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MULTIPLE SWITCH CONTROL

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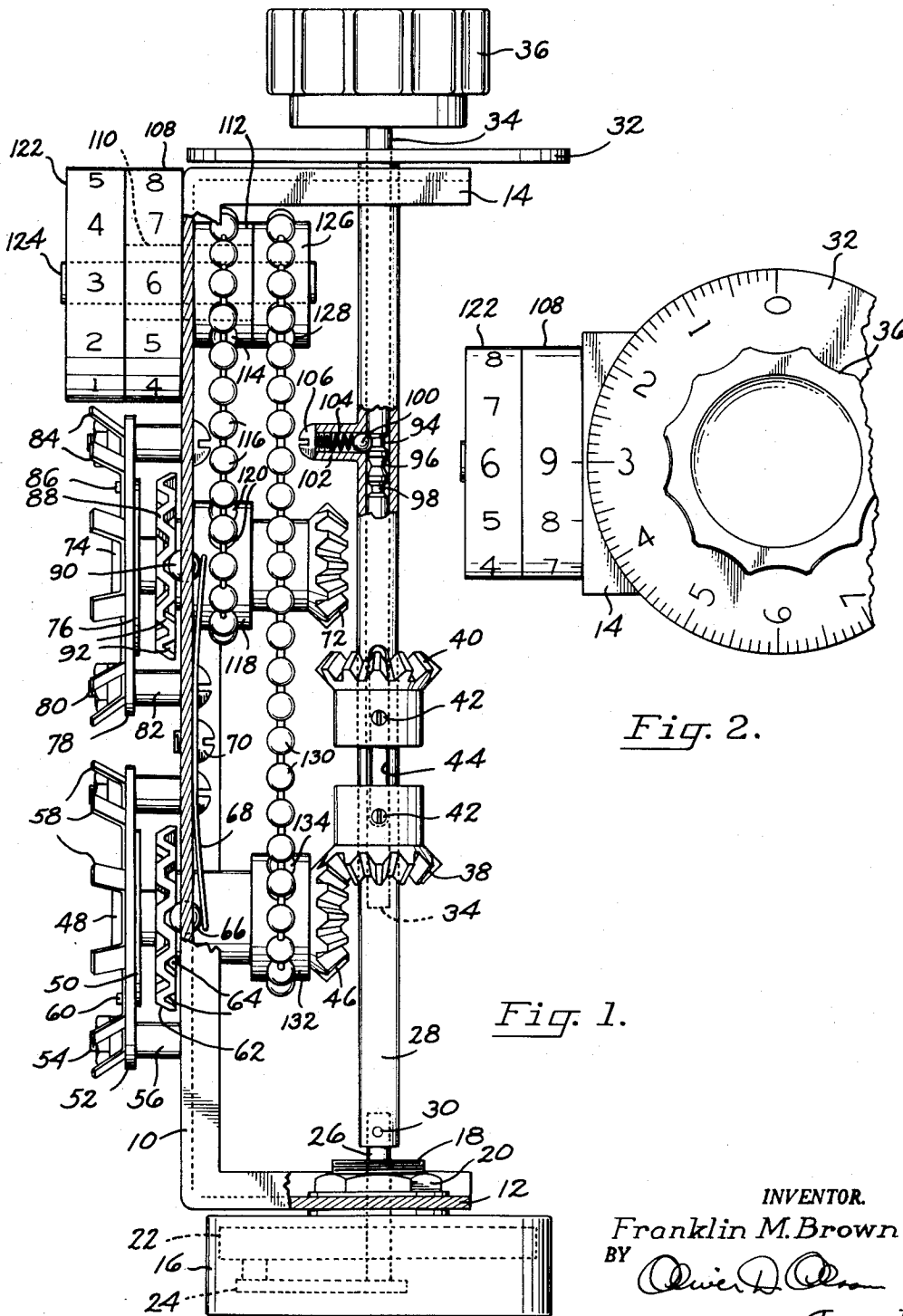


Fig. 2.

Fig. 1.

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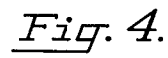
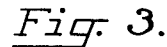
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MULTIPLE SWITCH CONTROL

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This invention pertains to electric switches, and relates particularly to novel control mechanism for operating a plurality of rotary switches and for indicating the relative positions of said switches.

In many types of electrical and electronic instruments and equipment, it is frequently required that relatively large numbers of switching adjustments be made, for example for selecting proper values of resistance, capacitance, or inductance. For example, in the operation of a voltage divider or rheostat, it is necessary frequently to make a large number of selections of resistance values in the search for or setting of the desired value.

It is a principal object of the present invention to provide a control by which a relatively large number of switching operations may be performed from a single dialing station.

Another important object of this invention is the provision of a control for operating a plurality of switches selectively by means of a single control knob.

A further important object of the present invention is to provide control mechanism for operating a plurality of switches, which mechanism is of compact design and thus occupies a minimum of space within electrical and electronic equipment with which it is to be associated.

Still another important object of the present invention is the provision of control mechanism for operating a plurality of switches, which mechanism is of simplified construction for economical manufacture, which is readily adapted for use with conventional type switches, and which is operable with speed, facility and precision.

The foregoing and other objects and advantages of the present invention will appear from the following detailed description, taken in connection with the accompanying drawings, in which:

Figure 1 is a view in side elevation of a multiple switch control embodying the features of the present invention, parts being broken away to disclose details of construction;

Figure 2 is a fragmentary plan view of the read-out dial assembly of the control mechanism shown in Figure 1;

Figure 3 is a view in side elevation of another form of multiple switch control embodying features of the present invention, parts being broken away to disclose details of construction; and

Figure 4 is a fragmentary plan view of the read-out dial assembly of the control mechanism shown in Figure 3.

Referring first to the embodiment illustrated in Figures 1 and 2, the multiple switch control mechanism illustrated therein includes an elongated main frame 10 provided with opposite end sections 12, 14 which project substantially normal to the main frame. Mounted upon the rearward end section 12 of the frame is an electric switch assembly contained within the housing 16. The housing is secured to the rearward end section of the frame by means of the threaded hub 18 and securing nut 20. Since the control mechanism illustrated is

2

adapted particularly for use in the assembly of voltage dividers or rheostats, the housing is shown to support a conventional potentiometer element 22. A rotary contact element 24 is arranged for sliding contact with the resistance element and is connected to a shaft 26 which extends through a central opening in the hub 18.

An elongated tubular drive shaft 28 is secured at one end to the potentiometer contact shaft 26, as by means of a pin 30, and projects through the forward end section 14 of the frame. The forward end of the tubular shaft supports a flat circular dial 32, which may be graduated appropriately to indicate the various positions of adjustment of the potentiometer contact arm with respect to the resistance element.

Mounted within the tubular shaft for longitudinal movement therein is a central shaft 34 which projects forwardly beyond the dial 32 and supports a control knob 36 at its forward end. This central shaft functions to operate selectively additional switch assemblies, as follows: Mounted slidably upon the tubular shaft intermediate the ends of the latter is a pair of spur gears 38, 40. These spur gears are secured to the central shaft 34 by means of set screws 42 which extend through an elongated slot 44 provided in the tubular shaft. In this manner longitudinal movement of the central shaft with respect to the tubular shaft causes simultaneous movement of the spur gears longitudinally of the tubular shaft.

The spur gear 38 is associated with a spur gear 46, the shaft 48 of which is mounted on the main frame 10 for axial rotation, on an axis substantially normal to the axis of rotation of the spur gear 38. The shaft 48 extends through the frame 10 and engages the central rotary section 50 of a wafer switch. The fixed section 52 of said wafer switch is supported upon the frame in spaced relation to the latter by such means as the securing bolts 54 and the spacer sleeves 56.

Wafer switches of the type illustrated generally include a plurality of spaced mounting lugs 58 supported upon the fixed section of the switch, and these mounting lugs are arranged for selective electrical engagement by one or more electrically conducting contacts 60 mounted on the central rotary section 50, in manner well-known to those skilled in the art. Accordingly, there is provided means for positioning the electrical contacts on the rotary section precisely at the spaced positions of the mounting lugs, to insure positive electrical connection therebetween.

In the embodiment illustrated in Figure 1, such means comprises a circular detent plate 62 provided with a plurality of circumferentially spaced pockets 64. The detent plate is mounted upon the shaft 48 of the spur gear 46, for rotation therewith, and is positioned adjacent the frame. An opening is provided in the frame for registration with the pockets in the detent plate, and this opening is adapted to contain a ball 66 freely therein for reception within the pockets of the detent plate. The ball is urged resiliently toward the pockets of the detent plate by means of a leaf spring 68 which is mounted upon the frame by means of a screw 70, with one end of the leaf spring overlying the ball. Thus, as the spur gear 46 is rotated the rotary section 50 of the wafer switch and the detent plate 62 also are rotated, and the electrical contacts on the rotary section of the switch are carried into positive contact with the mounting lugs, selectively as the ball is seated in the pockets of the detent plate.

Associated with the second spur gear 40 secured to the central shaft 34, is a spur gear 72, the shaft 74 of which is mounted upon the frame 10 for axial rotation on an axis extending substantially normal to the axes of rotation of the spur gear 40. In a manner similar to the assembly associated with the spur gear 46, the shaft 74 extends through the frame for engagement with

3

the central rotary section 76 of a second wafer switch assembly, the fixed section 78 of which is supported in spaced relation to the frame by means of the mounting bolts 80 and spacer sleeves 82. Spaced mounting lugs 84 are provided on the fixed section 78 and one or more contacts 86 are provided on the rotary section 76, in the manner and for the purpose previously explained. A detent plate 88 is mounted on the spur gear shaft 74, and a ball 90 is confined freely within an opening in the frame 10 for registry with the pockets 92 of the detent plate, with the opposite end of the leaf spring 68 overlying the ball 90 to urge the latter resiliently toward said pockets.

The spur gears 46, 72 are spaced apart a distance greater than the spacing between the associated spur gears 38, 40 secured to the central shaft 34. In this manner longitudinal movement of the central shaft functions selectively to interengage the sets of spur gears 38, 46 and 40, 72. In an intermediate position of longitudinal movement of the central shaft, both sets of spur gears are out of mesh.

Means preferably is provided to locate the central shaft selectively in the aforementioned positions of longitudinal adjustment, namely with the sets of spur gears intermeshed, and the intermediate position in which said sets of spur gears are out of mesh. In the embodiment illustrated in Figure 1, such means is provided by the three annular grooves 94, 96 and 98 formed in the central shaft 34 for selective reception of a ball 100 which is mounted in the central opening of a laterally extending hollow stud 102 mounted on the tubular shaft 28. The ball is urged resiliently toward the annular grooves by means of a compression spring 104 interposed between the ball and a screw cap 106 on the stud.

Thus, with the ball seated in the annular groove 94, as illustrated in Figure 1, the set of spur gears 38, 46 are intermeshed and the second set of spur gears are out of mesh, whereupon axial rotation of the central shaft 34 causes simultaneous rotation of the tubular shaft, the spur gear shaft 48 and the central rotary section 50 of the first described wafer switch. When the central shaft is pulled forwardly to the position at which the ball is seated in the intermediate annular groove 96, both sets of spur gears are out of mesh, whereupon axial rotation of the central shaft results in rotation only of the tubular shaft 28 and the rotary contact arm 24 of the potentiometer. With the central shaft pulled forwardly to the position at which the ball is seated in the annular groove 98, the set of spur gears 40, 72 will be intermeshed, to provide for rotation of the rotary section 76 of the second wafer switch.

Indicator means also is provided for indicating the various relative positions of the contacts and mounting lugs of each wafer switch. In the embodiment illustrated in Figure 1, a cylindrical dial 108 is provided with an axial hub 110, which extends rotatably through the frame 10 with the dial positioned on the outer side of the frame. A collar 112 is secured to the hub and is provided with a plurality of circumferentially spaced sockets 114 adapted to receive the beads 116 of a bead chain reeved over the collar. A similar collar 118 also is secured to the shaft 74 of the spur gear 72, for rotation therewith, and this collar also is provided with spaced sockets 120 adapted to receive said beads of the bead chain. Thus, rotation of the spur gear 72 causes simultaneous rotation of the collars 118, 112 and the indicator dial 108. The latter may be graduated and marked appropriately to indicate selective positions of rotation of the central rotary section 76 of the second wafer switch.

A second cylindrical indicator dial 122 is positioned adjacent the indicator dial 108, and is provided with a central shaft 124 which extends rotatably through an axial bore in the hub 110. A collar 126 is secured to the inner end of this shaft and preferably is positioned

4

adjacent the collar 112. The collar 126 is provided with a plurality of circumferentially spaced sockets 128 to receive the beads 130 of a second bead chain. A co-operating collar 132 is mounted upon the shaft 48 of the spur gear 46, and is provided with spaced sockets 134 for receiving the beads 130 of said chain. Thus, rotation of the spur gear 46 causes rotation of the indicator dial 122, and the latter may be graduated and marked appropriately to indicate the relative positions of rotation of the central rotary section 50 of the wafer switch.

The embodiment illustrated in Figure 1 is adapted particularly for use in the assembling of a plurality of resistance elements into a voltage divider or rheostat. The mounting lugs on the pair of wafer switches function to support and interconnect a plurality of fixed resistances in series chains, with the potentiometer functioning as an interpolating resistance. The various resistances may be interconnected in any manner desired, through the rotary sections of the wafer switches, to provide a voltage divider or rheostat of any selected design. For these purposes the read-out dials illustrated in Figure 2 may be so arranged and marked as to provide a direct reading of any resistance value selected by the various switches, through operation of the single control knob 36.

Referring now to the embodiment illustrated in Figures 3 and 4, the assembly includes a substantially U-shaped frame having spaced side sections 140, 142 and an interconnecting intermediate section 144. The intermediate section supports a switch mechanism housing 146 by means of a central threaded hub 148 which is secured to the intermediate frame section by means of the securing nut 150. As in the embodiment of Figure 1, the switch mechanism is illustrated in the form of a potentiometer resistance element 152 mounted within the housing 146. A rotary contact element 154 is mounted upon a shaft 156 which extends through a central bore in the housing hub.

An elongated tubular shaft 158 is secured at one end to the potentiometer contact shaft, as by means of a pin 160, and extends forwardly therefrom substantially centrally of and parallel to the side sections of the frame. A central shaft 162 extends slidably through the hollow tubular shaft for longitudinal movement therein, and supports a control knob 164 at its forward end. A pair of spur gears 166, 168 are mounted slidably upon the tubular shaft and secured firmly to the central shaft by means of the set screws 170 which extend through elongated slots 172 in the tubular shaft. The spur gears face each other but are spaced apart a substantial distance along the tubular shaft, as illustrated.

Associated with the spur gear 166 is a spur gear 174 the shaft 176 of which extends rotatably through the side frame member 140 and engages the central rotary section 178 of a wafer switch. The fixed section 180 of the wafer switch is supported in spaced relation to the frame member by means of the mounting bolts 182 and the pairs 184, 186 of spacer sleeves. A plate 188 is mounted between the pairs of spacer sleeves and supports a resilient leaf spring 190 which functions to urge a ball 192, mounted freely in an opening in the supporting plate 188, into the circumferentially spaced pockets 194 of the circular detent ring 196 secured to the spur gear shaft 176.

In similar manner, there is associated with the second spur gear 168 a spur gear 198 the shaft 200 of which extends rotatably through the other side frame section 142 and engages the rotary section 202 of a wafer switch. The fixed section 204 of the wafer switch is supported in spaced relation to said side frame member by means of the mounting bolts 206 and the pairs 208, 210 of spacer sleeves. A mounting plate 212 is supported between the pairs of spacer sleeves and carries a resilient leaf spring 214 which functions to urge the ball 216 into

5

the circumferentially spaced pockets 218 of the circular detent ring 220 mounted on the spur gear shaft 200.

In the embodiment illustrated in Figure 3, it is to be noted that the wafer switches are mounted on opposite sides of the tubular shaft, whereby to decrease substantially the length of the assembly as compared with the arrangement illustrated in Figure 1.

A read-out dial assembly also is provided for the assembly of Figure 3. In the embodiment illustrated, such read-out dial assembly includes a circular flat dial member 222 secured to the forward end of the tubular shaft 158, the dial member being graduated and marked appropriately to indicate selected positions of the potentiometer contact arm 154 with respect to the potentiometer resistance. A second dial member 224 is provided with a central circular depression 226 adapted to receive the dial member 222 freely therein. The second dial member 224 also is provided with a central hub 228 having an axial bore which is received freely over the tubular shaft for rotation independently of the latter.

On the under surface of the second dial member 224 is provided a plurality of spaced sockets 230, arranged on a circle, and adapted to receive therein the semi-circular projections 232 of the sprocket wheel 234 which is mounted for rotation on the side frame section 140. Associated with the sprocket wheel 234 is a second sprocket wheel 236 secured to the shaft 176 of the spur gear 174 and provided with a plurality of circumferentially spaced sockets 238 adapted to receive the semi-circular projections 232 of the sprocket wheel 234.

A third dial member includes the flat disc 240 which underlies the second dial member 224 and projects radially outward therefrom. An annular ring dial 242 is secured adjacent the outer periphery of the disc by such means as screws 244, and is provided with an upper flange 246 which extends radially inward to overlie an outwardly projecting shoulder 248 on the second dial member. The overlapping arrangement of the flange and shoulder functions to provide a support for the third dial member. The upper surfaces of the three dial members, 222, 224 and 242 are arranged on a common plane, and each may be provided with appropriate markings as previously described.

The disc 240 forming a part of the third dial member is provided with an enlarged central opening to permit interengagement of the sprocket wheel projections 232 and the sockets 230 in the second dial member. Similar sockets 250 are provided at circumferentially spaced intervals adjacent the inner edge of the disc 240, for reception of the semi-circular projections 252 on the sprocket wheel 254 which is mounted for axial rotation on the side frame section 142. Associated with this sprocket wheel is a second sprocket wheel 256 which is secured to the shaft 200 of the spur gear 198, and which is provided with a plurality of circumferentially spaced sockets 258 adapted to receive the projections 252 on the sprocket wheel 254.

It will be apparent that when the central shaft 162 is in the position illustrated in Figure 3, the set of spur gears 168, 198 are intermeshed, whereupon rotation of the control knob 164 causes simultaneous rotation of the rotary section 202 of the wafer switch and rotation of the outermost dial 242. With the central shaft pulled forwardly to its extreme limit, the set of spur gears 166, 174 are intermeshed to effect rotation of the central rotary section 178 on the other wafer switch and the intermediate dial member 224. With the central shaft positioned intermediate its limits of extension and retraction, the two sets of spur gears are out of mesh, whereupon rotation of the control knob effects rotation only of the contact arm 154 of the potentiometer.

The foregoing three positions of adjustment of the central shaft preferably are determined positively by such means as the longitudinally spaced annular grooves 260,

6

262 and 264 in the central shaft and the associated spring loaded ball arrangement discussed hereinbefore in connection with Figure 1.

As in the embodiment of Figure 1, the mechanism illustrated in Figure 3 is adapted primarily for assembly of resistance elements to form voltage dividers or rheostats of any desired configuration. Accordingly, the dial members may be graduated and marked appropriately to provide a direct read-out of resistance values selected by operation of the control knob 164. Markings providing such direct read-out are illustrated in Figure 4 of the drawings.

From the foregoing it is believed to be apparent that the present invention provides multiple switch control mechanisms which are adaptable for use in the assembly of various forms of electrical circuits, such as voltage dividers and rheostats, and that such assemblies are facilitated by the simplified mechanical arrangements provided by this invention. The mechanical assemblies of the present invention utilize a minimum of space, thereby affording convenient installation in electrical and electronic instruments. Although the control mechanisms of the present invention are of simplified construction, they afford maximum precision of operation, and because of such simplified construction, the mechanisms of the present invention are capable of assembly and disassembly with speed and facility, thereby affording maximum efficiency of manufacture, maintenance and repair.

It will be apparent to those skilled in the art that various changes may be made in the details of construction described hereinbefore, without departing from the scope and spirit of this invention. For example, although the mechanisms illustrated are designed particularly for the assembling of voltage dividers and rheostats, they may be used to perform other switching operations, such as are required in complex computer mechanisms. It may be desirable to replace the potentiometer units with wafer switch assemblies or other multiple contact switches. Various forms of multiple switches may be used in place of the wafer switches illustrated, and in some instances it may be preferred to omit the detent mechanisms. Since the foregoing and other modifications may be made, as desired, it is to be understood that the foregoing description is primarily illustrative of the invention and is not to be considered as limiting the scope thereof.

Having now described my invention and the manner in which the same may be used, what I claim as new and desire to secure by Letters Patent is:

1. A control for a plurality of rotary switch members, comprising a frame, a shaft mounted on the frame for axial rotation and for longitudinal displacement, a pair of rotary switch members mounted on the frame independently of the shaft and spaced apart with respect to the axis of the shaft for axial rotation substantially normal to the axis of the shaft, engagement means secured to the shaft and movable with the latter for selective engagement with each of the pair of rotary switch members one at a time for rotating the engaged rotary member simultaneously with the shaft, indicator dial means associated with each of the pair of rotary switch members and mounted on the frame for axial rotation substantially parallel to the axes of the said rotary switch members, flexible drive means interconnecting each dial means and associated rotary switch member, a third rotary switch member mounted on the frame for coaxial rotation with the shaft, coupling means interconnecting the shaft and the third rotary switch member for rotating the latter simultaneously with the shaft while permitting longitudinal displacement of the shaft, and indicator dial means associated with the third rotary member and secured to the shaft for rotation therewith.

2. A control for a plurality of rotary switch members, comprising a frame, a hollow shaft mounted on the frame for axial rotation, a central shaft mounted slidably within

the hollow shaft for axial rotation with and longitudinal displacement with respect to the latter, a pair of rotary switch members mounted on the frame independently of the shaft and spaced apart with respect to the axis of the hollow shaft for axial rotation substantially normal to the axis of the shaft, engagement means secured to the central shaft and movable with the latter for selective engagement with each of the pair of rotary switch members one at a time for rotating the engaged rotary member simultaneously with the central shaft, indicator dial means associated with each of the pair of rotary switch members and mounted on the frame for axial rotation substantially parallel to the axes of the said rotary switch members, flexible drive means interconnecting each dial means and associated rotary switch member, a third rotary switch member mounted on the frame for coaxial rotation with the hollow shaft, coupling means interconnecting the hollow shaft and the third rotary switch member for rotating the latter simultaneously with the central shaft while permitting longitudinal displacement of the shaft, and indicator dial means associated with the third rotary member and secured to the control shaft for rotation therewith.

3. A control for a plurality of rotary switch members, comprising a frame, a hollow shaft mounted on the frame for axial rotation, a central shaft mounted slidably within the hollow shaft for axial rotation with and longitudinal displacement with respect to the latter, a pair of rotary switch members mounted on the frame independently of the shaft for axial rotation substantially normal to the axis of the hollow shaft and spaced apart with respect to the axis of the hollow shaft, gear means on each rotary switch member, second gear means mounted slidably on the hollow shaft and secured to the central shaft and movable

able with the latter for selective engagement with each of the pair of rotary switch members one at a time for rotating the engaged rotary member simultaneously with the central shaft, indicator dial means associated with each of the pair of rotary switch members and mounted on the frame for axial rotation substantially parallel to the axes of the said rotary switch members, flexible drive means interconnecting each dial means and associated rotary switch member, a third rotary switch member mounted on the frame for coaxial rotation with the hollow shaft, coupling means interconnecting the hollow shaft and the third rotary switch member for rotating the latter with the central shaft while permitting longitudinal displacement of the shaft, and indicator dial means associated with the third rotary member and secured to the control shaft for rotation therewith.

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