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INSULATED HOMOPOLAR GENERATOR

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FIG. 1.

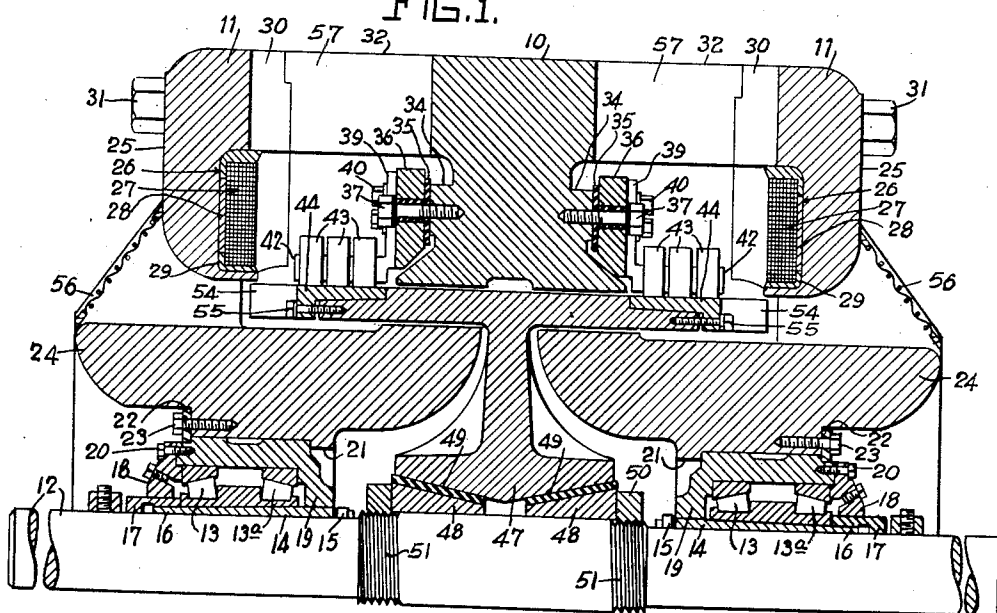


FIG. 2.

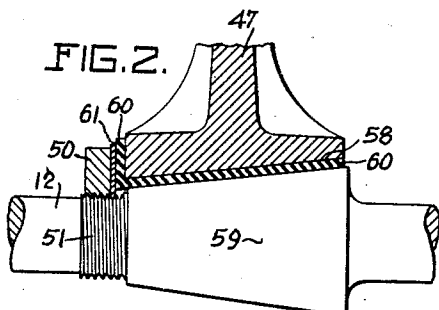


FIG. 3

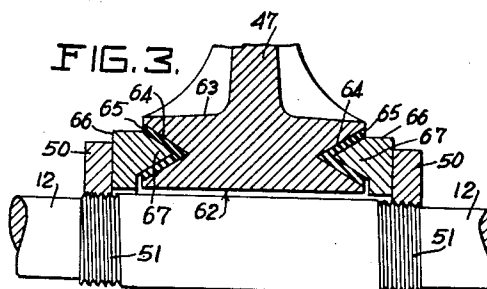
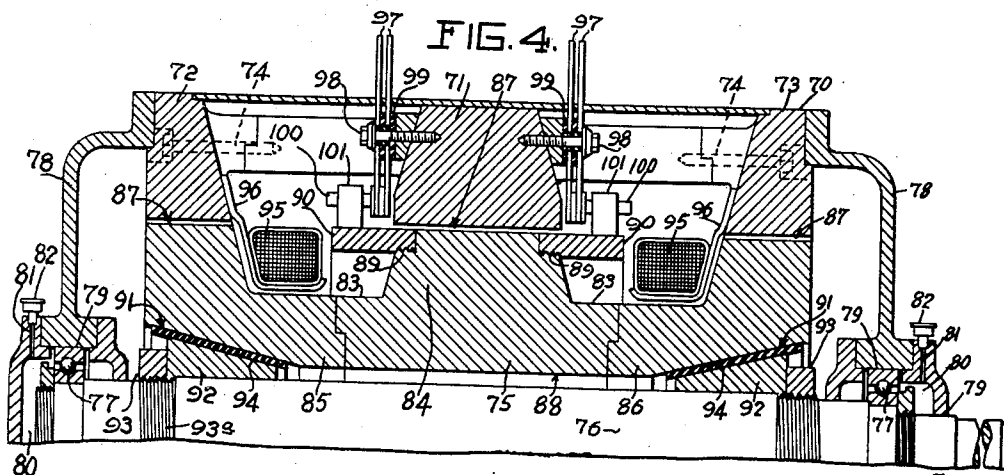


FIG. 4.



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INSULATED HOMOPOLAR GENERATOR

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4 Claims. (Cl. 171-212)

This invention relates to generators, and in particular, to homopolar generators for the production of low voltage currents, especially adapted for electro-plating purposes. In such generators the single inductor consists of the periphery of the rotor itself or a shell mounted directly thereon.

One object of this invention is to insulate the active portion of the rotor in such generators from the drive shaft so as to prevent the leakage of current through the drive shaft and the remainder of the apparatus.

Another object is to provide an insulation for the active portion of the rotor from the drive shaft of the generator, and at the same time to provide a mounting adapted to hold the rotor tightly in connection with the drive shaft.

Referring to the drawing:

Figure 1 is a half vertical section through the homopolar generator of my invention, the lower half of the generator from the drive shaft to the floor being omitted.

Figure 2 is an enlarged fragmentary section of a modification.

Figure 3 is an enlarged fragmentary section of another modification.

Figure 4 is a vertical section, similar to Figure 1, but of a third modification.

Hitherto, in the design of homopolar generators for electro-plating and similar purposes, requiring a low voltage and high amperage current, no attempt has been made to insulate the inductor from its supporting shaft and bearings. If the bearings are mounted in the generator frame and not in separate insulated pedestals, the entire frame is connected to the generator output circuit. This renders the apparatus open to the danger of a short circuit or leakage of current, in case either the positive or negative bus bar line from the generator comes in contact with any metal object which might be connected to the generator frame. Another danger also arises from the possibility of a fault in the insulation of the high voltage motor driving the generator, or the high voltage field coils that are commonly used to excite the homopolar generator. In such event the short circuit resulting might impress a high voltage upon the low voltage bus bars to the electro-plating tanks, thus creating a hazard to the men working at the plating tanks.

These bus bars in electro-plating tanks are ordinarily unprotected because the low voltages ordinarily used to charge the anodes and cathodes are not dangerous to human life. The use of metal tanks and heating coils, however, frequently creates an electrical connection from the low

voltage circuit to the pipe system and structural steel frame of the building. In such apparatus, as ordinarily constructed, insulation is provided only to the extent of preventing heavy low voltage currents from passing from tank to tank through pipes or supports, this insulation being generally inadequate to prevent the passage of high voltages as are used for motors and other purposes.

In loading and unloading the work pieces in the electroplating tank of electroplating apparatus, the operator's hands are commonly in contact with the work pieces while they are also in contact with the work rod, which is in turn, connected with one of the generator terminals. It is for such electroplating work that the homopolar generator of this invention is especially adapted. Under such circumstances, therefore, it will be seen that the operator is in danger of injury if the low voltage generator circuit is not thoroughly protected from the high voltage supplied for the driving motor of the apparatus, or from the high voltage current which is commonly used to excite the generator fields. It is to avoid such accidents and consequent injury that the insulation of the present invention is provided.

Hitherto, underwriters or local ordinances have provided that the frames of motors shall be grounded by connecting them to the piping or frame-work of the building, this being connected to the earth. If, however, the homopolar generator frame or shaft is connected to the motor frame through the couplings, or through a common bed plate, a ground connection would thereby be provided in the low voltage circuit which might lead to loss of current or danger to the operator. While it is possible to isolate the generator by the use of insulating pads and couplings, the danger is not completely eliminated because there is always liability of someone thoughtlessly making an additional connection by means of an oil-retaining case over the couplings, uninsulated locating pins, panel-board supports and similar structures.

To solve this problem of preventing such leakages or dangers in the homopolar generator of my invention, I insulate the pulley-shaped armature of my generator from the shaft and thereby eliminate this danger at the very source. This insulation may be applied to insulate the armature from its support on the shaft, or else to insulate its rim from the web attached to the hub.

Referring to the drawing in detail, Figure 1 shows the homopolar generator of my invention with the insulation applied thereto. The generator itself is provided with a central frame sec-

tion 10, spaced apart from the end frame portions 11. These frame members 10 and 11 constitute a stator which serves as pole pieces for the generator. Tapered roller bearings 13 and 13a are supported upon the tapered sleeves 14. Each pin 15 serves to prevent the tapered sleeve 14 from turning when tightening up the collar 17. The bearing cap 18 is supported by the cartridge housing 19 by means of screws 20. There is a running clearance between the collar 17 and the cap 18 sealed against loss of lubricant by felt rings in grooves in the cap 18. The cartridge housing 19 has similar grooves for felt rings to prevent leakage between it and the sleeve 14. The cartridge housing 19 is held between the shoulder 21 on the end frame 11 and the washer ring 22 by the bolts 23.

The end frames 11 are roughly L-shape in half section, the axial portion 24 extending laterally within the ring of the pulley-shaped rotor, described later. The radial portions 25 are provided with annular grooves 26 on their inner faces for receiving the field coils 27. The latter are mounted upon the insulation 28 and surrounded with sealing layers 29 on three sides. Above the field coils and extending inwardly from them are pads 30 through which pass the bolts 31 connecting the end frames 11 to the center section 10 of the generator frame. The generator center section 10 is provided with connecting peripheral portions 32 adapted to receive the threaded ends of the bolts 31, thereby connecting the outer frame portions 11 to the central frame portion 10.

The central frame portion 10 is provided with a series of bosses 34, on which are mounted insulation blocks 35, these in turn, carrying the brush holder ring 36. The latter is preferably of copper and is secured to the central frame portion 10 by means of machine screws 37, between the heads of which and the brush holder ring 36 are inserted suitable insulating washers. The brush holders 39 are mounted upon the brush holder rings 36 by the bolts 40, and are provided with brush-supporting arms 42 carrying the brushes 43. These brushes are yieldingly pressed into engagement with the collector rings 44.

The active portion of the generator rotor consists of a pulley-shaped member, generally designated 47, and having a half-sectional shape approximately like the letter I, the lower bar of the I representing the hub flange and the upper bar the peripheral flange. The bore of the rotor 47 is outwardly flared from its central transverse plane and in each of these flared portions, which are conical in shape, is provided an insulating member 49. Between this insulating member and the shaft 12 is provided an annular member 48, having a conical outer surface corresponding to the conical inner surface of the rotor bore. Two of these annular members 48 are employed, being urged toward one another by the collars 50, threaded onto the threaded portions 51 of the drive shaft 12. It will be obvious that when the collars 50 are tightened to force the annular members 48 inward, the insulating portions 49 will be forced against the inner surfaces of the hub bore of the rotor 47. In this manner there can be no passage of electricity from the armature or rotor 47 to the drive shaft 12, and thence to the frame or other portions in contact with the drive shaft.

The rotor 47 on its outer peripheral portion is provided with a plurality of radiating blades 54, which also serve as fan blades. These blades 54

are connected to the rotor 47 through the collector rings 44 by the screws 55. The rotation of the rotor 47 causes the blades 54 to create a suction, drawing air into the interior of the generator through the net-work 56 and discharging heated air through the apertures 57 located between the outer frame members 11 and the central frame member 10. By this means the rotor 47 is cooled and prevented from being damaged by heat.

The insulation 49 may be of any suitable material, preferably consisting of mica or micanite (mica flakes with shellac or synthetic resin binders). Non-metallic keys or driving pins, or insulated metal keys or pins may also be used to prevent slipping. After such insulation is baked it may be machined accurately like metal. Synthetic resin materials, such as Bakelite, may also be used, or mica cones.

In the modified form of insulated rotor mounting shown in Figure 2, the rotor or armature 47 is provided with a conical bore 58, having a taper corresponding to a conical enlargement 59 upon the drive shaft 12. The latter is provided with a single threaded portion 51 having a collar 50 threaded thereon, as in the previously described construction. Between the conical enlargement 59 and the conical bore 58 is arranged a flanged conical insulating member 60, serving the same purpose as the insulating members 49, described above. A washer 61 arranged between the flange of the insulating member 60 and the collar 50 serves to receive the thrust of the collar.

In the modified form of insulated armature or rotor shown in Figure 3, the armature or rotor is provided with an enlarged bore 62, spaced apart from the drive shaft 12, thereby forming an air gap. Each face of the armature hub 63 is provided with a groove 64 of V-shape in cross section and of annular extent. In each of these grooves 64 is mounted an annular insulating member 65, of V-shape cross section. Engaging the inner surface of this insulating member 65 is a ring 66 having an annular flange 67 of V-shape cross section. The drive shaft is provided with the usual threaded portions 51, upon which are mounted the threaded collars 50. By turning the collars 50 the rings 66 are forced into the annular grooves 64, thereby centering the rotor 47 with reference to the drive shaft 12, as well as creating the air space between its inner bore 62 and the drive shaft 12.

In the modified form of generator shown in Figure 4, the frame, generally designated 70, consists of a central frame portion 71 connected to the outer frame members 72 and 73 by the bolts 74. The rotating part of the generator consists of an armature 75 mounted upon a drive shaft 76, which in turn, is journaled in anti-friction bearings 77. The latter are mounted in the end plates 78 attached to each end of the machine and forming the casing thereof. One of the end plates 78 is provided with an axial bore 79 for the passage of the drive shaft 76, providing a lubrication space 80 to which lubricant is conveyed through the bore 81 from the grease cup 82.

The rotor or armature 75 is shaped roughly in the form of a drum, with peripheral grooves 83, between which is a central portion 84, facing the central frame portion 71, with an air space 87 therebetween. Similar air gaps 85 and 86 and the outer armature portions 85 and 86 and the outer frame members 72 and 70, respectively. Another air gap is formed between the enlarged bore 88 of the armature 75 and the drive shaft 76. The central armature portion 84 is threaded, 75

as at 89, to receive the collector rings 90. The armature 75 in its end portions 85 and 86 is provided with conical bores 91. These are adapted to receive the thrust of corresponding conical rings 92 as impelled by the threaded rings 93 upon the threaded shaft portions 93a. Between the outer armature portion bores 91 and the conical rings 92 are arranged the insulating layers 94. The latter are in the form of conical shells. This insulating layer serves to insulate the shaft 76 from the armature 75, producing the current, thus preventing the danger of leakage at its very source. This insulation may be of the same material and constructed in the same manner as described for the types shown in Figures 1 to 3, inclusive.

The field coils 95 are mounted in the annular grooves 83 and supported upon brackets 96 carried by the end frame members 72 and 73. The collection of the current from the collector rings 90 is made by means of bus bars 97 secured to opposite sides of the central frame member 71 by means of the screws 98, these bus bars 97 being insulated in an appropriate manner by the insulating members 99. The inner ends of the bus bars 97 are provided with brush holders 100, carrying the brushes 101. The latter, in turn, engage the collector rings 90 in order to collect and transmit the current produced in the armature.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A homopolar generator comprising a drive shaft, a unitary rotor thereon including a hub having a central portion with an annularly flanged rim portion thereon, an outer stationary magnetic structure disposed adjacent the outer surface of said flanged rim portion, an inner stationary magnetic structure disposed adjacent the inner surface of said flanged rim portion, means for collecting the electricity from said rotor at opposite sides of said outer stationary magnetic structure, and means for preventing the conduction of electricity between said rotor and said shaft whereby to confine the passage of the current generated from end to end of said flanged unitary rotor.

2. A homopolar generator comprising a drive

shaft, a unitary rotor thereon including a hub having a central portion with an annularly flanged rim portion thereon, an outer stationary magnetic structure disposed adjacent the outer surface of said flanged rim portion, an inner stationary magnetic structure comprising stationary magnetic members disposed adjacent the inner surfaces of said flanged rotor portion on opposite sides of said central rotor portion, means for collecting the electricity from said rotor at opposite sides of said outer stationary magnetic structure, and means for preventing the conduction of electricity between said rotor and said shaft whereby to confine the passage of the current generated from end to end of said flanged unitary rotor.

3. A homopolar generator comprising a drive shaft, a unitary rotor thereon including a hub having a central portion with an annularly flanged rim portion thereon, an outer stationary magnetic structure disposed adjacent the outer surface of said flanged rim portion, an inner stationary magnetic structure disposed adjacent the inner surface of said flanged rim portion, means for collecting the electricity from said rotor at opposite sides of said outer stationary magnetic structure whereby to direct the current generated from end to end of said flanged unitary rotor, and insulating structure disposed between said rotor and said shaft whereby to prevent the conduction of electricity through said shaft and to confine the conduction thereof from end to end of said rim portion.

4. A homopolar generator comprising a drive shaft, a unitary rotor thereon including a hub having a central portion with an annularly flanged rim portion thereon, an outer stationary magnetic structure disposed adjacent the outer surface of said flanged rim portion, an inner stationary magnetic structure disposed adjacent the inner surface of said flanged rim portion, means for collecting the electricity from said rotor at opposite sides of said outer stationary magnetic structure, and means for preventing the conduction of electricity between said rotor and said shaft whereby to confine the passage of the current generated from end to end of said flanged unitary rotor, said unitary rotor having its armature conducting means and its rotating magnetic means arranged in a single rotating structure.

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