Sept. 1, 1959 O. H. HASSELBAUM 2,902,646

ROTARY SWITCH ASSEMBLY WITH A SIGNAL LAMP

Filed Aug. 13, 1954 3 Sheets-Sheet 1

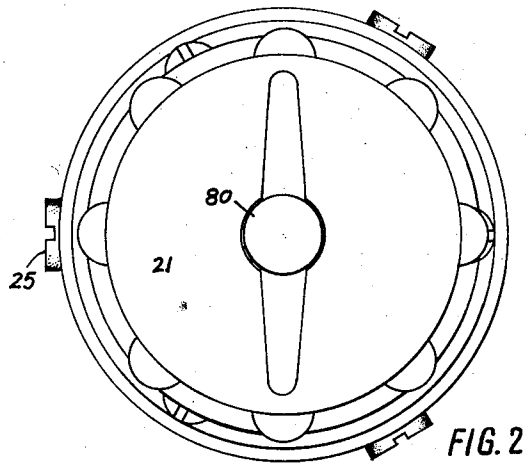


FIG. 2

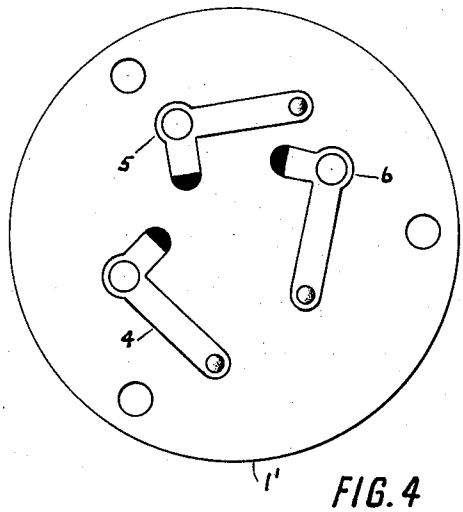


FIG. 4

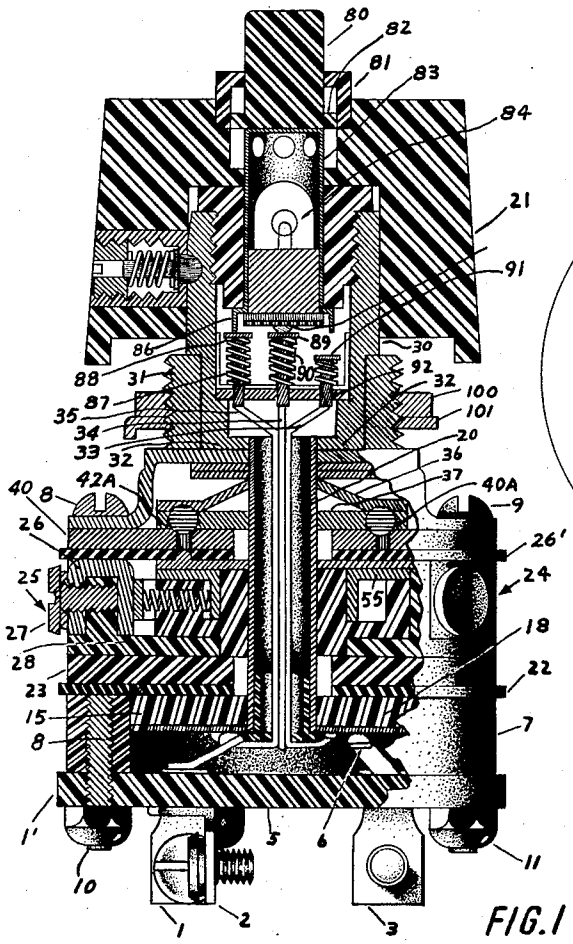


FIG. 1

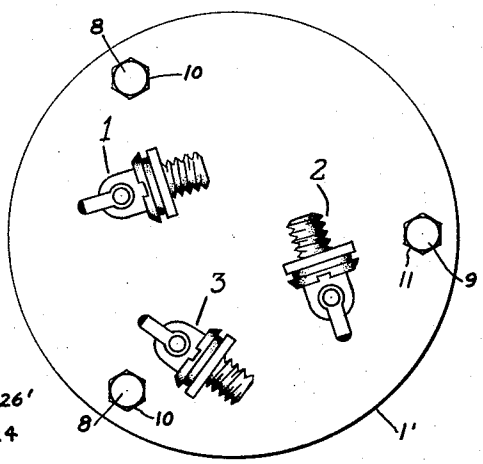


FIG. 3

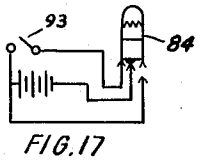


FIG. 17

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ROTARY SWITCH ASSEMBLY WITH A SIGNAL LAMP

Filed Aug. 13, 1954 3 Sheets-Sheet 2

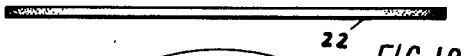


FIG. 10

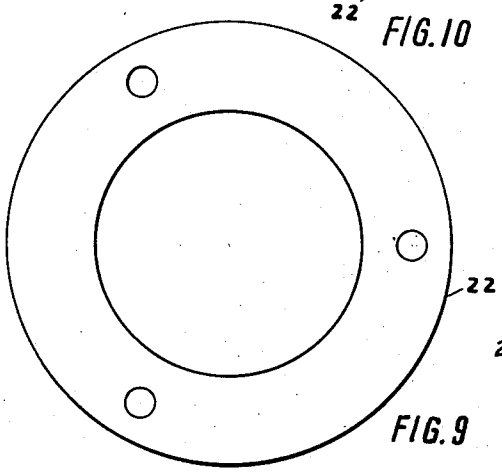


FIG. 9

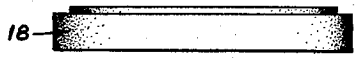


FIG. 8

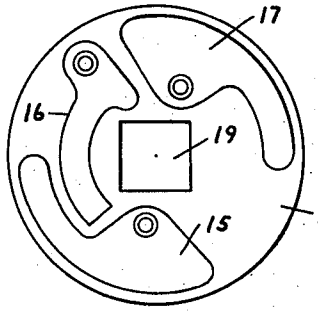


FIG. 7

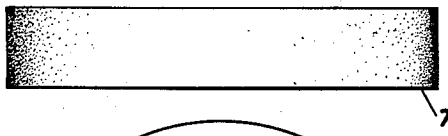


FIG. 6

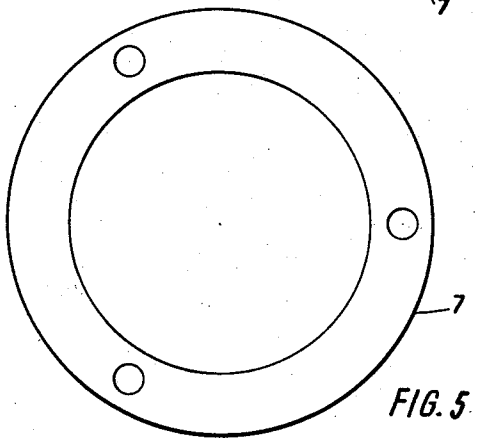


FIG. 5

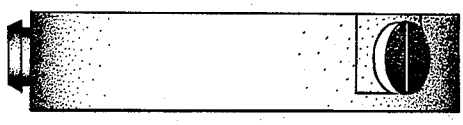


FIG. 14

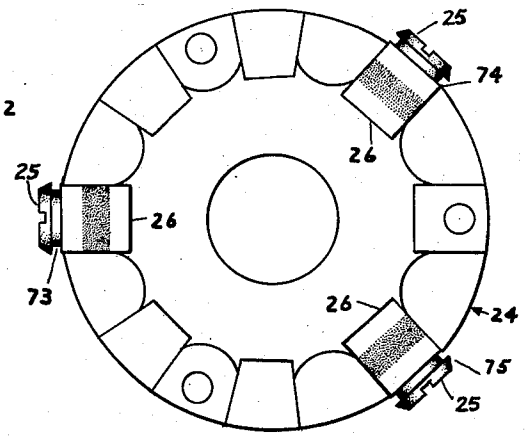


FIG. 13

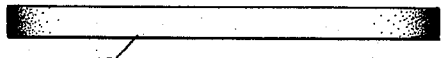


FIG. 12

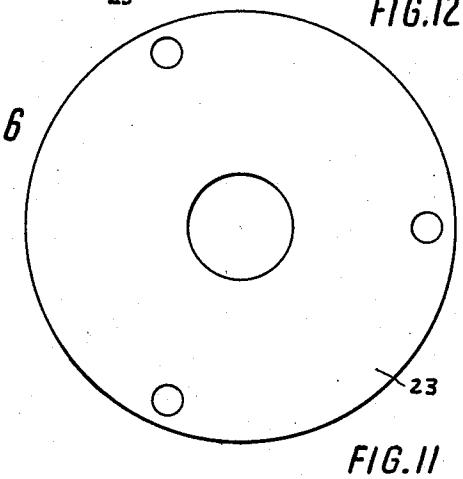


FIG. 11

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ROTARY SWITCH ASSEMBLY WITH A SIGNAL LAMP

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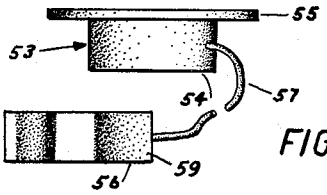


FIG. 15A

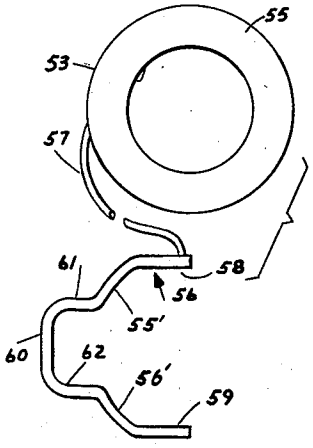
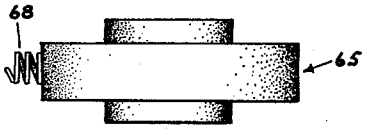


FIG. 15B

FIG. 15C



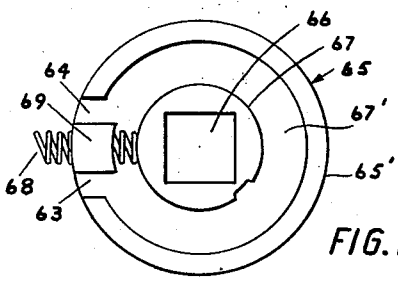


FIG. 15D

FIG. 15E

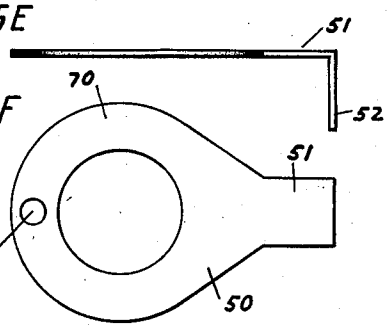


FIG. 15F

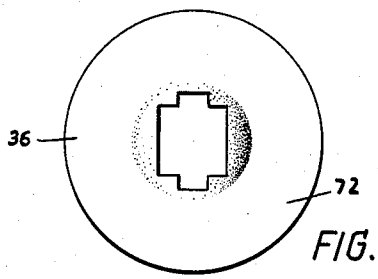


FIG. 16F

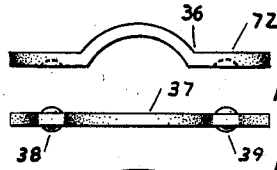


FIG. 16E

FIG. 16D

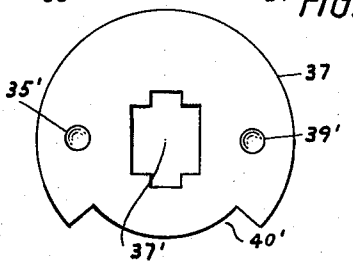


FIG. 16C

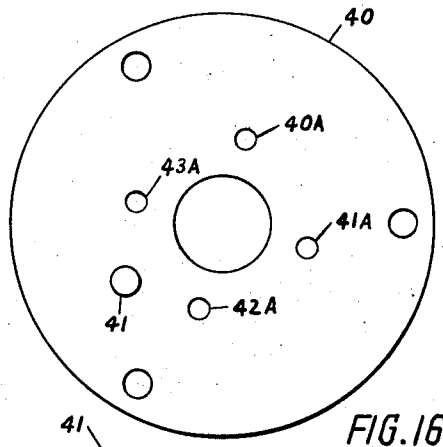


FIG. 16B

FIG. 16A

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United States Patent Office 2,902,646
Patented Sept. 1, 1959

2,902,646

ROTARY SWITCH ASSEMBLY WITH A SIGNAL LAMP

Oscar H. Hasselbaum, Buzzards Bay, Mass., assignor to Joseph Pollak Corporation, Dorchester, Mass., a corporation of Massachusetts

Application August 13, 1954, Serial No. 449,689

9 Claims. (Cl. 324—73)

The present invention relates to a rotary switch assembly in which there is incorporated a signal light. The rotary switch and signal light operate on separate individual circuits but are actuated by a single mechanism.

The rotary switch is provided with one or more contacts mounted on a stator element. Contacting the stator element is a rotor element mounted on an axis centrally disposed perpendicular to the stator element.

The rotor element is limited in its angular motion so that it is turned from one contact position making contact with one group of switch elements to a second contact position making contact with a group of second contact switch elements. As contrasted with this, the test or signal light circuit is affected by pressing a switch or making a connection along the axis of the rotor to make contact with one or more contact elements regardless of the rotated position of the contact or circuit elements.

Switches of this nature have particular application in circuits used on aircrafts, and for military purposes and have the function of combining in a unitary structure the desired operating mechanism for controlling the switch action of switch elements in a simple, compact, and reliable fashion.

In the present invention, the rotary switch comprises a stator assembly which is generally cylindrical in nature and a rotor assembly working within the stator and concentric thereto by means of which different contacts may be made in different positions as the rotor is turned with respect to the stator.

At the same time, a signal lamp for operating a test circuit is provided which is controlled by pressing a switch button operable in the axis of the rotor assembly as will be more fully learned from the description in the specification which follows.

While the invention will be described in connection with one set of stator switch elements, operable with a single rotor element, it is obvious that the invention may be applied to a number of stator elements operated with a number of sets of rotor switch elements. This may be accomplished by simply duplicating the stator and rotor switch elements for making desired switch contacts other than the test contact as will be understood from the description in the specification which follows.

As used herein the terms "rotor element," "rotor mechanism," "rotor member" and "rotor assembly" are synonymous and refer to the rotatable shaft and the elements carried by and rotatable with such shaft.

Without further describing the merits and advantages of the present invention which will be more fully understood from the description as set forth below, the invention will now be described in connection with the drawings illustrating an embodiment of the same, in which:

Figure 1 shows a longitudinal section through the switch having a single rotor and stator section.

Figure 2 shows an end view of the view shown in Figure 1 as seen from the top of Figure 1.

Figure 3 shows an end view of the view shown in Figure 1 as seen from the bottom of Figure 1.

Figure 4 shows the face of the bottom element shown in Figure 3 as viewed on the opposite side.

Figure 5 shows the element of Figure 1 lying next to the element shown in Figures 3 and 4.

Figure 6 is a side view of the element of Figure 5.

Figure 7 shows a face view of a contact plate element of the rotor situated in Figure 1 next to the element shown in Figures 5 and 6.

Figure 8 is a side view of element of Figure 7.

Figures 9 and 10 show respectively a face view and a side view of a washer lying against the element shown in Figures 5 and 6.

Figures 11 and 12 show respectively a face view and a side view of a spacer coming next to the washer of Figures 9 and 10 in the arrangement of Figure 1.

Figures 13 and 14 show a face view and side view of a collar section lying next to the spacer shown in Figures 11 and 12 in the section of Figure 1.

Figures 15A, 15C, and 15E show side views of the elements positioned within the element shown in Figures 13 and 14.

Figures 15B, 15D, and 15F show top views of the elements positioned within the element shown in Figures 13 and 14.

Figs. 16A, 16D and 16E show, respectively, side views of successive elements positioned above the collar of Figures 13 and 14 shown in Figure 1.

Figures 16B, 16C and 16F show respectively top views of successive elements positioned above the collar of Figures 13 and 14 shown in Figure 1, and,

Figure 17 shows a wiring diagram for the test circuit used in the present system.

In the assembly drawing indicated in Figure 1, the end plate **1'** of the switch is provided with three terminal connections indicated by the numerals **1**, **2** and **3**. These terminal connections are for the test circuit and each of the terminals is connected to a contact member, two of which are indicated on the inside of the plate **1'** in Figure 1, by numerals **5** and **6**. However, the three contact members **4**, **5** and **6** are more clearly shown in Fig. 4.

As will be seen in Figure 1, the lower section of the switch comprises for the most part a series of cylindrical shells or collars and internal elements which are rotatable with respect to the collars for making desired circuit connections. Positioned next to the end plate **1'** upon which the terminal connections **1**, **2** and **3** are mounted on the outside, and the contact members **4**, **5**, and **6** on the inside is a cylindrical collar or spacer element **7**, through which the screw studs **8**, **9**, and a third one not visible in Figure 1 pass to clamp the whole switch assembly together. These screw studs **8** and **9** are capped at the end by nuts **10** and **11** which may be of the usual self locking type.

The end plate **1'** as shown in Figure 4 has three contact members as indicated in Figure 4, **4** contacting the terminal member **1** in Figure 1, **5** contacting the terminal connection **2** in Figure 3, and **6** contacting terminal connection **3** in Figure 3. These contact members shown in Figure 4 come into contact with conductive wiping surfaces **15**, **16** and **17**, shown in Figure 7 which are mounted on the inserted insulating plate **18** of Bakelite or other suitable material positioned within the cylindrical collar or spacer element **7** shown in face view in Figure 5 and in side view in Figure 6. Insulating plate **18** with its conductive wiping surfaces is provided with a square hole **19** in the center and into which fits a square hollow shaft or tube **20** which is rotated by the top knob **21** as will be more fully explained later. Just above the insulating plate **18** having the conducting surfaces, there may be an insulating gasket or washer **22** which is shown in face view in Figure 9, and in side view in Figure 10. This washer is fixed and not turned with the shaft **20**. Just

above the insulating washer 22, is a cylindrical ring 23 which partially forms the outer cylindrical casing together with the cylindrical collar or spacer element 7 and the outer end element 1'. The cylindrical ring 23, the cylindrical collar or spacer element 7, and insulating gasket or washer 22 are all secured tightly in place by the screw studs 8 and 9. Above the ring 23 there is another outer cylindrical element 24 to which conducting terminal elements 25 are incorporated for providing connections to an external circuit operated by the internal rotor elements.

The outer cylindrical element 24 is provided with two similar conducting terminal elements, one of which is shown in section at 25, Figure 1. This comprises a U-shaped member 26, which is set in a recess cut around the sides and top of the outer cylindrical element 24 and is secured with a screw 27 which threads through the U-shaped member 26 and the element and secures the U-shaped member 26 rigidly in place. The cylindrical element 24 has an inwardly extending flange or base 28, on its lower side as shown in Figure 1, upon which the internal rotor mechanism rests and which turns within the outer cylindrical element 24. The rotor mechanism is controlled and operated through the knob 21 in the following manner. Within the knob 21 is a sleeve 30 which turns within a fixed outer sleeve 31 which may be fixed or attached to a fixed plate or switch board or on whatever machine the switch is supposed to be used. In the drawing of Figure 1, a lock nut and lock washer 100 and 101, respectively, threaded on the outer fixed sleeve 31 are provided to secure the switch as desired. The internal rotatable sleeve 30 has an inwardly extending lower flange or end cap 32, to which is firmly attached the square hollow shaft or tube 20 through which conductors 33, 34 and 35 extend to provide connections to the contact members 4, 5 and 6. The sleeve 30 together with the tube 20 carries with it at its top end, a spring plate 36 shown in Figures 16E and 16F beneath which is a disc 37 in which two ball bearings 38 and 39 rest for engaging the holes 40A and 42A and 41A and 43A, respectively in pairs (see Figure 16B) as the rotor is being turned. The plate or disc 37 is shaped as indicated in Figure 16C with a substantially square hole 37' so that it will engage and turn with the shaft 20 carrying with it the two ball bearings 38 and 39 which are set in the holes 35' and 39' in the disc 37. The disc 37 is in contact with and slides in its movement over the plate or disc 40 which is fixed to the casing by screw studs 8 and 9 and which is provided with a stud or pin element 41 and four holes 40A, 41A, 42A, and 43A, with which the ball bearings 38 and 39 engage in one or the other positions as the disc 37 is rotated clockwise or counter clockwise. A cut-out sector 40', is provided in the discs 37 which cut-out sector 40' engages the pin element 41 at either end of the disc's motion.

The mechanism within the outer cylindrical element 24 is indicated in Figures 15A, 15B, 15C, 15D, 15E and 15F. This comprises a conducting ring 50 which is formed at one end with an outwardly extending section or tab 51 and a downwardly terminating angle element 52.

Beneath this member 50 is the annular member 53, seen in Figures 15A and 15B, which comprises a sleeve portion 54 with an outwardly extending upper flange 55. The member 53 is conductively connected to a somewhat horseshoe-like spring element 56 by a conductive connection 57. The spring element 56 has its end elements 58 and 59 lying at either side of the sleeve portion 54 with the U-shaped middle section 60 of the element 56 having outwardly extending segments 55' and 56' to which ends 58 and 59 are integrally joined respectively. These ends when in position are close to the sleeve portion 54 of the annular member 53 and the short side sections 61 and 62 rest in the grooves 64 and 63 respectively of the rotatable element 65. The element 65 is rotated with the square shaft 20 on which it snugly fits through a center square hole 66. Surrounding this square hole is a hub section 67 in turn surrounded by a recess 67' formed on the top of the element 65 to receive the annular member 53 about which the sleeve portion 54 fits.

As has been stated above, the horseshoe spring element 56 fits around this sleeve portion 54 within the recess 67' and is held away from the sleeve portion by means of a small helical spring 68 which passes through a hole in the square section 69 in the outer concentric collar section 65' of the member 65.

The U-shaped middle section 60 of the horseshoe spring element 56 and the sleeve portion 54 lie against opposite ends of the helical spring 68 in a holding tension. This whole assembly of annular member 53 and horseshoe spring element 56 is placed in the recess 67' between the hub section 67 and the outer concentric collar section 65' with the horseshoe spring element 56 having sides extending through the outwardly extending grooves 63 and 64 and about the end of the helical spring 68 which goes through a hole in the square section 69 and bears against the sleeve portion 54 of the annular member 53.

The conductor ring 50 which is attached to the cylindrical element 24, Figure 13, by means of the outwardly extending section or tab 51 and downwardly terminating angle element 52, is fixed in position and does not rotate with the rotating elements of the switch. The ring portion 70 of the conducting ring 50, lies in face contact with the upper flange 55 of the annular member 53 and provides a connection to one side of the switching contact in the circuit. The sleeve portion 54 which is integral with the upper flange 55 is connected to the horseshoe spring element 56 by the conductive connection 57 which latter element makes contact in the U-shaped middle section 60 with one of the U-shaped member 26 of the terminals 73 or 74 as the shaft 20 is turned.

As the element 65 and its assembly is turned, contact is made either with terminals 73 or 74 (see Figure 13), selectively to the other terminal 75 which is permanently connected to the conducting ring 50 and outwardly extending section 51. The conducting ring 50, is held against the upper flange 55 by the plate 40 lying over the gasket 26. The ring portion 70 of the conductive ring 50 provides a definite point of contact with the lower surface of the plate 40. The spring plate 36 bears against the disc 37 in which ball bearings 38 and 39 rest in the holes 35' and 39' with the peripheral flange 72 projecting over the bearings 38 and 39, so that as the rotor turns the ball bearings will engage in holes 40A and 42A or 41A and 43A making definite angles of turn. Recesses are also provided in flange 72 of plate 36 to receive the bearings 38 and 39. The pin 41 on the plate or disc 40 is the limit of motion restraining the disc 37 so that a contact is made in the rotation of the switch either to the terminal 73 or the terminal 74.

Within the top knob 21, there is a test switch operating a signal light. This comprises a push button 80 positioned in the head of the casing and held in place by an insert section 81 inserted in the end of the casing. This inserted section forms a collar for the button 80 which collar has at its lower end a flange 82, working inside the hub or cavity of the insert section 81. Beneath the surface of the push button 80, there is a cap member 83 of aluminum or other conductive material which is cylindrical in form and contains at its lower end a signal or indicating light 84. This indicating light has a center contact 85 and a ring contact which makes connection with the outer flange contact 86 extending from the lower end of the cap member 83. This flange 86 also extends downward and makes contact with a small pin element 87 which has a head or cap 88 against which the downwardly extending flange of the cap 83 rests. This makes one connection to the test lamp circuit through the wire 35 which is connected to the head 88 of the pin 87. The center cap or head element 89 of the pin element 90, makes connection with the second wire 34 through the square tube 20 and the third cap element 91 makes con-

nection with the third connecting line 33 through the pin element 92. The spring supported conductive pin elements 87, 90 and 92 with their caps 88, 89 and 91, respectively, make contact with the test lighting circuit and therefore the signal or indicating light 84 is connected when the button 80 is pressed only slightly or not at all. This is a position for the ordinary test circuit when the switch 93 is closed as indicated in Figure 17. When the switch 93 is opened the signal or indicating light 84 will be off. The pins 90 and 92 and their contact caps 89 and 91 will be connected in circuit when the button 80 is pressed further down than necessary to make the connections to the caps 88 and 89. This will then close the circuit through the battery shown in Figure 17 and provide a test circuit through the lamp 84 when the switch 93 is open.

The test circuit may be operated depending upon the position of the top knob 21 of the switch. The wires 33, 34 and 35 go down within the hollow square tube 20 and make contact with conductive wiping surfaces 15, 16 and 17 upon which contact members 4, 5 and 6 bear as the knob 21 is turned. The terminal connections 1, 2 and 3 are therefore in the test circuit.

Having now described my invention, I claim:

1. A combination rotary switch and test circuit comprising: a housing having an outer cylindrical element with conducting terminal elements spaced on said outer cylindrical element, said terminal elements having outside and inside contact areas electrically connected together; a rotatable element having a spring element electrically connected together; a rotatable element having a spring element bearing outwardly against the inside of said outer cylindrical element and adapted when turned to contact said inside contact areas of said terminal elements; and means providing a test circuit including an insulating plate rotatable with said rotatable element and having conductive wiping surfaces thereon, contact members carried by an end plate in said housing adapted to contact said wiping surfaces, and a lighting circuit having a push button electrically connected to said wiping surfaces of said insulating plate.

2. In a combination rotary switch and test circuit, a housing having a segment formed as an outer cylindrical element, conductive U-shaped members spaced on the periphery of said cylindrical element with legs of said U-shaped members straddling a portion of said cylindrical element and facing radially to the outside and inside of said cylindrical element, screws threaded into the outer legs of said U-shaped members, a rotatable element within and rotatable with respect to said outer cylindrical element, a horseshoe spring element having a U-shaped middle section adapted for engagement with an outer concentric collar section of said rotatable element, a helical spring bearing against said U-shaped middle section urging said horseshoe spring element radially outward selectively to establish electrical contact with the inner legs of said conductive U-shaped members by rotation of said rotatable element.

3. In a combination rotary switch and test circuit, a rotatable element mounted on a hollow shaft, a set of spring supported conductive pin elements of differing lengths connected to said test circuit, means for mounting said spring supported conductive pin elements at one end of said hollow shaft, a set of conductive wiping surfaces mounted for rotation at the other end of said shaft, conductors extending through said shaft interconnecting said wiping surfaces and said pin elements, contact members supported independently of said shaft and adapted electrically to contact said wiping surfaces, a signal light having a contact, means for mounting said signal light to permit axial movement of said light with respect to said shaft, said light contact being positioned in proximity to said pin elements whereby movement of said light selectively connects electricallly said light to said pin elements thus actuating said test circuit.

4. In a combination rotary switch and test circuit, a rotatable element mounted on a hollow shaft, a set of spring supported conductive pin elements connected to said test circuit, means for mounting said spring supported conductive pin elements at one end of said shaft, a knob supported at the same end of said shaft as said pin elements, said knob having a signal light mounted therein for axial movement along said shaft, said signal light having contacts thereon for contacting two of said pin elements, with a contact adapted for contacting a third pin element when said signal light is further moved toward the opposite end of said shaft, means including conductors within said shaft, contact members and wiping surfaces, for selectively connecting said pin elements to exterior terminals as said knob is rotated.

5. In a combination rotary switch and test circuit, a rotatable element mounted on a hollow shaft, a set of spring supported conductive pin elements connected to said test circuit, means for mounting said spring supported conductive pin elements at one end of said shaft, a knob supported at the same end of said shaft as said pin elements, said knob having a signal light mounted therein for axial movement along said shaft, said signal light having contacts thereon for contacting two of said pin elements with a contact adapted for contacting a third pin element when said signal light is further moved toward the opposite end of said shaft, and conductive connections from said set of spring supported pin elements to exterior terminals on said rotary switch comprising an end plate having contact members mounted thereon within said switch and connected to said exterior terminals and conductive wiping surfaces having conductors to said spring supported pin elements, said wiping surfaces bearing against said contact members.

6. A combination rotary switch and test circuit comprising: a housing having an outer cylindrical element with conducting terminal elements spaced on said outer cylindrical element, said terminal elements having outside and inside contact areas electrically connected together; an annular member having a flange; a rotatable element adjacent said annular member on the opposite end of said annular member from said flange; a horseshoe spring element disposed between said upper flange and said rotatable element, said horseshoe spring element having a U-shaped middle section bearing against an outer concentric collar section of said rotatable element; a helical spring element bearing against said U-shaped middle section urging said horseshoe spring element radially outward against said inside contact areas of said terminal elements; and a fixed conducting ring adjacent said flange of said annular member.

7. A combination rotary switch and test circuit comprising: a housing having an outer cylindrical element with conducting terminal elements spaced on said outer cylindrical element, said terminal elements having outside and inside contact areas electrically connected together; an annular member having a flange; a rotatable element adjacent said annular member at the end opposite said flange; a horseshoe spring element disposed between said upper flange and said rotatable element, said horseshoe spring element having a U-shaped middle section bearing against an outer concentric collar section of said rotatable element; a helical spring, mounted in a radial hole in said rotatable element, bearing against said U-shaped middle section urging said horseshoe spring element radially outward against said inside contact areas of said terminal elements; and a fixed conductive ring adjacent said flange of said annular member.

8. In combination, a rotary switch and test circuit comprising: a housing formed in segments built one upon another, one of said segments being an outer cylindrical element with terminal elements spaced on the outside thereof, said terminal elements having inside contact areas electrically connected to said outside terminal elements; a rotatable element mounted for rotation within said

housing substantially opposed to said outer cylindrical element with a spring element adapted to engage said inside contact areas of the terminals of said outer cylindrical element; means providing an external friction connection for driving said rotatable element; a signal light test circuit mounted within said housing with conductive wiping surfaces adapted to be connected to the light of said test circuit; and a fixed end plate in said housing having contact members adapted to contact said wiping surfaces, said end plate having external terminal connections for connecting said contact members to external circuits.

9. In combination, a rotary switch and test circuit, comprising: a housing formed in segments built one upon another, one of said segments being an outer cylindrical element with terminal elements spaced on the outside thereof, said terminal elements having inside contact areas electrically connected to said outside terminal elements; a rotatable element mounted for rotation within said housing substantially opposed to said outer cylindrical element with a spring element adapted to engage said inside contact areas of the terminals of said outer cylindrical element; means limiting the angular movement of said rotatable element with respect to said outer cylindrical element whereby said spring element on said rotatable element will move only so far as to make contact with said inside contact areas of said cylindrical element from a point in between said contact areas; a test light circuit mounted within said housing with conductive wiping surfaces adapted to be connected to the test light of said circuit; and a fixed end plate in said housing having contact members adapted to contact said wiping surfaces, said end plate having external terminal connections for connecting said contact members to external circuits.

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