

Feb. 27, 1968

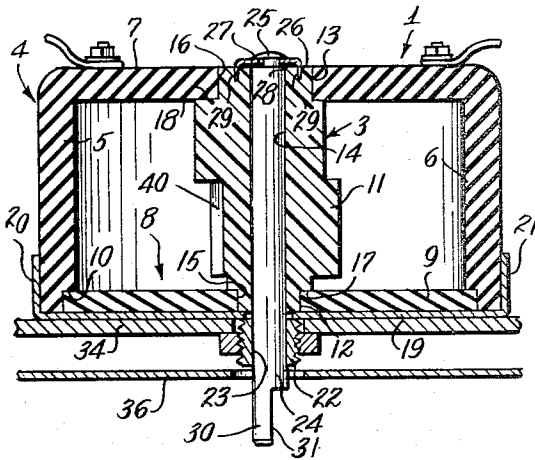
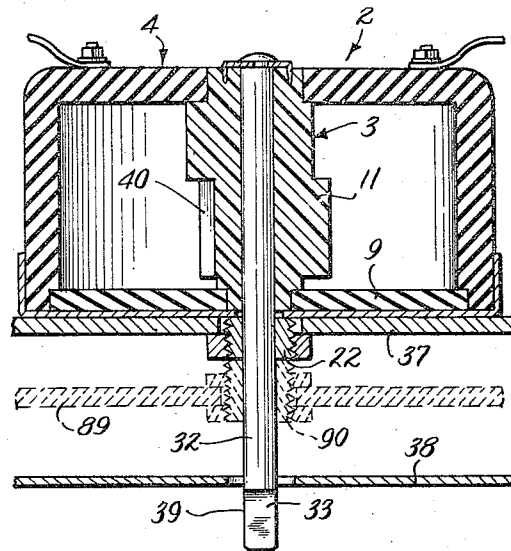
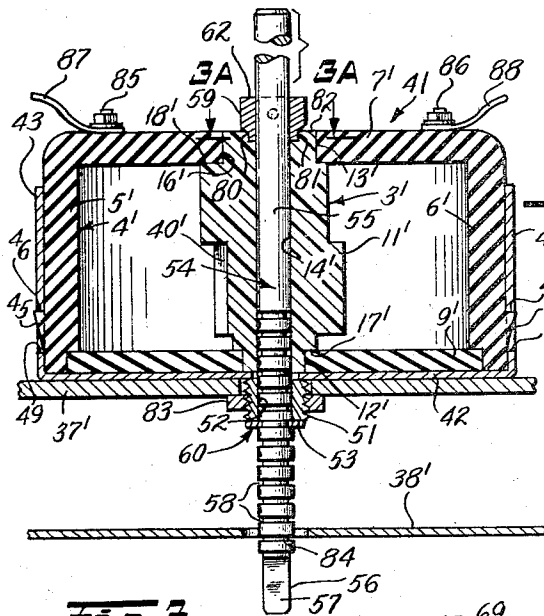
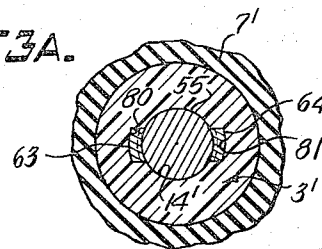
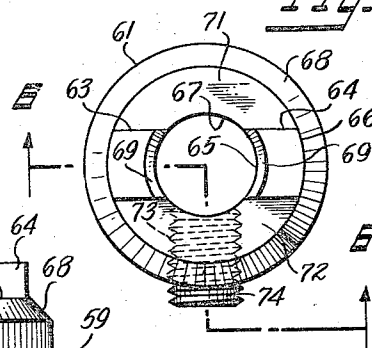
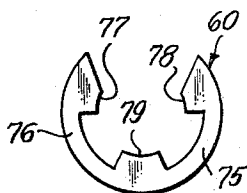
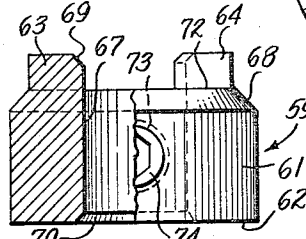
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3,370,482

SHAFT CONNECTING ARRANGEMENT

Filed April 26, 1965

2 Sheets-Sheet 1



10-12

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SHAFT CONNECTING ARRANGEMENT

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2 Sheets-Sheet 2

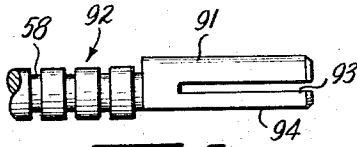


Fig. 7.

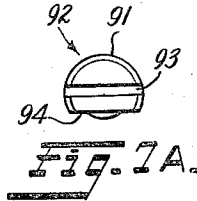


Fig. 7A.

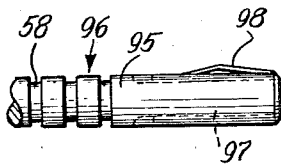


Fig. 8.

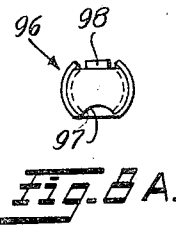


Fig. 8A.

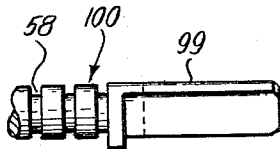


Fig. 9.

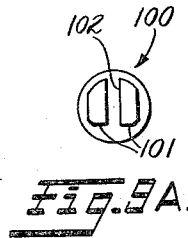


Fig. 9A.

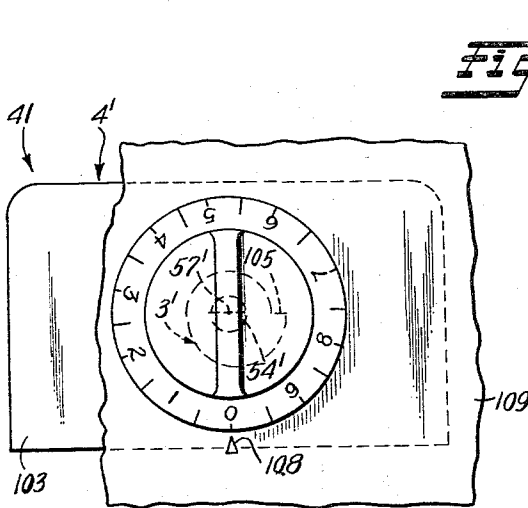
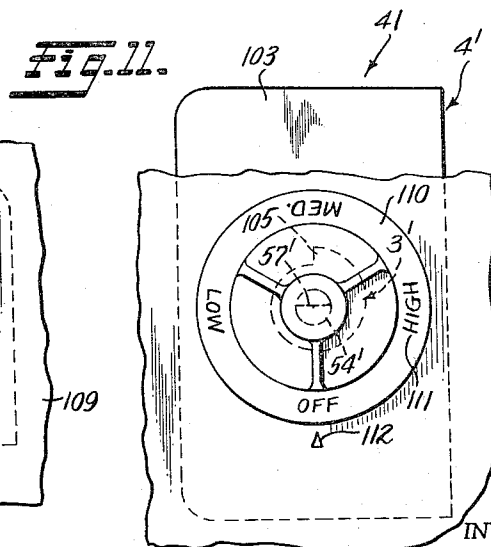


Fig. 10.



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3,370,482

SHAFT CONNECTING ARRANGEMENT
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Filed Apr. 26, 1965, Ser. No. 450,794

7 Claims. (Cl. 74—504)

ABSTRACT OF THE DISCLOSURE

An arrangement which permits a single model of control device such as a switch to be used as a replacement for any one of several similar control devices having different operating shaft arrangements. The shaft has a control knob receiving head and a body portion which extends through a rotatable control such as the contact operating element of the switch. Grooves are provided adjacent the knob receiving portion of the shaft to receive a thin washer to prevent movement of the shaft in one direction relative to the switch. At the end of the shaft opposite the knob is a combined shaft retainer and torque transmitting collar. The collar prevents movement of the shaft out of the switch and has axially extending projections which engage in a recess of the switch operating device. The collar is connectable to the shaft with a set screw. With this arrangement the shaft can be adjusted to any rotational position relative to the switch operating element before the set screw is tightened. This permits adjustment of the shaft so indicia of the knob corresponds to a position of the operating device.

This invention relates generally to a control device and operating shaft arrangement, and particularly to such an arrangement which permits a single model of control device to be used as a replacement for any one of several similar control devices having different operating shaft arrangements.

More particularly, the invention relates to a control shaft and replacement switch for home appliances, the arrangement being such that the same type of replacement switch can be substituted for similar original equipment switches in several appliances of different models and make in which the shaft requirements are different.

Manufacturers of equipment having control devices which require replacement, such as electric switches for stoves, refrigerators, and for other home appliances, frequently find that the overall cost of the appliance is reduced by using the same switch as is used by other manufacturers in the industry. The switch is usually made by a manufacturer who specializes in switches and supplies same to the appliance manufacturer for incorporation in the appliances. The manufacturer of the switch thus makes a basic switch and adapts it for use in appliances of several manufacturers by connecting to the switch and operating shaft that satisfies the mounting and control knob requirements. The shaft for one manufacturer of appliances will be of the proper length for attaching an operating knob, will have a knob receiving portion to receive the appropriate control knob, and will be connected to the switch in the proper angular position to maintain alignment between the indicia for the control knob and the several positions of the switch.

The same situation may also arise where an appliance manufacturer has different models of stoves which require a different shaft arrangement for the same switch.

In either instance the switch supplier provides a switch preassembled with the proper shaft for each of the several models and types of appliances of the appliance manufacturer.

When the switch is worn out and requires replacement

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it is customary to acquire a replacement switch from a jobber rather than resort to the time consuming process of ordering one from the appliance manufacturer or the switch manufacturer. Hence, it is necessary for the jobber to carry a large number of switches with preassembled shafts to be able to immediately supply a replacement switch for any particular type and model of appliance. Since a large inventory requires considerable cash outlay, the jobber either does not carry switches for certain models of appliances, or carries only one for each model and reorders each time a switch is sold. The jobber is thus unable to supply a certain type of switch, or is unable to supply more than one switch of a particular type until his order to the manufacturer is filled.

In accordance with applicant's invention the jobbers inventory of replacement switches is vastly reduced, and the jobber can supply switches for almost any model and make of appliance. The basic concept is to supply a standard switch and also to supply a plurality of different operating shafts. A selected one of the shafts can then be easily attached to the standard switch in accordance with one feature of applicant's invention. This arrangement allows the jobber to stock only several basic switches and perhaps 6 or 8 different operating shafts and still be able to fill orders for replacement switches for any of 40 or 50 different models and makes of appliances.

As previously mentioned, the basic differences between the switches are:

- (1) The length of operating shaft,
- (2) The type of knob receiving portion of the shaft, and
- (3) The angular position of the knob receiving portion relative to the operating elements of the switch.

To reduce the number of shafts which the jobber must stock all the shafts supplied are at least as long as the longest shaft which may be needed and it is merely necessary for the person replacing the switch to remove the excess length, if necessary. Although a different shaft is required for each of the different control knobs, two or three of each type of shaft can be readily stocked by the jobber without excessive cash investment because the cost of the shaft is only a very small portion of the cost of a switch. By virtue of applicant's invention the shaft can be adjusted to any predetermined angular position relative to the switch so that the indicia of the control knob accurately indicate the operating position of the switch.

In view of the foregoing an object of this invention is to provide a unique control unit and operating shaft arrangement.

Another object is a replacement control unit with an operating shaft that is adjustable both axially and angularly of the control unit.

Another object is a unique replacement control unit comprised of a switch and shaft which permits the same switch to be used in a number of replacement applications.

A further object is a unique torque transmitting connection, between an operating shaft and control unit, which permits infinitesimally fine angular adjustment of the shaft relative to an operating element of the control unit.

A further object is a replacement switch and operating shaft assembly which permits axial and angular adjustment of the operating shaft relative to the switch to allow a single type of switch to be used as a replacement for a large number of original equipment switches having different shaft length and mounting requirements.

Another and extremely important object is a control unit and operating shaft which is inexpensive to manu-

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facture, is adaptable to replace a large number of original control units, and is relatively easy to assemble and adjust by the person replacing the control unit.

In order that the manner in which these and other objects attained, in accordance with the invention, can be understood in detail, reference is had to the accompanying drawings, which form a part of the specification, and wherein:

FIGS. 1 and 2 are plan views in section showing prior art original switches having different shaft and mounting requirements either of which can be replaced in accordance with this invention, with a single replacement switch and operating shaft;

FIG. 3 is a plan view in section showing the switch and operating shaft arrangement of this invention;

FIG. 3A is an enlarged partial view in section taken along lines 3A—3A of FIG. 3;

FIG. 4 is an enlarged front elevational view of a retaining ring used to secure the operating shaft against axial movement;

FIG. 5 is an enlarged front elevational view of the adjustable torque transmitting connector which also secures the operating shaft against axial movement as shown in FIG. 3;

FIG. 6 is a partial sectional view of the torque transmitting connector taken along line 6—6 of FIG. 5;

FIG. 7 is a partial view in side elevation showing the knob receiving portion of one type of operating shaft;

FIG. 7A is a front elevational view of FIG. 7;

FIG. 8 is a partial side elevational view of another shaft showing a different type of knob receiving portion;

FIG. 8A is a front elevational view of the shaft of FIG. 8;

FIG. 9 is a side elevational view of a shaft having still another type of knob receiving portion;

FIG. 9A is a front elevational view of the shaft of FIG. 9;

FIG. 10 is a fragmentary view in front elevation showing one of the angular positions of adjustment of the operating shaft relative to the operating element of the switch; and

FIG. 11 is a fragmentary view in front elevation showing the switch differently oriented and the shaft adjusted to another angular position relative to the operating element of the switch.

Referring now to the drawings in detail and particularly to FIGS. 1 and 2 there are shown prior art switches 1 and 2 of the general type disclosed in U.S. Patent 3,110,789, Hild et al., issued Nov. 12, 1963. Switch 1 includes a contact operating device in the form of a cam 3 mounted for rotation within an enclosure formed by a molded box-shaped casing 4 of electrically insulating material. Cam 3 operates contacts (not shown) arranged in casing 4 as disclosed in the Hild et al. patent. Casing 4 has side walls 5 and 6, a rear wall 7, a bottom wall, and a top wall (not shown). An open front end 8 of the casing is closed by a front cover 9, also of insulating material which seats in a recess 10 at the front of the casing.

Cam 3 has a body portion 11 with reduced diameter, cylindrical ends 12 and 13 and a bore 14 which extends completely through the cam. Cylindrical ends 12 and 13 are each coaxial with bore 14 and are mounted in openings 15 and 16 of circular outline, formed respectively in front cover 9 and rear wall 7, the opening providing bearings in which the cam is journaled. A transverse shoulder 17 on body 11 adjacent cylindrical end 12 prevents movement of cam 3 in a direction toward front cover 9. Likewise, a transverse shoulder 18 adjacent cylindrical end 13 prevents axial movement of cam 3 toward rear wall 7. A coverplate 19 formed of sheet metal has ends 20 and 21 bent to extend along the outer surfaces of sides 5 and 6, respectively and are secured thereto to hold front cover 9 in position and fix plate 19 to switch 1.

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Fixed to plate 19 is a threaded bushing 22 having an opening 23 coaxial with opening 14 of cam 3. An operating shaft 24 extends through opening 23 of the bushing and through opening 14 of the cam. A tip 25 of the shaft projects slightly beyond rear face 26 of the cam, tip 25 having a recess 27 with a flat side face to engage with a corresponding flat face on a retaining member 28 having sharp prongs 29 which are forced through rear face 26 into the plastic material of the cam to secure the shaft to the cam for rotation therewith. The other end of operating shaft 24 has a knob-receiving end portion 30 with a flat longitudinally extending face 31 formed in the shaft to receive a control knob (not shown) in torque-transmitting relation.

Switch 2 is substantially identical to switch 1 and has an identical cam 3, an identical casing 4, a front cover 9, and a front plate 19 with an externally threaded bushing 22 fixed to the plate. The only differences between the switches of FIGS. 1 and 2 is the length of the operating shafts and the angular disposition of the knob-receiving portions of the respective shafts. Shaft 32 of switch 2 is seen to be substantially longer than shaft 24 of switch 1. A flat face 33 on operating shaft 32, to receive an operating knob, is at a position 90° counterclockwise to the position of flat face 31 of operating shaft 24. The reason for the differences in the shaft arrangement is twofold, first, because of the different mounting requirements for the switches 1 and 2; and second, because of the different operating knobs for the respective switches. As shown in FIG. 1, switch 1 is mounted to a bracket 34 of an appliance, by passing bushing 22 through an opening in the bracket and securing same with a nut 35. Knob receiving end 30 then extends a predetermined distance beyond a face plate 36 of the appliance to receive an appropriate control knob in the proper angular position corresponding to the operating position of the switch.

Referring to FIG. 2 the mounting arrangement for switch 2 includes a bracket 37 and a face plate 38 through which knob-receiving end 39 of shaft 32 extends. It is apparent that the distance between bracket 37 and plate 38 (FIG. 2) is substantially greater than the distance between bracket 34 and plate 36 (FIG. 1). Therefore, shaft 32 must project a substantially greater distance from switch 2 to permit mounting a control knob at the end 39. In each of FIGS. 1 and 2 the cam 3 is in the same angular operating position as evidenced by the location of a flat face 40 of the cam. However, the flat face 33 of shaft 32 is at an angular position 90° counterclockwise to flat face 31 of shaft 24. This difference in angular disposition is necessitated by the indicia control knob and indicia which the manufacturer supplies with the appliances in which the switches are used. Hence, to obtain proper alignment between the indicia of the control knob and face plate it is necessary that the flat portions of the knob-receiving ends of the shafts be properly oriented angularly before the shaft is secured to the cam.

FIG. 3 shows a switch and shaft arrangement 41 which, in accordance with this invention can be adapted to replace either of the original switches of FIGS. 1 and 2. For convenience of understanding elements of the switch 41 of FIGS. 3 are identified with primed (') numerals where the elements are identical to like elements of the switches 1 and 2. Where there is considerable significant difference of structure, new numbers are used.

As shown in FIG. 3 switch 41 has a casing 4' with side walls 5' and 6' and a rear wall 7'. A front cover 9' closes the front of the casing and is held in place by a sheet metal coverplate 42 having sides 43 and 44 bent rearwardly to extend adjacent side walls 5' and 6' of switch 41. Side wall 5' has a tapered lug 45 with a rearwardly facing edge 46 and a side wall 6' has a similar tapered lug 47 with a rearwardly extending edge 48. Side 43 has a lug receiving opening 49 and side 44 has a lug receiving opening 50, the openings 49 and 50 being so dimensioned and arranged as to engage behind edges 46 and 48 re-

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spectively to hold plate 42 in position on the casing as shown in FIG. 3. Such an arrangement simplifies detachably securing plate 42 to the casing since it is merely necessary to push the plate over the casing and the sides 43 and 44 which are somewhat resilient are flexed outwardly by lugs 45 and 47 until the lugs seat in openings 49 and 50 respectively whereupon the sides snap inwardly to engage behind edges 46 and 48 and fix the plate to the casing. To remove plate 42 it is merely necessary to spring the sides outwardly manually to disengage same from the lugs, and the plate is then easily removed.

Fixed to plate 42 is a threaded bushing 51 having a central opening 52 which is coaxial with and of approximately the same diameter as opening 14' of cam 3'. Bushing 51 extends in a direction away from casing 4 and terminates at an annular end face 53.

The cam 3' has cylindrical ends 12' and 13' which merge with body 11' at shoulder 17' and 18' respectively. Ends 12' and 13' extend into openings 15' and 16' respectively which serve as bearings to mount cam 3' for rotation relative to switch 41.

Extending through openings 14' and 52 is an operating shaft 54. Shaft 54 has a body portion 55 and a knob-receiving end 56 including a flat face 57 to receive a control knob in torque transmitting relation. A length of body portion 55 extending from knob-receiving end 56 is provided with a plurality of indentations in the form of axially spaced apart grooves 58 cut into the circumference of shaft 54. Each of grooves 58 is of the same depth and the distance between adjacent grooves is identical for the length of the grooved portion of the shaft.

The diameter of body 55 is such that shaft 54 can be easily slid axially into opening 14' of the cam 3'. Shaft 54 is secured to cam 3' by a torque transmitting connecting member in the form of a collar 59 which encircles the shaft and a retaining member in the form of a retaining ring 60 snapped into an appropriate one of grooves 58.

Collar 59 has a cylindrical body 61 having a flat face 62 at one end and a pair of diametrically spaced axially projecting lugs 63 and 64 at the other end. Lugs 63 and 64 each have curved inner sides 65, and curved outer sides 66 each concentric with the axis of a central opening 67 extending through body 61. The diameter measured between outer faces 66 of lugs 63 and 64 respectively is somewhat less than the diameter of body 61, and these outer surfaces are joined by a beveled shoulder 68. The ends of lugs 63 and 64 at inner faces 65 are chamfered to provide outwardly flaring surfaces 69. At the other end of body 61 opening 65 is similarly provided with a countersink 70. The structure of lugs 63 and 64 is best visualized by considering the manner in which the lugs are formed which comprises forming a collar of the general outline shown in FIG. 6 and then milling away the material to provide flat faces 71 and 72 on each side of lugs 63 and 64. Body 61 is provided with a radially extending bore 73 which is internally threaded to receive a set screw 74. The axis of bore 73 is spaced equidistantly circumferentially from each of lugs 63 and 64.

Retaining ring 60 is of the standard type formed from spring metal with relatively thin sections 75 and 76 to enhance its flexibility, and inwardly facing curved edges 77-79 dimensioned to engage and be retained by the cylindrical portion of the shaft within one of the grooves 58 when the retaining ring is snapped into position in a groove.

As best seen in FIGS. 3 and 3A end 13' of cam 3' is provided with a pair of slots 80 and 81 which extend axially from end face 82. Slots 80 and 81 are diametrically opposite each other and have the same cross sectional outline and length as lugs 63 and 64. Thus, when shaft 54 is placed in cam 3' with a retaining ring 60 in the appropriate one of the grooves 58, collar 59 is placed over the end of the shaft so that lugs 63 and 64 extend into slots 80 and 81, and when set screw 74 is tightened it is apparent that shaft 54 is secured to the cam for rotation

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therewith. It is to be noted that with the collar secured to the shaft axial movement of the shaft away from the switch is resisted by the engagement of faces 71 and 72 with end face 82 of the cam. Similarly axial movement of the shaft 54 in the opposite direction is resisted by engagement of end face 53 of bushing 51 with the flat side of retaining ring 60.

As previously explained, switch 41 can be used to replace either of the switches 1 or 2. Switch 41, as shown in FIG. 3 has been assembled to provide a replacement for switch 2. In this regard it is to be noted that mounting bracket 37' is the same distance from face plate 38' (FIG. 3) as mounting bracket 37 is from face plate 38 (FIG. 2); cam 3 is in the same operating position as cam 3'; flat face 33 occupies the same angular position as flat face 57; and hence, switch 41 can be used as shown as a replacement for switch 2.

In practice of this invention a basic switch unit 41 without shaft 54 secured thereto is supplied to a jobber. A plurality of shafts like shaft 54, collars 59, and retaining rings 60 are also supplied. When it is necessary to provide a replacement for a switch like that of FIG. 2 a shaft having the proper knob receiving end is selected and a retaining ring 60 is snapped into the appropriate one of grooves 58 so that knob receiving end 56 projects the proper distance from the front of the casing. Shaft 54 is then inserted through cam 3' and collar 59 is slipped over the end of the shaft, the outwardly flared surfaces 69 facilitating alignment of opening 67 with shaft 54. The shaft is then marked adjacent the plane of face 62, is removed from the cam, and is cut off at the mark. The shaft is then reinserted in cam 3' and the collar is again positioned so that lugs 63 and 64 extend into slots 80 and 81. Collar 59 is then rotated manually to rotate cam 3' to a predetermined operating position, for example, to a position in which the switch is off. Before set screw 74 is tightened shaft 54 is rotated until flat face 57 at knob receiving end 56 is at its proper angular position for indicia on a control knob to align with the corresponding indicia on face plate 38' to indicate that the switch is off. Set screw 74 is then tightened and the assembled replacement switch is then mounted on bracket 37' as shown in FIG. 3 and is secured by a nut 83 threaded onto bushing 51.

To provide a replacement for the switch of FIG. 1 where the distance between bracket 34 and face plate 36 is very small, the retaining ring 60 would be placed in the first one of grooves 58, identified in FIG. 3 as 84. Following the previously outlined procedure the excess length of the shaft is removed, the shaft is angularly adjusted so that control knob on the knob-receiving end is properly aligned with its indicia for a particular operating position of cam 3', and the set screws 74 is tightened. The fact that retaining ring 60 is relatively thin is indeed an advantage in assembling a replacement switch to replace the switch of FIG. 1, since the front face of bushing 22 is spaced only a very slight amount from the inner face of face plate 36. Hence, if a collar of the same axial length as collar 59 is provided there would be insufficient protruding length of shaft to receive the control knob. However, an axially thin retaining member such as retaining ring 60 can be used without difficulty and without interfering with the placement of a control knob on the end of the shaft.

It is to be noted that terminals 85 and 86 are located on casing 4' to permit connecting leads 87 and 88 to switch 41 without the need for soldering the leads. As shown in dotted line in FIG. 2 a mounting bracket 89 similar to bracket 39 is shown in a position closer to face plate 38 than the bracket 37. For proper mounting of switch 2 to bracket 89 it is necessary that bushing 22 be longer than shown in solid line in FIG. 2. Such increased length is shown in dotted line at 90. If a switch with a bushing of the length of bushing 22 is used leads 87 and 88 of the appliance may not be sufficiently long to permit the proper connection to terminals 85 and 86 without

splicing or replacing the leads. Hence, it is desirable that the switch assembly be mounted in the identical position as the original switch to avoid such modification of the leads. Therefore, if necessary a plate 42 having sides 43 and 44 may be provided with a bushing of increased length such as portion 90. Since it is a simple matter to connect plate 42 to casing 4' (as previously described) it is thus apparent that plates 42 of different structure can be supplied with switch 41 to permit adapting the switch for unusual mounting conditions as on bracket 89. This modified mounting plate assembly is also supplied by the jobber to meet the mounting requirements of the original switch.

Although the shaft 54 having a flat knob-receiving face 57 has been described as a preferred shaft to use with switch 41, replacement switches for other manufacturers of appliances will necessarily require different knob-receiving ends. Examples of different knob-receiving end portions for shafts that can be used with switch 41 are shown in FIGS. 7-9A. With reference to FIGS. 7-9 it is apparent that each of the shafts is provided with spaced apart grooves 58 like the grooves 58 for shaft 54. However, the knob-receiving ends are different.

As shown in FIGS. 7 and 7A knob-receiving portion 91 of shaft 92 is provided with a slot 93 and a flat face 94 so that a control knob can be connected to the shaft in only one angular position. The slot 93 is provided to increase the flexibility of knob-receiving portion 91 and permit same to be slightly compressed by the knob to assist frictionally retaining the knob on the shaft.

Another shaft arrangement is shown in FIG. 8. Knob-receiving portion 95 of shaft 96 has an axially extending groove 97 of arcuate section as viewed in FIG. 8. A retaining spring 98 is connected to portion 95 to assist frictionally retaining a knob on the shaft.

As shown in FIG. 9 a different knob-receiving portion may also be used. Here, knob-receiving portion 99 of shaft 100 has a pair of flat faces 101 which lie in a plane perpendicular to that of a slot 102. Faces 101 can receive the hub of a control knob in only one circumferential position and in torque transmitting relation. Slot 102 adds resiliency to knob-receiving portion 99 to frictionally hold the knob on the shaft.

FIGS. 10 and 11 illustrate but two of the many mounting positions of and angular relationships of control knob and shaft, to cam position, for the replacement switch 41 of this invention. As shown in FIG. 10 the long dimension of the rectangular front 103 of casing 4' is horizontal, cam 3' has a step 105 in a horizontal plane when the switch is off, and a control knob 106 has indicia 107 which indicate the switch to be off, or at zero position, by alignment with a pointer 108 on a face plate 109 of the appliance in which the switch is mounted. Shaft 54' has a flat face 57' which receives the hub of knob 106 in only one circumferential position, shown horizontal, to assure that indicia 107 are in proper alignment with pointer 108 for the off position of cam 3'. It is to be understood that the switch of FIG. 10 is the same as switch 41 in FIG. 3 and that the angular position of face 57' is adjusted relative to the off operating position of cam 3' at the time that shaft 54' is assembled to the switch in the manner described for the switch of FIG. 3.

FIG. 11 shows the same switch 41 as FIG. 10 but in this instance with front 103 mounted with its long dimension vertical and with a different control knob 110 having indicia 111 to indicate the position of the control knob by alignment with a pointer 112. It is to be noted that the casing of the switch shown in FIG. 11 is turned 90° counterclockwise from the position of FIG. 10. Hence, step 105 of cam 3' is vertical in FIG. 11, when the switch is off. Because of the indicia of control knob 110 and the structure of the hub of the control knob it is necessary that flat face 57' of shaft 54' be horizontal for the "off" mark of indicia 111 to align with pointer 112 when the switch is off. Such positioning of face 57' is accom-

plished by loosening set screw 74 to permit adjusting shaft 54' circumferentially relative to cam 3' to align the indicia of control knob 110 with pointer 112. Although FIGS. 10 and 11 show only two of the many positions of angular adjustment of shaft 54' relative to cam 3', it is to be understood that any infinitesimally fine adjustment of the shaft relative to the cam can be obtained by adjusting the shaft and then tightening set screw 74.

Although a preferred embodiment has been shown and described it is to be understood that numerous variations and modifications can be made without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. A shaft and control unit of the type described comprising in combination:

a control unit including a rotatable operating device having:

a shaft receiving opening;

an operating shaft comprising:

a body portion dimensioned to be freely rotatably received in said opening of said operating device, and

a portion adapted to be connected to a torque transmitting element;

a first member connected to said shaft to prevent axial movement of said shaft relative to said operating device in one direction;

a second member connected to said shaft to prevent axial movement of said shaft relative to said operating device in a second direction opposite to said first direction;

said second member having projections engageable with recesses of said operating device to key said operating device and second member together for simultaneous angular movement; and manually actuated means carried by said second member to fix said member to said operating shaft at any angular position relative to said shaft;

whereby said portion of said shaft adapted to be connected to a torque transmitting element can be precisely oriented angularly regardless of the rotational position of said operating device.

2. A shaft and control unit in accordance with claim 1 in which:

said portion of said shaft adapted to be connected to a torque transmitting element includes a length of said shaft of suitable cross section adjacent one end thereof, to receive a torque transmitting element in only one predetermined angular position relative to said shaft.

3. A shaft and control unit in accordance with claim 1 in which:

said operating shaft further includes a plurality of grooves formed in said shaft and spaced apart axially of said shaft, one of said grooves cooperating with said first member to retain same on said shaft.

4. A shaft and control unit in accordance with claim 1 in which:

said second member is a collar on said shaft, and said projections extend axially of said shaft from said collar.

5. A shaft and control unit in accordance with claim 1 in which:

said means carried by said second member to fix said member to said operating shaft is a set screw threaded into said second member and engageable with said shaft.

6. A rotary replacement switch arrangement for home appliances comprising in combination;

a rotary switch unit having a contact operating device;

an operating shaft including:

an elongated body portion; and

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a control knob receiving portion to receive the original control knob of the appliance in which said switch unit is installed;

said contact operating device having an opening there-through to freely receive said shaft, and said shaft being dimensioned to extend beyond the opposite ends of the material of said operating device which defines said opening to leave said control knob receiving portion exposed at one end of said operating device, and to leave a short portion of shaft exposed at the other end of said operating device;

an axially thin shaft retaining member;

said body portion of said shaft including axially spaced apart indentations to receive said shaft retaining member and to retain same against axial movement relative to said shaft;

said retaining member being engageable with a portion of said switch unit to prevent axial movement of said shaft relative to said switch unit in one direction;

a torque transmitting connection member mounted on said short exposed portion of said shaft and connected to said operating device to transmit torque from said shaft to said operating device; and

manually operable means carried by said connecting member to permit angular adjustment of said shaft relative to said operating device and to fasten said shaft to said operating device; said means being effective to prevent axial movement of said shaft relative to said operating device in a direction opposite to said one direction;

whereby, said shaft can be adjusted angularly relative to said operating device to accurately position indicia of a control knob placed on said knob receiving portion with a corresponding operating position of said operating device.

7. A control assembly and shaft arrangement comprising:

a control assembly having a housing;

an operating device rotatably mounted in said housing, said operating device having:

an axial opening extending therethrough, and

an axially exposed recess;

an operating shaft comprising:

a knob receiving portion, and

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a body portion extending axially from said knob receiving portion;

said body portion of said shaft extending through said opening in said operating device and being dimensioned to be freely movable within said opening both axially and rotatably;

first means mounted on and connected to said shaft, and engageable with said control assembly to prevent axial movement of said shaft in one direction;

second means mounted on and connectable to said shaft, and engaging said operating device to prevent axial movement of said shaft relative to said operating device in a direction opposite to said first direction, said second means being spaced from said first means and comprising:

a collar having an opening therein dimensioned to freely receive said shaft for relative movement both axially and rotatably,

projecting means on said collar engageable in said recess of said operating element to key said collar to said operating element for rotation therewith, and

manually operable fastening means on said collar to fix said collar to said shaft, at a selected axial position in which said projecting means engages in said recess, and at any selected rotational position of said shaft relative to said collar,

whereby, said knob receiving portion of said shaft can be precisely adjusted to any rotational position relative to said operating device and the shaft can then be fixed to the operating device for rotation therewith.

References Cited

UNITED STATES PATENTS

1,844,519	2/1932	Newill	74—504
2,937,535	5/1960	Wezner	74—548
3,110,789	11/1963	Hild et al.	200—122
3,218,425	11/1965	Olenick et al.	200—168
3,226,519	12/1965	Garmendia	200—166

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