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HIGH ALTITUDE ELECTRICAL EQUIPMENT

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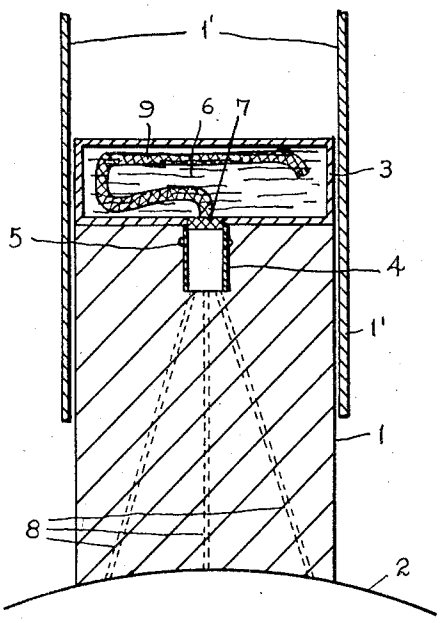


Fig. 1.

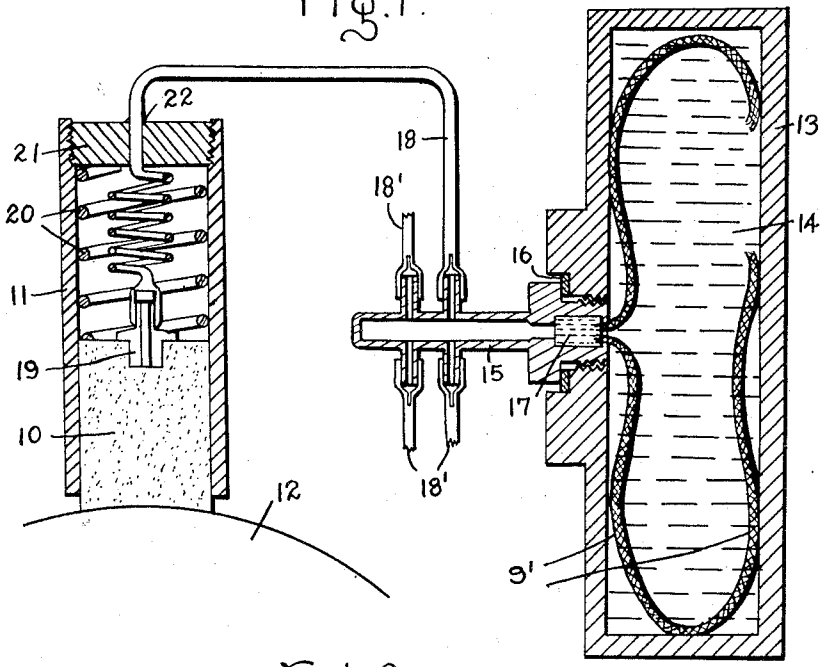


Fig. 2.

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HIGH ALTITUDE ELECTRICAL EQUIPMENT

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4 Claims. (Cl. 310—228)

This invention relates to electrical equipment intended for operation at high altitudes or in other regions of relatively low pressure and water vapour content, in particular to such equipment, for example electric motors or generators, of the kind in which electric current is transferred between relatively rotating parts of the equipment by means of a brush as of carbon or graphite on the one part making sliding contact with a co-operating contact member such as a slipring or commutator on the other part.

It is recognized that due to the reduction in the amount of water vapour in the atmosphere at high altitudes, brush wear is excessive. It is also well known that the effect of certain vapours, other than water vapour, reduces the brush wear and experiments have hitherto been conducted in which a suitable vapour is introduced into the vicinity of the brush, either by enclosing the brush-gear and the co-operating contact member in a closely fitting shroud and maintaining a suitable vapour pressure, or by directing a stream of vapour at the contact surface of the brush with the co-operating member.

An object of the present invention is to provide for brush lubrication in a manner which is less elaborate and which is more economical in the expenditure of vapour, so that only a relatively small reservoir is required.

The invention consists in introducing a suitable vapour into the contact area between the brush and the co-operating contact member by feeding the vapour to the contact area through the body of the brush.

The vapour may be supplied from a small reservoir secured to or located within the brush and adapted to contain a suitable vaporisable material capable of passing through the brush in vapour form: thus the vaporisable material in the reservoir may be a suitable solid or liquid having appreciable vapour pressure under the expected operating condition, such that vapour from such material will flow through the brush.

Alternatively a reservoir containing such material may be provided separately from the brush but in suitable communication with the body thereof. In any case means for restricting or controlling the fluid flow through the brush is interposed in the fluid flow path between the reservoir and the brush. Moreover a vapour chamber may be provided in which the vapour will collect prior to its entering the body of the brush.

Where the brush is of carbon or other porous material, as it is contemplated will usually be the case, the vapour may be arranged to pass to the contact area through the pores of the brush. In other cases the brush may be formed with suitable ducting for conveying the vapour through it to the contact area; such ducting may also be provided even when the brush is porous, thereby enhancing the flow of vapour to the contact area.

In carrying out the invention the vapour pressure of vaporisable material in a reservoir may be chosen such that the vapour becomes fully effective to provide lubrication only above a predetermined altitude, or alternatively the vapour pressure may be such that continuous lubrication is provided at all altitudes, increasing in effect as the altitude increases.

In order that the invention may be more fully understood reference will now be made to the accompanying drawing, in which Fig. 1 schematically illustrates a brush construction suitable for providing vapour lubrication in accordance with the invention, and Fig. 2 illustrates another arrangement employing a reservoir separate from the brush.

Referring to Figure 1 a brush of graphite say, is in use carried by a brush holder 1' and makes sliding contact with a slipring or commutator 2 of, say, copper. The brush 1 has secured to it, at the end remote from its sliding contact surface, a reservoir 3 in the form of a small vessel the cross-sectional area of which (namely in a plane perpendicular to the paper) is preferably similar to that of the brush 1. An open ended tube 4, secured around an opening in the wall of the reservoir 3 adjacent the brush 1, fits tightly into the body of the brush and is preferably sealed therein as by means of a sealing ring 5. A liquid or solid material 6 capable of giving off a suitable lubricating vapour under the expected operating conditions is contained in the reservoir 3, the material chosen being one which in the vapour state can provide a lubricating effect where carbon and copper are in sliding contact, without being detrimental to the transfer of current between the brush 1 and the slipring or commutator 2; that is the vapour should not be detrimental to, say, normal commutation in the case of a D. C. machine. A suitable material is, for instance, liquid trichlorethylene as it has the inherent characteristic of having good brush lubricating properties and is non-paste forming therewith. Tests with such material have indicated that very small quantities of its vapour may be sufficient to reduce high altitude brush wear to almost negligible proportions. A porous restriction 7, which may be a plug of unglazed porcelain or a metal plug having fine holes such as are obtainable in porous bronze, is inserted in the tube 4 to permit vapour from the reservoir 3 to flow into the bore of the tube at a rate determined, inter alia, by the degree of porosity and other characteristics of the restriction 7. Alternatively, flow of vapour into the bore of the tube 4 could be restricted by the use of a suitable membrane, constituted for instance by thin metal sheet, through which the vapour can and has to diffuse. In either case the restriction may be chosen to limit the flow of vapour to the minimum necessary for the required lubricating action.

In order to ensure that when the material in the reservoir 3 is a liquid it will pass into the porous restriction 7 irrespective of the position of the brush 1 round the member 2 (namely even if the brush 1 were on the underside of the member 2 so that the reservoir 3 would be below the brush), a wick or other length of fibrous material 9 embedded at one end in the porous restriction 7 may be arranged within the reservoir 3 in contact with the liquid material 6 therein, the action of this wick 9 being to draw the liquid into the porous restriction 7.

When the pressure outside the brush is less than the vapour pressure of the material in the reservoir 3 there will be a flow of vapour through the restriction 7 into the bore of the tube 4. From there the vapour passes into the body of the brush 1 and makes its way through the natural pores therein, and/or through specially provided ducts 8, to the contact surface betwen the brush and the slipring or commutator 2, the action being assisted by the relatively high temperature at the contact surface. To ensure that vapour appears only at the contact face of the brush it may be desirable to render the walls of the brush impervious by painting or some other suitable treatment.

In another arrangement somewhat different from that just described, lubricating vapour may be supplied to the brush by means of flexible vapour conveying means, such for instance as a flexible tube leading to the brush from a reservoir mounted separately from the brush. Such an arrangement is illustrated in Fig. 2 in which a brush **10** in a holder **11** is again assumed to make sliding contact with a slipring or commutator **12**. In this case however a reservoir **13** mounted externally of the brush holder contains the liquid or solid material **14** capable of giving off a suitable lubricating non-paste forming vapour under the expected operating conditions. A tube **15** screwed into or otherwise secured to a wall of the reservoir **13** and sealed therein as by means of a plastic washer **16** leads from the reservoir **13** and defines a vapour chamber between its closed outer end and a porous restriction **17** inserted in the tube **15** adjacent its inner end. As in the arrangement of Fig. 1, where the material in the reservoir **13** is a liquid, one or more wicks or other lengths of fibrous material **9'** lying in the reservoir may be embedded at one end in the porous restriction **17**. From the vapour chamber defined within the tube **15**, a tube **18** communicates with the body of the brush **10** by way of a plug **19** sealed into the brush body, and to allow for movement and wear of the brush this tube **18** is made flexible by coiling it as shown within the brush holder **11** the coiled portion of the tube **18** conveniently being located within the brush loading spring **20**. In passing through the top cap **21** of the brush holder **11** the tube **18** may be sealed into the top cap **21** as by a thermosetting resin **22**. The operation of the arrangement of Fig. 2 should be self-evident following the description of the operation of Fig. 1.

It is contemplated that several brushes may be supplied with lubricating vapour from a single external reservoir such as **13** in Fig. 2. For this purpose additional tubes leading from the vapour chamber within the tube **15** may communicate respectively with further brushes (not shown) in a manner similar to that in which the tube **18** communicates with the brush **10**, such additional tubes having been indicated at **18'** in Fig. 2.

What I claim is:

1. An electrical current collector comprising a brushholder, a contact-making brush in said brushholder, said brush having a body capable of passing vapor therethrough and formed with a contact-making surface adapted to cooperate with a rotatable member electrical contact surface, a reservoir for containing vaporizable material, a vaporizable material in said reservoir having brush contact lubricating properties and being non-paste forming in the vapor state with finely divided material of said contact-making brush, communicating means between said reservoir and a position located interiorly of said brush body and removed from said contact surface thereof for the passage of vapor from said vaporizable material in said reservoir to said brush body and to said latter contact surface, and restricting means through which said vapor can flow disposed in the path of the vapor between said reservoir and said brush body for controlling the rate of vapor flow into said brush and to said contact surface thereof.

2. An electrical current collector comprising a contact-making brush having a body capable of passing vapor therethrough and formed with an electrical contact-making surface adapted to cooperate with a rotatable member electrical contact surface, a reservoir for containing vaporizable liquid material, vaporizable liquid trichlorethylene in said reservoir having brush contact lubricating properties and being non-paste forming in the vapor state with finely divided material of said brush body, communicating means between said reservoir and a position located interiorly of said brush body and removed from said contact surface thereof for the passage of vapor from the vaporizable material in said reservoir to said latter contact surface, and flow restricting means in the form of a porous member disposed in the path of the vapor between said reservoir and said brush body for controlling the rate of vapor flow into said brush and to said contact surface thereof.

3. An electrical current collector comprising a brushholder, a contact-making brush in said brushholder, said brush having a body capable of passing vapor therethrough and formed with an electrical contact-making surface, a cooperating rotatable member with an electrical contact surface, a reservoir disposed separately from said brush for containing vaporizable material, vaporizable material in said reservoir which is non-paste forming in the vapor state with finely divided material of said contact-making brush body and has brush contact lubricating properties, communicating means extending between and connected to said reservoir and said brushholder and brush body including flexible vapor conveying means between the connection of said communicating means to said brushholder and a position located interiorly of said brush body and removed from said electrical contact surface thereof for the passage of vapor from the vaporizable material in said reservoir to said latter contact surface providing for easy movement of said brush in said brushholder, and flow restricting means through which the vapor can pass disposed in the path of the vapor between said reservoir and said brush body for controlling the rate of vapor flow into said brush and to said contact surface thereof.

4. An electrical current collector comprising a plurality of contact-making brushes, each brush having a body capable of passing vapor therethrough and formed with an electrical contact-making surface, a cooperating rotatable member with an electrical contact surface, a reservoir for containing vaporizable material, a vaporizable material in said reservoir having brush contact lubricating properties and being non-paste forming in the vapor state with finely divided material of said contact-making brushes, communicating means between said reservoir and a position located interiorly of each brush body and removed from said electrical contact surface thereof for the passage of vapor from the vaporizable material in said reservoir to said latter contact surface, a vapor chamber arranged intermediate the ends of said communicating means and communicating with each of said brushes through said communicating means, and flow restricting means through which the vapor can pass disposed in the path of the vapor between said reservoir and each brush for controlling the rate of vapor flow into said brush and to said contact surface thereof.

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