Dec. 29, 1959 MATSUO MISHIMA 2,919,360

COMMUTATOR DEVICE FOR A DIRECT CURRENT MICRO-MOTOR

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Fig. 1

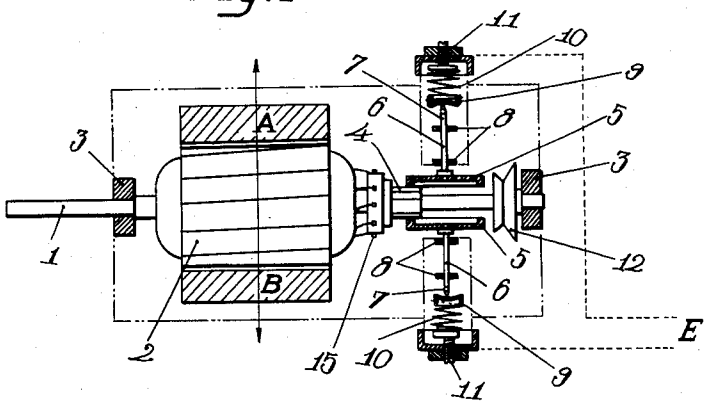


Fig. 2

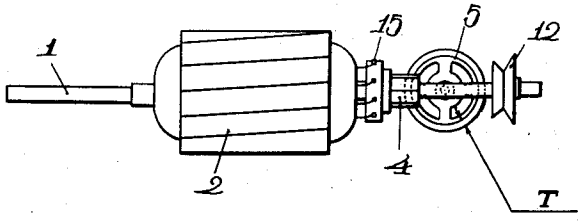
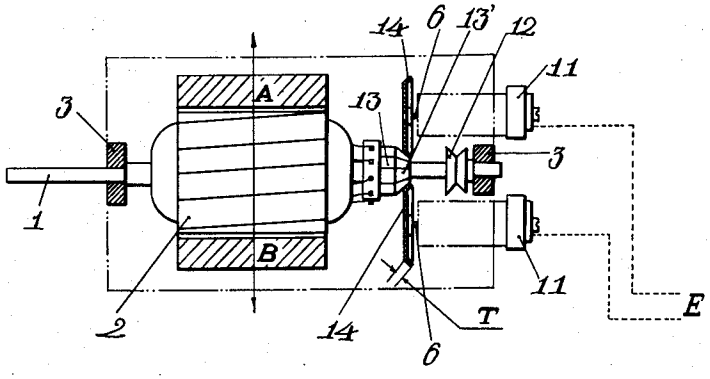


Fig. 3



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COMMUTATOR DEVICE FOR A DIRECT CURRENT MICRO-MOTOR

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The present invention relates to improvements in electric micro-motors or micro-generators and is directed particularly to an improved commutator device of the brush-wheel type for use in such motors or generators.

The use of rotary wheel contact brushes for supplying current to or from the commutator of an electric motor or generator in place of conventional brushes is known.

In case a brush type collector is used in such micromotor or generator, a certain minimum contact pressure between commutator and brush will be required in order to maintain electrical contact. The torque produced by such a micromotor is very small. In view thereof the output efficiency is substantially decreased due to the frictional loss between the brush and commutator.

The principal object of this invention is to improve upon such rotary brush commutating devices and adapt them for use in micro-motors or generators.

A more specific object of this invention is to provide a commutating device of the character described wherein a comparatively large brush wheel is mounted at one end of a spring-pressed shaft arranged substantially perpendicular to the rotational axis of a motor or generator armature, with the peripheral rim of the brush wheel in resilient rolling engagement with the commutator segments, whereby frictional contact between the commutator and the brush wheel is minimized, while at the same time, by virtue of the sliding action in addition to the rolling action between the brush wheel rim and the commutator due to differing peripheral velocities, the contacting surfaces are kept clean for continued low resistance electrical contact.

A further object of the invention is to provide a commutating device wherein an extremely light and comparatively large brush wheel is mounted at one end of a spring-pressed rotatably journalled shaft, the wheel and shaft having low inertia to oscillate freely, while contact pressure between the commutator and brush wheel is minimized and dynamic electrical contact resistance between the wheel and commutator remains low.

Another object of the invention is to provide for micromotors and generators a commutating device of the character described having superior performance, greater reliability and longer life, in which electrical losses due to imperfect brush contacts and dynamic contact resistance are reduced to a minimum.

Another object is to simplify the mechanism of a commutator for micro-motors, to strengthen its structure, and to provide stable power output at high efficiency.

Other objects, features and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings wherein

Fig. 1 and Fig. 2 show a direct current motor embodying one form of the invention.

Fig. 1 is a longitudinal cross-sectional view along the axis of the rotor of the direct current motor.

Fig. 2 is a top plan view showing electricity supplying mechanism.

Fig. 3 is another form of the invention.

In Fig. 1 the shaft 1 of rotor 2 rotating between two poles A and B of a permanent magnet is carried by two bearings 3, 3. This magnet may alternatively be an electromagnet. On one side of the rotor small cylindrical commutator segments 4, whose diameter is made as small as permissible, for example one and a half times the diameter of the rotor shaft, are fixed on the rotor shaft. Each segment is electrically connected to the armature circuit of the rotor 2 at junctures 15.

The commutator segments 4 are in rolling contact with the flanged rims of a pair of brush wheels 5 each fixed to one end of a shaft 6 arranged perpendicular to the rotor axis. Each shaft is rotatably carried by oilless bearings 8, 8 made of such materials as nylon. To the other end 7 of each shaft is attached a cone-shaped end member made of low contact resistance metal, which is pivoted by the concaved surface of a thrust bearing 9 pressed by coil spring 10 against the shaft.

The force of each spring 10 is transmitted to its shaft 6 and then to the contacting surfaces between its wheel 5 and the segments 4. This force can be adjusted by a screw or the like device adjustably arranged in an end cap 11 enclosing each of the springs 10.

Since all the elements from the brush wheel to the adjustment screw are made of electricity conductive materials, direct current is supplied through leads E connected to the adjusting screws, through the wheels and the segments to the armature.

The width T of the flanged rim of brush wheel above mentioned is determined in consideration of rolling contact pressure and the wear of the surface thereof.

The contact surfaces between the rims of the wheels 5 and the commutator segments 4 are polished by the self-grinding work of the rolling contact between them.

In order to avoid the lubrication oil of the bearing 3 leaking into the contacting surfaces of the commutator, a flange shaped oil separator 12 is fitted on the shaft 1 near the bearing.

In another form of application of this invention as shown in Fig. 3, shafts 6, 6 of the brush wheels 14, 14 are arranged in parallel with the rotor shaft 1. The commutator segments have a coned end surface 13' which is in rolling contact with the cone shaped rims of brush wheels. The width T of the rim is determined in the same way as the first example.

The segments 13 and the brush wheels 14, 14 have rolling contact at their coned surface between themselves in the same way as in the first example.

Electric current is supplied to or from the leads E through the brush wheels 5, 5, shafts 6, 6, thrust bearings 9, 9, and the springs associated with the end caps 11, 11.

Due to the simple structure of the brush wheel, it is possible to construct it so that it is comparatively very light in weight while being relatively large in size. Thus, it can be made to maintain contact with and follow any irregularities in the surfaces of the commutator which has a relatively small diameter. This contact is maintained with low contact pressure. The brush wheel's shaft 6 is made to slide axially while rotating in its oilless bearings 8. Thus, continuous dynamic contact is maintained between the respective contact surfaces of the commutator and brush wheel even at very high speeds without chattering or abnormal wear.

Although but two embodiments of the invention have been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes in the design, arrangement, and constituents of parts, such as the wheel axis being inclined to the rotor axis, or the application of the inven-

tion to generators, can be made without departing from the spirit and scope of the invention.

What I claim is:

1. In a commutator device for micro-dynamo electric machines having a rotary armature provided with a commutator, the combination comprising a rotatably journalled shaft, a brush wheel fixed at one end of said shaft and having a peripheral rim with an annular surface in rolling contact with the commutator periphery, electrical contact spring means at the other end of said shaft for pressing said brush wheel rim resiliently into contact with the commutator, and simultaneously maintaining electrical contact with said shaft, said brush wheel being so arranged with respect to said commutator that portions of the annular rim surface thereof contacting said commutator periphery surface, slide with respect to said commutator during rotation of the armature, for the maintenance of low electrical contact resistance between the surfaces and electrical conducting means connected to said spring means.

2. In a commutator device for micro-dynamo electric machines having a rotary armature provided with a commutator, the combination comprising a rotatably journalled shaft, extending substantially perpendicular with respect to the axis of rotation of the armature, a brush wheel fixed at one end of said shaft and having a peripheral rim with an annular surface in rolling contact with the commutator periphery, and spring means at the other end of said shaft for pressing said brush wheel rim resiliently into contact with the commutator and simultaneously maintaining electrical contact with said shaft, said brush wheel being so arranged with respect to said commutator that portions of the annular rim surface thereof contacting said commutator periphery surface slide with respect to said commutator during rotation of the armature, whereby said contacting surfaces are continually lapped clean for the maintenance of low electrical contact resistance therebetween, and electrical conducting means connected to said spring means.

3. The invention as defined in claim 2, wherein said shaft is journalled between a pair of axially-spaced oilless bearing members.

4. In a commutator device for micro-dyamo electric machines having a rotary armature provided with a commutator, the combination comprising a rotatably journalled shaft, extending substantially perpendicular with respect to the axis of rotation of the armature, a brush wheel fixed at one end of said shaft and having a peripheral rim with an annular surface in rolling contact with the commutattor periphery, a pivot member secured to the other end of said shaft, a disc-like concave thrust bearing member abutting against said pivot member with its concave side, a helical spring acting in compression against the convex side of said thrust bearing, said brush wheel rim being resiliently pressed thereby to contact with said commutator and electrical contact being thereby simultaneously maintained between said thrust bearing member and said shaft, said brush wheel being so arranged with respect to said commutator that portions of the annular rim surface thereof contacting said commutator periphery surface slide with respect to said commutator during rotation of the armature, whereby said contacting surfaces are continually lapped clean for the maintenance of low electrical contact resistance therebetween and electrical conducting means connected to said concave thrust bearing member.

5. The invention as defined in claim 4, including means for adjusting the compressional force exerted by said helical spring against said convex side of said concave thrust bearing.

6. The combination according to claim 1, wherein said shaft is pivotally supported to assume angular positions with respect to the axis of rotation of said commutator.

7. In a commutator device for micro-dynamo electric machines having a rotary armature provided with a commutator, the combination comprising a rotatably journalled shaft, a brush wheel fixed at one end of said shaft and having a peripheral rim with an annular surface in contact with the commutator periphery, electrical contact spring means at the other end of said shaft for pressing said brush wheel rim resiliently into contact with the commutator and simultaneously maintaining electrical contact with said shaft, a bearing means rotatably supporting said shaft and permitting rolling and sliding movement of said annular surface in contact with the commutator periphery, whereby said brush wheel maintains continuous electric contact with the commutator at low contact pressure and with minimum dynamic electrical contact resistance.

8. The combination according to claim 7, wherein said shaft extends substantially perpendicular to the axis of rotation of said armature.

9. The combination according to claim 7, wherein said shaft is pivotally supported to assume angular positions with respect to the axis of rotation of the armature.

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