Dec. 24, 1957 D. W. JOHNSON 2,817,722

ROTARY ELECTRIC SWITCH FOR MULTIPLE CIRCUIT CONTROL

Filed June 9, 1955

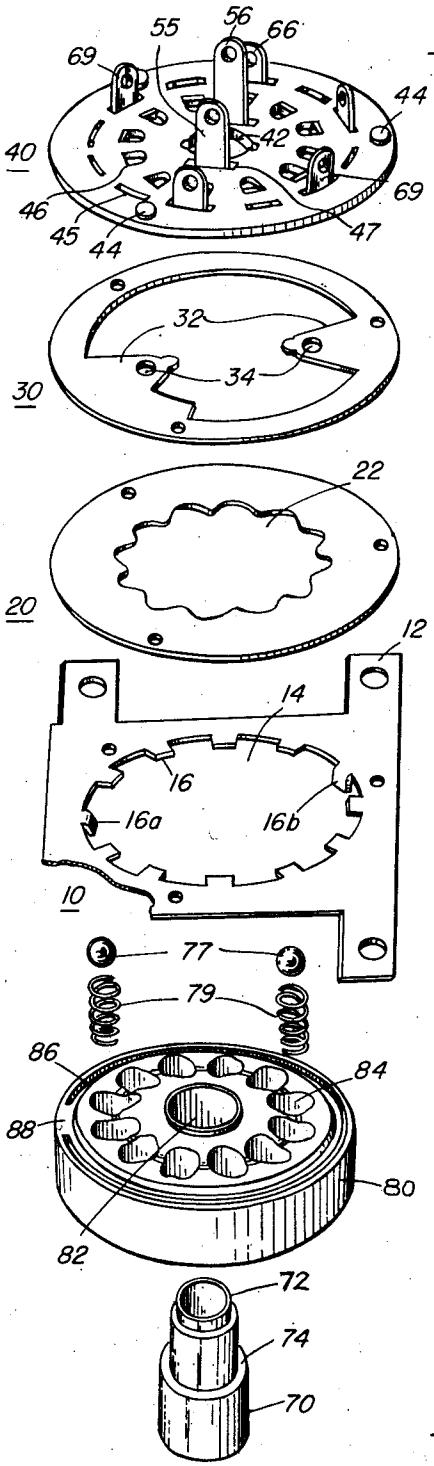


FIG. 1

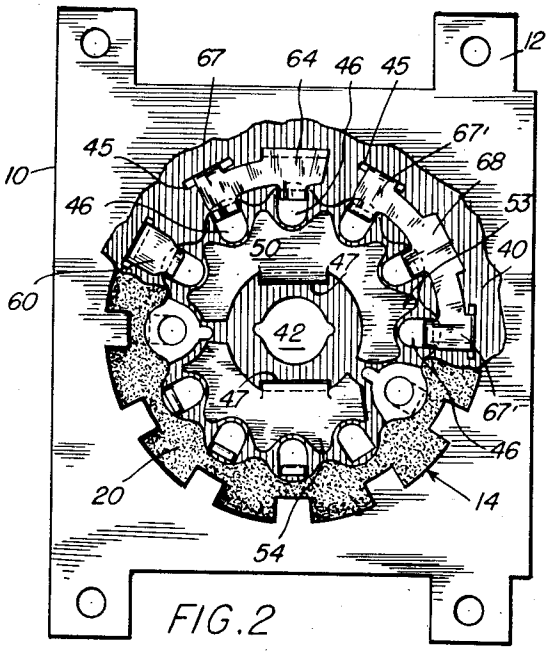


FIG. 2

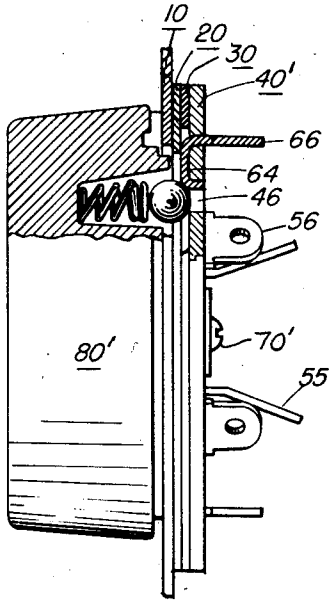


FIG. 3

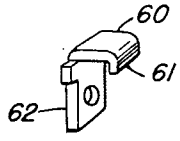


FIG. 4

INVENTOR.
David W. Johnson
BY his attorneys
Howson and Howson

United States Patent Office 2,817,722 Patented Dec. 24, 1957

2,817,722

ROTARY ELECTRIC SWITCH FOR MULTIPLE CIRCUIT CONTROL

David W. Johnson, Newington, Conn., assignor to The Arrow-Hart & Hegeman Electric Company, Hartford, Conn., a corporation of Connecticut

Application June 9, 1955, Serial No. 514,287

10 Claims. (Cl. 200—11)

This invention relates to electric switches. More particularly, it relates to rotary switches operable manually for controlling a plurality of circuits. The switch is capable of many uses only one of which is mentioned, as an example and not as a limitation, namely for controlling the operation of the fan and lamp of a picture projector.

One object of the invention is to provide a rotary switch which is manually operable into a plurality of angularly spaced positions to establish and break a plurality of circuits carrying small amounts of power, in which the mechanism of the switch may be made economically mainly from stamped sheet metal and sheet insulation parts, which will nevertheless be durable and reliable in operation.

Another object of the invention is to provide a switch of the foregoing type which is adaptable, during the course of manufacture by subsitution of different contact combinations, for control of many different circuit arrangements, in compliance with the requirements of different usages.

Another object of the invention is to provide a switch of the foregoing type in which a lesser number of parts are required than heretofore without sacrifice in reliability or quality, and without shortening the life of the switch.

Other objects and advantages will become apparent as the invention is described in connection with the accompanying drawing.

In the drawing:

Fig. 1 is an exploded perspective view of one form of the invention embodied in a rotary multi-circuit switch.

Fig. 2 is a plan view of the reversed side of the contact-carrying disc from the side illustrated in Fig. 1.

Fig. 3 is a transverse section view through the switch, partly broken away having a different form of handle.

Fig. 4 is a perspective view of one of the contact members.

Referring to the drawing, the parts are mounted on a thin flat metallic mounting plate **10** which may be stamped conveniently from sheet metal. As shown, it is square with mounting tabs **12** extending from the corners thereof; but obviously, it may have any other shape or form, as particularly usages may require. In the central portion of the mounting plate is a large central aperture **14** around the periphery of which extend inwardly a series of rectangular radial lugs **16**. Two of such lugs **16***a* and **16***b* may be bent at right angles to the mounting plate to form stops functioning in a manner as will hereinafter more fully appear.

On one surface of the mounting plate is mounted a thin stamped sheet insulation plate **20** having a large central opening **22** slightly less in diameter than the opening **14** in the mounting plate **10**.

Upon the insulating plate **20** is placed a circular packing washer **30** of sheet insulation so as to lie between the insulating plate **20** and a circular contact-carrying disc **40**. This disc, also, is stamped from sheet insulation with a central aperture **42** which is smaller, however, than the

apertures in the plate members **20** and **30**. The aperture **42** is adapted to receive the end of a retaining sleeve **70** as will hereinafter more fully appear.

The discs **20**, **30** and **40** are secured in sandwich fashion to the mounting plate by three small rivets **44** equally spaced around the periphery of the discs and passing through them into the mounting plate **10**.

To provide means for receiving portions of contact and terminal members hereinafter described, and for locating the contact and terminal members on the disc **40**, the disc **40** has a plurality of slots **45** (twelve being shown) stamped in a circular series near its periphery. These slots are equally spaced from one another. For the same purpose, in a circle inward from the slots are also stamped a series of twelve small semi-circular apertures **46** each of which is radially inward from a corresponding slot **45**. At diametrically opposite points or positions between the series of apertures **46** and the central aperture **42** are stamped two rectangular slots **47**, **47'**.

On the carrier disc **40** are mounted two central or inner combined contact-and-terminal members **50**, **52** of generally arcuate shape having a series of equally spaced pointed extensions **53**, **54** projecting radially outward from the periphery of their arcuate portions. These pointed extensions are bent up away from the surface of the disc **40** at an angle of approximately 35°. Each point extends between two of the semi-circular apertures **46**. These contact-and-terminal members may conveniently be stamped from thin conductive sheet metal. A terminal strip **55**, **56**, extending radially inward when each member is stamped, is bent at right angles to the arcuate portion in position to extend to the two innermost slots **47**, **47'** in the carrier disc **40**, so as to be available for connection of circuit wires thereto on the opposite side of the disc **40**.

Other contact-and-terminal members located outwardly on the disc from the inner contact-and-terminal members may be of either single, double or triple form, or otherwise. The single form is shown in perspective in Fig. 4. The member comprises a sheet metal stamping having a central flat part **60** adapted to lie upon the surface of the disc **40** with one end **61** formed as a narrow finger bent at right angles to enter the flat end of the semi-circular aperture **46**, while the opposite end **62** is bent at right angles parallel to **61** and extending through a slot **45**, so as to be available as a terminal on the opposite side of the disc **40** for connection of circuit wires thereto.

The double form is illustrated in plan in Fig. 2 and comprises a portion **64** similar to the portion **60** of the single form and similarly mounted in another semi-circular aperture **46** and its associated slot **45**, providing a terminal portion **66** similar to the terminal portion **62**. An arcuate lateral extension from the portions **64** connects with a second contact portion **67**, also lying flat upon the surface of the disc and having radially extending arms bent down into the semi-circular aperture **46** and its associated slots **45** next to the aperture and slot of the part **64**.

The triple form is illustrated in Fig. 2 also. It has a central portion **68** (similar to the portions **60** and **64** just described) and has a terminal portion **69** (similar to terminal portions **66** and **62**) extending through the disc **40**. Two contacts **67'** (similar to the contact portion **67**) lie on opposite sides of the middle contact portion **68** and are connected therewith.

The insulating plate **20** between the carrier disc **40** and the mounting plate **10** serves to insulate the contacts from the mounting plate and also to support the contacts. The periphery of the central opening **22** is scalloped around each of the semi-circular openings **46**.

To connect the contact portions of the outer contacts, either single, double or triple, with the inner contacts, a

plurality of conductive balls 77 are provided which are adapted to seat over one or another of the apertures 46, with the circumferences of the balls touching and pressing on the inner contact between the adjacent points 54, 53, and against the inner edge of the outer contacts 60, 64, 68, 67 or 67', as the case may be. The balls (two being shown in the example described) are movable and function as bridging contacts. They are pressed against the contacts by coiled compression springs 79 seated in cylindrical pockets in a manually operable rotary member 80.

The switch is operated by manual rotation of the operating member 80 which is preferably formed of molded insulating material in circular shape with a central bore 82 for the sleeve 70. The rotary operating member or handle lies on the opposite side of the mounting plate from the carrier disc 40 and is held rotatably on the sleeve by having the sleeve extend through the central bore of the handle and through the mounting plate and discs 20, 30 and 40. The end 72 of the sleeve is peened over onto the surface of the carrier disc 40. On the other side of the carrier disc, a shoulder 74, formed by an enlargement of the sleeve outside the handle, engages the outside face of the handle to hold the handle on the mounting plate rotatably.

The surface of the handle which faces the mounting plate 10 is provided with a series of cylindrical ball-and-spring-receiving pockets 84 or bores arranged in a circle about the handle axis in positions so that the axes of the pockets (and hence of the balls 77 and their springs 79) may register with the semi-circular apertures 46 in the carrier disc 40. By providing the same number of pockets 84 as recesses 46, the switch structure is adapted readily to changes in the number, the nature (single, double or triple, or otherwise) and location of the various fixed contacts and to different locations and numbers of balls. Thus, an infinite number of circuit combinations are possible, using only the switch and contact structures described above and as illustrated in the drawings.

The points 53 and 54 of the central contacts 50, 52 are located in radial alignment with and directed toward the extensions or points of the scalloped periphery of the aperture in insulating plate 20. The bending of points 53, 54 raises them into the plane of the insulating disc 20.

As the handle is rotated, the balls ride up on and between the ends of the points, and then down into the next opening 46 as the rotation through 30° is completed. Meantime the springs 79 have been compressed and expanded again to accommodate the movement of the balls. The action of the switch is thus made more positive and the location of the balls more certain.

In order to limit the rotation of a handle, a circular raceway 86 is provided adjacent its periphery in the inner face thereof. This raceway may extend through whatever angle, less than 180°, may be desired. The earlier-mentioned bent up lug 16*a* is positioned to extend up into the raceway. Hence, as the handle is rotated, the lug 16*a* will abut one end or the other of the raceway to limit rotation. In most instances, it will be desirable to have rotation limited to 180° or less. For that purpose and without the need to change the handle or its raceway, another lug 16*b*, also mentioned earlier, may be bent up to extend into the raceway 86. In this way, the rotation can be limited to a relatively small angle, if so desired, by one or another of the lugs 16*a*, 16*b* abutting the ends of the raceways. The degree of rotation will depend on the spacing of the lugs 16*a*, 16*b*. In order that the degree of rotation can be readily fixed without need to change the dies and molds for the device, the mounting plate 10 is stamped with twelve radial lugs like 16*a*, 16*b*. By bending any two of these lugs parallel to the axis of rotation of the handle, the degree of rotation can be determined from about zero to about 330°, assuming the gap 88 between the ends of the raceway extends about 30°.

For manufacturing reasons, it is desirable to place a packing disc or washer 30 between the insulating disc 20 and the carrier disc 40. Such washer is not essential to operation of the switch. However, its presence is employed to improve the switch action by providing on the washer radially extending tabs 32 in position to lie between the ends of the central contact members 50 and 52. Small round apertures 34 are provided in the tabs to receive the contact balls 77 and thereby keep them from dropping too low in the semi-circular openings 46 beneath the tabs. The switch operates more easily when the balls do not drop too low in said openings 46.

The form of the invention illustrated in Fig. 3 is the same in all respects as what has been previously described except that the shape of the handle 80' is slightly different and it is secured in another way.

In Fig. 3, the handle 80' is of molded insulation and is formed with a central bore into which is threaded an axial securing screw 70'. The securing screw 70' passes through a small aperture provided in the contact carrier plate 40' and is threaded into the axial bore in the handle 80'. A conventional washer may be inserted under the head of the screw 70'. But obviously, any other suitable and conventional means of securing the handle to the device may be employed without departing from the spirit of the invention.

In some forms of the invention, it may be desirable to use individual fixed contacts in lieu of all or some of the double and triple forms above illustrated. The use of individual single fixed contacts would be desirable when a large number of circuits are to be controlled. In such instances, only one conductive bridging ball 77 might be used. However, the use of one ball would tend to unbalance the forces exerted on the sleeve or screw and to affect the rotation of the handle. Undesirable wear could thus take place. To avoid that condition, an additional ball could be placed opposite to the conductive ball, but the additional ball would be of non-conductive material such as glass or any non-conductive and sufficiently hard synthetic material which can withstand the wear to which the ball is subjected during rotation of the switch.

Similarly in some instances, the use of two conductive balls might be desired spaced apart less than 180°. In that instance, also, it would be desirable to balance the forces by the use of a non-conductive ball equally spaced from the two conductive balls but on the opposite side of the switch axis.

It is also within the scope of the invention to form the center contacts as a single unitary stamping when the circuit arrangements, which the switch is to be used to control, require or permit such unitary central contact. It is believed not necessary to illustrate this variation.

From the foregoing, the operation of the device may be understood.

No description of circuit arrangements is given herein as the possibilities are myriad. It will be obvious, however, that if two power lines are connected to the central contacts, the location of one or more balls in the pockets will enable one or more circuits to be completed depending on how the contacts are connected to the devices to be energized.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore, the invention is not limited to the specific form and detail of the embodiment illustrated.

What is claimed is:

1. A rotary electric switch comprising an insulating carrier plate having a series of circularly arranged spaced openings, fixed contacts of stamped sheet metal on said carrier plate having portions adjacent opposite sides of the peripheries of said openings, terminal portions on said fixed contacts bent from the contact portions and extending through said carrier plate, some of said fixed contact portions being radially outward from the portions of the other fixed contacts on the other side of said aper-

tures, a manually operable rotary member, a plurality of resiliently supported balls carried by said rotary member, each ball being adapted to bridge a pair of said contact portions to establish various circuits as the rotary member is rotated into different switch positions.

2. A rotary switch comprising an insulating carrier plate having a series of circularly arranged spaced openings, arcuate fixed contact means of stamped sheet metal having portions on one side of the peripheries of said openings, a plurality of fixed contacts of stamped sheet metal having portions adjacent the opposite sides of said peripheries, terminal portions bent from said fixed contacts and extending through said carrier plate, said arcuate contact means being opposite more than one of said portions of the fixed contacts on the other side of said openings, a manually operable rotary member, a plurality of resiliently supported balls carried by said rotary member, and movable from one opening to another as said member is rotated, said balls bridging contact portions on the opposite sides of said openings in some positions to establish various circuits.

3. A rotary switch as claimed in claim 2 having an apertured insulating support plate overlying a portion of said fixed contacts and holding them on said carrier plate, inward extensions from said support plate around the periphery of its apertured between the openings in the carrier plate, outward extensions from said arcuate contact means toward said inward extensions, said inward and outward extensions cooperating to guide the movement of the balls from one arcuate position of the rotary member to another.

4. A rotary electric switch comprising a mounting plate, a carrier plate, an insulating plate between said mounting plate and carrier plate, a plurality of stamped sheet metal fixed contacts mounted on said carrier plate some of which have contact portions radially inward with respect to others, a manually operable rotary member, a plurality of resiliently supported balls carried by said rotary member, each ball bridging a pair of said radially spaced contact portions of said fixed contacts to establish various circuits as the rotary member is rotated into different positions, means to hold said plates together with said insulating plate overlying certain of said fixed contacts to maintain them in position, and means to mount said rotary member rotatively about an axis fixed relatively to said carrier plate.

5. A rotary electric switch comprising a mounting plate, a carrier plate, an insulating plate between said mounting plate and carrier plate, said carrier plate having a series of circularly arranged spaced openings, stamped sheet metal fixed contacts on said carrier plate having portions adjacent opposite sides of the peripheries of said openings, certain of said fixed contacts underlying said insulating plate and being held thereby on said carrier plate, a manually operable rotary member, a plurality of resiliently supported balls carried by said rotary member, each ball being adapted to bridge a pair of said contact portions to establish various circuits as the rotary member is rotated into different switch positions, and means to mount said rotary member rotatively about an axis fixed relatively to said carrier plate.

6. A rotary switch as claimed in claim 5 having a plurality of spaced lugs formed on said mounting plate any pair of which may be bent to engage said rotary member, stop means on said rotary member engaged by said lugs to limit the rotation of said rotary member.

7. A rotary switch as claimed in claim 4 having a plurality of spaced lugs formed on said mounting plate any pair of which may be bent to engage said rotary member, stop means on said rotary member engaged by said lugs to limit the rotation of said rotary member.

8. A rotary switch as claimed in claim 1 in which the manually operable member is on the opposite side of said carrier plate from said terminals.

9. A rotary switch as claimed in claim 1 having a molded insulation operating handle having individual recesses therein for said resiliently supported balls.

10. A rotary switch as claimed in claim 4 having a molded insulation operating handle having individual recesses therein for said resiliently supported balls.

References Cited in the file of this patent

UNITED STATES PATENTS

1,194,480	Clum	Aug. 15, 1916
1,410,855	Vereria	Mar. 28, 1922
1,624,374	Swoboda	Apr. 12, 1927
1,832,869	Macy	Nov. 24, 1931
2,186,638	Hall	Jan. 9, 1940
2,201,882	Bryant et al.	May 21, 1940