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ELECTRIC SWITCH FOR ILLUMINATING FIXTURES

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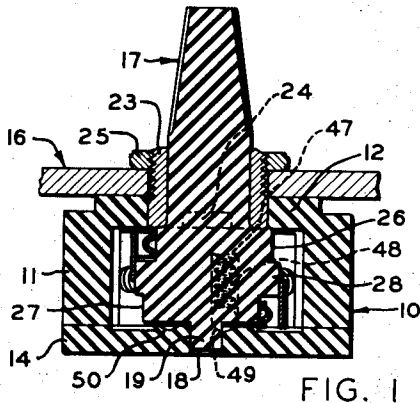


FIG. 1

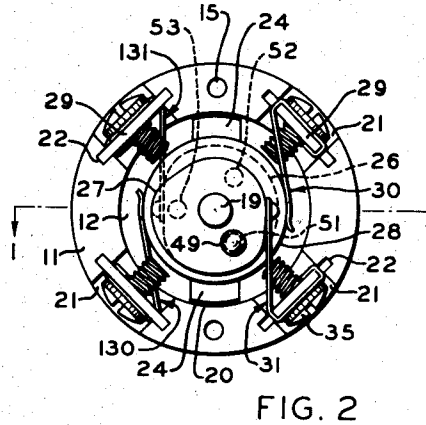


FIG. 2

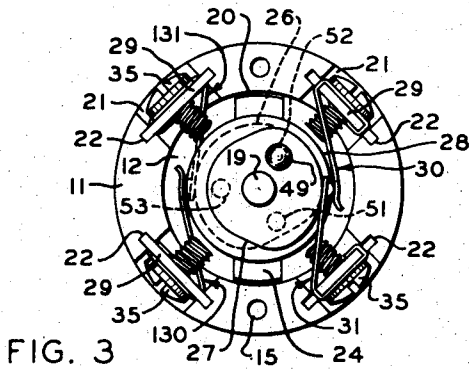


FIG. 3

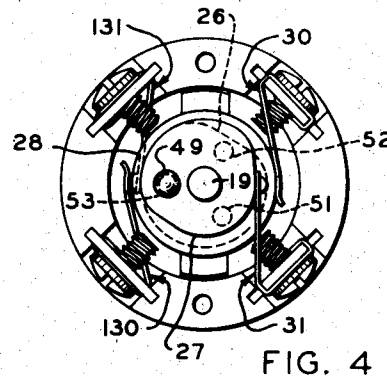


FIG. 4

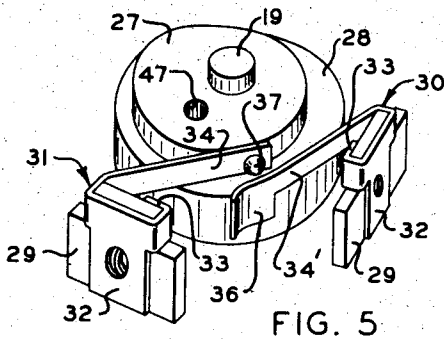


FIG. 5

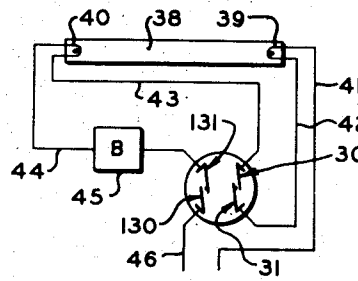


FIG. 6

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ELECTRIC SWITCH FOR ILLUMINATING
FIXTURES

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12 Claims. (Cl. 200—6)

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My invention relates to electric switches, and more particularly has reference to switches used in conjunction with lighting fixtures, especially with lamps of the fluorescent or discharge type.

Objects of my invention are to provide an electric switch featuring a simple design and comprised of relatively few parts leading to consequent ease of assembly and attendant low production costs in a switch which is capable of controlling a selected circuit of a plurality of circuits and which is particularly constructed for use with fluorescent tubes or lamps and is provided with control means for placing the electrodes of a fluorescent tube in a starting circuit whereby current flows through each electrode to heat the same after which the control means are actuated to connect the electrodes in an operating circuit whereby line current flows from a supply source to the anode of a tube and is conducted by the warmed gas in the tube to the cathode thereof for return to the supply source.

Other objects of the invention are to provide an electric switch of the type having a housing, a turn knob rotatably mounted in the housing and provided with cam means for selectively operating a plurality of pairs of resilient circuit controlling contact members carried by the housing wherein the turn knob, including the cam means, is of a one-piece construction and is preferably a molded member of an organic plastic material; to provide a switch of the character described wherein the contact members of each contact pair are in bearing with said turn knob when in inoperative or open position and wherein one contact member of each contact pair is always in bearing with said turn knob; and to provide, in a switch such as that set forth, means for mounting each contact member which makes use of a nut mounted in an opening in the wall of the switch housing with the contact member extending in part around the nut and with a screw for said nut which is adapted to extend through the contact member and which serves as a binding post for connecting an electrical conductor to the contact member.

Further objects of my invention include the provision, in combination with a switch of the character described, of means for rotatably mounting the turn knob of the switch within the switch housing and employing a sleeve secured to one end of the housing and adapted to have the turn knob extend therethrough, and utilizing in conjunction with said sleeve a closure for the other end of the housing provided with a bearing in which the turn knob is supported; and where-

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in said closure provides means for retaining contact members which are carried by the wall of said housing in mounted position and, in addition, serves as a base for indexing engagement with indexing means carried by the turn knob.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the article possessing the features, properties and the relation of the components thereof which are exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of my invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, wherein:

Figure 1 is a sectional elevation of the switch forming the subject matter of my invention taken on the line 1—1 of Fig. 2;

Fig. 2 is an end view of the switch of Fig. 1 taken from the cover plate end thereof with the cover plate removed, and illustrates the position of the switch in inoperative or "off" position and, in addition, diagrammatically shows the indexing positions for the turn knob of the switch;

Figs. 3 and 4 are end views similar to Fig. 2 and respectively illustrate the switch in "starting" and in "operating" positions;

Fig. 5 is a diagrammatic view, in perspective, showing in detail the turn knob with a pair of contact members associated therewith; and

Fig. 6 is a schematic view of a circuit having a fluorescent tube therein and provided with the switch of my invention for controlling the operation of the tube.

As heretofore intimated, the switch of my invention makes use of a housing, generally designated by the reference numeral 10, within which the operating components of the device are mounted or supported. Housing 10 is of course hollow and has a main peripheral wall 11 of cylindrical shape which is partially closed at one end with an annular end wall 12. Walls 11 and 12 are preferably of one-piece construction. The other end of the housing 10 is fully open and is adapted to be closed by a closure 14 in the form of a cover plate secured to the housing by drive screws engageable with holes 15 in the end of the main wall 11, or by other conventional fastening means.

As may be observed from the drawings, the opening in the annular end wall 12 has its center on the longitudinal axis of the cylindrical main

wall 11. Also, the annular end wall 12 provides a base for mounting the switch on a structure 16 which may comprise a panel, wall, shade or the like, adapted to form a part of the illuminating fixture with which the switch is associated, or the structure 16 may be spaced from said fixture and comprise, for example, a partition wall adapted to have the switch mounted thereon at a convenient height from the floor in instances where the lighting fixture is mounted overhead or from the ceiling.

The construction just described provides a cylindrical compartment in the housing 10 which is adapted to be closed at one end by the cover plate 14 but which remains partially open at the other end by reason of the annular end wall or mounting base 12 whereby to permit a turn knob, such as indicated generally at 17, to be rotatably supported within the housing and to have a finger grip portion thereof extend outwardly from the housing. To assist in supporting and retaining knob 17 in the housing, cover plate 14 is provided with a centrally located and cylindrical hole 18 therethrough adapted to serve as a bearing seat for the shaft-like end portion 19 of the turn knob 17 and adapted to have said end portion 19 receivably engaged and rotatably mounted therein while two or more channels 20, which communicate with the opening through the annular end wall of mounting base 12 and which extend radially from said opening, are formed in the inner surface of the mounting base 12 for cooperation with a sleeve used for retaining the turn knob in mounted position.

In further detail of the housing it may be noted that a plurality of mounting openings or apertures 21 are formed in the main wall 11 thereof in order to permit a plurality of circuit controlling resilient members to be carried by the housing. Openings 21 are circumferentially spaced around the housing wall 11 and each opening or aperture is adapted to receive an individual contact member mounting assembly. Each aperture 21 extends through the wall 11 and from the cover plate end of said wall to the inner surface of the end wall 12. In addition, it may be observed that each aperture 21 is slotted at each side thereof, as indicated at 22. Each slot 22 extends from the cover plate end of the wall 11 to the bottom or base of its respective opening or aperture and is adapted to receivably engage an end of a mounting or contact nut associated with each contact member. The illustrated embodiment of the invention discloses four openings or apertures 21.

The turn knob 17, as previously intimated, is provided with a relatively long finger grip portion. At least a part of the finger grip portion of knob 17 is in the form of a cylindrical shaft adapted to extend within the housing 10 and to be engaged within a sleeve 23 which is mounted in the opening in the annular end wall 12 and which provides a bearing for said turn knob adapted to support the turn knob in alignment with the bearing 18.

The sleeve 23 and the means for securing it to the housing also serve to mount the switch on the panel or other support structure 16 with which the switch is associated. These means make use of a plurality of ears 24 located at the inner end of said sleeve and radiating therefrom whereby each ear 24 is individually engageable with one of the channels 20 formed in the end wall 12 of the housing. Sleeve 23 is made sufficiently long so that it will extend through structure 16 when inserted therein and has its outer end threaded

for engagement with a nut 25 which will draw the annular end wall 12 tightly against the inner surface of said structure 16 when said nut is turned into appropriate bearing with the outer surface of said structure.

The contact members of each contact pair associated with the switch are placed in circuit closing and circuit opening relation upon rotation of the turn knob 17 by cam means which are provided on the turn knob. These cam means comprise a cam member for each circuit to be controlled and a contact operating member of cylindrical shape associated with each cam member. Location of the cam means is axially of the turn knob between the inner end of the finger grip portion thereof and the end portion 19 of the turn knob. Each cam member extends circumferentially of the turn knob with the periphery of the cam member providing a working cam surface for bearing engagement with a contact member of a contact pair while the periphery of the cylindrical operating member also provides a working surface for bearing engagement with a contact member of said pair. All working surfaces of the cam means lie outwardly of the periphery of the finger grip portion of the turn knob 17 and the periphery of a cylindrical operating member lies outwardly of any cam surface with which the operating member is associated.

The switch illustrated in the drawing is suitable for controlling two circuits and, as shown, is provided with two cam members 26 and 27 which are spaced apart axially of the turn knob and are located on opposite sides of an enlarged cylindrical portion 28 provided on the turn knob and adapted to form a contact operating member. This construction will therefore comprise a cylindrical portion which is located immediately of two adjacent cam members and which is common to both cam members.

The cam means has a length axially of the turn knob 17 substantially equal to the depth of the compartment formed in the housing 10 and has surfaces at its respective ends, namely, that end of the cam member 26 next to the annular end wall 12 and that end of the cam member 27 next to the cover plate 14, which are substantially flat and at substantially right angles to the axis of the turn knob. This expedient provides a flange at each of the just-mentioned ends of the cam means. These end flanges are respectively adapted for light bearing contact with the inner surface of the annular end wall 12, including the end of the sleeve 23, and with the inner surface of the cover plate 14 when the turn knob is mounted in the assembled switch.

An important feature of my invention resides in the fact that the housing 10, the cover plate 14 and the turn knob 17, including the cam means on the turn knob, all readily lend themselves to one-piece construction and an ease of manufacture and assembly which leads to low production costs. For example, if the cam members were made separately from the turn knob, procedure would be involved which required individual operations for the formation of the turn knob and individual operations for the formation of each cam member as well as assembly operations for mounting the cam members on the turn knob. Conveniently and from the standpoint of one-piece construction, the housing, cover plate and turn knob may each be formed of material which is a nonconductor of electricity. This in turn opens a wide choice of nonconducting materials suitable for use in electrical installations and se-

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lected from the field of moldable organic plastics and resins. The housing, cover plate and turn knob with cam means thereon are preferably intended to be formed by molding practices, including either injection or compression molding. Of the numerous plastic or resin materials available for the purposes of my invention, a preferred material is polystyrene which may be suitably shaped by injection molding. Bakelite may be mentioned as a material which is suited for use in my invention and which is adapted to be shaped by compression molding.

Conveniently, sleeve 23 lends itself to formation by pillar press operations or similar equipment carried out on continuous metal strip to provide shaped and formed sleeves which are finished by machine operations of a continuous nature wherein the individual sleeves, produced on the pillar press, are exteriorly threaded.

In keeping with the simplicity of design and construction of the parts of the switch previously described in detail, I make use of electrical conducting and resilient contact members and supports therefor which are easily constructed and assembled and mounted in said housing. The contact members are arranged in pairs so that each contact pair can be utilized to control an individual circuit. Two contact pairs, namely, contact members 30 and 31 and contact members 130 and 131, are shown in mounted position in the housing 10. Contact members 30 and 31 are shown in detail in Fig. 5 and are substantially similar in shape to contact members 130 and 131. Substantially similar mounting or contact nuts 29 are employed for mounting the contact members in the housing 10, each contact member being engaged with an individual nut.

As shown in the drawing, and particularly with reference to Fig. 5, each contact member has a base portion 32 and is provided at one end of the base portion and respectively on opposite sides thereof with a short extension in the form of an ear 33 and with a relatively long extension in the form of a contact finger which is designated by the reference numeral 34 for contact members 31 and 131 and by 34' for the contact members 30 and 130. Generally speaking, all contact members are similar so that a description as to the shape of a contact member 31 or 131 having a contact finger 34 will serve to describe a contact member 30 or 130 having a contact finger 34'.

In this regard and with reference to the contact member 31, the extension which forms the ear 33 is bent over upon itself into substantially parallel relation to the base portion 32 while the extension which forms the contact finger 34 is bent partially over upon itself and is angularly disposed to the base portion of the contact member to extend outwardly or away therefrom. Both the ear 33 and the contact finger 34 overlie the same surface of the base portion 32 of their respective contact members and extend in directions which are opposed to each other with the contact finger extending across and beyond the base portion 32 whereby it may be engaged with a working surface on the turn knob 17. For convenience, the surface of the base portion of a contact member, to which the ear 33 and the contact finger 34 or 34' are in overlying relation, may be considered as the back surface of the contact member and this surface is adapted to face the turn knob when the contact member is mounted within the housing.

Each contact or mounting nut 29 associated

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with each resilient contact is a relatively flat member and has the general shape of the letter T. This permits the back of the base portion 32 of a contact member to be placed in bearing contact with the front surface of the nut 29 associated therewith, including the leg and arm portions of the T, and to have the ear 33 and the contact finger 34 or 34' extend around opposite sides of the leg portion of the nut and to overlie the back surface of the nut. In fact, each contact member may be treated as having a general T shape with arm portions thereof constituted by the ear 33 and the contact finger 34 or 34' which extend, at least in part, around the leg portion of the nut 29.

A contact member and nut are assembled by merely sliding the nut within the bent over portions of the contact member with the leg portion of the nut and the base of the contact member in bearing whereupon the assembly may be inserted in an appropriate mounting aperture 21 in the housing. A contact screw 35, which serves as a binding post in that it provides means for connecting an electrical conductor or lead wire to the contact member, is adapted to extend through a hole in the base of the contact member and to engage the nut 29. A screw 35 may be engaged with a contact nut either before or after an assembled contact member and nut are inserted in a mounting aperture 21. It is to be observed that this construction permits the lead wire to be placed in direct bearing with the contact member whereby current is readily conducted to the contact member. Also, apertures 21 provide ready access to screws 35 for connection of wiring thereto.

The contact members of the switch are of a resilient character and are formed from continuous metallic strip material. A preferred material is Phosphor bronze. After formation each contact member is preferably coated with silver by conventional silver-dip processing practices whereby to limit arcing between contacts. As in the case of the other parts of the switch, the elements of each contact member mounting assembly, i. e., a mounting nut 29, contact member and contact screw 35 are readily formed by a simple continuous machine operation. For example, the contact members are produced from continuous strip material and are appropriately blanked and shaped on a multislide machine while the contact nuts are stamped from sheet metal stock and are then tapped. The contact screws are readily produced by means common to the art, as is also the case of the sleeve nut 25.

Each contact member mounting assembly is readily mounted in the switch by merely inserting the assembly in its proper aperture 21 in the end of the main wall 11 so that the ends of the arm portions of the nut 29 are engaged within the slots 22 of the aperture and the nut is seated on the base thereof. This permits the contact member to be carried by the main wall 11 of the housing and to have its contact finger 34 or 34' extend within the housing. The resilient character of a contact member will cause the contact finger 34 or 34' thereof to be constantly urged towards the turn knob 17 for engagement with a working surface on the turn knob 17. To be noted is the fact that each nut 29 extends from the base of its respective aperture 21 to the open end of the aperture whereby one edge of the nut is substantially flush with the end of the housing wall 11 and whereby the nut may be conveniently

retained in the aperture by the cover plate 14 when the plate is secured to the housing.

While, as previously stated, the contact members of the contact pair 30 and 31 are similar in general to the members of the contact pair 130 and 131, one contact member of each pair differs somewhat from the other member of the pair. For example, the contact members of a pair are opposites, i. e., left-handed and right-handed. Thus, if one faces the contact pair 29 and 31 it may be observed that the contact finger of the member 30 extends from the right to the left side of the nut 29 associated with said member 30 while the contact finger of the member 31 extends from the left to the right side of the nut associated with the member 31. A similar condition exists for the contact pair 130 and 131. Also, as shown, one contact member 30 and 130 of each contact pair has its contact finger 34' provided with an enlargement or foot 36 at the free end thereof while the other contact member 31 and 131 of each pair has its contact finger 34 provided with a raised contact hump 37 formed adjacent its free end for the purpose of improving electrical contact between the contact fingers of the pair as by providing spot contact or positive point contact therebetween.

It is to be observed that the contact fingers 34 and 34' of a mounted contact pair extend from the main wall of the housing towards each other by reason of the use of left and right handed contact member mounting assemblies. In this regard, the contact member mounting assemblies of a contact pair and the openings 21 in which said assemblies are mounted, including the spacing of these openings, are so arranged and constructed that the fingers 34 and 34' of said pair are in overlapping relation adjacent the free ends thereof. For a switch adapted to control two circuits, the openings or apertures 21 are conveniently spaced around the housing at 90° apart. The overlapping of the contact fingers of a contact pair permits the relative movement of the fingers required to bring them into and out of engagement with respect to each other.

The free ends of the contact fingers 34 and 34' of a mounted contact pair, when in inoperative or circuit opening relation, are adapted to engage the turn knob 17 at axially adjacent positions thereon, i. e., one finger 34 engages the working surface of a cam member on the turn knob while the other finger 34' is adapted to engage the cylindrical operating member associated with said cam member and located on the turn knob axially adjacent said cam member. This arrangement is achieved by providing the foot portion 36 on the contact finger 34' of that contact pair which is adapted to engage a cylindrical operating member on the turn knob.

For example, the contact pair 30 and 31 are intended for bearing respectively with cylindrical operating member 23 and the cam member 27 of the turn knob. Using the cover plate end of the housing as a reference location it will be appreciated that the axial position on the turn knob adapted to be engaged by the contact member 30 will lie at a greater axial distance from the cover plate end of the housing than the position on the turn knob adapted to be engaged by the contact member 31. Consequently, the contact member 30 is mounted so that the foot portion 36 thereon extends towards the annular end 12 of the housing or away from the cover plate.

In the case of the contact pair 130 and 131, the bearing location on the turn knob 17 for the

contact member 130 is closer to the cover plate end of the housing than the bearing location on the knob for the contact member 131. Under these conditions, the contact member 130 is mounted so that the foot portion 36 thereof will extend towards the cover plate end of the housing or away from the annular end wall 12. This requirement is readily satisfied without change in construction of the contact member mounting assemblies by the simple expedient of inserting the assemblies for the contact pair 130 and 131 in their respective mounting openings or apertures 21 in upside down relation with respect to the assemblies for the contact pair 30 and 31. Thus, each contact nut 29 of the assemblies for the contact pair 30 and 31 will have an edge of the arm portion of the nut seated on the base of a mounting aperture 21 while each contact nut of the assemblies for the contact pair 130 and 131 will have the end of the leg portion thereof seated on the base of an aperture 21.

A switch of the character shown in the drawing is, as already noted, designed for the control of a plurality of circuits. Such a switch is especially suited for use in conjunction with a fluorescent type of lamp which must be connected to a supply source in a starting circuit and then switched to an operating circuit. Use of my switch for this purpose affords an excellent example for illustrating its operation. In this regard the switch is diagrammatically disclosed in Fig. 6 in conjunction with a conventional fluorescent tube 38 which is provided with the usual electrodes 39 and 40 at opposite ends of the tube.

Electrode 39 is connected at one side by a lead 41 to a source of alternating current (not shown) and at the other side by a lead 42 to contact member 31. The other contact member 30 of the contact pair 30 and 31 is connected by a lead 43 to one side of the electrode 40. Lead 44 connects the other side of electrode 40 to the contact member 131 of the contact pair 131 and 130 through a conventional ballast while the contact member 130 is connected to the supply source through the lead 45.

Both Figs. 2 and 6 show the switch in "off" position with the contact members of each contact pair out of engagement with each other. In the off position of the switch the "low" portions on the cam members 27 and 28 are respectively opposite the free ends of the contact members 31 and 131 which are held in bearing with the low positions of the cams due to the resilient nature of the contact members and, consequently, in open relation to the contact members 30 and 130. Contact member 31 is adapted to be in substantially continuous bearing engagement with the cam member 27 which may be called the "starter" cam since it is adapted to control the starting circuit. Similarly, contact member 131 is arranged for substantially continuous bearing engagement with the cam member 23 which may be called the "line" cam since it is adapted to permit the line current to flow through the tube 38 between the electrodes therein for operating the lamp. In the off position, shown in Fig. 2, the contact members 30 and 130 are in bearing with the cylindrical working surface of the operating member 23 and, due to their resilient character, will remain in bearing with the member 23 until relieved by movement outwardly from the turn knob.

The switch is placed in "starting" position by rotation of the turn knob 17 from the position shown in Fig. 2 through 120° in a counterclock-

wise direction as viewed from the cover plate end of the housing 10. As a result of this rotation, "high" portions on the cam members 26 and 27 force the contact members 31 and 131 outwardly towards the housing and respectively into engagement with the contact members 30 and 130. This condition is illustrated in Fig. 3. With reference to Fig. 6, it may be observed that when the switch is in starting position, current passes through the electrode 39 and by way of the closed contact pair 30 and 31 to electrode 40 from which it returns to the supply source through the lead 44, the closed contact pair 130 and 131 and lead 46.

The switch is kept in the starting position for a few seconds to warm the electrodes 39 and 40 whereby to cause the gas within the tube 38 to become conducting. This condition is indicated by a faint glow around each electrode and the switch is then actuated to disconnect the electrodes from each other and to place the tube in the line or operating circuit. For this purpose, the turn knob is rotated through 120° from the position in Fig. 3 in a counterclockwise direction as viewed from the cover plate end of the housing 10.

Fig. 4 illustrates the switch in "operating" position and wherein the starter contact 31 is engaged with a low portion on the starter cam 27 and the line contact 131 is engaged with a high portion on the line cam 26 which is illustrated as a continuation of the high portion used on the cam 26 in the starting position of the turn knob. The inherent resiliency of the starter contact member 31 which maintains it in bearing with the starter cam 27 will cause the contact members 30 and 31 to be placed in circuit opening relation, i. e., out of bearing with each other, and will thus open the starter circuit. The contact members 130 and 131 are, however, maintained in circuit closing relation due to the continued engagement of the contact member 131 with the elongated high portion on the line cam 26.

With reference to Figs. 4 and 6, when the switch is in operating position current flows from the supply through lead 41 to electrode 39 and is then conducted by the gas in the tube 38 to the electrode 40 from which it is returned to the supply source through lead 44, ballast 45, closed contact members 130 and 131, and lead 46.

Return of the switch to the off position is effected by rotation of the turn knob through 120° from the position of Fig. 4 in a counterclockwise direction as viewed from the cover plate end of the housing. This restores the cam and contact members to the positions illustrated in Fig. 2.

It is important to note that cams 26 and 27 are designed so that they have a throw sufficient not only to move contact members 31 and 131 outwardly towards the wall 11 and respectively into bearing with the contact members 30 and 130, but also to move the contact members 30 and 130 outwardly by a slight distance sufficient to relieve them from bearing engagement with the cylindrical portion 28 on the turn knob. This expedient not only assures positive bearing engagement between the members of a contact pair when in circuit closing relation but avoids the necessity of working to close tolerance in the formation of the contact members as well as all other elements of the switch.

For example, this expedient permits considerable latitude in the angle at which the contact finger 34 or 34' of a contact member is adapted to be inclined to the base 32 of the contact mem-

ber. In this regard, a contact finger is intended to be bent at an angle at least sufficiently large to insure bearing engagement of the finger with the turn knob. It is immaterial if this angle is somewhat larger than that needed for bearing engagement. However, should this angle be under the required minimum, it is easily increased by bending the contact finger away from the contact member base. On the other hand, critical adjustment and fine tolerance are demanded by a construction wherein only one member of a contact pair is arranged for bearing with a turn knob and is adapted to be moved into contact with the other contact member of said pair which is so arranged and constructed that it will not bear against the turn knob.

It is desirable to be able to impart to an operator some sensory indication as to the different control positions of the switch. Although no perceptible touch sensation is to be expected when contact members of a pair are moved into circuit closing or circuit opening relation upon rotation of the turn knob, simple indexing means may be associated with the turn knob which permit an operator to feel when a control position for the switch is reached or is passed in the rotation of the knob.

One appropriate type of indexing means of this character is illustrated in the drawing as comprising a cylindrical recess 47 which is provided in the cover plate end of the cam member 27 and which is adapted to have a spring 48 and a ball 49 mounted therein. Ball 49 functions as a spring loaded detent member for engagement in suitably spaced depressions 50 formed in the inner surface of the cover plate 14. One such depression may be observed in Fig. 1. The depressions 50 are adapted to be positioned in the cover plate 14 so that the ball 49 will engage one of said depressions when the turn knob and cam means thereon are in a control position. By use of a spring 48 of sufficient stiffness, engagement and disengagement of ball 49 with a recess 50 is readily perceptible to the sense of touch during manual operation of the turn knob.

An individual depression 50 is formed in the cover plate 14 for each control position of the turn knob. Thus, in the switch illustrated, three such depressions 50 are provided and these depressions are spaced from each other by 120°, namely, the degree of rotation needed to rotate the turn knob from one control position to another. By treating the cover plate end of the cam member 27 as a reference plane the relative positions occupied by the indexing depressions in the cover plate are indicated in this plane in Figs. 2, 3 and 4 by the dotted circles 51, 52 and 53. Also illustrated in this plane, in the just-mentioned views, is the location of ball 49 with relation to the particular indexing location it is adapted to occupy for each control position of the switch.

A ball type of indexing means permits rotation of the turn knob in either clock or counterclockwise direction. While rotation of the turn knob in a direction opposed to that described for operative purposes is not harmful in the switch disclosed, in certain instances it may be desirable to restrict rotation to one direction. In such case, a spring loaded plunger, having a wedge shaped end adapted to engage in wedge shaped recesses in the cover plate 14, may be employed in place of the ball type indexing means disclosed in detail.

In addition to featuring a design for all of

the component parts of the switch which leads to simplicity of manufacture, it should also be kept in mind that another feature of my invention resides in the ease with which these parts may be assembled. The only parts which require assembly outside of the housing are the contact member mountings and such assembly is effected with facility. Following assembly of the contact member mountings it is merely a matter of inserting the various elements of the switch within the housing and fixing them therein by closing the end of the housing with the cover plate in secured position thereon.

While the embodiment of the switch chosen for illustration is particularly adapted for the control of two circuits, as in the operation of a fluorescent tube, it will be appreciated that the switch is usable for the control of other multi-circuit electrical installations and is readily susceptible to modification for the control of more than two circuits. Primarily, such modification involves duplication of certain parts and enlargements of others. For example, control of three circuits can be obtained by the addition of another cam member and associated cylindrical member to the turn knob while lengthening the housing to accommodate the increased length of the turn knob and by mounting another pair of contact members in the housing for the added circuit control.

Since certain changes may be made in the above article without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description, or shown in the accompanying drawing, shall be interpreted as illustrative and not in a limiting sense.

What I claim is:

1. An electric switch for connecting a selected circuit of a plurality of circuits, said switch comprising a housing of electrical nonconducting material, a turn knob of electrical nonconducting material rotatably mounted in said housing and extending therefrom to provide means for manually operating said switch by rotation of said turn knob, a cam member for each circuit to be controlled provided on said turn knob and extending circumferentially thereof whereby the periphery of said cam member provides the actuating cam surface of the cam member, a substantially cylindrical portion of the turn knob associated with each cam member and located adjacent thereto, a plurality of resilient circuit controlling contact members supported by said housing and extending inwardly from the wall of said housing towards said turn knob, said contact members being arranged in pairs, a pair of contact members for each individual circuit associated with an individual cam member whereby said pair of contact members are placed in circuit opening and circuit closing relation in accordance with the position imparted to said cam member associated therewith by rotation of said turn knob, one contact member of each contact pair being substantially continuously in bearing engagement with the cam member associated therewith and the other contact member of said contact pair being in bearing engagement with the cylindrical portion of said turn knob associated with said contact pair when said contact pair are in circuit opening relation to each other and being out of engagement with said cylindrical portion when said contact pair are in circuit closing relation to each other.

2. An electric switch as defined in claim 1 hav-

ing two cam members and two pairs of contact members, and wherein said cylindrical portion of said turn knob associated with said cam members is common to each said cam member.

3. An electric switch of the character set forth in claim 1 wherein said rotatable turn knob is provided with a pair of spaced apart cam members separated with respect to each other in a direction lengthwise of said knob, and wherein said cylindrical portion is located between said cam members.

4. An electric switch as characterized in claim 1 wherein the resilient contact members of each said contact pair are supported from the wall of said housing at locations spaced circumferentially thereof and extend from said wall within said housing in opposed directions to each other towards said turn knob and into bearing with said turn knob at axially adjacent positions thereon when the contact members of each said contact pair are in noncircuit closing and open relation with respect to each other.

5. An electric switch comprising a housing of electrical nonconducting material, a turn knob of electrical nonconducting material rotatably mounted in said housing and extending therefrom to provide means for manually operating said switch by rotation of said turn knob, a plurality of circumferentially spaced pairs of electrical conducting and resilient contact members carried by said housing and extending within the housing from the periphery thereof inwardly towards said knob for bearing therewith and the resiliency of each contact member substantially constantly urging the contact member into bearing with said knob, the contact members of each contact pair contacting each other when in circuit closing relation and being separated from each other when in circuit opening relation, said contact members of each said contact pair when separated from each other and in circuit opening relation being in bearing with said knob, and said knob being provided with cam means cooperative with a first contact member of each said contact pair for moving said first contact member toward the second contact member of each said contact pair and into contacting relation therewith in accordance with the rotation of said knob, said cam means having a throw such as to effect the movement of the first contact member of a contact pair in a direction outwardly from said knob and toward said housing by a distance greater than the separation between the contact members of said contact pair when said contact members of said pair are in circuit opening relation whereby to bring said first contact member of said contact pair into contacting relation with the second contact member of said contact pair and to free said second contact member of bearing engagement with said knob by moving the second contact member outwardly from said knob.

6. An electric switch comprising a housing having a closure at one end and an opening through the other end, a manually operable turn knob for actuating said switch extending through said open end of said housing and into said housing, resilient electrical contact means carried by said housing and adapted to be opened and closed by the rotation of said turn knob, means carried by said closure for receiving and rotatably supporting the end of said knob which extends within said housing, a sleeve extending through said opening in surrounding relation to said knob and providing a bearing support for said knob, flange means on the portion of said knob located within

said housing, the end of said sleeve which extends within said housing being in contacting relation with said flange means, a plurality of ears extending radially from said sleeve adjacent the end thereof located within said housing, the interior of the end of said housing having said opening therein being provided with a plurality of channels extending radially from said opening and each adapted to receive one of said ears, and fastening means for securing said sleeve to said housing with the ears thereon engaged within said channels.

7. An electric switch comprising a housing of electrical nonconducting material having a closure at one end and provided with an opening at the other end thereof, a manually operable turn knob of electrical nonconducting material for actuating said switch extending through said open end of said housing and into the housing, cam means provided on the portion of said knob within said housing and extending circumferentially and axially of the knob, said cam means having a flange portion at the end thereof adjacent the end of said housing provided with said opening, a plurality of resilient circuit controlling contact members arranged in pairs and supported by said housing and adapted to be placed in circuit opening and circuit closing relation by cooperation with said cam means in accordance with the position imparted to said cam means by rotation of said knob whereby each contact member of each contact pair is in bearing with a portion of the periphery of said knob including said cam means when said contact members of said contact pair are in open relation to each other and whereby one contact member of each contact pair is substantially free of bearing engagement with said knob when the contact members of said contact pair are in closed relation to each other, means carried by said closure for receiving and rotatably supporting the end of said knob which extends within the end of said housing, a sleeve extending through said opening in surrounding relation to said knob and providing a bearing support for said knob, the end of the sleeve which extends within said housing being in contacting relation with said flange means, a plurality of ears extending radially from said sleeve adjacent the end thereof located within said housing, the interior of the end of said housing having said opening therein being provided with a plurality of channels radiating from said opening and each adapted to receive one of said ears, and fastening means for securing said sleeve to said housing with the ears thereon engaged within said channels.

8. An electric switch comprising a housing of electrical nonconducting material having a closure at one end and provided with an opening through the other end thereof, a manually rotatable turn knob of electrical nonconducting material for actuating said switch extending through the open end of said housing and into the housing, cam means provided on the portion of said knob within said housing and extending circumferentially and axially thereof, a plurality of resilient circuit controlling contact members arranged in pairs and supported by said housing and the contact members of each contact pair contacting each other when in circuit closing relation and being separated from each other when in circuit opening relation, each said contact member extending inwardly from said housing toward said knob for bearing therewith and the resiliency of each said contact member sub-

stantially constantly urging the contact member into bearing with said knob, said contact members of each said contact pair being in bearing with said knob when in circuit opening relation, said cam means cooperating with a first contact member of each said contact pair for moving said first contact member toward the second contact member of said contact pair and into contacting relation therewith in accordance with the position imparted to said cam means by rotation of said knob, said cam means having a throw such as to effect the movement of the first contact member of a contact pair in a direction outwardly from said knob and toward said housing by a distance greater than the separation between the contact members of said contact pair when said contact members are in circuit opening relation whereby to bring said first contact member of said contact pair into contacting relation with the second contact member thereof and to free said second contact member outwardly from said knob, and spring pressed indexing means carried by said knob for cooperative indexing engagement with said closure whereby to give, through the sense of touch, an indication to a person operating said switch of the position of said cam means relative to said pair of contact members.

9. In an electric switch of the character having a housing, in combination, a contact member adapted to be supported by said housing and comprising electrical conducting material of a resilient nature shaped to have a base portion provided with a pair of extensions located at one end of the base portion on opposite sides thereof and at least partially bent over upon said base portion, one extension of said pair providing an elongated contact finger which is angularly disposed to said base portion for positioning in said housing, means for supporting said contact member for mounting in said housing comprising a mounting nut having a portion thereof inserted between said bent over extensions and a surface thereof in bearing with the base portion of said contact member whereby said extensions extend at least in part around the edges of said nut, fastening means for connecting an electrical conductor to said contact member, the wall of said housing at one end thereof being provided with an aperture therethrough, said nut with said contact member supported thereon being engaged and mounted within said aperture with said contact finger extending within said housing, and closure means secured to said housing for closing the end of the housing having said aperture, said closure means retaining said contact member and mounting nut in said aperture.

10. An electric switch as set forth in claim 9 wherein said nut is threaded and the base portion of said contact member is provided with an opening, and wherein the means for connecting an electrical conductor to said contact member comprise a screw adapted to extend through the opening in said base portion and to engage said nut whereby said conductor may be secured to the contact member in direct bearing therewith.

11. An electric switch as set forth in claim 9 wherein said nut is a relatively flat member having a general T shape and the base portion of said contact member is also relatively flat and is positioned in bearing with one face of said nut and wherein the second extension on the base portion of said contact member comprises an ear bent over upon itself to a position substantially parallel with said base portion to fully extend around the edge of the portion of the nut con-

stituting the leg of said T at a position adjacent the end of said leg whereby to overlie the face of said nut opposite to that with which the base portion of the contact member is in bearing, said contact finger being bent at least partially around the edge of the leg portion of said nut on the side of said leg opposite said ear to extend across and beyond the face of said nut with which said ear is in overlying relation at an inclination disposed away from said face.

12. In an electric switch of the character having a housing of electrical nonconducting material and means for actuating said switch comprising a turn knob of electrical nonconducting material rotatably mounted within said housing and extending therefrom for manual operation, in combination, circuit making and breaking means carried by the wall of said housing for bearing engagement with said turn knob and adapted to be controlled by rotation of said knob, said circuit making and breaking means comprising at least one pair of resilient contact members of electrical conducting material, each said contact member having a base portion provided with a pair of extensions located at one end of the base portion on opposite sides thereof and at least partially bent over upon said base portion, one extension of said pair providing an elongated contact finger which is angularly disposed to said base portion for positioning in said housing, means in association with each said contact member for supporting said member comprising a mounting nut individual to each said contact member and having a portion thereof inserted between said bent over extensions and a surface thereof in bearing with the base portion of said contact member with which the nut is associated

whereby said extensions extend at least in part around the edges of said nut, fastening means for connecting an electrical conductor to each said contact member, the wall of said housing at one end thereof being provided with a plurality of circumferentially spaced apertures therethrough, one aperture for each nut, each said nut with its respective contact member supported thereon being receivably engaged and mounted within its respective aperture with the contact finger of the contact member extending within said housing, the contact fingers of each pair of contact members having the free ends thereof located substantially opposite each other and when in operative position being spaced from each other but in bearing with said turn knob and being brought into operative contact with each other by rotation of said turn knob, and closure means secured to the housing for closing the apertured end thereof, said closure means overlying said apertures.

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