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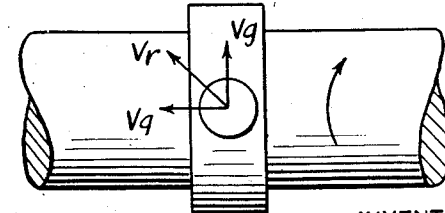
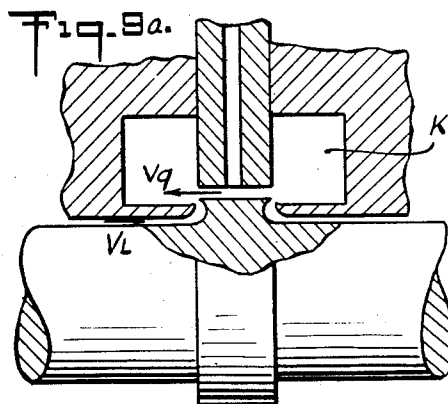
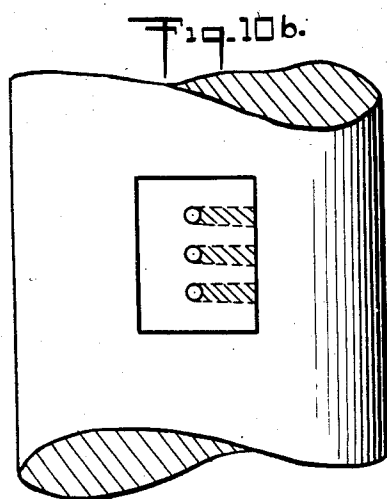
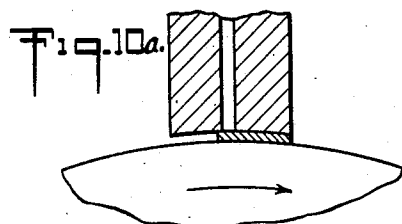
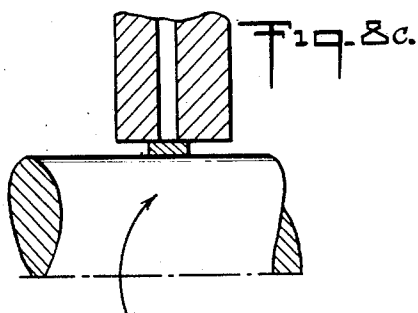
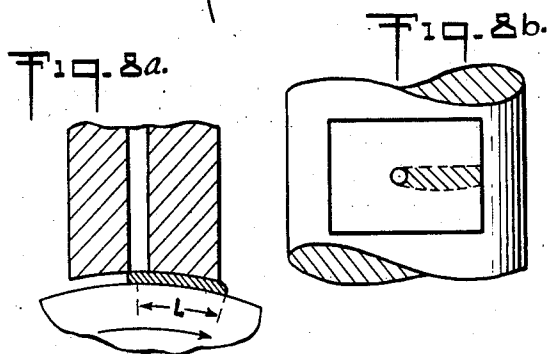
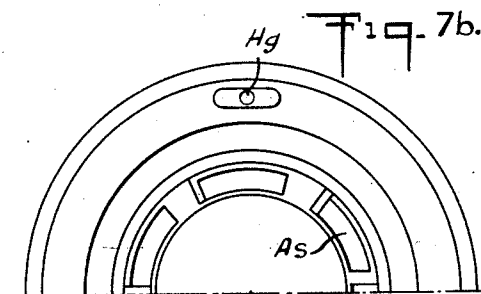
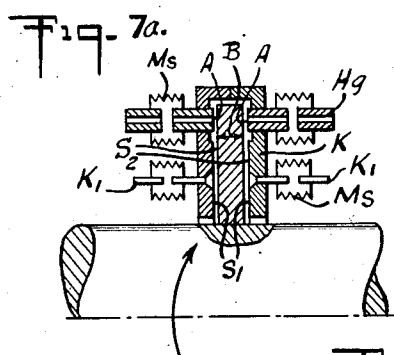
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LIQUID SLIDING CONTACT FOR UNIPOLAR GENERATORS OR THE LIKE

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2 Sheets-Sheet 2



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LIQUID SLIDING CONTACT FOR UNIPOLAR GENERATORS OR THE LIKE

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The present invention relates to sliding contacts, and more particularly to sliding contacts for unipolar A. C. and D. C. generators which remain closed in operation, especially to such sliding contacts comprising solid contact members and an interposed liquid contact distance for high current intensities exceeding 100 amps. and having relatively short dimensions in the direction of the current, in which the contact liquid is replaced continually or intermittently by the following cooler contact liquid, and is in contact with the contact members in relatively small portions of the surface thereof which are maintained technically free from foreign layers, the current density at the contact surface exceeding 2 amps. per square millimeter.

It is an object of the present invention to avoid, particularly at high amperage and large sliding speeds, large electric losses in the contact members and large mechanical losses in the contact liquid.

It is another object of the present invention to reduce losses due to friction of the liquid and eddies in the contact gap.

It is still another object of the present invention to reduce losses proportional to the kinetic energy of the contact liquid leaving the contact gap.

It is a further object of the present invention to improve the heat dissipation and the efficiency of the devices or generators of which the contact according to the invention forms part.

Other objects and advantages of the present invention will be apparent from the following detailed description thereof in connection with the accompanying drawings illustrating, by way of example, some embodiments of the present invention. In the drawings:

Fig. 1 is a diagram for explaining the principle of the invention,

Fig. 2a is an elevation, partly in section, of an embodiment of the present invention,

Fig. 2b shows part of Fig. 2a on an enlarged scale,

Fig. 3 is an elevation, partly in section, of another embodiment of the present invention,

Fig. 4 shows a further embodiment of the present invention,

Figs. 5a and 5b show another embodiment of the present invention,

Fig. 6a show another embodiment of the present invention,

Fig. 6b is a cross-sectional view of Fig. 6a taken on the lines A—B and C—D thereof,

Fig. 6c is a cross-sectional view of Fig. 6a taken along the line E—F thereof,

Figs. 7a and 7b show another embodiment of the invention,

Figs. 8a, 8b and 8c show still another embodiment of the invention,

Figs. 9a and 9b show still another embodiment of the invention, and

Figs. 10a and 10b show a further embodiment of the present invention.

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Referring now to the drawings, and first to Fig. 1, be it supposed that from an infinitely electrically conductive medium II a flow of current passes through a plane surface being vertical to the plane of the paper and limited by a circular line and supposed to be ideally free from foreign matter, to an infinitely large medium I insulated against the first medium except for this plane surface, the media I and II having equal specific conductivities. The flow of current has to overcome an electric resistance

$$R = \frac{1}{k \times r} \text{ ohms}$$

where k is the specific conductivity of the media in ohm $^{-1} \times \text{m.}^{-1}$ and r is the radius of the surface of passage of the current in meters.

For technically conductive materials with 2×10^6 to $58 \times 10^6 \text{ ohm}^{-1} \times \text{m.}^{-1}$ thus follow even for very small surfaces of passage of the current extremely small values of contact resistance, for instance for copper and a radius of the passage surface of 1 millimeter only about $2.5 \times 10^{-5} \text{ ohm}$ so that for such "contact arrangements" only very small actual contact surfaces (A) are needed.

Now technical liquids differ admittedly very much from the ideal arrangement shown in Fig. 1 (the contact members are in contact with each other not directly but under interposition of a contact liquid, they are limited and differently shaped from the conductive media shown in Fig. 1). However, even if the distance occupied by the contact liquid is very short, the liquid a good conductor of electricity, and the covered surfaces of the contact members are largely free from foreign layers, conditions exist which are as to order of magnitude very similar to those shown in Fig. 1. For, as the approximate course of the equipotential surfaces and the current lines of Fig. 1 shows (the equipotential surfaces being shown between which $\frac{1}{2}$ of the confined resistance is arranged), the resistance is mainly situated in the immediate neighborhood of the surface of the current passage. For this reason the shape of the contact members at a large distance from the surface of the passage of the current is relatively unimportant.

If highly conductive contact liquid distances short in the direction of the current are used it is possible according to the present invention to build liquid contacts for high amperages and sliding speeds which at the same time have low electrical and mechanical losses. Only the contact member surface portions to be covered have to be very small and technically largely free from foreign layers. This condition may be largely satisfied by using contact members which are cleaned carefully by a mechanical treatment and consist of materials being prone in themselves as little as possible to the formation of foreign layers and which are not amalgamated if mercury is used as contact liquid, e. g. molybdenum, tungsten, chromium, platinum, etc. However, the contact members may also consist of other highly conductive materials which are prone to the formation of foreign layers or amalgamation, if their surfaces after a corresponding cleansing from foreign layers are covered with thin electroconductive protective layers which are not prone to the formation of foreign layers and/or do not amalgamate. The production of such protective layers, for instance of molybdenum, tungsten, chromium, platinum, carbon, or the like, may be carried out by any of the known processes, for instance electrolysis, cathodic evaporation, deposition by evaporation, depositing from a glow discharge, or from a chemical compound or solution, or the like. However, it is possible, although less recommendable, to manufacture contact members from materials prone to the formation of foreign layers when exposed to air, provided care is taken that the contact members after a thorough cleansing of the surfaces thereof, for instance by turning under Hg

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or annealing in a high vacuum with simultaneous heating close to melting temperature, are kept during operation permanently under the protection of the contact liquid, for instance the Hg. Tests have shown that clean contact surfaces, for instance of iron, may be kept free from foreign layers under Hg for any time.

Of course, beside Hg other liquid metals or metal alloys may be used as contact liquid such as Wood's alloy or similar alloys or sodium potassium alloys or other metals at increased temperatures. The contact liquid must only not react chemically with the contact members, or form an alloy or amalgam with the same so as to avoid cloggings of the contact gap by slime formation at the sliding contacts.

At liquid contacts with contact members consisting of materials inclined to formation of foreign layers it is essential according to the present invention to avoid access of air to the point of contact. Fig. 2a shows an embodiment of the invention in which this is accomplished under using a Hg barrier by centrifugal action. The contact member K_1 rotates within the stationary contact member K_2 . As contact liquid mercury is used which is maintained in permanent circulation in the direction indicated by the arrows by means of the pump P. By means of a cooling device $Kü$ it is possible thereby to cool the mercury the temperature of which is increased by the current flow and the friction in the annular contact gap. The Fig. 2b the contact gap is shown on an enlarged scale. The annular gap S_p having the length s governs the conduction of the current. The surface portion of the contact member K_2 having the shape of a frustum of a cone (length of the conical frustum s , diameter D) is maintained according to the invention, as well as the opposite surface of the stationary contact member K_1 having the shape of a frustum of a cone, substantially free from foreign layers as shown in Fig. 2b by heavy lines. Access of air to the space (gap S_p) existing between the two surfaces shaped as frustums of a cone is prevented by the mercury barrier Hg_{sp} provided the relation

$$D_2^2(Hg-L) = HgD_1^2 - LD_3^2$$

is satisfied wherein D_1 , D_2 , D_3 are the diameters shown in Fig. 2b and Hg and L are, respectively, the specific gravities of the contact liquid and the air. Of course, it may be accomplished by corresponding steps that, under use of structural materials inclined to formation of foreign layers, the surface portions of the contact member within the gap S_p which control the conduction of the current, remain permanently covered by Hg even when the contact member K_1 is stationary (providing corresponding throttling valves (not shown) or the like.)

Another embodiment of the invention is shown in Fig. 3.

The stationary contact ring K_1 engages with the inner portion T thereof an annular trough-like recess of the movable contact member K_2 so that in horizontal and vertical directions narrow gaps having a width up to a few millimeters are generated which are filled according to the operating condition, with contact liquid. At rest and at slow motion of the contact member K_2 the gap S_{p1} is filled with contact liquid, as a rule Hg, shown in Fig. 3 as hatched area extending from the upper left to the lower right. The passage of the current from the movable to the stationary contact member is effected through the entire covered horizontal surface of the stationary contact member K_1 (Fig. 3). The large covered surface has no detrimental effect and does not cause any excessive frictional losses because the sliding speeds are moderate. At increasing rotational speed of the contact member K_2 , however, the mercury ascends parabolically in the annular dish shaped gap toward the outside so as to fill at high speeds the entire hollow cylindrical space R limited toward the interior by the protruding edge Ka shown in Fig. 3 by the hatching extending from the upper right to the lower left. The stationary contact member K_1 is provided on the part T engaging the annular recess

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an annular toroid-shaped projection Na consisting preferably of a material such as molybdenum not prone to the formation of foreign matter and being so dimensioned that it dips into the contact liquid shown in jet black for any speed condition of the movable contact member. Opposite this projecting part Na a channel shaped member H_k consisting of material not prone to formation of foreign layers is arranged in the movable contact member. Thus the passage of current at high peripheral speeds of the movable contact member K_2 is effected according to the invention only through very small covered areas of the stationary contact member indicated by the arrows shown in Fig. 3.

The fluid friction is small. In order to secure a replacement of material (replacement of the mercury having a temperature increased by joulean heat and friction by thermally less loaded Hg) the quantity of Hg may be apportioned larger than it is required for filling the hollow cylindrical space R. The excess Hg is then centrifuged at a fast rotation of K_2 over the edge Ka (see Fig. 3) tangentially into the hollow space Ho of the stationary contact member and collected, after yielding its kinetic energy by vortex formation, in the trough shaped space Wa of the stationary contact member K_1 , from which it is guided through the channel K/ having a toroidal edge Na by suction caused partly by siphon action (difference in height) and air pressure effect to the gap S_{p3} which to this end is inclined toward the outside, and is then guided to the contact gap between Na and H_k and thus maintained in circulation. Of course, inside the stationary contact member may be arranged cooling coils $Kü$ or cooling ribs for natural or artificial cooling so as to cool the contact member and thus the Hg during the circulation thereof.

The circulation of the mercury between the annular trough Wa and the contact gap Na- H_k may be maintained by means of corresponding tubular connections and a pump. Figs. 4 to 7 show embodiments of the invention with stationary contact members acting not over the entire perimeter of the contact members but only at single places of the contact ring and interposed contact liquid distances. (Current supply to the movable contact member, that is to the contact annulus as in brushes.) In Fig. 4 a central contact is shown.

A Hg vessel (stationary contact member K_1) is arranged below the movable (rotating) contact member K_2 , the axis of which coincides with that of the contact member K_1 . Contact of K_2 with the contact liquid (Hg) takes place in the rest position according to the present invention along a very small circle having a center arranged in the axis of rotation. At a rotation of the contact member K_2 the Hg is driven outwards in the direction of the arrows by the friction and centrifugal action, and returns in circulation through the recesses A in the inner tube to the latter, a cooling of the Hg being effected, if desired, as in the last example. The flow of current takes place in the direction of the arrows shown in dotted lines, from the stationary contact member K_1 to the movable contact member K_2 . In order to avoid throwing out of the radially moving Hg by centrifugal action the edge of the outer pipe R_2 of the stationary contact member is arranged somewhat higher than that of the concentric inner pipe R_1 .

Figs. 5a, 5b, 6a, 6b, 6c, 7a and 7b show embodiments of the invention in which a radial or axial bearing is applied. Whereas in Figs. 5a, 5b only at certain places of the perimeter of the movable contact member K_2 a specially supported, stationary contact member K_1 is indicated, the contact ring according to Figs. 6a, 6b, 6c carrying the stationary contact members encloses the movable contact member entirely so that good sealing and discharging possibilities for the contact liquid are realized. In Figs. 6a, 6b, 6c only one stationary contact member is shown for the sake of simplicity. The com-

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pressed air added for lubricating the bearing clearances S_1 , S_2 over the channels KI and filtered for preventing any contamination of the contact liquid, acts simultaneously as a seal towards the outside for the mercury used as contact liquid by means of the clearances S_2 . Figs. 7a, 7b show an axial bearing of the two-part contact ring supporting the stationary contact members by the lateral faces A of the movable contact member. This arrangement involves over that shown in Figs. 6a, 6b, 6c the advantage of eliminating the centrifugal expansion and of a lower thermic expansion of the movable contact member during a flow of current, since the distance B is much smaller than the diameter D in Figs. 6a, 6b, 6c, and the difficulties connected therewith such as the change of the contact gap, and in unfavorable cases a sliding of the movable contact member on the stationary contact member and thus a scratching of the surfaces of the contact members and/or a jamming of the movable contact member or of the support of the same. A lateral support as shown in Figs. 7a, 7b affords the advantage of an easier manufacture of new sliding surfaces or of a repair of damaged sliding surfaces of the contact members and allows with a unilateral plane bearing, an adjustment of the gap thereof during operation. If the contact members are designed as shown in Figs. 6a, 6b, 6c the stationary and the movable contact members have to be manufactured so that they are slightly conical in order to provide for an adjustment of the gap of the bearing. For the centering and the lubrication of the bearing it is feasible either to use compressed air, as in the embodiments shown in Figs. 5a, 5b, 6a, 6b, 6c, 7a and 7b in which an automatic centering of the carrier of the stationary contact member is effected particularly if the weight thereof as shown in Fig. 6b is equalized by intercalation of springs F or rollers, or else an additional air lubrication or an hydrodynamic lubrication may be used. The necessary air is sucked in automatically by the bearing from the surroundings, and by providing suitable recesses As shown in Figs. 6c and 7a in the bearing seats, corresponding baffling surfaces are generated.

In order to avoid a jamming of the bearing at low numbers of revolutions at which a sufficient hydrodynamic lubricating action is not yet obtained, it is advantageous to use as materials within the bearing gaps into which the contact liquid may not penetrate, for instance the gap S_1 in Figs. 6a and 7a, materials having good mutual sliding properties independently from their inclination to amalgamize, for instance bronze or gray cast iron on steel. For the sake of safety it is furthermore advantageous to grade the widths of the gaps, that is to provide the most narrow width for the gap S_1 , a somewhat larger width for the gap S_2 , and the maximum gap width for the liquid contacts themselves. In order to provide a centering or a carrier allowance of the contact members at impacts, preferably the current supply, the supply of the contact liquid and the air to the contact members and/or the carriers thereof is effected by means of resilient intermediate members such as rubber tubes or elastic metal hoses Ms shown in Figs. 6a and 7a.

In order to obtain, notwithstanding the arrangements of the liquid contacts at certain peripheral places of the movable contact member, a uniform course of the current in the rotor of the associated unipolar machine, for instance in the rotor shown in Fig. 6a and having a diameter D, it appears under circumstances advantageous to design the current collecting ring (shown in Fig. 7a with the width B) and operating as a movable contact member not in one piece with the rotor as shown in Fig. 7a, but to manufacture the same from a highly conductive material such as copper or silver and to place the rotor on the same. The rotor currents will be collected by this ring and conducted at its perimeter to the individual liquid contacts.

Attention has been drawn hereinbefore to the mechani-

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cal losses occurring at liquid sliding contacts. Besides the losses by internal friction of the liquid and vortex formation in the contact gap, also mechanical losses are to be considered which are generated by that, owing to the roughness of the surface and the adhesion of the contact liquid to the surface of the movable contact member, a kinetic energy is imparted to the contact liquid at least in a portion of the contact gap contiguous to the movable contact member, that is in the so-called boundary layer, the kinetic energy being lost when the contact liquid leaves the contact gap.

The losses due to liquid friction and vortices, and the loss of kinetic energy depend on the magnitude of the surface portions of the contact members covered by the contact liquid. In contradistinction to the hitherto known sliding contacts, according to the present invention the liquid contacts are to be designed with very small surface portions of the contact members covered by the contact liquid, said contact members being as free as possible from foreign layers in order to limit the electrical losses, the width of the slot being narrow in the direction of the current so as to decrease the electrical and mechanical losses, the power of the pump serving for pumping the contact liquid to the solid contact being reduced, and the capillary forces of the contact liquid in the contact gap being exploited. Numerical calculations and tests have shown that the current density in the liquid contacts according to the invention has to amount to at least 200 amps. per square centimeter in order to obtain simultaneously low electrical and mechanical losses, it being understood that the current density in the liquid contacts is equal to the ratio of the current intensity to the size of the covered surface of the contact member which should be as free as possible from foreign layers, this being contrary to sliding contacts of known design in which values up to 20 amps. per square centimeter are used.

The fact mentioned hereinabove that only a relatively thin boundary layer of the contact liquid contiguous to the movable contact member is imparted a high speed by the moving contact member whereas the major portion of the contact liquid in the contact gap does hardly participate in the motion provided it does not come into immediate contact with the movable contact member after leaving the contact gap, may be used for constructing low loss liquid sliding contacts as shown in Figs. 9a, 9b.

In this embodiment the contact liquid is imparted an axial speed component Vq by appropriate means, for instance by drillings in a suitable direction, by corresponding channels, or, for instance, by spinning and/or twisting bodies or the like which quickly remove the contact liquid from the surface of the movable contact member. The greater part of the contact liquid is separated from the movable contact member so as not to contact the same later in an undesired manner so that the mechanical losses are largely reduced.

The contact liquid may be prevented from escaping to the outside, in a manner similar to that shown in Figs. 6a, 6b, 6c, 7a and 7b, by an air current having the speed V_L (see Figs. 9a, 9b) which is directed from the outside towards the collecting and discharge chamber K of the contact liquid.

The kinetic losses may also be reduced by applying smooth covered surfaces of the movable contact member. The smoother these surfaces are, the lower is the portion or the layer thickness of the contact liquid carried along by the rapidly passing movable contact member.

If contact liquids having a high density and low viscosity, for instance mercury, are used the dynamical phenomena play a part in the generation of the distribution of the velocity within the boundary layer, or in the limiting case within the entire contact gap. A linear distribution of the velocity having the limiting value $v=0$ at the margin of the boundary layer in the contact liquid or the surface of the stationary contact member and $v=v$ the peripheral speed of the movable contact member

at the surface of the same, is established in a contact gap only following a certain transition range extending in the direction of the sliding velocity in which the liquid layers further removed from the surface of the movable contact member have lower velocities than those corresponding to a linear distribution of velocity. If the length L of the contact member measured in tangential direction (see for instance Figs. 8a, 8b, 8c) is shorter than the value thereof corresponding to this transition range, a linear velocity distribution is not yet established in the contact gap and the kinetic losses or the mean velocity are lower than they are at a linear velocity distribution. Thus the length L of the contact gap should be kept short, in particular with contact liquids having a high density and a low viscosity. However, it is not to be recommended to reduce the dimensions too much since then at a given liquid-covered surface of the contact member, which is required for electrical reasons, and a given width of the contact gap, a large outlet section is required, thus generating high kinetic losses. It has been established by experience that it is advantageous to provide a lenticular recess in the stationary contact member at the end of the delivery channel for the contact liquid, in which recess a relatively large quantity of Hg accumulates by hydrodynamical action. A current of the liquid issues from the accumulated quantity along the surface of the contact member, as shown in the plan view of Figs. 8a, 8b and 8c.

In order to reduce the probability of variations of the contact resistance, or in extreme cases of contact interruptions, owing to mechanical defects of the contact members moving against each other such as variations of the gap owing to machining faults, defects of the bearings, impacts, thermal or electrodynamic phenomena, the jet of the contact liquid may be subdivided as shown in Figs. 10a, 10b into two or more correspondingly thinner jets electrically connected in parallel. At a disturbance of any one jet the other jets take over to a greater extent the conduction of the current, and the total contact resistance is rendered uniform as confirmed by tests. It has been found advantageous to displace the outlets of the individual jets in tangential direction as shown in Figs. 10a, 10b so that the probability of a simultaneous occurrence of disturbances is reduced thereby.

In the contacts according to the present invention the continuous or intermittent replacement of the contact liquid by cooler contact liquid is of essential importance. Only by this it is rendered possible to reach the high current densities required according to the present invention and to effect simultaneously a good cooling of the contact by withdrawing the electrically and mechanically generated heat.

At large sliding velocities involving high frictional and vortical losses in the liquid contact distance it may happen that the cooling of the stationary and movable contact members effected by the flow of the contact liquid is not sufficient. In this case it is advantageous particularly at the stationary contact member, to provide a sufficient cooling by any other liquid, for instance water, flowing through correspondingly arranged cooling pipes. The movable contact member may be cooled in a simple manner, particularly by guiding water instead of the contact liquid through one of the stationary contact members arranged at the perimeter thereof as shown in Figs. 6a, 6b, 6c, or by spraying water against the movable contact member. The high specific heat and/or the heat of evaporation of the water admits of an extremely effective cooling. However, the movable contact member should consist in this case of materials such as molybdenum, rhodium, platinum, etc., which are not attacked by water and/or steam. A regulation of the stream of the contact liquid, that is an adjustment of the pressure of the contact liquid required in the contact gap for a good contact thereof with the contact members and/or with respect to phenomena due to the pinch effect, corre-

sponding to the peripheral speed of the movable contact member, may be obtained by means of throttle valves (not shown) in the contact liquid pressure pipe, or by adjusting the number of rotations of the pressure or suction pump (not shown) for the contact liquid. Thereby it is rendered possible to cool the contact liquid during the circulation thereof and/or to clean the same if necessary, for instance by filtering or centrifugal action.

A portion of the contact liquid issuing from the contact gap is finally atomized owing to the high kinetic energy imparted to the same and in some cases, for instance if Hg is used as a contact liquid, electrostatically charged. The recombination of the atomized contact liquid or previous separation thereof from air and the gas in which it is present may be effected at a high specific weight of the particles of the contact liquid under utilization of gravity or of the centrifugal effect in a centrifuge, particularly if a discharge of the atomized contact liquid is effected by a suitable contact of the fine particles of the contact liquid with electrically, for instance frictionally oppositely charged particles.

In order to secure permanently the presence of contact member surfaces which are free from foreign layers it may be advisable to operate the entire contact device according to the present invention in a higher or lower vacuum or under a protective gas. The shaft of the machine to which the contact device belongs, projects in this case, if necessary with application of an intermediate vacuum, from the evacuated space, or the torque is transferred from the evacuated space with application of magnetic means.

Thus it is seen that the sliding contacts remaining operatively closed and consisting of solid materials having a high electric conductivity are electrically connected by an intercalated contact liquid covering a relatively large portion of the surface thereof.

The contact resistance causing the electrical losses is particularly due to the foreign or starting layers which to a large extent are present on the surfaces of the contact members unless special means are applied or the materials are specially selected.

It is for this reason that contact members consisting of materials prone to the formation of foreign layers are often technically cleansed before the contact liquid covers them, for instance by applying solvents of greases and fats and by a mechanical working thereof such as by a treatment with emery, filing, scraping, grating, etc.

By this the current heat losses are reduced to a certain extent. However, experience has shown that they remain still considerable at high amperages. This is partly due to the fact that the surfaces of the contact members are only imperfectly cleansed physically from foreign layers by the mechanical treatment mentioned hereinabove since skins of foreign materials are partly maintained thus causing losses due to a confinement of the current path. On the other hand this is caused by the fact that during or between the mechanical treatment and the covering of the contact members by the contact liquid, resistive foreign layers are formed on the surfaces of the contact members by adsorption and/or a chemical bonding of foreign molecules from the surrounding air containing O_2 , H_2O , N_2 etc. However, formation of foreign layers also occurs when the surfaces of the contact members to be covered are subjected during operation temporarily to the influence of the surrounding air or, in arrangements with protective gases, to the influence of the latter.

For reducing the electrical losses in sliding liquid contacts the surface portions of the contact members and thus the cross-sections of the foreign layers which are specifically poor conductors of electricity are rendered relatively large, for instance by applying of surfaces extending over the entire perimeter up to several hundreds of square centimeters as disclosed in German Patent No. 351,593. This, however, leads, particularly at high sliding

speeds, to large mechanical losses due to frictional vortices in the liquid and to kinetic losses so that liquid contacts have been found unsatisfactory at high sliding speeds and amperages. The present invention overcomes these drawbacks as more fully explained hereinabove.

The present invention has been described hereinabove in connection with solid sliding contacts and a liquid contact distance intercalated between the same. However, it is to be understood that numerous changes, substitutions of equivalents, and modifications may be made in the contact arrangement described hereinabove without departing from the scope of the present invention.

What is claimed is:

1. In an electrical interconnection between the rotor and stator of a homopolar generator having a current capacity exceeding 100 amperes, the combination comprising, mutually spaced contact surface zones on said rotor and stator relatively movable with respect to each other when the generator is in operation, electrically conductive liquid intercalated in said spacing for establishing electrical connection between said contact surface zones, and means for replacing said liquid in said spacing with cooler liquid, said contact surface zones being substantially free of coatings of foreign matter and the surface areas of said surface zones electrically interconnected by said intercalating liquid being so small that a current value of at least two amperes per square millimeter through said liquid across said spacing is effected.

2. The electrical interconnection according to claim 1 wherein said electrically conductive liquid is comprised of a low melting temperature metallic substance.

3. The electrical interconnection according to claim 1 wherein said coating-free contact surface zones constitute surfaces machined under a protective inert environment.

4. The electrical interconnection according to claim 2 wherein said coating-free contact surface zones consist of a non-amalgamable material.

5. The electrical interconnection according to claim 1 wherein said coating-free contact surface zones consist of a thin coating of metal which is non-reactive with respect to said electrically conductive liquid.

6. The electrical interconnection according to claim 1 wherein said rotor and stator comprise copper portions backing said coating-free contact zones.

7. The electrical interconnection according to claim 1 including means for inhibiting the flow of liquid from said spacing while the generator is in operation so that said coating-free contact zone surface areas will not be exposed to external environmental influences.

8. The electrical interconnection according to claim 1 wherein said generator is arranged with the rotational axis of its rotor extending vertically and wherein said contact surface zones are so shaped that said contact zone surface areas covered by the liquid is increased by operation of the force of gravity acting on said liquid at decreasing speeds of rotation of said rotor.

9. The electrical interconnection according to claim 8 wherein the surface zone of said rotor is of annular cup-shape containing said liquid and wherein the surface zone of said stator is in the form of a knife-edged torus dipping into said liquid.

10. The electrical interconnection according to claim 1 wherein intercalating liquid extends only over a portion of the periphery of said spaced contact surface zones.

11. The electrical interconnection according to claim 1 including means to guide said liquid into said spacing, and means to remove said liquid from said spacing.

12. The electrical interconnection as defined in claim 11 wherein said guiding and removing means each comprises a plurality of conduit members secured with respect to the stator and peripherally arranged thereabout.

13. The electrical connection according to claim 1 wherein said mutually spaced contact surface zones comprise an annular member surrounding the contact surface zone on said rotor and closely spaced with respect thereto, said annular member having an annular recess facing said rotor contact surface zone, means directing said liquid through said annular member into said recess, means spaced from said liquid directing means for withdrawing said liquid from said recess and fluid flow means connected with said annular member for lubricating it with respect to said rotor.

14. The electrical connection as defined in claim 13 wherein said fluid flow means comprises a pressure-fed inert gas operative at each side of said annular recess to effect sealing with respect thereto.

15. The electrical connection according to claim 14 including conduit members connected with said annular member for carrying said fluid and said inert gas, said conduit members being resilient to allow relative motion with respect thereto of said annular member.

16. The electrical connection as defined in claim 1 wherein the contact surface zone on said rotor is substantially free of surface irregularities.

17. The electrical interconnection as defined in claim 1 wherein the surface areas of the contact surface zones covered by said liquid are small in the tangential direction.

18. The electrical connection as defined in claim 1 wherein said mutually spaced contact surface zones comprise an arcuate member adjacent the contact surface zone on said rotor and closely spaced with respect thereto, said arcuate member having an arcuate recess facing said rotor contact zone and providing an increased spacing distance between said contact zones, means directing said liquid through said arcuate member into said recess, means peripherally spaced from said liquid directing means for withdrawing said liquid from said recess, and gas pressure supply means connected with said arcuate member for conducting gas into the spacing between said arcuate member and said rotor and operative as a fluid bearing for said arcuate member and as sealing means for the liquid in said arcuate recess.

19. The electrical connection as defined in claim 18 wherein said contact surface zones comprise surface areas having low coefficients of friction.

20. The electrical connection as defined in claim 1 including means for cooling the contact surface zone of said rotor by a liquid other than said electrically conductive liquid.

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