

May 18, 1954

J. P. SMITH, JR.
ELECTRICAL DEVICES SUCH AS ATTENUATORS,
POTENTIOMETERS, RHEOSTATS, ETC

2,678,985

Filed Nov. 15, 1951

2 Sheets-Sheet 1

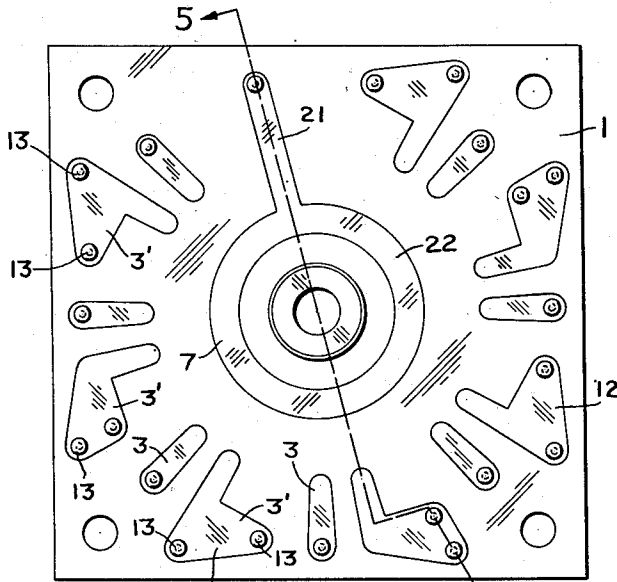


FIG. 2

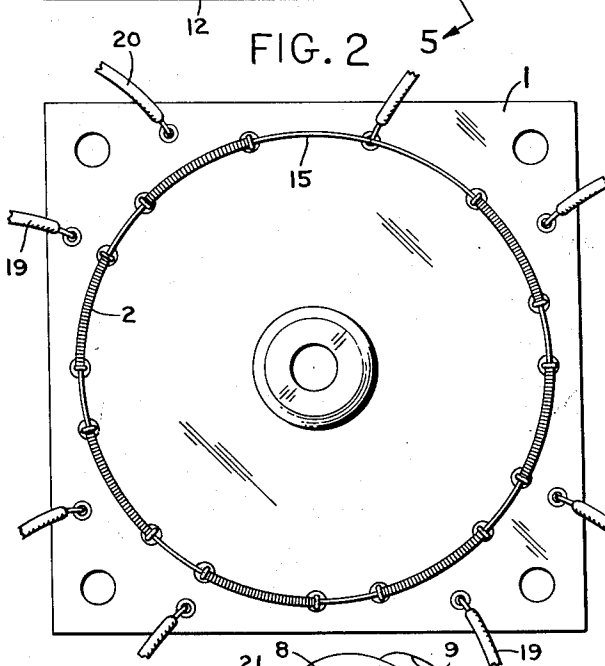


FIG. 4

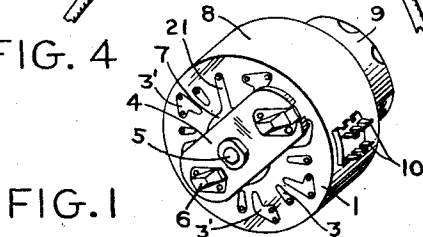


FIG. 1

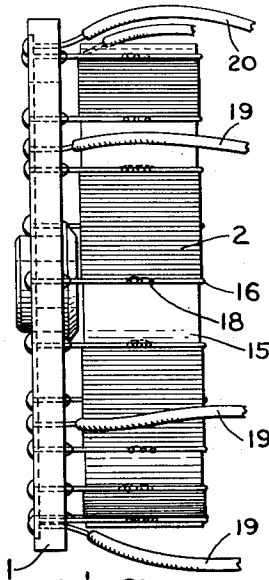


FIG. 3

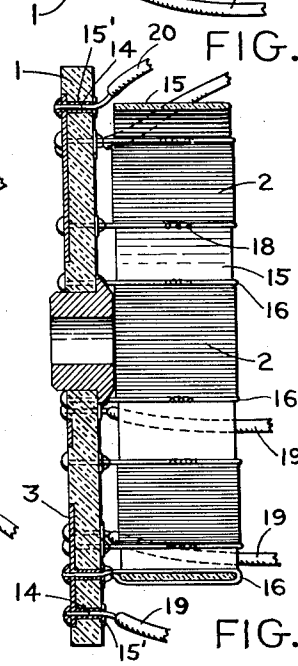


FIG. 5

JOHN P. SMITH, JR.
INVENTOR.

BY *Roland Meyer*
attorney

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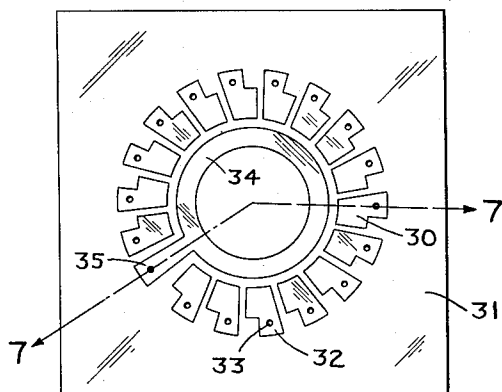


FIG. 6

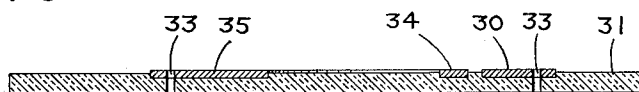


FIG. 7

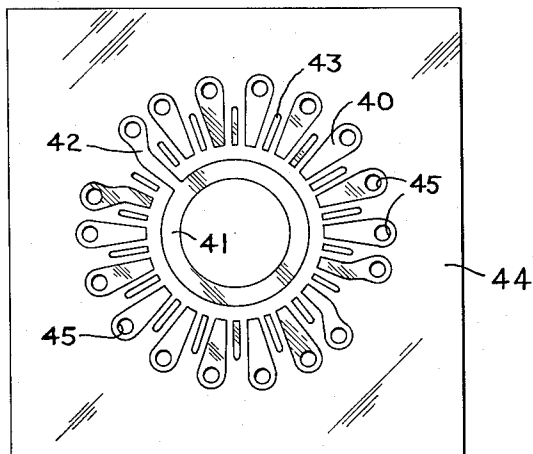


FIG. 8

JOHN P. SMITH, JR.
INVENTOR.

BY *Robert M. Meyer*
attorney

UNITED STATES PATENT OFFICE

2,678,985

ELECTRICAL DEVICES SUCH AS ATTENUATORS, POTENTIOMETERS, RHEOSTATS, ETC.

John P. Smith, Jr., Verona, N. J., assignor to The Daven Company, Newark, N. J., a corporation of New Jersey

Application November 15, 1951, Serial No. 256,555

12 Claims. (Cl. 201—48)

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This invention relates to electrical devices such as attenuators, potentiometers, rheostats, etc. used in communication circuits, and an object of the present invention is to provide such devices wherein the cost of material embodied therein and the cost of labor in assembly and wiring of the devices would be materially reduced over that for manufacturing similar devices of present day approved construction.

Another object of the present invention is to provide electrical devices as specified embodying printed circuits, i. e., wherein the circuits are formed upon the insulating panel or plate by any approved printing process and have their outer surfaces flush with the face of the insulating panel, whereby any size and shape of contact may be employed thus reducing switch arm rock and permitting a decrease in the number of contacts required in any circuit over those required in conventional devices, as well as materially reducing the amount of work required in connecting the various wires of the instrument to the contacts.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing electrical devices such as attenuators, potentiometers, rheostats, etc. of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a perspective view of an attenuator constructed in accordance with the present invention.

Figure 2 is a front view of the contact carrying insulating panel of the instrument.

Figure 3 is an edge elevation of the contact carrying insulating panel showing resistance coils and other wires connected thereto.

Figure 4 is a back view of the contact carrying insulating panel shown in Figure 1 showing the various resistance coils and wires connected thereto.

Figure 5 is a cross section taken on the line 5—5 of Figure 1.

Figure 6 is a front view of a modified form of the contact carrying plate.

Figure 7 is a cross section taken on the line 7—7 of Figure 6.

Figure 8 is a front view of another form of the contact carrying plate.

Referring more particularly to the drawings,

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Figure 1 shows an attenuator embodying the present invention and while an attenuator of a balanced ladder network structure is shown in Figure 1 of the drawings, it is to be understood that the present invention is applicable for use in attenuators, potentiometers, rheostats, balanced and unbalanced ladder attenuators, lever type attenuators, T attenuators, H attenuators, decade resistor units, single and multiple deck switches and other analogous instruments or devices wherein the structure of the present invention is applicable.

The attenuator shown in Figure 1 of the drawings includes the usual contact carrying plate 1 which is made of insulating material and to the back of which the various resistance coils 2 are attached and connected to the contacts 3 carried by the face of the insulating plate or panel 1. A switch arm 4 is carried by a shaft 5 and has switches 6 thereon which move over the contacts 3 for closing circuits through various of these contacts 3 and the central ring contact 7. The shaft 5 extends through the housing 8 of the attenuator and has an operating knob 9 thereon by means of which the shaft 5 is manually rotated for moving the switch structure 6 over the contacts 3. The input and output connections to the attenuator are made through various posts 10.

The above described construction is common in all electrical instruments of this type and the switch structures 6 shown in Figure 1 of the drawings are shown as switch structures of the type covered by U. S. Patents 2,424,745 and 2,430,215, although it is understood that any suitable type of switch structure may be employed without departing from the spirit of the present invention.

In the past the contacts of the electrical instruments of the type herein referred to have been made in the form of individual contacts attached to the insulating plate and projecting therefrom, necessitating considerable work in the construction and attachment of the contacts to the insulating plate or panel, as well as considerable work in making the proper wiring connections to the various contacts.

The form of the invention shown in Figures 1 to 5 of the drawings comprehends the provision of an instrument of this type wherein the contacts 3 are made by what is known as a printing process and imbedded in the insulating material of the panel 1. The outer faces of the contacts may be flush with the outer surface of the panel as is clearly shown in Figure 5 of the drawings

or they may project slightly therefrom as shown in Figures 6 and 7 of the drawings. One such method of making such insulating panels is disclosed in application Serial No. 181,159 filed August 24, 1950, now abandoned. The present invention does not incorporate the method of making the contact carrying insulating plate or panel 1 and the method of applying the contacts thereto.

The making of the contacts by the "printed" process permits contacts in Figure 1 of the drawings in lieu of the cylindrical button type contacts heretofore employed, thus reducing switch arm rock and permitting a decrease in the number of contacts required since contacts such as those indicated at 3' may be provided which have enlarged sections 12 permitting the connection of two wires to one contact and the spacing of such connections as shown at 13 sufficient distances apart to facilitate the ease in the making of the connections with the wires. The contacts 3 and 3' and the insulating plate or panel 1 has openings drilled therethrough as shown at 14 and the wires to be connected to the contacts are inserted through these openings and permanently connected by a spot of solder to the contacts 3 or 3'. Figure 5 of the drawings shows eyelets 15' inserted in the openings 14 but if it is desired these eyelets may be eliminated. The making of the panel 1 by the "printed" process lends itself to simple and novel construction and attachment of the various electrical resistance coils 2 and their method of attachment to the panel 1 and connection to the contacts 3 or 3'. The wires of the resistance coils 2 are wound about a ring or strip 15 of insulating material and the strip or ring 15 has attaching supporting wires 16 looped thereabout one end of which wires extends through certain of the openings 14, as shown at the lower end of Figure 5 of the drawings, and is soldered to one of the contacts. The other end of the looped wire 16 is soldered to the end of the wire 16 which extends through the opening 14 at the inner side of the insulating plate or panel 1 thus rigidly connecting the ring 15 to the insulating plate or panel 1. One of these looped wires 16 is located at each end of each of the coils 2 and the ends of the wires forming the resistance coils 2 are supportably connected to the wire 16 as shown at 18 thus providing a simple, neat construction.

The output wires indicated at 19 extend through other of the openings 14 and are soldered to the respective contacts 3'. It will be noted that all of the points of soldering of the wires to the various contacts 3 and 3' are outwardly of the sweep of the switches 6 so that the contacts of the switches will only move over the surfaces of the contacts. The power input wire 20 is connected to the radially extending arm 21 which is a part of the inner ring contact 22. The inner ring contact 22 and the arm 21 likewise may have its outer surface flush with the face of the insulating panel, or only slightly raised therefrom.

In Figures 6 and 7 of the drawings the contacts 33 are imbedded in the insulation plate 31 and have their outer switch engaged surfaces raised slightly, only a small fraction of an inch above the surface of the insulation plate 31 and they have "tails" or connection projections or elongations 32 formed integrally thereon. Small openings 33 are provided through the connection projections 32 and through the insulation plate 31, through which wires (not shown) are projected and attached to the connection projec-

tions 32 by a spot of solder as shown and described in connection with Figures 1 to 5 of the drawings. The connection elongations 32 extend beyond the sweep of the switch member (not shown) as in Figures 1 to 5 of the drawings. The central ring contact 34 is likewise imbedded in the insulating plate 31 and has its outer surface projecting from the surface of the insulation plate 31 the same distance as the distance of projection of the contacts 30. A connection projection 35 is formed integrally with the ring contact 34, projects beyond the sweep of the switch member and has a wire receiving opening therethrough. The resistance coils of the instrument are attached to the insulation plate 30 in the same manner as described in connection with Figures 2 to 5 of the drawings.

The contact carrying panel shown in Figures 6 and 7 of the drawings is particularly adaptable for use in instruments providing "make-before-break" switch panels construction wherein it is one of the purposes of the contacts to keep the switch arm from touching the insulating plate, causing it to always ride on metallic contact members so as never to open the circuit.

In some instruments it is desirable to provide a "break-before-make" operation and a contact carrying plate for use in such instruments is shown in Figure 8 of the drawings.

In the form of the invention shown in Figure 8, a plurality of "live" contacts 40 are arranged in a concentric circle about the inner ring contact 41 like in the other forms of the invention shown in Figures 1 to 7 inclusive. The ring contact has a connection projection 42 formed integrally therewith and extending radially between two of the contacts 40. Metal segments 43 are placed between the adjacent contacts 40 and between the connection projection 42 and the contacts 40 adjacent thereto. The metal segments 43 are "dead" segments, that is, they have no wires connected thereto. This construction keeps the rotating switch arm (not shown) from dragging across the insulating material, yet provides break-before-make operation. The contacts 40, ring 41, the connection projection 42 and the "dead" segments 43 are all imbedded in the insulating plate 44, and have their outer faces projecting slightly from the surface of the insulating plate 44 as in the form of the invention shown in Figures 6 and 7 of the drawings, and the contacts 40 and connection projection 42 have holes 45 drilled therethrough which extend through the insulating plate 44 to permit wire connections as shown in Figure 5 of the drawings. It is understood that the resistance coils may be employed with this form of the invention as disclosed and described in connection with Figures 1 to 5 of the drawings.

While in the drawings and the foregoing description the stationary contacts and metal segments of the electrical device are shown and described as wholly or partially imbedded in the plastic insulating material, it is to be understood that they may be formed upon the insulating plate by any of the approved "printing" methods well known, and be wholly free from any imbedding in the insulating plate without departing from the spirit of the present invention.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

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What is claimed is:

1. In an electrical instrument for use in audio communication, an insulating switch plate, a plurality of flat plates forming stationary electrical current conducting contacts imbedded in said insulating plate, said contact forming plates having all of their outer flat surfaces parallel with the outer surface of said insulating plate, electrical resistance coils at the inner surface of said insulating plate, said insulating plate and said stationary contacts having openings therethrough, and connecting wires from said resistance coils extending through said openings and soldered to said contacts.

2. In an electrical instrument for use in audio communication, an insulating switch plate, a plurality of flat plates forming stationary electrical current conducting contacts carried by said insulating plate, said contact forming plates having all of their outer flat surfaces parallel with the outer surface of said insulating plate, electrical resistance coils at the inner surface of said insulating plate, said insulating plate and said stationary contacts having openings therethrough, connecting wires from said resistance coils extending through said openings and soldered to said contacts, certain of said contacts having second openings extending therethrough and through the insulating plate, and output wires extending through said second openings and connected to the contacts.

3. In an electrical instrument for use in audio communication, an insulating plate, a plurality of flat plates forming stationary electrical conducting contacts arranged in spaced relation about the axis of said insulating plate and imbedded in the insulating plate and having all of their outer flat surfaces parallel with the outer surface of said insulating plate, a ring contact concentric of the axis of said insulating plate and located inwardly of said spaced contacts, a radially extending connection arm formed thereon, said ring contact and connecting arm imbedded in said insulating plate, electrical resistance coils at the inner surface of said insulating plate, said insulating plate and said spaced stationary contacts having openings therethrough, connecting wires from said resistance coils extending through said openings and soldered to said contacts.

4. In an electrical instrument for use in audio communication, an insulating plate, a plurality of stationary electrical conducting contacts arranged in spaced relation about the axis of said insulating plate, a ring contact concentric of the axis of said insulating plate and located inwardly of said spaced contacts, a radially extending connection arm formed thereon, said ring contact and connecting arm carried by said insulating plate, said insulating plate and said stationary contacts having openings therethrough, a band of insulating material at the inner side of said insulating plate, a plurality of electrical resistance coils wound in spaced relation on said band, looped supporting wires extending transversely across said band and having one of their ends extending through certain of said openings and soldered to certain of the contacts, the ends of said resistance coils connected to said supporting wires to establish connection between the coils and contacts.

5. In an electrical instrument for use in audio communication, an insulating plate, a plurality of stationary electrical conducting contacts arranged in spaced relation about the axis of said

insulating plate, said insulating plate and said stationary contacts having openings therethrough, a band of insulating material at the inner side of said insulating plate, a plurality of electrical resistance coils wound in spaced relation on said band, looped supporting wires extending transversely across said band and having one of their ends extending through certain of said openings and soldered to certain of the contacts, the ends of said resistance coils connected to said supporting wires to establish connection between the coils and contacts, certain of said spaced contacts having laterally extending enlargements formed integrally therewith, output wires connected to said laterally extending enlargements, a ring contact concentric of the axis of said insulating plate and inwardly of the inner ends of the spaced contacts, a connection arm formed integrally with said contact ring and extending radially to a point near the outer edge of the insulating plate.

6. An electrical instrument as claimed in claim 4 including metal segments positioned between adjacent contacts, said segments being free from connection in the electrical circuit of the instrument.

7. An electrical instrument as claimed in claim 4 wherein said stationary contacts have their outer surfaces projecting slightly from the face of the insulating plate and wherein said stationary contacts have elongations formed thereon, said elongations and insulating plate having wire receiving openings therethrough.

8. In an electrical instrument for use in audio communication, an insulating switch plate, a plurality of flat plates forming stationary electrical current conducting contacts carried by said insulating plate and having all of their outer flat surfaces parallel with the outer surface of said insulating plate, a switch member embodying movable contacts for movement over and engagement with said stationary contacts, said stationary contact-forming flat plates being of elongated shape and having wire connection portions projecting beyond the arc of the sweep of said switch, said wire connection projecting portions and said insulating plate being provided with openings extending therethrough and wires inserted through said openings and connected to the contacts at a point beyond the arc of the sweep of the switch member.

9. In an electrical instrument for use in audio communication, an insulating switch plate, a plurality of stationary electrical current conducting contacts imbedded in said insulating plate with their entire outer surfaces parallel to and substantially flush with one surface of said insulating plate, a switch member embodying movable contacts for movement over and engagement with said stationary contacts, said stationary contacts including wire connection portions parallel to and substantially flush with the contact carrying surface of said insulating plate and projecting beyond the sweep of said switch member, said insulating plate and said wire connection portions having holes drilled there-through to receive electric current conducting wires for solder connection to said contacts.

10. In an electrical instrument for use in audio communication, an insulating switch plate, a plurality of stationary electrical current conducting contacts imbedded in said insulating plate with their entire outer surfaces parallel to and substantially flush with one side of said insulating plate, a switch member embodying mov-

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able contacts for movement over and engagement with said stationary contacts, said stationary contacts including wire connection portions parallel to and substantially flush with the contact carrying surface of said insulating plate and projecting beyond the sweep of said switch member, said insulating plate and said wire connection portion having holes drilled therethrough to receive electric current conducting wires for solder connection to said contacts, said stationary contacts being arranged in a circle concentric of the axis of said insulating plate, the alternate stationary contacts having their portions beyond the arc of the sweep of said switch member enlarged, said enlarged portions provided with a plurality of openings therethrough to permit connection of a plurality of wires thereto and said enlarged portions lying parallel to and substantially flush with the contact-carrying face of said insulating plate.

11. An electrical instrument as claimed in claim 10 including a ring contact concentric of the axis of said insulating plate and inwardly of the

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spaced stationary contacts, and a wiring connection arm formed integrally with said ring contact and projecting radially therefrom to a point beyond the arc of the sweep of said switch member.

12. An electrical instrument as claimed in claim 11 wherein said ring contact and said connecting arm are imbedded in said insulating plate and have their outer surfaces substantially flush with the stationary contact carrying face of the insulating plate and wherein said wiring connection arm lies wholly within the area of said insulating plate.

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