

Oct. 7, 1958

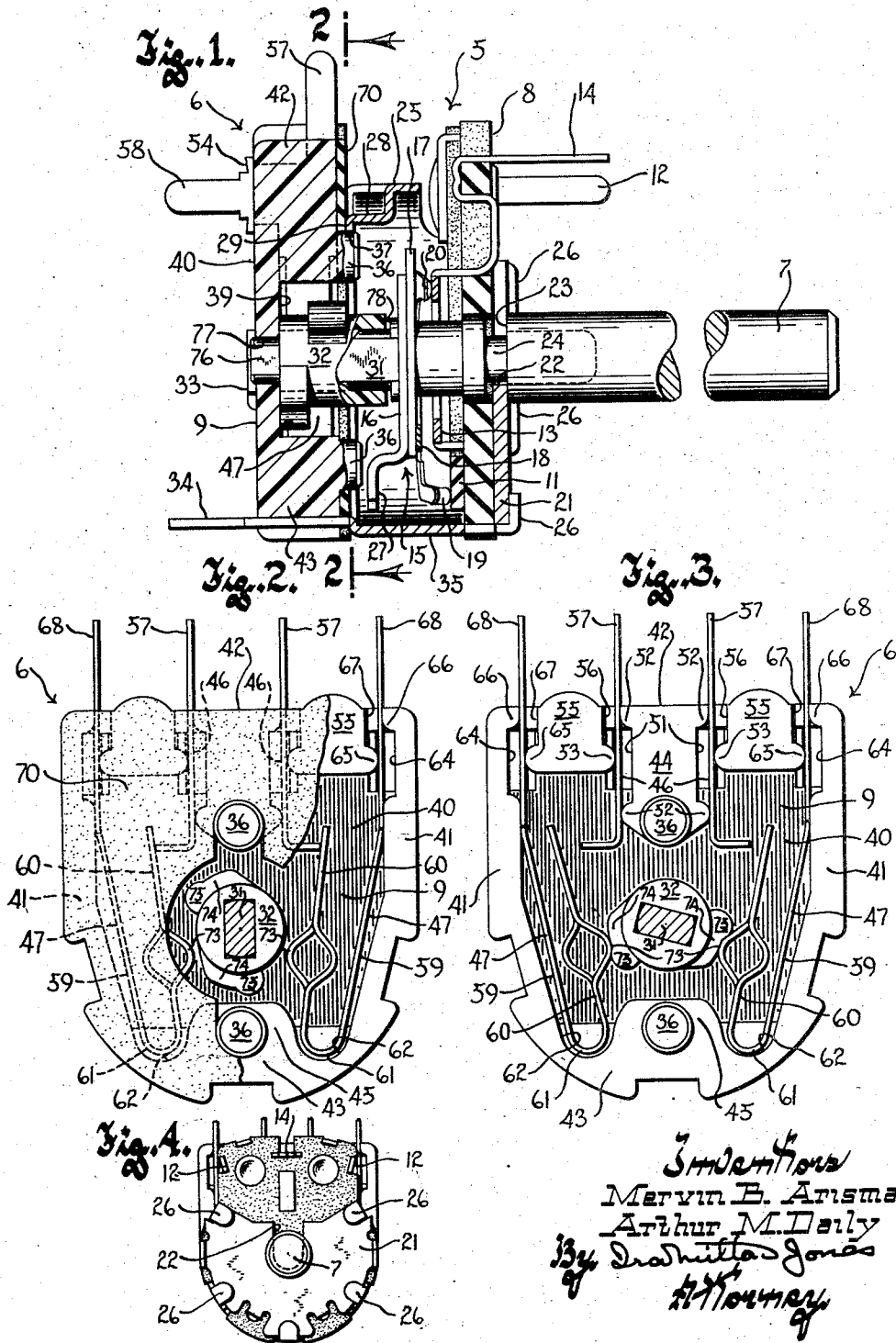
M. B. ARISMAN ET AL

2,855,490

COMBINED SWITCH AND VARIABLE RESISTOR COMBINATION

Filed July 30, 1956

3 Sheets-Sheet 1



Oct. 7, 1958

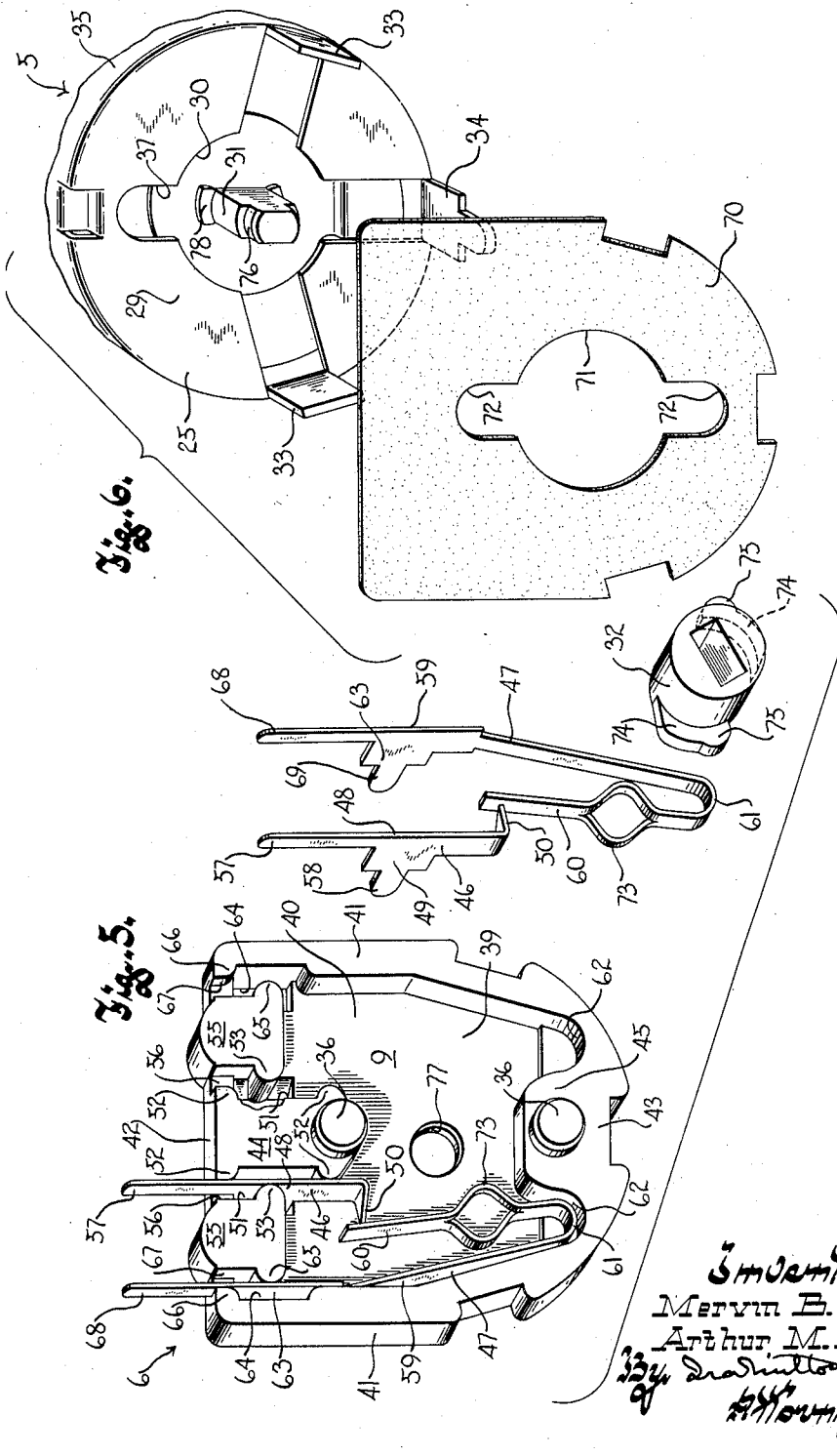
M. B. ARISMAN ET AL

2,855,490

COMBINED SWITCH AND VARIABLE RESISTOR COMBINATION

Filed July 30, 1956

3 Sheets-Sheet 2



Oct. 7, 1958

M. B. ARISMAN ET AL

2,855,490

COMBINED SWITCH AND VARIABLE RESISTOR COMBINATION

Filed July 30, 1956

3 Sheets-Sheet 3

Fig. 7.

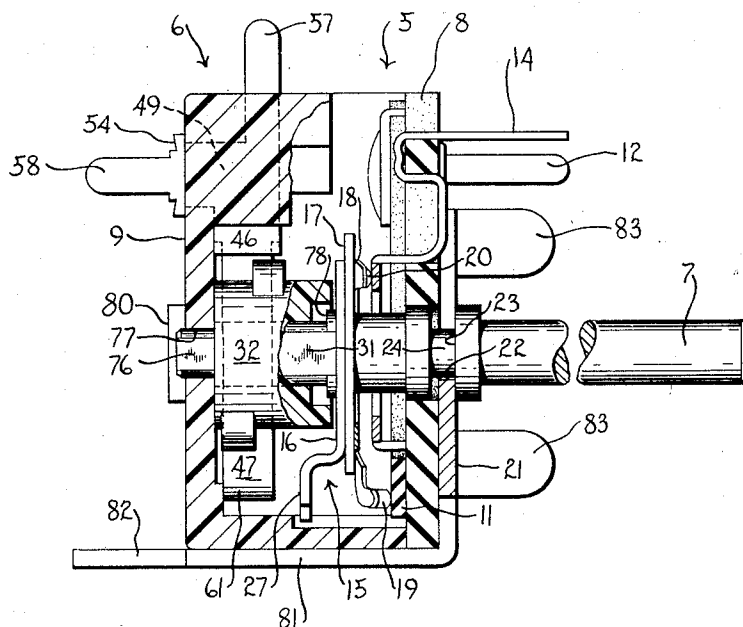


Fig. 8.

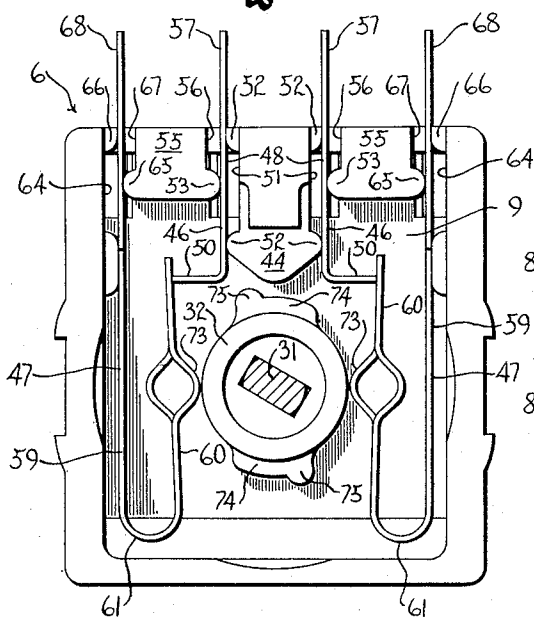
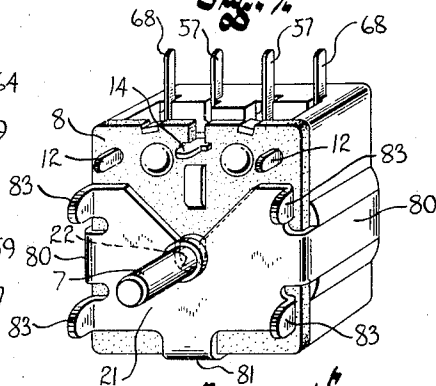


Fig. 9.



Inventors
Mervin B. Arisman
Arthur M. Daily
334
of
Dr. Milton Jones
Attorney

1

2,855,490

COMBINED SWITCH AND VARIABLE RESISTOR COMBINATION

Mervin B. Arisman, Elkhart, Ind., and Arthur M. Daily, Edwardsburg, Mich., assignors to Chicago Telephone Supply Corporation, Elkhart, Ind., a corporation of Indiana

Application July 30, 1956, Serial No. 601,058

7 Claims. (Cl. 201—55)

This invention relates to combined variable resistor and electric switch control devices of the type especially adapted for use with radio and television receivers.

The primary purpose of this invention is to provide a combination control of this type which is extremely compact and small in over-all size so that it lends itself well to use with small portable radio sets.

Another important purpose and object of this invention is to provide a combination control of the character described wherein the switch is of the two pole single throw type. Those skilled in this art will readily appreciate that small over-all size is not easily attained in a double pole switch. Therefore, the fact that this invention enables the entire control device—both resistor and switch—to be contained in a housing the external dimensions of which are on the order of $\frac{3}{4}$ of an inch in diameter, and $\frac{1}{2}$ of an inch in depth, is significant and important. This desired size reduction is obtained primarily through a novel arrangement of switch contacts and the manner in which the common operating shaft actuates the movable contacts of the switch.

In keeping with its main objective—small over-all size—this invention has as another of its objects to provide an improved and simplified way of securing the rotatable contactor assembly of the variable resistor and its operating shaft against endwise displacement, and more particularly, carrying the end thrust imposed upon the contactor assembly and shaft by the spring tension of the contact fingers or paddles.

Also with a view toward achieving utmost simplicity and small size it is another object of this invention to provide an improved way of mounting the switch contacts in their housing whereby compactness is obtained without sacrificing desirable long spring lengths for the movable contacts.

Still another object of this invention resides in the provision of switch contacts, both stationary and movable, which are so constructed and so mounted in the switch housing that portions of the contact members themselves project from the housing at more than one place to provide a plurality of selectively usable terminals.

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 two complete examples of the physical embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a longitudinal sectional view through a combined variable resistor and electric switch control device embodying one form of this invention;

2

Figure 2 is a cross sectional view through the control device taken on the plane of the line 2—2 in Figure 1, a portion of an insulating barrier between the switch and resistor being broken away, and said view showing both sets of the switch contacts closed;

Figure 3 is a view similar to Figure 2 but entirely omitting the insulating barrier between switch and resistor, and showing the switch in its open condition;

Figure 4 is a front view of the control device shown in Figure 1, but on a smaller scale;

Figure 5 is a perspective view of the switch base, its contacts, and the switch actuating cam, with one set of the contacts and the cam removed from the switch base;

Figure 6 is a perspective view of the rear portion of the variable resistor and the insulating barrier which serves as a cover for the switch housing and insulates the switch contacts from the adjacent metal wall of the resistor housing;

Figure 7 is a view similar to Figure 1 but illustrating a modified embodiment of the invention;

Figure 8 is a view looking into the switch of the modified embodiment of the invention, with its control shaft in cross section; and

Figure 9 is a perspective view of the control device shown in Figures 7 and 8, and illustrating particularly the front aspect thereof.

Referring now more particularly to the accompanying drawings in which like numerals indicate like parts, throughout the several views, the numeral 5 indicates generally the variable resistor of the combined control device, and 6 designates the switch which is mounted in tandem with and behind the variable resistor. Both components of the control are operable by a common control shaft 7.

In the embodiment of the invention illustrated in Figures 1 through 6 inclusive, the instrumentalities of the variable resistor and those of the switch are contained in separate housings, or at least in separate compartments of a single housing means, whereas in the other embodiment of the invention illustrated in Figures 7, 8 and 9, the instrumentalities of both the resistor and the switch are contained within a common enclosure. In both cases, however, it will be seen that the housing means has spaced apart front and rear walls 8 and 9, respectively. As will be more particularly described hereinafter, the front wall 8 is the base of the resistor and the rear wall 9 provides the base for the switch.

In both embodiments of the invention the variable resistor comprises an arcuate resistance element 11 mounted upon the rear face of the base 8 and provided with terminals 12 projecting forwardly from the base. Concentrically encircled by the arcuate resistance element is a collector ring 13, which, as is customary, is spaced a short distance back from the rear face of the base 8 and has its terminal 14 projecting forwardly from the base between the resistance element terminals 12.

The operating shaft 7 is journaled in a hole in the base 8, coaxial with the collector ring and arcuate resistance element, and has secured thereto a rotatable contactor assembly 15. This contactor assembly includes the customary drive arm 16 which is fixed to the shaft 7 and carries an insulative contact carrier 17 to which the contactor 13 is secured. The contactor has the customary spring fingers or paddles 19 and 20 which bear against the resistance element and collector ring to traverse the same as the contactor assembly is rotated.

To provide proper contact pressure the contactor assembly and the shaft 7 must be restrained against rearward displacement from a position in which the spring fingers or paddles are under a predetermined tension. The manner in which this result is achieved in the present

invention contributes to the compactness and simplicity of the control device. Heretofore, it was customary to use a C washer on the shaft in position to bear against the front end of a bushing in which the shaft was journaled and by which the control was mounted, or where the rear wall of the resistor housing could be used for the purpose, the contactor assembly included a bearing ring riding on the rear wall. These past ways of defining the position of the rotatable contactor assembly and maintaining the proper contact pressure are improved upon by the present construction wherein a simple interengaging connection between the control shaft and a ground plate 21 overlying the front face of the base 8 is all that is needed to carry the rearward end thrust imposed upon the contactor assembly.

In a sense the ground plate serves as a C washer since it has a U-shaped notch 22 interengaged with an annular groove 23 in the shaft, but this arrangement eliminates a part which is important. Obviously, of course, the notch is of a size to freely receive the neck 24 formed by the groove, but small enough that the rearwardly facing side of the groove may bear against the front face of the ground plate, and to guard against any interference with the correct contact pressure, the width of the groove 23 is greater than the thickness of the ground plate.

In that embodiment of the invention illustrated in Figures 1 through 6 inclusive the instrumentalities of the variable resistor are contained within a housing formed conjointly by the base 8 and a stamped cup-shaped metal cover 25 secured to the back of the base by tangs or ears 26 which also reach around and over the front of the ground plate to thus securely hold the ground plate, base and cover assembled. The limits of rotation of the rotatable contactor assembly are defined by cooperating stop abutments 27 and 28 on the drive arm 16 and cover 25 respectively.

As best shown in Figure 6 the rear wall 29 of the cover has a relatively large central opening 30 to accommodate a rearward extension 31 on the operating shaft and a switch actuating cam 32 which is mounted on the shaft extension. Some of the metal displaced to form the opening is used to provide a pair of substantially opposite tongues 33 and a third tongue 34. All of these tongues extend rearwardly from the side wall 35 of the cover to be received in notches in the switch base 9. The tongues 33 have their ends bent in over the back of the switch base to hold the same assembled with the resistor housing, but the third tongue 34 projects straight back to provide a ground terminal by which the metal cover 25 and the ground plate 21 may be conveniently connected to ground when the control is installed. Preferably the outer end portion of the third tongue is reduced in width, not only to provide a narrower terminal but also to provide metal to increase the length of the tongues 33.

Although the reception of the tongues 33 and 34 in their respective notches in the switch base affords fairly reliable means for lining up the switch and resistor, to make certain that the required alignment will be assured, locating pins or bosses 36 project from the front face of the switch base. One of these pins is received in the slot which results from the formation of the tongue 34 and the other is received in a notch 37 in the edge of the opening 30.

The switch base is molded of suitable insulating material and has a cavity 39 opening to its front face. This cavity is defined by a bottom wall 40 and opposite side walls 41 and end walls 42 and 43 projecting perpendicularly from the bottom wall at the edges thereof. The end wall 42 and the opposite side walls 41 are substantially flat and disposed at right angles to one another, but the other end wall 43 is curved and conforms to the cylindrical shape of the resistor housing cover 25,

the width of the base 9 being substantially equal to the diameter of the cover 25.

Putting into the cavity from the end walls 42 and 43 are piers 44 and 45 respectively. These piers symmetrically divide the cavity into two compartments at opposite sides of a median plane perpendicular to its bottom wall 40 and containing the axis of the control shaft and the switch actuating cam 32. The piers also have the locating pins or bosses 36 formed thereon to project forwardly from the front face of the switch base which is defined by the front surfaces of the side and end walls and of the piers, all of which surfaces lie in a common plane.

Within each of the two compartments of the cavity there is a separate set of stationary and movable switch contacts 46 and 47 respectively. The stationary contacts 46, as best shown in Figure 5, comprise sheet metal stampings in the form of elongated flat strips 48 each having a lateral branch 49 extending from one edge thereof and a contact portion 50 bent at right angles from one end thereof. The stationary contacts are mounted on the switch base directly contiguous to and at opposite sides of the pier 44 with their contact portions 50 projecting in opposite directions toward the side walls 41, and with their lateral branches 49 projecting through slots 51 in the bottom wall 40. Locating bosses 52 on the pier 44 near the opposite ends of the slots 51 and similar locating bosses 53 at the middle of the slots 51 but facing the pier 44, coact to firmly hold the stationary contact members in proper position, in which position they may be secured by swedging portions of their lateral branches 49 over the rear face of the base as at 54. The bosses 53 are on the facing sides of two short projections 55 which extend in from the end wall 42 in flanking relation with the pier 44.

The end portions of the stationary contact members beyond their branches 49 are somewhat narrower than their inner end portions and extend through slots 56 in the end wall 42 to provide upwardly projecting terminals 57 for the stationary contacts. A second set of rearwardly projecting terminals 58 is provided by the end portions of the lateral branches 49.

Attention is directed to the fact that the contact portions 50 of the stationary contact members are relatively close to the end wall 42 and hence spaced a substantial distance from the opposite end wall 43. This leaves much of the space within the cavity available for the movable contact members 47 and the cam 32.

The movable contact members are also stamped from sheet metal but are generally hairpin shaped with a long leg 59 and a short leg 60 connected by a bend 61. They are mounted in the cavity between the stationary contact members and the opposite side walls 41 with their long legs 59 contiguous to the side walls 41 and the bends 61 received in pockets 62 at opposite sides of the pier 45. Like the stationary contact members, the long legs 59 of the movable contact members have branch portions 63 projecting from one edge thereof and passing through slots 64 in the bottom wall 40 of the cavity. The slots 64 are at the corners defined by the junctions of the walls 41 and 42 and hence are directly adjacent to the short projections 55. Locating bosses 65 on the projections 55 and the sides 66 of slots 67 in the end wall 42 coact with the adjacent inner faces of the side walls 41 to hold the outer end portions of the long legs, that is, those portions of the long legs beyond the free ends of the short legs, firmly positioned on the switch base. To secure the movable contact members to the switch base, portions of their branches 63 are swedged over the rear face of the base.

The outer end portions of the long legs 59 extend through the slots 67 to provide one set of terminals 68 for the movable contact members, and as in the stationary contact members reduced end portions on the branches 63 provide a second set of terminals 69 for the movable contact members.

5

Inwardly of their branches 63 the movable contact members are free for at least limited movement across the plane of the bottom wall 40, and it should be noted that these free portions of the contact members are relatively long so that repeated flexure is possible without creating undue strain or spring fatigue. The normal spacing between the legs of the movable contact members is such that the free ends of their short legs are resiliently held against the contact portions 50 of the stationary contacts. In other words, the distance across the points of the stationary contacts 50 is greater than the distance between the free ends of the short legs if the short legs were unrestrained and permitted to assume their normal free positions. Both sets of contacts are thus normally closed.

The depth of the cavity in which the contact members are disposed is but slightly greater than the width of the contact members, and in fact, the anchored portions of the movable contact members and also the stationary contact members, have a width substantially equal to the depth of the cavity. It is therefore, necessary to provide an insulating barrier 70 between the switch and the metal cover of the resistor.

This insulating wall or barrier is shaped to conform to the front face of the switch base and has a central hole 71 with diametrically opposite notches 72 to accommodate the switch actuating cam 32 and the locating pins 36. In view of the fact that the anchored portions of the movable contact members and also the stationary contact members have a width substantially equal to the depth of the cavity, the insulating wall or barrier 70 could be relied upon to retain the contact members in their proper locations within the cavity, thereby dispensing with the need for staking or swedging portions of the contact members over the rear face of the base, but by staking them to the base, assembly of the control may be facilitated.

Both sets of contacts are simultaneously opened by rotation of the switch actuating cam 32 and to provide for torque transmission from the control shaft to the cam, the shaft extension 31 is non-circular in cross section, preferably flatted at opposite sides, and the cam has a correspondingly shaped hole which snugly though slideably fits the non-circular shaft extension.

To translate rotation of the cam into separation of the movable contacts from their respective stationary contacts, the short leg 60 of each movable contact member has an ear 73 sheared therefrom which coacts with one of two substantially diametrically opposite lobes 74 on the cam. It is to be noted however, that the lobes 74 are axially spaced with respect to one another so that one of them is directly contiguous to the bottom wall 40 of the cavity in the switch base while the other is contiguous to the open front face of the base. Also, the ear 73 on one of the movable contact members is at the edge of its short leg nearest the base while the ear 73 of the other movable contact member is at the edge of its short leg contiguous to the open face of the switch base cavity and the insulating barrier 70 covering the same. Accordingly, each cam lobe operates only on one of the movable contact members. This arrangement permits simultaneous opening or closing of the switch by rotation of the operating shaft through a few degrees of its full range of adjustment without creating interference at any other point during rotation of the operating shaft.

The sheared ears 73 project a distance sufficient to insure that when fully engaged by the cam lobes 74, as shown in Figure 3, the short legs 60 of the movable contact members will be spaced a substantial distance from the stationary contacts 50, and to create the desirable impression of "snap action" the lobes 74 have humps 75 over which the ears 73 pass as the shaft is turned to and from its position at which the switch is open.

The long length of the free portions of the movable

6

contact members together with the way in which the humps 75 coact with the ears 73 results in a wiping action at the point of contact. This follows from the fact that during the opening of the switch a certain amount of endwise shifting of the movable contact portions across the stationary contacts takes place before the contacts actually separate. Such wiping action is of course desirable to assure low contact resistance throughout the life of the switch.

The extreme end portion 76 of the shaft extension 31 upon which the cam is mounted is reduced in diameter, as best shown in Figure 6, and is received in a bearing hole 77 in the bottom wall 40. In this way the switch base provides an additional side thrust bearing for the operating shaft, it being understood that the switch base is so located on the back of the resistor housing that the bearing hole 77 is coaxial with the hole in the resistor base 8 in which the shaft is journaled.

As brought out hereinbefore the end thrust imposed upon the contactor assembly of the variable resistor is carried by the ground plate so that the contact pressure upon the resistance element can be accurately determined and maintained. To preclude the switch actuating cam from affecting the axial position of the contactor assembly and thereby altering the established contact pressure, the cam is shorter than the shaft extension 31 upon which it is mounted. More particularly, the length of the cam hub is less than the distance between the bottom wall 40 of the switch base cavity and the shoulders 78 formed at the junction of the reduced noncircular shaft extension 31 with the rest of the shaft.

Attention is directed to the fact that the cam 32 projects a substantial distance forwardly as well as rearwardly of the rear wall 29 of the resistor housing. This is compatible with the main objective of the invention, namely, small over-all size for the control, and still allows the cam to be long enough to assure a good driving connection with the shaft. The importance of this will be appreciated from the fact that the axial length of the hub of the cam 32 is less than one quarter of an inch.

The modified embodiment of the invention illustrated in Figures 7 to 9 inclusive in nearly all respects, is like that of the construction shown in Figures 1 to 6 inclusive. The chief distinction between the two embodiments as noted hereinbefore lies in the fact that in the Figures 7-9 construction, the instrumentalities of the switch and the variable resistor are contained within a common enclosure. This arrangement achieves an exceptionally shallow construction for the control. In fact, the over-all depth or axial dimension of the control in this case is but slightly greater than the depth of most variable resistor units of comparable size.

The elimination of the metal cover as part of the housing for the resistor is permitted in this embodiment of the invention by making the side and end walls of the switch base cavity somewhat higher and having the switch base 8 secured directly to the open front face of the base. Such securement is effected by ears 80 extending rearwardly from the ground plate and clinched over the back of the switch base. The ears 80 are located at opposite sides of the unit, and a third ear 81 extends back from the ground plate across the bottom of the unit to provide a convenient ground terminal 82.

In both embodiments of the invention the control device may be mounted upon a supporting panel, not shown, with the terminals of the variable resistor projecting through the panel for connection to printed circuitry on the panel, and of course, with the operating shaft also projecting through the panel. To so mount the control device mounting ears 83 project forwardly from the ground plate.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention pro-

vides an exceptionally compact combination variable resistor and electric switch despite the fact that the switch is of the double pole single throw variety.

What is claimed as our invention is:

1. A combination variable resistor and electric switch control device wherein the resistor comprises a resistance element on the back of an insulated base and a rotatable contactor assembly including an operating shaft journaled in the base and a spring contact finger bearing against the resistance element and thereby imposing a forward end thrust upon the contactor assembly, and wherein the switch is disposed in tandem relation with and behind the resistor and comprises cooperating movable and stationary contacts, said control device being characterized by: housing means in which the instrumentalities of the resistor and switch are contained, said housing means including the insulated base of the variable resistor which provides a front wall, and an insulated base for the switch which serves as a rear wall for the housing means, said front and rear walls being disposed in fixed spaced apart relation; a non-circular rearwardly projecting extension on the operating shaft of the rotatable contactor assembly; side thrust bearing means connecting the rear end of said non-circular shaft extension with said rear wall provided by the switch base; a switch actuating cam freely slidably fitted on the non-circular shaft extension to rotate with the shaft and by such rotation actuate the movable contact of the switch, said switch actuating cam being confined between opposing surfaces on the rotatable contactor assembly and said rear wall of the housing means but being slightly shorter than the distance between said surfaces; a ground plate overlying the front face of the resistor base; and end thrust bearing means interconnecting the operating shaft with the ground plate so that the ground plate carries the rearward end thrust imposed upon the rotatable contactor assembly, said end thrust bearing means comprising a notch in the ground plate interengaged with an annular groove in the shaft.

2. The combination variable resistor and electric switch control device of claim 1 further characterized by the fact that said housing means is formed partially by a metal cup-shaped cover disposed over the rear of the resistor base, and a cavity in the switch base, the end wall of the cover extending across the open front of said cavity and having an opening to accommodate the rearward extension of the operating shaft and the switch actuating cam mounted thereon, said cam extending a substantial distance forwardly as well as rearwardly of said end wall of the cover.

3. The combination variable resistor and electric switch control device of claim 1 wherein the housing means comprises a relatively deep cavity in the switch base which cavity is closed directly by the base of the resistor so that the resistor instrumentalities and the switch instrumentalities are contained within a common enclosure; and further characterized by fingers extending rearwardly from the ground plate over the sides of the switch base and clinched over the rear of the switch base to hold said two bases together.

4. A combination variable resistor and electric switch comprising: a base of insulating material having a cavity therein opening to one face thereof, said cavity being defined by a bottom wall and opposite side and end walls; two hairpin shaped resilient metal movable contact members in the cavity, one adjacent to each of the two opposite side walls, said movable contact members having spaced apart long and short legs, the long legs being closest to said side walls of the cavity; terminal portions on the parts of the long legs which extend beyond the free ends of the short legs, said terminal portions projecting through a wall of the cavity near one end of the cavity

to provide terminals for the stationary contact members; the short legs having their free ends facing and adjacent to but spaced from the end wall of the cavity at said end thereof, and the free end portions of the short legs providing movable contacts; two stationary contact members mounted in the cavity with their contact portions between and facing said movable contacts, said short legs being sprung towards the stationary contact members to engage the movable contacts with the contact portions of the stationary contact members; terminal portions on the stationary contact members remote from their contact portions and also projecting through a wall of the cavity near said end thereof; a wall of insulating material joining the edges of said side and end walls of the cavity to close the cavity and provide a front wall for the enclosure thus formed; a resistance element on the inner face of said front wall; a rotatable contactor assembly inside the enclosure and cooperable with the resistance element; a rotatable operating shaft entering the enclosure through said front wall and having the rotatable contactor assembly fixed thereto; a switch actuating cam drivingly mounted on the inner end of the shaft behind the rotatable contactor assembly and positioned between the short legs of the movable contact members; and cooperating abutments on the cam and said short legs to effect simultaneous opening or closing of both sets of switch contacts upon rotation of the control shaft through part of its full range of adjustment.

5. In a combination variable resistor and electric switch; a housing having front and rear walls in fixed spaced apart relationship, said walls having axially aligned bearings thereon; an operating shaft rotatably journaled in said bearings; a resistance element fixed on the rear face of the front wall; rotor means on the shaft to be driven thereby, said rotor means comprising a contactor assembly for the variable resistor at the rear of said resistance element and cooperable therewith, and a switch actuating cam directly behind said contactor assembly and confined between it and the rear wall of the housing; a double pole electric switch in the housing behind the contactor assembly, said switch including a pair of elongated resilient movable contact members carried by the housing in positions extending transversely thereacross at opposite sides of the cam and cooperating stationary contacts positioned to be engaged by the movable contact members; and means on the periphery of the cam at substantially diametrically opposite sides thereof operable upon portions of said movable contact members to effect simultaneous actuation of said contact members between switch open and switch closed positions as a consequence of rotation of the operating shaft.

6. The combination variable resistor and electric switch of claim 5 further characterized by the fact that each movable contact member and cooperating stationary contact has two terminals integral therewith, one of which extends through the rear wall of the housing and the other through an adjacent side wall of the housing.

7. The combination variable resistor and electric switch of claim 6 further characterized by the provision of anchoring means for the movable contact members and stationary contacts, comprising portions on their terminals which project through the rear wall of the housing staked over the outer face of said rear wall.

References Cited in the file of this patent

UNITED STATES PATENTS

2,059,712	Schellenger	Nov. 3, 1936
2,172,397	Meuer	Sept. 12, 1939
2,493,184	Budd et al.	Jan. 3, 1950
2,659,793	Daily et al.	Nov. 17, 1953