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Austin

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[54] **ROTARY SWITCH WITH SELECTIVELY LIMITED POSITIONING**

[75] Inventor: **Charles W. Austin,** Williamsville, N.Y.

[73] Assignee: **GTE Sylvania Incorporated,** Stamford, Conn.

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[52] **U.S. Cl.** ..... **200/169 R,** 74/10.41, 74/228, 74/327, 74/553

[51] **Int. Cl.** **H01h 3/20,** H01h 9/20

[58] **Field of Search** ..... 200/169 R, 155 K, 200/172 R, 172 A; 74/553, 527, 228, 10.41

[56] **References Cited**

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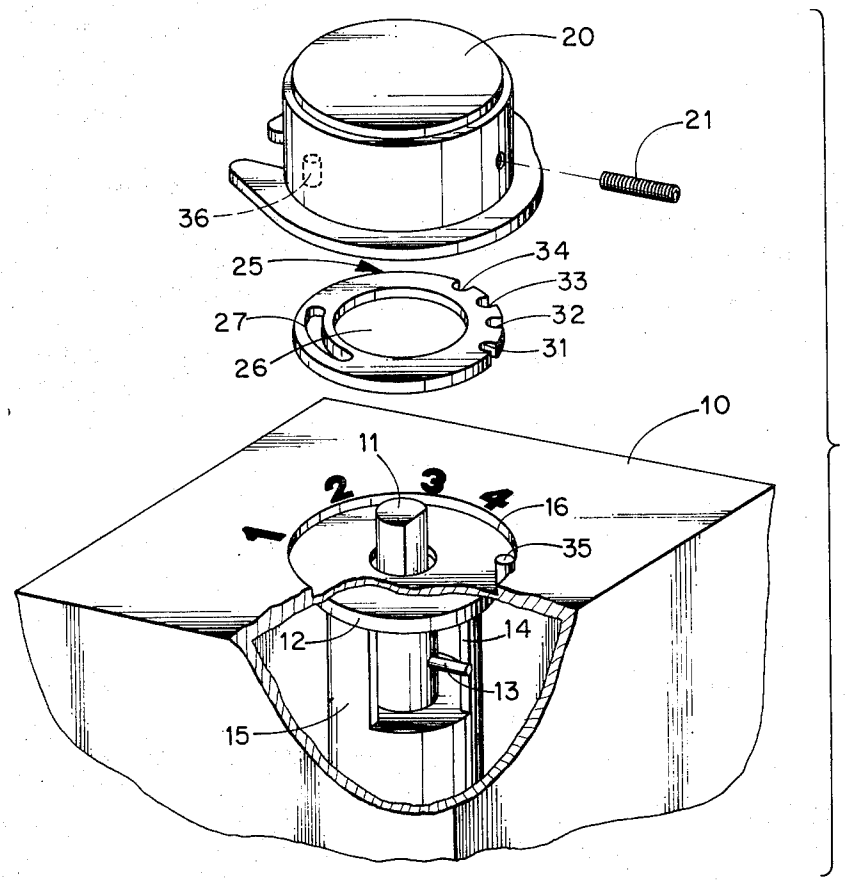
Primary Examiner—David Smith, Jr.

Attorney—Norman J. O'Malley et al.

[57] **ABSTRACT**

Rotary indexing switch which can be selectively limited for switching through one, two, three, or four positions. A disk is positioned between the base member and the knob of the switch mechanism. One of four spaced apart indentations in the disk is selected to engage a pin affixed to either the knob or the base member. A slot in the disk engages another pin affixed to whichever of the knob or base member does not have the first pin.

6 Claims, 5 Drawing Figures



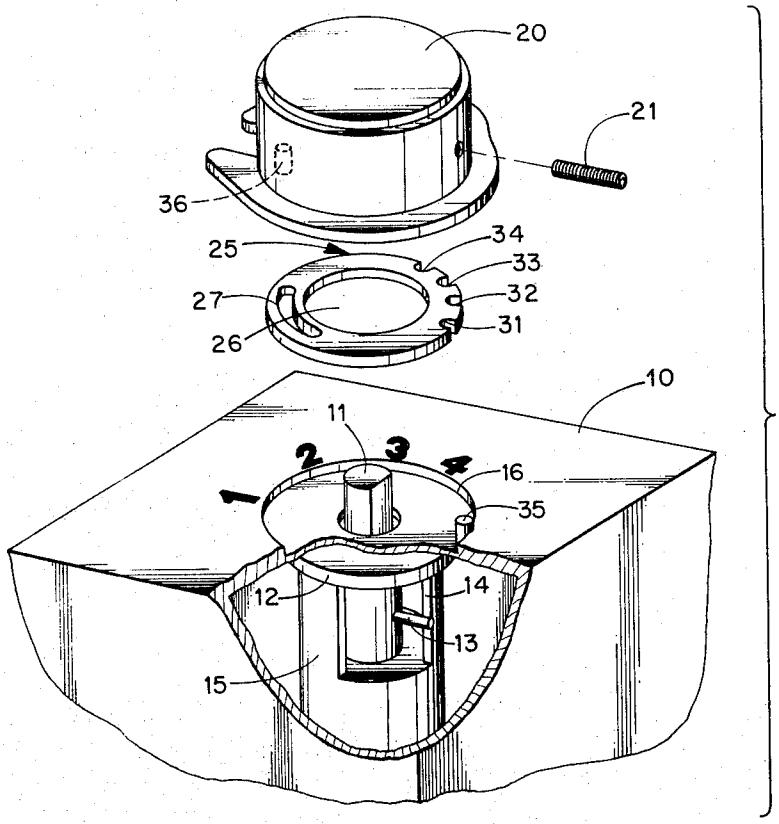

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35
12
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Fig. 1.

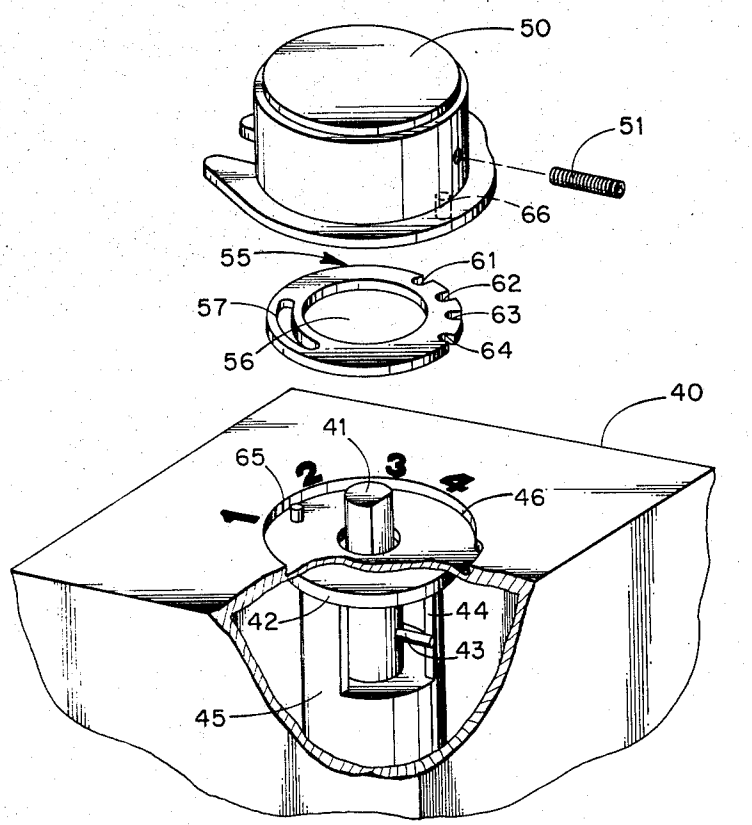

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42
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Fig. 3.

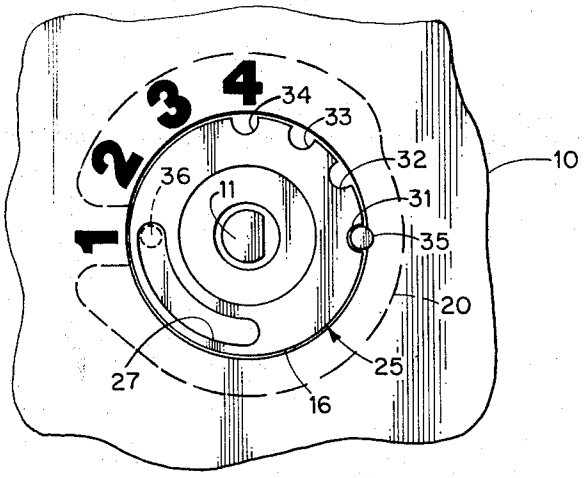


Fig. 2A.

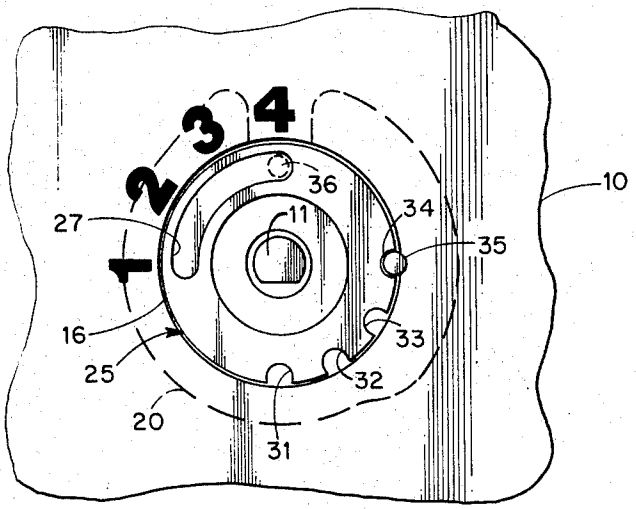


Fig. 2B.

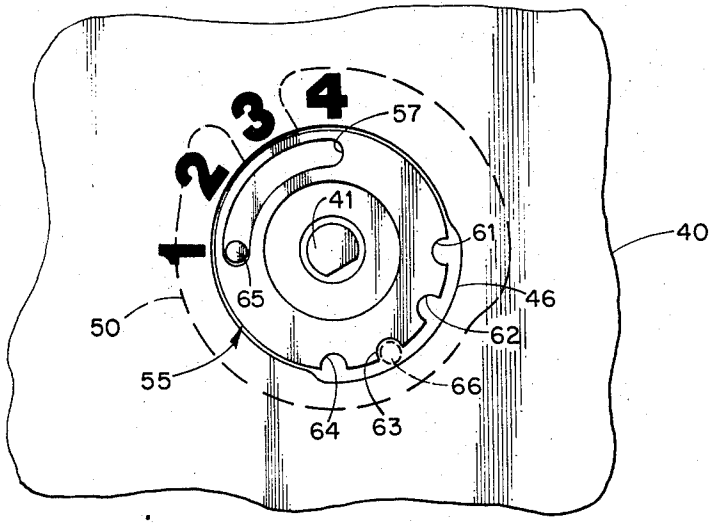


Fig. 4.

ROTARY SWITCH WITH SELECTIVELY LIMITED POSITIONING

BACKGROUND OF THE INVENTION

This invention relates to rotary switches. More particularly, it is concerned with rotary switches having limited angles of rotation which may be selectively varied.

In certain apparatus, such as, for example, small hand-held communication radios, it may be desirable to provide a capacity of several communication channels but be able to limit the number of channels available for use at any one time in a selective manner. For example, a communication radio may have the capability of employing up to four communication channels, and it may be desirable to selectively limit operation of the radio to only one, two, or three of the channels. The choice of a specific channel within the range selected typically is made by switching a rotary switch to the proper position for the desired channel.

SUMMARY OF THE INVENTION

A rotatable shaft mechanism having selectively limited angular positions for use with a rotary switch may be employed to switch channels in a communication radio is provided by the mechanism in accordance with the present invention. The mechanism is relatively inexpensive by virtue of employing standard switch elements in combination with other uncomplicated structural elements. In addition, selecting angular positions to which the shaft is to be limited is easily accomplished.

A rotatable shaft mechanism in accordance with the present invention includes a base member and a shaft which extends from the base member and is mounted for rotary movement with respect thereto. The shaft may be the shaft of a rotary switch. A knob member is fixed to the shaft. A plate is disposed between the base member and the knob member and lies generally normal to the shaft. The plate has a central opening through which the shaft extends, and also has an arcuate opening. One of the members, for example the knob member, has a pin affixed to it which provides a projection for extending into the arcuate opening. The other member is selectively fixed to the plate by a locking means in a manner which permits the fixed angular relationship between the member and the plate to be changed. Thus, the possible angular positions of the knob member with respect to the base member are limited by the excursion allowed by the pin in the arcuate opening, and may be changed by changing the particular fixed angular relationship between the plate and the member.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional objects, features, and advantages of rotatable shaft mechanisms in accordance with the present invention will be apparent from the following detailed discussion together with the accompanying drawings wherein:

FIG. 1 is an exploded view in perspective illustrating a rotatable shaft mechanism in accordance with the present invention;

FIG. 2A is a plan view of the shaft mechanism of FIG. 1 showing the elements arranged to be limited to only one of four possible switch positions;

FIG. 2B is a plan view of the shaft mechanism of FIG. 1 showing the elements arranged for switching to any one of the four possible switch positions;

FIG. 3 is an exploded view in perspective of an alternative embodiment of the rotatable shaft mechanism in accordance with the invention; and

FIG. 4 is a plan view of the shaft mechanism of FIG. 3 showing the elements arranged to permit switching to any of three of the four possible switch positions.

DETAILED DESCRIPTION OF THE INVENTION

One embodiment of a rotatable shaft mechanism in accordance with the invention is illustrated in the exploded perspective view of FIG. 1. The mechanism is shown mounted in a housing 10 which may, for example, be the casing of a hand-held communication radio. The housing has an opening through which a shaft 11 extends. The shaft is mounted for rotation in a base member 12 which is fixed to the housing 10.

The base member 12 may also include a detent or indexing arrangement which limits the shaft to movement in discrete angular increments through a fixed number of angular positions. Suitable miniature detent or indexing arrangements are disclosed in application Ser. No. 148,782, filed June 1, 1971, by Norman R. Diehl entitled "Miniature Detent Mechanism" and in application Ser. No. 148,781, filed June 1, 1971, by Raymond G. Hartman entitled "Miniature Indexing Mechanism." Both applications are assigned to the assignee of the present invention. In the specific embodiment under discussion, the shaft indexes through discrete positions in increments of 30°. A stop pin 13 extends outward from the shaft 11 so as to abut a shoulder 14 in the base member 12 and limit rotation of the shaft in the counterclockwise direction. As shown in FIG. 1, the shaft 11 is associated with a rotary switch 15. The shaft 11 has a flat surface and is adapted to fit in a suitable recess in a knob 20. The knob 20 may be fixed to the shaft 11 as with a set screw 21.

The elements as described herein up to this point are typical standard items as employed in rotary indexing switches. In accordance with the present invention, there is included between the knob 20 and the housing 10 a plate or disk 25 of generally circular configuration. The disk 25 has a central opening 26 to accommodate the shaft 11. The disk fits within a counter bore or circular depression 16 in the housing 10 of slightly larger diameter than the disk. Thus the disk is maintained centered with respect to the shaft and its upper surface is flush with the surface of the housing 10. The disk also has an arcuate opening 27 which extends in a circular arc centered about the center of the disk. The opening 27 as shown subtends a central angle of 90°. The disk also has a plurality of indentations 31, 32, 33, and 34 along a portion of its periphery which also subtends a central angle of 90°. The indentations 31–34 are each adapted to be capable of receiving a pin 35 affixed to the housing 10. A pin 36 extending from the underside of the knob 20 is adapted to engage the arcuate slot 27.

The manner in which the mechanism serves to control the number of possible positions of the switch is more clearly illustrated in FIGS. 2A and 2B which show the disk 25 on the housing 10 and the knob 20, in phantom, in its assembled position. In the specific arrangement illustrated in FIG. 2A, the parts are assembled with the disk 25 placed in the depression 16 on the

housing with the first peripheral indentation **31** meshing with the pin **35**. The disk **25** is thus locked in the position shown in FIG. 2A. The pin **36** on the knob **20** extends into the arcuate slot **27** at its clockwise end.

Thus, by virtue of this particular arrangement, selected by engaging the first indentation **31** with the pin **35**, the knob **20** cannot be moved in a clockwise direction beyond position 1 since the pin **36** in the knob abuts the disk **25** at the clockwise end of the slot **27**. Counterclockwise movement of the knob **20** is not prevented by the slot **27** and pin **36** combination. However, if as shown in FIG. **1** a stop pin **13** is provided on the shaft **11** and abuts the shoulder **14**, movement in the counterclockwise direction is also prevented, and the mechanism is locked with the knob **20** and shaft in position 1.

FIG. 2B illustrates another arrangement of the assembled parts of the mechanism of FIG. **1**. In this particular arrangement, the disk **25** is placed on the housing **10** with the pin **35** engaging the fourth indentation **34**. The disk **25** is thereby fixed in the position shown in FIG. 2B. When the knob **20** is mounted on the shaft **11**, the pin **36** engages the arcuate slot **27**. The arcuate slot **27** permits movement of the pin throughout its length and thus the knob **20** may be rotated through an arc of 90° to any one of the four positions 1, 2, 3, or 4. With a 30° detent arrangement, the shaft positively indexes at each of the four positions.

The mechanism may also be assembled with a disk **25** placed so that the pin **35** engages either of the other two indentations **32** or **33**. If the pin **35** engages the second indentation **32**, the shaft may be switched through positions 1 and 2. If the pin **35** engages the third indentation **33**, either positions 1, 2, or 3 may be chosen. Thus, by virtue of the assembled position of the disk **25** with a selected one of indentations **31–34** engaging the pin **35**, the switch can be limited in one, two, three, or four positions. The arrangement can be changed simply by removing the knob **20**, reorienting the disk **25** as desired, and replacing the knob **20**.

An alternative embodiment of the shaft mechanism in accordance with the present invention is illustrated in the exploded perspective view of FIG. **3**. A housing **40**, a shaft **41**, a base member **42**, a stop pin **43**, a shoulder **44**, and a switch **45** are similar to the corresponding elements illustrated in FIG. **1** and discussed previously. Similarly, a knob **50** and set screw **51** are similar to corresponding elements in FIG. **1**. A circular disk **55** is also similar to that shown in FIG. **1** having a central opening **56**, an arcuate slot **57** subtending a central angle of 90°, and a plurality of indentations **61, 62, 63,** and **64** along the periphery of the disk and subtending a central angle of 90°. The housing **40** has a pin **65** affixed thereto and the knob **50** has a pin **66** affixed thereto. The disk **55** fits within a depression **46** in the surface of the housing **40**. The depression has an enlarged portion to accommodate the pin **66** on the knob **50**.

One of the four possible arrangements for assembling the mechanism of FIG. **3** is illustrated in FIG. **4**. In this embodiment of the invention the disk is fixed selectively with respect to the knob **50** rather than with respect to the housing **40** as in the embodiment of FIG. **1**. As shown in FIG. **4**, the pin **66** of the knob **50** engages the third indentation **63** in the disk **55** and thus is fixed for rotation therewith. In FIG. **4**, the knob **50** is shown in its most clockwise position, position 3, with pin **65** which is fixed to the housing **40** abutting the end of the slot **57**. The shaft may, of course, be rotated to either position 1 or 2, further counterclockwise movement being prevented by the stop pin **43** and the shoulder **44**. The shaft may not be rotated clockwise further to position 4 because the portion of the disk at the end of the slot **57** abuts the pin **65**.

The parts of the mechanism may also be assembled with the pin **66** of the knob **50** inserted in either of the other indentations **61, 62,** or **64** so as to fix the disk **55** with respect to the knob **50** in a different angular position. The shaft is thereby limited to position 1, positions 1 and 2, or positions 1, 2, 3, and 4, respectively.

While there have been shown and described what are considered preferred embodiments of the present invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention as defined by the appended claims.

What is claimed is:

1. A rotatable shaft mechanism having selectively limited angular positions including

a base member;

a shaft extending from said base member and mounted for rotary movement with respect thereto;

a knob member fixed to said shaft;

a plate disposed between the base member and the knob member and lying generally normal to said shaft, said plate having a central opening through which said shaft extends and having an arcuate opening therein;

one of said members having a pin affixed thereto and extending into said arcuate opening; and

locking means for selectively fixing the plate to the other of said members in different angular ralationships about the shaft whereby the possible angular positions of the knob member with respect to the base member are selectively limited;

said locking means including

a second pin fixed to the other of said members; and

a plurality of pin receiving openings in said plate, each of which is adapted to receive said second pin, rotary movement between the plate and the other of said members being prevented by the pin abutting the walls of the pin receiving opening when the pin is in an opening.

2. A rotatable shaft mechanism in accordance with claim **1** wherein

said plate is a circular disk;

said pin receiving openings are a plurality of equally spaced indentations along the periphery of the disk, the plurality of indentations subtending a central angle of a particular value; and

said arcuate opening lies along a circular arc having its center at the center of the shaft and subtends a central angle of said particular value.

3. A rotatable shaft mechanism in accordance with claim **2** wherein

said first-mentioned pin is affixed to said base member; and

said second pin is affixed to said knob member.

4. A rotatable shaft member in accordance with claim **2** wherein

said first-mentioned pin is affixed to said knob member; and

said second pin is affixed to said base member.

5. A rotatable shaft mechanism in accordance with claim 2 including

a stop means for limiting rotation of said shaft in one direction whereby the amount of rotation of the shaft is selectively varied by selectively changing the fixed angular relationship between the plate and the other of said members.

6. A rotatable shaft mechanism in accordance with claim 5 including

detent means for causing the shaft to index in a predetermined number of positions whereby the number of possible positions of the shaft is selectively varied by selectively changing the fixed angular relationship between the plate and the other of said members.

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