Dec. 13, 1949 H. H. MATTHEWS 2,491,193

ELECTRICAL RESISTANCE

Filed Dec. 3, 1945 2 Sheets-Sheet 1

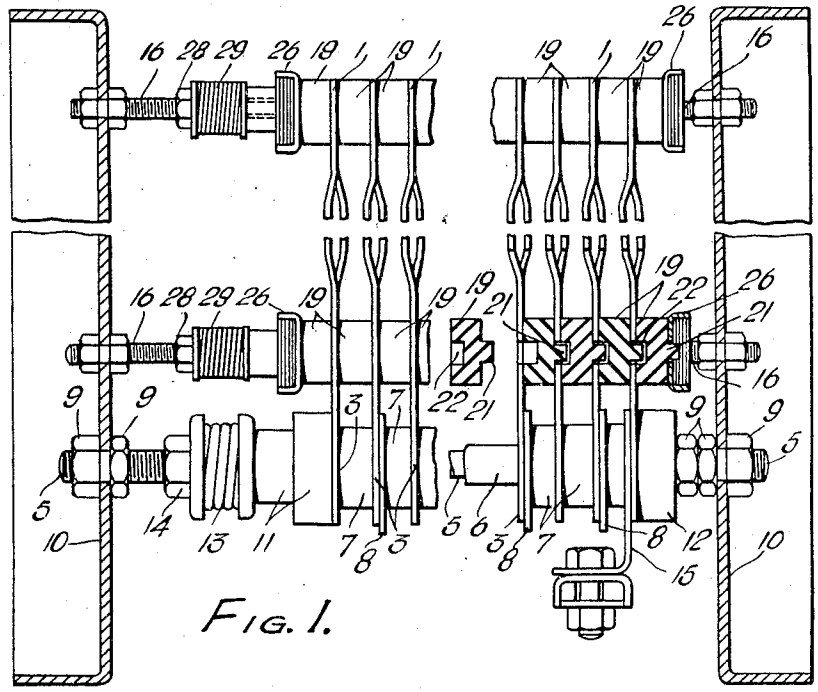


FIG. 1.

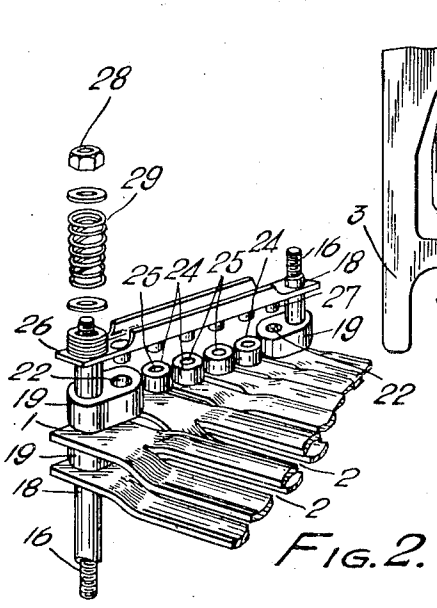


FIG. 2.

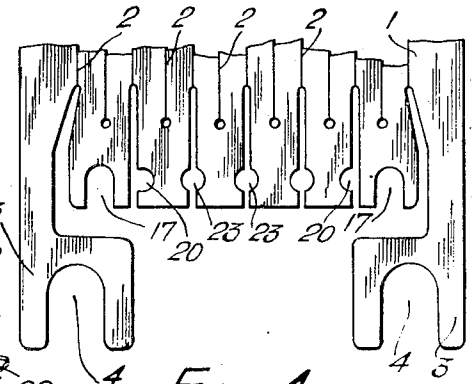


FIG. 4.

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ELECTRICAL RESISTANCE

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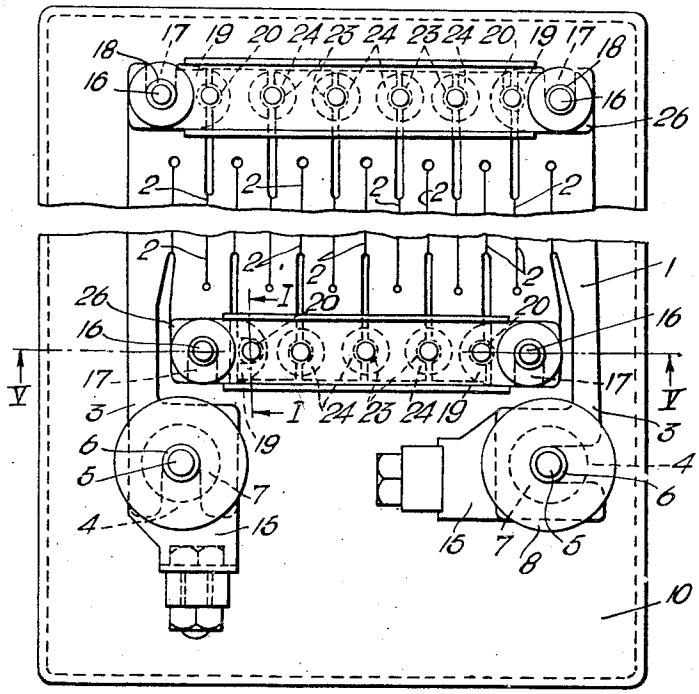


FIG. 3.

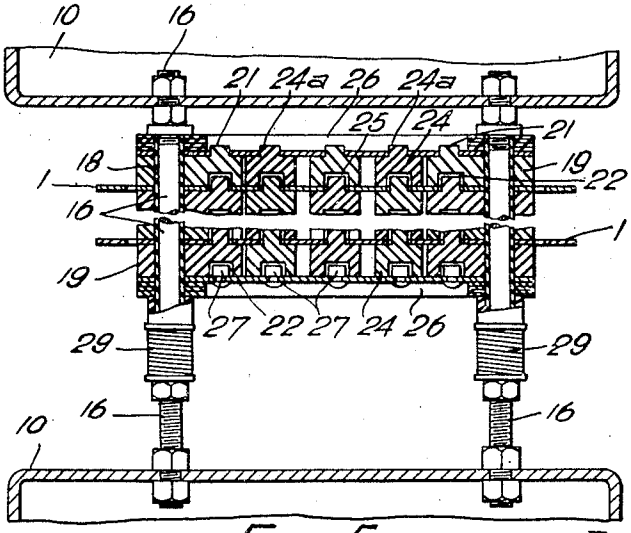


FIG. 5.

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ELECTRICAL RESISTANCE

Harold Herbert Matthews, Brighton, England

Application December 3, 1945, Serial No. 632,402
In Great Britain November 13, 1944

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Patent expires November 13, 1964

2 Claims. (Cl. 201—69)

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This invention relates to electrical resistances and refers particularly to those electrical resistances which comprise a pack of spaced and slotted plates of resistance metal. The object of the invention is the provision of an improved electrical resistance of this kind.

The invention consists broadly of an electrical resistance structure comprising a number of grids of the kind consisting of plates with slits cut into them from opposite edges alternately, said grids being clamped together in parallel spaced relation with insulating spacer elements interposed between them.

In order that the invention may be the more clearly understood a resistance structure in accordance therewith will now be described, reference being made to the accompanying drawings, wherein:

Figure 1 is a part sectional elevation of said resistance structure shown in section on line I—I of Figure 3;

Figure 2 is a perspective view of a portion of the same with certain of the parts exploded;

Figure 3 is an elevation of the same looking from the right of Figure 1 with part removed;

Figure 4 is a face view of a resistance element slightly different from the one shown in Figure 3;

Figure 5 is a section on line V—V of Figure 3.

Referring to these drawings the resistance is built up of a number of similar grids 1 of stamped resistance metal connected in series.

Each grid consists of a roughly rectangular sheet of resistance metal with a number of spaced cuts or slots 2 extending from each of two opposite edges nearly to the other, the spaced slots which extend from one end edge interleaving those which extend, from the other edge, so that the whole plate forms a grid having a long zig-zag conductive path. The arrangement is such that the two extremities of said conductive path are located at opposite ends of the same edge of the plate, and the plate is formed with extensions 3 which continue the conductive path at its two extremities and project beyond the general line of the said edge.

A number of such plates 1 are mounted in superimposed spaced relation as will be hereinafter described. The said end extensions 3 are formed with apertures 4 and each of the two sets of superimposed end extensions are coupled together by means of a bolt 5, surrounded by an insulating bush 6 passing through said apertures 4, said bushed bolt having circular conducting spacers 7 threaded on it, between adjacent end extensions 3.

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Insulating washers 8 are provided on each bolt 5 so as to prevent alternate spacers 7 from affording electric contact between the end extensions 3 on each side as will be clear from Figure 1. Also the insulating washers 8 on the one bolt 5 are in staggered relation with respect to those on the other, and it will thus be seen that the grids are connected in series by means of the non-insulated conducting spacers 7.

The bolts 5 extend beyond the bank of grids 1 and are connected at their ends by nuts 9 to relatively massive supporting end plates 10. Threaded on each bolt 5 just beyond the two outermost grids 1 are two insulating bushes 11 and 12. The bush 11 is pressed against the end extension 3 of its adjacent grid by means of a coil spring 13 which is in compression between said bush 11 and a nut 14 screwed on the bolt 5. This compresses the whole of the end extensions 3, spacers 7 and washers 8 together and also compresses the insulating bush 12 between the adjacent outermost end extension 3 and the adjacent nut 9.

In practice the end extensions 3 are enlarged at their extremities as clearly shown and the apertures 4 in them take the form of notches bifurcating the enlarged portions, and thus the bolts 5 with the spacers on them can easily be slipped into place sideways.

In Figure 3 the notches 4 for the two bolts 5 are shown differently orientated, whereas in Figure 4 they are shown similarly orientated. The reference 15 designates the terminal connecting plates for the whole series of grids. These plates as shown, are each simply threaded on to the appropriate bolt 5 between the appropriate end extension 3 and the adjacent spacer 7.

The plates 1 are also mounted on four bolts 16 passing through apertures 17 in said plates. Each of these bolts 16 is surrounded by an insulating bush 18 for insulating it from the plates 1, and each bolt 16 also has threaded on it a number of insulating spacers 19 between adjacent plates. The apertures 17 in each plate for the four posts 16 take the form of four notches in the edges of the plate. More particularly as shown each of the edges from which the slots 2 extend have two of the notches 17 in it, the two notches in each edge being roughly in line with the two end slots 2 of the series which extend from the opposite edge.

The insulating spacers 19 on the four posts 16 are also made so as to interengage with each other and with the plates 1 and thus to ensure correct location. To this end each of the plates

1 is formed with four more apertures 20 respectively close to the said notches 17, and the spacers 19 are extended so as to overlie these apertures 20, and each spacer 19 is formed with a projecting stud 21 on one side and with a corresponding recess 22 on the other, the arrangement being such that each stud 21 passes through the said additional aperture 20 of the plate 1 at that side and into the recess 22 of the spacer on the other side of that plate. In practice each of the said additional apertures 20 is constituted as shown by a notch formed in the remote side of the next slot 2, in the series extending from the same edge, in the direction away from the end extension.

It will be seen that, as so far described, near each of those edges of each plate 1 from which the interleaving slots 2 extend, two bolts 16 pass through the plate and also two studs 21 apertaining to spacers 19 threaded on said bolts. These bolts and studs are as shown the same distance from the respective edge of the plate 1, lying on an imaginary line parallel to the said edge. Where each of these imaginary lines intersects the slots 2 in between, extending from the respective edge, the plate is formed with further circular apertures 23, and further insulating spacers 24 are provided each having a stud 24*a* at one side of it and a reces 25 on the other, and these further insulating spacers are arranged so that the stud 24*a* of each one passes through one of the further circular apertures 23 and into the recess 25 of the next spacer 24, just as in the case of the studs 21 and recesses 22 of the spacers which are threaded on the posts.

The series of plates 1 and intervening spacers 19 and 24 terminates with spacers 19 and 24 at each end of the series, and it will be seen that the spacers 19 and 24 at one end of the series will have exposed studs whereas the spacers 19 and 24 at the other end of the series will have exposed recesses. More particularly at one end of the series of plates and spacers, there will be two rows of spacers 19 and 24 with exposed recesses and at the other end of said series there will be two rows of spacers 19 and 24 with exposed studs. Covering each of these four rows of spacers is a relatively thick and rigid metal strip 26. In the case where the metal strip covers a row of spacers with exposed studs, as at the right hand side of Figure 1, said metal strip 26 will be formed with holes as shown through which the studs project, and, in the case where the metal strip 26 covers a row of spacers with exposed recesses as at the left hand side of Figure 1 and in Figure 2, said metal strip has metal studs 27 (Figure 2) rivetted to it which project into said recesses. Moreover each of these two metal strips near its two ends is formed with holes through which pass the two bolts 16.

The metal strips 26 at the opposite ends of the structure are clamped towards one another by means of nuts 28 screwed on said bolts at the one end and corresponding nuts, not seen, at the other end. Between the nuts 28 and the metal strips 26 coil springs 29 are compressed.

The said four bolts 16 are rigidly secured at their ends by means of nuts 30 to the aforesaid supporting end plates 10. To increase their rigidity the metal strips 26 may be made of channel section as shown with the channel walls set outwardly from the pack.

The four corner spacers 19 are of oblong form as shown with rounded ends. The other spacers 24 are circular.

All the insulating spacers are of ceramic material for example "Steatite." It will be observed that the construction and arrangement is such that the mechanical strain applied to the spacers is relatively small.

As shown the cuts or slots 2 are widened towards the edges of the plate 1 and where said slots are not widened the metal strips between them are pressed out of the plane of the plate alternately in opposite directions as clearly shown and thus there is no danger of adjacent strips making contact with each other.

I claim:

1. An electrical resistance structure comprising a series of grid plates with slots formed therein from opposite edges, said grid plates being in parallel spaced relation, clamping plates parallel to said grid plates located on the outside of the two outer grid plates of the series, a plurality of individual insulating spacer elements between each adjacent pair of grid plates and between each outer grid plate and the adjacent clamping plate, each individual spacer element being formed with a stud projecting from one side and with a recess in the opposite side, a clamping plate on the outside of one of the outer grid plate being provided with projecting studs and a clamping plate on the outside of the other outer grid plate being formed with apertures, each spacer element between grid plates having its stud passing through an aperture in an adjacent grid plate and into a recess in a spacer element on the other side of said grid plate, each spacer element between the first named clamping plate and the adjacent outer grid plate having its recess in engagement with a stud of said clamping plate and its stud passing through an aperture in said adjacent outer grid plate and into the recess of a spacer element on the other side of said grid plate, and each spacer element between the second named clamping plate and the adjacent outer grid plate having its recess engaged by the stud of a spacer element on the other side of said outer grid plate passing through an aperture in said grid plate and having its stud in engagement in an aperture of said clamping plate, said spacer elements being located by said studs, recesses and apertures and being without bolts passing through them, and means for drawing the clamping plates toward one another and thereby clamping the grid plates and spacer elements.

2. An electrical resistance structure comprising a series of grid plates with slots formed therein from opposite edges, said grid plates being in parallel spaced relation with the edges from which the slots extend in superimposed relation, four elongated clamping plates parallel to said grid plates located on the outside of the two outer grid plates of the series respectively alongside the four edges of said two outer grid plates from which the slots extend, two rows of individual spacer elements between each adjacent pair of grid plates, each of said rows extending alongside the grid plate edges from which the slots are extended, a row of individual spacer elements between each clamping plate and the outer grid plate adjacent thereto, each individual spacer element being formed with a stud projecting from one side and with a recess in the opposite side, two of said clamping plates being provided each with a row of projecting studs, and the other two of said clamping plates being provided each with a row of apertures, each spacer element between the adjacent grid plate having its stud passing

through an aperture in an adjacent grid plate and into a recess in a spacer element on the other side of said grid plate, each spacer element between a studded clamping plate and the adjacent outer grid plate having its recess in engagement with a stud of said clamping plate and its stud passing through an aperture in said adjacent outer grid plate and into the recess of a spacer element on the other side of said grid plate, and each spacer element between an apertured clamping plate and the adjacent outer grid plate having its recess engaged by the stud of a spacer element on the other side of said outer grid plate passing through an aperture in said grid plate and having its stud in engagement in an aperture of said clamping plate, said spacer elements being located by said studs, recesses and apertures and being without bolts passing through them, and means for drawing the clamping plates toward one another and thereby clamping the grid plates and spacer elements.

HAROLD H. MATTHEWS.

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