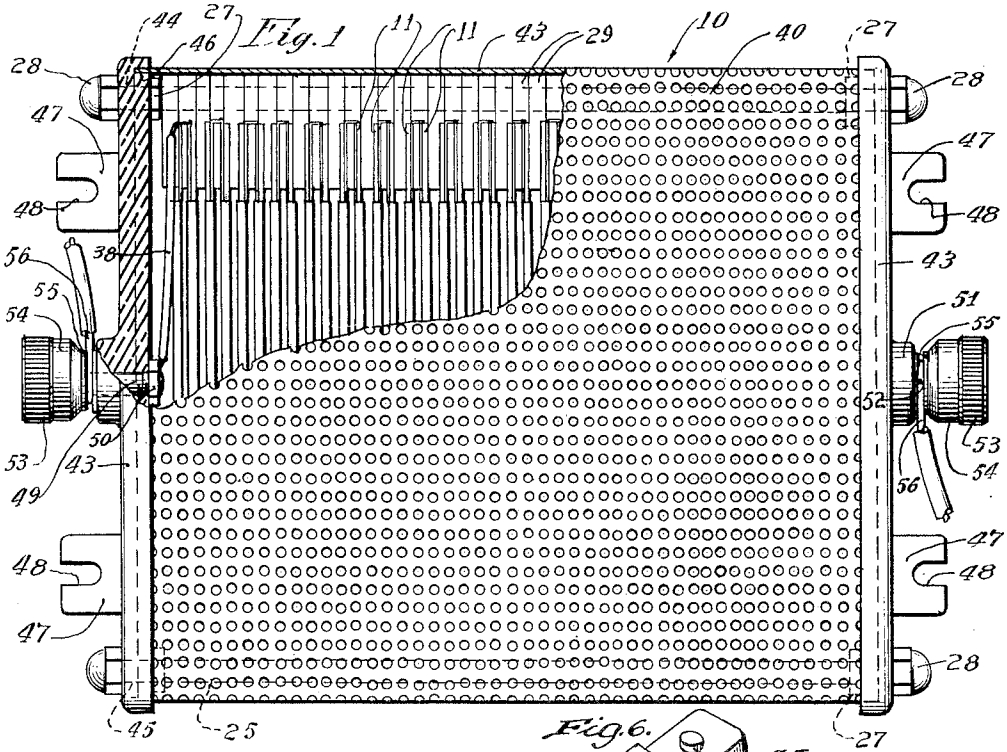
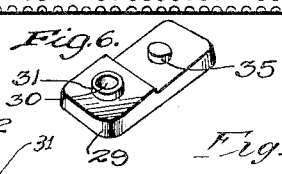
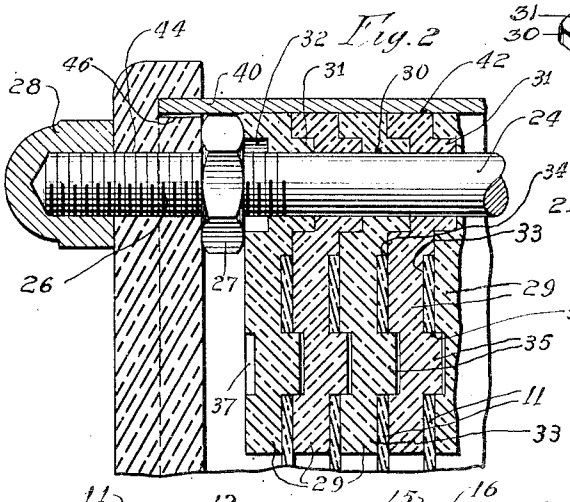
July 9, 1929. R. SIMPSON 1,720,381

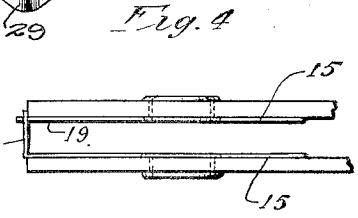
RESISTOR

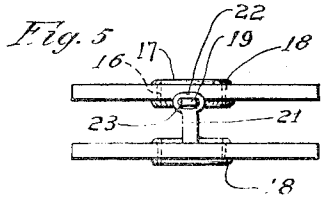
Filed April 28, 1927

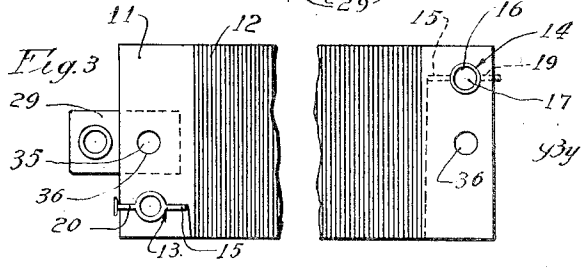












Inventor:
Ray Simpson.
By: Williams, Bradbury, McCaleb & Hinkle
Attys.

Patented July 9, 1929. 1,720,381

UNITED STATES PATENT OFFICE.

RAY SIMPSON, OF RIVER FOREST, ILLINOIS, ASSIGNOR TO JEWELL ELECTRICAL INSTRUMENT CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

RESISTOR.

Application filed April 28, 1927. Serial No. 187,278.

My invention relates to electrical resistors, being more particularly concerned with that type of electrical resistor having a plurality of spaced insulating members wound with electrical resistance wire. In the resistors of the prior art it has been customary to support the resistance wire upon a series of spaced mica plates, the plates being in turn supported by a plurality of bolts or rods passing through apertures in the mica plates and the spacing members located between them.

When one of the resistance coils in a resistor of this type burns out or has to be replaced for any other reason, it is necessary to dismantle the entire resistor, taking off all of the mica plates on one side of the defective coil, substituting a new plate and coil, and rethreading the other plates in succession upon the supporting bolts or rods. This operation consumes considerable time, and in addition many of the connections between the respective coils are broken or weakened, so that further trouble with the resistor is inevitable.

One of the objects of my invention is the elimination of the foregoing difficulties of replacement by the provision of a resistor assembly from which any of the resistance supporting plates may be removed and replaced without removing the others.

Another object of my invention is the provision of a resistance supporting frame, including a plurality of molded insulating clamping elements which are threaded upon rods or bolts, and which are adapted to clamp each resistance supporting plate in spaced relation to the others in such manner that any of the resistance supporting plates may be removed without disturbing the assembly of the other plates.

Another object of my invention is the provision of a novel assembly of elements composing an electrical resistance and including a novel type of simple electrical connection between respective resistance coils which may be soldered to provide a relatively permanent connection, but which may also be readily disjoined for the removal and replacement of defective coils.

Other objects and advantages of my invention will appear more fully from the following description and from the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the drawings Fig. 1 is a side elevational view of my resistance unit with the cover partially broken away to show the resistance supporting frame,

Fig. 2 is an enlarged medial cross-sectional view taken on the plane of the axis of the supporting rod,

Fig. 3 is a detail plan view of a single resistance coil with its connectors,

Fig. 4 is a side elevational view of a portion of two resistance coils and plates showing the method of forming connections,

Fig. 5 is an end view of the same,

Fig. 6 is a view in perspective of the clamping member.

Referring to Figs. 1, 2, and 3, 10 indicates in its entirety my resistance unit comprising a plurality of mica insulating plates 11 which are supported in spaced relation by a supporting frame further to be described, and which carry coils 12 of standard resistance wire wound in a plurality of spaced turns. The resistance coils 12 may be covered with a layer of shellac to hold them firmly in place, and also provided with an insulating layer of oiled paper glued upon the same by the shellac.

Each of the mica plates 11 may be provided at its opposite ends with electrical connectors 13 and 14 to which the ends of the resistance wire 12 are soldered respectively. The connectors 13 and 14 may be similar in form in so far as they are thin metal plates having an inwardly projecting tab 15 to which the resistance wire may be soldered and a central tubular flange 16, which is adapted to pass through an aperture 17 in the mica plate and to rivet said connectors upon said plates, as at 18.

The male connector 14 may have a narrow outwardly projecting tab 19 which projects but slightly beyond the edge of the mica plate 11, while the female connector 13 may have a similar projecting tab 20 which is of sufficient length to extend to the adjacent edge of the mica plate 11, from which it is bent at right angles to the plate 11 forming a laterally projecting ear 21 terminating in

an enlarged portion 22 having an aperture 23 of sufficient size to receive the end of the tab 19. The length of the flange 21 should be such that it is adapted to extend between the two mica plates when they are held in assembled relation, as shown in Figs. 1 and 2, and the connectors 13 and 14 may be fastened together permanently by placing a drop of solder upon the tab 19 above the aperture 23 in the enlarged portion 22. This furnishes a convenient and simple method of connecting the resistance coils 12 permanently together, but if at any time it is desired to remove a mica plate 11 with its corresponding resistance coil, the connection can readily be disjoined by merely melting the drop of solder with a soldering iron and permitting it to drop off from the connector.

Referring to Fig. 3, it will be observed that each plate is provided with a female connector at one end and a male connector at the other end in such manner that all of the plates are identical in form, but they are adapted to be connected to each other by alternately reversing the plates so that the male connector of one plate is adjacent the female connector of the other and vice versa.

The supporting frame work of my resistance unit 10 comprises a pair of rods 24 and 25 preferably of metal, each rod having each end threaded as at 26 for the reception of a nut 27 within the casing and a cap nut 28 outside of the casing. Each of the rods 24 and 25 is provided with a plurality of similar insulating clamping members 29 which are threaded upon the rods, the rods passing through the apertures 30 in the clamping members 29. The insulating clamping members 29 are preferably molded from insulating material, such as a phenol condensation compound, and when in assembled relation they are adapted to support the mica plates 11 firmly upon the rods 24 and 25, at the same time providing additional insulation about the metal rods and between the respective plates.

The molded clamping members 29 comprise substantially flat rectangular plates of insulating material having an aperture 30 at one end which is adapted to receive the rod 24 or 25. In order to provide a broken joint between the respective clamping members and to increase the insulation about the rods 24 and 25, the clamping members 29 are each provided with tubular projections 31 which are adapted to extend into a complementary counterbore 32 in the adjacent side of the next clamping member 29.

The lower portion of the clamping members 29 is reduced in thickness as at 33 upon one side, by an amount which is slightly less than the thickness of the mica plates 11, in such manner that when the clamping members 29 are firmly pressed against each other, a considerable clamping force is exerted upon the ends of the mica plates 11 by the lower portions 33 of the clamping members 29. This reduced thickness also forms a transverse shoulder 34 upon the insulating clamping members which lies squarely against the end of the substantially rectangular mica plates 11, thereby aiding in maintaining these plates in fixed position and preventing relative rotation between these parts. The lower end of the insulating clamping members 29 is also provided with an integral projecting lug 35 preferably cylindrical in form and adapted to fit within an aperture 36 in the mica plate 11. These projections may be of any shape, but are preferably made cylindrical in order that they may fit in a circular aperture which is conveniently made by means of standard drills. The lug 35 and aperture 36 are located upon their respective parts in such manner that when the lug 35 projects through the aperture 36 the adjacent edge of the mica plate 11 fits flatly against the shoulder 34 upon the insulating clamping member.

Each of the insulating clamping members is also provided with a substantially cylindrical aperture 37 upon the opposite side from the lug 35, but otherwise similarly located in such manner that each of the lugs 35 may project through a mica plate 11 into the adjacent clamping member, the lugs 35 being of slightly less length than the combined thickness of the mica plates 11 and the depth of the apertures 37. It will thus be observed that the insulating clamping members 29 may be threaded upon the rods 24 and 25, after which the mica plates with their resistance coils 12 may be inserted between the clamping members 29 with the lugs 35 extending through the apertures 36, and each mica plate supported at each end between a pair of clamping members 29. The mica plates are, of course, alternately reversed in position so that the female connector 13 upon each plate may come adjacent the male connector 14 upon the next plate, and by tightening the screws 27 at each end of the bolts 24 and 25 the mica plates will be firmly clamped between the insulating clamping members 29 on each rod and the whole assembly will be bound together to form a rigid frame work.

The flanges 21 upon the female connectors are ordinarily bent upward until this time in order that they may not interfere with the process of assembly, but they may now be bent downward so that the aperture 23 receives the tab 19 of the adjacent male connector, after which a drop of solder may be placed upon each of the tabs 19 and enlarged portions 22, thereby permanently connecting the same together. The connectors of the end plates 37 may be soldered directly to a

flexible lead wire 38 which is covered with an insulating tubular sheath 39 of heat resistive insulating material.

The casing 40 may consist of a sheet of metal provided with a multiplicity of apertures 41 which are regularly spaced for convenience in construction, and which are adapted to provide a foraminous covering which will permit the circulation of the air between the spaced mica plates 11 about the resistance coils 12 to dissipate the heat produced by the electric current. The casing member 40 may consist of a single sheet of perforated metal bent in four places with its ends joined together by a plurality of rivets or other convenient fastening means to form a box-like casing having both ends open. The size of the casing 40 is preferably such that the flat surfaces 42 formed by the outside edges of the clamping members 29 when in assembled relation, are adapted to fit exactly within the opposite sides 43 and 44 of the casing 40 to provide additional support and reenforcement for the casing member. The width of the casing may be slightly greater than the width of the mica plates 11 in order to provide ample air space within the casing.

The casing member 40 is provided at each end with an insulating cover 43 of similar shape, which is preferably constructed of molded insulating material, such as a phenol condensation compound, and provided with a pair of apertures 44 and 45, adapted to register with and receive the ends of the rods 24 and 25. The insulating covers 43 are each formed with a groove 46 upon the inside surface of the covers 43, the grooves 46 being preferably of substantially rectangular cross section, extending completely around the insulating cover in the shape of a rectangle and adapted to receive the rectangular end of the foraminated casing 40. The covers 43 are, of course, of substantially rectangular shape and slightly larger than the end of the casing 40, which they are designed to cover.

Each cover 43 may be provided with a pair of laterally projecting lugs 47 located at one extreme edge of the cover, and having substantially U-shaped grooves 48 extending through said lugs. The lugs 47 with their grooves 48 provide a convenient means upon each cover for the reception of screws to fasten the same to the wall or any machine to which the resistor is to be attached.

The covers 43 may also be provided with a connecting bolt 49 having a nut 50 on its inner end, and the bolt 49 extending through the cover 43 and a substantially cylindrical projection 51 upon the cover. The outside end of the bolt may be provided with a metal washer 52 and the bolt may be also provided with a cap nut consisting of a molded insulating casing 53 having a metal ferrule 54 molded therein and projecting therefrom as at 55. The cap nut 53 thus provides an insulated cap which may be screwed upon the bolt 49 clamping the wire 56 or other electrical conducting member between the metallic ferrule 55 and washer 52. The inner end of the bolt 50 may be soldered to the end of the flexible conductor 38.

It will thus be observed that when the mica plates have been assembled and clamped by the clamping members 29, as previously described, and the electrical connections made between the respective coils 12 on the mica plates and between the bolt 49 and the lead 38 at each end of the resistor, the circuit through the resistance plates will be as follows:

Beginning at one connecting bolt 49 the electrical circuit will transverse the flexible conductor 38 to one of the connectors 13 or 14 upon a mica plate 11, thence downward through the resistance coil 12 upon that plate, thence through the connectors 13 and 14 to the adjacent resistance coil, thence to the next resistance coil by a connection formed at the top of the same, and so on to a similar connecting bolt 49 at the other end of the resistance unit. The assembly of the balance of the resistance is as follows:

The foraminous casing 40 may be slid upon the assembled mica plates and clamping members 29, after which the flexible lead wires 38 may be soldered to the bolts 39 at each end, after which the covers 43 may be placed with the bolts 24 and 25 in the apertures 44 and 45, and with the rectangular end of the foraminous casing 40 in the groove 46. The cap screws 28 may then be threaded upon the ends of the bolts 24 and 25 exterior to each cover, and the cover clamped against the ends of the casing 40.

It will thus be observed that I have invented a resistance unit comprising a plurality of spaced resistance supporting plates which are adapted to be clamped in fixed relation by a series of molded insulating clamping units in such manner that the clamping nuts may be turned back and any two of the molded clamping members may be separated to remove any mica plate with its corresponding coil. The mica plate thus removed may be as easily replaced and the soldered connection formed without disassembling the complete resistance unit. The casing for my resistance unit is likewise supported by the same two bolts which perform the clamping function, and I have thus provided a simple, convenient, and economical structure in which the component parts are completely insulated from each other in a manner which provides a high factor of safety.

While I have illustrated and described a specific embodiment of my invention, many modifications may be made without depart-

ing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States is:

1. In an electrical resistance device, the combination of a plurality of resistance supporting elements, frame members extending at substantially right angles to a surface of said supporting members at opposite ends of the same, a plurality of clamping members, threaded on said frame members and interposed between said supporting members, means for pressing said supporting members between said clamping members, a foraminated casing surrounding all the foregoing elements and supported by said clamping members, covers for the ends of said casing having grooves to receive the ends of said casing and apertures for said frame members, and means on said frame members to clamp said covers against said casing.

2. In an electrical resistance device, the combination of a plurality of resistance supporting elements, a bolt for supporting insulating members, an insulating member threaded on said bolt on each side of each supporting element and adapted to clamp said resistance supporting elements, each insulating member having a lug projecting through an aperture in a supporting member into the next insulating member, said insulating member having an aperture for said bolt and said aperture being spaced from said lug.

3. In an electrical resistance device, the combination of a plurality of resistance supporting elements, a bolt for supporting insulating members, an insulating member threaded on said bolt on each side of each supporting element, each insulating member having a lug projecting through an aperture in a supporting member into the next insulating member, and a shoulder lying against the edge of said supporting member to hold the same in fixed relation.

4. In an electrical resistance device, the combination of a plurality of resistance supporting elements, a bolt for supporting insulating member, an insulating member threaded on said bolt on each side of each supporting element, each insulating member having a lug projecting through an aperture in a supporting member into the next insulating member, a shoulder lying against the edge of said supporting member to hold the same in fixed relation, and tubular projections on each insulating member about said rod, projecting into a complementary aperture of an adjacent insulating member.

5. In an electrical resistance device, the combination of a plurality of resistance supporting elements, means clamping each of said supporting members, resistance wire wound upon said supporting elements, a flat sheet metal connector at one end of said wire, carried by said supporting member having an upwardly projecting ear, a second connector at the other end of said wire, carried by said supporting member and having a laterally projecting flange with an aperture to receive one of said ears, and a drop of solder on said ear about said aperture.

6. In a removable resistance element, a flat insulating member having a plurality of spaced turns of resistance wire, a connector carried by said plate at each end of said wire, one of said connectors having a projecting ear and the other a transverse flange with a hole to receive a similar ear.

7. In a removable resistance element, a flat insulating member having a plurality of spaced turns of resistance wire, a connector carried by said plate at each end of said wire, one of said connectors having a projecting ear and the other a transverse flange with a hole to receive a similar ear, said connectors being fixed to said plates by flanges pressed out of the body of said connectors to form a tubular rivet.

8. In an electrical resistance device, the combination of a plurality of resistance supporting elements, frame members extending at substantially right angles to a surface of said supporting members at opposite ends of the same, a plurality of molded insulating members threaded on said frame members and adapted to rotate out of a clamping position, said insulating members having depressed surface to clamp said supporting members when the insulating members are in close contact with each other, and means to draw said insulating members together to fasten all foregoing elements in fixed relation.

9. In an electrical resistance device the combination of a plurality of supporting elements, a frame member extending transversely to said elements at one end thereof, and a plurality of clamping members carried by said frame member and interposed between said supporting members and adapted to rotate out of a clamping position, said supporting members having apertures in the same and said clamping members having lugs adapted to be received in said apertures to secure said supporting members.

10. In an electrical resistance device the combination of a plurality of supporting elements, a frame member extending transversely to said elements at one end thereof, and a plurality of clamping members rotatably carried by said frame member for movement into non-clamping position and interposed between said supporting members, said supporting members having aper-

tures in the same, said clamping members having lugs adapted to be received in said apertures to secure said supporting members, and each clamping member having a complementary aperture to receive the lug on an adjacent clamping member.

11. In an electrical resistance device the combination of a plurality of supporting elements, a frame member extending transversely to said elements at one end thereof, and a plurality of clamping members rotatably carried by said frame member and interposed between said supporting members, said clamping members being rabbeted to clamp said supporting members and to engage each other adjacent said frame member when in clamping relation and being adapted to rotate into non-damping position.

12. In an electrical resistance device, the combination of a plurality of insulating clamping members with a frame member of electrical conducting material passing through said clamping members, each insulating member being provided with a projecting sleeve on one side about said frame member and a complementary depression upon the opposite side, adapted to receive the sleeve of an adjacent clamping member, a plurality of resistance supporting elements interposed between said clamping members, said resistance supporting elements having apertures in the same and said clamping elements having lugs to be received in said apertures.

13. In an electrical resistance device, the combination of a pair of insulating end plates, with a ventilating casing having open ends adapted to fit about a portion of said end plates and to abut against another portion of said end plates, transverse frame members for binding said plates on said casing, insulating clamping members carried by said frame members and a plurality of resistance supporting elements interposed between said clamping members.

14. In an electrical resistance device, the combination of a pair of insulating end plates, with a ventilating casing having open ends adapted to fit about a portion of said end plates and to abut against another portion of said end plates, common means for binding said casing between said plates and for supporting resistance elements within said casing, and resistance elements carried by said supporting elements and connected to terminals carried by said insulating plates.

15. In an electrical resistance device, the combination of a pair of insulating end plates, with a ventilating casing having open ends adapted to fit about a portion of said end plates and to abut against another portion of said end plates, transverse frame members for binding said plates on said casing, insulating clamping members carried by said frame members and a plurality of resistance supporting elements interposed between said clamping members, said supporting elements having apertures in the same and said clamping members having lugs adapted to be received in said apertures.

16. In an electrical resistance device, the combination of a pair of insulating end plates, with a ventilating casing having open ends adapted to fit about a portion of said end plates and to abut against another portion of said end plates, transverse frame members for binding said plates on said casing, insulating clamping members carried by said frame members and a plurality of resistance supporting elements interposed between said clamping members, said supporting elements having apertures in the same and said clamping members having lugs adapted to be received in said apertures and in each other.

17. In a resistor, the combination of a plurality of flat resistance supporting elements with a plurality of substantially flat clamping members having lugs for passing through said supporting members, said clamping members having apertures adapted to receive a bolt, and releasable means for securing said clamping members together on said bolt, said clamping members being movably mounted on said bolt for removing intermediate resistance supporting elements when said securing means is released.

In witness whereof, I hereunto subscribe my name this 25th day of April, 1927.

RAY SIMPSON.