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2,406,383

ELECTRICAL TERMINAL

Filed July 29, 1943

FIG. 1

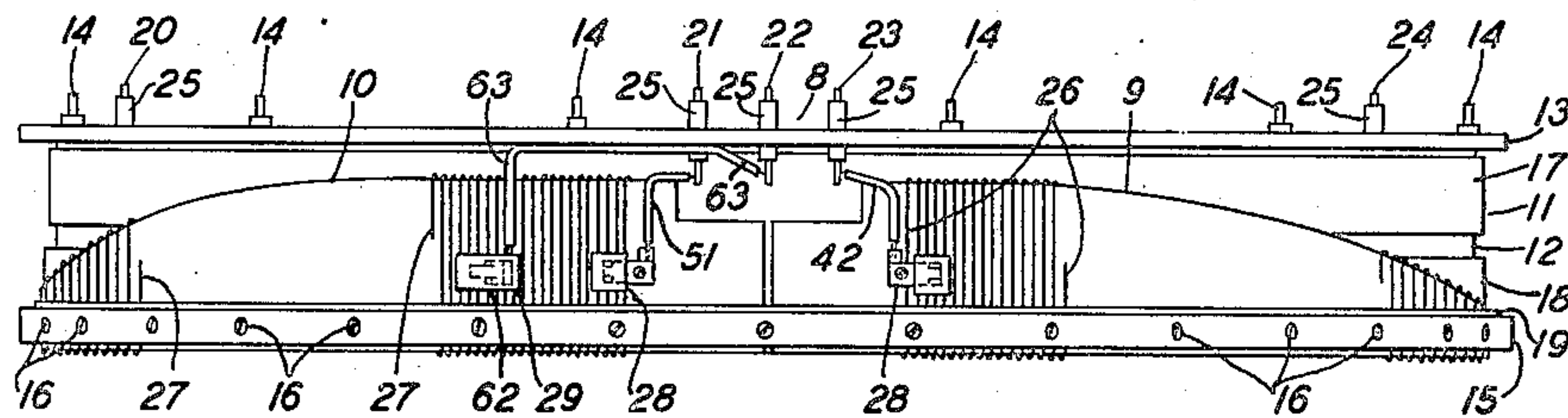


FIG. 2

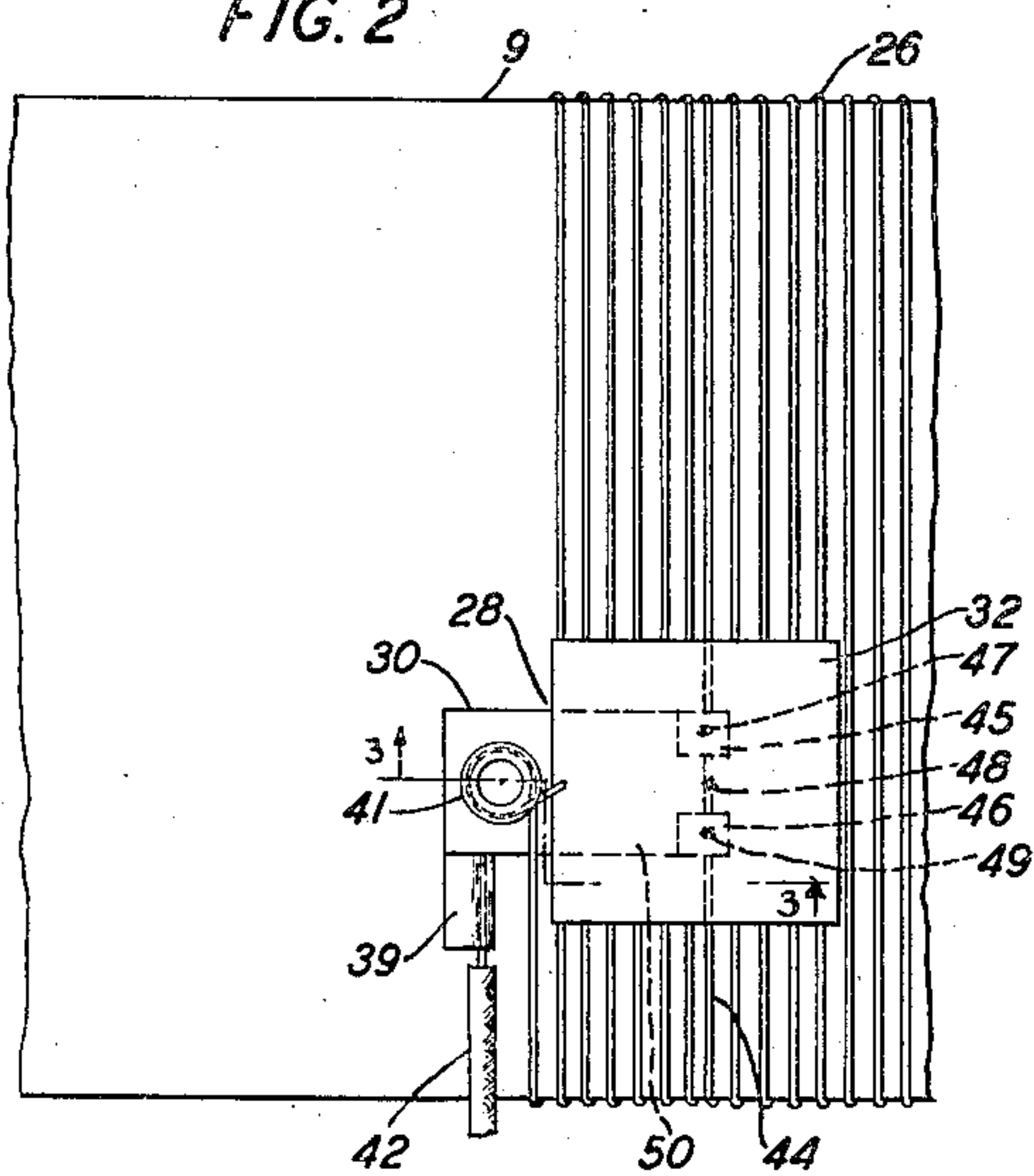


FIG. 3

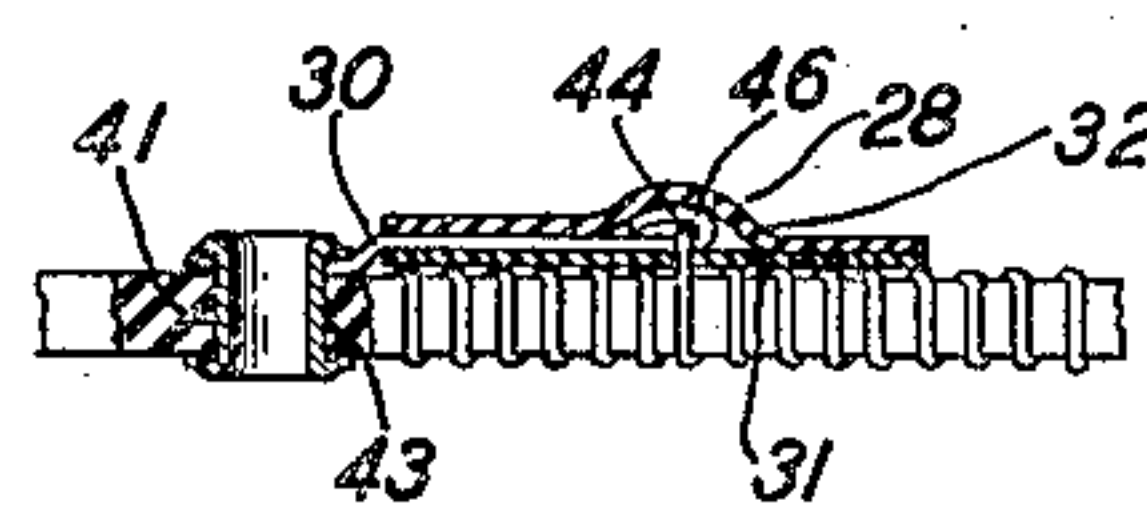


FIG. 4

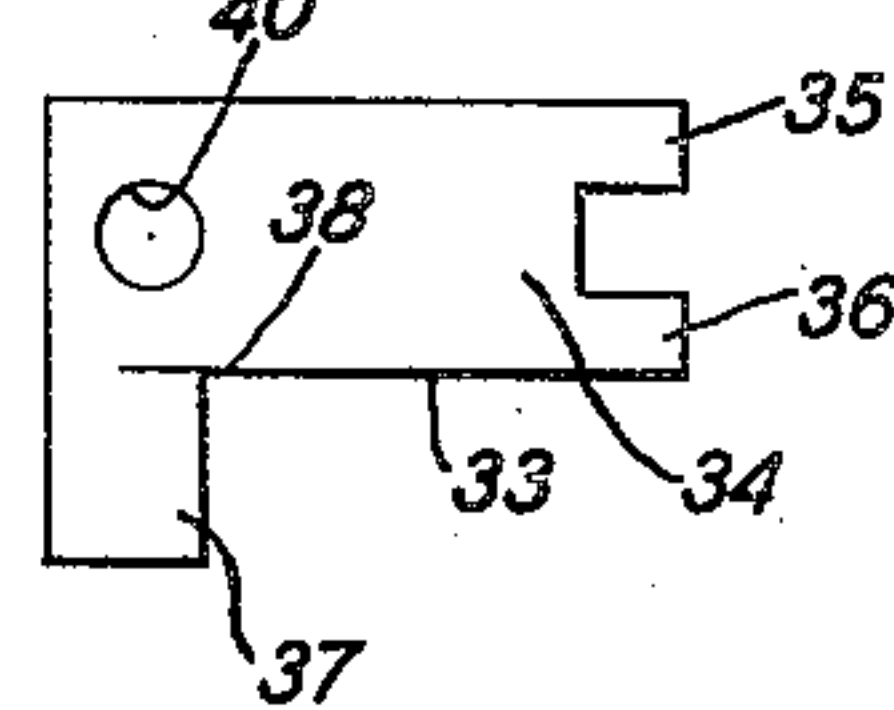


FIG. 5

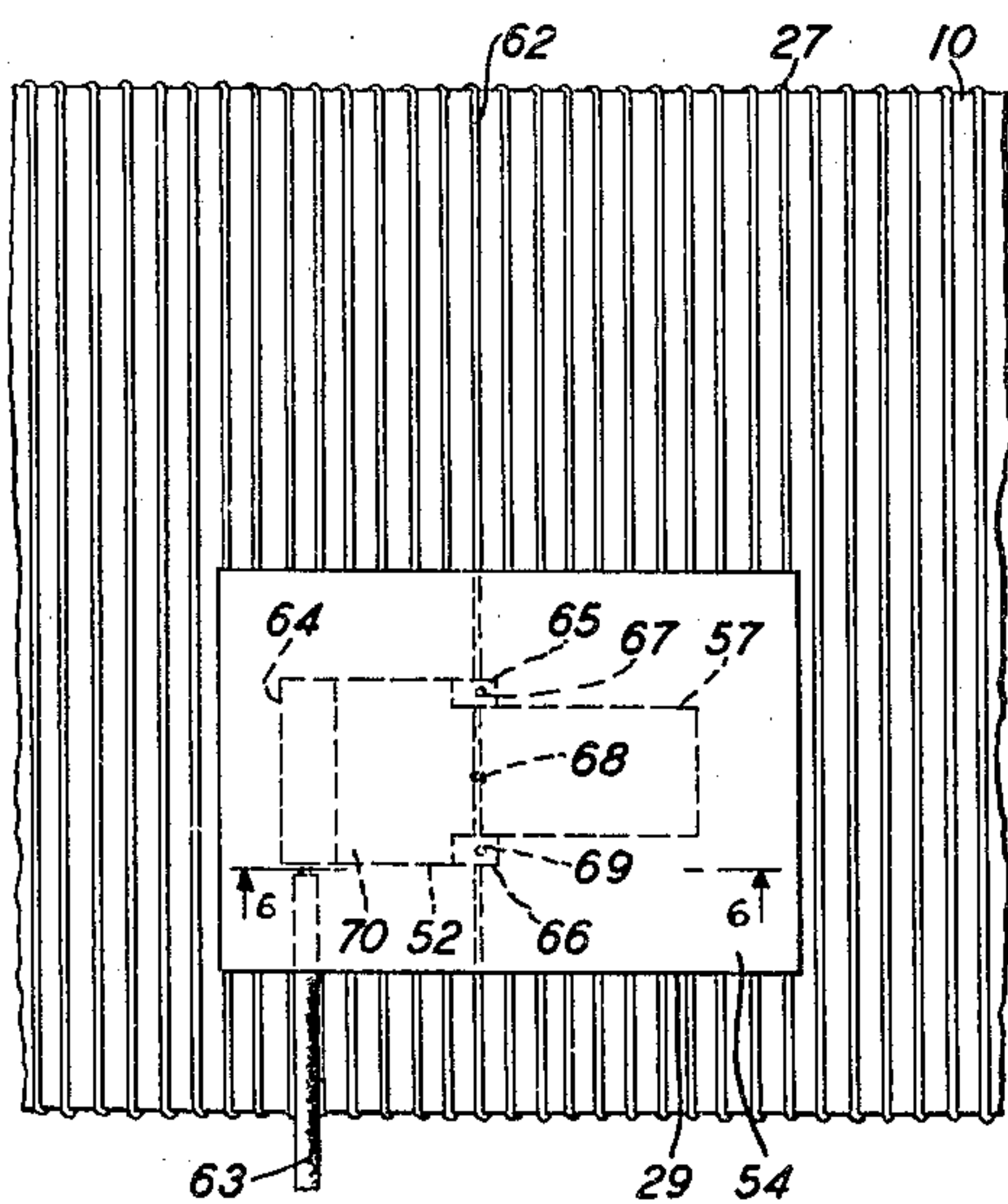


FIG. 6

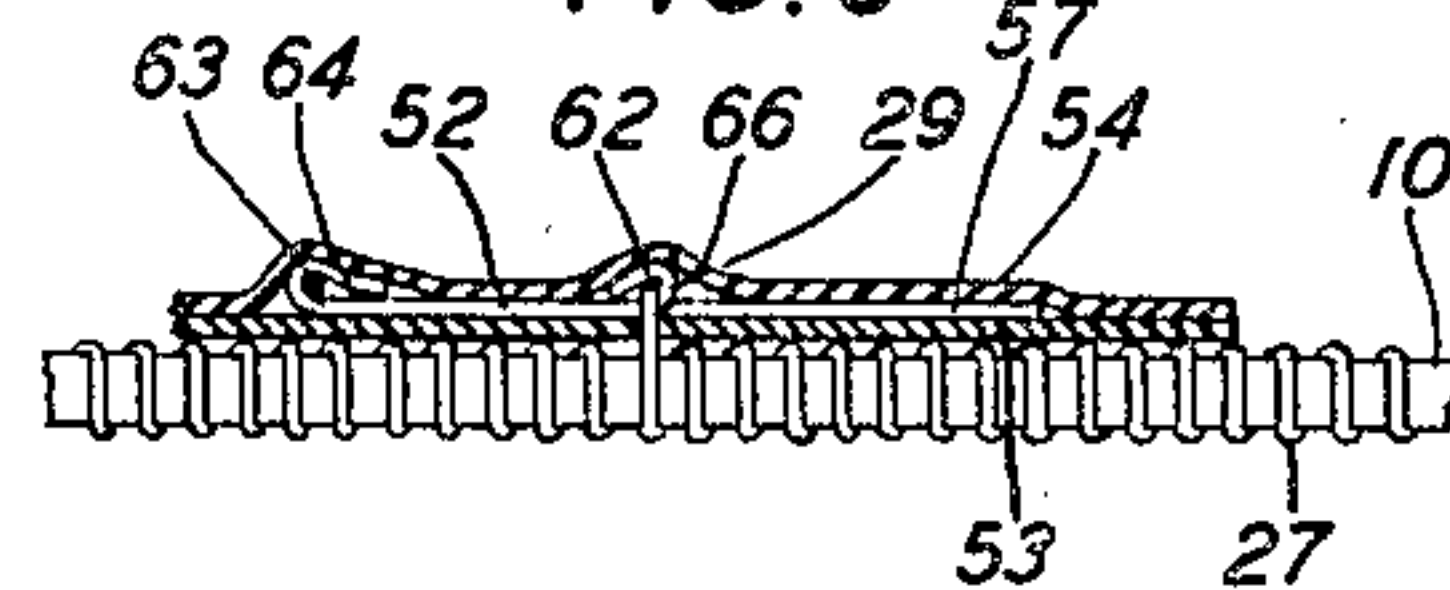
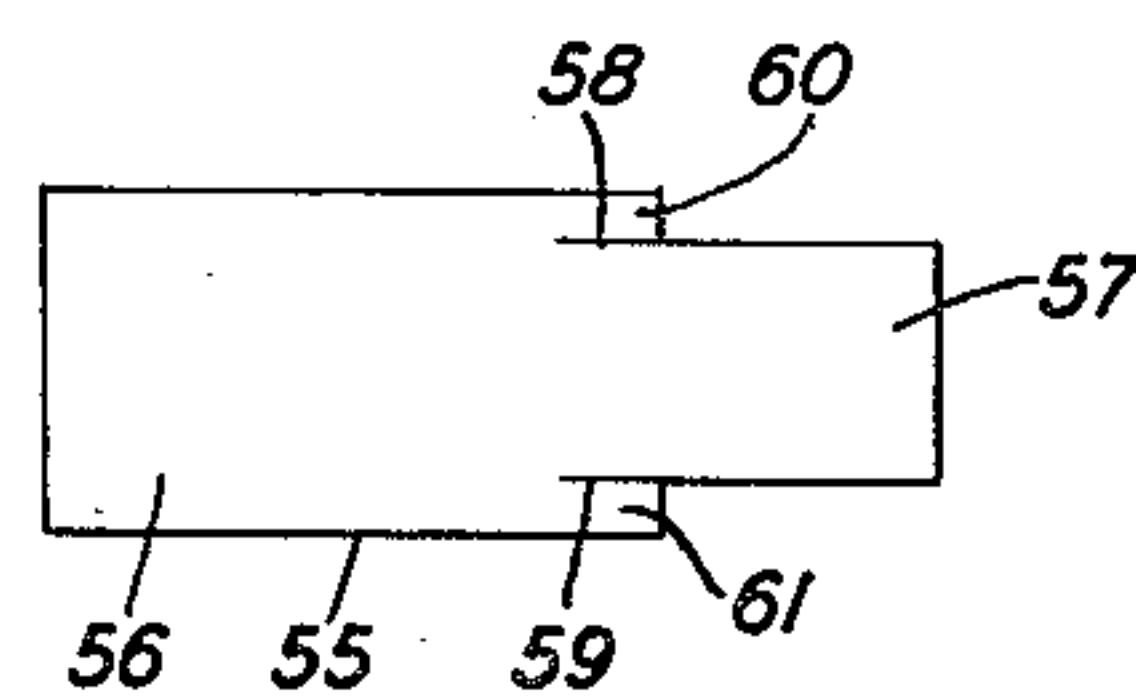


FIG. 7



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ELECTRICAL TERMINAL

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10 Claims. (Cl. 201—63)

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This invention relates to electrical terminals and more particularly to electrical terminals suitable for use in electrical devices in which a wire is wound in a plurality of turns on a support.

The object of the invention is to provide an improved terminal structure suitable for serving as an electrical connection between a selected turn of wire on the support and a fixedly supported outside terminal of a device.

A feature of the invention resides in the structure of a conducting plate in the terminal.

Another feature resides in insulating means provided in the terminal structure.

The terminal of this invention is constructed and arranged so that conducting parts of the terminal are insulated from turns of wire lying near the selected turn, the terminal is connected to a plurality of points on the selected turn of wire and means are provided to prevent strains applied to a lead wire from being transmitted to the points at which the terminal is electrically connected to the selected turn of wire.

In the drawing:

Fig. 1 is a side elevational view of what is known as a potentiometer unit and in which the present invention is used. The potentiometer unit comprises a drum type support and wire wound cards supported on the support;

Fig. 2 is an enlarged view of a portion of one of the wire wound cards and shows one form of the present invention mounted on the wire wound card;

Fig. 3 is an edge view, partly in section, of a portion of the wire wound card with the invention in the form shown in Fig. 2 supported thereon. The section is taken on the line 3 in Fig. 2;

Fig. 4 shows a conducting plate prepared for development into one of the parts of the terminal shown in Figs. 2 and 3;

Fig. 5 is an enlarged view of a portion of one of the wire wound cards shown in Fig. 1 and a terminal of another form of the present invention mounted on the wire wound card;

Fig. 6 is an edge view of a portion of the structure shown in Fig. 5; and

Fig. 7 shows a conducting plate prepared for development into one of the parts of the terminal shown in Figs. 5 and 6.

In resistance devices in which a resistance wire is wound in a plurality of turns on a support, it is sometimes found necessary in order to obtain predetermined precise resistance values to tap the resistance wire at precise points instead of simply connecting ends of the resistance wire to terminals and using the whole length of re-

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sistance wire as a resistance element. The point of tapping may have to be so precise that a particular turn of the resistance wire must be tapped and the connection cannot be within limits of only full turns of the wire but must be within closer limits. This requirement is found in making a precision potentiometer unit 8 of the type shown in Fig. 1 in which cards 9 and 10 of insulating material and having a precise predetermined form are wound with resistance wire and mounted on a drum type support 11 and particular points of the resistance wire are tapped in order to obtain required values at certain predetermined points. The resistance wire employed in this potentiometer unit is of relatively fine gauge and the wire is wound in a plurality of turns on the insulating card.

The drum type support 11 shown in Fig. 1 is circular in form and comprises a barrel portion 12 and a flange 13. Studs 14 are mounted in spaced relation on the flange 13 to provide means for mounting the potentiometer unit 8 on a suitable support, not shown. The cards 9 and 10 are bent around the barrel portion 12 of the drum type support 11 and are held in place by means of a hoop 15 equipped with spaced set screws 16. Bands 17 and 18 of insulating material are provided on the drum type support 11 between the inner faces of the cards 9 and 10 and the barrel portion 12 of the drum type support 11. A band 19 of insulating material is disposed between the hoop 15 and the turns of resistance wire on the outer faces of the cards 9 and 10. The flange 13 is apertured at spaced points to receive conducting pins 20, 21, 22, 23 and 24 which serve as fixedly supported outside terminals for the potentiometer unit 8. Each conducting pin extends through a sleeve 25 of insulating material extending through an aperture in the flange 13.

The cards 9 and 10 are wound with resistance wire, card 9 having a resistance wire 26 wound thereon and extending in a plurality of turns for most of the length of the card 9 and card 10 having a resistance wire 27 wound thereon and extending in a plurality of turns for most of the length of the card 10. It will be seen that each card varies in width from one end to the other and that when the resistance wire is wound on the card a so-called tapered resistance is formed. The lower edges of the cards are maintained in a common plane slightly below the lower end of the barrel portion 12 of the drum type support 11 and so that a wiper contact, not shown, may be swept in frictional engagement with the turns of wire extending about the lower edges of the cards.

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It is required that certain points of the resistance wires 26 and 27 be electrically connected to the conducting pins supported on the flange 13 and the terminals of this invention provide the required electrical connecting means.

The invention is made in two forms one of which is clearly shown in Figs. 2 and 3 and which will hereinafter be called the end tap terminal 28. The other form of the invention and which is shown clearly in Figs. 5 and 6 will be hereinafter called the intermediate tap terminal 29.

The end tap terminal 28 comprises a plate 30 of conducting material and two layers 31 and 32 of insulating material. The plate 30 may be developed from a sheet metal plate 33 originally cut to the form shown in Fig. 4 and having a body portion 34 with spaced tabs 35 and 36 extending longitudinally of and from one end of the body portion 34. An arm 37 extends laterally from the other end of the body portion 34 and a cut is made at 38 at the juncture of the arm 37 and the body portion 34 so that the arm 37 may be rolled into the form of a tube 39 shown in Fig. 2. The plate 33 is apertured at 40 to receive an eyelet 41 shown in Figs. 2 and 3.

Each wire wound card 9 and 10 is provided with two end tap terminals 28, one being located near the wide end of the card and electrically connected by means of an insulated wire to one of the conducting pins mounted on the flange 13 and the other being located near the narrow end of the card and electrically connected by means of an insulated wire to another of the conducting pins.

The card 9, for instance, has an end tap terminal 28 on its wide end and this terminal is electrically connected to one of the turns of the resistance wire 26. Electrically connected to and extending from the conducting plate 30 of the terminal 28 is an insulated wire 42 which is electrically connected to the conducting pin 23. Another end tap terminal 28, not shown, but supported on the narrow end of the card 9 is electrically connected to a turn of the resistance wire 26 and is electrically connected by means of another insulated wire, like 42, to the conducting pin 24. In each case as shown in Figs. 2 and 3 the conducting plate 30 of the terminal 28 is secured by means of an eyelet 41 to the insulating card, the eyelet 41 extending through the aperture 40 and through an aperture 43 formed in the card. The eyelet 41 in addition to holding the conducting plate 30 in required position on the card also serves as a point of anchorage for one end of the resistance wire 26. Before the terminal 28 is formed and applied to the wire wound card 9 a bared end of the lead wire 42 is electrically connected to the arm 37 on the plate 33 by folding the arm 37 in the form of a tube about the bared end of the lead wire 42 to form the tubular portion 39 shown in Fig. 2. The tubular portion 39 is squeezed into close engagement with the bared end of the lead wire 42. I may apply solder to the bared end of the lead wire 42 and to the tubular portion 39 to more strongly connect the parts.

The particular turn of the resistance wire to be connected to the terminal is selected and the conducting plate of the terminal is connected to the selected turn of wire. The selected turn of the resistance wire 26 is identified in Figs. 2 and 3 as 44. The conducting plate of the terminal is placed so that the tabs 35 and 36 shown in Fig. 4 extend under the turn 44 of resistance wire 26. The plate 33 may be slid lengthwise of the turn 44 to a required predetermined position where it is

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desired to have the electrical connection made. At the point where the aperture 40 in the plate 33 comes over the card 9 the aperture 43 is formed in the card. The eyelet 41 is inserted through the

aperture 40 in the plate 33 and through the aperture 43 in the card 9. The end of the resistance wire 26 is wrapped around the body of the eyelet 41 and the ends of the eyelet 41 are spun over to hold the plate 30 and the end of the resistance wire 26 in place, the end of the resistance wire 26 being trapped against the outer face of the conducting plate by means of the spun over end of the eyelet 41 on that side of the conducting plate. The tabs 35 and 36 are bent outwardly of the turn 44 of resistance wire and are then folded over the turn of resistance wire and back on themselves and against the body of the plate to clamp the turn 44 against the body of the conducting plate. It will be seen that the tabs 35 and 36 of the plate 33 shown in Fig. 4 have become tubular members 45 and 46 of the conducting plate 30 in Figs. 2 and 3 and that the selected turn 44 of the resistance wire 26 passes through the tubular members 45 and 46. After the tubular members 45 and 46 have been formed welds are made at selected points in the structure by the application of suitable welding apparatus to the parts. In Fig. 2 I have shown three points of weld indicated by the spots 47, 48 and 49. At 47 and 49 the tubular members 45 and 46 are welded to the selected turn 44 of the resistance wire 26 and at 48 the selected turn 44 of the resistance wire is welded to the body portion 50 of the plate 30. The welds may be made in any well-known manner to obtain good electrical connection of the parts and the apparatus used in welding the parts is a matter of choice. I have found, however, that a convenient way of welding the parts is to precoat the plate 30 with tin or other relatively low melting point metal and heat the plate and the selected turn of wire to solder connect the parts. In order to apply heat to the parts, I insert a piece of metal foil under the conducting plate of the terminal and so that the piece of foil is in electrical contact with the portions of the terminal underlying the selected turn of wire 44. The piece of metal foil is connected to one side of an electrowelding apparatus and so that it forms one electrode of the electrowelding apparatus. The other electrode of the welding apparatus is brought into contact with the outer surfaces of the tubular members 45 and 46 of the conducting plate 30 of the terminal and sufficient pressure and electrical current is then applied to the parts to cause the tubular members 45 and 46 to be permanently connected to the selected turn of wire 44. It will be obvious that precoating the metal plate with low melting point metal need not be resorted to in all cases and that the conducting plate of the terminal and the selected turn of wire may be directly welded together at the required points by applying sufficient electrical current to the parts to make them fuse together. While the piece of metal foil is in contact with the conducting plate of the terminal the weld at point 48 may be made by applying the other electrode of the welding apparatus to the selected turn to wire 44 in the vicinity of the desired point of weld.

After the conducting plate 30 of the terminal 28 and the selected turn 44 of wire are electrically connected at the required points the sheet 31 of insulating material is placed under the conducting plate 30 to insulate the plate 30 from turns of the resistance wire in the vicinity of the

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selected turn 44, the sheet 32 of insulating material is then placed over the main portion of the conducting plate 30 of the terminal and in registry with the sheet 31 of insulating material and is held in place by means of cement or other suitable material. The sheets 31 and 32 are larger than the conducting plate 30 of the terminal and form respectively front and back insulating coverings for the portion of the conducting plate 30 lying over the turns of resistance wire on the card. The sheets 31 and 32 may be made of insulating adhesive tape and may be arranged so that the sheet 31 sticks to the turns of wire and to the card 9 in the vicinity of the selected turn 44 of the resistance wire and the sheet 32 sticks to the sheet 31 and to the outer surface of the conducting plate 30 of the terminal. It will be seen as shown in Fig. 1 that the insulated lead wire 42 is electrically connected at one end to the conducting pin 23 and that the terminal 28 and the insulated wire 42 serve as an electrical connection between the selected turn 44 of the resistance wire 26 and the conducting pin 23. In this construction the conducting plate 30 of the terminal 28 is secured to the selected turn 44 of the resistance wire 26, the conducting plate 30 is secured to the card 9 by means of the eyelet 41, the sheet 31 is secured by means of adhesive material to the turns of wire and the card 9 in the vicinity of the selected turn of wire and the sheet 32 is secured by means of adhesive material to the outer surface of the conducting plate 30 and to the sheet 31.

In Fig. 1 an end tap terminal 28 is provided on one end portion of the insulating card 10 and is electrically connected by means of an insulated wire 51 to the conducting pin 21. The terminal 28 in this case is electrically connected to a selected turn of the resistance wire 27 and is constructed like the terminal 28 above described. Another end tap terminal 28 is also provided for the other end of the resistance wire 27 and this last-mentioned end tap terminal is electrically connected to the conducting pin 20.

In the modification of the invention shown in Figs. 5 and 6 the intermediate tap terminal 29 follows in general the pattern of the end tap terminal 28 above described but is constructed and arranged so that it may be used in places where there is no space available for securing the conducting plate of the terminal to the card by means of an eyelet.

The intermediate tap terminal 29 as shown in Figs. 5 and 6 comprises a conducting plate 52 and the insulating sheets 53 and 54. The conducting plate 52 is formed from a piece of sheet metal originally cut to the form of the plate 55 shown in Fig. 7. The plate 55 comprises a body portion 56 and a tail portion 57, which is narrower than the body portion 56 and extends longitudinally of and from one end of the body portion 56. Spaced cuts 58 and 59 are made in the body portion 56 in line with the parallel edges of the tail portion 57 and so that bendable tabs 60 and 61 are provided near the inner end of the tail portion 57. The terminal 29 as shown in Figs. 1, 5 and 6 serves as an electrical connection between a selected turn 62 of the resistance wire 27 on the card 10 and the conducting pin 22.

In making the intermediate tap terminal 29 the conducting plate 52 of the terminal 29 is formed from the plate 55 and electrically connected to a bared end of the insulated lead wire 63 by folding an end of the body 56 of the con-

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ducting plate 55 about the bared end of the lead wire 63 to form a tubular portion 64 and by pressing the tubular portion 64 into engagement with the bared end of the lead wire 63. The tubular portion 64 and the bared end of the lead wire 63 may be secured together by welding or soldering the parts. After the lead wire 63 has been electrically connected to the conducting plate 55, the conducting plate 55 is placed so that the tabs 60 and 61 are under the selected turn 62 of the resistance wire 27. The tabs 60 and 61 are bent outwardly of the turn 62 of the resistance wire and are then folded over the turn 62 and back on themselves and against the body of the conducting plate 55 to clamp the turn 62 against the body of the conducting plate 55. It will be seen as shown in Figs. 5 and 6 that the tabs 60 and 61 of the conducting plate 55 shown in Fig. 7 have become tubular members 65 and 66 respectively of the conducting plate 52 shown in Figs. 5 and 6 and that the selected turn 62 of the wire 27 passes through the tubular members 65 and 66. After the tubular members 65 and 66 have been formed about the selected turn 62 of the resistance wire 27 welds are made at selected points in the structure by the application of suitable welding apparatus to the parts. In Fig. 5 I have shown three points of weld indicated by the spots 67, 68 and 69 and it will be understood that the welds may be made in the same manner as set forth in the description of the terminal 28. At 67 and 69 the tubular members 65 and 66 are welded to the selected turn 62 of the resistance wire 27 and at 68 the selected turn 62 is welded to the body portion 70 of the conducting plate 52 of the terminal 29. The sheet 53 of insulating material is inserted under the conducting plate 52 and the selected turn 62 of the resistance wire and so that the sheet 53 extends over turns of the resistance wire in the vicinity of the selected turn 62. The tail portion 57 and the body portion 70 of the conducting plate 52 rest on the sheet 53, the body portion 70 extends from the left of the selected turn 62 of the resistance wire and the tail portion 57 extends from the right of the selected turn 62. It will be seen by looking at Fig. 5 that if a force is applied to the lead wire 63 such as might cause the conducting plate 52 to pivot on the selected turn 62 and move outwardly of the sheet 53 such pivotal action is prevented by the tail portion 57 of the conducting plate 52 and that the body portion 70 of the conducting plate 52 prevents opposite rotation of the conducting plate 52 about the pivotal point of attachment involving the selected turn 62 of the wire 27. The sheet 54 of insulating material is applied over the outer surface of the conducting plate 52 of the terminal and is secured thereto and to the sheet 53 in any suitable manner. The sheets 53 and 54 are larger than the conducting plate 52 and may be made of insulating adhesive tape or other suitable insulating material. The insulated wire 63 as shown in Fig. 1 is electrically connected at one end to the conducting pin 22.

As above mentioned the sheets 31 and 32 used in Figs. 2 and 3 and the sheets 53 and 54 used in Figs. 5 and 6 may be made of insulating adhesive tape or of other suitable insulating material. It is intended that this terminology be considered in its broad sense since many forms of sheet insulating material suitably prepared for adhering to surfaces to which applied may be used. In some cases for instance the card mem-

ber of the wire wound card may be made of rubber or rubberized material and the sheets may be made of material prepared for adhering to the card material. The card member may be made of insulating fibre and the sheets may be coated or impregnated with a suitable cement to secure the sheets in place.

What is claimed is:

1. An electrical terminal comprising a metal plate, a tube member formed on said plate to receive and hold a wire, spaced tubular tabs formed on said plate and arranged in alignment with each other to receive and hold a second wire and a sheet of insulating material in face-to-face relation with and underlying said plate and providing an insulating support for said plate.

2. An electrical terminal comprising, in combination, two sheets of insulating material, an adhesive substance on said sheets, a plate of conducting material disposed between and in flat face-to-face engagement with said sheets, a wire electrically connected to one end of said plate, spaced tabs on said plate for electrically connecting said plate to another wire and said sheets being fastened together and to said plate by means of said adhesive substance.

3. An electrical terminal comprising, in combination, two sheets of insulating material, a conducting plate disposed between said sheets, a tubular portion on one end of said plate, a wire extending into and electrically connected to said tubular portion, spaced tubular tabs on said plate, said tabs being constructed and arranged for electrical connection to another wire and means adhesively connecting said sheets to each other in face-to-face relation.

4. An electrical terminal comprising, in combination, a conducting plate, a tubular portion on one end of said plate, a wire extending into and electrically connected to said tubular portion, spaced tubular tabs on said plate, said tabs being constructed and arranged for electrical connection to another wire, a sheet of insulating material disposed on the back of said plate and serving as an insulating backing for said plate and a second sheet of insulating material overlying the first sheet and the front of said plate and adhesively connected to said first sheet.

5. An electrical terminal comprising, in combination, a conducting plate, tubular members formed on said plate for securing wires to said plate, a lead wire connected to one of said tubular members, a sheet of insulating material covering one face of said plate, a second sheet of insulating material covering the opposite face of said plate and the first sheet, adhesive material in said sheets and holding said sheets together and to said plate and means to secure said terminal to a support.

6. An electrical terminal comprising, in combination, two sheets of insulating material containing an adhesive substance, an apertured conducting plate of narrower form than said sheets, disposed between said sheets and lying in flat face-to-face relation with said sheets, said sheets and said plate being secured together by the adhesive substance in said sheets, folded tabs on said plate for securing said plate to a wire, a tubular member integral with said plate and extending angularly of said plate, a lead wire extending into and electrically connected to said tubular member and means extending through the apertures in said plate for securing said plate to a support.

7. An electrical terminal comprising, in combi-

nation, two sheets of insulating material containing an adhesive substance, a conducting plate of narrower width than said sheets and disposed in face-to-face relation with and between said sheets, a body portion on said plate, a tail portion on said plate narrower than said body portion and extending longitudinally of said body portion, folded tabs formed on said body portion where said body portion terminates in said tail portion, said tabs being located near opposite edges of said tail portion and providing means for connecting said plate to a wire, a tubular member formed on one end of said body portion and a lead wire extending into and electrically connected to said tubular member.

8. In an electrical device comprising a card of insulating material and a wire wound in a plurality of turns on said card, a terminal comprising, in combination, a sheet of insulating material inserted under a selected turn of said wire and extending over other turns of said wire in the vicinity of the selected turn, a conducting plate extending in face-to-face relation with said sheet and under the selected turn of said wire, said conducting plate being electrically connected to the selected turn of said wire, a lead wire electrically connected to one end of said plate, a second sheet of insulating material disposed in face-to-face relation with the first-mentioned sheet and extending over said plate and covering the first sheet and the points at which said plate and the selected turn of said wire are electrically connected and means in said sheets operating to hold said sheets and said plate together and to retain said terminal in required position.

9. In an electrical device comprising a card of insulating material and a wire wound in a plurality of turns on said card, a terminal comprising, in combination, a sheet of insulating material extending under a selected turn of said wire and lying over other turns of said wire in the vicinity of the selected turn of said wire, a conducting plate of smaller width than said sheet, extending under the selected turn of said wire and in face-to-face relation with said sheet, tabs on said plate electrically connected to the selected turn of wire, a lead wire electrically connected to said plate, a second sheet of insulating material covering the first sheet and the points at which said plate and the selected turn of wire are connected and adhesive material on said sheets and holding said sheets in required position.

10. In an electrical device comprising a card of insulating material and a wire wound in a plurality of turns on said card a terminal comprising, in combination, a sheet of adhesive insulating tape extending under a selected turn of said wire and over other turns of said wire in the vicinity of the selected turn, said sheet being adhesively fastened to the turns of wire it overlies and to said card, a conducting plate of narrower width than said sheet and lying in face-to-face relation with said sheet and extending under the selected turn of wire, spaced tabs on said plate clamped around and electrically connected to the selected turn of wire, a second sheet of adhesive tape extending over said plate and covering the first sheet and the point at which the selected turn of wire is electrically connected to said plate, said second sheet being adhesively secured to the first sheet and to said plate, a tubular portion on said plate and a lead wire extending into and electrically connected to said tubular portion.