Sept. 10, 1946. E. M. PATTERSON 2,407,326

WOVEN-WIRE RESISTANCE AND METHOD OF FORMING THE SAME

Filed Jan. 30, 1943

FIG. 1

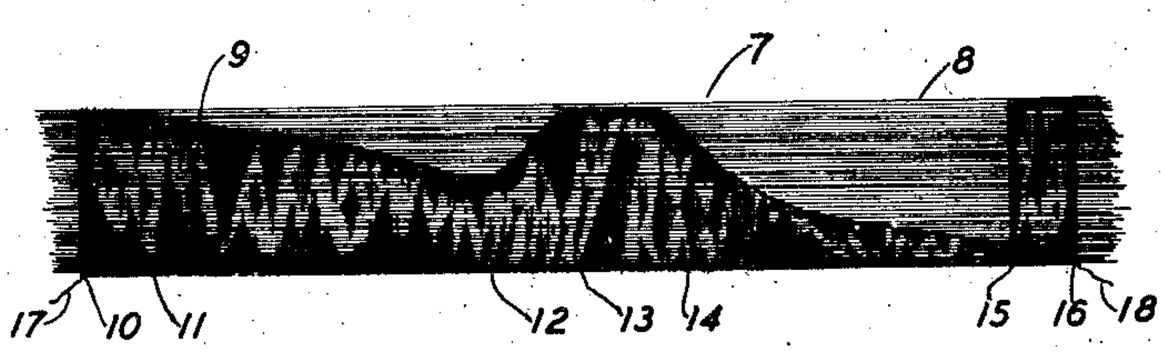


FIG. 2

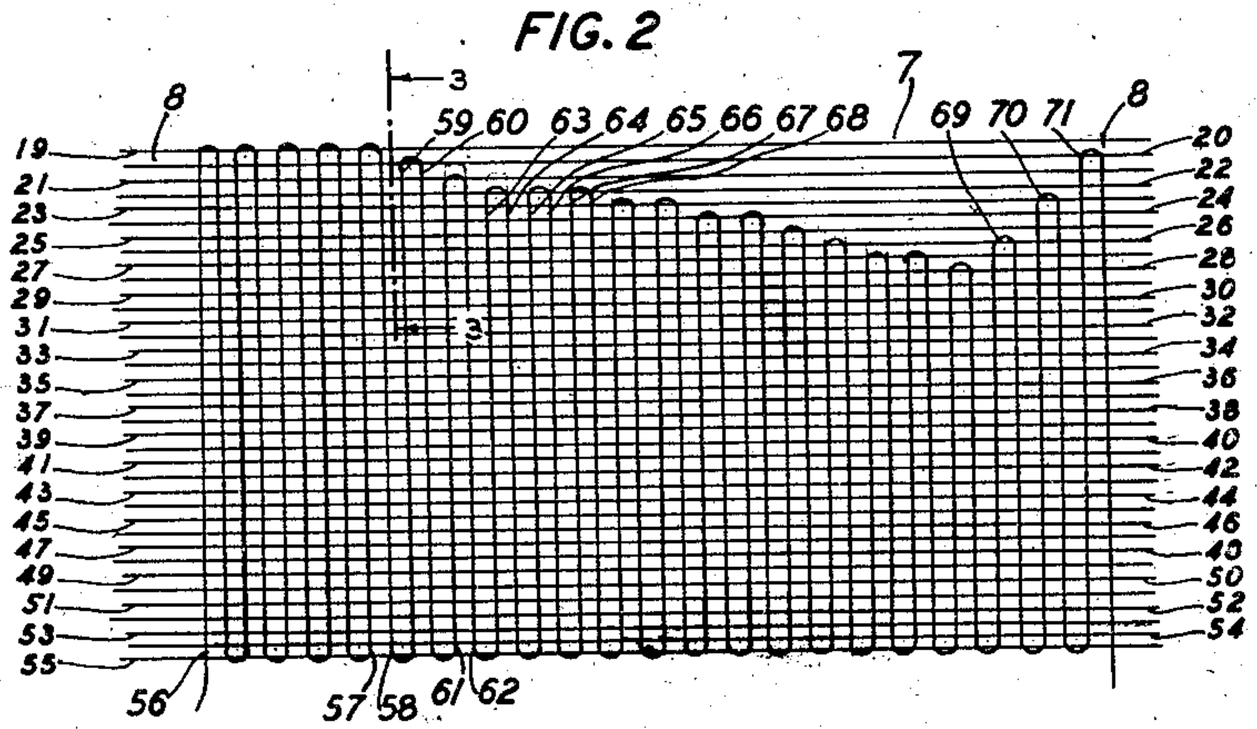


FIG. 3

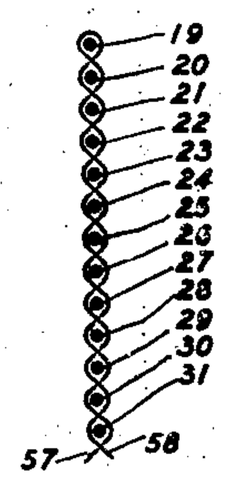


FIG. 4

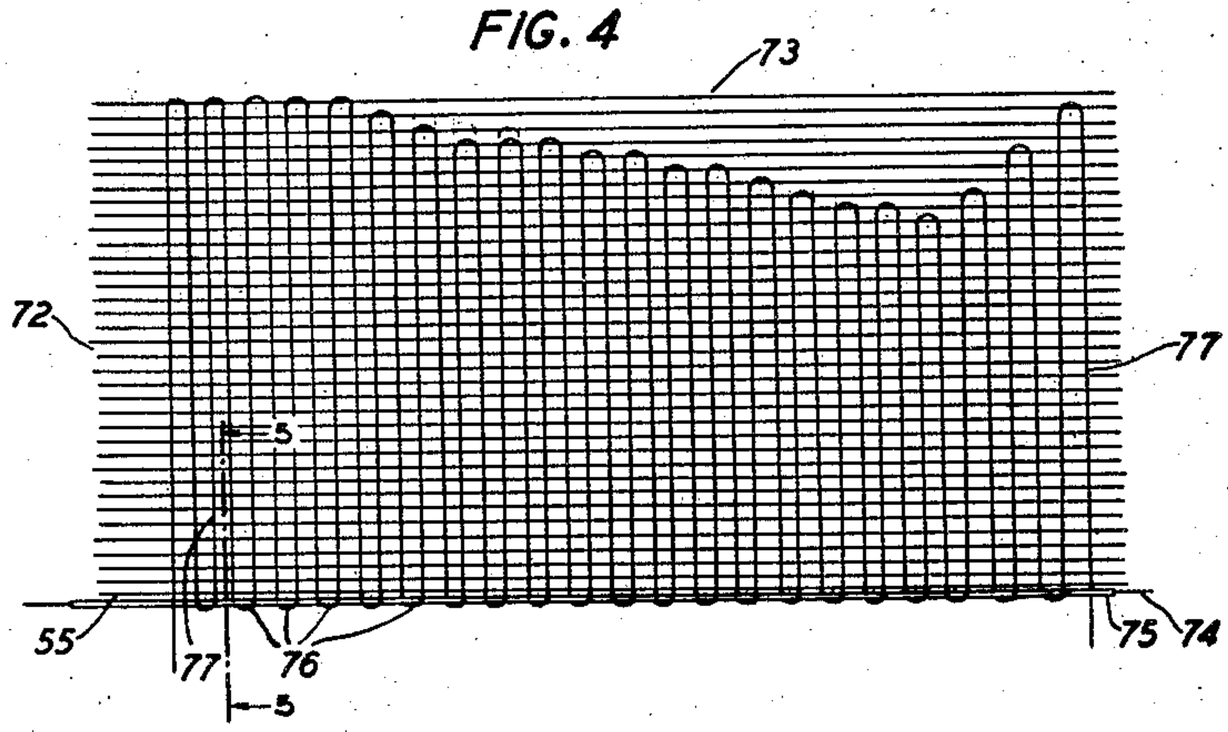
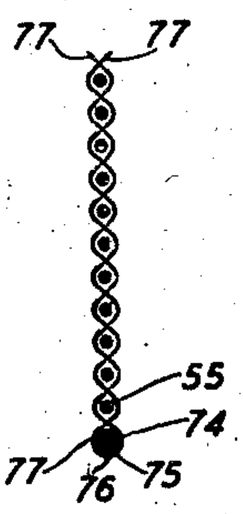


FIG. 5



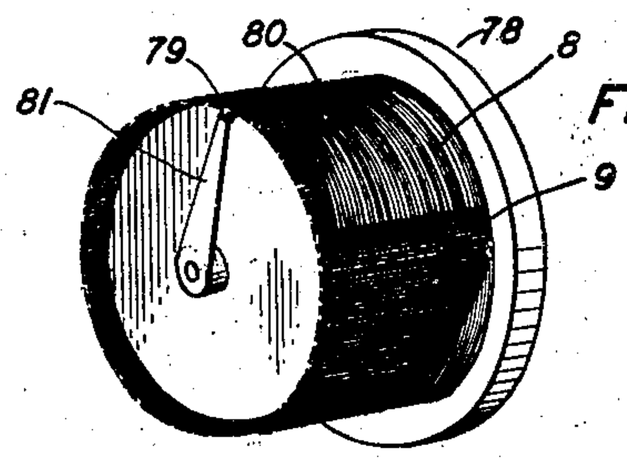


FIG. 6

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WOVEN-WIRE RESISTANCE AND METHOD OF FORMING THE SAME

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Application January 30, 1943, Serial No. 474,130

4 Claims. (Cl. 201—60)

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This invention relates to electrical resistance devices and a method of forming them, and more particularly to resistance devices in which the resistance values obtained at various points along the resistance must be in accordance with a required pattern.

An object of the invention is to provide an inexpensive resistance of so-called tapered form and in which no tapered form support for the wire is necessary in the structure.

Another object is to provide a method of readily making a tapered resistance device in which the variation in resistance value taken along the length of the device may be in the form of a very steep curve.

A feature of the invention resides in the structure of the resistance element.

Another feature resides in a modification providing a reenforcement along an edge of the resistance element.

In the drawing:

Fig. 1 shows one form of resistance element embodying the invention;

Fig. 2 is an enlarged view of a portion of the resistance shown in Fig. 1;

Fig. 3 is an enlarged cross-sectional view of a portion of Fig. 2 taken on the line 3—3;

Fig. 4 is an enlarged view corresponding to Fig. 2 but showing a modification of the invention;

Fig. 5 is an enlarged cross-sectional view of a portion of Fig. 4 taken on the line 5—5; and

Fig. 6 is a view in perspective of a potentiometer with a resistance element constructed in accordance with the invention and mounted on a body of the potentiometer.

In constructing resistance elements for use in potentiometers and rheostats requiring that the resistance value shall change in accordance with a predetermined curve when a wiper contact is moved over and in engagement with turns of a resistance wire supported in the structure, the resistance wire is often wound on a card-type support of tapered form, the wire-wound card-type support being later bent into the form of a ring and mounted on a cylindrical body of the device so that a wiper contact may be rotated over and in contact with turns of the wire located on an edge of the card-type support. In some cases very precise and sudden changes in resistance values are required and the card-type support must be very accurately formed and have an edge portion embodying relatively steep curves. When the curves required on the card-type support are of very steep form, it is found

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difficult to accurately wind wire on the steep curved portions of the card-type support and to prevent the turns of wire from slipping along the curved portions of the support. Notches or other means must be provided on at least the curved edge portions of the card-type support to form rests for the turns of wire extending about the edge of the card-type support. The notches or other means for the purpose must be accurately made and in some cases very closely spaced. The manufacture of the card-type support is therefore quite expensive.

In the present invention no card-type support for the resistance wire is required. The invention is a woven wire type resistance, the wire being woven into a warp in a required pattern.

As shown in Fig. 1 the resistance element 7 comprises a warp 8 usually made of insulating material and a woof 9 of resistance wire. The warp 8 comprises a plurality of spaced threads and the woof 9 is a suitable length of resistance wire woven back and forth across the warp in a predetermined pattern, the picks of wire being run entirely across the warp at some points and only part way across the warp at other points. It will be seen that by varying the length of the picks of resistance wire in accordance with a predetermined pattern a resistance element may be made having a change in value from point to point in accordance with a required resistance changing curve.

Assuming that the woven resistance of the pattern shown in Fig. 1 is used as the resistance element in a resistance device having a wiper contact and the wiper contact is operated entirely along the resistance element to successively engage the picks of resistance wire to change the resistance value in a circuit the resistance value will be changed in accordance with the pattern of the resistance wire. When the wiper contact is traveling from point 10 to point 11 the increase in resistance will be theoretically in equal steps the value of each of which will be the value of two picks of the resistance wire. From point 11 to point 12 the increase in resistance will be more gradual since some picks of resistance wire are shorter than preceding picks. From point 12 to point 13 the increase in resistance for each step will be much greater since each pick of resistance wire is longer than a preceding pick. From point 14 to point 15 the increase in resistance will be quite gradual since each pick of resistance wire is shorter than a preceding pick. From point 15 to point 16 the increase in resistance will be in equal steps since all picks of

the resistance wire between these points are of equal length. The ends of the resistance wire in the woof 9 are identified as 17 and 18.

The manner in which the resistance element is made is indicated in the enlarged views in Figs. 2 and 3 in which the warp 8 contains the threads 19 to 55, inclusive. The resistance wire 56 to form the woof 9 is woven into the warp 8 and so that the picks extend alternately over and under the warp threads in a common and well-known manner in weaving indicated in Fig. 3. To obtain a required change in resistance value from point to point in the woven resistance, however, the picks of resistance wire are run at some points entirely across the warp 8 and at other points are run only part way across the warp, the length of each pick being determined by the resistance pattern required. It will be seen as shown in Fig. 2 that the picks 57 and 58 extend entirely across the warp 8 and that the next two picks 59 and 60 are shorter than the picks 57 and 58 and the wire 56 returns through the warp 8 without passing around the warp thread 19. The picks 61 and 62 are shorter than the picks 59 and 60 since the wire 56 does not pass around the warp threads 19 and 20 but returns across the warp 8 at the position of the warp thread 21. The picks 63, 64, 65, 66, 67 and 68 are of equal length and do not extend to the warp thread 21. They are, therefore, shorter than the picks 61 and 62. It will be quite obvious at this point in the description that the resistance may be made to have a predetermined resistance curve characteristic by making the picks of wire shorter or longer as required and that to point out and indicate the length of each succeeding pick would only unnecessarily lengthen the specification. To shorten the specification and at the same time sufficiently describe the invention it seems only necessary to now point out that by increasing the length of the picks of wire as shown at the points 69, 70 and 71 the resistance curve may be made to have a steeply rising characteristic. At these points it will be seen that each upward run of the wire is longer than the preceding one by an amount equal to the spacing of two warp threads.

In Figs. 4 and 5 a modification of the invention is shown. In this case the warp 72 of the resistance 73 contains a reenforcing means along one edge of the warp 72. The reenforcing means serves in some measure to stiffen the structure and provides a backing for the loops of wire located on one edge of the resistance. The reenforcing means may be, for instance, a wire 74 having a coating 75 of insulating material, the insulated wire 74 being located along the lower edge of the warp 72 so that the loop portions 76 of the resistance wire 77 are supported by the insulated wire 74. The resistance 73 shown in Fig. 4 may be constructed in the same manner as the resistance 7 shown in Figs. 1, 2 and 3, except for the inclusion in the structure shown in Fig. 4 of the reenforcement means involving the insulated wire 74, the warp 72 having the same number of threads as the warp 8 but having the insulated wire 74 running parallel with and next to the warp thread 55 and through the loop portions 76 of the resistance wire.

The resistance 7 or 73 may be used as a resistance element in a resistance device 78 shown in Fig. 6. The resistance element is identified in this figure as 79 and is wrapped around a flanged

cylindrical body 80 in which a wiper contact 81 is rotatably supported to rotate over and engage an edge of the resistance element 79. The ends of the warp may be tied together or be secured to the body 80 in any suitable manner to hold the resistance element 79 in the form of a ring, the original straight edge portion of the element being disposed for engagement by the wiper contact 81. When the resistance element 79 is constructed like the resistance 7 shown in Figs. 1, 2 and 3 the pressure of the wiper contact 81 against the edge portion of the resistance element should be very light to prevent the pressure of the wiper contact from distorting the engaged edge of the resistance element. When the resistance element 79 is constructed like the resistance 73 and includes a reenforcing means such as the insulated wire 74 the reenforcing means serves as a backing for the loop portions 76 of wire on the engaged edge of the resistance element and prevents distortion of the loop portions 76 of wire on the edge portion of the resistance engaged by the wiper contact 81.

What is claimed is:

1. A woven-wire type resistance comprising a warp of spaced threads and a woof of picks of resistance wire woven transversely through said warp and in which between certain predetermined points taken along said resistance picks of resistance wire are made in predetermined varying lengths, extending from one edge of said warp and partially across said warp to make the resistance value taken from one of said points to another follow a predetermined curved resistance changing pattern.

2. A woven-wire resistance comprising a warp of spaced threads, a resistance wire woven back and forth in a plurality of picks of predetermined varying lengths across said warp, one end of each of said picks being located on one edge of said warp and providing loops of said wire along an edge of said resistance and a cord included in said warp and extending through the loops of said wire and providing a backing means for the loops of said wire.

3. A woven-wire resistance comprising a warp of spaced threads, a resistance wire woven back and forth across said warp in a series of picks of predetermined different lengths and supported by the threads in said warp, all of said picks extending to one edge of said warp, said wire having loop portions formed along an edge of said resistance and an insulated wire in said warp and extending through the loop portions of said resistance wire and providing a reenforcement for said warp and a backing means for the loop portions of said resistance wire.

4. A method of forming a tapered resistance having one long straight edge and a required pattern of resistance change measured at various points along the resistance comprising weaving a length of resistance wire back and forth across a warp of spaced threads to form a series of picks of resistance wire, extending all picks to one edge of said warp and making some picks in different predetermined lengths so that the unit resistance values of the picks will be non-uniform and the changes in resistance values measured at various points along the resistance will be in accordance with the required resistance change pattern.

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