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P. MELCHIOR ET AL.

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JOINING OF ALUMINUM PARTS TO ONE ANOTHER OR TO OTHER METAL PARTS

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Inventors:
Paul Melchior,
Robert Pohl,
Karl Cordes,

by Harry E. Dunham
Their Attorney.
JOINING OF ALUMINUM PARTS TO ONE ANOTHER OR TO OTHER METAL PARTS

Paul Melchior, Robert Pohl, and Karl Cordes, Berlin, Germany, assigns to General Electric Company, a corporation of New York

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It is known that joining parts of aluminum or of their alloys with copper parts provides difficulties, especially when the stability of the contact formation must be maintained. Through moisture influences, element actions take place between the two contacting metals, thereby causing corrosion. In order to counteract such phenomena, special insertions have been placed between aluminum and copper, wherein two layers of the two metals were so connected with one another on the interior, that no moisture could penetrate through them. Thus, when the aluminum layer is brought into contact with the aluminum part to be connected, and the copper layer with the copper part to be connected, so that equal metals rest upon one another, no corrosions can occur. This, however, does not also eliminate the disadvantageous influence of the oxidation on the contact surface, which, particularly in the case of aluminum, owing to its great affinity for oxygen, makes itself noticeable. Aluminum oxide is a poor conductor, so that the transition resistance between the parts to be connected is considerably increased.

It has already been suggested to protect the contact surface of aluminum parts from the influence of oxygen by covering it over with copper by galvanic means. Such galvanic coatings cannot however be produced perfectly on aluminum. Nor is it possible, in the case of large machine bodies, to undertake coppering processes on individual points, in order to create a joining surface there on the spot. According to the present invention, the formation of the disadvantageous film of oxide on the contact surface of the aluminum is avoided by soldering thereon a thin contact metal sheet, preferably of copper, in such a way that the contact surface is made substantially impervious to the influence of the air. This protective layer produces a good current passage, and can be applied without difficulty on all large machine bodies by soft solder. A solder consisting of tin and zinc produces, as proved by experience, a strong soldering seam on aluminum. A particularly suitable solder is a tin-zinc alloy with 64% tin content.

The novel features which are characteristic of our invention are set forth with particularity in the appended claims. Our invention, however, will best be understood from reference to the following specification when considered in connection with the accompanying drawing in which Fig. 1 is a view partly in cross section and partly in elevation of an assembly of parts illustrating our invention; Fig. 2 is a view on an enlarged scale of a portion of Fig. 1, while Figs. 3 to 9 inclusive, illustrate the application of our invention to different devices.

In Fig. 1, a and b are two parts of aluminum or of an aluminum alloy, which are to be connected together by a copper tie c with the help of a screw-connection. A thin sheet of copper d approximately .5 mm thick is soldered on to the contact surface of each of the two aluminum parts. The solder is spread over the entire contact surface f, as indicated in Fig. 2. The contact surface of the aluminum bodies is thus rendered impervious to the influence of air.

Figs. 3 and 4 show the invention employed for an end hood of a large alternating current generator, which, to avoid eddy current losses through the end leakage field, consists of non-magnetic material, viz. an aluminum alloy. The setting of the hood in front of the ends of the machine housing requires, especially when there is a shaft passing through, a division of the hood approximately into two halves g and h. It has proved that at the joints of the two halves of the hood, there is considerable heating-up caused by the high transition resistance owing to the oxide layers that are formed at that point on the aluminum hood parts. If a good electrical union of the two halves of the hood is made, this undesirable heating is avoided. According to the invention, therefore, on surfaces within the range of the adjoining rims m and n (Figs. 5 and 6) of the halves g and h, thin copper sheets d are soldered. They extend over the greatest part of the length of those rim borders. According to Fig. 5, the copper layers lie on the exterior of the flange. Fitted over them are connecting ties p, of copper, which are pressed with their side-pieces by means of screws r against the soldered-on copper layers. It is possible, as shown in Fig. 6, to solder the copper strips d also at the joint on the inner surfaces of the flanges m and n, so that they are then pressed directly against one another by the screw bolts r.

A further use for the invention is illustrated in Figs. 7 and 8. The proposition here is groove locking keys s for toothed revolving field magnets of large synchronous generators, whose manufacture from aluminum or aluminum alloys is required in many cases. Such keys which hold the winding in the grooves, serve also as bars of the damper squirrel cage. For this purpose, they are electrically connected at their ends by a bandage of bronze wire, which is arranged in trough-shaped openings of the key-ends. It is
necessary that a lasting good contact be assured between the bandage \( t \) and the aluminum keys \( s \). In order to obtain this, according to the invention, in the trough-shaped opening on the exterior of the wedges thin copper sheets \( d \) are soldered on, which protect from oxidation the layer surface of the aluminum keys for the short-circuiting ring formed by the bronze bandage. The same advantage would also obtain if the damper bars of aluminum were not connected by special bandages acting as short-circuiting rings, but by caps serving to fix the winding heads or by special short-circuiting rings. The same idea can also be used for squirrel-cage windings of asynchronous machines generally, when the squirrel-cage bars consist of aluminum and special short circuit rings rest on the ends thereof.

The invention is further important for brushholders of electrical machines, when these consist of aluminum. Here it is difficult to create a lasting contact between the holders and the brush holder pins. According to the invention, the difficulties in question are avoided by soldering, in accordance with Fig. 9, on to the inner wall of the bore of the aluminum holder for the passage of the carrier pins, a bush \( d \) of thin sheet copper. This renders the contact surface of the aluminum in the bore impervious to air, so that a dependable transition of the current from the brush holder to the pin is assured.

The employment of the invention is not restricted, however, to the examples described here for electrical machines, but can be utilized to advantage in all cases where aluminum parts are to be joined electrically to one another or to other metal by screwing, riveting or equivalent means. It should be understood that where the term "aluminum" is employed in the claims it is intended to cover not only the use of aluminum but aluminum base alloys as well.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. The method of connecting two aluminum structures to provide a good electrical contact between them which comprises soldering a layer of copper to each aluminum structure and thereafter applying pressure to each copper layer by separate electrically conducting means adapted to hold said aluminum structures in a desired position.

2. In combination, a pair of aluminum structures each structure having a surface layer of copper soft soldered thereto, and separate means providing a path of low electrical resistance and applying pressure to said copper layers and holding said aluminum structures in a desired position.

PAUL MELCHIOR.
ROBERT POHL.
KARL CORDES.