No. 832,353. PATENTED OCT. 2, 1906.

R. S. WHITE.

COMMUTATOR.

APPLICATION FILED OCT. 14, 1902.

2 SHEETS—SHEET 1.

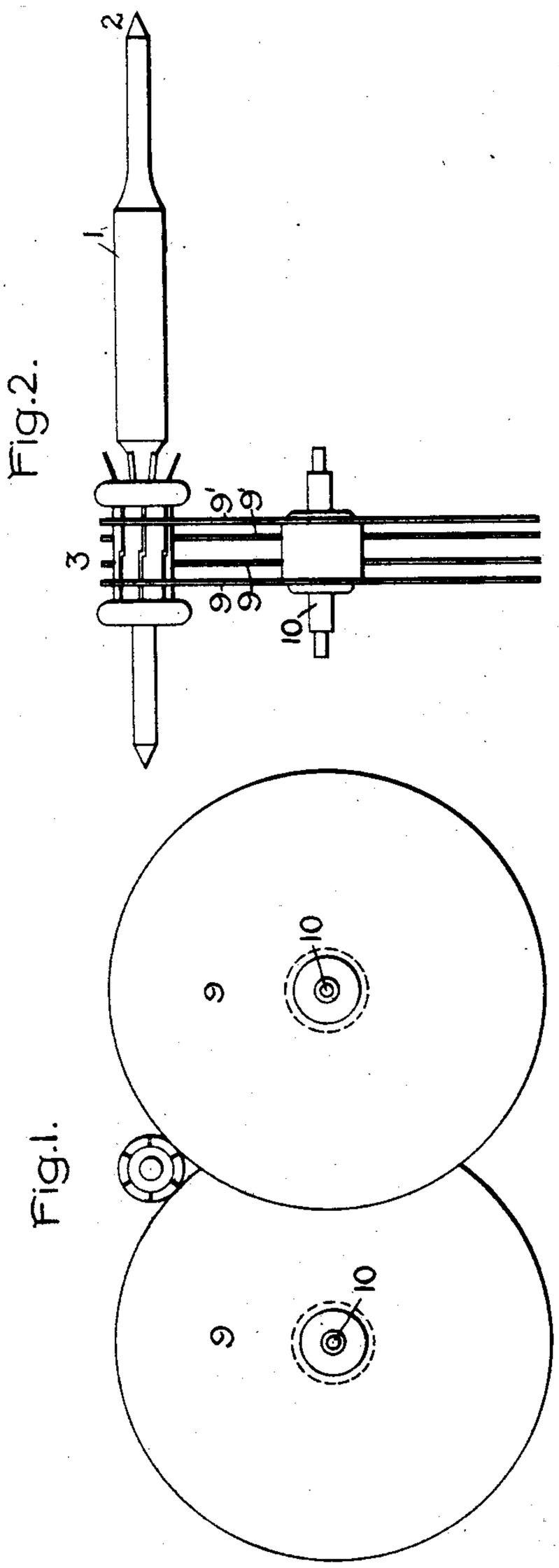


Fig. 2.




Fig. 1.

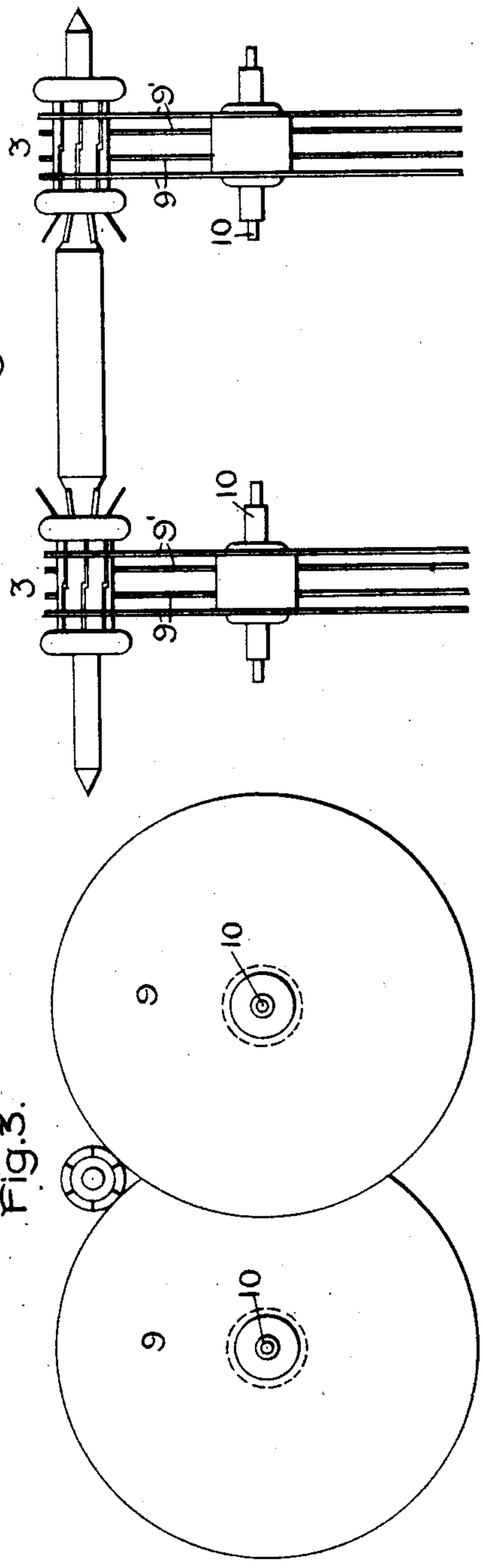


Fig. 4.




Fig. 3.




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2 SHEETS—SHEET 2.

Fig.13.

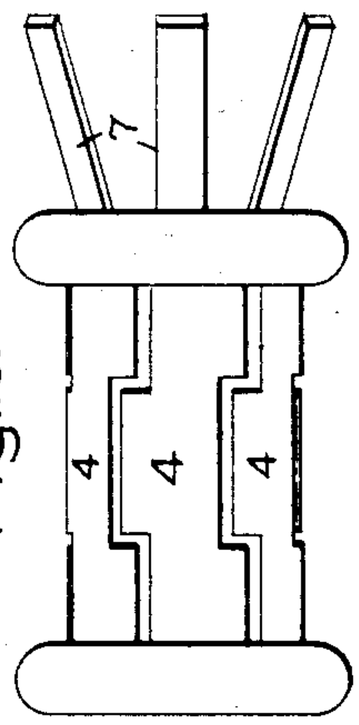



Fig.14.

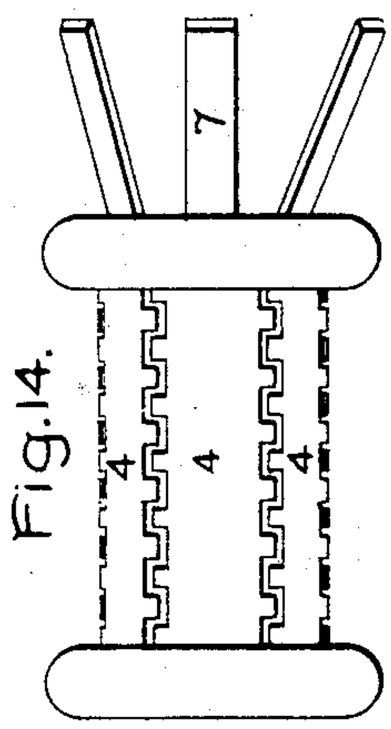



Fig.15.

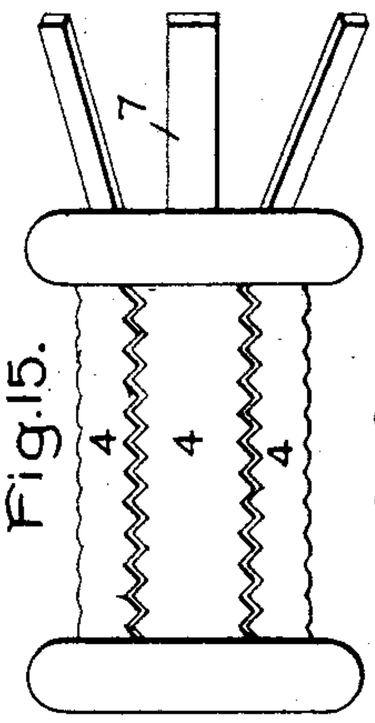



Fig.16.

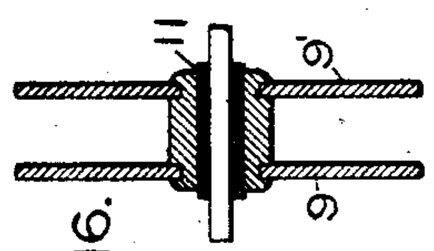



Fig.5.

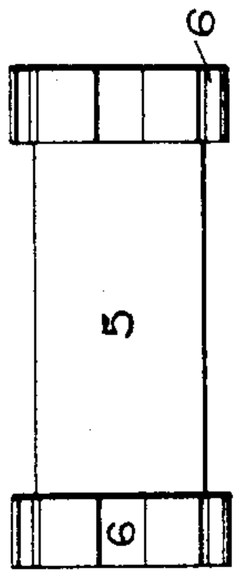



Fig.6.

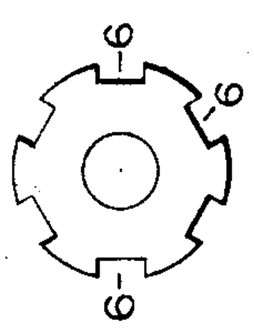



Fig.7.

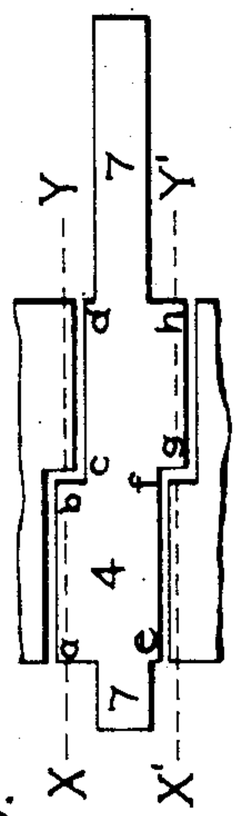



Fig.8.

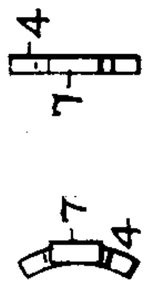



Fig.9.

Fig.10.

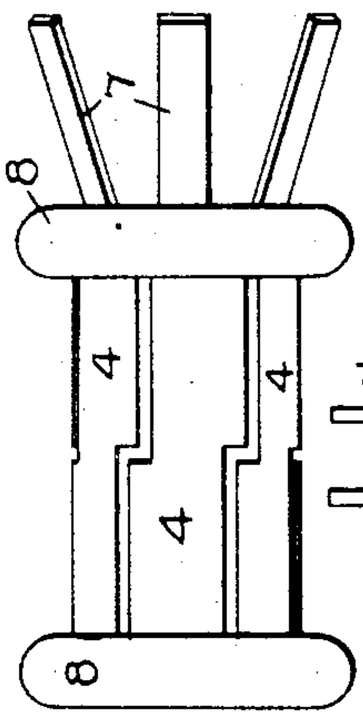



Fig.11.

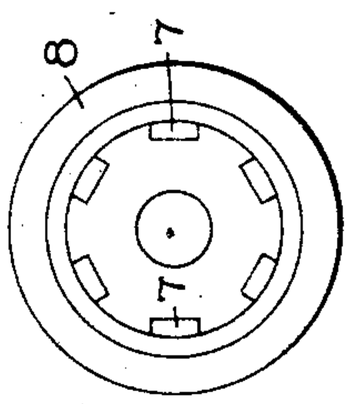
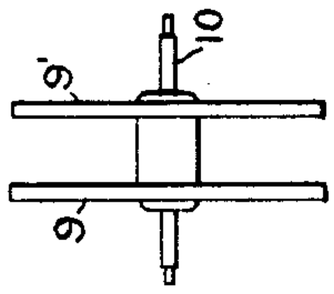



Fig.12.




Witnesses.

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by Albert G. Davis

Atty.

# UNITED STATES PATENT OFFICE.

ROGER S. WHITE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## COMMUTATOR.

No. 832,353. Specification of Letters Patent. Patented Oct. 2, 1906.

Application filed October 14, 1902. Serial No. 127,229.

*To all whom it may concern:*

Be it known that I, ROGER S. WHITE, a citizen of the United States, residing at Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Commutators, of which the following is a specification.

My invention relates to new and useful improvements in the construction of commutators and of roller-collectors for electric-motor meters, and is especially adapted to those having an armature mounted on a horizontal shaft supported by roller-bearings which also coöperate with the commutator and act as current-collectors. Heretofore in motors of this type commutators have been used having the usual straight-edge segment, rendering it necessary to make the gaps or air-spaces between the segments as small as possible, as each gap, forming, in effect, a flattened surface, breaks the continuity of the true circular path of contact on the commutator-surface of the roller-bearings and allows the armature to "settle" a minute distance as each gap passes a roll. This is more particularly noticeable with a very small load and introduces an error which, while almost negligible when a very light armature is employed and when the commutator-segments are very near together, becomes serious when an armature of heavier construction is used, as in wattmeters or large-capacity instruments, and when higher differences of potential between adjoining segments having an increased air-gap is desired. Now in order to eliminate this source of error I employ a new and improved commutator and roll by means of which I secure and maintain an even, true, and constant condition of contact of commutator and collecting device. I provide two pairs of rollers on which the commutator of the meter-motor bears, each pair being connected to one side of the line and taking the place of a single brush, and I so construct the parts that one roller of each pair is slightly ahead of the other roller of that pair relatively to the segments of the commutator. I accomplish this by mounting the two rollers of each pair on the same shaft and forming the commutator-segments so that they extend around the cylindrical surface of the commutator enough to make each segment overlap the next. For this purpose the segments may be curved helically throughout their length, or, as I prefer to make them, one-half of each segment may be offset relatively to the other half so as to be slightly in advance of it on the surface of the commutator. As thus constructed the commutator rests on the two pairs of rollers which constitute the antifriction-bearing for one end of the shaft, the two rollers of each pair being of the same size and mounted to engage the commutator on opposite sides of the offset in the segments. If segments are used which are curved throughout their length, the rollers of each pair are mounted a sufficient distance apart to have the same effect. It will thus be seen that one roller of each pair is slightly in advance of the other roller of that pair relatively to the commutator-segments, and I so arrange the parts that this advance is sufficient to bring one roller into contact with a segment as the commutator is turned on its axis just before the other roller of that pair breaks contact with the adjacent segment. As the two rollers of each pair are electrically connected, a coil of the armature is thus short-circuited momentarily when the current therein is reversed. Also the slight drop or lateral movement of the shaft and armature when a segment leaves the roller is prevented, as one roller of each pair is always in engagement with a segment, and thus supporting the shaft in proper position. Moreover, there are two paths for the current entering and leaving the commutator, thus affording better electrical connections to the coils of the armature.

The features of novelty of my invention will be definitely indicated in the appended claims.

The details of construction and the mode of operation will be better understood by reference to the accompanying drawings, which show one embodiment of my invention.

In the accompanying drawings, Figure 1 is an end view of a commutator embodying my invention. Fig. 2 is a side elevation of the same, showing a single commutator and set of rolls. Fig. 3 is an end view of a modification. Fig. 4 is a side elevation of the same, showing two commutators each with its own set of rolls. Fig. 5 shows the insulating body or spool of a commutator. Fig. 6 is an end view of the same. Fig. 7 is a view of the preferred shape of commutator-segment. Fig. 8 is an end view of the same.

Fig. 9 is an end view of the same bent to the desired curvature. Fig. 10 shows the assembled commutator. Fig. 11 is an end view thereof. Fig. 12 shows a double-disk roll in proximity to the commutator. Figs. 13, 14, and 15 illustrate various modified forms of segments, and Fig. 16 shows a roll in which the contact portions are insulated from the shaft.

Let 1 represent the armature-shaft of the motor-meter, preferably supported in a horizontal position either on a conical bearing 2 at one end and a roller-commutator 3 at the other, as shown in Fig. 2, or on roller-commutators at both ends, as shown in Fig. 4. The preferred shape of commutator-segment is shown in Figs. 2, 4, 7, and 10, where the portion *a b* of one edge of the segment 4 overlaps a slight distance beyond the theoretical line of commutation X Y, while the remaining portion *c d* of the same edge does not extend to said line. The opposite edge of said segment is similarly stepped, the portion *e f*, corresponding to and parallel with the portion *a b*, stopping short of the line of commutation X′ Y′, while the portion *g h*, corresponding to and parallel with the portion *c d*, overlaps said line by the same amount as the portion *a b* overlaps the line X Y. It is really necessary that these edges *a b*, *g h* should extend only to the theoretical line of commutation; but by overlapping them a little less accuracy is requisite in shaping the segments and in assembling the commutator.

The segments are preferably punched from sheet metal and are then curved, as shown in Fig. 9, to fit the periphery of the body or spool 5 of insulation. The heads of the spools have equispaced notches 6 to receive tongues 7 on the segments, which are then clamped in place by rings 8.

The rolls which support the commutator and serve to convey current to the armature each comprise two parallel metal disks 9 9′ of the same diameter mounted on a shaft 10. Ordinarily both disks support the commutator, being so arranged that the edges *a b*, *e f* pass over one disk and the portions *c d*, *g h* over the other. Suppose the commutator shown in Fig. 10 to be rotating. It is evident that when the gaps adjoining the edges *c d*, *g h* pass the disk 9′ the other disk 9 alone supports the commutator, and when in turn the gaps adjoining the edges *a b*, *e f* reach the disk 9 the commutator will be supported by the disk 9′ only. In each instance the supporting-disk will engage a cylindrical portion of a segment, so that there will be no jolt as the gaps pass the other disk.

It is obvious that many other shapes of commutator-segment may be used. Thus in Fig. 13 there are two steps, in Fig. 14 a plurality of small steps having square edges, and in Fig. 15 a plurality of V-shaped steps. With segments of such shapes the number and relative position of the disks must be modified to correspond. Indeed, with Figs. 14 and 15 a cylindrical roller extending the full length of the commutator may be used. It is obvious, also, that flat brushes may be used in conjunction with my improved meter-commutator with marked advantage. In the case of brush and commutator contact as in ordinary use it is found that it constitutes by far the largest friction factor in meters, especially marked as a gap is passing a brush, for the receding edge of one segment allows the brush in contact with it to "drop" until the approaching edge of the next segment comes in contact with and raises it to its normal position. In doing this, however, it not only lifts the brush against the force of its "spring," but it does so with its more or less sharp cutting edge, which acts like a scraper on the surface of the brush.

By using my improved meter-commutator with a flat brush sufficiently wide to bridge one or more of the transverse gaps (or transverse portion of the air-gaps) the brush will be held and supported in a normal constant position and the contact friction will not only be reduced, but maintained at a minimum.

The armature-shaft may have more than one armature, and they may be arranged in several different ways and connected up in different electrical circuits, as will be apparent to any one skilled in the art. If it is desired to use an insulated roller-bearing, the disks may be insulated from the shaft by an insulating-sleeve 11, as shown in Fig. 16.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An electrical instrument comprising an armature-shaft, a commutator having overlapping segments carried thereby, and pairs of current-carrying rollers supporting said commutator.

2. In an electrical instrument, a shaft, an armature and commutator carried thereby, and two pairs of coaxial rollers on which said commutator bears, said commutator being so constructed and arranged that one roller of each pair is in advance of the other of that pair relatively to the segments of the commutator.

3. An electrical instrument comprising a shaft and armature, a commutator having overlapping segments carried by said shaft, and a pair of current-carrying rollers arranged so that one of the rollers passes the gap between adjacent segments before the other roller.

4. In an electrical instrument, a shaft, an armature and commutator carried thereby, and pairs of concentric rollers on which said commutator bears, said commutator and rollers being arranged to short-circuit coils of

the armature successively and to prevent jarring of the shaft as the segments of the commutator leave the rollers.

5. In an electrical instrument, a shaft, an armature carried thereby, a commutator on said shaft having segments which overlap longitudinally of the commutator, and current-carrying bearing-rollers for supporting said commutator.

6. In an electrical instrument, a shaft, an armature carried thereby, a commutator on said shaft, a portion of each segment of the commutator being in advance of the remainder of the segment circumferentially of the commutator, and current-carrying bearing-rollers for supporting said commutator.

7. In an electrical instrument, a shaft, an armature and commutator carried thereby, each segment of said commutator having an offset therein advancing a part of the segment ahead of the remainder circumferentially of the commutator, and a pair of rollers mounted to make electrical contact with and support the segments of the commutator on opposite sides of said offsets.

8. In an electrical instrument, a shaft, an armature and commutator carried thereby, each segment of said commutator having an offset therein advancing a part of the segment ahead of the remainder circumferentially of the commutator, and two pairs of rollers on which the commutator bears, the rollers of each pair being arranged to contact with the several segments of the commutator on opposite sides of the offsets.

9. In an electrical instrument, a shaft, an armature and commutator carried thereby, each segment of said commutator having an offset therein advancing a part of the segment ahead of the remainder circumferentially of the commutator, and two pairs of rollers on which said commutator bears, the rollers of each pair being electrically connected and arranged to contact with the commutator-segments on opposite sides of said offsets.

In witness whereof I have hereunto set my hand this 11th day of October, 1902.

ROGER S. WHITE. [L. S.]

Witnesses:

EDMUND JONES,

A. STANLEY PETERSON.