

March 30, 1926.

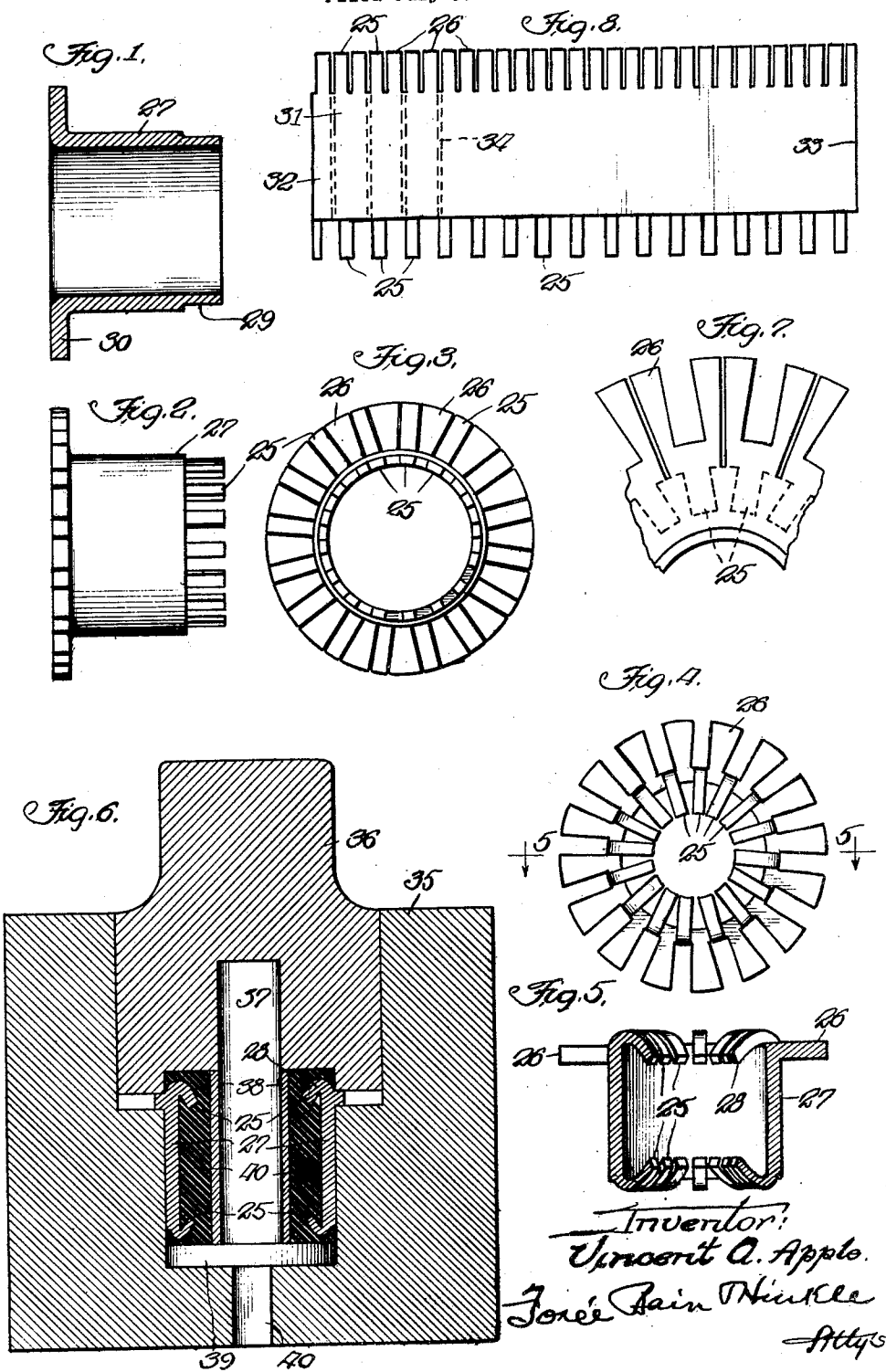
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V. G. APPLE

COMMUTATOR AND THE METHOD OF MAKING IT

Filed July 3, 1920

3 Sheets-Sheet 1



Inventor:
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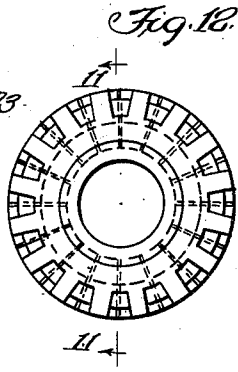
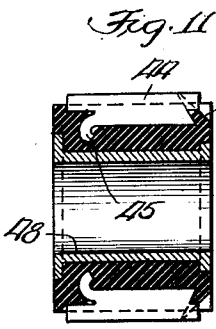
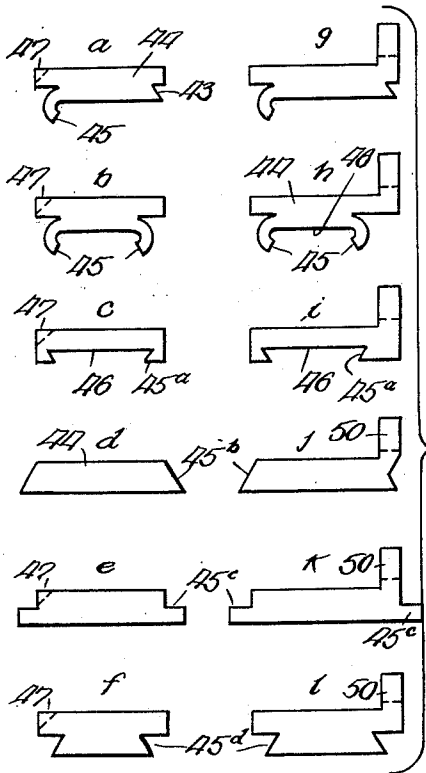
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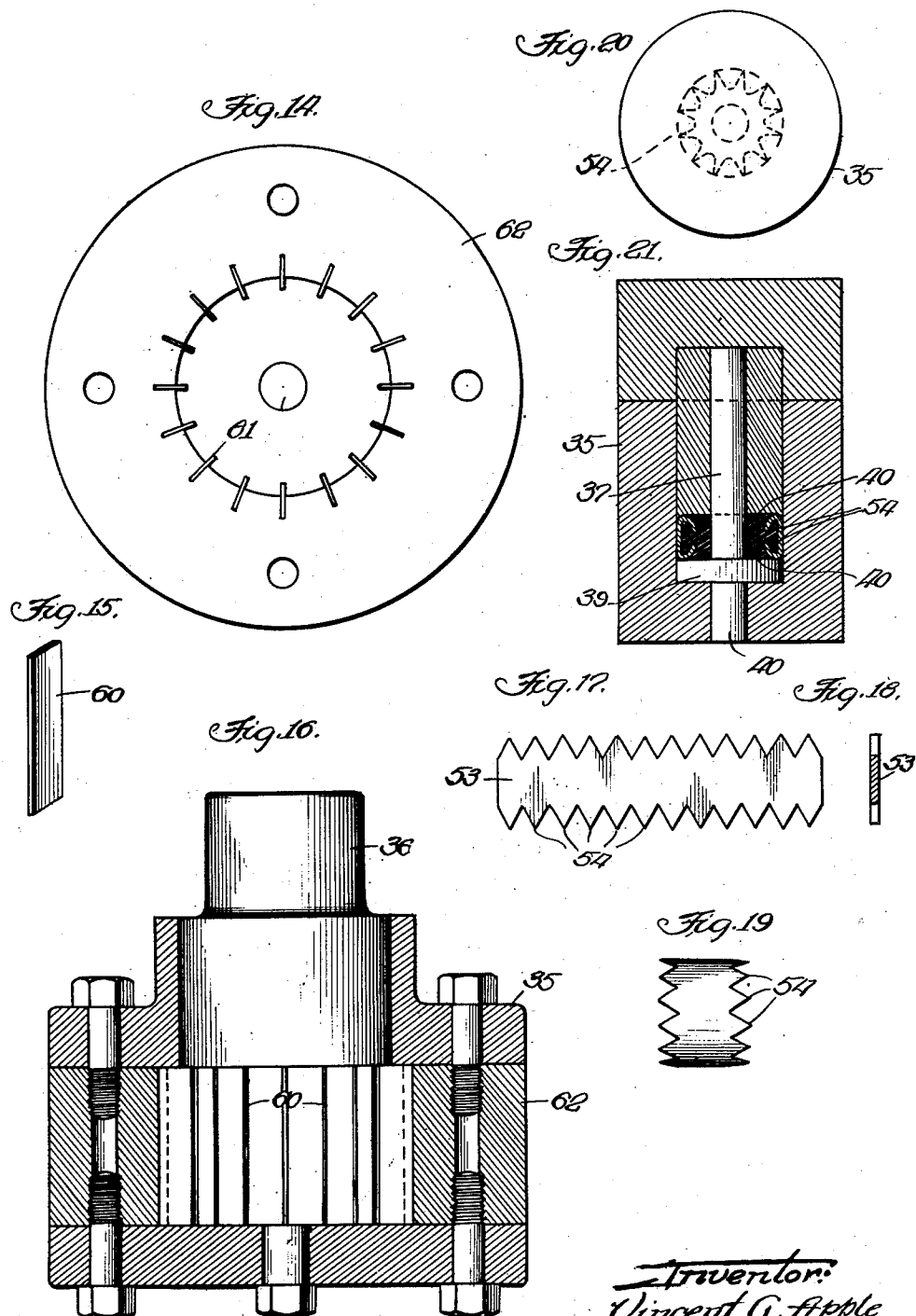
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COMMUTATOR AND THE METHOD OF MAKING IT

Filed July 3, 1920

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

VINCENT G. APPLE, OF DAYTON, OHIO.

COMMUTATOR AND THE METHOD OF MAKING IT.

Application filed July 3, 1920. Serial No. 393,836.

To all whom it may concern:

Be it known that I, VINCENT G. APPLE, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Commutators and the Methods of Making Them, of which the following is a specification.

This invention relates to improvements in commutators and the method of making them.

One of the objects of the invention is to generally improve the construction of commutators for dynamo electric machines.

Another object is to provide a new and improved method of procedure and the process of making commutators.

A commutator is, usually, a metallic cylinder or disk divided into a plurality of segments or bars, subsequently spaced apart and held by suitable means in spaced relation. In making commutators by the usual system of construction, it frequently happens that the separated bars or segments become displaced or the composite cylinder or disk is eccentric to the true axis, requiring excessive reduction of metal on one side of the axis in truing up the completed structure.

In carrying one of my modes of procedure into effect, I provide a true cylinder having a plurality of internal holding means or anchors; I then apply an insulating moldable material to the cylinder with the anchors embedded therein, and then divide the cylinder into the required number of segments. The cylinder is so formed that when the moldable, plastic material is applied thereto, and the cylinder is subsequently cut into the required number of bars or segments, each bar or segment will be individually held in place, being supported by the moldable insulating material.

Commutators, have heretofore been made, in which the commutator bars, or segments, have been held together, with accompanying insulating material, by metallic clamps and in some instances the bars have been partially embedded in a mass of insulating material and the commutator bars thus put together held between metallic clamps, or other metallic supports in other instances. These metallic supports have been embedded in the insulating material, also, with other reinforcing substances, such as cloth, paper or the like.

My invention relates to a new method of making commutators in which a cylinder, having a circumferentially continuous body with insulation engaging parts, has a plastic, moldable, insulating material applied thereto and subsequently it is cut, between the engaging parts or bar anchors, into a required number of bars or segments.

Instead of primarily using a seamless cylinder or tube, I may make the cylinder or tube of a flat strip of conducting material, such as copper, previously formed so as to indicate the commutator segments or bars and having parts that are bent or contorted which will serve to hold the individual commutator bars or segments after the cylinder, thus formed, has been divided into a plurality of such bars or segments.

In the drawings:—

Fig. 1 shows a diametric section of a cylinder having spaced apart projections that serve as holding means and as risers, the latter for connection to the conducting wires of an armature.

Fig. 2 is an elevation of the cylinder.

Fig. 3 is an end view.

Fig. 4 is an end view showing parts of the structure that have been bent inwardly into positions to hold the insulating material that is subsequently to be applied to the cylinder.

Fig. 5 is a section taken on line 5—5 of Fig. 4.

Fig. 6 shows the device in a mold, or hollow die, as a means for applying the insulating material.

Fig. 7 is an enlarged rear end view of Fig. 3 showing the risers that are notched to receive the conducting wires.

Fig. 8 shows a strip of metal of which the cylinder, shown in Figs. 1 and 2, may be made instead of using a tube, in which event, the divided portions are punched from the sheet or strip.

Fig. 9 is a modification of the structure, shown in Fig. 6, and it is a section taken on line 9—9 of Fig. 10.

Fig. 10 is an end view of the structure shown in Fig. 9 similar to Fig. 7.

Fig. 11 is another modification showing a section taken on line 11—11 of Fig. 12. Fig. 12 is an end view of Fig. 11.

Fig. 13 shows a number of modifications of different forms that the cylinder may take before being cut into the commutator segments.

Fig. 14 shows the intermediate part of the die, shown in Fig. 16, with the end plate removed.

Fig. 15 is a separator to be inserted in the slot shown in Fig. 14 that may consist of mica, or the like.

Fig. 16 is a central section thru a mold showing a commutator therein.

Fig. 17 is a strip of conducting material to be subsequently formed into a cylinder and is a modification of the structure shown in Fig. 8.

Fig. 18 is a section thru the strip 17.

Fig. 19 shows the strip 17 after having been made into a cylinder.

Fig. 20 is a plan view of Fig. 21, and Fig. 21 is a mold in which the commutator of the cylinder 19 is contained after the application of the insulating material.

In all the views the same reference characters are employed to indicate similar parts.

Figs. 1, 2 and 3 show a cylinder in which certain cuts are made to provide fingers or tongues 25 and risers 26. The tongues 25 are to be bent under the main body part or cylindrical part 27 toward the axis, as shown at 28, in Figs. 5 and 6. Fig. 1 shows the cylinder before the tongues 25 are made in the front end and shows how the front end may be reduced in cross section, as at 29. In making the radial cuts, the flange 30 is first made on the cylinder 27, and then the flange is slotted and the tongues are turned inwardly, leaving the risers 26 spaced apart. In Fig. 7 the fingers or tongues 25 are shown in dotted lines to have been turned down and the notch in the risers, from which they came, may be used for inserting the wires that are to be connected to the commutator. This is shown in Figs. 4 and 5. In Fig. 8 the parts are cut away between the tongues 25 and slots are made between the risers 26 and the tongues 25 on the opposite side. When the strip 31, shown in Fig. 8, is formed into a cylinder, the edges 32 and 33 are brazed or welded together after which the tongues 25 are turned inwardly as shown in Fig. 5 and the risers are turned in the opposite direction. In Fig. 8 the dotted lines 34 show the cut that is to be made subsequently in the cylinder to form commutator bars or segments.

After the parts have been formed to shape, as shown in Fig. 5, they are placed in a mold or hollow die 35 provided with a plunger 36. The plunger is hollow to receive a mandrel or stem 37 which is intended to be the size of the shaft upon which the commutator is to be placed. A metal sleeve 38, neatly fitting the mandrel 37, may be placed over the mandrel and then the commutator cylinder may be placed in the mold 35 upon an axially movable hardened disk 39. The disk 39 acts as an ejector when a tool is inserted in the bore 40 after the commutator has been

formed. After the commutator skeleton shown in Fig. 5 is placed in the mold 35, as shown in Fig. 6, the mandrel 37 is placed in the bore of the plunger 36 and a sleeve 38 is placed over the mandrel, then a quantity of condensation product, or other suitable material, is placed in the mold and the plunger 36 is forced into the position shown in Fig. 6, and, while in this position, the mold and contents are heated until the insulating material 42 becomes hardened by the baking process. When the commutator comes out of the mold, the cylinder portion 27 is intact or continuous. The structure is now placed in a milling machine and the lines 34, as shown in Fig. 8, are cut thru the body portion 27. The tongues 25 have already been separated and, therefore, it is only necessary to cut thru the cylinder portion 27 until the cutter comes in contact with the underlying insulating material 40 and, therefore, the insulating material is not greatly weakened by the separating slot. If the tongues 25 were not separated, before bakelite was placed in the structure, then it would be necessary to cut to the bottom or entirely thru the tongues and this would weaken and very nearly sever the insulating material.

In Fig. 13, there are shown twelve modifications of different forms that the cylinder may take prior to its manipulation and to molding the bakelite inside of the cylinder. The form *a* shows a notch 43 at one end and a downturned portion of the bar 44 indicated by the reference character 45. Section *b* shows the downturned portion 45 at both ends and section *c* shows that the cylinder has been counter-bored to form a dovetail circumferentially extending slot 46. In the sections *a*, *b* and *c*, the conducting wires are connected in a slot 47, formed in one end of the commutator bars.

The commutator shown in Fig. 11 is made of segment *a* and it is provided with a spool 48 instead of a sleeve.

Fig. 9 shows a commutator made of the section *b* illustrated in Fig. 13, in which the risers 50 are parts of a flange of a cylinder, and in which the cylinder portion 51 is subsequently cut into sections after the insulation 40 has been applied thereto. The inwardly curved tongues 45 may be separated from the main portion of the cylinder by spinning or turning, or they may be cast with the main body portion 51 of the cylinder. Before the structure, shown in Fig. 9, is insulated the interior of the cylinder may be cut internally to the line 52, the cut being made thru the tongues 45, and a portion of the body part 51, and after the cylinder has been insulated, in the manner heretofore described, then the cylinder may be further cut into a series of sections, or bars, in the same radial plane in which the cuts 52 were

previously made. In each instance the tongues 25 and 45 are separated from each other before the application of the insulation, so that the cylinder may be subsequently severed in the same radial plane without severing the insulating body.

In Fig. 17, a strip 53 is provided with saw-tooth or serrated edges, each of the serrations providing a tongue, or tooth, 54, of the same general character, and intended for the same purpose as the tongues 25 and 45. The strip 53 is then bent into the form of a cylinder, shown in Fig. 19, after which the tongues 54 are bent downwardly and inwardly, as more clearly shown in the mold in Figs. 20 and 21.

When mica is to be used between the contiguous commutator bars, the separator 60, shown more clearly in Fig. 15, may be placed in the slots 61, of the body 62 of the mold 35 shown in Figs. 14 and 16. The mica serves as separators instead of the homogeneous condensation product, which would otherwise be forced into the spaces occupied by the mica, should the mica be left out.

While I have herein shown a number of modifications of the various parts of my invention, it will be manifest, to persons skilled in the art, that other modifications are within the possibilities thereof, and that other changes may be made in the general form and construction and disposition of the parts within the scope of the appended claims.

Having described my invention what I claim as new and desire to secure by Letters Patent is:—

1. The method of making a commutator which consists in providing a cylinder having separated tongues at each end, one for each commutator bar; turning the tongues inwardly from the body part of the cylinder towards the axis thereof to provide a hold-

ing means; placing a moldable, adhesive, insulating material inside of the cylinder, about the tongues, and dividing the body of the cylinder into a plurality of commutator bars.

2. The method of making a commutator which consists in providing a cylinder having separated tongues at each end; turning certain of the tongues inwardly from the body part of the cylinder towards the axis thereof to provide holding means, and certain of the tongues outwardly to provide risers; placing a moldable, adhesive, insulating material inside the cylinder, about the tongues, and dividing the body of the cylinder, between the risers, into a plurality of commutator bars.

3. The method of making a commutator which consists in providing a strip of metal; dividing the longitudinal side edges thereof into separated tongues; rolling the strip and joining the ends to form a cylinder; turning certain of the tongues inwardly from the body of the cylinder, towards the axis thereof to provide holding means and turning certain of the tongues outwardly to provide risers; placing a moldable, adhesive, insulating material in the cylinder, about the tongues, and dividing the body part of the cylinder, between adjacent pairs of tongues, to provide a plurality of separated commutator bars, with one riser for each bar.

4. A commutator having a plurality of commutator bars, arranged in cylindrical form, each bar having a pair of spaced anchors extending inwardly from the ends of the bar, and a mass of moldable, insulating material within the cylinder entirely surrounding said anchors and the ends of the bars to hold the bars in place.

In testimony whereof I hereunto subscribe my name.

VINCENT G. APPLE.