No. 747,873. PATENTED DEC. 22, 1903.

H. F. T. ERBEN.

COMMUTATOR.

APPLICATION FILED AUG. 10, 1901.

NO MODEL.

Fig. 1.

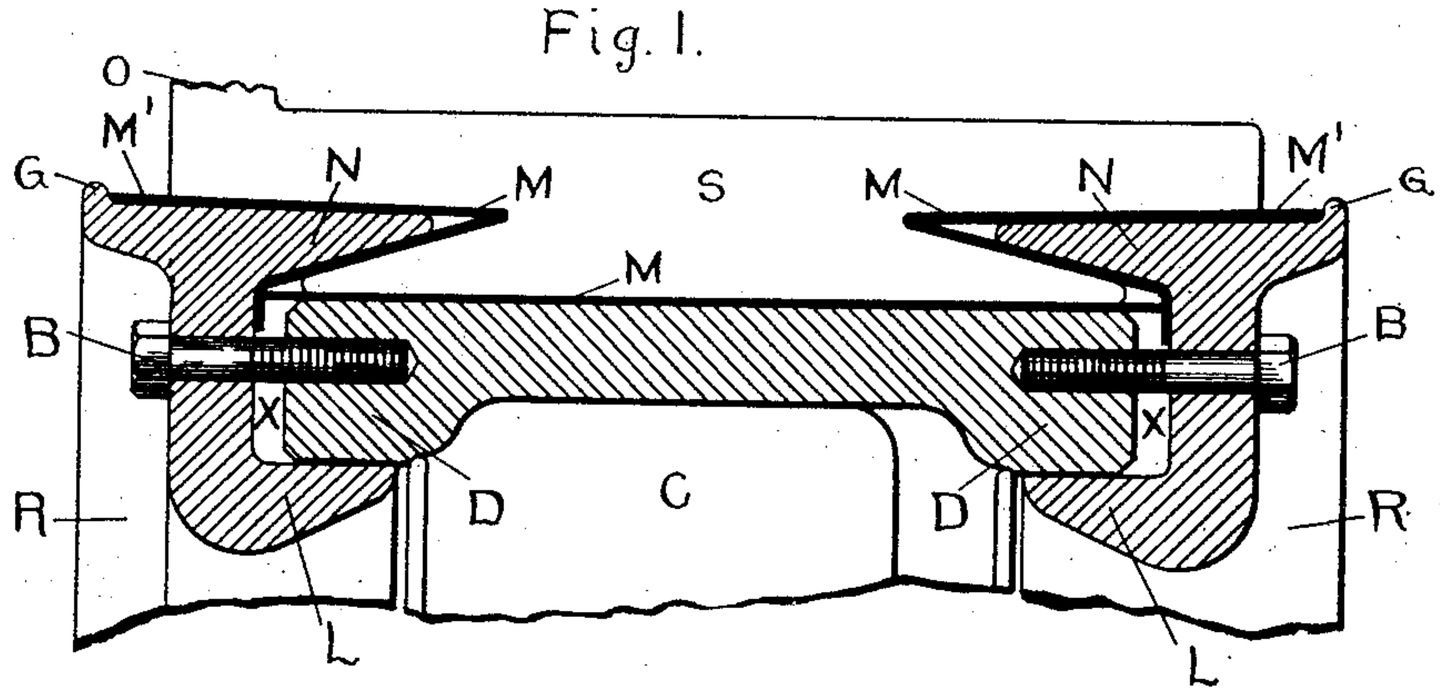
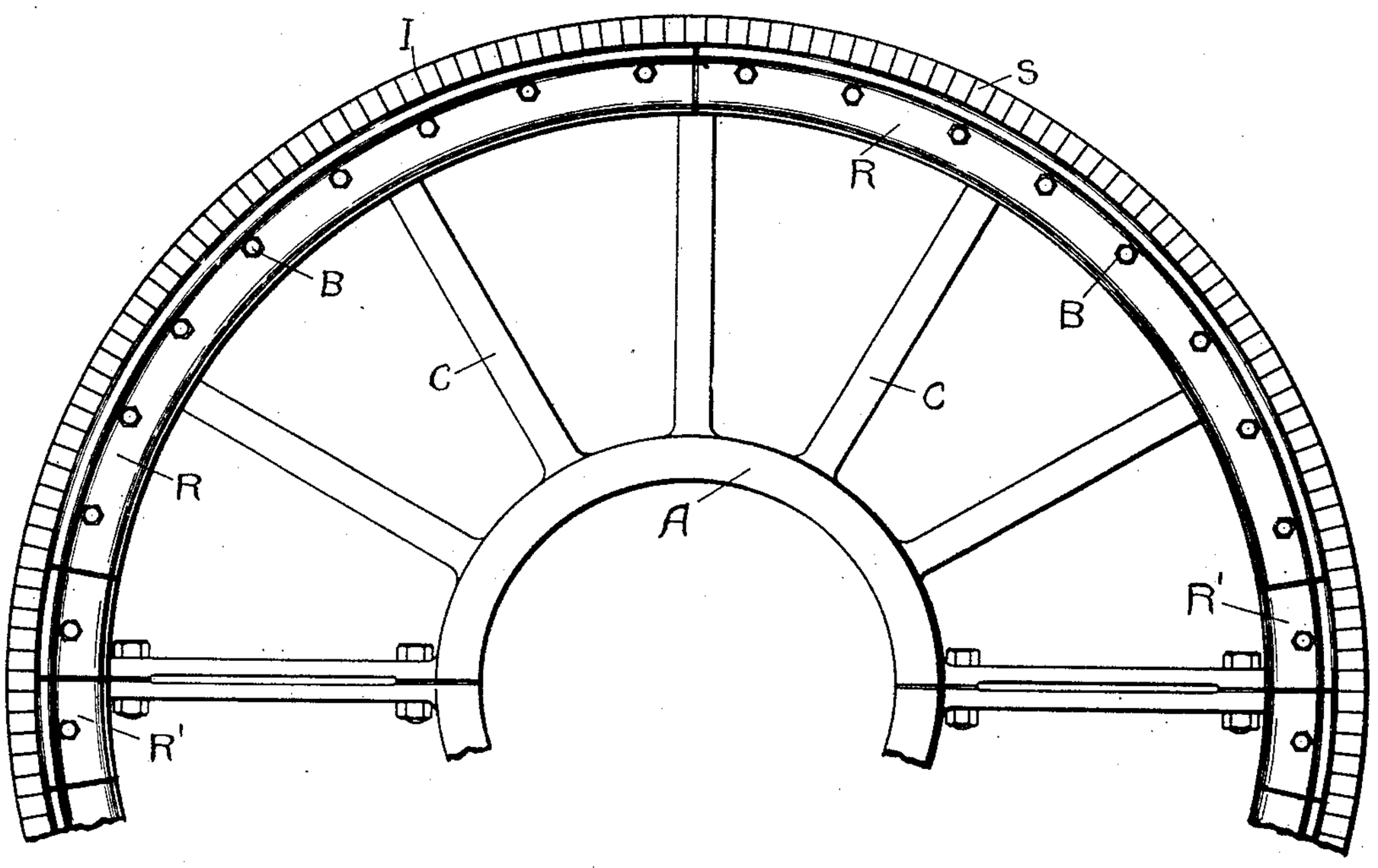



Fig. 2.




Witnesses:

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Benjamin B. Hull

Inventor.

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by Albert G. Davis

Atty.

No. 747,873. Patented December 22, 1903.

# UNITED STATES PATENT OFFICE.

HERMANN F. T. ERBEN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## COMMUTATOR.

SPECIFICATION forming part of Letters Patent No. 747,873, dated December 22, 1903.

Application filed August 10, 1901. Serial No. 71,647. (No model.)

*To all whom it may concern:*

Be it known that I, HERMANN F. T. ERBEN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Commutators, of which the following is a specification.

This invention relates to improvements in means for securing in place upon a frame or spider the bars of commutators of large electric machines, the object of the invention being to simplify and improve the construction and operation of such means.

In the drawings, Figure 1 is a section showing the peripheral portion of a large commutator to which the invention is applied, and Fig. 2 is a lateral elevation of this commutator.

As shown in Fig. 1, the commutator-bars S, adapted at O for the attachment of the armature-leads, are securely held in position upon the frame or spider A or arms C thereof by clamping-rings R, which are secured to the spider by bolts B, which are seated in flanges D of the spider. Clamping-rings have been used for a number of years for this purpose, as have also clamping-rings having an outer flange to grip the commutator-bars and an inner flange to grip the spider. It has often been found advisable to divide the clamping-rings into very small segments, so that when, for example, a commutator-bar required to be removed and replaced it would not be necessary to take the whole commutator apart. Therefore in order to hold these clamping-segments to the frame against centrifugal force an inner flange was added to the flanges and rings. In modern small commutators, where the clamping-ring is not divided into segments, and hence no inner flange is required, it has been customary to bevel the single flanges, such as the outer ones shown in Fig. 1, which engage in dovetails in the commutator-bars. The present invention, however, relates to bar-clamping means adapted for use for large commutators, where the frame or spider may be split on account of its great size. The commutotor-bars are assembled and shipped upon each half of the spider separately, and the two halves are not finally assembled until the commutator is installed with its machine. Since the spider is split, the clamping-rings are also split, but not into as many segments as in the commutators above mentioned, because in the commutators to which this invention is applied it is not considered essential, as it is not likely that frequent repairs will be required. On the other hand, the clamping-ring segments are of considerable length, so that there is a large difference in curvature between their ends, the function of which construction will be indicated hereinafter. Preferably and for convenience in case of repairs there will be a larger number of segments of the clamping-ring than the number of parts into which the spider is divided.

Since it is necessary that the clamping-rings be split, it follows that they must be provided with inner flanges L to hold them to the spider, as it is obvious that the bolts B would not hold the commutator-bars and clamping-ring segments from being thrown off by centrifugal force when the commutator is rapidly rotated. A number of years ago, when the first machines having inner and outer flanged clamping-rings were built, the segments on the rings were quite short for the purpose, as above described, of avoiding the necessity of taking the whole or a large portion of the commutator apart to merely replace one or two commutator-bars. In order to give a wedging action to these segments, the outer edge of the inner flange was beveled to engage a corresponding bevel with the frame. While the broad idea of beveling was very useful and is retained in the present construction, a serious disadvantage of the above-described specific construction in cases where it was advisable to use short clamping-segments was that the very short segments in being drawn to their seats by the bolts, such as B, almost always tipped up or down with respect to the bolts B as a center—that is to say, either the inner or the outer flange would move in faster than the other, so that the difficulty of assembling was very great. More recently adjusting-screws have been employed for the purpose of lessening this difficulty; but their use is very awkward and expensive and generally

undesirable. A further disadvantage of the wedging construction above described was that there was considerable friction upon the insulation, such as M, which was used between the clamping-ring segments and the commutator-bars when said segments were being drawn to their seats. This latter fault was designed to be remedied by a construction in which the bevel in the frame or spider was reversed, the outer surface of the inner flange being made straight and beveled nuts or bolts being employed for drawing the ring-segments to their seats; but the latter construction also possessed the disadvantage that the very short sections were liable to tip in being drawn to their seats, and although I have used this construction for a number of years the additional beveled nuts and bolts entailed quite an expensive construction in cases where a large number of clamping-segments were employed. The difficulty of tipping, which is common to both structures above outlined, and the expense of the extra nuts and bolts of the latter structure are all avoided by this invention and further improvements are added, as will now be made clear.

By reference to Fig. 2 it will be seen that the frame or spider A, provided with arms C, is split in two at the horizontal line and that the clamping-ring consists of pieces R of considerable length and quite short pieces R′. As shown in Fig. 1, the arms C have a peripheral portion formed with lateral flanges D, to which the ring-segments or ring-pieces R and R′ are secured by the bolts B. The pieces R′ are located only at points adjacent to the lines of division between the two halves of the spider for convenience of assembling, and the joints between the different segments are preferably calked with oakum and waterproof varnish. The greater part of the clamping-ring, however, is composed of the long segments R, and these segments are of such length and have consequently such a difference of curvature between their ends that they cannot be tipped in being drawn to their seats without bending the metal of which they are composed. As they are made of wrought-iron or steel, it is obvious that this construction absolutely overcomes the very objectionable feature of tipping. This desirable result is accomplished, however, by reason of the peculiar structure shown in Fig. 1, as will now be explained.

It will be noted that the lower surfaces of the flanges D and the upper surfaces of the flanges L are made straight, while the requisite bevel for drawing the clamping-segments to their seats is provided at the upper flanges N, the insulation M being interposed in accordance with the patent to Edison, No. 438,302. The reason for this arrangement is that if the bevel were formed on the inner flanges L and the straight surfaces upon the outer surfaces N, as has hitherto been the case, the clamping-rings would have to be composed of very short segments in order to obtain the desired amount of adjustment. It is clear that a long segment would be distorted if it were attempted to draw it more than a short distance. No matter how short the adjustment the beveled inner flange of a long segment would be liable to reach its limit before the outer flange had gripped the commutator-bars tightly, and such uncertainty of action cannot be tolerated in modern methods of manufacturing commutators.

In addition to the advantages described as resulting from the construction shown in the drawings it is obvious that the well-known advantages of dovetailed commutator-bars and end clamps are retained. In former structures where the beveled clamping nuts or wedges were used, so that the outer surfaces of the inner flanges were separated by the nuts from the inner surfaces of the flanges of the frame, oil was very liable to be driven by centrifugal force out to and between the commutator-bars, and, in fact, this was certain to result unless the greatest care was exercised in so proportioning the bars that the clamping-segments would abut closely against the frame-flanges when the commutator-bars were properly secured in position. To accomplish this result, it was also necessary, of course, to machine not only the beveled nuts or wedges, the inner surface of the frame-flange, and the outer surface of the inner clamp-flange, but also the outside surface of the frame-flange and the inside adjacent surfaces of the clamping-pieces. The engaging surfaces of the flanges D and L of Fig. 1 are the only inner parts of the structure which it is necessary to machine, and no especial care is required to bring the clamps and the flange D laterally into close contact, as any oil is effectively prevented from working into the space X. For the purpose of preventing oil which escapes from the side of the structure from working from above into the insulation M′ points G are provided, from which the oil is thrown off into space by the rotation of the commutator.

In all the structures hitherto in use there has been considerable difficulty with oil and copper and carbon dust working down between the commutator-bars and the outer flanges of the clamping-ring. When this occurred, it inevitably resulted in the destruction of the insulation I between the bars, so that the latter were short-circuited and the commutator seriously damaged. In the structures possessing this fault the outer flanges of the clamping-pieces extended over the tops of the commutator-bars and the space between the flanges and the bars presented a very unfinished appearance even when filled, according to custom, with twine or equivalent material. The evident advantage of my improved structure is that the flanges N extend underneath the outer surface of the commutator-bars, so that there is necessarily no space

between such flanges and the ends of the bars to give an unfinished appearance and provide a path for oil and dust. Finally, it may be stated that the advantages of the commutator structure constructed in accordance with this invention are of such practical importance that this construction has recently been adopted as a substitute for the structures described above to the entire exclusion of the latter.

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

In a commutator for electric machines, the combination with a frame, of the commutator-bars thereon, sectional clamping-rings, the sections of which are of sufficient length to prevent tipping in being seated, straight flanges on the rings for holding them to the frame, and flanges on the rings for holding the bars on the frame, the latter flanges being beveled to engage corresponding portions of the commutator-bars, to permit the proper seating of the long clamping-ring sections.

In witness whereof I have hereunto set my hand this 8th day of August, 1901.

HERMANN F. T. ERBEN.

Witnesses:
B. B. HULL,
MARGARET E. WOOLLEY.