July 19, 1960 A. M. DAILY 2,946,032

VARIABLE RESISTOR

Filed Sept. 11, 1957 3 Sheets-Sheet 1

Fig. 1.

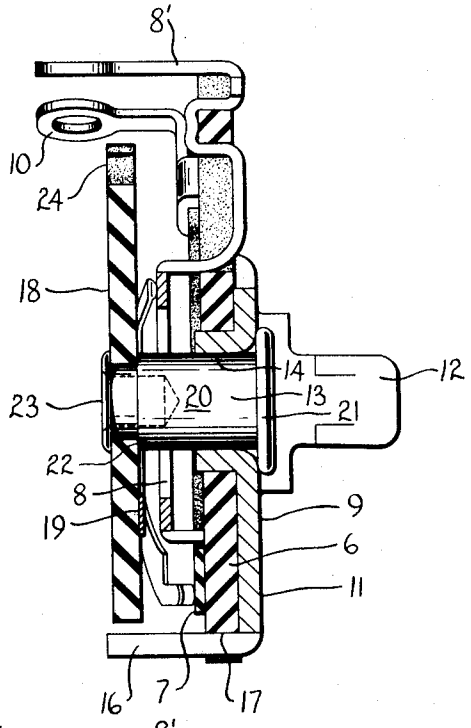
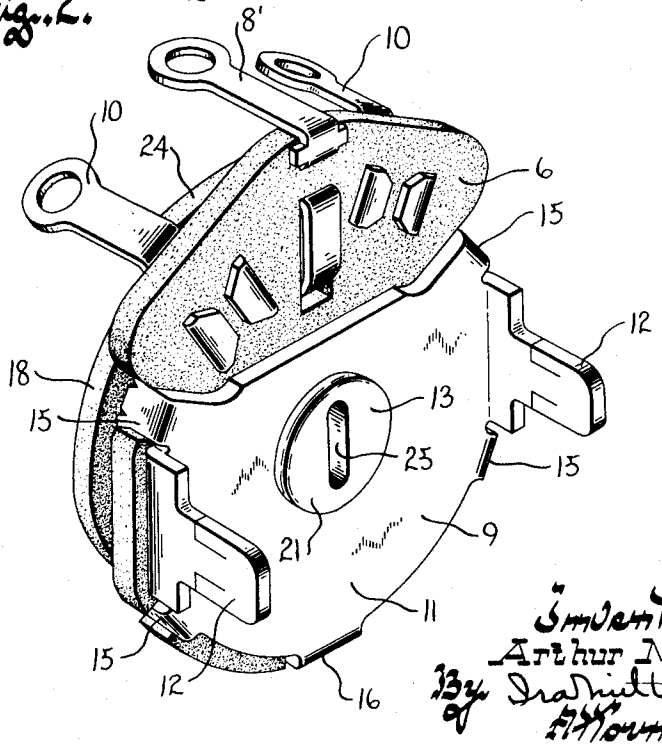


Fig. 2.



Inventor
Arthur M. Daily
By Pritchett & Jones
Attorneys

July 19, 1960 A. M. DAILY 2,946,032

VARIABLE RESISTOR

Filed Sept. 11, 1957 3 Sheets-Sheet 2

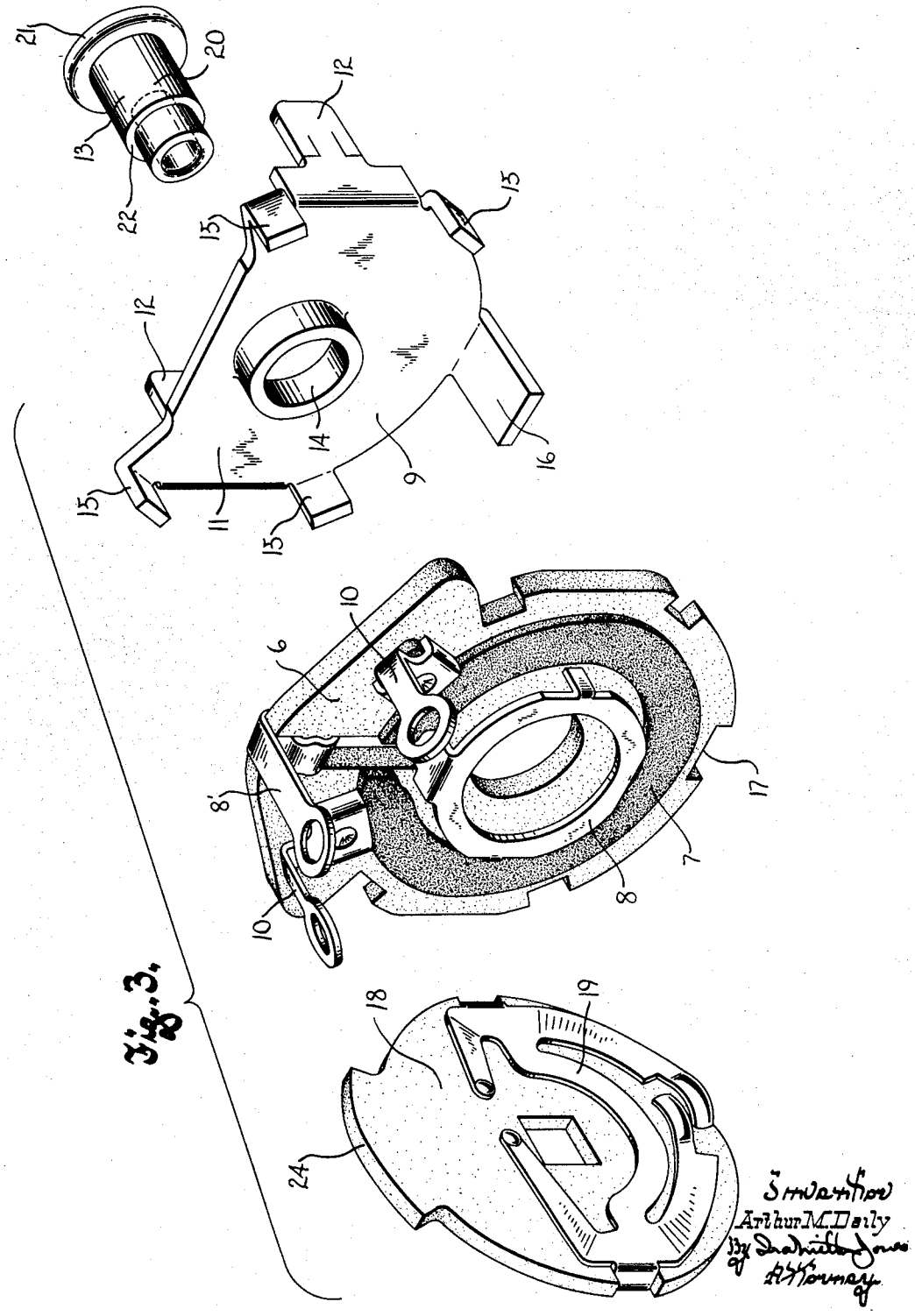


Fig. 3.

Inventor
Arthur M. Daily
by Dudley Jones
Attorney

July 19, 1960 A. M. DAILY 2,946,032

VARIABLE RESISTOR

Filed Sept. 11, 1957 3 Sheets-Sheet 3

Fig. 4.

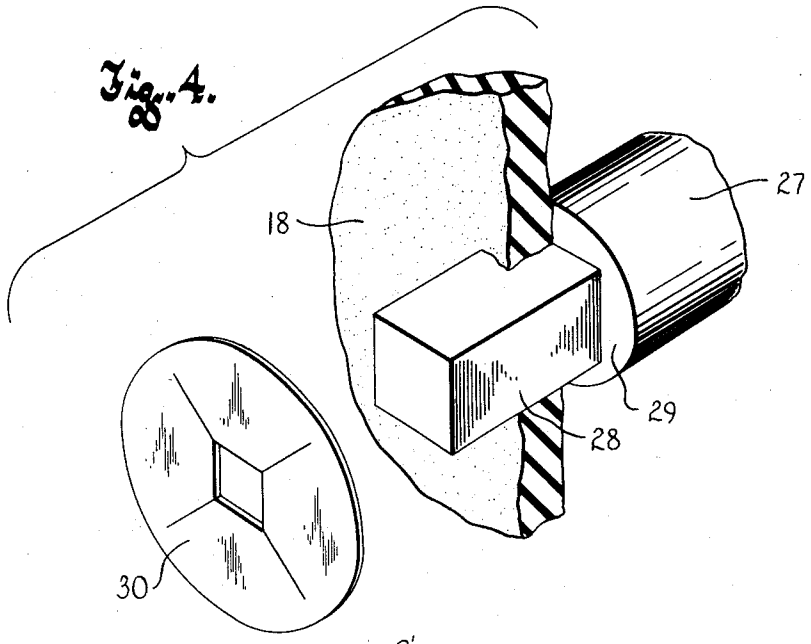
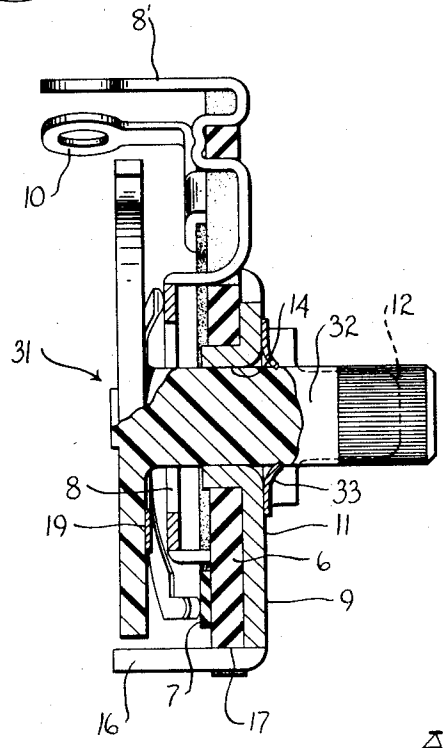


Fig. 5.



Inventor
Arthur M. Daily
By Dudley Jones
Attorney

United States Patent Office 2,946,032 Patented July 19, 1960

2,946,032

VARIABLE RESISTOR

Arthur M. Daily, Edwardsburg, Mich., assignor to CTS Corporation, Elkhart, Ind., a corporation of Indiana

Filed Sept. 11, 1957, Ser. No. 683,239

4 Claims. (Cl. 338—174)

This invention relates to variable resistors and similar controls. Television receivers and other electronic equipment assemblies require many controls which are adjusted only infrequently. These are commonly referred to as pre-set controls. Due to the relatively large number of such controls needed by set manufacturers, a persistent and continuing demand exists for cost and price reductions. One of the largest cost factors is direct labor. Elimination of any step of the manufacturing operation, whether it be piece part production or an assembly operation, may reasonably be expected to yield a savings through a reduction in direct labor costs.

It is, therefore, a primary purpose of this invention to provide a variable resistor of the character described wherein the number of parts is reduced to result in a double labor saving; first, in the cost of producing parts, and, secondly, in the cost of assembling the parts into the finished product.

Many of the circuits in which these pre-set controls are used are adequately shielded and protected from dirt, dust and other injurious elements, or the circuits are not expected to operate under conditions which would require such protection. For such uses, the control requires no separate cover. However, in the conventional variable resistor, the cover, or at least parts thereof, perform functions in addition to that of enclosing the control. Accordingly, this invention has as another of its objects to provide a variable resistor which is completely operative though it has no cover.

With a view toward achieving these general objectives, this invention has as a more specific object, to provide a variable resistor of the character described, wherein the end thrust of the shaft is borne by the mounting plate which is constructed so that it has the strength to carry such end thrust without distortion and thereby insure the maintenance of the desired spring contact pressure without the use of the conventional C washer.

Another object of this invention directed specifically toward the simplification of the control resides in the provision of a stop lug formed integrally with the mounting plate and projecting rearwardly therefrom to cooperate with abutments on the drive arm and thereby obviate the usual cover carried stop ear.

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 herein disclosed 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 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 variable resistor embodying this invention;

Figure 2 is a front perspective view of the variable resistor;

Figure 3 is an exploded perspective view of the various components of the resistor;

Figure 4 is a fragmentary perspective view illustrating a slight modification of one of the details of the device; and

Figure 5 is a longitudinal sectional view through a variable resistor embodying this invention in somewhat different form.

Referring now particularly to the accompanying drawings, it will be seen that the stator assembly of the variable resistor comprises essentially a base **6** of insulating material with an arcuate resistance element **7** and a collector ring **8** mounted on the rear face thereof, and a mounting plate **9** on its front face. In the embodiments of the invention illustrated, the resistance element is fixed to the base by its terminals **10** which overlie the ends of the resistance element and secure the same to the base, preferably in the manner described in United States Patent No. 2,736,783; however, those skilled in the art will appreciate that the resistance element need not be a separate part but instead could be painted or otherwise applied directly to the base, or provided in any other well-known manner.

The collector ring **8** with its integral terminal **8'** is also preferably mounted in the manner shown in Patent No. 2,736,783.

The mounting plate **9** is a sheet metal stamping formed with a flat body portion **11** which overlies a substantial area of the base, and has a pair of twist-type mounting ears **12** extending forwardly from its opposite sides. To mount the control these ears project through a mounting panel (indicated in dotted lines in Figure 1) and have their outer end portions twisted.

A hole in the body portion **11** of the mounting plate accommodates the operating shaft **13** of the rotor assembly, and the edge of this hole is extruded to provide a rearwardly projecting flange **14**. This flange fits snugly into a hole in the base, which hole is concentric with the resistance element and collector ring; and the inside of the flange is accurately sized to receive the shaft **13**. The extruded flange thus accurately positions the mounting plate on the base and provides a smooth correctly positioned bearing for the rotor.

A plurality of legs **15** bent rearwardly from the edge of the mounting plate fit into notches in the periphery of the base and by a staking operation which swages the rearwardmost ends of the legs **15**, the mounting plate and base are secured together. The mounting plate also has a leg **16** bent rearwardly therefrom and substantially normal to the plane of the base. This leg is received in a notch **17** in the periphery of the base and extends rearwardly beyond the base to serve as a rotation limiting stop for the rotor assembly.

The rotor assembly consists of the shaft **13**, a drive arm **18**, and a rotatable contactor **19**. The shaft preferably is of the upset type that can be produced on a cold heading machine. Its shank **20** snugly but freely rotatably fits the inside of the flange **14** and a head **21** at the front end of the shaft bears against the front face of the mounting plate to restrain the shaft against rearward axial displacement.

The rear end portion of the shaft is hollow and is reduced in diameter to provide a shoulder **22**. A non-circular, preferably square hole in the drive arm receives the reduced rear end portion of the shaft which is secured therein by a swaging operation which forms a rolled-over edge **23** on the shaft and clamps the drive arm against the shoulder **22**. The swaging tool used to form the rolled-over edge **23** deforms the thin wall of the rear portion of the shaft in a manner to cause it to substan-

tially fill the non-circular hole in the drive arm. Accordingly, the drive arm and shaft are solidly secured together to turn as one.

The drive arm **18** consists essentially of a round disc of insulating material having a short radial projection **24** on its edge. The sides of this projection provide abutments to collide with the leg **16** and define the limits of rotation of the rotor assembly; and to enable the rotor to be turned to adjust the variable resistor, the front end of its shaft has a screw driver slot **25** therein.

The contactor **19** which is clinched onto the drive arm has the customary spring fingers which bear against the resistance element and collector ring. The rearward end thrust imposed upon the rotor assembly as a result of this engagement is, of course, restrained by the head **21** on the shaft bearing against the mounting plate, and since this plate is quite stiff, the correct contact pressure is accurately maintained.

If desired, the metal shaft of the construction described may be supplanted with a shaft **27** molded of suitable insulating material, as shown in Figure 4. In this event, the rearwardmost end portion **28** of the shaft is square beyond a shoulder **29**, to fit the hole in the drive arm and project beyond the rear face of the arm. A spring retaining washer **30** pressed onto this square end portion of the shaft clamps the arm against the shoulder **29** and thus secures the arm to the shaft. The washer **30** is of the type having a plurality of inwardly directed tooth-like serrations which bite into the shaft as the washer is applied.

Another modified embodiment of the invention is illustrated in Figure 5, wherein the shaft and drive arm are one integral molding designated generally by the numeral **31**. In this case, the rotor is assembled with the stator from the rear and the front end portion **32** of the shaft protrudes from the front of the control to be directly grasped and turned to effect adjustment of the control. The rotor and stator are held assembled by means of a spring washer **33** similar to the washer **30**, but to assure correct tension on the spring fingers of the contactor, the shaft has preformed notches into which the teeth of the washer engage. In all other respects, the structure of the modified embodiment of the invention shown in Figure 5 is like that of Figures 1 to 3, inclusive.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in this art that the present invention achieves utmost simplicity and low cost in a variable resistor of the type adapted for use in radio and television receivers. To a large degree this simplification and cost reduction flows from the elimination of the cover with which variable resistors are usually equipped, but, more significantly, it stems from the fact that the mounting plate performs the additional function of defining the limits of rotation of the rotor assembly and thus makes possible the desired reduction in the number of component parts. It will also be apparent that this invention provides an exceptionally shallow control, especially in the form thereof illustrated in Figures 1, 2 and 3, wherein the front end of the rotor shaft lies but a very short distance ahead of the front face of the mounting plate.

What is claimed as my invention is:

1. A variable resistor especially adapted for use as the pre-set control in radio and television receivers, which comprises a stator assembly having a base of insulating material; an arcuate resistance element overlying the rear face of the base and retained thereon by its terminals, and a collector ring also overlying the rear face of the base within the arcuate resistance element; a rotor assembly having a shaft, a drive arm of insulating material fixed to the shaft and having a pair of abutments on the edge thereof, and having spring fingers which bear against the resistance element and the collector ring; said variable resistor being characterized by a stamped metal mounting plate overlying and fixed to the front of the base and having a hole therein, the edge of which is extruded rearwardly to provide a locating flange which is received in a hole in the base and to provide a smooth bearing for the shaft, the shaft being journalled in said flange; abutment means on the shaft bearing against the front of the mounting plate to restrain the rotor assembly against rearward axial displacement; and said mounting plate having a leg bent back from its edge and projecting rearwardly therefrom beyond the base and into the path of the abutments on the drive arm to cooperate therewith in defining the limits of rotation of the rotor assembly.

2. The variable resistor of claim 1 further characterized by the fact that the mounting plate has a plurality of legs bent back from its edge and extending rearwardly through notches in the base of insulating material, said legs being staked at the rear side of the base and thereby securing the base and mounting plate together.

3. A variable resistor having a stator assembly including means providing a resistance path and a collector path concentrically located at one side of a base of insulating material, and a rotatable contactor assembly at said one side of the base and comprising an operating shaft and spring contact fingers which press upon the resistance and collector paths and thereby impose end thrust upon said contactor assembly in the direction tending to separate the two assemblies, characterized by: a stamped metal mounting plate having a hole with an extruded lip providing a bearing for the operating shaft; means connecting the mounting plate and stator assembly in fixed relation to one another with the mounting plate overlying and supportingly engaging a substantial area of the base at the side thereof remote from the contactor assembly, and with said shaft bearing accurately centered with respect to the resistance and collector paths and projecting into the base, the operating shaft passing through the bearing and having an exposed end by which rotation may be imparted to the contactor assembly; and further characterized by abutment means on the contactor assembly bearing against the mounting plate at the side thereof remote from the contactor assembly to transmit to the mounting plate the end thrust imposed upon the contactor assembly by the spring contact fingers as well as any end thrust that may be externally applied to the exposed end of the shaft.

4. The variable resistor of claim 3, further characterized by: mounting ears integral with the mounting plate and projecting substantially perpendicularly outwardly from the periphery thereof at widely spaced points, so that said mounting ears are remote from the bearing, said mounting ears having means integrally formed thereon to secure the resistor to a panel and by their attachment to the panel holding the stator assembly of the resistor against rotation.

References Cited in the file of this patent

UNITED STATES PATENTS

804,232	Jackson	Nov. 14, 1905
2,069,440	Hathorn	Feb. 2, 1937
2,484,667	Arisman et al.	Oct. 11, 1949
2,593,332	Mucher	Apr. 15, 1952
2,594,493	Puerner	Apr. 29, 1952
2,639,358	Budd et al.	May 19, 1953
2,661,415	Daily et al.	Dec. 1, 1953
2,745,927	Daily et al.	May 15, 1956
2,858,397	Littleton	Oct. 28, 1958
2,861,158	Jarvis	Nov. 18, 1958