To all whom it may concern:

Be it known that I, CHARLES A. ECK, a subject of the King of Sweden and Norway, and a resident of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Brushes and Brush-Holders, of which the following is a specification.

My invention relates to brushes and brush-holders for dynamo-electric machines; and the object of the invention is to provide a brush-holder and brush which will maintain the latter in a proper position with relation to and in full contact with the commutator, so as not to wear the said brush unevenly.

In an application for Letters Patent of the United States, filed by me on the 34th day of November, 1900, Serial No. 37,659, I showed means for supporting a brush under tension, but loosely, as on a joint, against the commutator, so as to permit the said brush to accommodate itself to the motion of the commutator. It has, however, been found in practice that the means there disclosed do not accomplish the desired result, owing to the fact that the construction is such that the leverage of the brush prevents the consummation of my object. In the present application means are shown whereby the desired result will be accomplished, the brush and brush-holder being constructed in such a manner that there is practically no leverage, and consequently no uneven wear.

In order to facilitate the explanation of my invention, I have embodied it in the means shown in the accompanying drawings, which means may of course be varied within the scope of the claims.

Figure 1 is a view of a commutator with my brush-holder and brush in position embodying my invention. Fig. 1 is a sectional view of the brush. Fig. 2 is a detail view of the adjustable stop. Fig. 2 is a diagrammatic view of the means shown in the sister application hereinafter referred to, showing the means in their ideal position before any wear has taken place. Fig. 3 is a diagrammatic view of the means shown in the present application, also before any wear has taken place. Fig. 4 is a view of the means shown in Fig. 2 after the brush has been worn down. Fig. 5 is a view of the means shown in Fig. 3 after the brush has been worn down.

Similar letters of reference indicate corresponding parts in the different views.

I shall describe a brush-holder and brush and adjacent elements embodying my invention and afterward point out the novel features in the claims.

A is the commutator, mounted upon the armature-shaft a'. B is the brush-holder, and C is the brush. The brush-holder is provided with a bushing b', having a hole b', which is adapted to receive the stationary portion b', attached to the framework of the motor in any suitable manner. From the bushing b' extends the downwardly-projecting portion b', doubled up at the bottom, as at b', where it receives the spring b', made of two layers of material, as copper and steel, in a manner similar to that set forth in the prior application. At the other end of the said spring is the brush-supporting portion b', comprising a suitable strip of metal having a concave bearing-surface b'. The spring may be fastened to this brush-supporting portion by means of the pin b', passing through the same and serving also to prevent the displacement of the brush. On the downwardly-projecting portion b' is a split bushing b'. In this bushing is inserted the adjustable stop D, consisting of a rest in the split bushing, and the vertical extension d', provided with the transverse portion d', preventing the supporting portion b' from flying against the commutator when the brush is removed. The portion d' is utilized as a manipulating-handle when it is desired to adjust the stop, the pin d' being fastened to the position to which it has been adjusted by means of the set-screw b', which tightens the split bushing around the pin d'.

The brush C is adapted to fit with its convex surface c in the bearing portion b' of the supporting portion b' and is provided with an aperture c', adapted to receive the pin b', so that displacement cannot take place; but the aperture is made larger than the pin, so that the brush is free to move.

Referring now to the diagrammatic views, Figs. 2, 3, 4, and 5, I remark that the natural tendency of a revolving body like a commu-
tator is to rotate another body having constant contact with same. This is a result of leverage, and the greater the leverage the greater the tendency, for power increases by leverage. The smaller the leverage the less tendency there is. If there is no leverage at all, there will be no tendency whatever. In Fig. 2 is shown a diagrammatic view of the means shown in the previous application.

Here, the brush being concave on the surface that contacts the brush-holder, the center $x$ of the arc $x'$ of the brush is located outside of the brush and so far away from the fulcrum of the brush, which is on the portion bearing against the commutator, that a great deal of leverage is created, with a consequent tendency on the part of the commutator to turn the brush. This tendency to drag the brush is shown in Fig. 4, where the brush is illustrated as it looks when it has been worn down. The ultimate result of this is that the brush flies out of the brush-holder. In Fig. 3, on the other hand, the surface of the brush which bears against the brush-holder being convex the center $y$ of the arc $y'$ is located substantially on a line with the periphery $z$ of the commutator, the result being that no leverage is created, as the said center $y$ is on or very near the natural fulcrum of the brush, and on account of this no movement takes place, as shown in Fig. 5, where the brush is worn down and yet maintains its proper position.

It is not absolutely necessary to have the center $y$ of the arc $y'$ on the fulcrum of the brush. It can be either slightly inside or outside of the periphery of the commutator; but it is absolutely necessary that the arc $y'$ should be convex and not concave, like $x'$, as the latter structure places the center too far away from the fulcrum of the brush.

Having thus described my invention, what I claim is:

1. The combination of a commutator, a brush-holder and a brush supported loosely but under tension so as to move freely, having a concave and a convex surface, the concave surface contacting the commutator and the convex surface the brush-holder, the center of the arc of the bearing-surface contacting the brush-holder being substantially coincident with the periphery of the commutator, substantially as described.

2. The combination of a commutator, a brush-holder and a brush, supported loosely but under tension so as to move freely and having a concave and a convex surface contacting respectively the commutator and the brush-holder, the center of the arc of the bearing-surface contacting the brush-holder being substantially coincident with the periphery of the commutator, substantially as described.

3. The combination of a commutator, a brush-holder and a brush supported loosely but under tension so as to move freely and having a concave and a convex surface contacting respectively the commutator and the brush-holder, the center of the arc of the bearing-surface contacting the brush-holder being substantially coincident with the periphery of the commutator, substantially as described.

4. The combination of a commutator, a brush-holder and a brush supported loosely but under tension so as to move freely and having a concave and a convex surface contacting the commutator and a convex surface contacting the brush-holder, substantially as described.

5. The combination of a commutator, a brush-holder and a brush supported loosely but under tension so as to move freely and having a concave surface contacting the commutator and a convex surface contacting the brush-holder, substantially as described.

6. The combination of a commutator, a brush-holder and a brush supported loosely but under tension so as to move freely and having a concave bearing-surface contacting the commutator and a convex bearing-surface contacting the brush-holder, the center of the arc of the convex surface being located at a point intermediate the center and the periphery of the commutator, substantially as described.

7. The combination of a brush-holder having a concave bearing-surface and a brush having a concave and convex bearing-surface, the concave bearing-surface contacting the commutator, and the convex bearing-surface contacting the concave bearing-surface of the brush-holder, substantially as described.

8. The combination of a brush-holder and a brush adapted to be supported by the brush-holder and to bear against a commutator, a concave bearing-surface on said brush-holder, and a convex bearing-surface on the brush adapted to rest in the concave bearing-surface of the brush-holder, substantially as described.

9. The combination of a brush-holder and a brush adapted to be supported by the brush-holder and to bear against a commutator, a convex bearing-surface on the brush the center of whose arc is located substantially at the fulcrum of the brush, substantially as described.

10. The combination of a brush-holder and a brush adapted to be supported by the brush-holder and to bear against a commutator, a convex bearing-surface on the brush the center of whose arc is substantially coincident with the periphery of the commutator, substantially as described.

11. In a dynamoelectric machine, a brush having a convex bearing-surface located opposite to the surface which contacts the commutator, substantially as described.
12. In a dynamo-electric machine, a brush having a convex bearing-surface located opposite to the surface which contacts the commutator, the center of the arc of the convex bearing-surface, being substantially coincident with the arc of the bearing-surface of the commutator, substantially as described. Signed at Newark, in the county of Essex and State of New Jersey, this 20th day of February, A. D. 1901. CHARLES A. ECK.

Witnesses:
GEORGE W. DUNN,
AXEL V. BEEKER.