Aug. 18, 1925. 1,550,641

G. H. WHITTINGHAM

RESISTANCE UNIT

Filed April 25, 1924 3 Sheets-Sheet 1

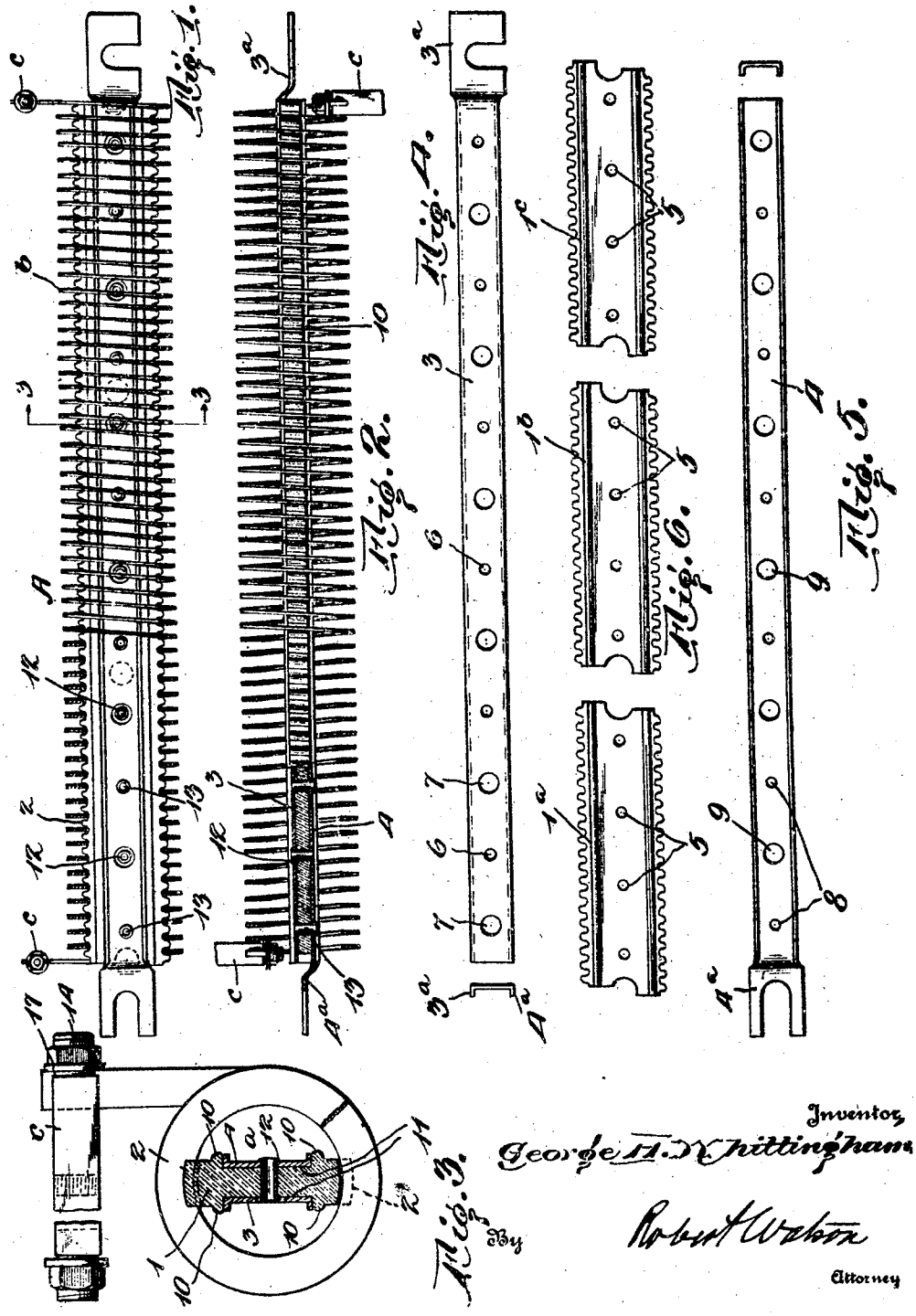


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

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Aug. 18, 1925. 1,550,641

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RESISTANCE UNIT

Filed April 25, 1924 3 Sheets-Sheet 2

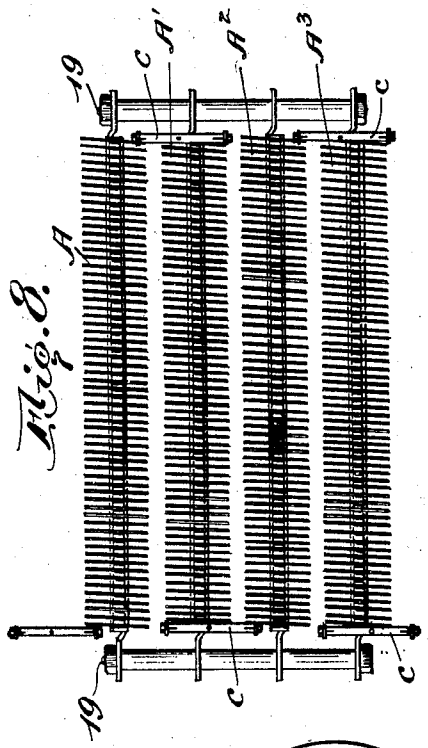


Fig. 8.

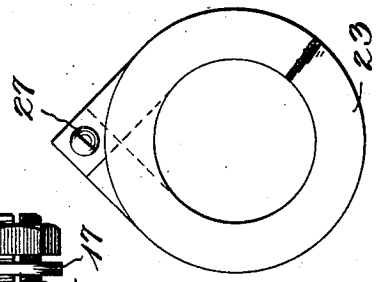


Fig. 10.

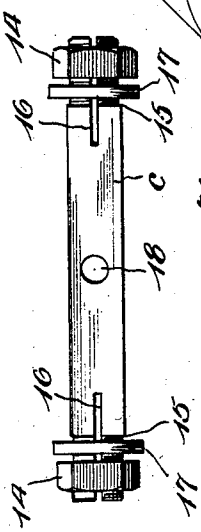


Fig. 7.

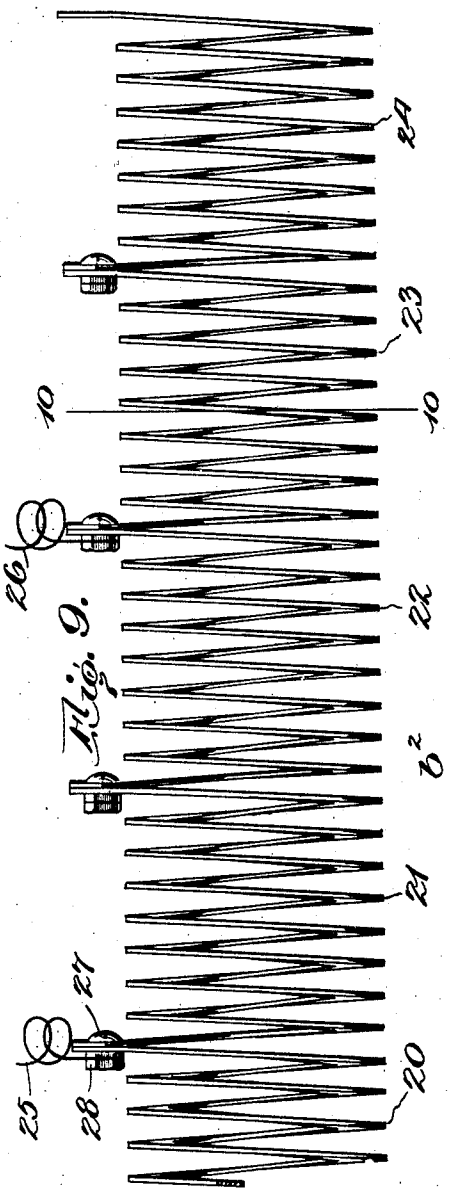


Fig. 9.

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RESISTANCE UNIT

Filed April 25, 1924 3 Sheets-Sheet 3

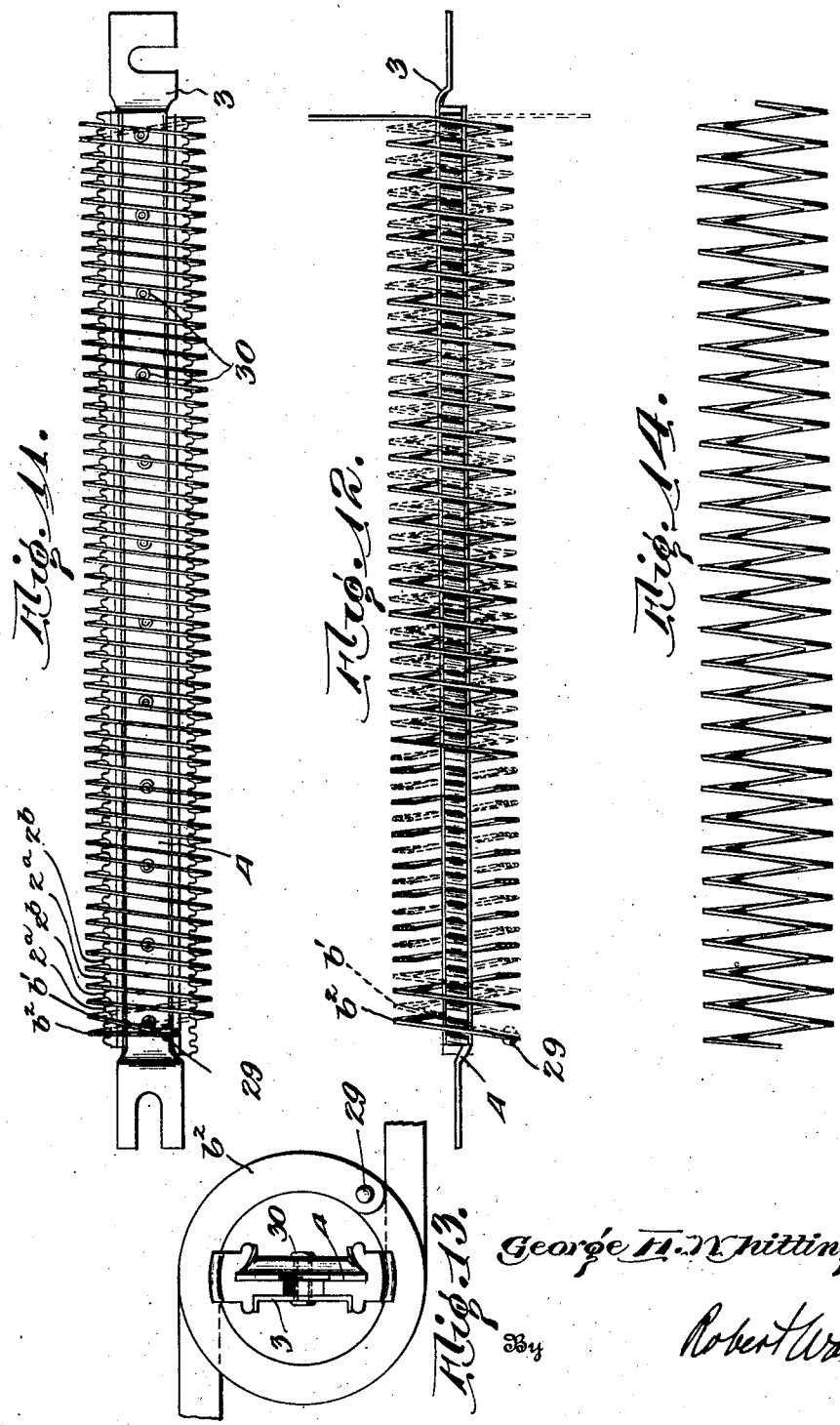


Fig. 11.

Fig. 12.

Fig. 14.

Fig. 13.

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Patented Aug. 18, 1925. 1,550,641

UNITED STATES PATENT OFFICE.

GEORGE H. WHITTINGHAM, OF BALTIMORE, MARYLAND, ASSIGNOR TO MONITOR CONTROLLER COMPANY, OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

RESISTANCE UNIT.

Application filed April 25, 1924. Serial No. 708,943.

To all whom it may concern:

Be it known that I, GEORGE H. WHITTINGHAM, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Resistance Units, of which the following is a specification.

This invention relates to a resistance unit, adapted especially for use in rheostats for controlling electric motors, but, of course, having other uses. In carrying out the invention, I provide a core or support composed of a relatively flat bar of refractory material, preferably porcelain, and this is formed with screw threads in its edges. The bar is preferably composed of relatively short sections, arranged end to end, the number of sections employed depending upon the desired length of the bar. These sections are held together and supported by metal strips arranged at opposite sides of the bar, each strip being secured to each section of the bar. The ends of the strips, at opposite ends of the bar, project beyond the ends of the latter, and they are off-set so as to lie in the central plane of the bar and are suitably formed for connection to a supporting frame.

The resistance element comprises a helix formed of a flat ribbon of resistance metal, wound edgewise and fitting between the threads on the edges of the bar, the convolutions of the helix being spaced evenly apart by the threads. The internal diameter of the helix is such that its convolutions will freely fit between the threads in the edges of the bar, and the helix may be applied by threading it on to the bar. When the unit is in use, the bar extends horizontally and lies in a vertical plane, so that the air can flow upward on each side of the bar between the spaced convolutions of the resistance element, and these convolutions being of flat metal have large surfaces exposed to the air so that the heat is quickly carried off. Each helix or coil, like the bar, may be composed of short sections, so that a unit may be built up to any desired length.

For use with alternating currents, the bar of refractory material is provided with double-screw threads on its edges, and two helices of resistance metal are threaded on to the bar, theses helices being connected together at one end of the bar. As the convolutions of one helix alternates with the convolutions of the other, and the current flows in opposite directions through these convolutions, the induction between the helices is neutralized. This prevents the generation of currents in the metal strips which supports the unit. These strips may, if desired, be riveted together through openings in the refractory material without becoming heated by induced currents.

In the accompanying drawing,

Fig. 1 is a side elevation of a resistance unit embodying my improvements, the resistance element being shown partly in section;

Fig. 2 is a top plan view of the same, the resistance element and supporting core being shown partly in section;

Fig. 3 is a section on the line 3—3 of Fig. 1, on a enlarged scale;

Fig. 4 is a side view of one of the supporting strips forming part of the core for supporting the resistance element;

Fig. 5 is a similar view of the opposing strip;

Fig. 6 is a side elevation of a sectional bar of refractory material which carries the resistance element;

Fig. 7 is a top plan view of one of the connectors, or terminals for the resistance element;

Fig. 8 is a top plan view of a bank of resistance units connected together;

Fig. 9 is a side elevation of a resistance element composed of a plurality of small units connected together;

Fig. 10 is a section on the line 10—10 of Fig. 9;

Fig. 11 is a side elevation of a resistance unit in which the refractory bar is provided with double-screw threads on its edges and carries two coils which are connected together at one end of the unit to form a single resistance element;

Fig. 12 is a top plan view of the same, the coils being shown partly in section and the convolutions of one coil being shown in light lines to distinguish these convolutions from those of the other coil;

Fig. 13 is an end view of the unit shown in Fig. 11, looking from left to right; and,

Fig. 14 is a side elevation of a resistance coil.

Referring to Figs. 1 to 7, inclusive, of the drawing, *a* represents a relatively flat sup-

porting core comprising a bar 1 of refractory material having on its edges screw threads 2, and this bar of refractory material is carried by metal supporting strips 3 and 4, secured to the sides of the bar. The bar 1 is preferably made of porcelain, molded in short sections 1^a, 1^b, and 1^c, which are arranged end to end between the supporting strips and secured thereto. Each section of the bar is provided with a plurality of rivet holes 5. The strip 3 is provided with perforations 6, adapted to aline with certain of the openings 5 in the refractory bar and with larger openings 7, arranged to register with other openings in said bar. Likewise the strip 4 is provided with rivet holes 8, adapted to register with certain rivet holes in the bar and with alternate openings 9, larger than said rivet holes, adapted to register with other openings or perforations in the bar. The bar of refractory material is provided on each side with shoulders 10 and shallow channels 11 are thus formed in the side of the bar between the shoulders, for receiving the supporting strips. The supporting strips are provided with flanges 3^a and 4^a, adapted to abut against the shoulders. In assembling the parts which form the core, rivets 12 are placed through the small perforations 6 in the bar 3 and through rivet holes in the porcelain sections, and the ends of these rivets are turned over against the faces of these sections, as shown in Fig. 3. Similarly, rivets 13 are passed through openings 8 in the strips 4 and through corresponding perforations in the porcelain members, and are turned over against said members. The rivets which connect the strip 3 with the porcelain members project into the openings 9 in the strip 4, and the rivets which connect the strip 4 with the porcelain members project into the openings 7 in the strip 3. These openings are larger than the over-turned ends of the rivets so that while the two strips are connected to each of the sections of the refractory bar, and are connected together through the medium of said sections, they are not connected electrically by the rivets. This is to prevent local currents from circulating through the supporting strips, as would happen if the supporting strips were electrically connected by rivets and an alternating current were passed through the coil.

The end 4^a of the supporting strip 4 is offset and extends beyond one end of the core, and the end 3^a of the supporting strip 3 is offset and projects beyond the opposite end of the core. These ends of the strips lie in the central plane of the refractory bar and they are suitably formed at their ends for connection to a suitable supporting frame.

The resistance element b is composed of a flat ribbon of resistance metal wound edgewise into the form of a helix, the internal diameter of which is such that the convolutions of the helix will lie easily between the threads on the edges of the refractory bar, as shown in the drawing, and is applied by screwing it on to the bar. When in position, the convolutions of the helix are kept separate and spaced evenly apart by the teeth or threads on the bar. When the unit is in use, the core is supported at its ends and is held in the horizontal position with the bar of refractory material lying in a vertical plane. As the bar is relatively flat and does not fill the space within the coil, the air may pass freely through the spaces between the convolutions of the coil, at the sides of the bar, and as the coil is made from a flat ribbon a large area of the coil is exposed to the air which carries off the heat.

For convenience in connecting one unit to another, or to a current source, the ends of the resistance element are extended upwardly, as shown in Fig. 3, and connectors c are provided for attachment to these projecting ends. As shown in Figs. 3 and 7, each connector is threaded at its ends to receive clamping nuts 14, and at the ends of the threaded portions are shoulders 15. Each end of the connector has a slot 16, adapted to receive one end of a resistance element, this slot extending to a distance beyond the shoulder 15, which is somewhat less than the width of the end of the resistance element. Washers 17 are provided between the nuts 14 and shoulders 15 and when the end of the resistance element is inserted in the inner part of the slot, the nut is tightened and this presses the walls of the slot against the sides of the ribbon composing the resistance element and the washer 17 bears against one edge of the ribbon and the latter becomes clamped between the washer and the end of the slot. The connectors are provided with threaded openings 18 to receive binding screws by which wires may be connected to the elements.

In Fig. 8, I have shown a series or bank of resistance units A, A′, A^2 and A^3, connected in series by connector c, the same as shown in Fig. 7, and the ends of the units are shown supported by rods 19.

Fig. 9 shows a heating element b^2, composed of a series of short sections 20, 21, 22, 23, and 24, each section being connected at one end to the end of an adjoining section. The resistance element may be built up to any desired length by using a series of short units and each point of connection between the sections provides a convenient place to connect lead wires, such as 25 and 26, to the element. As shown in Figs. 9 and 10, the ends of the short sections are connected by screws 27 and clamping nuts 28. They may, however, be connected in various ways.

In Figs. 11 and 12, the core for the heating element is the same as in the previously described figures except that the edges of the refractory bar are provided with double screw threads 2^a and 2^b, and two helices b' and b^2 are threaded on to the bar, the ends of these helices at one end of the bar being riveted or otherwise connected together, as shown at 29. Thus, the coils are connected in series with the convolutions of one coil alternating with the convolutions of the other coil, and it will be evident that when an alternating current is passed through the resistance element, the inductive effect between the coils will be neutralized. Hence, the metal supporting strips 3 and 4 will be free from induced currents and for that reason, if desired, the rivets 30 may extend from one strip through the porcelain parts to the other strip, and may be headed over on the latter strip.

What I claim is:

1. A resistance unit comprising a relatively flat bar of refractory material having threads on its edges, metal supporting strips secured to the opposite sides of the bar, the opposite ends of the strips extending from opposite ends of the bar, and a helix of flat resistance metal having its coils arranged edgewise between the threads.

2. A resistance unit comprising a relatively flat bar of refractory material composed of several sections arranged end to end and having threads on their edges, metal supporting strips arranged on opposite sides of the bar and secured to the several sections thereof, and a helix of flat resistance metal having its coils arranged edgewise between the threads.

3. A resistance unit comprising a relatively flat bar of refractory material composed of sections arranged end to end and having threads on their edges, two metal supporting strips arranged on opposite sides of the bar, each strip being secured to each section and the strips being insulated from one another, and a helix of flat resistance metal having its coils arranged edgewise between the threads.

4. A resistance unit comprising a relatively flat bar of refractory material having longitudinal channels on its sides and threads on its edges, metal supporting strips fitting in said channels and a helix of flat resistance metal having its coils arranged edgewise between the threads.

In testimony whereof I hereunto affix my signature.

GEORGE H. WHITTINGHAM.