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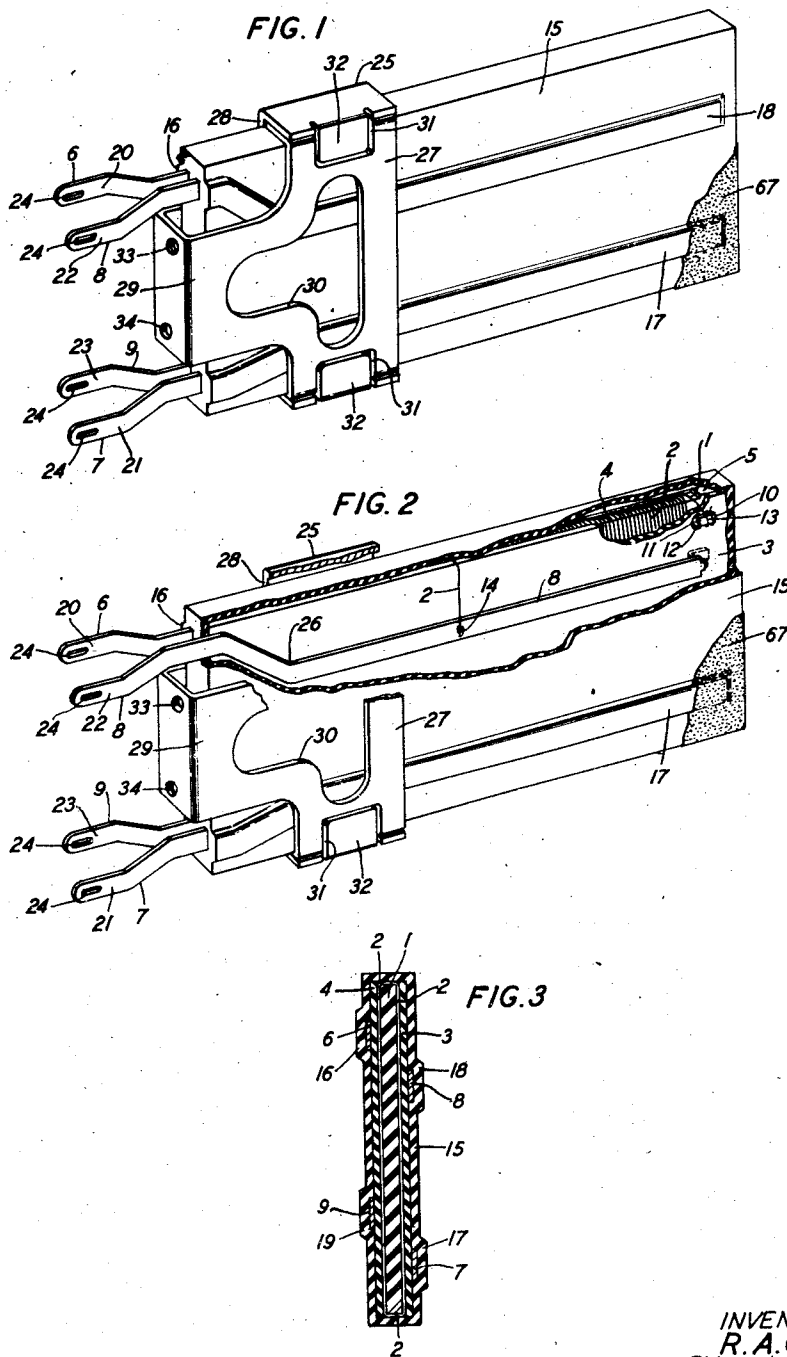
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RESISTANCE DEVICE

Filed Feb. 21, 1940

2 Sheets-Sheet 1



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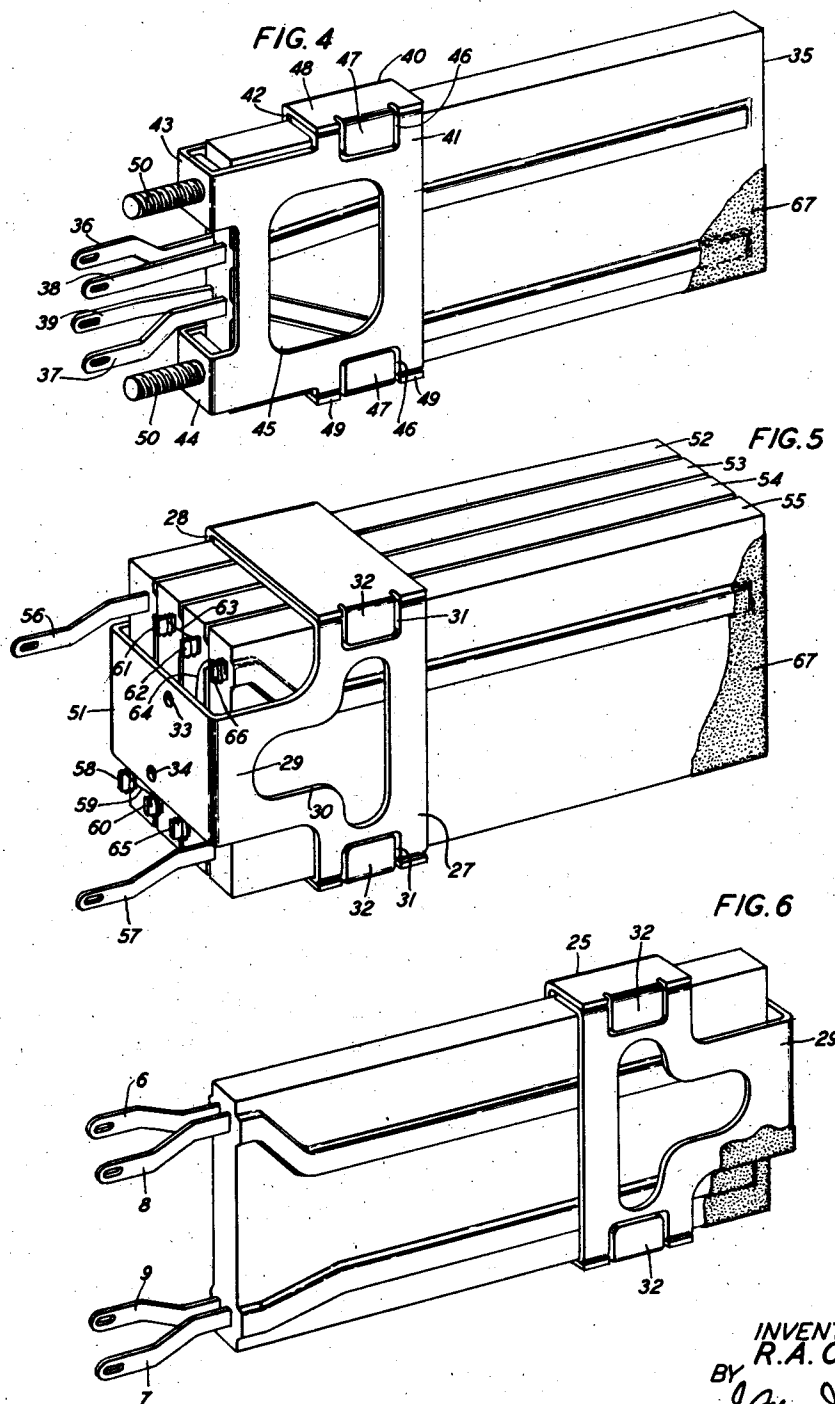
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UNITED STATES PATENT OFFICE

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RESISTANCE DEVICE

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3 Claims. (Cl. 201—67)

This invention relates to electrical resistance devices and more particularly to a type of resistance device commonly known as a flat type resistance device. A resistance device of the type mentioned is disclosed in F. S. Kochendorfer et al. Patent 1,677,240, dated July 17, 1928.

The object of this invention is to improve and simplify the construction of such resistance devices and lower the manufacturing cost thereof.

A feature of the invention resides in the structure and arrangement of terminal members on the device.

Another feature resides in a mounting bracket provided on the device and by means of which the device may be suitably mounted on a support.

Another feature resides in a resistance pad comprising a plurality of the resistance devices and a modification of the mounting bracket which serves as a common mounting means for the resistance devices in the pad.

In the drawings:

Fig. 1 is a view in perspective of the resistance device equipped with the mounting bracket;

Fig. 2 is a view corresponding to Fig. 1, but with certain parts broken away to disclose inner portions of the structure;

Fig. 3 is a cross-sectional view of the device taken on the lines 3—3 in Fig. 1;

Fig. 4 is a view in perspective of a modification of the resistance device and a modified form of the mounting bracket;

Fig. 5 is a view in perspective of a resistance pad made of a plurality of resistance devices and having a mounting bracket common to the resistance devices in the pad; and

Fig. 6 is a view in perspective of a resistance device of the form shown in Fig. 1 but with the mounting bracket located on the other end of the resistance device.

It is common practice to use in central offices of telephone systems a large number of flat type resistance devices. The resistance devices are often mounted side by side in rather closely spaced relation and arranged in rows on a supporting frame and with the terminals of the resistance devices projecting through an apertured panel in the frame and the body portions of the resistance devices projecting normal to the plane of the panel.

In the common and well-known form of the resistance device illustrated in the above-mentioned Kochendorfer patent, two terminals of the device are formed to provide means for mounting the device on the panel. Each of the

two terminals has also a channel shaped portion extending the full length of the resistance device and clamped to an edge of the resistance device. Extending longitudinally of the channel shaped portion is a male threaded stem portion adapted to extend through an aperture in the panel and arranged to receive a nut to hold the resistance device on the panel. The terminals are rather expensive to produce and attach and are found in some cases to be an objectionable form because rather closely spaced resistance devices on the panel are often accidentally short-circuited or cross-connected through a screwdriver or other tool when a wireman or repair man is doing wiring or repair work on the panel. It has been found that in some cases undesirable capacitance effects are also produced by reason of the form and arrangement of the terminals and the relatively close spacing of the resistance devices on the supporting panel.

My invention provides a cheaper construction of resistance device than the form above mentioned and does not have the objectionable features inherent in that form.

The resistance device shown in Figs. 1, 2 and 3 comprises a flat core 1 of insulating material on which is wound the resistance wire 2. Two flat strips 3 and 4 of insulating material are provided against the opposite faces of the core 1 to cover the various turns of the resistance wire extending across the flat faces of the core 1. The strips 3 and 4 and the core 1 are preferably made of the same kind of insulating material and this material is such that the strips and core may be bonded together to form a substantially homogeneous structure. The material may be, for instance, phenolized asbestos and the parts may be bonded together by applying heat and pressure to the strips 3 and 4 and the core 1. The core 1 except for the end portions 5 is made slightly smaller in width than the strips 3 and 4, the end portions 5 being about the same width as the strips 3 and 4. This arrangement makes the portions of the wire 2 passing over edges of the core 1 to come about flush with the edges of the strips 3 and 4 as shown in Figs. 2 and 3.

Terminals for the resistance device are provided in the structure, the number of terminals provided being dependent upon the type of resistance required. In the resistance shown in Figs. 1, 2 and 3, four terminals 6, 7, 8 and 9 are provided in the structure. Each terminal extends to and is connected to the resistance wire 2 at some predetermined point in the resistance wire. It will be assumed merely for the purpose

of illustration that the terminal 6 is connected to one end of the resistance wire 2, the terminal 7 is connected to the other end of the resistance wire 2, and the terminals 8 and 9 are each connected to some predetermined intermediate point in the resistance wire 2. If the whole resistance wire 2 is required in a circuit, the terminals 6 and 7 may be brought into connection with the circuit wires. When a resistance of lower value than the total value of the resistance wire 2 is required, the same resistance may be used for this lower value requirement by making connection of the circuit wires to other of the terminals provided. For instance 6 and 8 or 6 and 9 may be brought into the circuit instead of 6 and 7. Other resistance values may also be obtained by other suitable selections of the terminals.

Each of the terminals 6, 7, 8 and 9 is a flat strip of metal extending almost the full length of the resistance device. The terminals may be conveniently made by cutting or stamping them out from a sheet of metal. One end of each terminal is reduced in width to provide an end lug 10. The lug 10 is bent to extend normal to the plane of the main portion of the terminal and is then bent again at about 90 degrees to extend in a plane parallel to the plane and longitudinally of the main portion of the terminal. Spaced apertures 11, not visible in the drawing, are provided in one end portion of the core 1, the apertures 11 being adapted to receive the lugs 10 of the terminals. Spaced apertures 12 are also provided in the strips 3 and 4, the apertures 12 being in register with the apertures 11 in the core 1 and being adapted to receive the lugs 10 of the terminals. The terminals 7 and 8 lie against the outer face of the strip 3 and with the lugs 10 extending through the apertures 12 in the strip 3, and through the associated apertures 11 in the core 1, and thence through the associated apertures 12 in the strip 4 and so that the end portions of the lugs 10 lie against the outer face of the strip 4. The terminals 6 and 9 lie against the outer face of the strip 4 and with the lugs 10 extending through the apertures 12 in the strip 4, and through the associated apertures 11 in the core 1 and thence through the associated apertures 12 in the strip 3 and so that the end portions of the lugs 10 lie against the outer face of the strip 3. It will be understood that one end of the resistance wire 2 is electrically connected to the lug 10 of one of the terminals and that the opposite end of the resistance wire is connected to another of the terminals. Since the strips 3 and 4 are located on opposite faces of the core 1 and the terminals are located on the outer faces of the strips 3 and 4 and the lug portions 10 of the terminals are bent over against the outer faces of the strips 3 and 4, the electrical connections between the resistance wire 2 and the terminals are made by bringing portions of the resistance wire 2 over an edge of the strips 3 or 4 and to the required terminals. As shown in Fig. 2 one end of the resistance wire 2 is brought over the upper edge of the strip 3 and then downward against the outer face of the strip 3 to the lug 10 of the terminal 6 and is electrically connected at 13 to the lug 10 of the terminal 6. The other end of the resistance wire 2 is electrically connected to the terminal 7 by bringing the wire 2 over an edge of the strip 3 and over an outer face of the strip 3 and then securing the wire to an outer face of the terminal 7. The latter

electrical connection is not shown in the drawings since it is hidden by the outer covering of the resistance device. The manner in which it is made can be understood, however, by looking at terminal 8 in Fig. 2. Terminal 8 is shown as being electrically connected to an intermediate portion of the resistance wire 2, a portion of the wire 2 being brought over an edge portion of the strip 3 and over an outer face of the strip 3 and then solder connected at 14 to an outer face of the terminal 8. Terminal 9 is electrically connected to some other predetermined point of the wire 2 in the same manner as shown for terminal 8, except that in this case the wire is brought over an edge and an outer face of the strip 4 and is electrically connected to an outer face of the terminal 9. Such connections may be made, for instance, by soldering the resistance wire to the required terminal or by providing a suitable lead-in wire between the terminal and the resistance wire at the point required, the lead-in wire being electrically connected to the resistance wire 2 and to the required terminal.

An outer covering 15 of insulating material is provided on the resistance device. This outer covering 15 extends over the main portions of the terminals 6, 7, 8 and 9 and over the outer surfaces of the strips 3 and 4 and the upper and lower edges of the core 1. The covering 15 is preferably made of a material adapted to be bonded under heat and pressure to the strips 3 and 4 and may be made, for instance, of phenolized asbestos applied in sheet form over the outer faces of the strips 3 and 4, the terminals 6, 7, 8 and 9 and over the upper and lower edges of the strips 3 and 4, the core 1 and the portions of the resistance wire 2 lying adjacent the upper and lower edges of the core 1. After the covering 15 is applied the resistance device is subjected to heat and pressure to make the covering 15, the strips 3 and 4 and the core 1 to become, in effect, a homogeneous structure, with the resistance wire 2 and the main portions of the terminals 6, 7, 8 and 9 embedded therein. When the heat and pressure is applied to the parts, embossings 16, 17, 18 and 19 are formed on the outer surface of the covering 15 due to the underlying terminals 6, 7, 8 and 9.

The terminals 6, 7, 8 and 9 are made of sufficient length to leave leg portions 20, 21, 22 and 23 extending outwardly from one end of the resistance structure. Each leg portion is apertured at 24 to facilitate connecting of the leg portion to a circuit wire and is offset from the plane of the main portion of the terminal. The leg portions 20 and 22 of the respective terminals 6 and 8 are located near the upper edge of the resistance device and the leg portions 21 and 23 of the respective terminals 7 and 9 are located near the lower edge of the resistance device. This arrangement of the leg portions of the terminals leaves a relatively large space at one end of the resistance device to accommodate a portion of a mounting bracket 25, the structure and function of which will be subsequently explained. The lug portion 10 of the terminal 6 is located near the upper right corner of the structure as shown in Fig. 2 and the leg portion of this terminal projects from the structure near the upper left portion of the resistance device. This terminal may therefore be made substantially straight from the end on which the lug portion 10 is formed to the point of emergence from the opposite end of the resistance device. The terminal 8 is made

somewhat different in form from the terminal 6 since the lug portion 10 of the terminal 8 is located in apertures in the strips 3 and 4 and in the core 1 coming directly below the apertures accommodating the lug portion 10 of the terminal 6. The main portion of the terminal 8 extends for the greater portion of its length in a lower plane than the terminal 6 and then turns upward at 20 to bring the leg portion 22 out near the leg portion 20 of the terminal 6, the leg portions 20 and 22 being oppositely offset from the planes of the main portions of the respective terminals. The terminal 7 may be of about the same form as the terminal 6 since the terminal 7 extends in about a straight line from apertures in the strips 3 and 4 and in the core 1, but located in the lower right portion of the structure to the lower left portion of the device. The terminal 9 follows about the same form as the terminal 8 since the lug portion 10 of the terminal 9 is located in apertures in the strips 3 and 4 and in the core 1 and located above the apertures accommodating the lug portion 10 of the terminal 7. The terminal 9 therefore extends for the greater portion of its length in a plane above that of terminal 7 and then bends downward to bring the leg portion 23 out near the leg portion 21 of the terminal 7, the leg portions 21 and 23 of the respective terminals 7 and 9 being oppositely offset from the planes of the main portions of the terminals.

The mounting bracket 25 is made from a single piece of sheet material capable of being bent to required form. It will be assumed merely for the purpose of explaining the structure and not in the sense of limiting the structure to the use of such material, that it is made of sheet metal. The bracket 25 is made in the form of a skeleton casing comprising two reclining T-shaped side wall portions 27 and 28 joined by an integral reclining U-shaped end portion 29 which passes in spaced relation across an end portion of the resistance device and in spaced relation with the terminals 6, 7, 8 and 9. A T-shaped aperture 30 is provided in each side wall portion 27 and 28 to lighten the structure and to reduce capacitance between the wire winding and the bracket. The side wall portion 27 bears against one face of the resistance device and the side wall portion 28 bears against the opposite face of the resistance device. The upper and lower ends of the side wall portion 27 are bent to extend transversely across the respective upper and lower edges of the resistance device and rectangular apertures 31 are formed at the points where these upper and lower ends are bent across the edge portions of the resistance device. The apertures 31 do not extend across the edge of the resistance device but only from the point of bend toward the center of the side wall portion 27. The upper and lower ends of the side wall portion 28 are bent transversely across the respective upper and lower edges of the resistance device and in overlapping relation with the bent over ends of the side wall portion 27 and are equipped with tongues 32 adapted to fit into the apertures 31. The tongues 32 are bent toward the center of the side wall portion 27 and are pressed into the apertures 31. When the tongues 32 are pressed into required position, they bear against underlying edges of the apertures 31 and lock the wall portion 27 against outward movement. Outward movement of the wall portion 28 is prevented by the pressure of the tongues 32 against the portions of the resistance device com-

ing within the spaces defined by the apertures 31. The U-shaped end portion 29 of the bracket 25 is apertured and tapped at spaced points 33 and 34 to receive machine screws or bolts, not shown, for securing the bracket 25 to a support. The support might be an apertured panel or cross-bar of a frame. It will be seen that the bracket 25 closely grips the resistance device and provides a means for supporting the resistance device on a supporting frame, not shown, that the terminals 6, 7, 8 and 9 are not utilized as a supporting means for the resistance device and that the terminals do not extend along outer edge portions of the resistance device, but are for the greater portions of their length enclosed in the homogeneous structure cooperatively formed by the strips 3 and 4 and the outer covering 15. It will also be seen that the terminals 6, 7, 8 and 9 are substantially flat strips of metal and that no expensive machining or forming operations are required to produce them.

In Fig. 4 the resistance device 35 is made in the same general form as the resistance device shown in Fig. 1. The terminals 36, 37, 38 and 39 corresponding to the respective terminals 6, 7, 8 and 9 are in this case, however, led outwardly from points nearer the center of the end portion of the resistance device than in the structure shown in Fig. 1. The mounting bracket 40 in Fig. 4 is a modification of the bracket 25 in Fig. 1 and comprises two spaced side wall portions 41 and 42, joined by two spaced reclining U-shaped end portions 43 and 44. The end portions 43 and 44 are integral with the side wall portions 41 and 42 and pass in spaced relation across an end portion of the resistance device 35. An aperture 45 is provided in each side wall portion 41 and 42 to lighten the structure and to reduce capacitance between the wire winding and the bracket. The upper and lower ends of the side wall portion 41 are bent transversely across the respective upper and lower edges of the resistance device and are apertured at 46 to accommodate the tongues 47. The tongues 47 are extensions from upper and lower leg portions 48 and 49 of the side wall portion 42, the leg portions 48 and 49 being bent transversely across the respective upper and lower edges of the resistance device 35 and lying in overlapping relation with the respective bent over end portions of the side wall portion 41. The tongues 47 are pressed into the apertures 46 to hold the side wall portions 41 and 42 against outward movement in the same manner as the side wall portions of the bracket 25 in Fig. 1 are held in position. The end portions 43 and 44 of the bracket 40 are equipped with threaded studs or bolts 50 to facilitate mounting of the bracket 40 on a support, not shown. It will be seen that the main portions of the terminals 36, 37, 38 and 39 are embedded in the resistance device 35 and that the outwardly projecting end portions of the terminals extend in parallel spaced relation with the end portions 43 and 44 of the bracket 40 and are also in parallel spaced relation with the studs 50. The bracket 40 closely embraces the resistance device 35 and serves as a mounting bracket therefor.

In Fig. 5 the mounting bracket 51 is constructed in the same form as the mounting bracket 25 in Fig. 1. The parts of the bracket 51 are therefore identified by the same numbers as in Fig. 1. The bracket 51, however, is made large enough to embrace four resistance devices 52, 53, 54 and 55. The resistance devices 52, 53,

54 and 55 are shown in Fig. 5 as having only two terminals on each resistance. Resistance devices having more than two terminals may be used, however, if such resistances are required. The mounting bracket 51 may also be made in a different size if the plurality of resistance devices to be supported therein is more or less than four. The resistance devices shown in Fig. 5 are arranged to cooperatively form a resistance pad and are stacked together in flat face-to-face relation within the mounting bracket 51. The mounting bracket 51 clamps the resistance devices in the required positions and serves as a mounting bracket common to the resistance devices 52, 53, 54 and 55. Both terminals on each of the resistance devices 53 and 54 have been shortened to leave only stub portions of the terminals projecting from the end portions of the resistance devices. One terminal on each of the resistance devices 52 and 55 has also been shortened to leave only a stub portion of the terminal projecting from the end of the resistance device. The unshortened terminal 56 of the resistance device 52 serves as one terminal for the resistance pad. The other terminal for the resistance pad is the unshortened terminal 57 of the resistance device 55. The stub portion of the terminal 58 on resistance device 52 is connected by means of a conductor 59 to the stub portion of the terminal 60 on resistance device 53. The stub portion of terminal 61 on resistance 53 is electrically connected to the stub portion of terminal 62 on resistance device 54 by means of a conductor 63. Conductor 64 is electrically connected to the stub portion of terminal 65 on resistance device 54 and to the stub portion of terminal 66 on resistance device 55. The resistance devices 52, 53, 54 and 55 are therefore connected in series and are held together by means of a single mounting bracket 51 which may be secured to a support, not shown.

In Fig. 6, the mounting bracket 25 is identical in structure to the mounting bracket 25 in Fig. 1, but is positioned on an opposite end portion of the resistance device to the position occupied in Fig. 1.

The resistance devices above described may be given a coating 67 of paint to protect them from moisture. The coating 67 may be extended over the required portions of the resistance devices and over the mounting brackets.

What is claimed is:

1. A resistance device comprising an apertured core of insulating material, a resistance wire wound thereon, apertured strips of insulating material covering said core and said wire, an insulating covering over said strips, said covering, core and said strips being bonded together and strip terminals having end portions hooked into apertures in said core and said strips and connected to said wire, free end portions extending longitudinally outward of said strips and intermediate portions embedded in said covering.

2. A resistance device comprising an apertured core of insulating material, a resistance coil wound thereon, apertured strips of insulating material disposed against opposite faces of said core and covering said core and said coil, the apertures in said strips being in register with the apertures in said core, terminals extending along outer faces of said strips and through apertures in said strips and in said core and hooked into engagement with said strips and said core, said terminals being electrically connected to said coil, a covering of insulating material covering said strips and the terminal portions extending along said strips and covering edge portions of said core, said core, strips and covering being bonded into a homogeneous structure and end portions of said terminals extending longitudinally outward of said structure.

3. A resistance device comprising an apertured core of insulating material, a resistance wire wound thereon, apertured strips of insulating material disposed against opposite faces of said core and covering said wire, the apertures in said strips being in register with the apertures in said core, terminals for said wire having main portions extending along outer faces of said strips, end lugs on said terminals extending through the apertures in said strips and core and clamping said core and strips together, an outer covering of insulating material enclosing said core, said strips and the main portions of said terminals, said covering, strips and core being bonded together into a homogeneous structure and leg portions on said terminals extending beyond one end of said structure.

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