

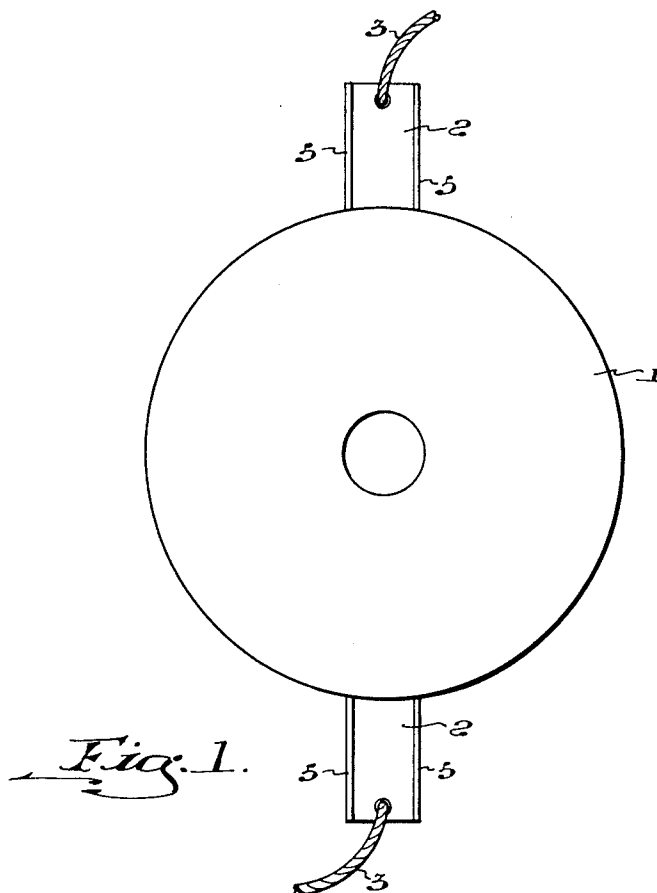
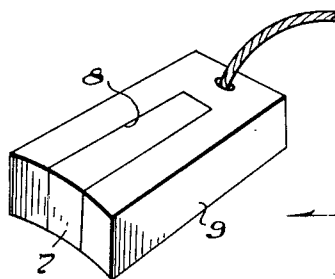
March 20, 1956

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2,739,255

HIGH ALTITUDE BRUSHES

Filed Nov. 16, 1954



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2,739,255

## HIGH ALTITUDE BRUSHES

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Application November 16, 1954, Serial No. 469,218

9 Claims. (Cl. 310—228)

This invention relates to carbon brushes for dynamo-electric machines that are used at high altitudes, and to a method of increasing the life of such brushes.

It now is well-known that the carbon brushes of electric motors and generators used in airplanes flying at high altitudes dust or wear away very rapidly unless they are specially treated to prolong their usefulness. The general way of treating such brushes is to impregnate them with certain compounds that have been found to be effective for that purpose. For example, lithium carbonate has been used, as well as many non-hygroscopic metallic halide salts as disclosed in Elsey Patent 2,414,514. However, the percentage of any one of these compounds that can be added to a carbon brush by impregnation is rather limited, and there are other additives that it would be desirable to use but which are not suitable as impregnants. Moreover, impregnated brushes require a running in period which is undesirable in many cases, and they sometimes have undesirable high operation temperatures.

It is among the objects of this invention to provide a high altitude brush that can be used immediately, that has a low operating temperature, that can include a life-prolonging agent with which it could not be impregnated and in which any desired percentage of such an agent can be incorporated.

In accordance with this invention, the brush has a carbon body and a contact surface at one end which is adapted to engage a rotating current-collecting ring. Extending across that surface is a narrow strip of an adjuvant which comprises a mixture of resin and graphite and a compound that increases the life of carbon brushes at high altitudes. The strip may be formed by one end of a layer of an adjuvant covering one side of the carbon body, or it may be one end of a slug of the adjuvant filling a slot in the brush.

The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a schematic view showing a pair of our brushes engaging the rotating current-collecting member of an electrical machine; and

Fig. 2 is a perspective view of another form of our brush.

Referring to Fig. 1 of the drawings, the rotating ring-like element 1 represents the commutator or slip ring of an electrical machine of any desired type. This current collecting member will be referred to herein as a ring. Engaging the periphery of this ring is a plurality of carbon brushes 2 having concave contact surfaces, against which the ring slides as it rotates. The brushes are pressed against the ring in the usual manner by springs (not shown). The usual shunt wires or pigtails 3 are connected to the outer ends of the brushes.

Each brush has its front or back side (relative to the direction of rotation of the ring), or both of those sides, covered with a thin layer 5 of an adjuvant. The inner end of each layer appears as a narrow strip that extends across the contact surface of the brush and forms

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a part of it in engagement with the ring. The adjuvant layer is formed from a mixture of synthetic resin and graphite and any compound that is known to increase the life of carbon brushes at high altitudes. Examples of some of these compounds are the halides referred to in the Elsey patent referred to above. Others are lithium carbonate and molybdenum disulphide. The particular life-prolonging compound used forms no part of this invention. The compound in powdered form is mixed with powdered resin and graphite and with a solvent for the resin so that the resin will coat the particles of compound and graphite. A paste made in this manner is applied in a thin layer to a side of the carbon body of the brush. The solvent soon evaporates so that the brush can be handled without the added layer running off. The brush then is cured at a temperature between 400° and 600° F. The temperature used should be higher than the brush will meet when in service. The resin helps bond the graphite and high altitude compound together and to the carbon body, which the resin penetrates slightly. Resins suitable for this purpose are well-known and need not be enumerated here. Although the percentage of the different elements can be varied to some extent, a mixture consisting of about 25% resin, 30% graphite and 45% the high altitude compound generally is satisfactory, but between 25% and 35% graphite can be used without affecting the results materially.

It has been found that if the graphite is omitted, the brush will not perform satisfactorily. Without graphite, the added layer will spall quickly and become ineffective. The graphite also improves the brush by helping to equalize the wear rates and thermal expansion of the carbon body and adjuvant layer. It also appears to absorb some of the mechanical shock imparted to the brush in use.

It will be seen that the percentage of compound in the brush can readily be increased by merely using a thicker layer of the adjuvant. This process of making a high altitude brush is cheaper than the old impregnation process in cases where several impregnations are necessary. Furthermore, it allows the use of molybdenum disulphide, with which a brush cannot be impregnated successfully. In many cases, our brush has a lower operating temperature than those known heretofore.

In Fig. 2, the adjuvant is in the form of a slug 7 filling a slot 8 that extends entirely across the concave contact surface of an electric brush having a carbon body 9. The slot can be filled by pouring into it the mixture made as described in connection with Fig. 1. As soon as the solvent evaporates, the mixture will set and the brush then can be fired to cure it. The slot extends towards the opposite end of the brush a distance determined by the allowable wear of the brush. The width of the slot in the direction of rotation of the ring is determined by the amount of treatment desired. It usually is about one-quarter of the width of the brush. Here again the brush would not perform successfully if it were not for the graphite in the material filling the slot.

According to the provisions of the patent statutes, we have explained the principle of our invention and have illustrated and described what we now consider to represent its best embodiment. However, we desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

We claim:

1. A high-altitude brush having a contact surface at one end adapted to engage a rotating current-collecting ring, the brush comprising a carbon body, and a narrow strip of an adjuvant extending across said surface and forming a part of it, said adjuvant comprising a mixture of resin and graphite and a compound that increases

the life of carbon brushes at high altitudes, the amount of said graphite being substantially the minimum amount required for avoiding spalling.

2. A high-altitude brush having a contact surface at one end adapted to engage a rotating current-collecting ring, the brush comprising a carbon body, and a layer of an adjuvant covering a side of said body with one end of the layer extending across said surface and forming a part of it, said adjuvant layer comprising a mixture of resin and graphite and a compound that increases the life of carbon brushes at high altitudes, the amount of said graphite being substantially the minimum amount required for avoiding spalling.

3. A high-altitude brush having a contact surface at one end adapted to engage a rotating current-collecting ring, the brush comprising a carbon body provided with a slot extending across said surface and toward the opposite end of the brush, and an adjuvant filling the slot and forming a part of said surface, said adjuvant comprising a mixture of graphite and resin and a compound that increases the life of carbon brushes at high altitudes, the amount of said graphite being substantially the minimum amount required for avoiding spalling.

4. A brush in accordance with claim 1, in which about one-third of the adjuvant is graphite.

5. A brush in accordance with claim 1, in which between about 25% and 35% of the adjuvant is graphite.

6. A brush in accordance with claim 1, which has been cured at a temperature between about 400° and 600° F.

7. A brush in accordance with claim 1, in which the resin coats said compound and bonds it to the carbon body.

8. The method of making a high-altitude brush, comprising providing one end of a carbon body with a slot extending across it and toward the opposite end of the body, mixing powdered resin and graphite and a compound that increases the life of carbon brushes at high altitudes with a solvent for the resin to coat the compound with the resin, filling said slot with the mixture, about one-third of said mixture being graphite, and curing the brush at a temperature between about 400° and 600° F.

9. The method of making a high-altitude brush, comprising mixing powdered resin and graphite and a compound that prolongs the life of carbon brushes at high altitudes with a solvent for the resin to coat the compound with the resin, applying the mixture in a thin layer to one side of a carbon brush body from one end thereof toward the opposite end, about one-third of said mixture being graphite, and curing the brush at a temperature between about 400° and 600° F.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |         |               |
|-----------|---------|---------------|
| 2,105,038 | Helwig  | Jan. 11, 1938 |
| 2,414,543 | Moberly | Jan. 21, 1947 |
| 2,656,475 | Diehl   | Oct. 20, 1953 |