Feb. 24, 1959 E. SCHOCH 2,875,310

ELECTRICAL RESISTOR STRUCTURE

Filed Aug. 26, 1958

2 Sheets-Sheet 1

Fig. 1.

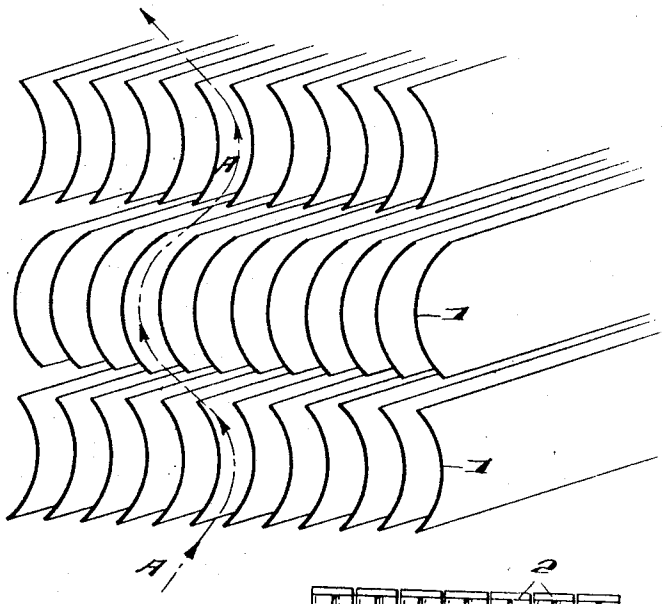
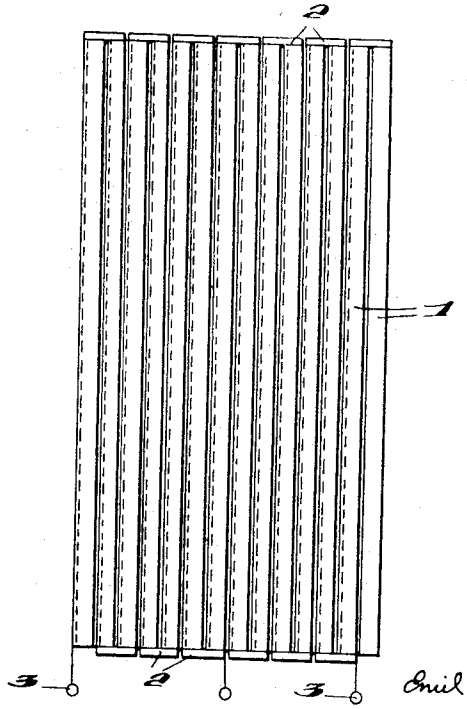


Fig. 2.



INVENTOR

Emil Schoch

BY Pierce Scheffler & Parker

ATTORNEYS

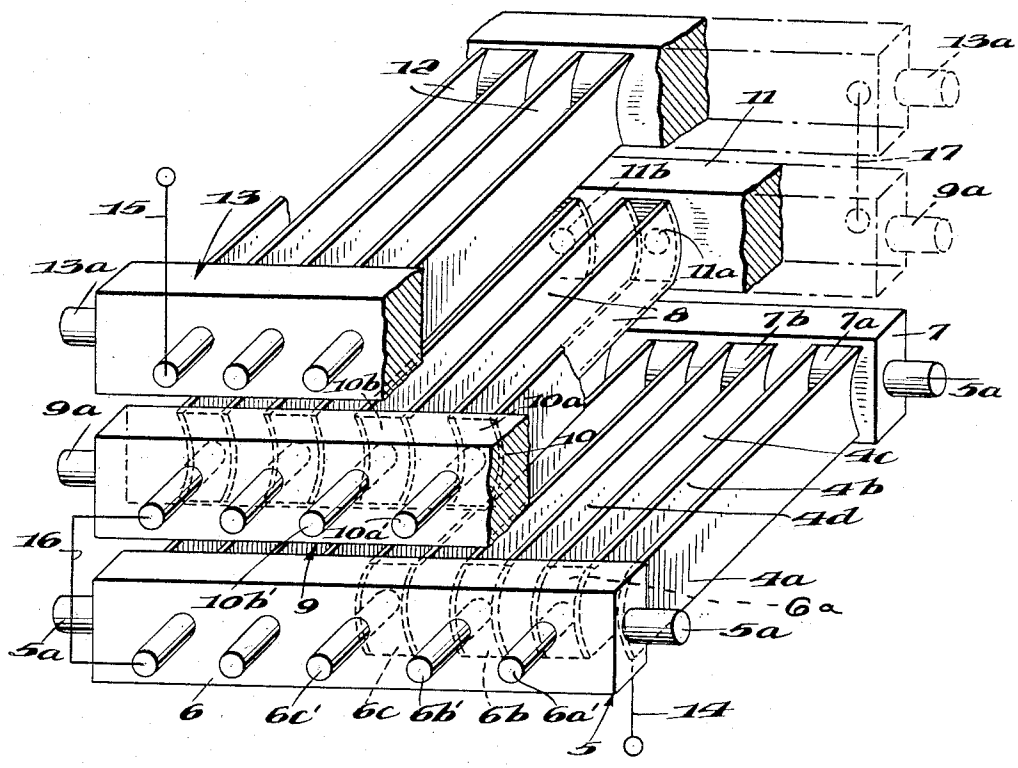
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Fig. 3.



INVENTOR

Emil Schoch

BY Peirce, Scheffler & Parker

ATTORNEYS

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ELECTRICAL RESISTOR STRUCTURE

Emil Schoch, Wettingen, Switzerland

Application August 26, 1958, Serial No. 757,363

4 Claims. (Cl. 201—69)

This invention relates to an improvement in the structure of electric resistances designed for use with starting and regulating devices on electrically driven vehicles.

The present application is a continuation-in-part application of my prior U. S. application Serial No. 603,356, filed August 10, 1956, now abandoned.

There are presently known today resistance elements of thin metal tape which are drawn in corrugated condition over ceramic insulating rolls and formed, together with separators, into a unit. These corrugated resistance elements cannot, however, be assembled closely and, besides, they require a comparatively expensive supporting construction. In another construction, U-shaped bent resistance elements of metal mesh or thick metal tape are used. The manufacture of such elements is comparatively expensive and, above all, the effectiveness is poor since all surfaces cannot be cooled efficiently due to the shape of the elements.

In accordance with the present invention there is provided an electrical resistance having a construction which requires less space in comparison with the existing resistances; it is much lighter and is produced in an extremely simple way. Furthermore the construction is particularly suitable for the artificial cooling of the resistance elements. All of these properties are attained, according to the invention, by providing a resistor which consists of a plurality of vane-shaped resistance elements, each made of metal tape, and assembled in multiple spaced layers as superimposed grids, wherein the direction of curvature of the elements of each grid runs inversely in comparison with the direction of curvature of the elements of adjacent grids.

The invention is explained in detail by way of the appended drawing, in which:

Fig. 1 shows schematically several resistance elements in perspective view;

Fig. 2 represents in plan form a grid assembled of resistance elements; and

Fig. 3 illustrates by a partly broken away perspective view the multilayer construction of the resistor unit having superimposed grids.

The resistance elements consist of vane-shaped arched elements **1** which are, for example, fabricated from rolls of thin metal tape pieces. The particular resistance elements **1** are assembled in a serpentine series arrangement by means of connecting straps **2** into gratewise grids, as may be seen from Fig. 2. The electrical connecting leads are designated by the reference numerals **3**. These grids are superimposed in multiple layers, and the number of grids is determined as desired. The resistance elements **1** of the particular grids are oriented in such a way that the curved directions of the elements run inversely from one grid to another. When the resistor is cooled artificially by pressure air blown through the grid-pile, the air flow shows, due to the alternate vane-shaped arrangement of the elements **1**, a course indicated by the arrow "A" in Fig. 1. The effect of the cold air is, in this way, extremely advantageous when taken from

the kinetic viewpoint, since no eddy currents of air occur and practically the entire faces of the resistance elements are covered with cold air.

Several very substantial advantages are attained with the resistance described above. The ratio "surface to resistance volume" is far more advantageous than in all existing resistances with tape elements, so that the same output may be obtained in smaller space. Hence, this new resistance is particularly suitable for electric vehicles where space saving plays an important part. The vane-shaped elements of thin metal tape show such a mechanical strength that no special carrier means are required for the assemblage of said elements. Under artificial cooling of the resistance, due to the very favorable current conditions, the drop in pressure is smaller than in all existing constructions, so that the cooling installation may be dimensioned smaller. Further, no oscillations appear under artificial cooling in view of the natural inflexibility of said elements. Finally, there must be emphasized the extremely simple form of the resistance elements, their very small weight, and their inexpensive production under application of thin resistance material with large surface.

Referring now to the detailed perspective view of Fig. 3, the resistance elements **4** of the lowermost grid **5** are arranged parallel to each other in the same plane and are all arched in the same direction. At their ends the resistance elements **4** are rigidly supported by the parallel insulating blocks **6** and **7**, which may be of ceramic or other suitable insulating material. Mounted within the insulated supporting blocks **6** and **7** are a plurality of conductive connecting straps which electrically connect the resistance bars **4** in a serpentine series arrangement. For example, resistance bar **4***a* is connected in series with one end of bar **4***b* by the strap **7***a*. Bar **4***b* is electrically connected at its other end in series with bar **4***c* by the connecting strap **6***a*. Resistance bar **4***c* is electrically connected in series with bar **4***d* by the connecting strap **7***b*, and so on. The resistance bar ends may be secured to the connecting straps by welding, soldering, brazing, or any other suitable means.

The resistance bars **8** of the superimposed spaced second grid **9** are similarly supported at their ends by the insulating blocks **10** and **11**. These resistance bars are connected in a series serpentine manner by the conductive connecting straps **11***a*, **11***b*, **10***a*, **10***b* in the manner of the connections of the bars of grid **5**. The bars **12** of grid **13** are connected in series serpentine in the same manner by the electrically-conductive connecting straps. The connecting straps which electrically connect adjacent resistor bars of the same grid have pin portions which extend through and are mounted within the insulating blocks. The pin portions **6***a'*, **6***b'*, **6***c'*, **10***a'*, **10***b'* have been indicated by reference numerals in the drawings. The projecting pin portions of the connecting straps provide means for connecting the resistor element into an electrical circuit. As shown in Fig. 3, the input lead **14** is connected in series with the output lead **15** through the serpentine series arrangement of resistor bars **4** of grid **5**, through electrical jumper **16** to the serpentine series arrangement of resistor bars **8** of grid **9**, through jumper **17** to the serpentine series-connected bars **12** of grid **13**. It is apparent that various numbers of the resistance bars of the grids may be connected to the external electrical circuit depending on which of the connecting strap pins of the grids are connected to the circuit. Thus innumerable resistance values may be achieved for the resistor.

The insulator bars of the grids **5**, **9** and **13** are provided with axially-extending pins **5***a*, **9***a* and **13***a*, respectively, by means of which the resistor structure may be supported in the desired position.

While in accordance with the Patent Statutes I have

illustrated and described the best embodiment of my invention now known to me, it will be apparent to those skilled in the art that other changes and modifications may be made in the apparatus described without deviating from the scope of my invention as defined in the following claims.

I claim:

1. Electric resistance for starting and regulating devices, in particular on electrically driven vehicles, characterized by vane-shaped arched resistance elements which are assembled into horizontal grids in which the individual elements have the same arched direction and are connected together solely by electrical connecting straps, the individual grids being vertically superimposed and arranged to cause the arched direction of the bars of one grid to be reversed from the arched direction of the bars of the next adjacent grid.

2. An electrical resistor structure comprising a plurality of superimposed spaced horizontal grids, each of said grids consisting of a plurality of parallel spaced resistance bars, an insulating block at each end of said resistance bars for supporting the ends thereof, and conductive connecting straps at the ends of said resistance bars electrically connecting said bars into a serpentine series arrangement, the longitudinal central portions of each of said bars of the grid being arched in the same direction, the superimposed grids of the resistor being oriented to cause the direction of arched curvature of

the bars of one grid to be reversed from the direction of arched curvature of the bars of the next adjacent grid, and electrical jumper connections electrically connecting the resistance bars of one grid with the resistance bars of another grid.

3. An electrical resistor as defined in claim 2 wherein at least some of said connecting straps of each grid have pin portions which extend through the adjacent insulating locks, the electrical jumper connections from one grid to another grid being made across said connecting strap pin portions.

4. An electrical resistor as defined in claim 2 wherein the insulating blocks of each of said grids have pin portions axially extending from each end thereof providing means for supporting said grids.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,875,310 February 24, 1959

Emil Schoch

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 9, for "locks" read -- blocks --.

Signed and sealed this 9th day of June 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

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