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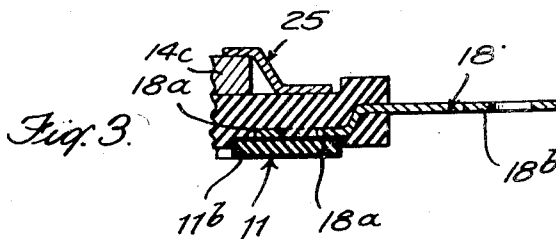
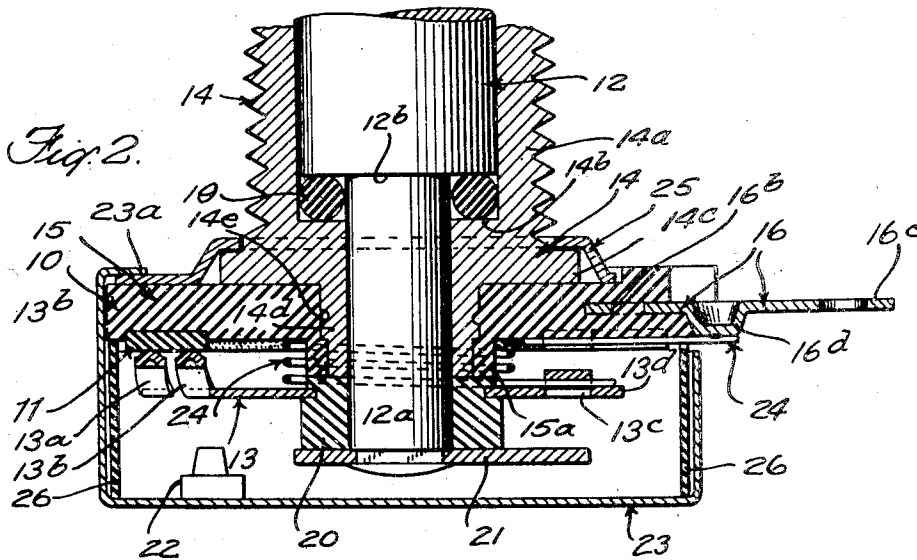
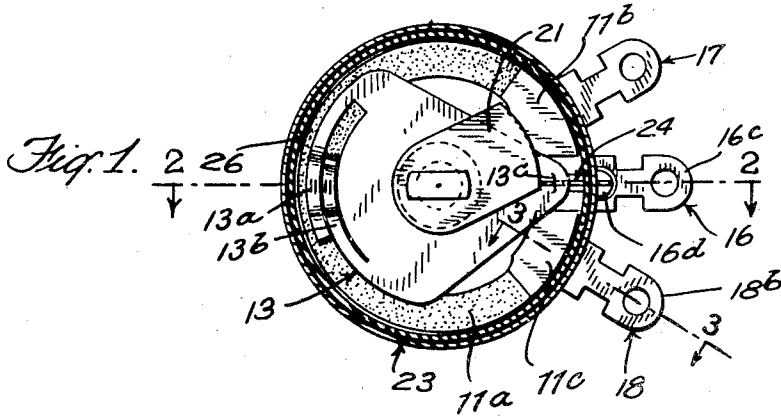
E. G. LODGE

2,437,166

VOLUME CONTROL

Filed June 2, 1944

4 Sheets-Sheet 1



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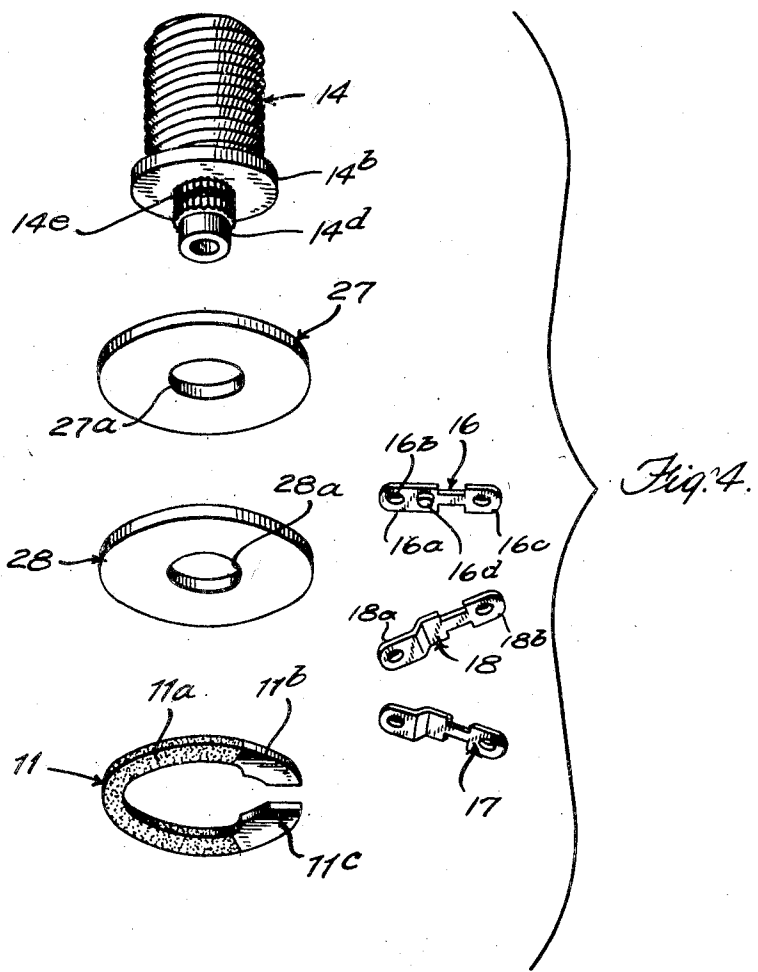
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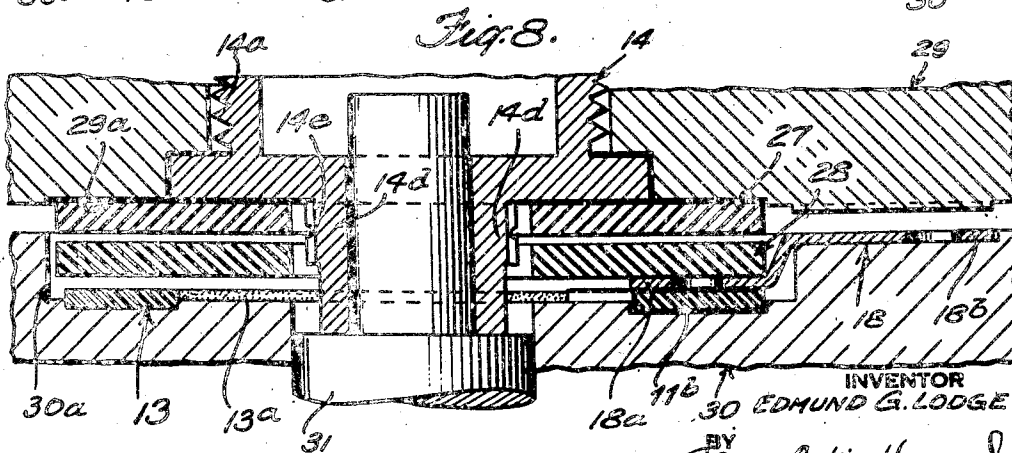
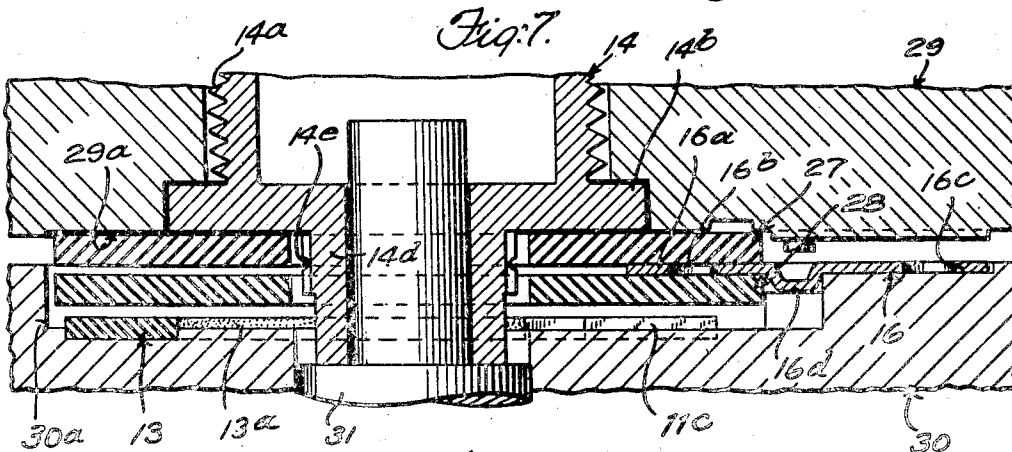
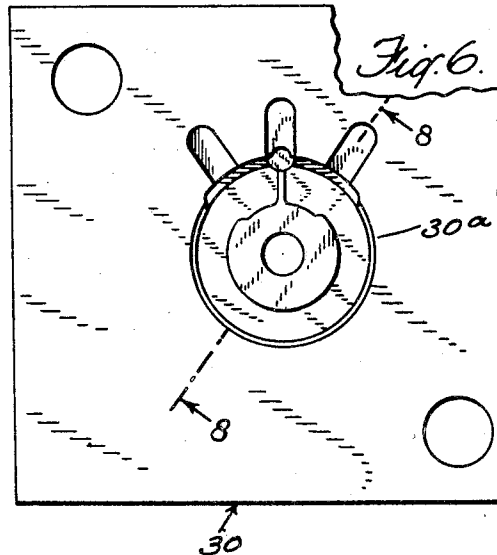
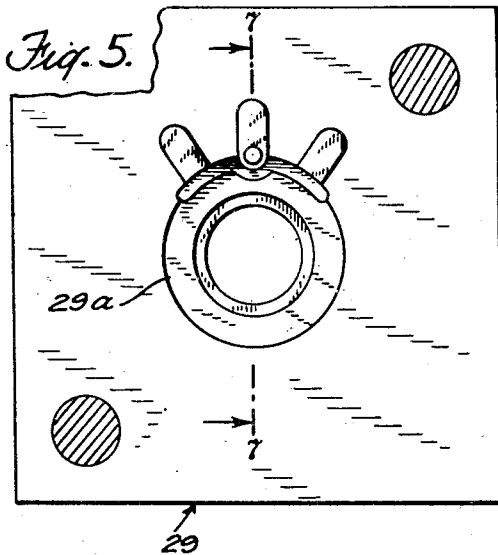
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Filed June 2, 1944

4 Sheets-Sheet 3



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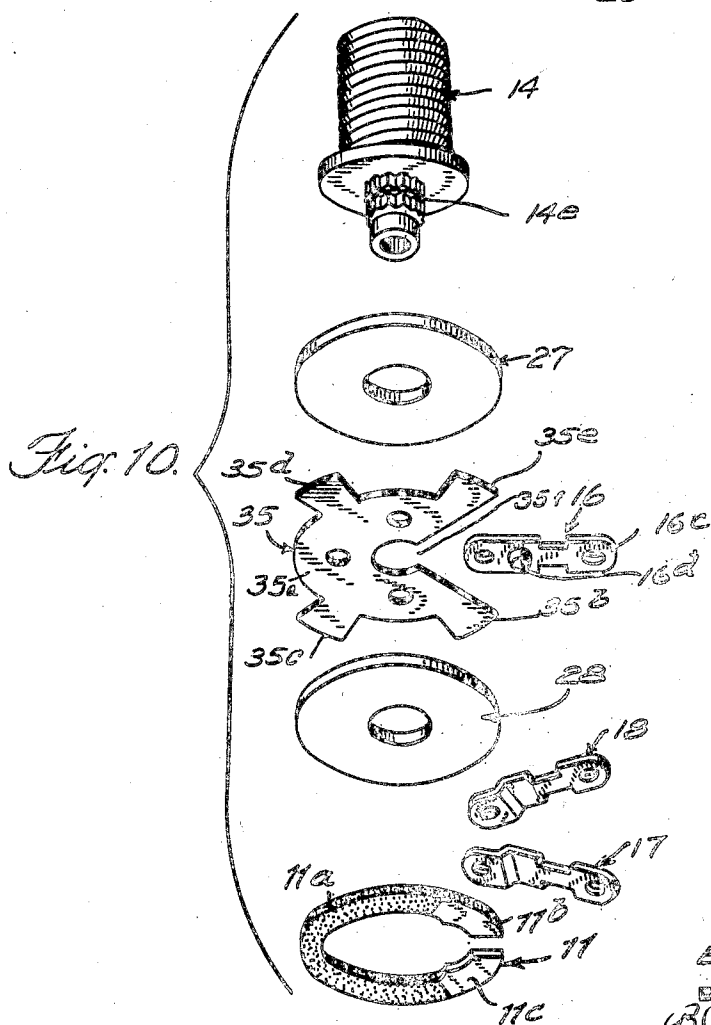
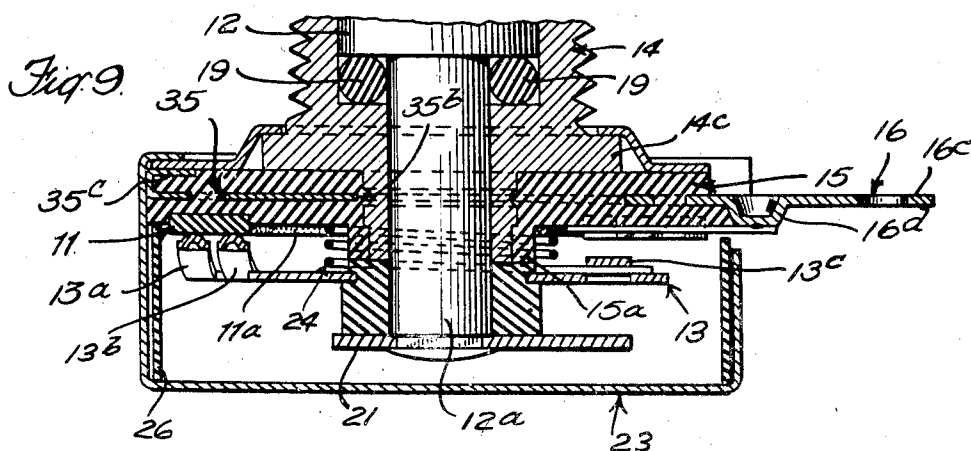
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VOLUME CONTROL

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,437,166

VOLUME CONTROL

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Application June 2, 1944, Serial No. 538,389

8 Claims. (Cl. 201—55)

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This invention relates to a rheostat or the like particularly suited for volume and tone control in radio and a method of making the same.

One of the objects of this invention is to provide a volume control structure which will be simple, practical and thoroughly durable. Another object is to provide a method of producing such a volume control wherein the usual number of assembly operations is materially reduced. Another object is to provide a method of producing such a volume control in which important economies are achieved by a reduction in number of parts and the expense of such parts. Another object is to provide such a method of producing a volume control wherein the resultant costs of manufacture are materially reduced. Another object is to provide such a volume control and method wherein a unitary structure comprising a major portion of the control is produced in a single quick operation. Another object is to provide for use of elements in such an operation which have been previously completed with all desired resistance characteristics. Another object is to provide such a control and method in which the electrical connection between the terminals and resistance element is reliable and of highest quality. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangements of parts and in the several steps and relation and order of each of the same to one or more of the others, all as will be illustratively described herein, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of the various possible embodiments of this invention:

Figure 1 is a top plan view of the volume control with the cover removed;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1 on a slightly enlarged scale and with the cover assembled on the unit;

Figure 3 is a fragmentary sectional view taken along the line 3—3 of Figure 1;

Figure 4 is an exploded perspective of certain parts of the control before the major assembly operation;

Figure 5 is a fragmentary plan view of the

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upper section of a mold used during such assembly operation;

Figure 6 is a plan view of the bottom section of such mold;

Figure 7 is a fragmentary sectional view of the mold and parts to be molded just prior to the molding operation and taken generally along the line 7—7 of Figure 5 but including both upper and lower mold sections;

Figure 8 is a fragmentary sectional view similar to Figure 7 but taken along the line 8—8 of Figure 6;

Figure 9 is a fragmentary sectional view of the embodiment of Figure 9 and similar to the lower portion of Figure 2; and

Figure 10 is an exploded perspective similar to Figure 4 but showing another embodiment of the invention.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring to Figures 1 and 2, the volume control comprises generally a base assembly generally indicated at 10, including a resistance element 11, an operating shaft 12, and an armature part 13 secured to the shaft and contacting the element.

Base assembly 10 is a unitary structure in which the various individual parts have been molded into a unit in a manner to be later described. It includes the central bushing 14 having an enlarged threaded neck portion 14a for reception of the shaft 12 and an annular shoulder portion 14b. Bushing 14 also includes an annular flange part 14c and extending therefrom is a sleeve portion 14d through which the reduced portion 12a of the shaft 12 extends. A molded base 15 which is a part of the base assembly 10 and which is preferably a plastic having dielectric properties, such as phenolic condensation product, rests on the lower side of the flange portion 14c and extends outwardly therefrom as viewed in Figure 2. Base portion 15 also includes a portion 15a fitting snugly about sleeve portion 14d.

Preferably there is an annular groove 14e in sleeve portion 14d and the material of the base 15 is molded to fill this groove.

The resistance element 11 which is shown as a separate part in Figure 4 before the molding operation comprises a circular, fibrous strip hav-

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ing a resistance coating 11a applied thereto and highly conductive coatings 11b and 11c covering and enveloping all sides of the opposite ends thereof. The resistance coating 11a is preferably a graphite or carbon deposition in a plastic binder such as any well-known varnish. This coating may be applied by spraying, dipping, or other methods and a variety of final resistance characteristics, such as complex tapers and gradients, may be given the resistance element in accordance with well-known accepted practice. The coatings 11b and 11c are preferably metallic, such as silver, and applied by spraying, painting, sputtering or other methods.

Referring back to Figures 1 and 2, element 11 is partially sunk in the base 15 during the molding operation so that a binding connection, such as a bond, is formed between base and element. The element is thus positioned in the base with its end portions adjacent the opposite sides of a central terminal 16, as best seen in Figure 1.

Central terminal 16 and side terminals 17 and 18 all have portions embedded in the base 15 during the molding operation and portions extending radially from the base for easy electrical connection. Thus terminal 16 includes an embedded portion 16a with a hole 16b and a protruding portion 16c. A pimple 16d is provided in terminal 16 adjacent the periphery of base 15, for purposes of electrical connection, as will be later fully explained. The structure and assembly of terminals 17 and 18 and adjacent portions of the base 15 are identical and thus the following description is limited to terminal 18. As best shown in Figure 3, terminal 18 comprises an embedded portion 18a and a portion 18b extending therefrom. The embedded portion 18a is in close contact with the metallic coating 11b on the element 11. As these parts are molded into this position and thus after molding held firmly against displacement as well as sealed against atmospheric conditions, such electrical connection is well able to withstand adverse conditions in usage.

The shoulder 12b formed by the reduced portion 12a of the shaft 12 rests upon a packing ring 19 of any suitable composition. A collar 20 is secured to the shaft 12 and rests upon the sleeve portion 14d of the bushing while a stop arm 21 is secured below the collar as viewed in Figure 2, for example, by heading over the end of the shaft. Stop arm 21 may cooperate with a stop 22 diagrammatically indicated in the drawings and so located on the cup-shaped casing 23 as to stop rotation of the armature arm as its contacting brush portions reach points adjacent the ends of the element.

The armature arm 13 is preferably substantially triangular in shape and includes two cut-out brush portions 13a and 13b which are bent downwardly to engage the adjacent surface of the resistance element. The brush portions are preferably resilient in character to maintain a close running contact with the element at all positions of the armature arm. A coil wire connector 24 has one end supported by a lanced portion 13c of the armature arm and connected to the arm at 13d; the other end is connected to the pimple 16d on terminal 16; such connections may be achieved by welding or other well-known manner.

A ground plate 25 fits over flange portion 14c of the bushing and extends outwardly to rest on the base 15. Plate 25 is held in position by a suitable number of ear portions 23a of the casing 23 bent down thereon during assembly. An

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insulating ring 26 is disposed within the casing 23 adjacent the side wall thereof.

Accordingly, there is provided a volume control which is simple in construction and operates with ease. Furthermore, it will be noted that the main portion of this volume control comprises the base assembly 10. The other parts of the control may be easily fitted into position on the base assembly thus making for a rapid completion of the control once the base assembly is provided. An important aspect of this invention is the provision of a rapid and efficient method of manufacturing these base assemblies.

More particularly, this method comprises a molding operation involving the parts shown in Figure 4 comprising the bushing 14, the element 11, the terminals 16, 17, and 18 and two sheets 27 and 28 of resin-impregnated fibrous material which may be uncured or partially cured. The surface of sleeve portion 14d of the bushing adjacent annular groove 14e is knurled and slightly larger in diameter than holes 27a and 28a provided in the sheets 27 and 28. The resistance element 11 is prefabricated in the manner described above so that it is provided with the proper and desired resistance characteristics. The parts are then ready for the molding operation and they are molded in the relation indicated by exploded perspective in Figure 4.

To be specific, sheet 27 is slipped down upon sleeve portion 14d of the bushing until it rests flat against the flange portion 14c thereof. The sheet 28 is similarly related to the bushing and the left-hand portion of the terminal 16, as viewed in Figure 4, is slipped between the sheets 27 and 28. The element 11 rests against the sheet 28 with the inwardly-extending portions of terminals 17 and 18 resting beneath the coatings 11b and 11c thereon. This is the position of parts shown in Figures 7 and 8.

The parts shown in Figure 4 may be molded into the base assembly 10 by any of several well-known methods, all depending upon particular manufacturing conditions. Thus an upper mold section 29 (Figure 5) and a lower mold section 30 (Figure 6) may be utilized having cavities 29a and 30a shaped to provide the desired form of base assembly suitable for a particular volume control construction. It will be understood that such a base assembly is a basic part of any volume control, and thus this method is not limited to a particular construction, such as the volume control structure hereinabove described. However, where such base assembly is to be used in the above volume control, cavities 29a and 30a will take the shape indicated.

Immediately prior to the actual molding operation, i. e., before pressure and heat are applied to the parts and the top and bottom sections of the mold brought together, the parts of the base assembly and the mold sections will have the positions shown in Figures 7 and 8. In addition to the upper and lower mold sections 29 and 30, there is a plunger 31 extending into the sleeve portion 14d of the bushing and supporting the bushing and related parts in relation to the lower mold 30. Upon the application of heat and pressure, the sheets 27 and 28 are reduced to a plastic state and merge with each other to become the unitary and integral base 15. The terminals 16, 17, and 18 and the element 11 assume the positions described above and shown in Figures 1 and 2, and thus when the mold sections are separated, the base assembly is complete. Element 11 is firmly embedded in and bonded to the base

15. All of the terminals are embedded in the base with the terminals 17 and 18 in electrical contact with the conductive coatings 11b and 11c of the element. The resistance coating 11a on the element 11 is baked thereon prior to this molding operation at a temperature in the neighborhood of 200° C. The above molding operation may be successfully carried on at temperatures in a range of 150° to 160° C., materially below the baking temperature of the element. Thus it has been found in practice that this molding operation has practically no effect on the resistance characteristics of the element. The most the molding operation might do would be to lower the resistance value of the element. Hence, allowance for any such changes in resistance value can be predetermined and taken care of in advance. The molding operation will not vary any complex tapers applied to the resistance element prior thereto.

In the embodiment of the invention shown in Figures 9 and 10, the various parts are preferably identical with those described above and related in the same manner except for the addition of a plate 35 embedded in the base 15. This plate 35, formed from a good heat conducting metal such as copper, preferably takes the shape best seen in Figure 10. Thus there is a substantially circular central portion 35a and radially extending leg portions 35b, 35c, 35d and 35e. The legs 35b and 35e border a V-shaped opening terminating in a central aperture 35f.

The base assembly may be molded in a single molding operation such as described above, the parts being related in the mold in the relative positions shown in Figure 10. Thus after the completion of the molding operation, the base assembly unit includes the plate 35 having its legs extending radially from the base 15. The legs are then bent back over the top portion of the base as viewed in Figure 9, and after final assembly of the parts the ground plate 25 rests on the legs and on flange part 14c of the bushing.

In operation the resistance element heats the base 15, but this heat is distributed throughout the base by the plate 35 to avoid hot spots at any particular point. Furthermore, plate 35 aids in the rapid dissipation of heat so generated by conducting the heat to the ground plate 25 which is connected to the bushing 14 and the cover plate 23 which are exposed to the atmosphere.

Accordingly, by this method a construction is achieved wholly lacking in rivets, eyelets, or like parts. No stamping or tacking operations are necessary in the assembly of this control and the primary parts comprising the bushing, base, terminals and elements are all assembled in a single simple molding operation. Further still the resistance element may be preformed to meet any given set of specifications and then assembled to become a bonded section of the base assembly without any complicated operations. Thus the various objects hereinbefore mentioned are successfully accomplished in a practical manner.

As many possible embodiments may be made of the mechanical features of the above invention and as the art herein described might be varied in various parts, all without departing from the scope of the invention, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In the art of assembling a volume control part including a base of insulating plastic, a cen-

tral bushing, terminals, and a resistance element comprising an insulating core coated with resistance material, the steps comprising completing the resistance element with the desired resistance characteristics and form to be used in the volume control when completed, relating the parts with terminals in electrical contact with spaced points on the element, and molding the plastic about the parts to provide a base with the completed element bonded to one side thereof and with portions of the terminals embedded in the base and in contact with said element.

2. In the art of assembling a volume control part including a base of insulating plastic, a central bushing, terminals, and a resistance element comprising an insulating core coated with resistance material, the steps comprising completing a resistance element having desired resistance characteristics and form to be used in the volume control when completed, and molding a base and terminals in position so that the element is bonded to the base and the terminals are electrically connected to the element at spaced points.

3. The method of assembling a resistance element and the base of a volume control, comprising the steps of coating a dielectric strip and baking the strip to provide a resistance element having proper characteristics, and heat molding the preformed element upon a plastic base portion to form a bond therebetween without varying materially the resistance characteristics of the element.

4. The method of assembling a resistance element and the base of a volume control, comprising the steps of coating a dielectric strip and baking the strip to provide a resistance element having proper characteristics, and heat molding the preformed element upon a plastic base portion, the molding temperature being below the baking temperature to form a bond therebetween without varying materially the resistance characteristics of the element.

5. The method of assembling a volume control base with its resistance element, comprising preforming the resistance element with the desired characteristics by baking, relating the element with a sheet of resin-impregnated fibrous material which has not been completely cured, and applying heat and pressure to the sheet and element to mold them together to form a bond therebetween without varying materially the resistance characteristics of the element.

6. The method of assembling a volume control base with its resistance element, comprising preforming the resistance element with the desired characteristics by baking, relating the element with a sheet of resin-impregnated fibrous material which has not been completely cured, and applying heat and pressure to the sheet and element to mold them together, the molding temperature being such as to avoid damaging the resistance characteristics of the element.

7. The method of assembling a volume control base with its resistance element, comprising preforming the resistance element the desired resistance characteristics of which may be changed materially by excessive heat, and heat molding the element to a plastic base to form a bond therebetween, said molding operation being at a temperature sufficiently low to avoid varying materially the resistance characteristics of the element.

8. The method of assembling a resistance element and the base of a volume control, comprising the steps of heating a strip at a tempera-

ture in the neighborhood of 200° C. to form a resistance element having the proper characteristics and heat molding the element to a plastic base at a temperature in the neighborhood of 150° C. to form a bond between the element and the base without varying materially the resistance characteristics of the element.

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