Feb. 6, 1940. A. H. FESSLER ET AL 2,189,515

RESISTOR

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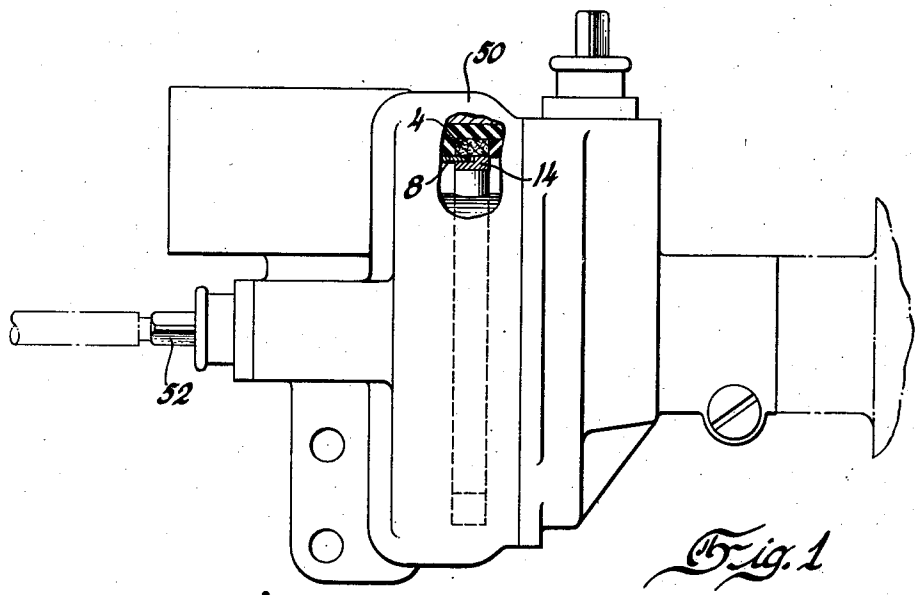


Fig. 1

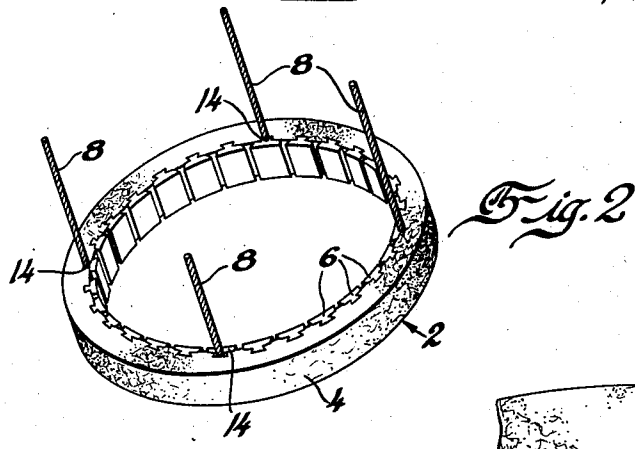


Fig. 2

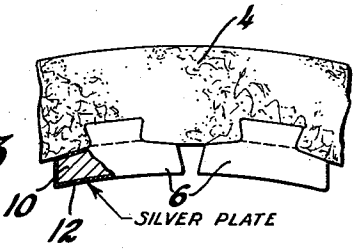


Fig. 3

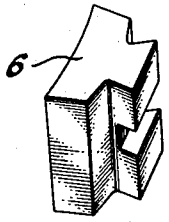


Fig. 4

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RESISTOR

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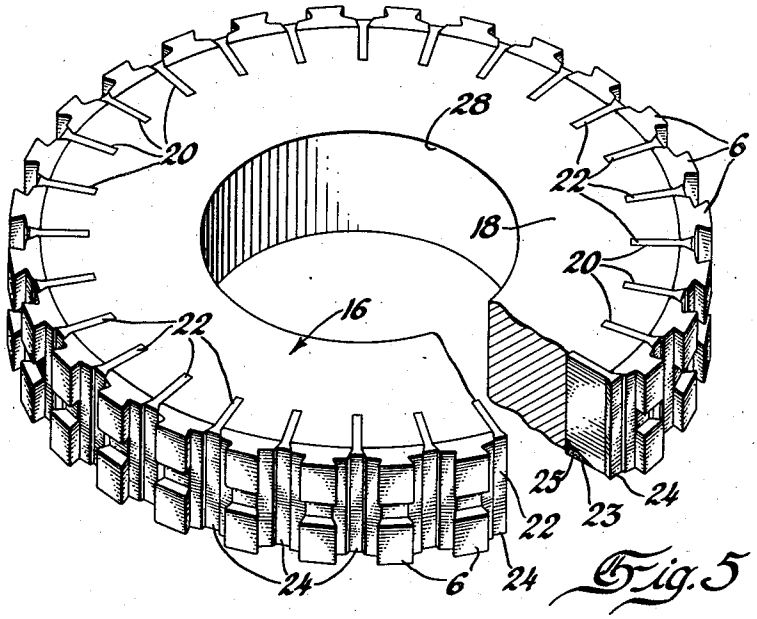


Fig. 5

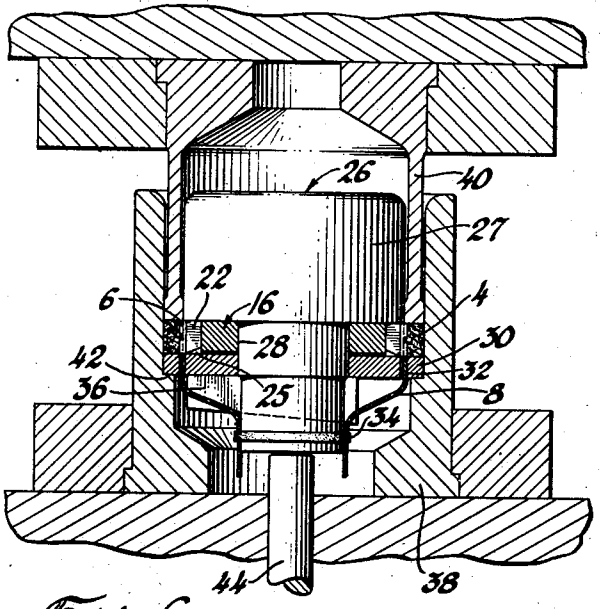


Fig. 6

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Patented Feb. 6, 1940

2,189,515

UNITED STATES PATENT OFFICE

2,189,515

RESISTOR

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Application August 6, 1937, Serial No. 157,668

2 Claims. (Cl. 201—76)

This invention relates to a resistance device and the method and apparatus for making the same.

There are certain installations and designs of apparatus in which it is necessary to obtain from a substantially constant potential unidirectional source of current, a fluctuating or pulsating current and from this to obtain a rotating field. This is, true in various installations on automotive vehicles where the source is a storage battery but a rotating field is desired to be generated by some rotating part for indicating purposes such as speed, time, etc. It is of course possible to generate a pulsating current from a constant potential source in combination with rotatable means. It is necessary however to have some pseudocommutating means to acomplish this purpose.

It is therefore an object of our invention to provide a resistance commutator means.

It is an object of our invention to provide a resistance device having a plurality of supply connections at spaced intervals whereby contact at various points therealong will supply different potentials depending on their location.

It is an object to provide conducting inserts in a resistance device to allow a more satisfactory transfer of electrical energy.

It is an object to provide a new and novel method of manufacturing the unit.

It is a further object to provide means for carrying out the method of manufacture.

With the above and other objects in view, which will become evident as the specification proceeds, the embodiments of our invention are described in the following specification and claims and illustrated in the accompanying drawings, in which:

Figure 1 is an elevation partly in section of the resistant member in place in a suitable assembly.

Figure 2 is a perspective view of one form of resistance commutator element.

Figure 3 is an enlarged view of a portion of the element, part being shown in section.

Figure 4 is a perspective view of one of the segments.

Figure 5 is an enlarged perspective view, parts being broken away and shown in section, of the spacer or holder for assembling purposes.

Figure 6 is a vertical section through the press used in assembly.

The particular form of resistance commutator is best shown in Figure 2 but it is of course to be understood that this configuration is merely illustrative as any other shape might be used without departing from the inventive concept.

The ring 2, shown in Figure 2, is composed of an outer composite resistor ring 4 into which are molded a series of commutator segments 6, certain segments having staked thereinto suitable connecting wires 8 at any desired interval. The resistance material 4 is formed in this instance of four constituents, namely, graphite, asbestos, resin and a lubricant. In this construction it is of course evident that the molded and baked resistance material is the supporting portion of the whole assembly and therefore it must have adequate mechanical strength to maintain a desired configuration as well as uniform electrical resistance and stability of the resistance with temperature changes. The mechanical strength is provided in this instance by the fibrous asbestos filler and the uniform electrical resistance is obtained mainly by utilizing uniform raw materials with accurate proportioning and uniform mixing of the same as well as careful handling in the molding and baking process. For example, if the asbestos is of larger particle size, less graphite is needed to produce the same electrical resistance than if the particles were finer. In order to maintain a uniform result therefore with a larger particle size, it was found necessary to grind the material in a porcelain mill for a period of time until it was believed to be approximately the same size as had formerly been used. The two materials then produced substantially the same result in a measurement of resistance. The materials are then mixed in the desired proportions, for example: 450 grams ground asbestos, 345 grams of graphite, 250 grams of resin and 10 grams of lubricant. This material forms a plastic mass that is then ready for molding.

The segments 6 are formed of a copper base 10 preferably formed by extrusion to desired cross section and then cut off to a given length. With the early experimentation it was discovered that a copper surface would not adhere satisfactorily to the resistance backing ring and therefore it was necessary to coat the surface or at least that part of the segment surface which is to contact with the backing ring with some suitable material so that proper adherence could be secured. The copper segments are therefore treated, preferably by enveloping them with silver as shown at 12 before they are ready to be placed in the assembly. The oxidation of the silver coating on the segments causes little or no change in the resistance whereas oxidation of an exposed copper surface increases with time and gradually causes a considerable change and the silver coating is therefore advantageous from the standpoint of prolonged uniformity of operation. Certain of the segments, such as shown at 14, are drilled and have the ends of the conductors 8 staked therein to provide connections at these points, in the illustration shown in Figure 2 there being four of these points.

After these segments have been silver coated they are placed in the spacer ring 16 as shown in Figure 5. The spacer ring is formed mainly of

an annular member 18 which has a series of radial slots 20 cut around the periphery and in these slots are carried a series of dovetailed pins 22, the inner portion of which is merely flat and fit within the slots 20 but the outer portion is broadened or widened out as shown at 24 in a tapered manner so that it overlies the tapered edges of the segments 6 on either side and therefore maintains the same in their circular relation until the plastic resistant material has been applied thereto. The inner edge of the dovetailed pins 22 is tapered as shown at 23 so that they may be secured in the slots by hard solder 25 to maintain the assembly. This solder must be of such consistency that it will remain in solid form under temperatures as high as 300° F.

The mixed composition is then uniformly distributed in a preforming die and placed under pressure for a short time, approximately five seconds, and then taken out and the "resultant preform" dried for from two to four hours at 120–130° F. The amount of drying is important for if the ring assemblies are not dried the resultant assembly may be high in resistance and adhere to the mold. If, however, the drying time is too long the resistant material or composition will not adhere sufficiently to the segments.

The assembly then is taken and a core 26 is placed within the circular opening 28 of the spacer ring and the clamping ring 30 is positioned immediately below the spacer ring assembly and has therein a series of openings 32 through which are led the wire conductors 8, the same being secured to the core 26 at a smaller diameter through a rubber band 34. The core 26 has an enlarged head portion 27; then it is reduced at the portion projecting through the spacer ring and the clamping ring 30 and is then further reduced for the remainder of its length. A key 36 extends diametrically through an opening in the core and is tapered to press the clamping ring 30 tightly against the spacer ring 16.

This assembly is then placed within the main die which is shown roughly as being composed of two sections, namely a lower stationary section 38 and an upper movable section 40, the clamping ring 30 being supported on an annular notch 42 in the lower die and the upper annular cup-shaped die projecting down to press the preform tightly against its lower surface and the clamping ring. Before any actual molding is done it is necessary to preheat the die core to a temperature of between 145–150° C. After this the die is closed and a substantially high pressure is applied thereto to mold the ring.

After a sufficient time has elapsed the dies are opened and the molded ring assembly removed. The mold assembly may adhere to either the upper or lower die and if it is removed with the upper die the rubber band 34 is first removed and the key 36 knocked out with a suitable instrument without damaging the wires. The clamping ring 30 is then tapped horizontally, care being exercised not to impart any rotary motion thereto so as to avoid any damage to the wires 8 which project through openings 32 therein. The clamp is then removed when it parts from the spacer ring and the spacer is ejected by use of any conventional press. The core is then lifted from the upper die and the process can be repeated.

If, however, the ring assembly remains in the lower die when the press is opened, an ejector pin 44, which is vertically movable, is raised to loosen the entire assembly, the whole assembly therefore being taken out in mass and the same procedure followed as before in sequence of the removal of the parts.

The rings are placed in pans and are placed in a temperature of 130° C. for approximately one and one-half hours, then the temperature is raised to 140° C. for substantially the same length of time. The final heat treatment is 150° C. for one hour. In the first stage of the heat treatment the resistance does not change appreciably but in the second stage the resistance of a given ring will increase from two to three ohms and at the final stage the resistance again increases two or three ohms. The resistance of the particular rings illustrated here is slightly less than ten ohms following the molding and averages from between thirteen and sixteen ohms when it has finished the heat treatment. If after the above heat treatment the resistance is not sufficiently high, the ring assembly failing to have a sufficient amount of resistance may be submitted to higher temperatures until the resistance has reached a desired point.

The ring assemblies so formed have been very satisfactory in that they maintain a substantially uniform electrical resistance and have sufficient strength to withstand vibration and wear. This particular resistance assembly as shown broadly in Figure 2 may be applied to a suitable casing 50 as shown in Figure 1. A rotatable shaft 52 projects therein and has thereon suitable brushes (not shown) which travel over the interior surface of the segments. These brushes may be supplied with current from a storage battery and therefore the current flowing in any one of the leads 8 will be dependent on the distance from the brush to the lead and will fluctuate to give a pulsating current in each lead if desired.

We claim:

1. The method of obtaining an increase of approximately 18% to 38% in the resistance of an electrical conductor element molded from a mixture including asbestos filler, finely divided graphite conductor material and a resin binder combined in proper proportions to afford a molded element of approximately ten ohms capacity, said method comprising baking the molded element at a temperature of 130° C. for one and one half hours, then raising the baking temperature to 140° C. for one and one half hours and finally raising the baking temperature to 150° C. for one hour.

2. The method of decreasing the conductivity of a relatively low-resistance molded assembly containing asbestos, graphite and resin and whose electrical resistance is on the order of ten ohms, comprising baking the assembly for about one and one half hours at approximately 130° C. to condition the same for an increase in resistance, then raising the baking temperature approximately 10° C. for about one and one half hours to increase the resistance two or three ohms and again raising the baking temperature approximately 10° C. for about one more hour to increase the resistance another two or three ohms.

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