July 2, 1929. J. F. TRUDEAU 1,719,407

DYNAMO CLEANING AND COOLING DEVICE

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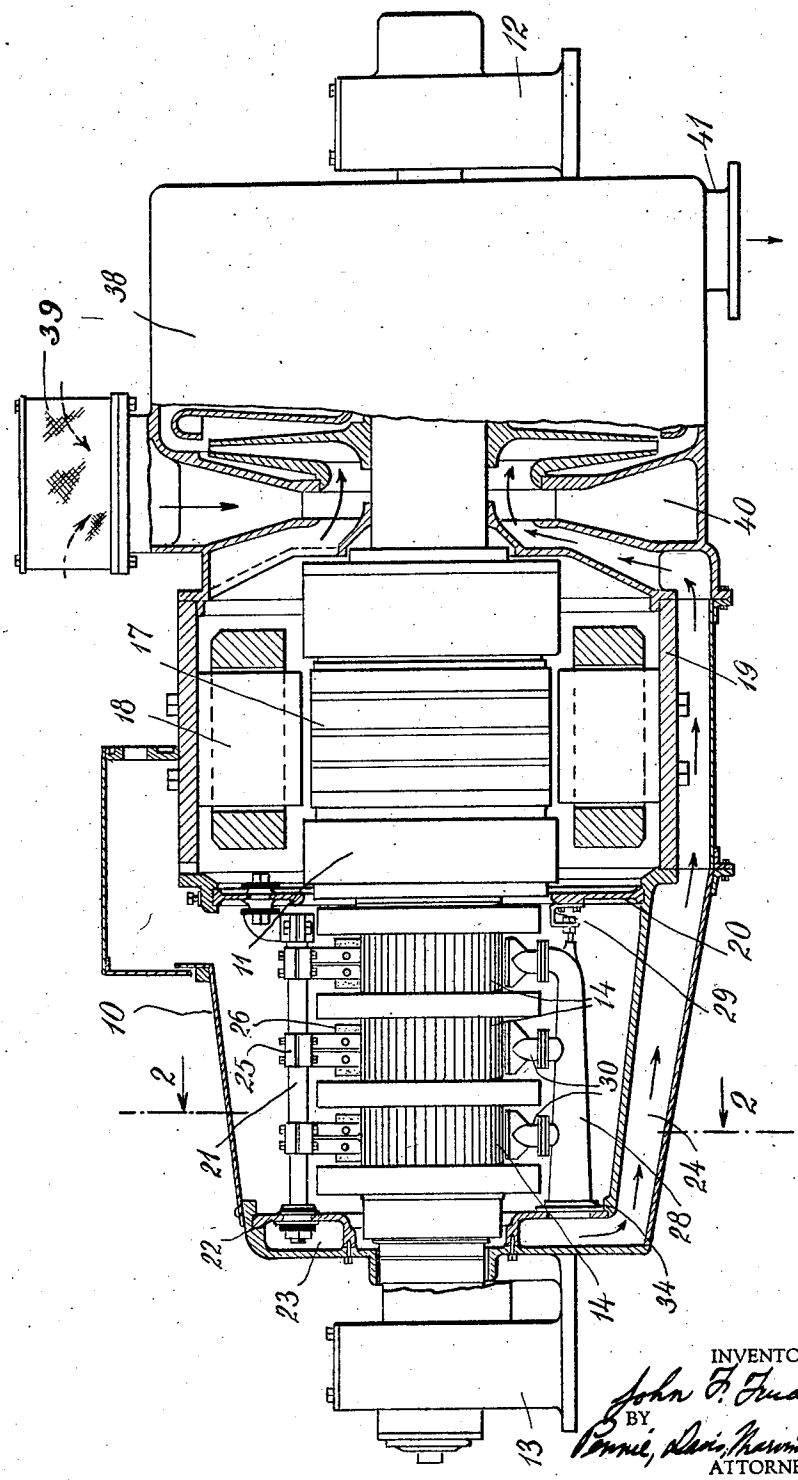


Fig. 1.

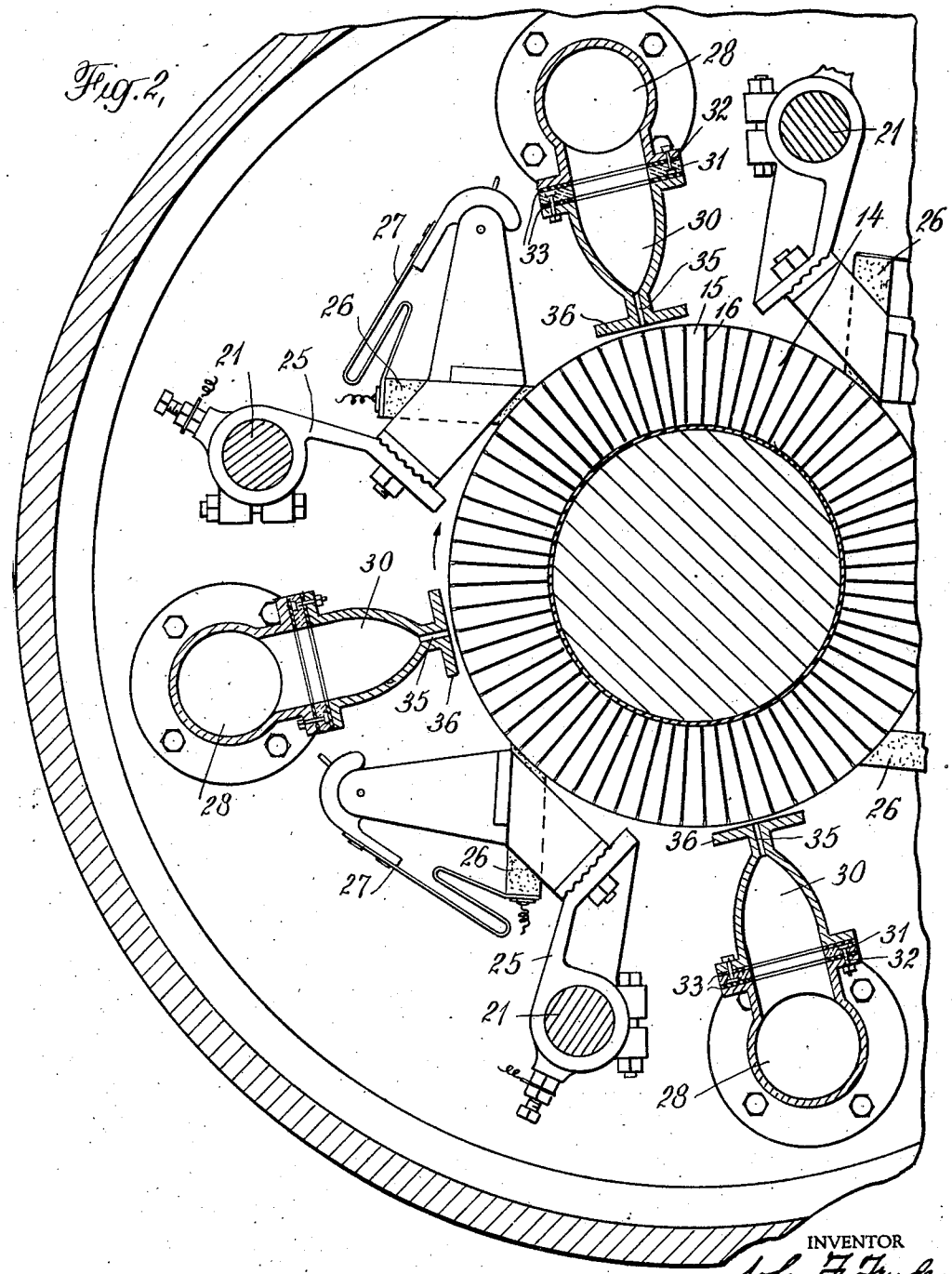
INVENTOR
John F. Trudeau
BY
Bonnie, Davis, Thrasher & Elliott
ATTORNEYS

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Fig. 2.



INVENTOR
John F. Trudeau
BY
Bruce, Davis, Thurman & Clark
ATTORNEYS

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UNITED STATES PATENT OFFICE.

JOHN F. TRUDEAU, OF BAYONNE, NEW JERSEY, ASSIGNOR TO ELECTRO DYNAMIC COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

DYNAMO CLEANING AND COOLING DEVICE.

Application filed February 1, 1928. Serial No. 250,962.

This invention relates to devices for cooling and simultaneously maintaining the engaging surfaces of sliding contacts clean and has particular reference to devices for cooling and keeping clean frictionally engaging electrical contacts such as commutators or collecting rings and their contacting brushes of dynamo-electrical machines, especially high speed types such as turbo-generators, high speed direct current dynamos and the like. In order to maintain perfect electrical connection between brushes and collecting rings or commutators so as to prevent sparking and insure perfect commutation and current collection or distribution, the pressure between them must be uniform and relatively great so that the resultant friction, especially at high speeds, develops considerable heat which, if not dissipated in some way, may cause damage to either or both the brushes and commutator or collecting rings in addition to increasing the objectionable heat developed in other parts of the machine due to different causes. Provisions have been made heretofore for removing the heat within the machine housing by blowing devices and the like, but these are not effective for removing the heat immediately from the surfaces where it is produced by a friction because the centrifugal action developed by high speed of the machine prevents the access of air or other cooling medium to the engaging surfaces. A further objection attending the operation of high speed machines and caused by the frictional effects between the brushes and the contacting surfaces arises from the wearing down of carbon brushes and to a lesser extent of the commutator or collecting ring surfaces which produces a fine, impalpable dust. This dust, which forms a good electrical conductor when massed, clings to edges of the brushes and surfaces of the commutator or collecting rings and frequently causes imperfect commutation, current collection or distribution and sparking, in addition to coating other parts of the machine with a film of dust. On undercut commutators, especially, the conducting dust collects and packs between the adjacent commutator bars and short-circuits them, causing imperfect commutation and considerable electrical loss. This dust accummulates relatively rapidly, especially in a high-speed machine, so that the machine must be stopped at frequent intervals for removing the dust, either by scraping, brushing or by other means, causing loss of time and contributing to inefficient operation.

The principal object of the present invention is to overcome these objections attending the operation of high speed machines, by providing a device which continuously cools the commutator or collecting rings, and preferably the brushes also, immediately at the points where the heat is developed by friction and simultaneously removes the dust produced by the wearing down of the brushes and commutator or collecting ring surfaces before the dust can collect on any part of the machine. A further object of the invention is to provide means whereby the commutation or current collection is maintained at highest efficiency between sliding contacts no matter what the speed of relative movement between the contacting surfaces may be, this means being only operative when it is needed; i. e., only when the machine is running.

The invention consists in providing one or more nozzles immediately adjacent the commutator or collecting ring and preferably behind one or more of the brushes engaging the commutator and collecting ring surfaces, these nozzles effecting by means of negative or positive pressure the circulation of air directly on the sliding surfaces, whereby these surfaces are cooled. Simultaneously, by means of this air circulation, the dust produced by the wearing down of the brushes and commutator or collecting ring surfaces is removed before it can be deposited upon the brushes and other parts of the machine or collected between undercut commutator bars, or the like. The nozzles are so arranged with respect to the rotating surfaces that the circulation of the air induced thereby is unaffected by the centrifugal or blowing action produced by the relative rotation of the sliding parts, and it is preferred that suction be used so that the dust is entirely removed from the machine as well as the heated air which is withdrawn by the nozzle from the friction-heated sliding surfaces.

For a better understanding of the invention, reference is made to the accompanying drawings in which

Figure 1 is a longitudinal cross-section of

a dynamo electric machine, employing the cooling and cleaning device of this invention; and

Fig. 2 is an enlarged section taken along the line 2—2 Figure 1, illustrating the arrangement of the cooling and cleaning device adjacent the commutator of the dynamo.

In these drawings, numeral 10 designates the dynamo housing which may be formed of cast or sheet metal in any desirable shape to satisfy requirements, and which contains the dynamo armature 11 journaled in suitable bearings 12 and 13 which are secured upon piers or other support. The machine illustrated is a direct current motor provided with three commutator face sections 14 and which may be of the undercut bar type illustrated in Fig. 2, in which the commutator bars 15 extend radially beyond the insulating material, such as mica, disposed between the bars 15. The armature windings 17 rotate between suitable poles 18 which are secured to the frame 19 of the machine or fastened in place in any other manner desirable, the particular construction of the dynamo not being any part of this invention.

A peripheral web 20 mounted between the winding and commutator chambers carries one end of the brush bar 21, the other end of which is secured in the wall of a channel-shaped ring 22 which forms with the end wall of housing 10 an annular chamber 23, one portion of which communicates with an elongated passage 24 formed between machine housing 10 and machine frame 19. Suitable brush holders 25 are spaced along brush bar 21 and are secured thereto by a split bushing and bolt combination, or the like, as illustrated in Fig. 2. Brushes 26 of carbon, or any other suitable material, engage commutator sections 14 and are carried by the brush holders 25 so as to bear with uniform pressure against the surfaces of commutator sections 14, and any one of several means for accomplishing this may be employed, one of these means being spring clips 27 engaging and pressing upon the free ends of brushes 26, as illustrated in Fig. 2.

Communicating with annular chamber 23, which is made air tight at its joints, are a number of manifold tubes 28, preferably extending parallel to the axis and adjacent the surfaces of commutator sections 14. The opposite ends of tubes 28 may be braced by securing them to peripheral web 20 by means of a clip 29 as illustrated in Fig. 1. Communicating with each one of manifold tubes 28 are three nozzles 30, which are arranged so that each one of the nozzles is disposed adjacent a commutator section. These nozzles are each insulated from tubes 28 by means of three rings of insulating material, the center ring of which, 31, is provided with counter-bored holes for the reception of bolts or screws 32 which project from insulator 31 in alternate directions and are secured in the flanges of tube 28 and nozzles 30. In turn insulating the heads of bolts or screws 32 from the flanges of nozzles 30 and tube 28 are a pair of thin insulating rings 33, so that there is no electrical contact between any part of tube 28 and the several nozzles 30 connected thereto. Similar sets of insulating rings 34 electrically insulate each of tubes 28 from their supporting means in peripheral web 22, so that in no case will any short circuit between the commutator rings and the nozzles or between any part of the armature and manifold tube 28 pass to the frame or other part of the machine.

Nozzles 30 are each provided with elongated slots 35 which extends parallel to commutator bars 15 and substantially along their entire length. Extending from either side of each nozzle slot 35 are flanges 36 which are preferably tangent to the surfaces of the commutator sections 14, there being only a short gap between the mouth of slots 35 and the surface of the commutator rings 14. As illustrated in Fig. 2 these nozzles are arranged between the brushes 26 and it is preferred that these nozzles be arranged as closely as possible to the brushes 26.

The elongated passage 24 connected to the annular air box 23 with which each one of manifold tubes 28 communicates, is in communication with some suitable source of negative air pressure such as a suction pump, the intake side of a compressor or the like. In Fig. 1 of the drawings, an arrangement is shown in which a centrifugal compressor 38, having an air intake 39, is directly connected to the dynamo and passage 24 communicates with the intake chamber 40 of the compressor 38, so that suction is maintained through slots 35, nozzles 30, manifold tubes 28, annular air box 23 and passage 24. Obviously, if desired, a blowing effect may be produced through nozzles 30 by connecting passage 24, annular air box 23 or manifold tubes 28 to the discharge side 41 of a blower or other device producing positive air pressure.

In operating the machine, especially at high speeds, considerable heat is developed on the commutator sections 14 and brushes 26 by the friction between them. Simultaneously, the friction between brushes 26 and the commutator sections 14 causes the brushes to wear down considerably and the commutator bars 15, which are usually of copper, to wear down also but to a considerably lesser extent. The resulting fine impalpable dust of carbon or of other material from which the brushes 26 are made, as well as a slight amount of copper dust, adheres to the edges of brushes 26 and to the surface of commutator sections 14 and becomes packed between the undercut commutator bars 15 so that sparking of the brushes

and imperfect commutation because of short circuiting of the commutator bars 15 results, this fine dust when packed being a good electrical conductor. Consequently, the heat and dust developed by the friction between brushes 26 and commutator sections 14 results in inefficient and imperfect operation of the machine as a whole. The device of this invention removes these products of friction by means of the suction of nozzle slots 35 lying parallel to the commutator bars 15 and immediately adjacent the surface of commutator rings 14, by withdrawing the heated air from along the surface of the commutator sections and from brushes 26 immediately after the air is heated by radiation and conduction from the heated surfaces of the commutator and the brushes, and before this heated air can be circulated with consequent harmful effects to other parts of the machine by the centrifugal action of the commutator. The tangency of flanges 36 of nozzles 30 to the surfaces of the commutator sections provides a gap of decreasing width from the edges of flanges 36 to slots 35 with an effect that the air is drawn in with increasing velocity from beyond the edges of flanges 36 to slot 35. Simultaneously, the dust produced by the wearing down of the brushes 26 and the surfaces of commutator sections 14 is removed through slot 35 by suction and prevents the packing of this dust between the undercut commutator bars 15, since the suction of the nozzles is produced along the slots formed between the commutator bars 15. Accordingly, all of the objectionable electrical conducting dust is removed from the machine as a whole before it is affected by centrifugal action so that it can not produce any harmful effects on the commutation or circulate through the housing of the machine to be deposited on other parts thereof. Obviously, the suction device may be applied in the same way to alternating current machines in which brushes and slip rings are employed, the wearing down of the brushes and slip rings and the heating thereof because of the frictional action between them having the same harmful effects as described in connection with a direct current machine.

The new cooling and cleaning device for dynamo electric machines accordingly eliminates many of the problems attending the operation of high speed machines, principal among which is the problem of keeping the commutator or slip ring surfaces and their contacting brushes cool and clean so that perfect electrical distribution, collection or commutation is insured, and efficient machine operation obtained. While the cooling and cleaning device of this invention has been described in connection with a machine of specific form, it is to be understood that the device may be applied to any type of machine involving the objectionable production of heat and/or undesirable dust or other particles of foreign matter, and may be modified to suit requirements without departing from the invention.

I claim:

1. In a dynamo-electric machine, having relatively moving brushes and a cylindrical surface in frictional engagement, the combination of a flat plate arranged substantially tangent to the surface, said plate having a slot disposed substantially at the point of tangency, a tube communicating with the slot, and a source of pressure connected to the tube.

2. In a dynamo-electric machine, having relatively moving brushes and a cylindrical surface in frictional engagement, the combination of a nozzle arranged adjacent each brush and tangent to the surface, said nozzles each having an elongated slot extending transversely of the surface, flanges on either side of said nozzle slots extending substantially tangent to the surface, a conduit common to all nozzles, and a source of pressure connected to the conduit.

3. In a dynamo-electric machine having relatively moving brushes and cylindrical surfaces in frictional engagement, the combination of a nozzle adjacent each surface, flanges on each nozzle extending to either side of the opening thereof and substantially tangent to the surface, a manifold connected to each nozzle, and a source of pressure connected to the manifold.

In testimony whereof I affix my signature.

JOHN F. TRUDEAU.