

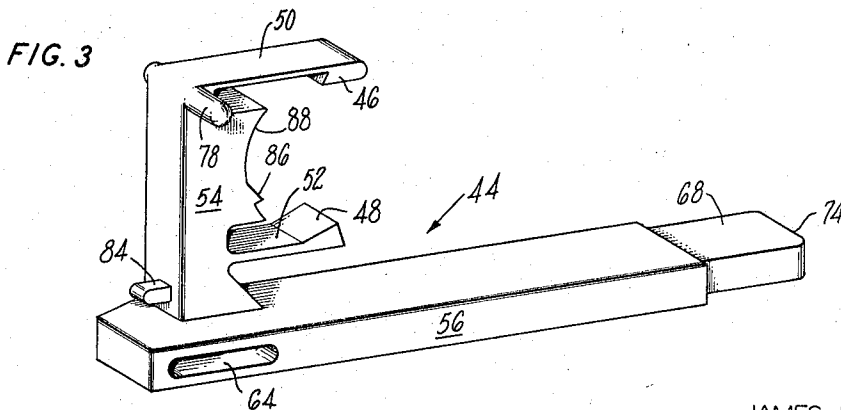
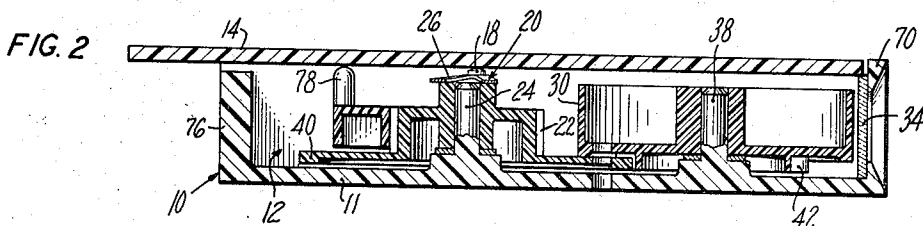
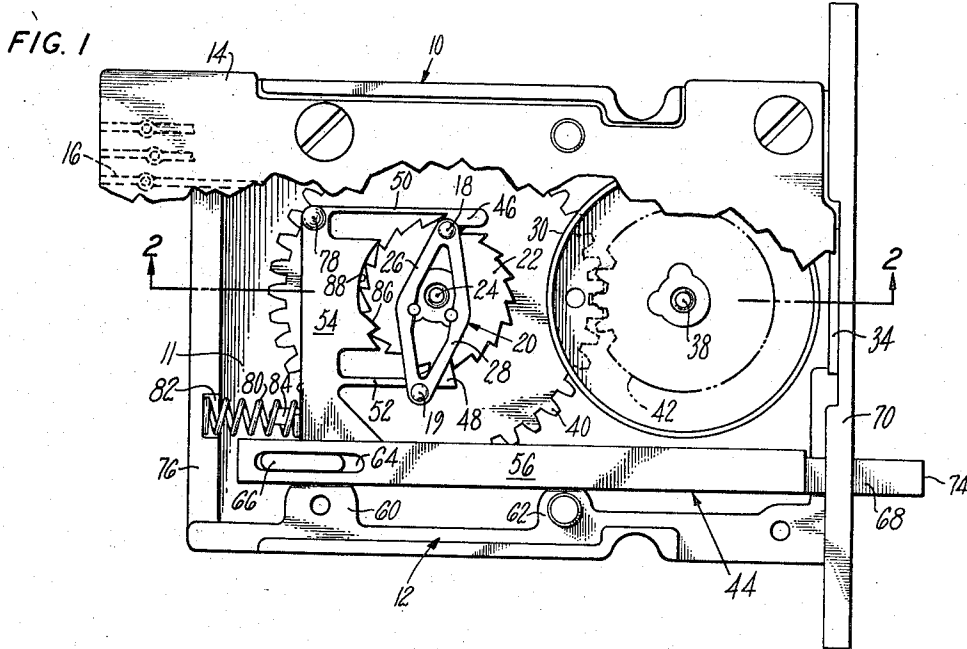
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PUSHBUTTON ROTARY SWITCH HAVING UNITARY ACTUATOR

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## PUSHBUTTON ROTARY SWITCH HAVING UNITARY ACTUATOR

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### ABSTRACT OF THE DISCLOSURE

Switch comprising a housing and a rotary brush supported therein, a printed circuit board supported on said housing in perpendicular relation to the rotational axis of the rotary brush, the rotary brush having contacts carried thereon in contact with the printed circuit board, and a unitary actuator including a double drive pawl and ratchet wheel subassembly drivingly connected to the rotary brush for selectively orienting the contacts relative to the printed circuit board to establish a desired electrical circuit connection.

This invention relates to switches and particularly concerns switches for controlling a plurality of electrical circuits.

A primary object of the invention is to provide an improved switch which is quick and easy to operate and is of notable use in selectively setting a plurality of circuit connections in an electrical control system.

Another object is to provide an improved switch particularly suited for miniaturized application in conjunction with a printed circuit plate.

A further object of the invention is to provide an improved switch having a minimum number of parts and incorporating a push button drive of compact integral construction for establishing a preselected circuit connection.

Another object of the invention is to provide an improved switch which is economical to manufacture and assemble in an easily installed modular unit and which is capable of providing long reliable service virtually free from maintenance requirements.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth, and the scope of the application of which will be indicated in the appended claims.

In the drawings:

FIG. 1 is a side view, partly broken away, showing a preferred embodiment of a switch constructed in accordance with the invention;

FIG. 2 is a sectional view, partly broken away, taken generally along line 2—2; and

FIG. 3 is an isometric view of an actuator incorporated in the invention.

Referring now to the drawing in detail, a switch of the invention is shown as having a housing 10 which includes a rectangular side panel 11 and an outwardly projecting wall 12 extending around its peripheral edges. The housing 10 is closed by a printed circuit plate 14 removably mounted thereto in oppositely facing relation to the side panel 11. A series of conductors, illustrated in phantom at 16 on the inside surface of the printed circuit plate 14, are connected to an associated electrical control system, not shown.

A pair of bridging contacts 18, 19 are carried on a rotary brush 20 illustrated as being mounted adjacent the printed circuit plate 14 to one side of a ratchet wheel

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22 supported for rotation on a support shaft 24. The rotary brush 20 comprises a pair of V-shaped arms 26, 28 interconnected to extend in opposite directions. The arms 26, 28 are of equal length and are mounted to the ratchet wheel 22 in eccentric relation to its rotational axis. The contacts 18, 19 are fixed on the extremities of the arms 26, 28 which are biased axially outwardly of the ratchet wheel 22 for engaging the printed circuit plate 14.

It will be understood that the conductors 16 may be arranged in any suitable manner on the printed circuit plate 14 to provide fixed contacts which, in conjunction with the movable contacts 18, 19 of the rotary brush 20, provide a switching action to change the circuit connections of an electrical control system. A number wheel 30 is drivingly connected to the ratchet wheel 22, and suitable indicia is provided on the number wheel 30 corresponding to predetermined angular positions of the rotary brush 20 relative to the printed circuit plate 14. The resulting circuit connections of the electrical control system thus may be readily determined by a visual reading of the corresponding indicia appearing in window 34 in front of the housing 10.

In the specific embodiment, the number wheel 30 is rotatably mounted on a shaft 38, and rotational movement of the ratchet wheel 22 is transmitted to the number wheel 30 by meshing spur gears 40 and 42. Spur gears 40 and 42 are mounted on shafts 24 and 38 adjacent the side panel 10 and respectively formed in integral coaxial relation to the ratchet wheel 22 and the number wheel 30. The rotary brush 20, which is as indicated above is biased against the printed circuit plate 14, assists in retaining the ratchet wheel 22 in proper position on its support shaft 24, and any suitable stabilizing means may be used to retain the number wheel 30 against axial movement on its shaft 38.

So that the rotary brush 20 may be moved to preset and electrical circuit connection as determined by a visual reading of the number wheel 30, an actuator 44 is provided having a pair of driving pawls 46, 48 engaging diametrically opposed portions of the ratchet wheel 22 for alternately driving it in one angular direction through a series of switch positions. The drive pawls 46, 48 are respectively mounted on the ends of a pair of flexible fingers 50, 52 which are cantilever supported on an upright pawl support portion 54 of the actuator 44. The base of the pawl support portion 54 is integral with an inner end of an elongated arm portion 56 mounted for reciprocating movement in the lower part of the housing 10. The flexible fingers 50, 52 project outwardly from the pawl support portion 54 in the same direction in parallel spaced relation to the arm portion 56 for supporting the drive pawls 46, 48 respectively on upper and lower portions of the ratchet wheel 22.

The arm portion 56 of the actuator 44 is mounted for sliding movement on a pair of upstanding lugs 60, 62 in the lower portion of the housing 10, and a slotted opening 64 is provided in the arm portion 56 at its inner end for receiving a guide 66 projecting outwardly from the side panel 11. The guide 66 and the slotted opening 64 cooperate to maintain the arm portion 56 in proper alignment and prevent it from moving up and down within the housing 10. The outer end of the arm portion 56 is provided with an extension 68 of reduced size extending through an opening in a front panel 70 of the wall 12. The extension 68 serves to provide a manually operable push button 74 positioned externally of the housing 10, and minimum peripheral clearance is provided between the extension 68 and the opening in the front panel 70 to minimize any free movement between the actuator 44 and the housing 10.

The actuator 44 is limited to reciprocating rectilinear movement between a first or right-hand position shown

in the drawing, and a second or left-hand position, wherein the inner end of the arm portion 56 engages a back panel 76 of the wall 12. Side-to-side movement of the actuator 44 is minimized by the provision of a projection 78 extending laterally outward of the pawl support portion 54 to continuously engage the printed circuit plate 14. To retain the actuator 44 in its right-hand position wherein the drive pawls 46, 48 maintain the ratchet wheel 22 against reverse turning, one end of a coil spring 80 is seated in a recess 82 in the back panel 76 and its opposite end is seated against the pawl support portion 54. The coil spring 80 is maintained in proper position by a post 84 projecting from the panel support portion 54 coaxially within the coil spring 80. Thus, it will be seen that the actuator 44 is continuously biased by the coil spring 80 toward its right-hand position to maintain the rotary brush 20 in a selected switch position even though the customary no-back pawl has been eliminated by the above described unitary structure of the actuator 44.

To prevent overthrow of the ratchet wheel 22 by the drive pawls 46, 48 during its rotation from one angular position to the next, a stop 86 protrudes from an arcuate inner face 88 of the pawl support portion 54 for engaging the ratchet wheel 22 when the actuator 44 is in its normal right-hand position. In this position, the inner face 88 extends circumferentially about a portion of the ratchet wheel 22 intermediate the flexible fingers 50, 52.

By virtue of the above described structure, the switch of the invention is adapted for miniaturized application wherein the unitary construction of the actuator 44 inherently provides self-aligning, guiding and stopping features while serving to drive the rotary brush 20 through a series of switch positions and to firmly maintain it in a selected switch position. Moreover, the actuator 44 is particularly suited to be molded as a single unit of suitable plastic such as "Delrin" so as to assure low cost manufacture and assembly.

To briefly summarize the operation of the switch, the circuit connections of the electrical control system may be selectively changed merely by depressing the push button 74 to move the entire actuator 44 into the left-hand position in opposition of the force of the coil spring 80. This causes the upper drive pawl 46 to positively drive the ratchet wheel 22 in a counterclockwise direction while the lower drive pawl 48 is flexed downwardly to slip over the teeth on the opposite side of the ratchet wheel. Upon releasing the push button 74, the actuator 44 automatically returns to its normal right-hand position under the force of the coil spring 80 to cause the lower drive pawl 48 to rotate the ratchet wheel 22 counterclockwise while the upper drive pawl 46 flexes upwardly and slips over the ratchet wheel 22. The drive pawls 46, 48 thus alternately advance the rotary brush 20 from one angular position to the next in two half step movements of the ratchet wheel 22 in response to a two stroke reciprocating movement of the actuator 44 thereby to change the circuit connections of the electrical control system as indicated by a visual reading of the number wheel 30.

It will be obvious that the above described switch can be combined with others to provide a stack or bank of modules, e.g., for linking a number of electrical control systems. Overthrow of the ratchet wheel 22 is effectively prevented by the stop 86 and reverse turning is eliminated by the double drive pawl and ratchet arrangement whereby the electrical connection can be changed only when the actuator 44 is operated to reciprocate between its right and left hand positions. The switch of the invention is quick and easy to operate and provides a positive driving action which is obtained in a structure requiring a minimum number of parts economical to manufacture and assemble.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure

from the spirit and scope of the invention, the scope of which is defined in the appended claims.

We claim:

1. A switch comprising a housing, switching means provided in said housing for controlling a plurality of electrical circuits and including a rotary brush mounted in said housing, a printed circuit board supported on said housing in perpendicular relation to the rotational axis of said rotary brush, and contacts carried on said rotary brush in contact with said printed circuit board, a ratchet wheel supported for rotation in said housing, a driving connection between said rotary brush and said ratchet wheel, and an actuator mounted in said housing for operating said ratchet wheel, said actuator having integral therewith a pair of flexible fingers having spaced opposed free ends and a pair of drive pawls fixed thereto, said drive pawls engaging diametrically opposed portions of said ratchet wheel to alternately drive the same in one angular direction for selectively setting electrical circuit connections in accordance with the angular position of said rotary brush relative to said printed circuit board.

2. The switch of claim 1 wherein said actuator includes an arm portion mounted for reciprocating rectilinear movement in said housing and cooperating therewith to establish first and second positions limiting the movement of said actuator in opposite directions, a pawl support portion having one end integral with said arm portion, said flexible fingers being cantilever supported on said pawl support portion, said drive pawls being fixed to said free ends of said flexible fingers for movement parallel to the axis of movement of said arm portion thereby to provide a unitary actuator for alternately driving said ratchet wheel from one angular position to the next in two half step movements responsive to a two stroke reciprocating movement of said arm portion between the first and second positions, an stop protruding from said pawl support portion intermediate said flexible fingers, said stop engaging said ratchet wheel when said actuator is in the first position to prevent overthrow of said ratchet wheel by said drive pawls during its movement from one angular position to the next.

3. The switch of claim 2 wherein said flexible fingers project in the same direction from said pawl support portion in parallel relation to the axis of movement of said arm portion.

4. The switch of claim 2 wherein said arm portion of said actuator includes an extension at one end thereof projecting through an opening in said housing to provide an externally positioned push button for operating said actuator, and wherein a coil spring is seated between said housing and said actuator continuously urging the same toward the first position whereby upon actuating said push button, said actuator moves to the second position in opposition to the face of said coil spring and upon releasing said push button, said actuator automatically returns under the force of said coil spring to the first position.

5. The switch of claim 1 further including a number wheel supported for rotation in said housing and a window therein to permit viewing of said number wheel, and a driving connection between said ratchet wheel and said number wheel whereby said number wheel provides a visual reading of a predetermined angular position of said rotary brush with respect to said printed circuit board.

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