Nov. 10, 1931. R. F. JUDISCH 1,831,534

COMMUTATOR ASSEMBLING PROCESS

Filed July 3, 1929

Fig. 1.

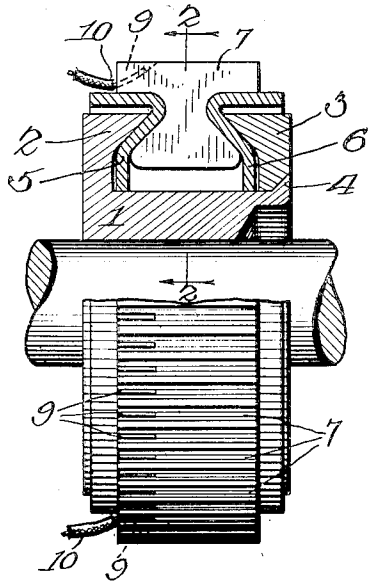
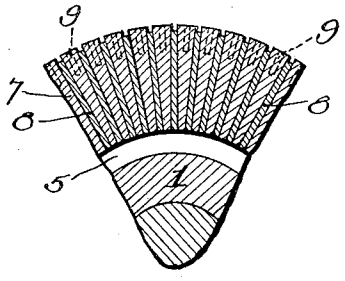



Fig. 2.

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# UNITED STATES PATENT OFFICE

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## COMMUTATOR ASSEMBLING PROCESS

Application filed July 3, 1929. Serial No. 375,631.

The present invention relates to commutators, and more particularly to the process of assembling commutators for dynamo electric machines, and has for its object an improved, more economical and simplified method of such assembly.

More specifically the present invention relates to an improved method of assembling commutators whereby, through the treatment of certain parts, certain steps of the usual commutator assembly process may be omitted.

In the drawings:

Figure 1 is a view partially in cross section through a commutator constructed in accordance with the present invention.

Figure 2 is a fragmentary cross sectional view of a sector of the commutator shown in Figure 1, the section being taken upon the line 2—2.

The commutator disclosed in Figures 1 and 2 comprises the parts found in the usual commutator, including the commutator shell 1, shown as positioned upon a motor shaft, and having the annular clamping jaw 2, the clamping ring 3, which is positioned upon the member 1 and held in place thereon in any suitable manner, as by the turning of the end of the shell 1 as shown at 4, insulating collars 5 and 6, made of mica or similar insulating material, and commutator segments 7 of copper which are positioned between the jaw 2 of the shell 1 and the clamping means 3, and separated therefrom by the insulating collars 5 and 6. As in the usual commutator construction the segments 7 are separated one from another by insulating segments 8. Grooves 9, such as would be obtained by a saw cut, are provided in the ends of the commutator segments or bars 7 within each of which the end of an armature lead 10 is positioned and secured by soldering. The aforedescribed parts comprise the usual commutator construction and no invention is claimed in their bodily arrangement.

In the operation of an electric machine possessing a commutator, as in D. C. generators and motors, commutation is an essential factor determining the characteristics and the performance of the machine. It is essential that the current-carrying copper bars of the commutator be separated and insulated one from another by insulating segments so that, in the operation of the machine, perfect commutation may be effected, and it has been the teaching of experience that these insulating segments, which are commonly formed of mica, must not extend to the level of the current-carrying bars or segments. The friction of the carbon brushes upon the commutator, with the resulting wear of the copper bars and the eating away of said bars by the sparking, results in the lowering in height thereof at a rate faster than that of the insulating segments which separate them. As soon as parts of the insulating segments extend above the copper segments poor commutation results, since the brush jumps from one high point to another, making insufficient contact with the copper bars, and causing increased sparking and inefficient operation. Electrical manufacturers have resorted, in their effort to maintain satisfactory commutation, to the undercutting of the commutator, which is, in effect, the reduction of the height of the insulating segments which separate the current-carrying segments. This undercutting is accomplished by the use, in some instances, of a hand tool, which is passed between the copper segments and which cuts away the insulator, and in other instances by the use of a revolving circular saw, which runs the length of the segments and which serves to cut away the insulator. In either operation, and particularly the latter, a portion of the copper segment on each side of the insulation segment is removed, through the carelessness of the workmen, in the first instance, and through the impossibility of maintaining the saw in exact alinement with the insulating segment, in the second instance.

In the past it has not been possible to use insulating bars of lesser height than that of the copper bars to effect the required relation of segment heights, for the reason hereinafter set forth. The current-carrying leads which come from the armature of the machine, and which are indicated in the draw-

ings by the reference character 10, are attached each to a separate commutator segment, and are secured by soldering, but the soldering of such leads individually is both tedious and expensive. In order that the ends of the leads will not extend above the surface of the commutator segments, the practice has arisen of cutting the grooves in the copper segments and, after the leads are placed therein, soldering them all in place simultaneously by submerging the entire commutator in the solder. In the submerging operation, however, the solder adheres not only to the leads and to the areas adjacent thereto within the grooves 9, but also alloys with the copper bars along their length, and frequently bridges across the slot between adjacent bars, which results, if not removed, in the short-circuiting of the bars involved and failure of commutation. This difficulty has been overcome in the past by the undercutting operation, which both reduced the height of the insulating segments and served to remove any undesired metallic connections between bars.

The operation of undercutting was therefore required, not only to lower the height of the insulation segments but also to insure the absence of the injurious solder deposits.

In the construction of a commutator in accordance with the present invention, the insulating segments may be made initially of a lesser height than the current-carrying copper segments, so that when positioned in the commutator shell and clamped there by the clamping ring they do not project to the surface of the commutator, but present the desired undercut formation without the necessity of the sawing or cutting by hand.

According to the present invention the current-carrying copper bars, either before or after their assembly in the commutator shell, but before their exposure to the solder for the purpose of attaching the armature leads, are provided with a solder-resistant coating, a preferred manner of carrying out the step being to form a film of oxide thereon, as by heating in air or by dipping in a chemical solution. In order that an armature lead may be attached, a slot 9 is made in each bar or segment, as by a saw cut, after the copper segment has been oxidized, resulting in a new unoxidized surface in the cut to which the solder will adhere, the proper flux being applied to the lead and the adjacent unoxidized surface in the slot. The entire commutator may be dipped into the soldering solution with the wires positioned in their grooves, as shown in Figure 1, and the solder will adhere only to the lead and the adjacent area in the groove 9 in the copper bar 7 which has been freshly cut and has been treated with the flux. No solder attaches to the commutator segments at any point save that at which the armature lead contacts, because, as described above solder will not adhere to an oxidized surface. As the insulating segments used in the assembly are of a height less than that of the copper segments, the desired relative height of the segments is effected, and as the possibility of short-circuiting solder connections between the copper bars is eliminated, there is no necessity for the undercutting operation, the omission of that step resulting in economy of time and the preservation of the original commutator bar width heretofore lessened somewhat by the undercutting operation.

It will be understood that the solder-resistant coating may be any suitable coating which will prevent the adhesion of solder, which can be conveniently formed, which will not materially interfere with the formation of the grooves 9, and which may be conveniently removed from the outer brush-contacting surface of the commutator after it is assembled and connected. For instance, a film of waterglass, or any other suitable solder resistant material, might be applied instead of forming an oxide coating, and the terms used herein are intended to be interpreted to include any suitable means to secure the result stated.

In assembling and connecting the commutator, in accordance with the present invention, therefore, the expensive and unsatisfactory undercutting of the commutator is eliminated, and the desired separation between the copper bars is obtained without the use of the slow and expensive method heretofore required.

I claim:—

1. The process of assembling and connecting commutators comprising assembling commutator bars and insulation segments upon a commutator shell, and securing them in place thereon, treating the assembly to form a solder-resistant coating on all but a portion of the exposed surface of each of said bars, positioning the current-carrying leads adjacent to uncoated surfaces of their corresponding commutator bars, and exposing the entire commutator as a whole to a solder to secure said leads to said bars.

2. The process of assembling and connecting commutators comprising assembling upon a commutator shell commutator bars and insulation segments of a height less than that of said bars, and arranged alternately with said bars, treating the assembly to form upon the commutator bars a coating to which solder will not adhere, providing an uncoated surface on each of said bars, positioning current-carrying leads each adjacent the uncoated surface of its corresponding commutator bar, and soldering said leads to said bars.

3. The process of assembling and connecting commutators comprising assembling commutator bars and insulation segments in al-

ternate relation upon a commutator shell and securing them in place thereon, treating the whole assembly to form a solder-resistant coating upon said bars, forming a slot in each bar, positioning a current-carrying lead in each slot and dipping the assembly in a solder to secure said leads to said bars.

4. The process of assembling and connecting commutators comprising assembling commutator and insulation segments upon a commutator shell and securing them thereon, oxidizing the assembled commutator shell and segments to prevent the adherence to the commutator segments of foreign matter, providing an unoxidized surface on each of said bars and connecting the current-carrying leads to said unoxidized surface of said bars.

5. The process of assembling and connecting commutators comprising assembling on a suitable retainer commutator bars and insulation segments of lesser height than that of said bars, and arranged alternately with said bars, treating the assembly to form a coating on said bars to which solder will not adhere for the purpose of preventing the interconnection of said bars by solder, forming a slot in each bar below the brush-contacting surface thereof which will be uncoated, positioning a current-carrying lead in each of said slots, and bathing the complete assembly in solder to secure the leads in the slots.

Signed at North Canton, in the county of Stark, and State of Ohio, this 27th day of June, 1929.

ROBERT F. JUDISCH.