May 15, 1962 W. A. BARDEN 3,035,241

GROUND PLATE FOR VARIABLE RESISTORS

Filed Oct. 12, 1960

2 Sheets-Sheet 1

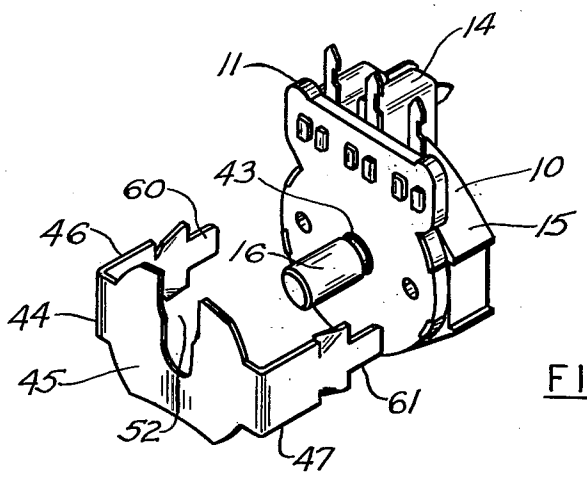


FIG. 1.

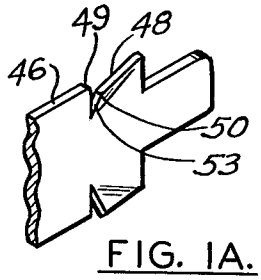


FIG. 1A.

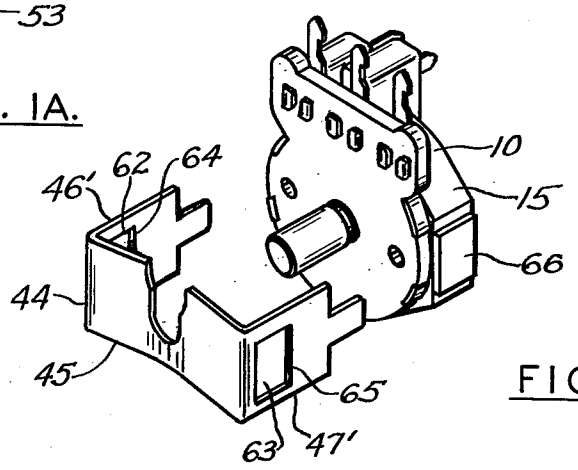


FIG. 2.

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2 Sheets-Sheet 2

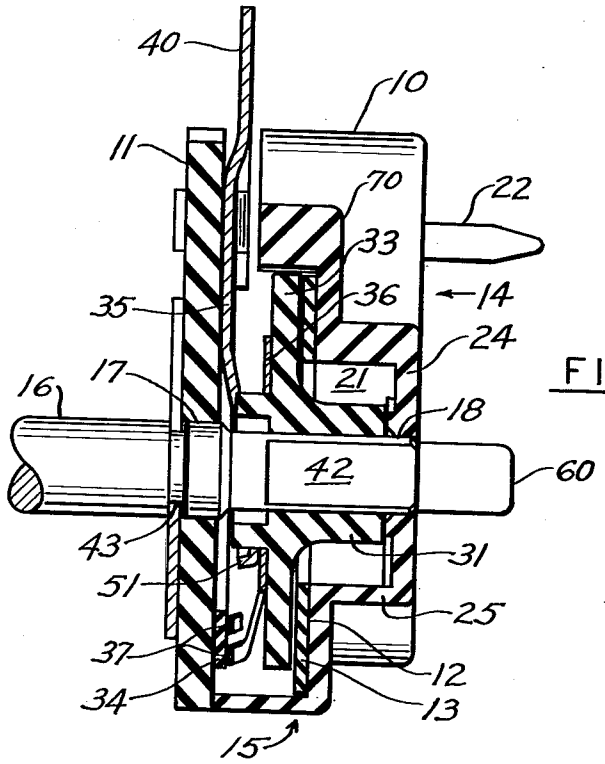


FIG. 3.

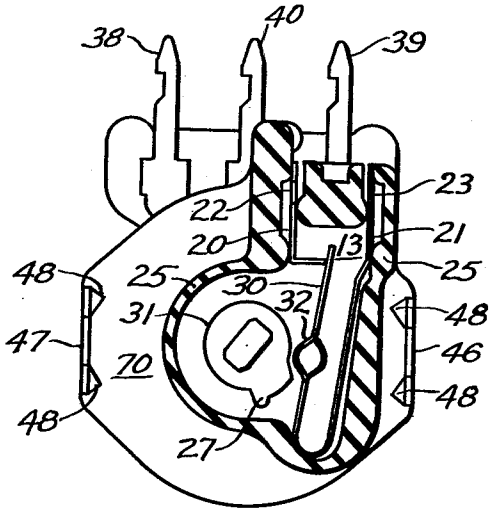


FIG. 4.

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GROUND PLATE FOR VARIABLE RESISTORS

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This invention relates to electrical controls, such as variable resistors, switches, and combinations of variable resistors and switches, and, particularly, to electrical controls which can be assembled without staking, swedging, and clinching one part against another to hold the assembly together.

Specifically, this invention relates to a ground plate which is so constructed that it will not only serve to ground the control to the panel in which it is mounted, but in addition will maintain the control in its assembled condition. This latter function is of particular importance since in a field such as this where literally hundreds of thousands of these controls must be produced daily, any improvement which allows a control to be assembled easier and quicker produces savings in the assembly time required for the control and, consequently, an increase in production.

One of the steps always required in the final assembly of all controls is a staking, clinching, or swaging step. This step usually comes last and serves to secure and lock the many parts of the control in their assembled position. Further, this step is performed in a power-operated die of some description and the various parts of the assembly must be maintained in proper relationship to each other while being transferred to said die.

It is an object of this invention to provide a ground plate for an electrical control which will hold the control in its assembled condition without requiring any staking, clinching, or swaging of one part against another, thus eliminating the final step in the assembly of a control as described above and the many problems inherent therein.

Conventional electrical controls are generally housed in cup-shaped metal covers. This is necessary where the control is to be used in circuits of high impedance so that each control will be shielded from the other components of the circuit. In the battery-operated radios, becoming more and more popular today due to their great transportability and small size, the high intensity alternating magnetic fields common in radios using alternating current are not present. In the low current D.C. circuits used in this type equipment, there is little magnetic coupling between the circuits even though they may be in close physical proximity to each other. If the equipment uses transistors, the likelihood of magnetic or electrostatic coupling between the circuits is further reduced due to the low impedance circuits associated with transistors. Controls for this type equipment need not be individually housed in metal covers but may be grouped together in a common cover of nonconductive material, with only insulating plates or partitions between them.

It is an additional object of this invention then to provide a ground plate which is so designed that it will maintain various electrical components, such as switches and variable resistors grouped together in a common housing, in an assembled position.

It is a further object of this invention to provide a ground plate for an electrical control which will allow the control to be assembled and disassembled easily and quickly without the need of tools or fixtures of any kind.

The invention will now be described in detail with reference to its use with a control consisting of a combination variable resistor and switch as illustrated in the accompanying drawings, in which:

FIGURE 1 is an isometric view of the preferred form of the ground plate which is the subject of this invention and an isometric view of the control assembled and in position to receive the ground plate;

FIGURE 1A is a fragmentary isometric enlarged view showing the detail of the locking ears provided on the arms of the ground plate.

FIGURE 2 is an isometric view of an alternate form of the ground plate in position to be assembled with the control;

FIGURE 3 is a cross-sectional view of a control consisting of a variable resistor and a switch assembled to take advantage of this invention; and

FIGURE 4 is a rear view of the control with the rear portion of the cover removed to show the arrangement of the switch components.

Referring to FIGURE 3, a cup-shaped cover **10**, which is preferably molded of insulating material, cooperates with the base **11** to form a housing for the control. A shoulder **12** is molded approximately midway from the bottom of the cover **10** and combines with the insulating plate **13** to divide the housing into two compartments. The rear compartment **14** houses the switch, while the front compartment **15** combines with the base **11** to house the variable resistor.

The arrangement of the switch is best seen in FIGURE 4 where the rear wall **24** of the cover has been removed. The switch contactors **20** and **21** are assembled simply by inserting their rearwardly extending terminals **22** and **23** through slots provided therefor in the rear wall **24**. These slots are not shown in the drawings but are designed to fit the terminals snugly so as to help maintain the contactors in their proper position.

Also functioning to keep the contactors in position are the side walls **25** of the rear compartment **14**. These walls are contoured so that they engage the contactors at strategic places and coact with the slots engaged by the terminals **22** and **23** to prevent any lateral movement of the contacts.

Longitudinal movement of the contactors is prevented in one direction by the rear wall **24** of the cover **10** and in the other direction by the insulating plate **13**. As seen in FIGURE 3, the contactor **21** is of such a width that it is firmly engaged by the rear wall and the insulating plate when the switch is assembled. The stationary contact **20** is of equal width and is similarly held against longitudinal movement.

All movement of the contacts is not prevented, of course, since they must be free to move into and out of engagement. This movement occurs in the short leg **30** of the contact **21**, which is provided with an expanded portion **32** which rides against the cam **31**. The cam is equipped with the lug **27** which moves the leg **30** out of engagement with the contact **20** whenever it engages the expanded portion **32**. This is usually arranged to occur when the rotor of the variable resistor approaches the end of its travel in one direction. Since the cam **31** is an integral part of the contact carrier **33**, this sequence of operation can easily be provided.

On the other side of the insulating plate **13** and within the front compartment **15** of the cover **10** is located the variable resistor. Comprising its rotor section is the contact carrier **33** made from nonconducting material and the contactor **36**. The stator section comprises the base **11** upon which is mounted the arcuate resistive element **34** and the center connector **35**. In addition, the center connector has two resilient arm **51** which engage the contactor **36** and the contactor has two resilient arms **37** which engage the circular resistive element **34**. Completing the variable resistor are the terminals **38** and **39** which are connected with each end of the resistive element **34** and the terminal **40** which connects to the

center connector 35. In fact, in this case, the terminal 40 is an integral part of the center connector. The terminals 38 and 39 also serve to attach the resistive element 34 to the base 11 in a manner well known in the art. The terminal 40 attaches the center connector to the base in the same manner.

Extending through the control is the shaft 16 which is rotatably journaled in the base at 17 and in the rear wall 24 of the cover at 18. Mounted on the shaft and arranged to rotate therewith is the contact carrier 33. To impart rotation to the contact carrier, the shaft is provided with milled flats 42 which engage a corresponding flat-sided opening in the contact carrier. In addition, the shaft is provided with a groove 43 which is located adjacent the outside wall of the base 11.

This completes the description of all the components of the control with the exception of the ground plate 44. At this point, it should be noted that with the exception of the clinching required during the subassembly of the resistive element and the center connector to the base and the attaching of the contactor to the contact carrier, no clinching, staking, or swaging of one part to the other has been necessary during the assembly of this control. With the special ground plate described below, this assembly can now be completed without requiring one of these time-consuming steps.

The ground plate 44 in its preferred form is illustrated in FIGURES 1 and 1A. It consists of a face plate 45 and two arms 46 and 47 which extend more or less perpendicularly rearward from the edges of the face plate 45. A key-hole shaped opening 52 in the face plate is designed to engage the groove 43 in the shaft 16. In addition, the face plate is not flat but is slightly curved in a rearward direction. As can be seen, the ground plate comprises a generally U-shaped member and is preferably formed of spring steel.

The arms 46 and 47 are equipped with locking ears or barbs 48 as best seen in FIGURE 1A. These ears are formed by slitting the arms vertically as at 49 and then bending the portion 50 inwardly until the edge 53 forms an angle of approximately forty-five degrees with the arm. These barbs are formed on each side of each arm, thus providing two forwardly facing shoulders 53 on each arm. These locking ears are so located that these forwardly facing shoulders 53 engage the rear wall 70 of the front section 15 when the mounting plate 44 is in position engaging the groove 43 in the shaft 16 and with its front face 45 substantially flat against the base 11.

In this position, the ground plate acts to maintain the control in its assembled position. By engaging the groove 43 in the shaft 16 and also engaging the base 11, the shaft is prevented from further entering the control. Also, the interaction of the groove 43 and the face plate 45, the arms 46 and 47, the forwardly facing shoulders 53, and the rear wall 70 of the front compartment 15 of the cover 10 prevents the shaft from moving longitudinally out of the control. The ground plate not only holds the shaft in position, but it also holds the base firmly against the open end of the cover 10. By doing this, all the components of the control are maintained in their relative positions within the cover since they are so designed in relation to each other that they must move longitudinally to be disassembled.

As the ground plate is assembled on the control, it is necessary, of course, that the arms 46 and 47 move outwardly to the extent necessary to allow the barbs 48 to reach the rear wall 70 of the front compartment 15. This is the reason for making the ground plate out of spring steel. The arms will then be resilient and force the barbs to snap into position behind the front compartment 15 once they have cleared the side walls of the cover 10. Providing additional force urging the barbs 48 into position is the flattening of the initially curved face plate 45 against the base 11 when the ground plate reaches its final position. This feature also insures that the barbs

are held snugly against the rear wall of the front compartment 15, thus making allowance for manufacturing tolerances.

Extending rearwardly of the arms 46 and 47 are the mounting lugs 60 and 61. These lugs are used to mount the control in a panel and, of course, once in place, they will insure that the locking ears do not move from their position against the rear wall 70 of the front compartment 15. By providing the mounting ears in this way, the resiliency of the arms 46 and 47 will not need to be relied upon to maintain the control in its assembled condition throughout its operating life, but only until the control has been installed in a control panel.

An alternate version of the invention is illustrated in FIGURE 2. Here, instead of locking ears, the arms 46' and 47' are provided with rectangular openings 62 and 63. These openings provide forwardly facing shoulders 64 and 65. To engage these shoulders, the side walls of the front compartment 15 of the cover 10 are equipped with rectangular bosses 66. These bosses are designed to engage the rectangular openings 62 and 63 and thereby perform the same functions as the locking ears 48 perform with the rear wall 70 of the front section 15 in the preferred form of the invention. All of the other features remain the same in this alternate form, the only difference being the type of interlocking shoulders which are provided.

From the above description, it will be apparent to those skilled in the art that, as a result of this invention, great savings can be realized in the final assembly of electrical controls of this type. There are additional advantages. For example, should it be necessary to disassemble the control for any reason, this can be accomplished easily and speedily simply by unsnapping the arms of the ground plate from their position alongside the side walls of the cover 10, and the control will literally fall apart. The faulty part of the control can then be replaced and the control reassembled just as easily as it was disassembled.

While there are above disclosed but a limited number of embodiments of the structure of the invention herein presented, it is possible to produce still other embodiments without departing from the inventive concept herein disclosed, and it is desired, therefore, that only such limitations be imposed on the appended claims as are stated therein, or required by the prior art.

The invention claimed is:

1. An electrical control comprising, a cup-shaped cover for the control having an end wall and a side wall, a base of nonconductive material arranged to close the open end of the cover, a shaft journaled in the base and extending into the cover, means for maintaining the shaft, cover, and base in assembled relationship, said means comprising, a groove in the shaft adjacent the base, a thin metal plate initially curved in the direction of the base; the plate being forced flat when installed against the base and in engagement with the groove, a plurality of arms attached to the plate and extending along the side wall of the cover, surfaces on the arms facing in the direction of the plate, surfaces on the cover facing in the opposite direction from the surfaces on the arms, the arms being biased laterally inward by the flattening of the plate against the base so that the laterally extending surfaces thereon will be resiliently held in engagement with the rearwardly facing surfaces on the cover to thereby maintain the base in position against the open end of the cover and to prevent outward movement of the shaft from the control.

2. An electrical control comprising, a cup-shaped cover having side walls and an end wall, a base of insulating material, the base and the cover combining to form a housing for the control, a control shaft extending outwardly from the base, the shaft being journaled in the base and the end wall of the cover, a groove in the shaft adjacent the portion journaled in the base, means for maintaining the cover, base, and shaft in assembled rela-

tionship; said means comprising: a thin electrically conductive member of resilient material initially curved in the direction of the base; said member being installed substantially flat against the outer wall of the base in engagement with the groove in the shaft, arms connected to the member and extending substantially perpendicularly therefrom along the side walls of the cover, and laterally extending preformed barbs on the arms which engage the end wall of the cover, the arms being biased laterally inward by the flattening of the member when installed flat against the housing to resiliently hold the barbs in engagement with the end wall of the cover.

3. An electrical control comprising, housing means for the control, an operating shaft extending through the control and journaled in opposite sides of the housing means and extending from one side thereof, means for maintaining the housing means and the shaft in assembled relationship; said means comprising: a groove in the shaft in line with the side of the housing means from which it extends, a thin member of resilient material initially curved in the direction of the housing means; said member being installed flat against the side of the housing means from which the shaft extends and in engagement with the groove, a plurality of arms extending substantially perpendicularly from the member alongside the housing means, and laterally extending barbs on the arms engaging the opposite side of the housing means from the side from which the shaft extends, the arms being biased laterally inward by the flattening of the member when installed flat against the housing means to resiliently hold the barbs in engagement with the housing means.

4. The electrical control of claim 3 further characterized by the provision of extensions on said arms. The extensions being of reduced width to provide mounting tabs for the control.

5. An electrical control comprising, a housing means for the control, an operating shaft extending through the control, the shaft being journaled in opposite sides of the housing means and extending from one side thereof, means for maintaining the shaft and housing means in assembled relationship; said means comprising: a groove in the shaft adjacent the side of the housing from which the shaft extends, a metal C-washer, a plurality of arms extending approximately perpendicularly from the C-washer and having laterally extending flanges formed integrally thereon, oppositely facing surfaces on the housing arranged to be engaged by the laterally extending flanges on the arms; said means further characterized by the fact that the C-washer is initially curved in the direction of the arms so that when installed flat against the housing and in engagement with the groove in the shaft, the arms will be biased inward laterally toward each other.

6. An electrical control comprising, housing means for the control, an operating shaft extending through the control, the shaft being journaled in opposite sides of the housing means and extending from one side thereof, means for maintaining the shaft and housing means in assembled relationship; said means comprising: a groove in the shaft

adjacent the side of the housing from which the shaft extends, an initially curved thin metal member installed substantially flat against the housing and engaging the groove in the shaft, arms connected to the member and extending substantially perpendicularly therefrom along the side walls of the cover, each arm having a portion removed to provide a forwardly facing surface, rearwardly facing portions on the housing arranged to engage the forwardly facing surfaces on the arms.

7. The electrical control of claim 6 wherein the rearwardly facing surfaces on the housing are formed by bosses of approximately the same shape as the portion removed from each arm.

8. An electrical control comprising, in combination, a switch and a variable resistor, a generally cup-shaped cover of nonconductive material having a lower portion for the switch, the lower portion having an end wall and a side wall; and an upper portion of the cover for the variable resistor, the upper portion having an end wall and a side wall, a base of nonconductive material for the variable resistor arranged to close the open end of the cover, a shaft extending through and journalled in the base and arranged to operate the variable resistor and the switch, a groove in the shaft adjacent the base, a metal of resilient material arranged to engage the base and the groove in the shaft, a plurality of arms of resilient material extending approximately perpendicularly from the periphery of the C-washer along the side wall of the upper portion of the cover, forwardly facing surfaces on said arms, and rearwardly facing surfaces on said cover arranged to engage said forwardly facing surfaces on said arms.

9. The control as described in claim 8 wherein the forwardly facing surfaces on said arms consist of laterally inwardly extending portions of the arms formed by partially cutting through each arm from the top and bottom thereof, and bending the portion rearward of each cut inwardly so that the rearward side of the cut provides the forwardly facing surface.

10. The control as described in claim 8 wherein the rearwardly facing surface is the end wall of the upper portion of the cover.

11. The control as described in claim 8 wherein the forwardly facing surfaces are formed by removing a rectangularly-shaped portion from each arm.

12. The control as described in claim 11 wherein the rearwardly facing surfaces consist of bosses formed on the side of the upper portion of the housing and arranged to snugly fit the portion removed from each arm.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,035,241 May 15, 1962

Wayne A. Barden

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 33, for "said arms. The" read -- said arms, the --.

Signed and sealed this 5th day of March 1963.

(SEAL)
Attest:

ESTON G. JOHNSON
Attesting Officer

DAVID L. LADD
Commissioner of Patents