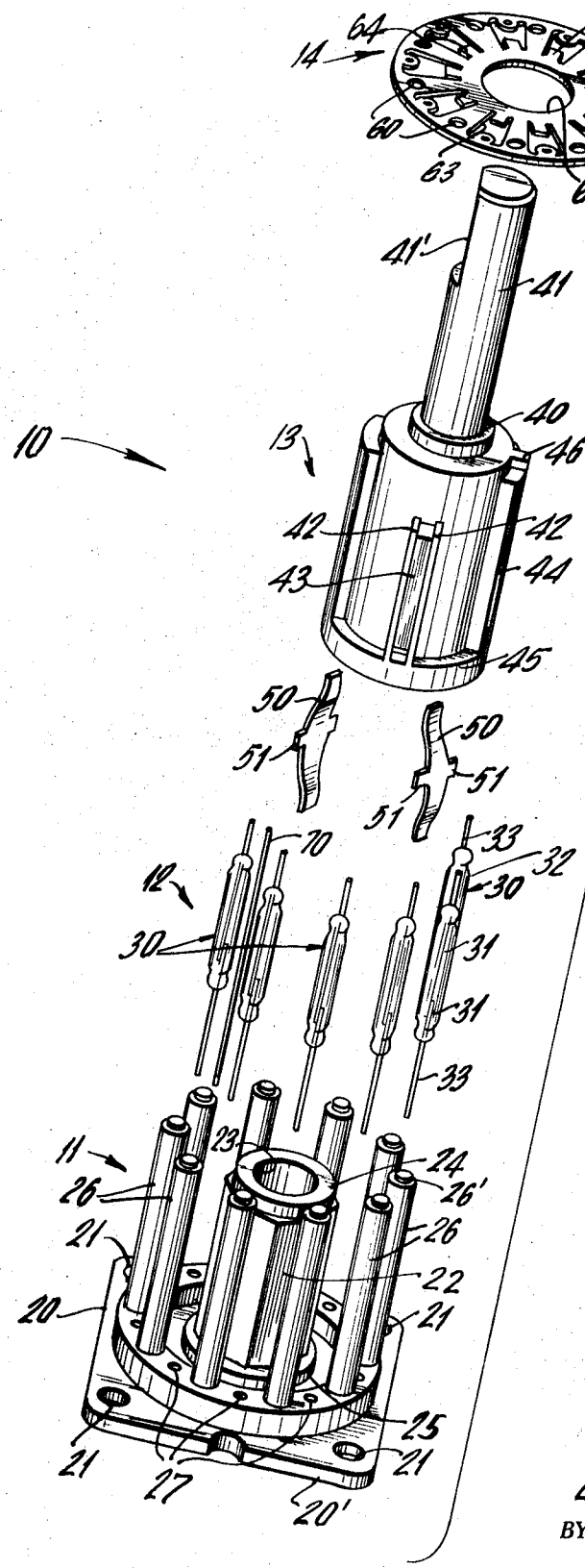


FIG. 1

INVENTOR.
LAWRENCE P. WEISENBURGER
BY

Thomas M. Marshall
ATTORNEY

ROTARY REED SWITCH

The present invention relates to reed switches, and more particularly a new and improved rotary reed switch wherein the reeds are mounted in a generally cylindrical configuration so as to provide an extremely compact and efficient switching means. The rotary reed switch may be employed in an application where it is desired to connect a single electrical input lead to a plurality of other circuits, e.g. audio or computer switching applications.

Reed switch and reed relay applications have grown markedly in the past several years primarily because of the outstanding characteristics of reed switches. These characteristics include the ability of reed switches to be operated over an extreme ambient temperature range, and the capability of reed switches to be uneffected by radiation effects. Furthermore, reed switches exhibit a very low noise output, and are practically bounce-free. In addition, reed switches have an extremely long life, as compared to contact switches.

Each reed switch consist of two plated reeds or steel blades cantilevered from each end of an elongated sealed glass tube, either evacuated or inert gas filled. Mercury wetted reed switches use small quantities of mercury to help make contact and reduce bounce.

Rotary reed switches known to date have taken the form of a plurality of reed switches mounted on a printed circuit board, with the axes of the glass tubes extending radially from a central post on which the magnet is mounted. The magnet is fixed to an arm rotatable mounted on the central post whereby, upon rotation of the arm, the magnet passes over the individual reed switches causing actuation thereof. One of the primary problems with a reed switch of this type is the large planar area covered by the reed switch. For example, a basic 10 position reed switch is about 4 inches square. Besides the large planar size of known rotary reed switches, the requirement for a printed circuit board in order to mount and interconnect the various reed switches is costly, whereby the overall cost of a rotary reed switch of this type is prohibitive in light of available contact switches.

It is an object of this invention to provide an improved rotary reed switch which overcomes the problems mentioned above, while enabling the use of reed switches for use in a rotary selector switch.

It is a further object of this invention to provide a low cost reed switch which is extremely reliable and compact in size.

It is another object of this invention to provide a rotary reed switch including an integral support structure having a central rotor support, and an array of support members and reed switches surrounding said central rotor support, with a rotor having a magnet mounted thereon being rotatably mounted on said central rotor support for actuating said reed switches.

It is another object of this invention to provide a rotary reed switch of the type aforementioned including an electrically conductive plate mounted on the central rotor support, with each of said reed switches being connected thereto.

It is still another object of this invention to provide a rotary reed switch of the type aforementioned wherein the reed switch includes indexing means for controlling the rotational position of the rotor.

It is another object of the invention to provide a rotary reed switch of the type mentioned wherein stop means are provided for limiting the rotational movement of the rotor.

Other and further objects will become evident from the following description and drawings wherein:

FIG. 1 is an exploded perspective view of the rotary reed switch of the subject invention;

FIG. 2 is a partial sectional plan view of the rotary reed switch of the subject invention;

FIG. 3 is a partial sectional elevational view of the rotary reed switch taken along line 3—3 in FIG. 2; and

FIG. 4 is a partial sectional plan view taken along line 4—4 in FIG. 3.

FIG. 1 illustrates an exploded perspective view of the various components making up the rotary reed switch of the subject invention. The rotary reed switch **10** basically comprises

an integral support structure **11**, an array of reed switches **12**, a rotor **13**, and an electrically conductive common ground plate **14**. The support structure **11** comprises an integral unit preferably molded of a plastic material or other suitable dielectric material, and includes a base **20** preferably of square plan form, having mounting holes **21** disposed in each corner for connection to a suitable chassis to which the rotary switch is mounted. Extending perpendicularly from the base is a central rotor support or post **22** which may have a constant diameter bore **23** therethrough, with the outer surface of the center post **22** being polygonical in configuration. The upper end of the center post is in the form of an annular flange **24** to define a bearing surface for the rotor, to be described. Similarly, disposed at the lower end of the post is an enlarged diameter, annular bearing surface **25** which also provides a bearing surface for the rotor. The combination of bearing surfaces **24** and **25** provides stability to the rotor.

Arranged in an array about the center post **22** are a plurality of vertical support members **26** integrally connected at their lower end an annular flange **20'** formed on base **20**. The upper end of each post **26** includes a reduced diameter portion **26'**. Interposed between each pair of post **26** is a hole **27** extending through the flange **20'** and the base structure **20**, and providing a support means for one lead of each reed switches, to be described more fully hereinafter.

As previously mentioned, each reed switch **30** comprises two plated reeds or steel blades **31** cantilevered from each end of a sealed glass tube **32**, with the glass tube being either evacuated or formed with an inert gas. Leads **33** extend from each end of the reed switch.

The rotor **13** is also made of a dielectric material and is generally cylindrical in configuration, and closed at its upper end except for a small diameter opening **40** into which is pressed fitted control shaft **41** for manually positioning the rotor. Formed integral with the rotor on the outer surface thereof is at least one pair of spaced elongated ribs **42**, which ribs provide a slotted support for a permanent magnet **43**. Preferably, the magnet **43** is bonded or cemented to the rotor between the ribs **42**. Also formed integral with the body of the rotor **13** are enlarged elongated hollow portions **44** which extend the full axial length of the rotor, and correspond in diameter to an enlarged diameter, annular flange **45** disposed along the lower end of the rotor body. The inner surface of flange **45** provides a bearing surface for cooperation with the bearing flange **25** formed on the center post **22**. Each portion **44** is hollow to accommodate curved, e.g., half-elliptical, spring **50** having a pair of stabilizing tabs **51**, **51** with each spring **50** being mounted in its associated portion **44**, as illustrated in FIG. 3. Springs **50** cooperate with the multi-sided polygonical exterior surface of the center post **22** to provide an indexing means or stepping arrangement for controlling the position of the rotor **13**.

The common ground plate **14** is mounted on the small diameter projections **26'** of the vertical support members **26** by means of a plurality of holes **60** (see FIG. 2) disposed in an array around the annular ground plate **14**, with the plate including a center aperture **61** through which the central shaft **41** passes. Also formed in the common ground plate is an array of holes **62** through which one lead **33** of each reed switch **30** is accomodated As shown in FIG. 3, when the rotary reed switch of the subject invention is fully assembled, one lead of each reed switch passes through a hole **62** in the common ground plate **14** and is suitable connected thereto, for example, by soldering or welding.

FIG. 2 illustrates a detailed view of the common ground plate **14** which, in addition to the holes **61** and **62**, includes a series of punched out openings **63**, each of which defines a tab **64**. The common ground plate **14** is preferably made of electrically conductive material which may be deformed.

Formed integral with the rotor **13** and disposed above one of the portions **44** is a projection **46**. When the rotary reed switch is fully assembled, the projection **46** passes beneath the tabs **64**, and it is possible to define a stop means for limiting

the rotary movement of the rotor **13** by merely bending one of the tabs **64** downwardly in the direction of the projection **46**.

The common ground plate **14** serves several functions in that it (1) holds the entire rotary reed assembly together; (2) provides a common ground for the several reed switches; (3) provides a common connection for the input signal lead; and (4) forms a portion of the rotary stop means for the switch.

As illustrated in FIG. **3**, each reed switch **30** is connected at its upper end to the common ground plate **14**, while the lead **33** at its lower end passes through an associated hole **27** in the integral support structure **11** where it may be suitably connected to a printed circuit board or the like. As also shown in FIG. **3**, shaft **41** includes a flat or land **41'** to provide a means for accommodating a conventional knob (not shown) to aid in positioning the rotor about the center post **22**.

As illustrated in FIG. **1**, the rotary reed switch includes a plurality of reed switches **30** which are interspersed between the vertical support members **26**. The switch also includes a single lead **70** which is disposed between a pair of vertical members **26** and connected, by soldering or welding, at one end to the common ground plate **14**, with the other end thereof extends through a hole **27** in the integral support structure. As is readily apparent, a signal passed through the common lead **70** would be distributed via the common ground plate **14** through the reed switch which is in its closed position by virtue of the magnet **43** being positioned opposite therefrom.

In order to change the signal to a different conductive path, it is merely necessary to rotate the rotor **13** whereby the magnet would activate a different reed switch, while simultaneously resulting in the previous reed switch being opened or deactivated. The indexing means in the form of the springs **50** acting against the polygonical outer surface of the center post **22** ensures that the magnet is indexed to a position radially opposite a reed switch. Furthermore, with a tab **64** bent downwardly, the projection **46** operates in conjunction therewith to limit the rotational movement of the rotor.

Although a preferred embodiment of the subject rotary reed switch has been described hereinabove, it will be understood that variations of the construction of the rotary reed switch are contemplated within the scope of the present invention. Thus, the integral support structure could be formed of a plurality of members suitably bonded together, and more or less reed switches may be employed in combination with a common lead, or alternatively, the lead could be dispensed with, and connected directly to the common ground plate without extending through the base **20** and between a pair of vertical members **26**. In like manner, the indexing means may take other common forms in lieu of the illustrated embodiment wherein a pair of springs are biased against the polygonical outer surface of the center post. In another modification, a printed circuit board may be employed in lieu of the common ground plate **14** in order to provide an interconnection between the various reeds and the input signal. Furthermore, the return leads from the printed circuit board may be threaded through elongated openings extending through hollow vertical support members **26**. Alternatively, the vertical support members **26** may be made of electrically conductive material such as brass.

In an alternate embodiment of the rotary reed switch of the subject invention, the ground plate **14** may be formed of two halves which are mechanically and electrically separate, and with one-half of the reed switches being respectively connected to each half of the plate **14**. Furthermore, two magnets may be mounted on the rotor **13** thereby effectively providing two rotary reed switches in one unit. It is also possible to add more magnets to define different combinations of elements to provide other variations of the subject rotary reed switch. Other forms of reed switches may also be employed in the subject switch (e.g. Form "A," "B," or "C"), and, of course, several rotary reed switches may be arranged in a stacked configuration.

It is also noted that the rotary reed switch may be constructed without a detent mechanism, especially for those applications where the rotor is rotated at high speeds, as in a shaft counting or precision locating application.

The present invention should not be limited by the above description and drawings but rather by the following appended claims.

WHAT IS CLAIMED IS:

1. A rotary reed switch comprising:

an integral support structure including a base, a central rotor support extending perpendicular to said base, and an array of support members extending perpendicular to said base and surrounding said central rotor support;

a rotor mounted for rotation on said central rotor support and having at least one magnet mounted on the outer surface thereof;

an electrically conductive plate mounted on said support members; and

a plurality of reed switches mounted in an array around said rotor in the spaces between said support members, each reed switch connected at one end to the electrically conductive plate and supported at the opposite end thereof by said base, said reed switches being selectively actuated by the magnet in accordance with the rotational position of said rotor.

2. A rotary reed switch as in claim **1** wherein means are provided for indexing the rotation of the rotor to positions in alignment with the reed switches.

3. A rotary reed switch as in claim **1** wherein the exterior surface of said central rotor support is in the form of a polygon, and said rotor includes spring means which cooperate with the polygonical exterior surface of said central rotor to define an indexing arrangement for the rotor.

4. A rotary reed switch as in claim **1** wherein said base includes a plurality of holes disposed in an array around said central rotor support, with the opposite ends of said reeds passing through and being supported by said holes.

5. A rotary reed switch as in claim **1** wherein the rotor includes two external ribs defining a slot for mounting the magnet.

6. A rotary reed switch as in claim **1** wherein the electrically conductive plate comprises a printed circuit board.

7. A rotary reed switch as in claim **1** wherein the rotor includes a projection at one end thereof, and said electrically conductive plate includes a plurality of deformable tabs, whereby, upon deforming of a tab in the direction of the rotor, said deformed tab and projection cooperate to define a stop for limiting the rotational movement of said rotor.

8. A rotary reed switch as in claim **1** wherein the electrically conductive plate includes a central opening, and a control shaft passes through said central opening and is secured to the rotor.

9. A rotary reed switch as in claim **1** wherein two magnets are mounted on said rotor.

10. A rotary reed switch as in claim **1** wherein the integral support structure is formed of molded plastic.

11. A rotary reed switch as in claim **1** wherein a common lead is disposed between two of said support members and is connected at one end to the electrically conductive plate, while the opposite end thereof extends to the base.

* * * * *