Jan. 9, 1951 A. P. SIEKLUCKI ET AL 2,537,796

RESISTOR CONSTRUCTION AND INSULATOR

Filed Sept. 23, 1948 2 Sheets-Sheet 1

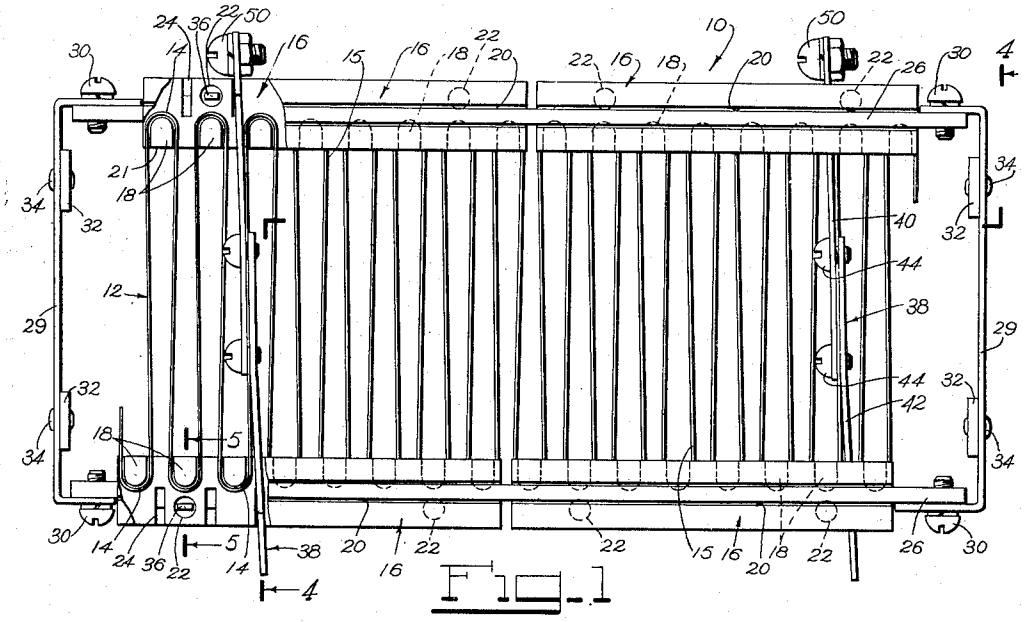


Fig. 1

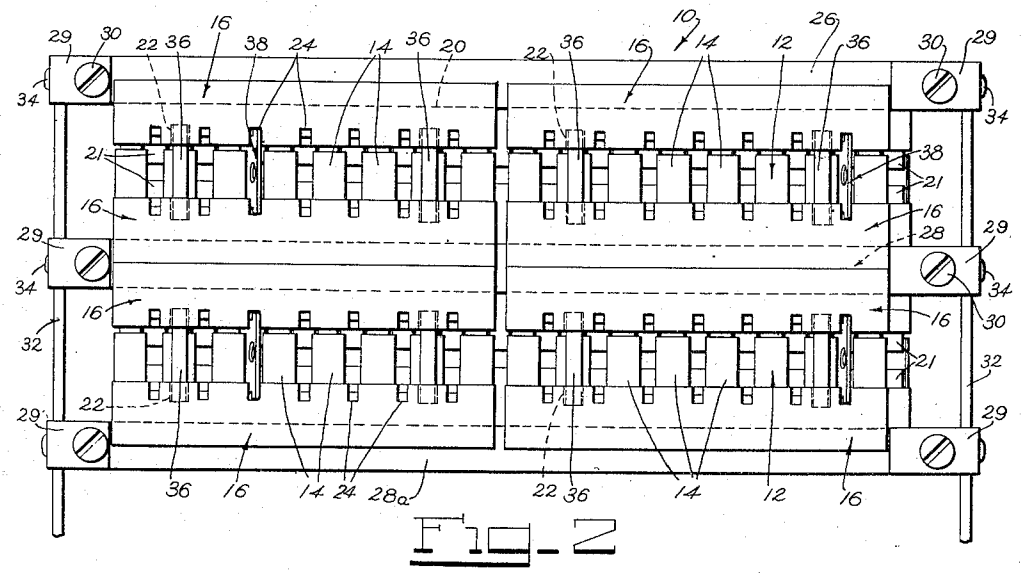


Fig. 2

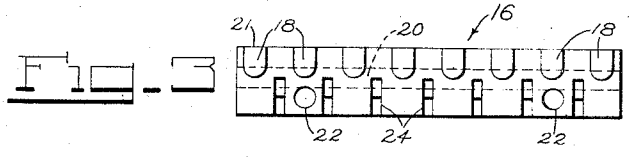


Fig. 3

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Filed Sept. 23, 1948 2 Sheets-Sheet 2

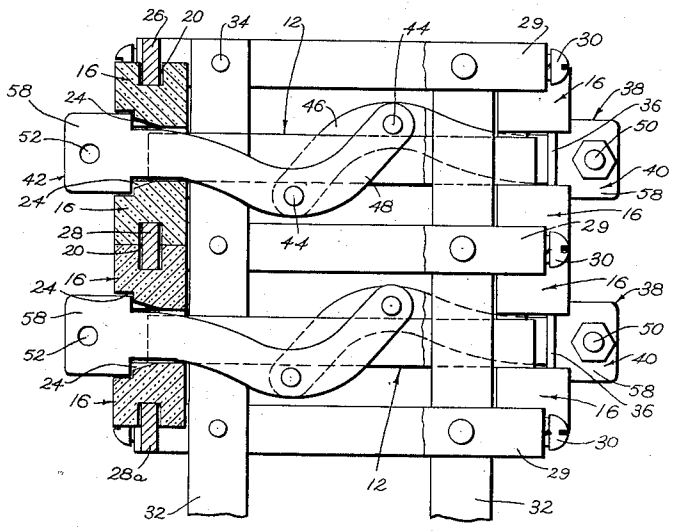


Fig. 4

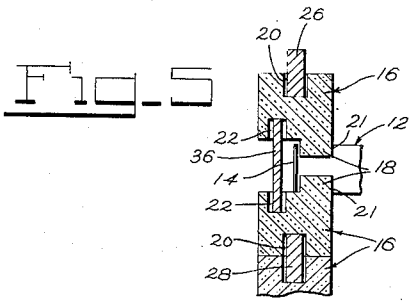


Fig. 5

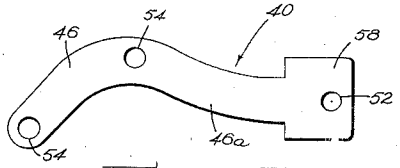


Fig. 7

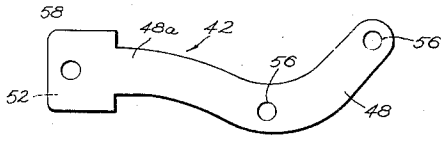


Fig. 6

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Patented Jan. 9, 1951

2,537,796

UNITED STATES PATENT OFFICE

2,537,796

RESISTOR CONSTRUCTION AND INSULATOR

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Application September 23, 1948, Serial No. 50,824

20 Claims. (Cl. 201—63)

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The present invention relates to resistors and more particularly to resistors of the type used in connection with electric motor controls and starters, electric furnaces and ovens, electrical heating units, etc.

Due to the fact that resistance elements undergo alternate heating and cooling in normal operation, said elements are subject to sagging while heated and to excessive tension while cooling or when they are cold. It is therefore one of the objects of the present invention to provide improved supporting means for the resistance elements to properly support the latter, without sagging, under maximum heat conditions thereof, and to prevent excessive stresses when the resistance elements contract upon cooling.

Pursuant to another object of the invention, the supporting means comprise a plurality of insulators which are so constructed that they may be relatively arranged for supporting resistance elements of different widths in a comparatively wide range of widths of resistor elements.

According to another object of the invention, the insulators are so constructed that they are free of undercut or other contoured portions which would interfere with the production thereof by a simple and inexpensive molding process.

Another object of the invention is to provide a resistor construction made of parts which are so constructed that they may be easily manufactured and assembled.

Another object of the invention is the provision of a resistor construction in which the end terminals may be supported by the insulators, which may be positioned selectively at any point along the length of the resistance element, and which may be placed in position or have their positions altered without requiring disassembly of the resistance element and the supporting means.

A further object is generally to provide a resistor which is compact, rugged and durable, and which is simple in construction and comparatively inexpensive to manufacture.

The above and other objects of the invention, objects ancillary thereto, and the above mentioned and other features and advantages of the invention will be fully understood from the following description considered in connection with the accompanying drawings, said description and drawings, however, to be considered as illustrative of the invention but not in limitation thereof.

In the drawings:

Fig. 1 is a plan view of a resistor embodying the present invention, parts broken away for the purpose of illustration;

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Fig. 2 is a side view of the resistor shown in Fig. 1;

Fig. 3 is a plan view of one of the insulators of the supporting means;

Fig. 4 is a view partly in end elevation and partly in section on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view on the line 5—5 of Fig. 1;

Figs. 6 and 7 are side views of a pair of terminal members, respectively.

Referring now to the drawings in detail, the resistor 10 as illustrated, comprises a plurality of units assembled together, as hereinafter more particularly described, but it will be understood that the resistor may consist of only one unit. The unit includes a resistance element 12 and its individual supporting means.

In the illustrated form of the resistor 10, the resistance element 12 is of serpentine form, having a series of reflexed end portions 14 at its opposite longitudinal sides, i. e., at the opposite ends of the series of transverse parts 15. Thus, for example, when element 12 is formed of a sheet metal strip, the latter is folded back and forth in zig zag fashion, along its length in a well understood manner. It is to be understood, however, that the invention is not limited to the use of a resistance element formed of sheet metal, since the features of the present invention may be utilized in connection with resistance elements of other types. The resistance element 12 is preferably a non-oxidizing, heat resisting sheet metal strip such as Nichrome.

The resistance element is mounted in and supported by insulators 16, each of said insulators being of the same construction and size and preferably formed of porcelain. Said insulator 16 is molded in the form of a block having a series of integral projecting portions 18 which are disposed in spaced relation longitudinally of the block adjacent the inner side 21 thereof. As best shown by Figs. 1 and 5, the projections 18 are positioned at the adjacent reflexed portions 14, respectively, of the resistance element 12, at the inner sides of said reflexed portions, respectively. The insulators 16 are comparatively short so as to minimize the possibility of cracking and warping thereof, and for this reason there are a plurality of these insulators along the length of the unit. It will be observed that the insulators 16 are arranged in pairs at each longitudinal side of the resistance element, the insulators of each pair at each longitudinal side of the resistance

element being in opposed spaced relation as illustrated in Fig. 5 and also in Fig. 4, so that the projections 18 of each pair of insulators 16 overlap the adjacent reflexed portions 14 of the resistance element 12. The insulators 16 are also provided with a longitudinally extending groove 20, with a pair of recesses 22 and with a series of spaced transverse grooves 24, having the respective functions which will presently be described.

The insulators 16 are held in position in the above described relation to resistance element 12 by upper and lower longitudinal members, here shown as bars 26 and 28, respectively, there being two upper bars 26, one at each longitudinal side of the unit, and two lower bars 28 one at each longitudinal side of the unit. As clearly shown in the drawings, these bars are received in the longitudinal grooves 20 of the insulators 16, the lower bars 28 supporting the lower insulators 16 of each unit. Said bars extend for the full length of the resistor unit and have their opposite ends, connected to each other by cross members or brackets 29 to which the adjacent ends of said bars are releasably secured in any suitable way, preferably by screws 30. Cross members 29, at each end of the unit are held in vertically spaced relation by rigid bars or rods 32 to which said cross members may be secured in any suitable way, for example, by being riveted thereto as indicated at 34. It will be understood that the vertical distance between cross members 29 depends upon the width of the resistance element 12. Accordingly, it will be understood that the insulators 16 of the same size may be used for resistance elements 12 of different widths, since, bars 26 and 28 may be secured in the required spaced relation depending upon the width of the resistance element 12 which is to be provided in the resistor unit.

It will be noted that the lower bars 28 of the upper resistor unit constitute the upper bars of the adjacent lower resistance unit, as is clearly evident from an inspection of Figs. 2, 4 and 5, the lower bars of said last mentioned resistance unit being indicated at 28*a* in Figs. 2 and 5. It will be noted that bars 26 and 28 and 28*a* are identical in construction and are interchangeable, and that each bar is wide enough to project into two grooves 20 of adjacent insulators 16, as is clearly apparent from an inspection of Figs. 2, 4 and 5. In this connection, it will be observed that when a plurality of resistor units are assembled together, the lower insulators of one unit are disposed adjacent to the upper insulators of the lower adjacent resistance unit. Thus the resistor units may be disposed in stacked relation, in compact fashion without however interfering with the free flow of air around the resistance elements. It will be noted that the bar which is disposed between adjacent resistor units, in this case, bar 28 also constitutes means to space the resistance elements of adjacent units from each other.

The opposed insulators of each pair, at each side of the resistor unit, are held in predetermined spaced relation against movement toward each other by spacing members 36, the ends of which are received in the recesses 22 of the opposed confronting insulators. As best shown in Figs. 2 and 5, spacing members 36 are sufficiently long to provide clearance between the resistance element 12 and the opposed insulators of each pair, at each side of the resistor unit, so that the resistance element is free to expand when heated. Also, the space between the insulators at the opposite sides of the resistance element, i. e., laterally viewing Figs. 1 and 4, is slightly greater than the distance between the reflexed end portions 14 at one longitudinal side of the resistance element and the reflexed portions 14 at the opposite longitudinal side of the resistance element, as clearly illustrated in Fig. 1, so that in the unheated condition of the resistance element, when the latter is in its normally contracted condition, there is substantially no pressure or stress on said resistance element in said lateral direction.

Referring to the terminals 38 for the resistance element, each of the latter comprises the companion terminal members 40 and 42 which are supported in the above mentioned grooves 24 of the insulators 16. The companion terminal members 40 and 42 may be positioned anywhere along the length of the resistance element 12, the series of spaced grooves 24 being provided for this purpose. Said companion terminal members 40 and 42 are disposed at opposite sides of a transversely extending portion 15 of the resistance element 12, as illustrated in Fig. 1, said companion terminal members being tightly clamped against said transverse portion of the resistance element by the screws 44. As clearly shown in Fig. 4, the outer end portions 46 and 48 of terminal members 40 and 42, respectively, extend in opposite directions and are of sufficient length to project beyond the upper and lower edges, respectively, of the resistance element 12 for securement of the companion terminal members to each other in clamping relation to said resistance element by said screws 44. Further it will be noted that the companion members 40 and 42 are of the same configuration so that either of said elements may be placed at either longitudinal side of the resistor unit at which the terminal-wire fastening screw 50 is provided, the outer ends 58 of said companion terminal members having opening 52 for the shank of said terminal screw. Further it will be observed that each terminal member has a reversely curved formation which includes the outer end portion 46 and 48 and the inner end portion 46*a* and 48*a*, respectively. By reason of this construction, each terminal member may be inserted between the confronting opposed upper and lower insulators of each pair, at either side of the resistor assembly, while said insulators are in their assembled positions, shown in Figs. 1, 2 and 4, it being unnecessary to release any of the bars 26 or 28, or 28*a* in order to mount the terminal members 40 and 42 in the desired position, selectively, along the length of the resistance element 12. It will be understood, of course, that as clearly shown in the drawings the grooves 24 for the terminals 38 in one insulator of each pair are in vertical registry with the corresponding grooves of the companion insulator of the pair at each side of the resistor unit. As hereinbefore indicated, terminal members 40 and 42 are of the same formation and are identical in all respects except that the openings 54 of terminal member 40 are not screw threaded, while the openings 56 of the companion terminal member 42 are screw threaded for screw threaded engagement by the screw fastening, openings 54 being slightly larger than the shanks of said screws. Thus, the companion terminal members 40 and 42 are reversible with respect to each other in fastening them to the resistance element.

In the drawings, each resistor unit is shown

as comprising two upper and two lower insulators arranged in end to end relation at each side of the unit. It will be understood that when the resistance element 12 is longer than in the illustrated unit, additional insulators may be easily assembled in end to end relation, bars 26 and 28 for one unit, and bars 28 and 28a for the next unit, when provided, being of correspondingly increased length. In other words, the unit may be of any length, the only requirement being a proportionate number of the relatively short insulators 16 longitudinally of the holding bars, according to the length of the resistance element 12. On the other hand when the resistance element 12 is wider than that illustrated, it is only necessary to proportionately space the adjacent cross members 29 longitudinally of the vertical spacing rods 32. It will be observed that all of the projections, grooves and recesses of insulator 16 extend depthwise in the same direction, i. e., in the direction running between two opposite sides of the insulator block, thus enabling the insulator to be molded complete by a simple molding operation. Also, it will be noted that the insulators 16 are devoid of any undercut or other contoured formations which would complicate the molding thereof. Thus, a single die may be used to produce all of the necessary insulators in a wide range of widths, lengths and thicknesses of resistance elements.

While we have shown and described the preferred embodiment of our invention it will be understood that various changes in the details of construction and in the form and arrangement of parts may be made without departing from the underlying idea or principles of our invention within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent, is:

1. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the reflexed portions of said element at one of said longitudinal sides thereof being disposed between the confronting surfaces of said one pair of insulators, the companion insulators of another of said pairs of insulators being positioned in opposed relation, the reflexed portions of said element at the opposite longitudinal side thereof being disposed between the confronting surfaces of the other of said pairs of insulators, at least one insulator of each of said pairs having a series of spaced portions extending therefrom toward its companion insulator, respectively, said extending portions overlapping adjacent reflexed portions, respectively, of said element for retaining said reflexed portions against movement in a direction inwardly of said adjacent reflexed portions, and means for holding said insulators in said positions thereof.

2. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the reflexed portions of said element at one of said

longitudinal sides thereof being engaged between the confronting surfaces of said one pair of insulators and the companion insulators of another of said pairs of insulators being positioned in opposed relation, the reflexed portions of said element at the opposite longitudinal side thereof being engaged between the confronting surfaces of the other of said pairs of insulators, each of said insulators having a series of spaced portions projecting therefrom toward its companion insulator, respectively, said projecting portions overlapping adjacent reflexed portions, respectively, of said element at the inner sides of said portions, respectively.

3. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the confronting surfaces, respectively, of said companion insulators being contiguous to the reflexed portions of said element at one of said longitudinal sides thereof and the companion insulators of another of said pairs of insulators being positioned in opposed relation, the confronting surfaces, respectively, of said other pair of insulators being contiguous to the reflexed portions of said element at the opposite longitudinal side thereof, at least one insulator of each of said pairs having means projecting therefrom toward its opposing insulator, respectively, said means overlapping adjacent reflexed portions, respectively, of said element inwardly of said reflexed portions, respectively, spacing members between the confronting surfaces of the insulators of each pair for preventing movement of the companion insulators toward each other and providing clearance between the resistance element and the insulators, said insulators having longitudinal grooves therein, respectively, and means engaging said insulators for holding said insulators in the aforementioned positions thereof.

4. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the confronting surfaces, respectively, of said companion insulators being contiguous to the reflexed portions of said element at one of said longitudinal sides thereof and the companion insulators of another of said pairs of insulators being positioned in opposed relation, the confronting surfaces, respectively, of said other pair of insulators being contiguous to the reflexed portions of said element at the opposite longitudinal side thereof, each of said insulators having a series of spaced portions projecting therefrom toward its companion insulator, respectively, said projecting portions overlapping adjacent reflexed portions, respectively, of said element at the inner sides of said portions, respectively, spacing members between the confronting surfaces of the insulators of each pair for preventing movement of the companion insulators toward each other and providing clearance between the resistance element and the insulators, and means engaging said

insulators for holding said insulators in the aforementioned positions thereof.

5. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the reflexed portions of said element at one of said longitudinal sides thereof being engaged between the confronting surfaces of said one pair of insulators and the companion insulators of another of said pairs of insulators being positioned in opposed relation, the reflexed portions of said element at the opposite longitudinal side thereof being engaged between the confronting surfaces of the other of said pairs of insulators, each of said insulators having a series of spaced projecting portions which overlap adjacent reflexed portions, respectively, of said element at the inner sides of said portions, respectively, the insulators of each pair being disposed so that the said spaced portions of one insulator of the pair project toward and are in registry with the spaced portions, respectively, of the other insulator of the pair.

6. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the reflexed portions of said element at one of said longitudinal sides thereof being disposed between the confronting surfaces of said one pair of insulators, the companion insulators of another of said pairs of insulators being positioned in opposed relation, the reflexed portions of said element at the opposite longitudinal side thereof being disposed between the confronting surfaces of the other of said pairs of insulators, each of said insulators having a series of spaced portions projecting therefrom toward the companion insulator, respectively, said projecting portions overlapping adjacent reflexed portions, respectively, of said element at the inner sides of said reflexed portions, respectively, each of said insulators having spaced transverse grooves in the spaces between said spaced portions, respectively, the grooves of one insulator of a pair being in opposed confronting relation with the grooves of the other insulator of the pair, a terminal member disposed in a selected pair of confronting grooves of a pair of opposed insulators at one longitudinal side of the resistance element and supported by said pair of insulators, and a terminal member similarly disposed and supported by a pair of insulators at the opposite side of said resistance element, said terminal members being secured to each other and to a part of said resistance element in the space between said last mentioned pairs of insulators.

7. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the reflexed portions of said element at one of said longitudinal sides thereof being disposed between the confronting surfaces of said one pair of insulators, the companion insulators of another of said pairs of insulators being positioned in opposed relation, the reflexed portions of said element at the opposite longitudinal side thereof being disposed between the confronting surfaces of the other of said pairs of insulators, at least one insulator of each of said pairs having a series of spaced portions extending therefrom toward its companion insulator, respectively, said extending portions overlapping adjacent reflexed portions, respectively, of said element for retaining said reflexed portions against movement in a direction inwardly of said adjacent reflexed portions, a terminal member extending transversely of the confronting surfaces and between said confronting surfaces of the opposed insulators of a pair at one side of said resistance element, a terminal member extending transversely of the confronting surfaces and between said confronting surfaces of the opposed insulators of a pair at the opposite side of said element, said terminal members being supported by said insulator pairs, respectively, and connected to each other and to a part of said resistance element in the space between the said two last mentioned pairs of insulators.

8. A resistor comprising a resistance element having a series of reflexed portions along the length thereof at its opposite longitudinal sides, a plurality of pairs of insulators for mounting said resistance element, the companion insulators of one of said pairs of insulators being positioned in opposed confronting relation, the reflexed portions of said element at one of said longitudinal sides thereof being disposed between the confronting surfaces of said one pair of insulators, the companion insulators of another of said pairs of insulators being positioned in opposed relation, the reflexed portions of said element at the opposite longitudinal side thereof being disposed between the confronting surfaces of the other of said pairs of insulators, at least one insulator of each of said pairs having a series of spaced portions extending therefrom toward its companion insulator, respectively, said extending portions overlapping adjacent reflexed portions, respectively, of said element for retaining said reflexed portions against movement in a direction inwardly of said adjacent reflexed portions, a terminal member extending transversely of the confronting surfaces and between said confronting surfaces of the opposed insulators of a pair at one side of said resistance element, a terminal member extending transversely of the confronting surfaces and between said confronting surfaces of the opposed insulators of a pair at the opposite side of said element, said terminal members being supported by said insulator pairs, respectively, and connected to each other and to a part of said resistance element in the space between said two last mentioned pairs of insulators, said terminal members having inner end portions extending transversely of said part of the resistance element, said end portions being secured to each other, said terminal members having outer portions which are in angular relation to their said inner end portions, respectively, each of said outer end portions having an opening for a terminal fastener.

9. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions dis-

posed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being positioned between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being disposed between the confronting surfaces of the insulators of another pair at least one insulator of each of said pairs having a plurality of spaced means projecting therefrom toward the opposing insulator, respectively, said projecting means overlapping adjacent end portions, respectively, of said element for retaining said end portions against movement in a direction inwardly of said end portions.

10. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being positioned between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being disposed between the confronting surfaces of the insulators of another pair at least one insulator of each of said pairs having a plurality of spaced means projecting therefrom toward the opposing insulator, respectively, said projecting means overlapping adjacent end portions, respectively, of said element for retaining said end portions against movement in a direction inwardly of said end portions, a terminal member extending transversely of the confronting surfaces and between said confronting surfaces of the opposed insulators of a pair at one side of said resistance element, a terminal member extending transversely of the confronting surfaces and between said confronting surfaces of the opposed insulators of a pair at the opposite side of said element, said terminal members being supported by said insulator pairs, respectively, and connected to each other and to one of the said transverse parts of said resistance element.

11. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being positioned between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being disposed between the confronting surfaces of the insulators of another pair, at least one insulator of each of said pairs having a plurality of spaced means projecting therefrom toward the opposing insulator, respectively, said projecting means overlapping adjacent end portions, respectively, of said element for retaining said end portions against movement in a direction inwardly of said end portions, said insulators having longitudinal grooves therein, respectively, and means including longitudinal members engaging said insulators in said grooves, respectively, for holding said insulators in the aforementioned positions thereof.

12. A resistor, comprising a plurality of resistor units disposed in adjacent relation, each resistor unit comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being positioned between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being disposed between the confronting surfaces of the insulators of another pair, at least one insulator of each of said pairs having a plurality of spaced means projecting therefrom toward the opposing insulator, respectively, said projecting means overlapping adjacent end portions, respectively, of said element for retaining said end portions against movement in a direction inwardly of said end portions, said insulators having longitudinal grooves therein, respectively, and means including longitudinal members engaging said insulators in said grooves, respectively for holding said insulators in the aforementioned positions thereof, certain of said longitudinal members being common to and engaging the adjacent insulators of adjacent resistor units.

13. A resistor, comprising a plurality of resistor units disposed in adjacent relation, each resistor unit comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being positioned between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being disposed between the confronting surfaces of the insulators of another pair, at least one insulator of each of said pairs having a plurality of spaced means projecting therefrom toward the opposing insulator, respectively, said projecting means overlapping adjacent end portions, respectively, of said element for retaining said end portions against movement in a direction inwardly of said end portions, said insulators having longitudinal grooves therein, respectively, and means including lon-

gitudinal members engaging said insulators in said grooves, respectively, for holding said insulators in the aforementioned positions thereof, certain of said longitudinal members being common to and engaging the adjacent insulators of adjacent resistor units, and means for releasably securing said bars in spaced relation for holding said insulators in said positions thereof.

14. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being engaged between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being engaged between the confronting surfaces of the insulators of another pair, at least one insulator of each of said pairs having means projecting therefrom toward its opposing insulator, respectively, said means overlapping adjacent end portions, respectively, of said element inwardly of said end portions, respectively, and spacing members between the confronting sides of the insulators of each pair for preventing movement of the companion insulators toward each other and providing clearance between the resistance element and the insulators.

15. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being engaged between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being engaged between the confronting surfaces of the insulators of another pair, at least one insulator of each of said pairs having means projecting therefrom toward its opposing insulator, respectively, said means overlapping adjacent end portions, respectively, of said element inwardly of said end portions, respectively, spacing members between the confronting sides of the insulators of each pair for preventing movement of the companion insulators toward each other and providing clearance between the resistance element and the insulators, and means engaging said insulators for preventing movement of the companion insulators away from each other and for preventing relative movement between the insulators at one longitudinal side of the resistance element and the insulators at the opposite longitudinal side of said element.

16. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being engaged between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being engaged between the confronting surfaces of the insulators of another pair, each of said insulators having a series of spaced projections which are disposed transversely of said end portions, respectively, of the resistance element at their respective inner sides.

17. A resistor, comprising a resistance element which includes a plurality of transverse parts connected to each other by end portions disposed in spaced relation at each of the opposite longitudinal sides of the element, and pairs of opposed insulators at each of said opposite longitudinal sides disposed in spaced confronting relation and engaging the end portions only of said element at said opposite sides, respectively, of said element for supporting the latter only at said opposite longitudinal sides thereof, the end portions at one side of the resistance element being engaged between the confronting surfaces of the insulators of one of said pairs and the end portions at the opposite side of said element being engaged between the confronting surfaces of the insulators of another pair, at least one insulator of each of said pairs having means projecting therefrom toward its opposing insulator, respectively, said means overlapping adjacent end portions, respectively, of said element inwardly of said end portions, respectively, there being a plurality of said pairs of insulators arranged in end to end relation at each of said longitudinal sides of the resistance element, said insulators having grooves therein in their outer sides, and holding bars received in the grooves of the insulators which are in said end to end relation, one bar being common to a plurality of insulators.

18. An insulator comprising a block of insulation material having a series of spaced projections at one of two opposite sides thereof and a series of spaced transverse grooves in said side positioned in offset relation with respect to said projections transversely and longitudinally of the block, said projections having an axial dimension extending from a marginal edge portion of said one opposite side to a point spaced from the opposing marginal edge portion of said one opposite side and said grooves extending from said opposing marginal edge portion to a point spaced from said first mentioned marginal edge portion.

19. An insulator comprising a block of insulation material having a series of spaced projections at one of two opposite sides thereof and a series of spaced transverse grooves in said side positioned in offset relation with respect to said projections transversely and longitudinally of the block, said projections having an axial dimension extending from a marginal edge portion of said one opposite side to a point spaced from the opposing marginal edge portion of said one opposite side and said grooves extending from said opposing marginal edge portion to a point spaced from said first mentioned marginal edge portion, and a longitudinal groove in the other of said two opposite sides of said block.

20. An insulator comprising a block of insulation material having a series of spaced projec-

tions at one of two opposite sides thereof and a series of spaced transverse grooves in said side positioned in offset relation with respect to said projections transversely and longitudinally of the block, said projections having an axial dimension extending from a marginal edge portion of said one opposite side to a point spaced from the opposing marginal edge portion of said one opposite side and said grooves extending from said opposing marginal edge portion to a point spaced from said first mentioned marginal edge portion, and a longitudinal groove in the other of said two opposite sides of said block, all of said projections and grooves extending depthwise in the direction extending between said two sides of the block.

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