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3,308,675 3/1967 Jonsson 200/6 A X
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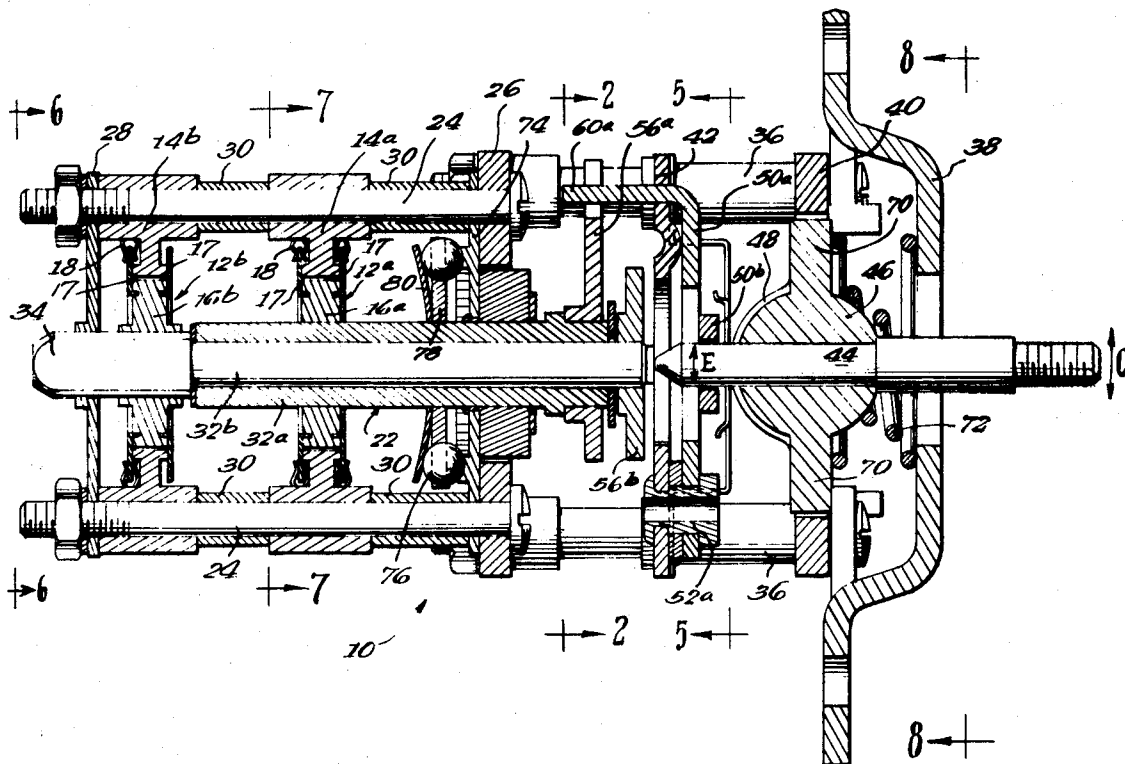
[54] **FOUR-WAY TOGGLE SWITCH WITH IMPROVED JOYSTICK CONTROL MECHANISM**
 12 Claims, 8 Drawing Figs.

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 H01h 21/00
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 14, 17, 168 S, 153.19, 153.7; 338/200; 74/471

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ABSTRACT: A rotor-actuating means for use in a rotary switch which includes at least one generally planar switch section disposed along a drive shaft with the rotor of the switch section being driven by the drive shaft. A toggle lever is pivotally mounted on a frame generally concentric with the axis of the drive shaft for generally linear reciprocating movement in at least one plane generally perpendicular to the plane of the switch section. A drive yoke member is pivotally mounted on the frame at a point spaced from the drive shaft adjacent one end of the shaft with an elongate radial slot intersecting the axis of the shaft and receiving the toggle lever, and with an axially extending arm diametrically disposed on the side of the drive shaft opposite the pivot point for the drive yoke member. A driven yoke member is fixed on the shaft and has a radially extending slot for receiving the arm of the drive yoke whereby linear movement of the toggle lever is translated through the drive yoke and driven yoke members to an increment of rotational movement of the shaft and rotor.



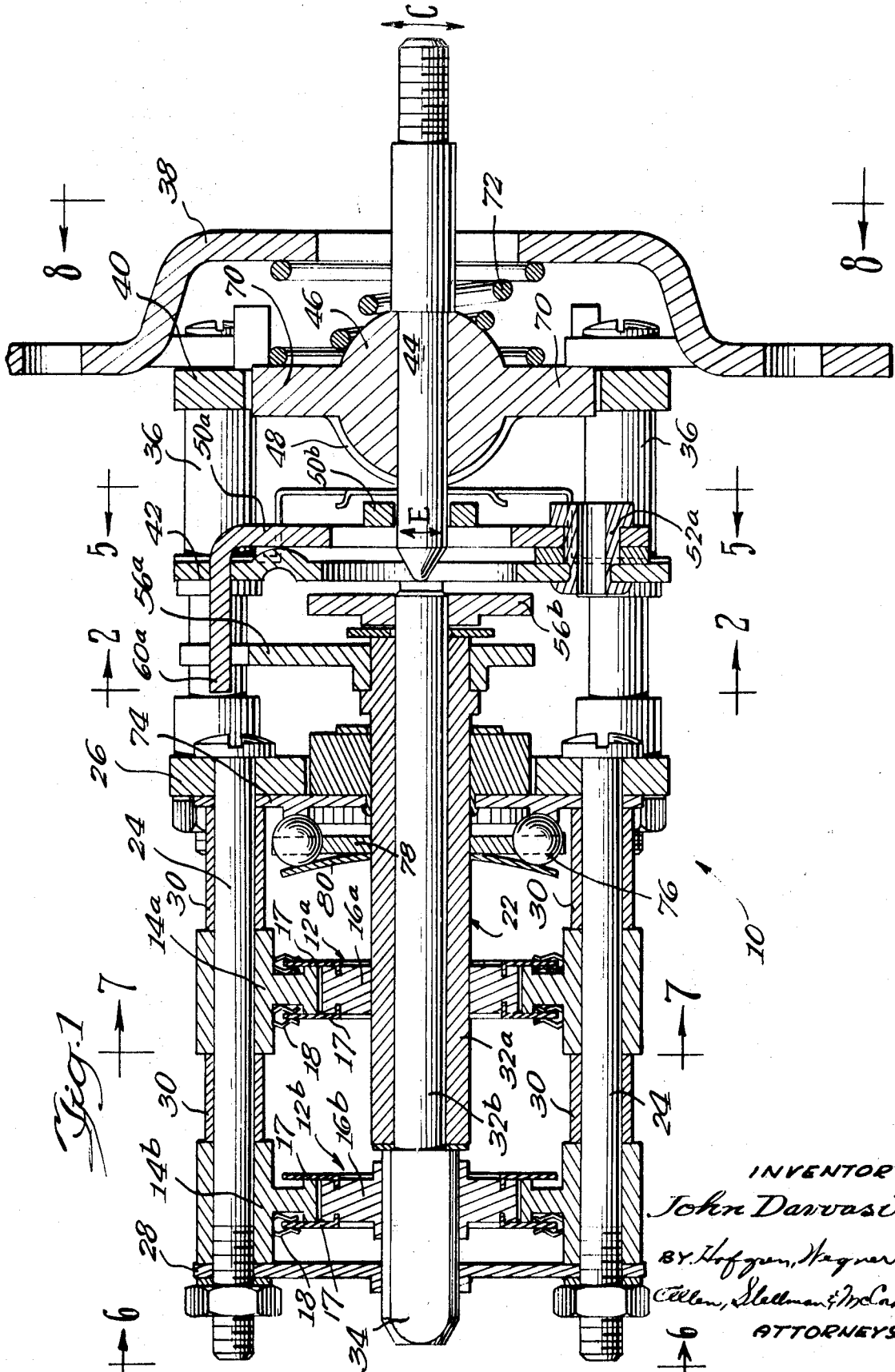


Fig. 1

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Fig. 2

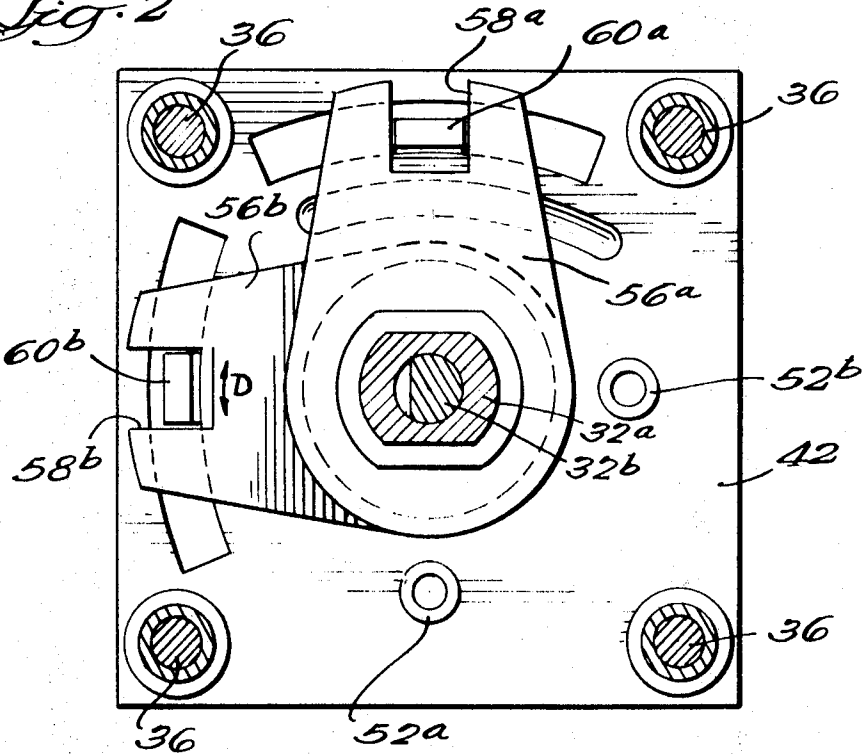
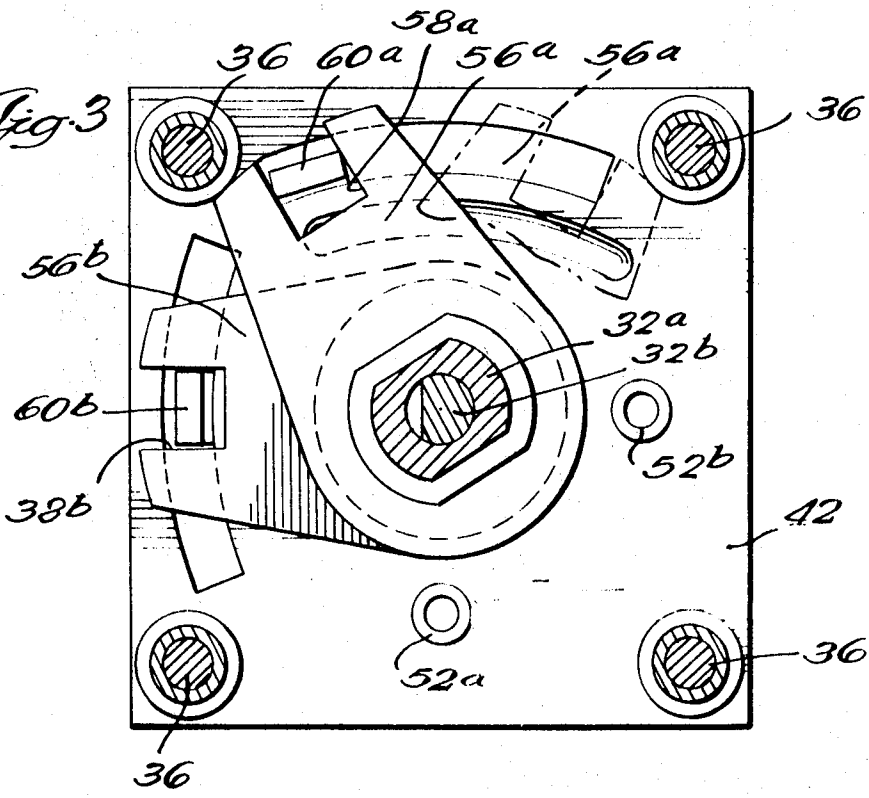
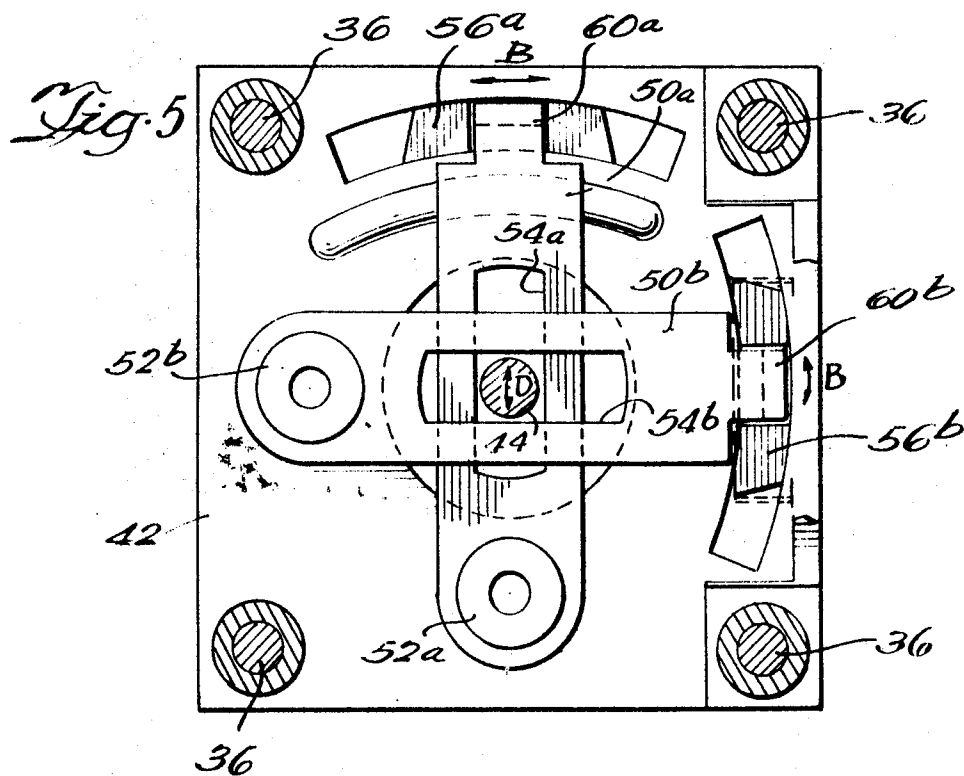
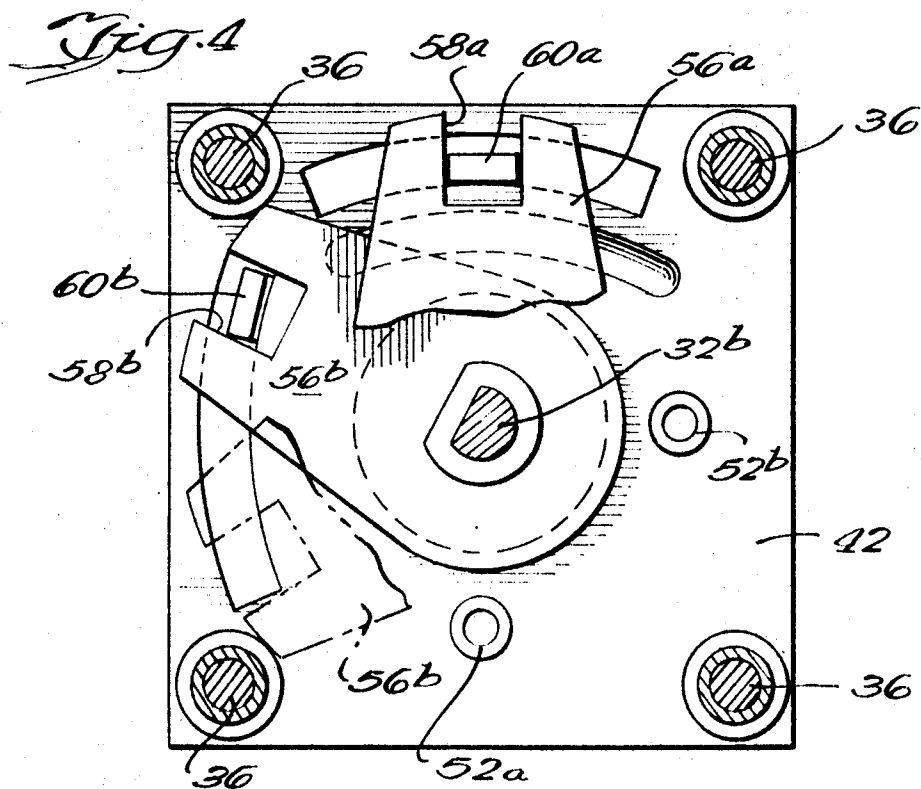
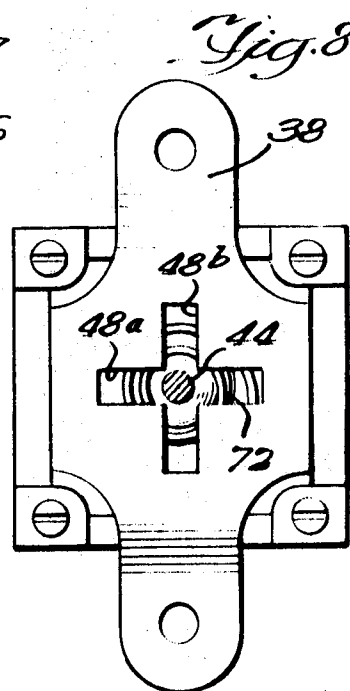
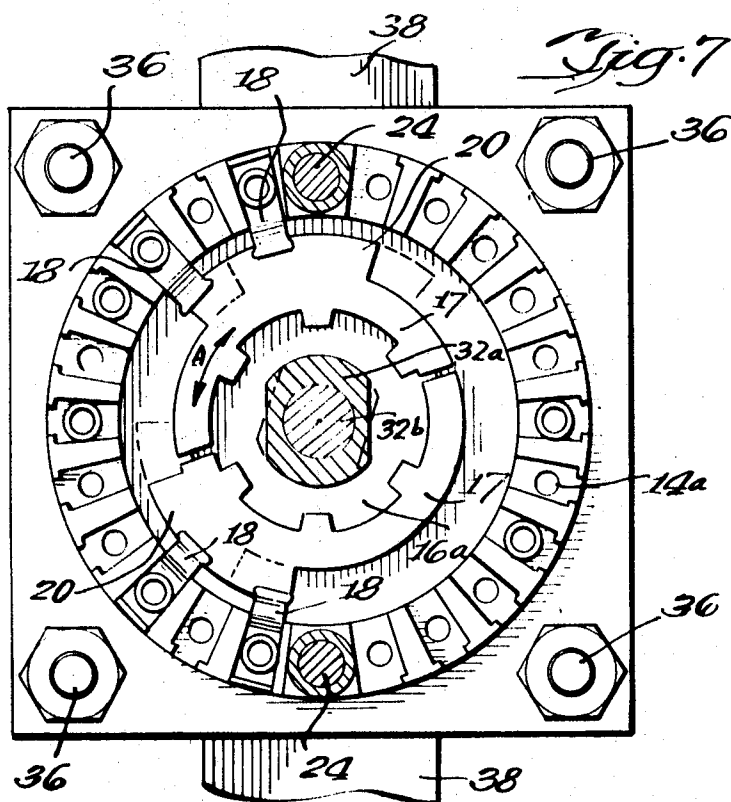
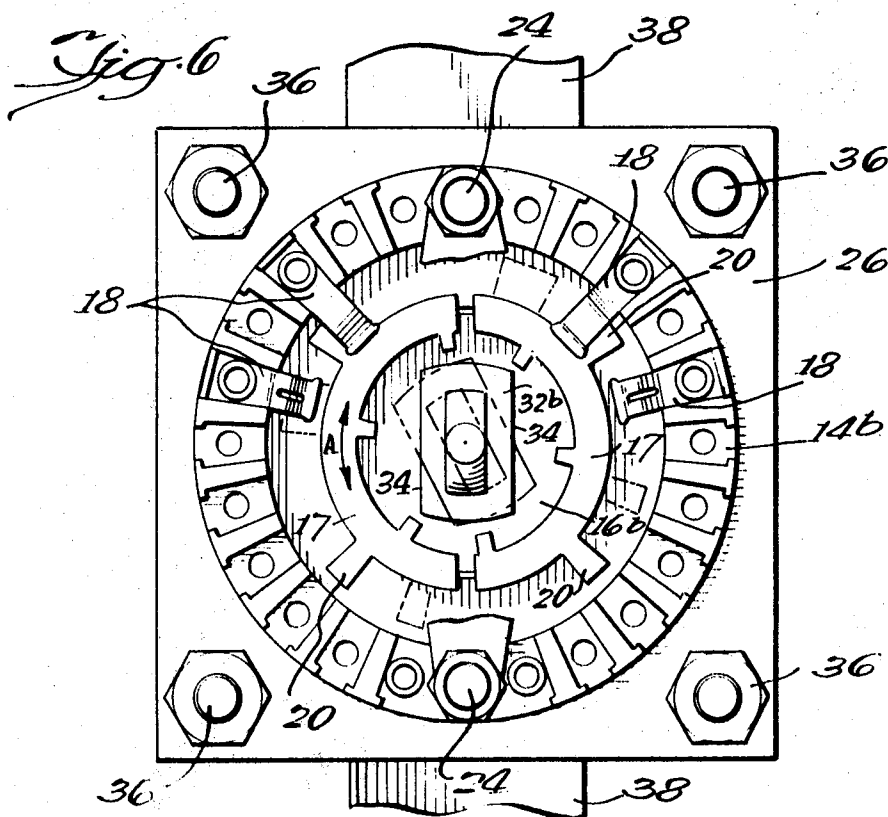


Fig. 3







FOUR-WAY TOGGLE SWITCH WITH IMPROVED JOYSTICK CONTROL MECHANISM

BACKGROUND AND SUMMARY OF THE INVENTION

The principal object of this invention is to provide a toggle operating type rotor actuating means for use in a rotary switch.

Heretofore, manually operated rotary switches universally include some type of knob or handle which is mounted on the frame of the switch for rotation in a plane generally parallel to the plane of the switch sections so as to rotate the drive shaft and thus the rotor of one or more switch sections which is driven by the drive shaft. In some situations, it would be desirable to permit actuation of the rotary switch by using a more positive linearly movable toggle operating type member. Conversely, most conventional toggle switches utilize leaf or similar type of contact members which are closed or opened in response to the linear, pivotal movement of the toggle lever. In some situations, a rotary switch has greater operative advantages than leaf-type contact switches which are operated by toggle levers. This invention is directed to solving these problems by providing a toggle operating type rotor actuating means for rotary switches, including novel connecting or link means which translates linear, pivotal movement from the toggle lever to rotary movement of the switch rotor for one or more switch sections operated by a single toggle-mounted lever.

Another object of the invention is to provide a rotary switch which includes at least one generally planar switch section disposed along a drive shaft with the rotor of the switch section being driven by the drive shaft, and including a toggle operating type rotor actuating means for rotating the drive shaft. A toggle lever is pivotally mounted on a frame for the switch for generally linear reciprocating movement. A yoke is fixed to the drive shaft and extends outwardly therefrom for rotation therewith. A connecting means is provided between the toggle lever and the yoke for translating linear movement from the lever to rotational movement of the yoke, shaft and rotor through a segment of an arc.

A further object of the invention is to provide a rotary switch as set forth in the preceding paragraph wherein the pivot mounting for the toggle lever is disposed concentric with and at one end of the drive shaft. The aforementioned yoke comprises a driven yoke member, and including a drive yoke member pivotally mounted on the switch frame at a point spaced from the drive shaft for rotational movement in a plane transverse to the axis of the shaft. Connecting means are provided between the driven and drive yoke members spaced from the drive shaft and the pivot point of the drive yoke member to provide for simultaneous rotation of the yoke members. Connecting means is provided between the toggle lever and the drive yoke member for translating linear movement from the toggle lever to rotational movement of the drive yoke member, driven yoke member, shaft and rotor.

Still another object of the invention is to provide a rotary switch as set forth in the preceding paragraph wherein the connecting means between the driven and drive yoke members includes an arm extending away from one of the members axially of the drive shaft and received in a radial slot in the other of the yoke members. The connecting means between the toggle member and the drive yoke member comprises a radially disposed slot in the drive yoke member intersecting the axis of the drive shaft and receiving the toggle lever at a point spaced from its pivot mounting on the switch frame.

With the structure as set forth in the preceding paragraphs, the rotors of a plurality of switch sections axially disposed along the drive shaft may be actuated independently by a toggle-mounted lever member. The drive shaft may include a plurality of concentric relatively rotatable shaft members for independently rotating the rotors of the various switch sections. A plurality of angularly spaced drive yoke members and driven yoke members are provided, one driven yoke member

secured to each of the concentric shaft members as described above. The radially disposed slots in the drive yoke members are oriented so that all intersect the axis of the drive shaft and all receive the one end of the toggle lever. The drive yoke members are disposed at various angular orientations with respect to the axis of the drive shaft. The toggle lever is journaled on the switch frame at a point concentric with the axis of the drive shaft for universal movement to provide linear movement in a number of planes all parallel to and intersecting the axis of rotation of the concentric drive shaft members. By properly angularly orienting the drive yoke members, linear movement of the universally journaled toggle lever in a given one of said planes will cause movement of only one of said drive yoke members through a segment of an arc and thereby actuate only one rotor of one of the plurality of switch sections.

Further objects, advantages and features of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal central section taken through the toggle-operated rotary switch of the present invention;

FIG. 2 is a section taken generally along the line 2—2 of FIG. 1;

FIG. 3 is a section similar to that of FIG. 2 illustrating the limit positions of one of the driven yoke members;

FIG. 4 is a section similar to that of FIG. 2 illustrating the limit positions of the other of the driven yoke members;

FIG. 5 is a section taken generally along the line 5—5 of FIG. 1;

FIG. 6 is an end elevational view of the rotary switch taken generally in the direction of line 6—6 of FIG. 1;

FIG. 7 is a section taken generally along the line 7—7 of FIG. 1; and

FIG. 8 is a front elevational view, on a reduced scale, of the rotary switch of this invention taken generally in the direction of line 8—8 in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

The toggle operating type rotor actuating means of this invention is shown embodied in a rotary switch, generally designated 10 in FIG. 1. The rotor actuating means is shown as providing switching functions of a plurality of generally planar switch sections. Two switch sections, generally designated 12a and 12b, are illustrated in the drawings and are shown best in FIGS. 6 and 7. The switch sections 12a, 12b each comprise a stator portion 14a, 14b, respectively, and a rotor portion 16a, 16b, respectively. In conventional manner, the rotors of each switch section carry a plurality of flat segmental contacts 17 on opposite sides thereof and about the outer periphery thereof for selectively making contact with a plurality of conventional double-wipe contacts 18 mounted on the stators of the switch sections. Referring to FIGS. 6 and 7, contact extensions 20 are disposed at the outer edge of each segmental contact 17 and are adapted to engage the jaws of the double-wipe contacts 18. Of course, the number of contacts 18 and contact extensions 20, as well as their angular disposition about the stator and rotor, are a matter of choice depending upon the use of the switch and the switching functions desired.

The switch sections 12a, 12b are disposed along a drive shaft means, generally designated 22, with the rotors of the switch sections being rotated back and forth in the direction of arrows A (FIGS. 6 and 7) by the drive shaft means, as described in greater detail hereinafter. The switch sections are held in place along the drive shaft means 22 by a pair of bolt-like strut members 24 which are mounted on a rear frame portion which includes front and rear frame plates 26 and 28, respectively. Spacer sleeves 30 maintain the positioning of the switch sections 12a, 12b on the strut members 24 to maintain their axial disposition along the shaft means 22.

At this time it should be pointed out that the shaft means 22 includes a pair of concentric relatively rotatable shaft members 32a and 32b. The outer shaft member 32a comprises a sleeve for the inner shaft member 32b and has a "double-D" exterior, as best seen in FIG. 7, which mates with a similarly shaped aperture in the rotor 16a. The inner shaft member 32b extends beyond the rear end (the left end in FIG. 1) of the outer sleeve shaft member 32a and has flat surfaces 34 for engaging similar abutment surfaces on the rotor 16b to translate rotational movement thereto.

The switch has a front frame portion which includes four post members 36 which are secured to the frame plate 26 and which mount a front guide plate 38 (FIG. 1), a toggle-mounting plate 40 behind the front guide plate 38, and an intermediate mounting plate 42 which mounts the drive yoke members, to be described in greater detail hereinafter.

The toggle operating type actuating means of this invention includes a toggle lever 44 which is journaled by a toggle ball 46 in a concave socket portion 48 of the toggle-mounting plate 40, for universal movement of the toggle lever 44 about the toggle ball 46. The ball 46 and socket 48 are disposed concentric with the axis of the shaft means 22 whereby the toggle lever 44 is disposed coaxial with the axis of the drive shaft means 22 at the front end of the shaft means when the toggle lever is in its center or "home" position shown in FIG. 1.

Referring to FIGS. 1 and 8, the front guide plate 38 has a pair of guiding slots 48a and 48b disposed at 90° to each other and intersecting at and extending about the toggle lever 44 which extends forwardly through the front guide plate 38. These guide slots 48a, 48b restrict the universal movement of the toggle lever 44 to two linear directions, one for each of the switch sections 12a, 12b, respectively, to rotate the rotors of the respective switch sections independently of each other in response to linear movement of the toggle lever pivotally about toggle ball 46 in one or the other directions defined by the guide slots 48a, 48b, as set forth below.

The connecting means between the toggle lever 44 and the shaft members 32a, 32b (along with their respective rotors 16a, 16b, respectively) will now be described. It first should be pointed out that the suffix letters a and b, as used above, are used for those members which cooperate to actuate the respective rotors 16a, 16b of the switch sections 12a, 12b, respectively. Referring to FIGS. 1 and 5, a pair of drive yoke members 50a, 50b are mounted by riveted shaft members 52a, 52b, respectively, to the mounting plate 42 at points spaced from the axis of the drive shaft means 22. The short rivet shaft members 52a, 52b are angularly disposed about the axis of the drive shaft means 22, 90° from each other, with the drive yoke members 50a, 50b extending radially therefrom to opposite sides of the shaft means and intersecting on the axis of the shaft means, as best seen in FIG. 5. Each of the drive yoke members 50a, 50b has a radial slot 54a, 54b, respectively, which receives or through which extends the inner end of the toggle lever 44 at points spaced to the rear of the pivoted toggle ball 46. The slots 54a, 54b provide for motion of the lever radially in the slots with the sides of the slots engaging the lever to translate linear movement from the lever (as defined by the guide slots 48a, 48b in the front guide plate 38) to rotational movement of the drive yoke members.

Referring to FIGS. 1 through 4, a pair of driven yoke members 56a, 56b are fixed to the front ends of the outer and inner shaft members 32a, 32b, respectively, for rotational movement with the shaft members in a plane transverse to the axis thereof. Referring to FIG. 2, each of the driven yoke members 56a, 56b has a radially disposed slot 58a, 58b, respectively, at the radially outer edges thereof receiving arm portions 60a, 60b which protrude rearwardly from the drive yoke members 50a, 50b, respectively. As with the slots 54a, 54b in the drive yoke members, slots 58a, 58b provide for motion of the arm portions 60a, 60b radially in the slots, but with the sides of the slots 58a, 58b being engaged by the arm portions 60a, 60b to translate simultaneous rotational movement from the drive yoke members 50a, 50b to the driven yoke members 56a, 56b,

and thus, in turn, to the drive shaft members 32a, 32b and the rotors 16a, 16b of the switch sections 14a, 14b, respectively.

The full operation of the toggle rotor actuating means of this invention will now be described. The operation will be described only in relation to the switch section 12b. Referring to FIG. 1, linear movement of the outer end of the toggle lever 44 in the direction of arrow C within the guide slot 48b in the front guide plate 38 will cause the lever to pivot about toggle ball 46 and correspondingly move the inner end of the lever in the direction of arrows E (FIGS. 1 and 5). The inner end of the toggle lever 44 will engage the sides of the slots 54b in the drive yoke member 50b and cause the drive yoke member 50b to pivot about the short rivet shaft 52b (FIG. 5). As the drive yoke member 50b pivots or rotates about shaft 52b, its arm portion 60b (FIG. 2) will move in the direction of arrow D (FIG. 2) and engage the sides of the slot 58b in the driven yoke member 56b which is secured to the front end of the inner shaft member 32b. Rotation of the driven yoke member 56b in the direction of arrow D (FIG. 2) correspondingly will rotate the inner shaft member 32b and cause rotation of the rotor 16b of the switch section 12b to make or break selective contacts 18 and 20.

Referring to FIGS. 1 and 4, it can be seen that movement of the toggle lever in the direction of arrow C (FIG. 1) downwardly in guide slot 48b will cause movement of the driven yoke member 56b upwardly to the position shown in full lines in FIG. 4. Movement of the toggle lever upwardly in guide slot 48b will cause the driven yoke member 56b to move to the position shown in phantom in FIG. 4. Correspondingly, referring to FIG. 3, horizontal movement of the lever (i.e. movement in guide slot 48a) will cause movement of the driven yoke member 56a between the full line and phantom positions shown in FIG. 3.

Specialized switching functions also may be incorporated with the present invention. For instance, projecting arms 70 may be provided on the toggle ball 46 and an hourglass spring member 72 may be positioned between the projecting arms 70 and the inside of the front guide plate 38 to urge the toggle lever 44 to its center or home position as shown in FIG. 1. In the embodiment illustrated, the biasing of the hourglass spring 72 is provided to function with the switch section 12b. Alternatively, a conventional detent structure which includes a detent plate 74 (FIG. 1), detent balls 76, ball carrier plate 78, and plate spring 80 may be employed to hold the toggle lever in one or both of its extreme positions. In the embodiment illustrated, the detent structure is mounted to the outer shaft member 32a and thereby controls or holds the switch positions for the switch section 12a.

It should be pointed out that only two switch sections have been shown in the drawings and described above for illustration purposes only. It is contemplated that with the present invention more than two switch sections, concentric drive shaft members, driven yoke members, drive yoke members, and guide slots (i.e. 48a, 48b) may be employed for a wide number of switch sections.

The foregoing detailed description has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom as some modifications will be obvious to those skilled in the art.

What I claim is:

1. In a rotary switch which includes at least one generally planar switch section, a toggle rotor actuating means, comprising: a drive shaft means mounted on a frame for rotation relative to the frame, said switch section being disposed along said drive shaft means with the rotor of said switch section being driven by said drive shaft means, a toggle lever pivotally mounted on the frame for generally linear reciprocating movement, said pivotal mounting being concentric with said drive shaft means, and connecting means between said toggle lever and said drive shaft means for translating linear movement from said toggle lever to rotational movement, through a segment of an arc, of said drive shaft means and, in turn, to said rotor.

2. The rotary switch of claim 1 including yoke means having a driven yoke member fixed to said drive shaft means and extending outwardly therefrom for rotation therewith, and connecting means between said toggle lever and said yoke means for translating linear movement from said toggle lever to rotational movement of said driven yoke member.

3. The rotary switch of claim 2 wherein said yoke means includes means defining generally radially disposed surface means engageable by said toggle lever to translate linear movement from the toggle lever to rotational movement of said yoke means.

4. The rotary switch of claim 3 wherein said surface means is defined by a generally radially disposed slot receiving said toggle lever at a point spaced from its pivotal mounting on said frame, said slot providing for motion of the lever radially in the slot, and with the sides of the slot engaging the lever to translate linear movement from the toggle lever to rotational movement of said yoke means, shaft means and rotor.

5. The rotary switch of claim 1, including a yoke means comprising a driven yoke member and a drive yoke member, the driven yoke member being fixed to said shaft and extending outwardly therefrom for rotation therewith, the drive yoke member being pivotally mounted on said frame at a point spaced from said shaft for rotational movement in a plane transverse to the axis of the shaft, connecting means between said driven and drive yoke members spaced from said shaft and the pivot point of said drive yoke member providing for simultaneous rotation of the yoke members, and connecting means between said toggle lever and said drive yoke member for translating linear movement from said toggle lever to rotational movement of the drive yoke member, driven yoke member, drive shaft means and rotor.

6. The rotary switch of claim 5 wherein said driven yoke member includes means defining generally radially disposed surface means, and said drive yoke member has an arm portion extending generally parallel to said drive shaft means and into engagement with said surface means to translate simultaneous rotational movement from said drive yoke member to the driven yoke member.

7. The rotary switch of claim 6 wherein said surface means is defined by a radially disposed slot in said driven yoke member receiving said arm portion of the drive yoke member, said slot and said arm portion being spaced from and disposed on the side of said shaft generally diametrically opposite the pivot for said drive yoke member.

8. The rotary switch of claim 7 wherein said connecting means between said toggle lever and said drive yoke member comprises means defining radially disposed surface means intersecting the axis of rotation of said shaft means and engagea-

ble by said lever.

9. The rotary switch of claim 8 wherein said surface means is defined by a generally radially disposed slot receiving said lever at a point spaced from its pivotal mounting on said frame, said slot providing for motion of the lever radially in the slot, and with the sides of the slot engaging the lever to translate linear movement from the lever to rotational movement of the drive yoke member, driven yoke member, drive shaft means and rotor.

10. In a rotary switch which includes at least a pair of generally planar switch sections, a common toggle rotor actuating means for said switch sections, comprising: drive shaft means including at least a pair of concentric relatively rotatable shaft members, said switch sections being disposed along said drive shaft means with the rotor of each of said switch sections being driven by one of said shaft members, a toggle lever journaled on the frame for generally universal pivoting movement about a pivot point generally on the axis of said shaft means, at least a pair of driven yoke members one fixed to each of said shaft members and extending outwardly therefrom at varying angles for rotation therewith, at least a pair of drive yoke members one associated with each of said driven yoke members and pivotally mounted on said frame at points angularly about said shaft and spaced from said shaft means for rotational movement in planes transverse to the axis of the shaft means, connecting means between each of the associated driven and drive yoke members spaced from said shaft and the pivot points of the drive yoke members providing for simultaneous rotation of the associated driven and drive yoke members, and connecting means between the toggle lever and said drive yoke members for translating linear movement from the toggle lever to rotational movement of one of the driven yoke members when the lever is pivoted in a predetermined linear direction and to rotational movement of the other drive yoke member when the lever is pivoted in a different predetermined linear direction.

11. The rotary switch of claim 10 including guide means restricting the universal movement of said toggle lever to only said predetermined directions.

12. The rotary switch of claim 10 wherein the connecting means between said toggle lever and said drive yoke members comprises means defining a radial slot in each of the drive yoke members intersecting on the axis of rotation of said shaft means and receiving said toggle lever at points spaced from its universal mounting on said frame, said slots permitting motion of the toggle lever radially in the slots, and with the sides of the slots engaging the toggle lever to translate linear movement from the toggle lever to rotational movement of the drive yoke members.

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