Dec. 8, 1942. N. C. SCHELLENGER 2,304,479

COMBINED SWITCH AND RHEOSTAT

Filed Aug. 3, 1940 5 Sheets-Sheet 1

Fig. 1.

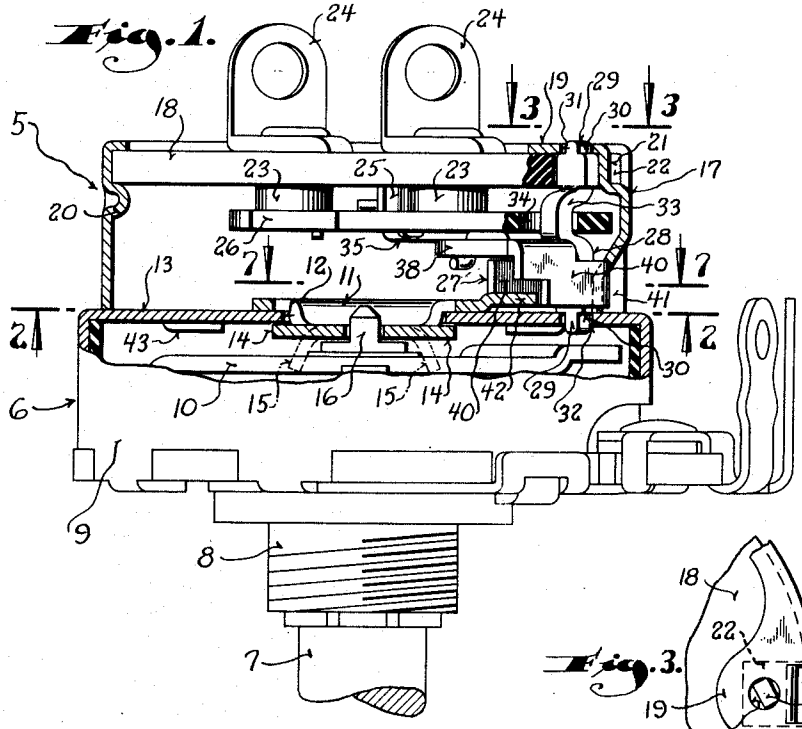


Fig. 3.

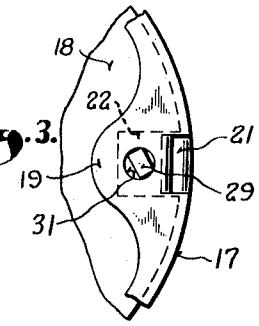
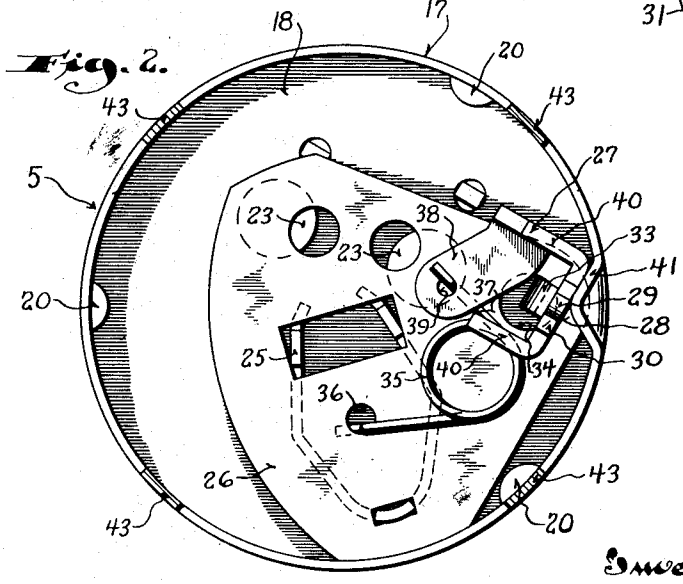


Fig. 2.



Inventor

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Attorney

Dec. 8, 1942. N. C. SCHELLENGER 2,304,479

COMBINED SWITCH AND RHEOSTAT

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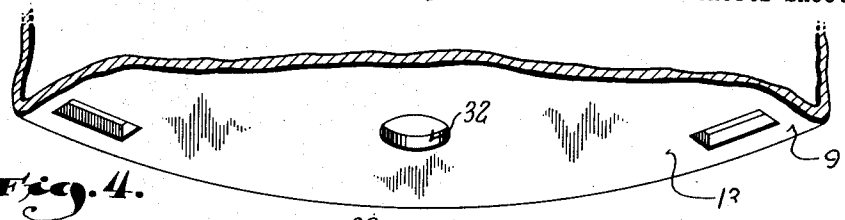


Fig. 4.

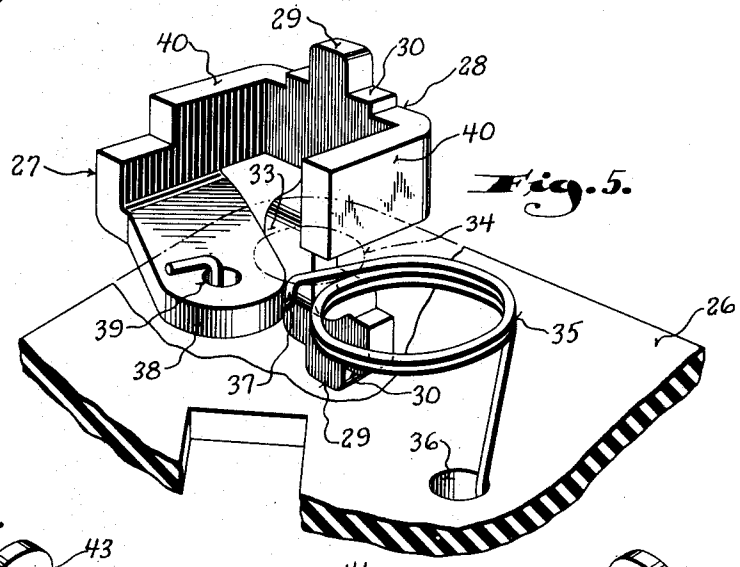
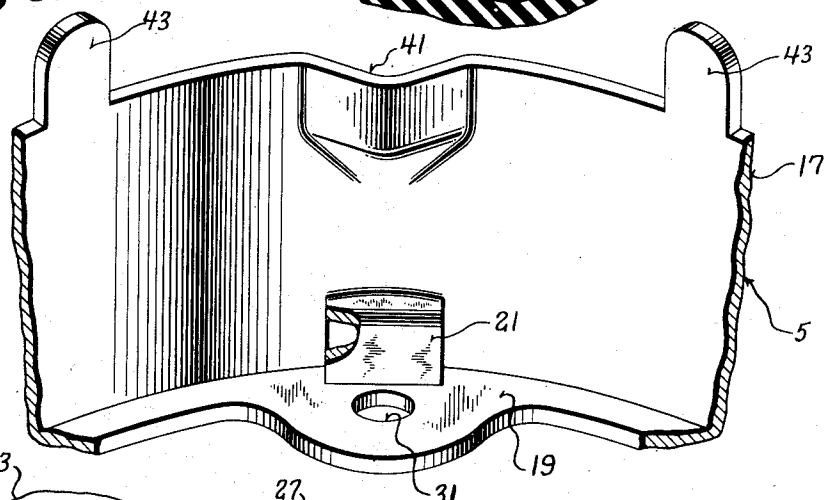


Fig. 5.

Fig. 6.



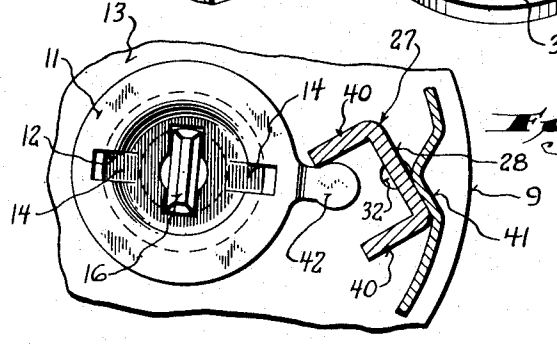


Fig. 7.

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Dec. 8, 1942. N. C. SCHELLENGER 2,304,479

COMBINED SWITCH AND RHEOSTAT

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Fig. 8.

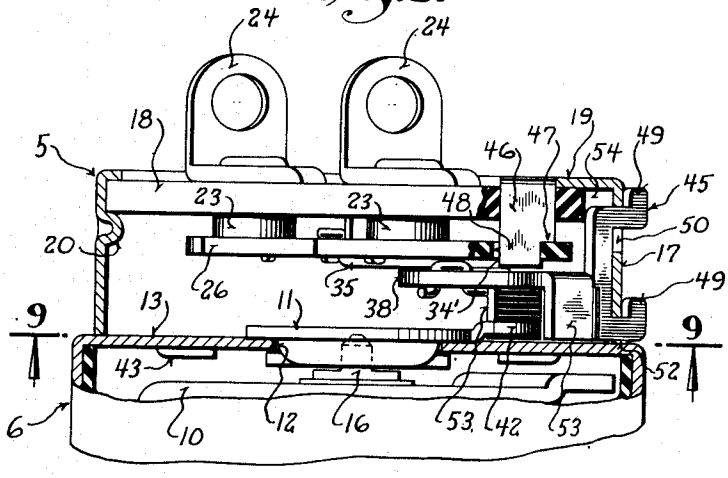
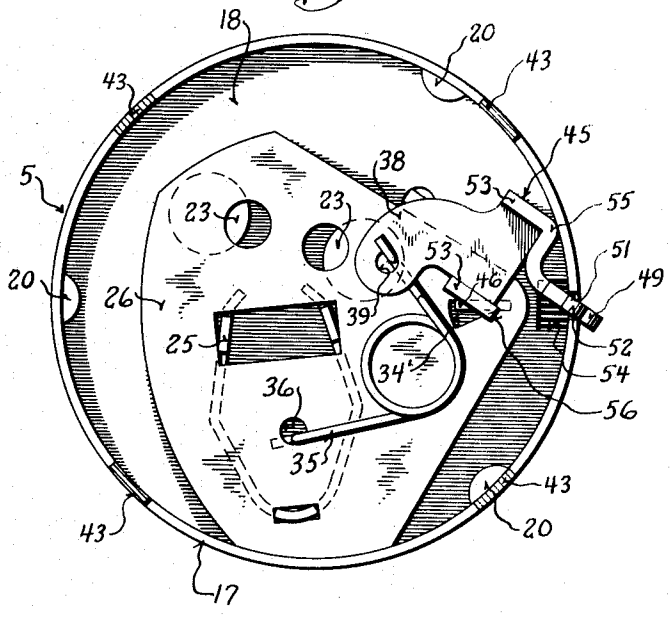


Fig. 9.



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COMBINED SWITCH AND RHEOSTAT

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Fig. 10.

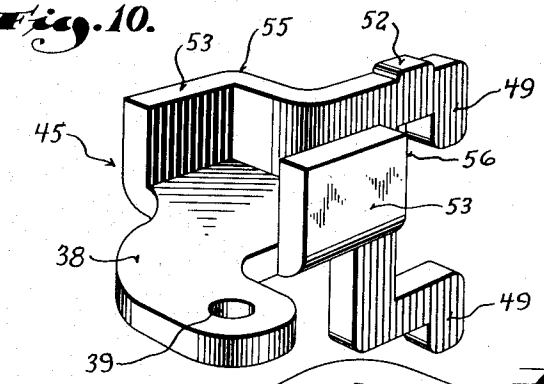


Fig. 11.

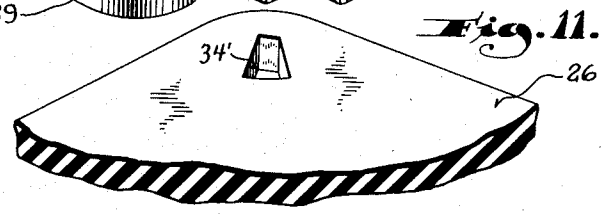


Fig. 12.

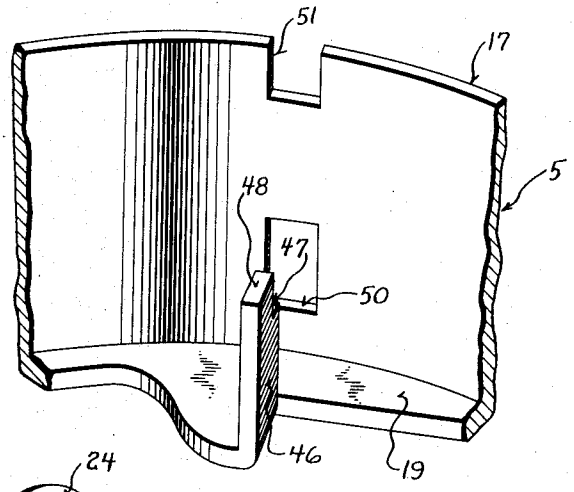
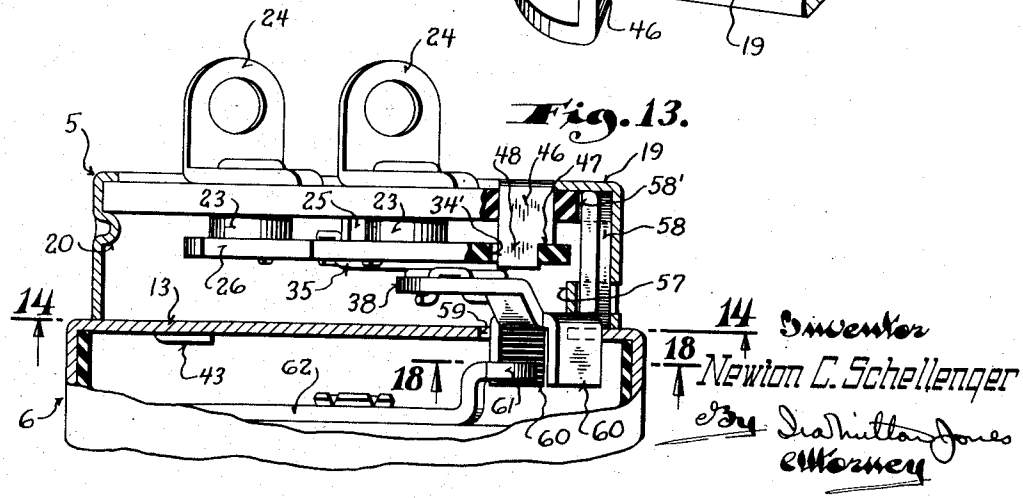


Fig. 13.



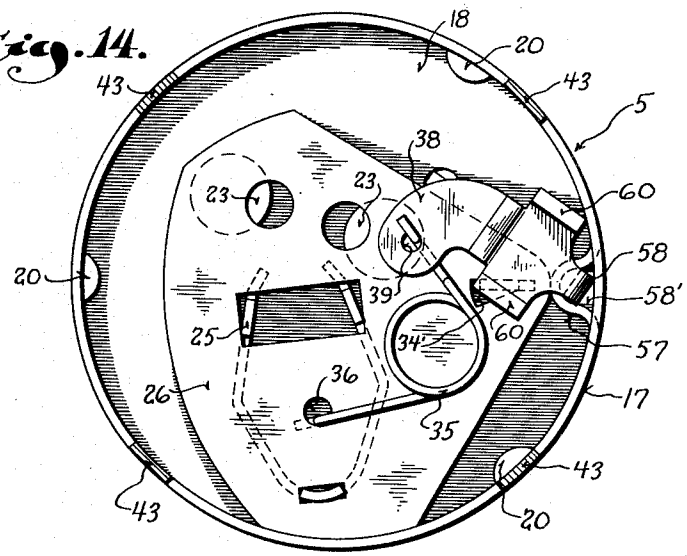
Inventor
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Dec. 8, 1942. N. C. SCHELLENGER 2,304,479

COMBINED SWITCH AND RHEOSTAT

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Fig. 14.



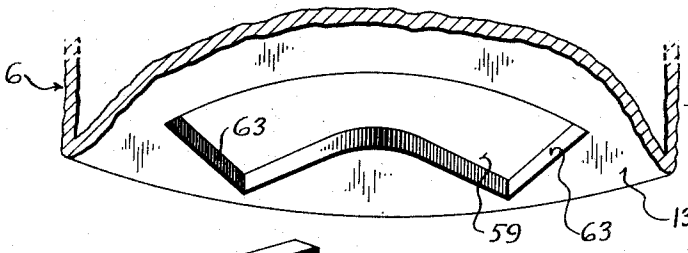


Fig. 15.

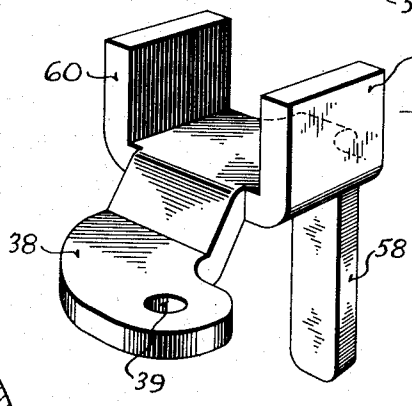
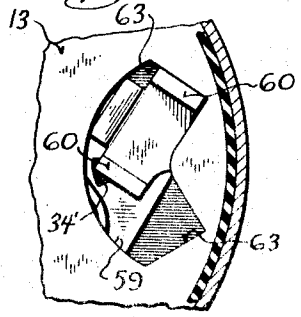


Fig. 16.

Fig. 18.



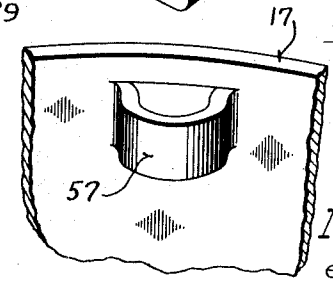


Fig. 17.

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Patented Dec. 8, 1942

2,304,479

UNITED STATES PATENT OFFICE

2,304,479

COMBINED SWITCH AND RHEOSTAT

Newton C. Schellenger, El Paso, Tex., assignor to Chicago Telephone Supply Company, Elkhart, Ind., a corporation of Indiana

Application August 3, 1940, Serial No. 351,038

17 Claims. (Cl. 200—67)

This invention relates to electrical control devices and refers particularly to a combined switch and rheostat.

Combination controls of this type may be used in many different types of apparatus, but are particularly useful as a combination power switch and volume control for radio receivers. In this capacity these combination controls must meet quite an array of important requirements.

Inasmuch as the two circuits in which the component units of the control are connected must be shielded from each other, it is of prime importance that electrostatic shielding be provided between the switch and the rheostat.

Another factor having a very material effect upon the design of combination controls of this type is the ever increasing demand for reduction in size. Compactness, therefore, must be carried to the extreme limit compatible with good mechanical and electrical design.

However, the most perplexing problem confronting the manufacturer of controls of this type is how to reduce the cost of manufacture to a point where competition can be successfully met without sacrificing adequate shielding, compactness and longevity in service.

Through intensive development in recent years the design of these combined controls has been carried to a high level of efficiency and satisfaction in service, but further improvement and reduction in cost of production is constantly being demanded. The present invention responds to this demand by proposing a combination switch and volume control so designed that material savings can be effected in the cost of production by virtue of an entirely new manner of assembling certain of the component parts of the switch mechanism.

To this end it is an object of this invention to provide a combined switch and volume control wherein assembly of the two units secures the movable elements of the switch mechanism in place.

Another object of this invention resides in the provision of a simplified and considerably less expensive manner of pivotally mounting the movable switch arm and its actuating cam by which the conventional pivot post for the cam is entirely eliminated.

A further object of this invention resides in the provision of interengaging pivot and socket means on the switch actuating cam and the switch housing so designed that the connection may be readily effected during assembly of the control device to be maintained merely by the attachment of the rheostat housing to the switch housing.

Still another object of this invention is to provide an interengaging pivot and socket connection between the switch actuating cam and the housing or housings of the control device whereby the cam has a metal to metal connection with both housings.

A further object of this invention is to provide a novel manner of mounting the switch arm to facilitate assembly of the mechanism and to utilize the toggle spring for maintaining the arm in its proper plane of movement.

With a view toward simplifying assembly it is another object of this invention to pivotally mount the switch arm on a portion of the cam so that by placing the cam in position the arm is automatically properly located.

Another object of this invention is to provide an alternative form of pivotal mounting for the switch arm wherein the arm engages a pivot lug struck up from the end wall of the switch housing.

Still another object of this invention resides in the provision of a novel manner of transmitting driving force from the rheostat mechanism to the switch actuating cam which includes a rotatable driver carried by the end wall of the rheostat housing so as to be properly correlated to the cam merely upon assembly of the two housings.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate several complete examples of the physical embodiment of the invention, constructed in accordance with the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a view partly in side elevation and partly in section illustrating a combined switch and rheostat embodying one form of this invention;

Figure 2 is a cross sectional view through Figure 1 on the plane of the line 2—2 but showing no part of the rheostat unit;

Figure 3 is a fragmentary detail view looking

at a portion of the end wall of the switch housing on the plane of the line 3—3 in Figure 1;

Figure 4 is a perspective view of part of the rheostat housing of that form of the invention shown in Figure 1;

Figure 5 is a perspective view of the cam per se and illustrating part of the switch arm and the toggle spring properly correlated to the cam;

Figure 6 is a perspective view showing the inside of part of the switch housing, said view together with Figures 4 and 5 illustrating the manner in which the cam and the switch arm are pivotally mounted upon assembly of the two housings, and to facilitate illustration are shown reversed from their positions in Figure 1;

Figure 7 is a detail sectional view taken through Figure 1 on the plane of the line 7—7 and illustrating the manner in which the cam is driven from the shaft actuated driver and the manner in which the limits of cam motion are defined;

Figure 8 is a view similar to Figure 1 illustrating another embodiment of this invention;

Figure 9 is a cross sectional view taken through Figure 8 on the plane of the line 9—9 but showing no part of the rheostat unit;

Figures 10, 11 and 12 are respectively perspective views of the switch actuating cam, part of the switch arm, and a portion of the switch housing of that embodiment of the invention illustrated in Figures 8 and 9 and showing these parts in their proper order of assembly, but reversed from their positions in Figure 8;

Figure 13 is a view similar to Figure 1 illustrating another embodiment of the invention;

Figure 14 is a cross sectional view taken through Figure 13 on the plane of the line 14—14 but showing no part of the rheostat unit;

Figures 15, 16 and 17 are perspective views of part of the rheostat housing, the cam, and part of the switch housing of that embodiment of the invention shown in Figures 13 and 14 and illustrating these parts in their proper order of assembly, but reversed from their positions in Figure 13; and

Figure 18 is a detail sectional view taken through Figure 13 on the plane of the line 18—18.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts, and especially to Figures 1 to 7, inclusive, the numerals 5 and 6 designate the switch and rheostat units respectively of a combined switch and rheostat operated from a common shaft 7.

The rheostat unit 6 may be of any conventional type as the details of its construction form no part of this invention. If desired it may be like the unit illustrated in the copending application of Newton C. Schellenger, Serial No. 284,840, filed July 17, 1939, which matured into Patent No. 2,262,821 on November 18, 1941. It is sufficient to state that the operating shaft is journalled in a mounting bushing 8 grounded to a cup-shaped metal housing 9, and that the mechanism 10 of the rheostat includes rotatable structure adapted to be driven by the shaft 7.

For the purpose of transmitting driving force from the shaft to the mechanism of the switch unit 5, a disc-like driver 11 is positioned in a central opening 12 in the end wall 13 of the cup-shaped metal rheostat housing. This disc-like driver is substantially dish-shaped and is held on the end wall 13 by having the bottom of its rim overlying the edge of the opening on the outside of the end wall and by having a plurality of tongues 14 bent from an initial assembling position shown in dotted lines 15 (see Figure 1) to an operative position overlying the inner peripheral edge of the opening 12.

An oblong hole in the driver receives a correspondingly shaped projection 16 on the operating shaft so that the driver is rotated with the rheostat mechanism by the shaft. Through this connection between the shaft and the driver the driver is held properly centered to preclude objectionable rubbing between the edge of the hole 12 and the rim of the driver.

The mechanism of the switch unit is contained within a substantially cup-shaped switch housing 17 the side wall of which is formed by a metal shell and the end wall of which is formed jointly by a base 18 of insulating material and an overlying metal portion 19 integral with the side wall.

The base is held assembled with the metal shell which forms the side wall of the housing and the end wall portion 19, being confined between the wall portion 19 and indentations 20 on the side wall. The wall portion 19 may consist of no more than a narrow rim encircling the housing, but at one point at least it has substantial radial width for a purpose to be later described.

Adjacent to this portion of increased radial with the corner of the side wall is struck in as at 21 to provide a boss which engages in a marginal notch 22 in the base to properly l cate the same. This marginal notch has substantial radial depth as illustrated in dotted lines in Figure 3.

Mounted on the base 18 are stationary contacts 23 each provided with a terminal 24, the contacts and terminals being secured together by common rivets as is customary. The contacts are adapted to be electrically bridged by a contactor 25 movable to and from a bridging position by a switch arm 26.

The switch arm 26 is a substantially triangular piece of insulating material and has the bridging contactor loosely mounted thereon between it and the inner face of the insulating base so that the contactor is free to adjust itself to the contacts during closure of the switch.

Switch opening and closing motion is imparted to the switch arm by means of a cam indicated generally by the numeral 27. The cam 27 is stamped from sheet metal and is of rather novel design principally from the standpoint of obviating the conventional pivot post heretofore used in switches of this type.

To this end the cam has a main stem portion 28, the opposite ends of which have pivot forming tongues or projections 29 extending beyond sharply defined shoulders 30. These pivot forming portions or tongues are pivotally received in aligned sockets formed by holes 31 and 32 respectively in the wide portion of the metal end wall 19 of the switch housing and the end wall 13 of the rheostat housing.

The shoulders 30 engage the inner surfaces of these end walls to hold the cam against endwise shifting, and the enlarged radial notch 22 in the base accommodates the adjacent stem portion of the cam as clearly shown in Figure 1.

The medial portion of the main stem 28 is reduced in width and is offset as at 33 to provide a pivot or bearing for the switch arm, being received in a hole 34 near one corner of the arm. The hole is large enough to permit the outer end portion of the cam to pass therethrough.

It is to be observed that formation of the switch arm pivot is such that the pivoted end of the arm is held the same distance from the base as its portion disposed over the contacts.

The switch arm and cam are connected by a toggle spring 35 so that pivotal movement of the actuating cam in one direction snaps the switch arm in the opposite direction and vice versa.

One end of this spring is hooked into a hole 36 in the switch arm and its other end is stepped and offset as at 37 (see Figure 5) to engage under an arm 38 projecting from the cam and to be hooked into a hole 39 in said arm.

The arm 38 extends angularly from one of two spaced abutments or walls 40 projecting laterally from the main stem part of the cam toward the major axis of the combined switch and rheostat.

The throw of the cam is defined by the engagement of the back of the yoke formed by the lateral abutments 40 and the main stem portion with either side of a substantially V-shaped indentation 41 in the adjacent portion of the housing side wall, (see Figure 2).

Pivotal movement is imparted to the cam from the driver 11 by means of a rounded projection 42 projecting radially from the driver and so located as to move into engagement with one or the other of the cam walls or abutments 40 as the driver is rotated. In this manner a transient driving connection is established between the operating shaft and the switch mechanism.

From the description thus far it will be apparent that proper assembly of the cam and switch arm is quickly and easily effected by merely assembling these parts with each other, placing them in the switch housing and securing the housings of the two component units together, this being effected by tangs 43 extending from the edge of the switch housing and passing through holes in the end wall 13 of the rheostat housing to be struck over the inside thereof, as clearly shown in Figure 1.

Inasmuch as the toggle spring has a downward component acting to separate the switch arm and the overlying arm of the cam, it follows that by securing the cam in place the switch arm is urged toward the base 18.

It will also be apparent that inasmuch as the pivot portions of the cam are received in the sockets formed in the metal walls of the switch housing and rheostat housing the cam is effectively grounded to both housings and that the substantially complete shielding barrier formed by the end wall 13 of the rheostat housing and the driver 11 is not affected by the provision of the socket 32 as this relatively small opening is substantially closed by the grounded cam. An exceptionally compact and readily assembled structure is thus obtained.

Another embodiment of this invention is illustrated in Figures 8 to 12, inclusive.

In this case the same general structural relationship between the switch unit 5 and the rheostat unit 6 is followed, but the specific manner in which the switch arm 26 and the cam 45 are mounted is different.

In this embodiment of the invention the radially wide portion of the switch housing metal end wall 19 has an instruck lug 46 projecting through the insulating base 18. The extreme end of this instruck lug is stepped to provide an abrupt shoulder or rest 47 and a pivot portion 48. The pivot portion 48 is received in the hole 34' of the switch arm to pivotally mount the same with the inner surface of the arm engaging the shoulder or rest 47 to be held thereby at the proper elevation from the base 18.

The cam 45 in this construction has spaced hook-like portions 49 engaged in a hole 50 and a notch 51 in the side wall of the switch housing, a notch 54 in the base 18 accommodating that portion of the cam which projects into the plane of the base. An interlocking pivotal connection is thus established between the side wall of the switch housing and the cam which is so designed that it requires bodily movement of the cam toward the open end of the switch housing for disassembly. Hence, when the housings are secured together the end wall 13 of the rheostat housing in overlying the cam secures it in place.

The end wall 13 also provides a support against which the toggle spring reacts inasmuch as the spring, as in the embodiment previously described, tends to separate the switch arm and cam in a direction parallel with the pivotal axis of the cam.

To prevent friction losses and insure smooth operation the cam portion adjacent to the wall 13 has a slightly raised projection 52 which provides a localized bearing between the cam and the end wall 13.

As in the embodiment previously described, the cam has spaced abutments 53 forming an integral part thereof and positioned to be engageable by the rounded projection 42 of the driver 11. The limits of pivotal movement of the cam are defined by having the corners 55 and 56 of its arms 53 engage the inner face of the switch housing side wall.

While the actual limits of switch arm movement in the switch open position are defined by engagement of the arm with the side wall of the switch housing, and in the switch closing position by the engagement of the contactor with the stationary contacts, the hole 34' in the switch arm which receives the pivot portion 48 is substantially triangular to accommodate the stationary pivot portion as the arm swings about the stepped edge thereof.

Figures 13 to 18, inclusive, illustrate another form of this invention.

In this construction the switch arm is mounted in the same manner, that is, by means of an instruck lug on the metal end wall portion 19 of the switch housing, but the construction of the cam and the manner of mounting the same is again different. To the extent that the cam is pivotally mounted on the side wall of the switch housing, this construction follows that illustrated in Figures 8 to 12, inclusive, but instead of interlocking hook-like connection, the side wall of the switch housing has an instruck looped portion 57 providing a socket into which a tongue 58 formed as an integral part of the cam projects.

The tongue 58 is long enough to reach down to the bottom of the cup-shaped housing so as to enter a notch 58' in the insulating base and also bear against the inner surface of the end wall portion 19. The engagement of the tongue 58 in the notch 58' holds the tongue against lateral displacement and thus precludes binding as a result of the tendency of the spring to tilt the cam.

As in the other embodiment of the invention, the end wall 13 of the rheostat housing overlies the cam to hold the same in place, and thus also insures electrical grounding of the cam to the two housings.

The end wall 13 of the rheostat housing in this case is imperforate except for the opening through which the tangs 43 of the switch housing project and a substantially segment shaped hole 59 through which the spaced abutments 60 on the cam project to be engageable by a projection 61

on a cam driver 62 which is rotatable by the operating shaft. The opening 59 is shaped to accommodate the swinging motion of the cam portion projecting through it and is of such size that its angularly disposed ends 63 provide stops against which the abutments 60 engage to define the limits of pivotal motion of the cam. Before assembly of the two housings, the cam throw is limited by its engagement with the side wall of the switch housing.

It is to be observed especially from Figure 18 that the cam substantially closes the hole 59 so as to minimize the possibility of electrostatic radiations passing from the switch through the hole 59 and reaching the rheostat mechanism.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent that this invention entirely obviates the necessity for the conventional pivot post used to mount the cam in combined switch and rheostat devices of this type heretofore in use, and that the means employed to pivotally mount the cam and the switch arm effects material savings in the cost of production without in anywise sacrificing compactness, smoothness of operation or necessary electrostatic shielding between the switch and rheostat.

What I claim as my invention is:

1. In a control device of the character described: a substantially cup-shaped switch housing having a side wall provided with spaced openings forming pivot sockets; switch mechanism in the housing; a switch actuating cam for the switch mechanism, said cam having hook-like pivot portions interengaging with said socket forming openings in the side wall to pivotally mount the cam, disengagement of the cam pivot portions from their sockets requiring movement of the cam toward the open end of the housing; and a wall secured across the open end of the switch housing with a part thereof disposed over the cam to hold the same against disassembling movement.

2. A control instrumentality of the character described, comprising: a substantially cup-shaped switch housing having a metal side wall and an end wall at least part of which is metal; a looped portion struck in from the side wall to provide a socket over the metal part of the end wall; switch instrumentalities within the switch housing; a switch actuating cam having an elongated tongue forming a pivot and received in said socket to pivotally mount the cam; and a metal cover wall disposed over the open end of the switch housing with a part thereof engaging the cam to hold its pivot forming tongue in the socket, said tongue being long enough to engage the metal part of the end wall of the switch housing so that endwise location of the cam is defined by the end wall of the housing and the cover wall and the cam is electrically grounded to the housing and said cover wall.

3. In an electrical control, the combination of: a substantially cup-shaped housing having a metal side wall; means on the metal side wall providing a pivot socket; switch instrumentalities within the housing, including a movable switch arm; a pivot for the switch arm carried by the end wall of the housing, said switch arm being mounted on the pivot in a manner enabling free removal of the switch arm therefrom upon motion of the arm toward the open end of the housing; a punched and stamped switch actuating cam having an integral part thereof forming a pivot engaging in the pivot socket of the housing side wall and having a part overlying the switch arm to block disassembling motion of the arm from its pivot; a toggle spring connecting said cam part with the switch arm to snap the arm from one position to the other as the cam is oscillated on its pivot, said spring also tending to spread the arm and cam apart so that by holding the cam in position both of said parts are held assembled with the housing; an oscillatable operating member adapted for transient engagement with said cam to oscillate the same from one position to the other; and means carrying said oscillatable operating member and connected with the housing with a part thereof disposed over the cam to hold the same against movement toward the open end of the housing.

4. In an electrical control, the combination of: a substantially cup-shaped housing having a metal side wall; a looped portion struck in from the side wall to provide a socket; a punched and stamped sheet metal actuating cam within the housing, said actuating cam having a main body portion from which spaced abutments extend in one direction and having an elongated tongue projecting from the body portion in the opposite direction, said tongue being received in said socket to pivotally mount the actuating cam in a manner permitting free removal thereof upon motion toward the open end of the housing; an oscillatable operating member having a part adapted for transient engagement between the spaced abutments of the actuating cam to swing the same from one position to another upon oscillation of the operating member; and means carrying said oscillatable operating member and connected with the housing with a part thereof disposed over the actuating cam to hold the same against movement toward the open end of the housing and thereby retain the actuating cam pivotally assembled with the housing.

5. In an electrical control device: a cup-shaped housing; means on one inside wall thereof defining a socket for a cam pivot; control mechanism inside the housing including a movable arm, and a cam for affecting motion of the arm, said cam having an integral part thereof forming a pivot which is engaged in said socket in such a manner that removal of the cam necessitates movement of the cam toward the open end of the cup-shaped housing; an oscillatable operating member having a part adapted for transient engagement with the cam to swing the same from one position to another upon oscillation of the operating member; and means carrying the oscillatable operating member and connected with the housing, said means having a part disposed over the actuating cam to hold the same against movement toward the open end of the housing for retaining the actuating cam pivotally assembled with the housing.

6. In an electrical control device: a housing open at one end; control instrumentalities in the housing including an actuating cam; interengaging pivot and socket means on the cam and one wall of the housing, said means becoming disengaged by movement of the cam toward said open end of the housing; an oscillatable operating member transiently engageable with the cam to drive the same; and means independent of the pivot and socket means for blocking movement of the cam toward said open end of the housing to thus maintain the pivot and socket means interengaged.

7. In an electrical control device: a housing

open at one end; control instrumentalities in the housing including an actuating cam; interengaging pivot and socket means on the cam and one wall of the housing, said means becoming disengaged by movement of the cam toward said open end of the housing; an oscillatable operating member transiently engageable with the cam to drive the same; and an end wall closing said open end of the housing and having a part thereof engaging the cam to hold the same in place with the pivot and socket means interengaged.

8. In an electrical control device: a cup-shaped housing; control instrumentalities within the housing; an actuating cam for said instrumentalities inside the housing; opposite projecting aligned pivots on the cam, the end wall of the housing having a socket to receive one of said pivots; an end wall for closing the open end of the housing and having a socket to receive the other of said pivots whereby said last mentioned end wall cooperates with the housing to pivotally mount the cam; and an oscillatable operating member having a part inside the housing and engageable with the cam to drive the same.

9. In an electrical control device: a substantially cup-shaped housing the bottom of which provides an end wall; another wall closing the open end of the housing, said end walls having opposite portions facing the interior of the housing formed of metal providing aligned pivot sockets; control mechanism in the housing including a movable arm, and an actuating cam therefor having oppositely projecting pivots engaging in said pivot sockets; spaced abutments on the cam defining a yoke opening toward the center of the housing; and a cam driver rotatably mounted on the second designated end wall with a part thereof inside the housing and movable in an arc which enters the yoke on the cam for transient engagement with the yoke abutments.

10. In an electrical control device: a substantially cup-shaped housing the bottom of which provides an end wall; another wall closing the open end of the housing, said end walls having opposite portions facing the interior of the housing formed of metal providing aligned pivot sockets; control mechanism in the housing including a movable arm, and an actuating cam therefor having oppositely projecting pivots engaging in said pivot sockets; spaced abutments on the cam defining a yoke opening toward the center of the housing; a cam driver rotatably mounted on the second designated end wall with a part thereof inside the housing and movable in an arc which enters the yoke on the cam for transient engagement with the yoke abutments; and an indentation in the side wall of the housing providing stop abutments adjacent to the cam with which parts of the cam engage to define the limits of pivotable movement of the cam.

11. In an electrical control device: a cup-shaped housing; a cover for the open end of the housing, said cover and the end wall of the housing having pivot sockets; control mechanism in the housing including a movable driving arm; an actuating cam in the housing having oppositely projecting pivots received in said pivot sockets so that the cam is pivotally mounted to swing between defined limits of angular motion, said cam having a medial portion providing a support for the movable driving arm, the movable driving arm having an aperture receiving said medial portion of the cam so that the arm is pivoted on the cam; a toggle spring connecting the arm and cam in a manner to effect a toggle driving connection therebetween so that movement of the cam in one direction across dead center snaps the arm in the opposite direction and vice versa; and an oscillatable operating member having a part inside the housing and transiently engageable with the cam to move the same between its limits of angular motion.

12. In a control device of the character described: a housing having one end open and having an end wall at its opposite end at least part of which is metal, and the metal portion having a pivot socket; switch mechanism in the housing including a movable switch arm having a hole near one edge thereof; a stamped sheet metal switch actuating cam having a medial offset portion received in the hole of the switch arm to pivotally mount the arm and having pivot portions projecting oppositely from the medial portion to provide pivots substantially aligned on an axis parallel to but offset from the pivot formed by said medial portion, one of said pivot portions being received in the socket of the end wall of the housing; a metal cover wall over the open end of the housing, said cover wall having a pivot socket in line with the pivot socket of the housing end wall and having the other pivot portion of the cam received therein; shoulders on the pivot portions of the cam engaging with the walls in which the sockets are formed to hold the cam against axial shifting and to ground the cam to the housing and cover-wall; an oscillatable operating member for the switch mechanism; and a driving connection between said operating member and the cam.

13. In an electrical control device: a substantially cup-shaped housing having an end wall and a metal side wall; means on the side wall forming a pivot socket; switch mechanism in the housing including a movable switch arm; a switch actuating cam having a pivot portion engaging said socket to pivotally mount the cam; a toggle spring connecting the cam and switch arm so that movement of the cam in one direction snaps the switch arm in the opposite direction, disassembly of said pivot portion of the cam from the socket requiring movement of the cam toward the open end of the housing; and a cover for the open end of the housing having a part thereof overlying the cam to hold the same against disassembling movement.

14. In an electrical control device: a substantially cup-shaped housing having an end wall at least part of which is metal and a metal side wall, the side wall having a pivot receiving socket; a switch arm pivot carried by the metal portion of the end wall and disposed within the housing; switch mechanism in the housing including a movable switch arm mounted on said pivot in a manner permitting free disassembly of the switch arm therefrom by movement of the switch arm toward the open end of the housing; a switch actuating cam having a pivot portion engaging said socket on the side wall to pivotally mount the cam from the side wall of the housing in a position over the switch arm, disassembly of the pivot portion of the cam from its socket requiring outward movement of the cam toward the open end of the housing; a toggle spring connecting the cam and switch arm and having a downward component yieldingly urging the switch arm toward the closed end of the housing; an oscillatable operating member adapted for transient engagement with said cam to actuate the same from one position to another; and means carrying said oscillatable operating member and connected with the housing, said means having a part disposed over the cam

to hold the same against movement toward the open end of the housing.

15. In an electrical control device of the character described: a substantially cup-shaped housing having a metal side wall and an end wall at least part of which is metal; means on the side wall providing a pivot socket; an instruck lug on the metal portion of the end wall projecting into the interior of the switch housing and having a stepped outer end providing a switch arm pivot and a rest; switch mechanism in the housing including a movable switch arm, said switch arm having a hole to receive the switch arm pivot with a portion thereof engaging the rest to be supported thereby against movement toward the end wall of the housing; a switch actuating cam having a pivot portion engaging the pivot socket on the side wall to pivotally mount the cam in a position over the switch arm, disassembly of the pivot portion of the cam from its socket requiring movement of the cam toward the open end of the housing; a toggle spring connecting the cam with the switch arm to snap the arm from one position to the other as the cam is actuated, said spring tending to push the arm toward the end wall of the housing and the cam outwardly toward the open end of the housing; a cover for the open end of the housing having a part engaging the cam to hold the same against such spring propelled outward motion to thereby prevent detachment of its pivot portion from the socket; and switch operating means having a part disposed within the housing and transiently engageable with the cam to actuate the same.

16. In an electrical control device: a substantially cup-shaped housing having a metal side wall, part of said side wall being indented to form a loop-like socket; switch mechanism in the housing including a movable switch arm; a pivot for the switch arm carried by the end wall of the housing; a switch actuating cam having an elongated tongue received in the loop-like socket to pivotally mount the cam from the side wall of the housing with a part thereof overlying the switch arm; a toggle spring connecting said cam part with the switch arm so that pivotal movement of the cam snaps the switch arm from one position to the other; spaced abutments on the cam projecting out from the open end of the housing; a cover for the open end of the housing, said cover having an opening through which said spaced abutments project, part of said cover overlying the cam to hold the cam in place; means for securing the cover to the housing; and a driver having a part transiently engageable with said spaced abutments on the cam.

17. In an electric control device: a substantially cup-shaped housing having a metal side wall, part of said side wall being indented to form a loop-like socket; switch mechanism in the housing including a movable switch arm; a pivot for the switch arm carried by the end wall of the housing; a switch actuating cam having an elongated tongue received in the loop-like socket to pivotally mount the cam from the side wall of the housing with a part thereof over-lying the switch arm; a toggle spring connecting said cam part with the switch arm so that pivotal movement of the cam snaps the switch arm from one position to the other; spaced abutments on the cam projecting out of the open end of the housing; a cover wall secured over the open end of the housing, said cover wall having an opening through which said spaced abutments project, part of said cover wall overlying the cam to hold the same in place; and a driver having a part transiently engageable with said spaced abutments on the cam for imparting pivotal movement to the cam, said opening in the cover wall having edges engageable by the cam to define the limits of pivotal movement of the cam.

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