April 8, 1947. H. W. BATCHELLER 2,418,616

MULTIPLE PURPOSE ELECTRIC SWITCH

Filed April 5, 1944

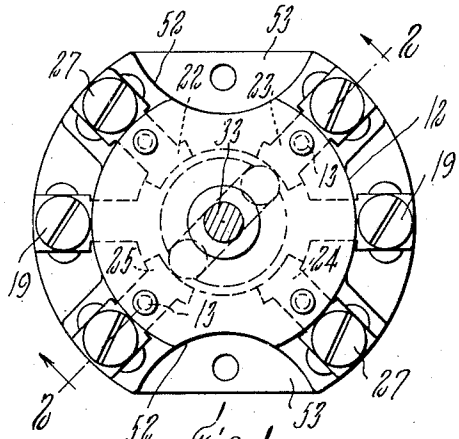


Fig. 1.

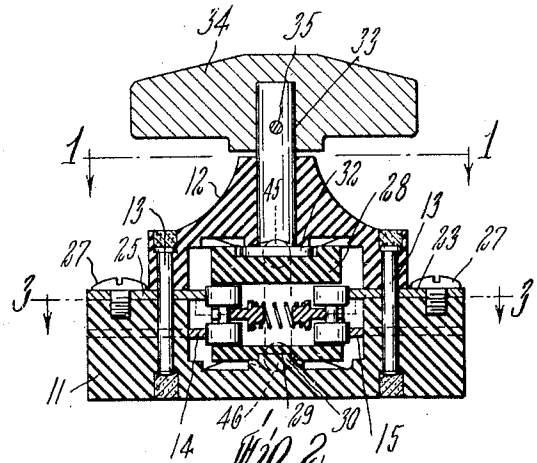


Fig. 2.

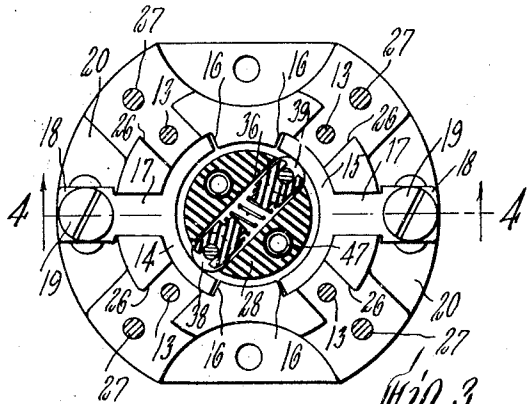


Fig. 3.

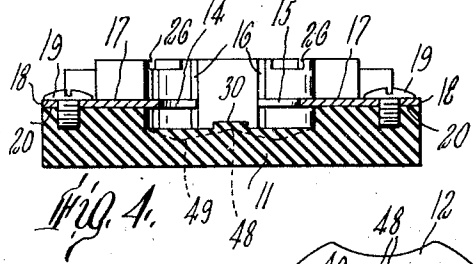


Fig. 4.

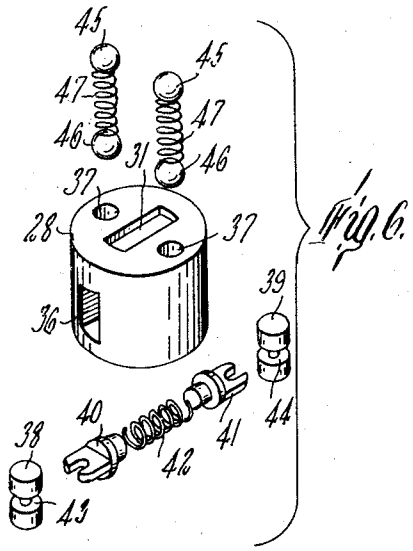


Fig. 6.

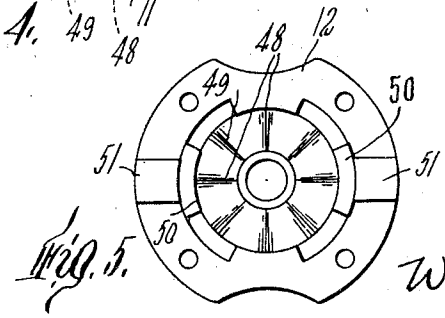


Fig. 5.

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MULTIPLE PURPOSE ELECTRIC SWITCH

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11 Claims. (Cl. 200—6)

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This invention relates to electric switches and is designed to furnish a switch construction adapted to control a plurality of circuits, to be readily put into condition for controlling any number of circuits up to a maximum determined by the dimensions of the housing, and to provide means in connection with such a switch for creating adequate pressure between the movable and fixed contacts and balancing such pressure so as to eliminate in great measure frictional resistance to the movement of the rotatable part and to provide improved and simplified means for holding the movable parts in definite positions and for advancing them to different ones of such positions when they have been shifted part of the way from other positions.

The invention comprises the novel principles, constructions and combinations exemplified by an illustrative switch described in the following specification and depicted in the accompanying drawings.

In the drawings,

Fig. 1 is a plan or end view of a specific switch embodying this invention, with the operating shaft or spindle thereof shown in section on line 1—1 of Fig. 2;

Fig. 2 is a section of the switch taken on line 2—2 of Fig. 1;

Fig. 3 is a plan view of the switch base and a section of the movable parts thereof taken on line 3—3 of Fig. 2;

Fig. 4 is a cross section of the base taken on line 4—4 of Fig. 3;

Fig. 5 is an under plan view of the cover of the switch housing;

Fig. 6 is a dismembered view of the movable parts of the switch comprising a rotor, movable switch contacts, and detent for centering the rotor in definite positions.

Like reference characters designate the same parts wherever they occur in all the figures.

The switch housing comprises a base 11 and a cover 12 made of insulating material and secured together detachably by rivets 13, the heads of which are in countersunk holes and covered by insulation. These members enclose an internal cavity or chamber in which a rotor and movable switch contacts are contained.

Stationary contact members are mounted on the base. These include, in the presently illustrated embodiment, two arcuate pieces of electrical conductive metal 14 and 15 which subtend large angles around the axis of the internal chamber of the switch close to the enveloping walls of the chamber. Without intending to in-

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dicate limitations of the invention I may say that the angles above mentioned are, in the present illustration, about 125° each. These arcuate pieces terminate adjacent to shoulders 16 in the walls of the base which surround the central cavity or chamber thereof. Each contact piece is made in integral connection with a neck 17 which extends through a notch in the adjacent chamber wall and has a widened head portion 18 in which is mounted a binding screw 19 for attachment of an electrical conductor. These necks and heads rest on portions 20 of the base which are of less height than the balance of the walls of the chamber.

Other stationary contact members 22, 23, 24 and 25, shown by broken lines in Fig. 1, are mounted on a thicker or higher part of the base than the parts which support the contacts 14 and 15. They have relatively narrow arcuate inner ends and necks which extend through shallow notches 26 in the cavity wall, and each has an aperture through which passes the shank of a binding screw 27. The contacts 22, 23, 24 and 25 are located substantially in the same plane perpendicular to the axis of the inner chamber, while the contact members 14 and 15 are located in a parallel plane spaced apart therefrom. All of the contacts are insulated from one another by the non-conductive material of which the base is made and by open spaces in the inner chamber of the base. The contacts 22 and 25 are in substantial axial alinement with the end portions of the contact 14 but are spaced apart angularly from each other, and the contacts 23 and 24 are similarly related to the contact 15.

The cooperative circuit closing contacts are supported and propelled by a rotor 28, formed conveniently as a cylindrical block of insulating material of smaller diameter than the chamber within the housing. This rotor contains a shallow cavity 29 in the center of one of its ends which forms a step bearing and receives a projection 30 rising from the bottom of the cavity. It has an elongated recess 31 in its opposite end to receive a complementally formed head or bar 32 on the inner extremity of a shaft 33 which has a rotative bearing in the cover and protrudes from the cover. An operating handle or knob 34 is secured to the protruding end of shaft 33 by a pin 35.

The rotor 28 also contains a diametral transverse passage 36 and two parallel longitudinal passages 37 at opposite sides of its axis, and of the passage 36, and equidistant therefrom. Two movable contact members 38 and 39 of electrically

conductive metal are contained in the orifice portions of the transverse passage 36 and are engaged with forked pushers 40 and 41 respectively, which occupy the passage and are movable endwise therein. A spring 42 is contained in the passage between the pushers and is under compression when the parts are in the assembled operative position shown in Figs. 2 and 3. In this operative position the outer sides of the contacts 38 and 39 are separated by the diametral distance between the stationary contacts 14 and 15 and are pressed outwardly against the latter by the spring acting through the pushers 40 and 41. These pushers are of insulating material. The contact members 38 and 39 are preferably made as cylindrical rollers so as to travel along the stationary contacts and intervening portions of the chamber walls with minimum frictional resistance. They are provided with deep grooves 43 and 44 in their mid length to receive the forks of the pushers 40 and 41. Their length is sufficient to bridge across the distance between the planes in which the two sets of stationary contacts lie, and the passage 36 is appropriately disposed to hold the opposite end portions of each roller contact against the stationary contacts in these respective planes. For this purpose the height of the passage is slightly greater than the length of the roller contacts and its width slightly greater than the diameter of the rollers but less than their height; while the upper boundary of the passage is above the plane of the contacts 22—25, and the bottom boundary is below the plane of the contacts 14 and 15 when the rotor is in centered and supported engagement with the bearing projection 30.

The longitudinal passages 37 in the rotor contain two detents 45, 46 and a spring 47 in each. These detents are preferably steel balls, although they may be of other character, and they are placed in their respective passages with the spring between them. The bottom and top walls of the chamber within the housing are formed with alternate shallow humps 48 and depressions 49 in circular series around the axis of the chamber. These lie in the paths traveled by the detents when the rotor 28 is turned, and the humps in one wall are axially alined with those in the other, so that all of the detents ascend the humps next adjacent to them at the same time and descend into the depressions at the same time under the pressure of their springs 47. The depressions are so related to the contacts 22, 23, 24 and 25 that two of them in each end wall are occupied by the detents whenever the movable contacts are in engagement with two of the above mentioned stationary contacts. Thus when, as in the present illustration, there are four such contacts arranged 90° apart around the axis of the switch, and the detents are in an axial plane of the rotor at right angles to that in which the contacts 38 and 39 are located, there are four depressions each located in the same axial plane of the switch housing with the median line of one of the contacts 22, 23, etc. In other embodiments of the invention containing stationary contacts at more or less than 90° apart, the depressions are varied from the specific positions exhibited in the present embodiment, appropriately to maintain the same essential relationship to the contacts.

By virtue of the depressions and intermediate humps, and the detents with their actuating springs, the switch rotor is held in each of its circuit closing positions with a force which prevents accidental displacement but can be easily

overcome by manual force applied to the handle 34. When, in rotation of the rotor, the detents have been carried past the crests of the humps in front of them, reaction with the further slopes of the humps, under pressure of their springs, causes the rotor to be propelled forward into circuit closing position with respect to the next stationary contacts. The slopes of the humps or ridges are equal on both sides of the crests, in this embodiment, whereby the rotor may be turned in either direction with equal resistance and equal forward propulsive effect at each step. But it is within my contemplation to modify the formation of these parts so as to permit rotation in only one direction, where such limitation of movement is required.

The material of the base comprised between the shoulders 16 at each side of the axis is substantially coaxial and flush with the inner bounding edges of the contacts 14 and 15, and extends the full height of the bounding chamber walls; and the cover 12 has inward projections 50 from the side walls of its interior cavity, which protrude between the inwardly projecting parts of the contacts 22 and 25 at one side, and 23 and 24 at the other side, and the inner surfaces of which are substantially coaxial and flush with the inner bounding edges of those contacts. Thus the space in which the contacts 38 and 39 travel is surrounded by substantially continuous surfaces, composed in part of electrically conductive metal and in part by the insulating substance of which the housing is made, over which the contacts 38 and 39 may travel smoothly and without appreciable radial displacement at any point.

The cover is provided with projections 51 on its end face which fit into the notches in the base through which the necks 17 of the contacts 14 and 15 pass, and the outer faces of such projections bear closely on those necks. The balance of the end surface of the cover bears on the end face of the base and overlies the notches 26 therein which contain the necks of the contacts 22, 23, 24 and 25, bearing also on the upper faces of those necks. Thus the housing entirely encloses the rotor and the cooperative parts of the stationary contacts, excluding dust and other foreign matter from the moving parts and the contact surfaces.

It will be apparent that each of the traveling contacts 38 and 39 is adapted to complete a circuit between each of the contacts 14 and 15 and one or the other of two of the overlying contacts; that is, between 14 and either of contacts 22 or 25, and between 15 and either of contacts 23 or 24. With the rectangular arrangement of contacts here shown, the switch is adapted to close two of the four circuits at the same time when in two of its positions of rest, and to close the other two circuits when in its other two positions of rest. The construction of the housing here shown is such that a piece or pieces of insulating material having the same shape and dimensions as one or more of the stationary metal contact pieces can be substituted for such contact pieces, whereby the switch may be put into condition for controlling less than four circuits; for instance, one, two or three circuits. Ordinarily, after a prescribed arrangement of metal contacts, or of metal contacts and insulating segments, has been set up in the housing, the parts thereof are permanently secured together by rivets, as shown. But alternatively the cover may be connected to the base by removable fastenings, permitting it to be taken

off and desired substitutions of conductive or insulating segments to be made. The binding screws 19 and 27 are not meshed with threads in the base, but occupy sockets of large enough diameter to permit easy entrance and exit of the screws. They are secured with adequate security and rigidity by engagement with their respective conductive strips which, in turn, are secured by the cover.

A greater or lesser number of stationary contacts of either group, (that is, the group consisting of contacts 14 and 15 and the group containing the contacts 22, 23, 24 and 25), may be provided within the scope of this invention suitably arranged in accordance with the principles of the foregoing description. Thus the invention comprehends variations of the basic idea, and each specific embodiment is capable of conversion to a variety of uses by equipping it with all of, or less than, the maximum number of stationary contacts which it can accommodate.

Other features of important utility possessed by the invention are the balanced arrangement of the traveling contacts and the balanced arrangement of the detents. The radial pressure exerted by the spring 42 on each of the movable contacts is balanced by the pressure on the other contact, and the reactions of the contacts with the surrounding surfaces are balanced. This balance of forces relieves the bearings of the rotor and its propelling shaft of lateral pressure and friction. This same condition exists regardless of the number of stationary contacts with which the switch may be equipped, for the substitution of non-conductive segments for these contacts provides reaction surfaces for the traveling contacts. Likewise the disposition of detents at opposite ends of the rotor and a common spring for the detents of each pair, balances endwise thrust and eliminates end friction; and the symmetrical arrangement of two pairs of detents at diametrically opposite sides of the axis balances all lateral forces and resistances due to the detents. The only unbalanced force is the tangential force resisting rotation of the rotor, which is overcome by torsional stress applied to the shaft 33, and has no appreciable radial component.

The parts of the housing and the contact pushers 40 and 41 are made of molded Bakelite in the herein illustrated embodiment of the invention; but any other suitable non-conducting material may equally well be used. The base is molded with recesses 52 in its opposite sides providing webs 53 which are perforated to receive screws whereby the switch base may be secured in position for use.

What I claim and desire to secure by Letters Patent is:

1. An electric switch comprising a housing having an interior chamber, a rotor contained in said chamber, electrical contact members carried by said rotor at opposite sides of the axis thereof, and insulated from one another, common force applying means acting on said contact members tending to move them outwardly from said axis against the surrounding walls of the chamber, and coacting contact means in locations spaced apart from one another along the axis of the rotor, each of said contact members being formed to make bridging engagement with two axially spaced contact means.

2. An electric switch comprising a housing of insulating material having an internal chamber, a rotor mounted in said chamber, detents carried

by said rotor arranged to project from opposite ends thereof for engagement with the respectively adjacent end walls of the chamber, such end walls having humps and depressions arranged for cooperation with the detents, common force applying means for said detents acting thereon with tendency to move them simultaneously outward, and cooperating circuit making and breaking means mounted on the base and rotor respectively.

3. An electric switch comprising a housing having an interior chamber, electrical contacts mounted in said housing having inner boundaries which, with contiguous portions of the chamber walls form a substantially continuous cylindrical surface, said contacts being spaced apart axially of the chamber, a rotor mounted in said chamber with its axis substantially coincident with the axis of such cylindrical surface and having a diametral passage, contact members insulated from each other and movably mounted in the opposite ends of said passage having a dimension axially of the chamber greater than the spacing between the before named contacts in the same direction, and being arranged to bridge across said contacts when the rotor is in a prescribed position, and a spring contained in said passage between the movable contacts arranged to exert force outwardly on both.

4. An electric switch comprising a housing having an internal chamber, a rotor mounted in said chamber having a transverse passageway intersecting its axis of rotation and substantially axial passages on opposite sides of said transverse passageway, electrically conductive contact members and an intermediate spring located in the transverse passageway in an arrangement such that the spring tends to force the contact members out of the passageway, a pair of detents and an interposed spring located in each of said axial passages in an arrangement such that the springs tend to force their associated detents out of the passages, the housing having humps and depressions in its walls adjacent to the ends of the rotor arranged for pressure engagement by the detents, and members arranged in the housing for cooperation with said contact members to make and break an electrical circuit.

5. An electric switch comprising a housing having a substantially cylindrical chamber in its interior, stationary contact members mounted in the side walls of said chamber, a rotor arranged coaxially of said chamber, means for turning the rotor, movable contact members carried by the rotor for engagement with the before named stationary contact members arranged to exert balanced pressure simultaneously against the enveloping walls of the chamber at opposite sides of the rotor, axially movable detent members carried by the rotor for engagement with respectively adjacent end walls of the chamber, and pressure applying means acting on said detents to press them simultaneously and oppositely against the adjacent chamber walls, said walls having alternate projections and depressions in the path of travel of the respective detents.

6. An electric switch comprising a base having a substantially cylindrical cavity and notches of different depth in the wall encircling such cavity, a contact member having a neck contained in a relatively deep notch and an inner boundary extending in an arc substantially concentric with the axis of the cavity, a second contact member having a neck contained in a notch of less depth and having an inner boundary also

concentric with the cavity, the inner boundaries of both contact members having substantially the same radius, a cover secured to the base and overlying said cavity, a rotor mounted in the cavity substantially coaxial therewith, and a movable contact member carried by said rotor having portions in the same planes with the before named stationary contact members and arranged to bridge across the space from one to the other when the rotor occupies one of its possible positions.

7. An electric switch comprising a base having a substantially cylindrical cavity and notches of different depth in the wall encircling such cavity, a contact member having a neck contained in a relatively deep notch and an inner boundary extending in an arc substantially concentric with the axis of the cavity, a second contact member having a neck contained in a notch of less depth and having an inner boundary also concentric with the cavity, the inner boundaries of both contact members having substantially the same radius, and subtending in part the same angle, but one of them subtending a greater angle than the other, a third contact member mounted on the base in the same plane with the contact of shorter angular extent and subtending a different fraction of the angle subtended by the contact of greater extent, a cover overlying said cavity, a rotor mounted in the cavity substantially coaxial therewith, and a movable contact member carried by the rotor and placeable by movement of the rotor in positions where it forms bridging contact with the stationary contact of greater angular extent and each of the contacts of lesser angular extent exclusively.

8. An electric switch comprising a base and cover of insulating material forming a housing and having an interior chamber, stationary contact members passing between contiguous surfaces of said base and cover in gripped engagement therewith, having inner boundaries forming arcs substantially concentric with the chamber, such boundaries of different contacts being in different planes transverse to the chamber, there being a plurality of separated contacts in one plane each subtending a fraction of the angle subtended by a contact in the other of said planes, a rotor mounted in the chamber, and a movable contact carried by said rotor and having portions extending across the before named planes adapted to make bridging engagement between the stationary contacts in said planes.

9. An electric switch comprising a base and cover of insulating material forming a housing and having an interior chamber, stationary contact members passing between contiguous surfaces of said base and cover in gripped engagement therewith, having inner boundaries forming arcs substantially concentric with the chamber, such boundaries of different contacts being in different planes transverse to the chamber, there being a plurality of separated contacts in one plane each subtending a fraction of the angle subtended by a contact in the other of said planes, a rotor mounted in the chamber, movable contacts mounted in diametrically opposite sides of the rotor, each having portions lying in both of the two planes, and spring means between said contacts acting on and reacting between them tending to force them outwardly from the rotor.

10. An electric switch comprising a housing having a substantially cylindrical chamber in its interior, stationary contact members mounted in the side walls of said chamber, with separation between them axially of the chamber, a rotor arranged coaxially of said chamber, having a diametral passage open at both ends, the walls of which are of insulation, means for turning the rotor, movable electrically conductive contact members carried by the rotor protruding from the ends of said passage for engagement with the before named stationary contact members, a spring contained in the passage and insulating pushers between the ends of the spring and the respectively adjacent contact members, said spring being under compression and free to shift endwise in the passage, whereby it causes the movable contact members to exert balanced pressure simultaneously against the enveloping walls of the chamber at opposite sides of the rotor, the movable contact members being disposed to bridge across the axially disposed space between the stationary contact members.

11. An electric switch comprising a base and a cover of insulating material forming a housing and having a cylindrical interior chamber, the walls of said chamber being provided with a number of relatively deep notches, the bottoms of which are in substantially the same plane transverse to the axis of the chamber, and also having a number of relatively shallow notches, the bottoms of which are in a different plane transverse to said axis, contact members having necks seated in the notches and against the bottoms thereof, and having inner boundaries extending in arcs substantially concentric with said axis, such arcs of all the contact members which are in one plane having the same radius and the walls of the chamber being formed with material substantially filling the arcuate spaces between adjacent contacts in each plane with concave surfaces of equal radius and substantially flush with the inner boundaries of the adjacent contact members, the base and cover being complementally formed to fill so much of the notches as are not filled by the contact members, a rotor contained within said chamber having an operating shaft extending through the cover, a movable contact carried by the rotor in position to make bridging engagement with contacts in different planes in the course of rotation, and means acting on said movable contact to force it outward against the stationary contacts and the intermediate portions of the encircling chamber wall.

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