

Aug. 1, 1950

M. A. ISAACSON

2,516,880

COMMUTATOR AND METHOD OF MAKING SAME

Filed March 27, 1946

2 Sheets-Sheet 1

FIG. 1

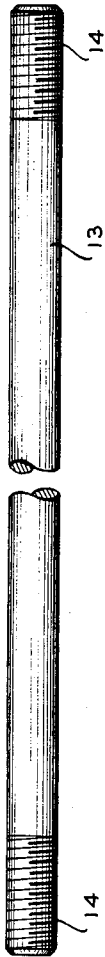


FIG. 2

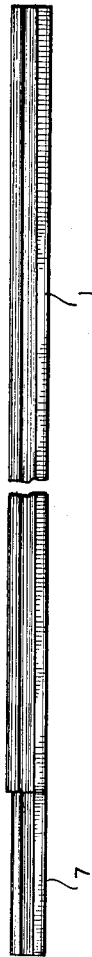


FIG. 3

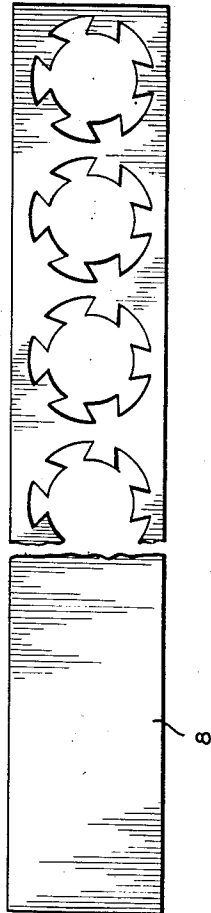


FIG. 1a



FIG. 2a

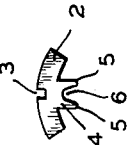


FIG. 3a

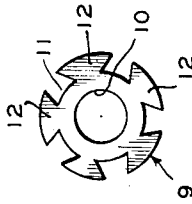


FIG. 4a

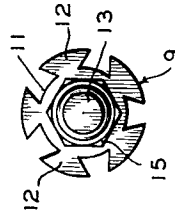


FIG. 4

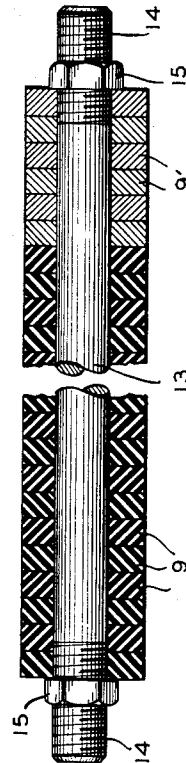


FIG. 2b

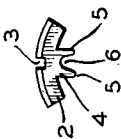
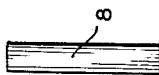


FIG. 3b



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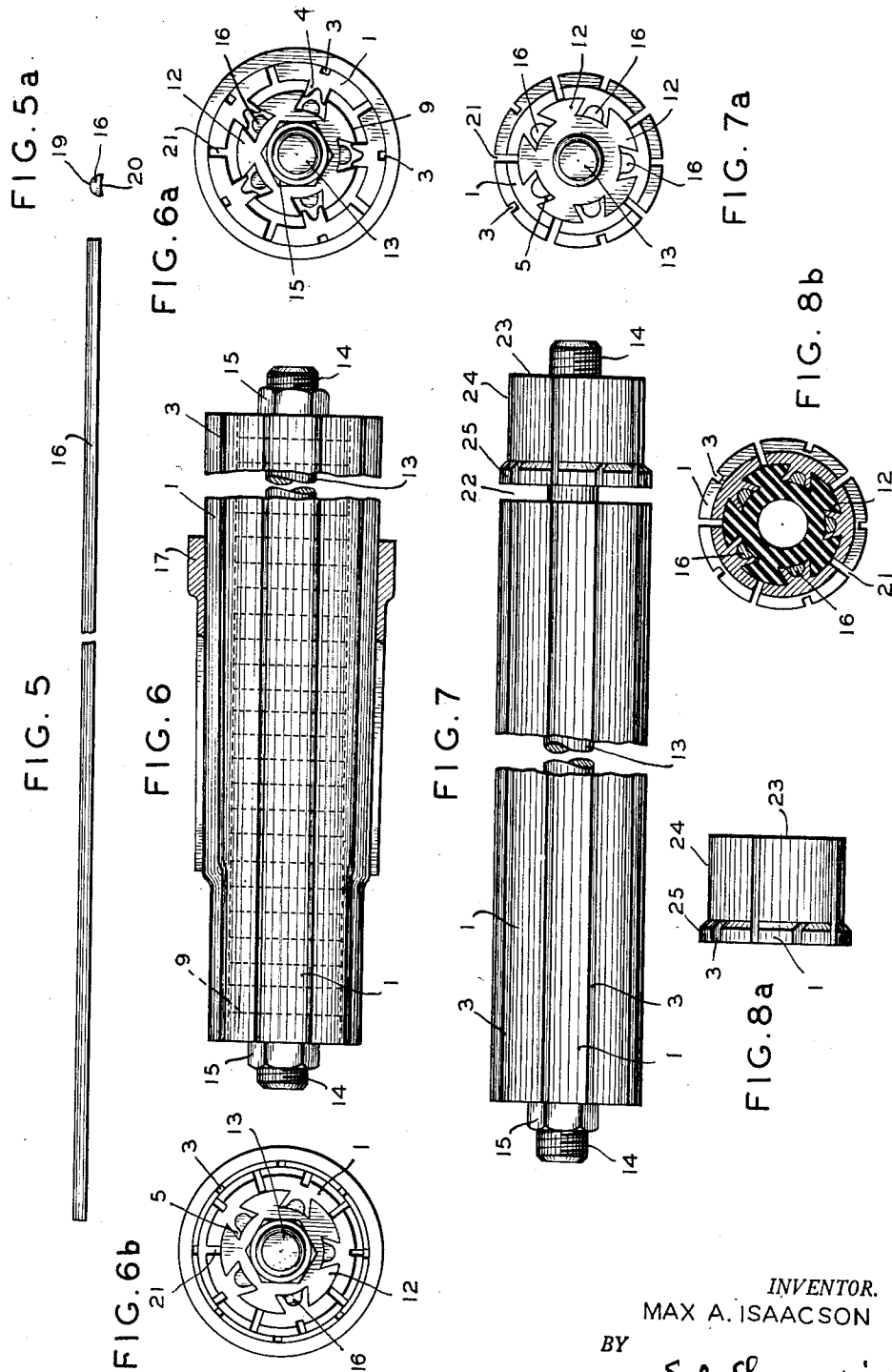
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2 Sheets-Sheet 2



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COMMUTATOR AND METHOD OF MAKING
SAME

Max A. Isaacson, Dayton, Ohio

Application March 27, 1946, Serial No. 657,390

8 Claims. (Cl. 171—321)

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This invention relates to commutators, to more or less continuous stock from which commutators may be cut, and to methods of producing such commutators and stock.

Among the objects of the present invention is the production of commutators of novel type, particularly commutators useful for small motors.

Further objects include the production of commutator stock from which commutators, particularly of small size, may be readily cut or produced.

Still further objects of the invention include the production of such commutators and stock by simple and economical procedures.

Still further objects and advantages of the present invention will appear from the more detailed description set forth below, it being understood that this more detailed description is given by way of illustration and explanation only, and not by way of limitation, since various changes therein may be made by those skilled in the art, without departing from the scope and spirit of the present invention.

In connection with that more detailed description there is shown in the accompanying drawings,

Figure 1, representing a side view of the assembly rod, and Figure 1a an end view thereof; in

Figure 2, a form of elongated commutator segment bar that may be utilized in carrying out the present invention, in side view thereof, and Figure 2a and Figure 2b being respective end views; in

Figure 3, a sheet of insulation material from which insulation lamina may be cut, one of the laminations at Figure 3a, and an end elevation of the sheet at Figure 3b; in

Figure 4, an assembly of laminations of the kind shown in Figure 3, assembled on the assembly rod of Figure 1, as side view partly in section being shown, while an end view is shown in Figure 4a; in

Figure 5, a side view of the rod or wire used in the assembling of such commutator structure, with an end view shown at Figure 5a; in

Figure 6, an assembly of commutator segment bars, and insulation laminations, partly in section, with respective end views at Figure 6a and 6b; in

Figure 7, a side view of the finished commutator stock with an end view at Figure 7a; and in

Figures 8a and 8b, side and end views respectively of a commutator cut from the stock of Figure 7.

The present invention is thus concerned with the production of commutators, particularly of small size for use in small motors and commutator stock from which such commutator ele-

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ments may be cut or formed, and to the methods of producing such commutators and commutator stock. The invention is particularly concerned with utilizing a core of insulating material carrying peripheral slots therein in which elongated commutator segment bars are inserted and fixed in position to produce commutator stock from which individual commutators, particularly when of small size, may be readily formed. In the production of such stock, there are desirably utilized elongated commutator segment bars as set forth in Figure 2, produced for example, from copper or other desired similar metals employed for commutator segments in the desired configuration by any desired means, preferably by extruding. Such elongated commutator segment bars as illustrated at 1 in Figure 2 is desirably provided with a brush contacting face portion 2 desirably arcuate in cross-section, such arcuate face member 2 being provided with a groove 3 longitudinally of the bar for purposes hereinafter set forth. A projection 4 extends outwardly from such face contacting portion 2 and as shown, is desirably provided with separate leg portions 5, 5, between which is provided a groove or channel portion 6. One end 7 of the commutator segment bar 1 may be reduced in size for purposes hereinafter set forth.

The commutator stock is desirably built up from a core of insulation material provided with peripheral slots formed between projections of such material. In the most desirable form of the invention, such insulating core is produced from laminations of insulation material. In this event a sheet 8 of desired insulating material is employed from which a series of insulating laminations 9 are stamped or cut in any desired way, each of the laminations having a central opening 10 to enable assembly of the laminations on an assembly rod, the laminations each being provided with peripheral slots 11, separated by projections 12 of the insulation material between the slots 11, 11. As shown the slots 11 are desirably dovetailed. This insulation material used for the production of the insulation laminations or where an unlaminated material is employed, for the laminated core itself, may be of any desired insulation material such as formica or a linen or fiber base of any type impregnated with insulating material such as Bakelite, etc.

Where the insulated core is produced from such laminations, a rod 13 having threaded ends 14, 14 is provided and on such rod a series of steel laminations 9', 9' of substantially the same shape and size (Figure 4—l) as the insulating laminations 9, 9 are placed, and then a series of the laminations 9, 9 are mounted with the slots 11 and projections 12 of the laminations being aligned

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and held in position on the rod 13 by means of nuts 15, 15.

In the channels formed by the aligned slots 11, a wedging element such as wire 16 of steel or other material, desirably harder than that of which the elongated commutator segment bar is composed, is placed in each of said slots at the base thereof as shown in Figure 6a, and an elongated commutator segment bar 1 is then placed with the projection 4 thereof entering such slot 11. The number of slots employed determines the number of elongated commutator segment bars which are employed, there being one such bar for each channel formed by the aligned slots. While five are shown in the drawing, any number more or less than five may be utilized. As shown in Figure 6, after the parts have been assembled in this way, a sleeve or spring fingers 17 may be utilized to hold the parts in assembled relation. The assembly as shown in Figure 6 is subjected to a rolling or other pressing operation to force the bars inwardly toward the axial center of the laminations to seat the bars on or in the aligned laminations with the brush contacting desirably arcuate faces 2, 2, forming a peripheral series of commutator segments held in position by the legs 4 within the slots 11. During such operation where the bars are thus forced into position, a wire 16 in each of the slots 11 serves to spread the leg portions 5, 5 within the slot 11 in order to anchor the bars in position on the insulating core.

In carrying out such operation, rolling may be employed and such rolling operation will employ a number of rollers corresponding to the number of bars utilized in producing such commutator stock. Such rollers may be provided with an annular ridge or projection which fits into each of the grooves 3 carried on each of the bars 1 for the purpose of centering the elongated bar in the slot 11. By providing the wire 16 with a rounded upper face 19 and a concave lower portion 20, a rigid structure is readily produced. The wire should desirably have a width less than that of the slot 11 but sufficient so that the legs 5, 5 on the projection 4 of the bar 1 are spread to bite into the formica or other insulation material. The form of wire 16 shown is desirably used but any other form may be employed. While a wire round in cross-section could be employed, it is more desirable to make it of the sectional contour shown in Figure 5a in order to avoid unnecessary biting into the formica or other insulation material employed.

The reduced ends 7 of the commutator bars enable the assembly as shown in Figure 6 the more readily to be passed into and between the shaping rolls that are employed. The length of the reduced ends 7 corresponds approximately to the length of the stack of steel laminations 9' as shown in Figure 4 and Figure 6. The interlock between the steel laminations 9', wires 16 and the reduced ends 7 formed when the assembly is initially passed between the rollers, is sufficiently strong so as to prevent the reduced ends 7 of the bars from spreading radially outwardly from the core after passing through the rollers. In addition, the steel laminations give a rigid end to the commutator stock to enable it more readily to be handled and manipulated.

The result of the rolling or pressing operation is to produce a commutator stock as shown in Figure 7, having a series of elongated commutator segment bars 1, carried peripherally about the insulating core 9, the bars being held rigidly in

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position by the legs 5, 5 on the projection 4 of the commutator segment bars being spread by the wire 16 as the rolling takes place. Such stock, of course, carries the grooves 3, 3 in each of the commutator segment bars, while the segment bars are themselves separated from each other by spaces 21, 21. Only that portion of the stock produced with insulating laminations is used to produce commutators.

From such commutator stock as shown in Figure 7, individual commutators may be cut of the desired length by cutting through the stock material as indicated at 22 to produce the individual commutator 23. At the same time or in any desired order with relation to such cutting operation, a portion of the metal may be cut or removed or ground from the commutator 23 leaving a riser 25 at the end thereof with the grooves 3, 3 therein, such grooves, however, having been removed from the brush contacting face 24 of the commutator 23. Such grooves as are retained in the riser portion 25 of the commutator element 23 may be utilized for electrical connection.

The operations including assembly and production of the continuous commutator stock of any desired length may be readily carried out, and commutator elements removed from such stock of any desired length by simple operations.

A number of modifications along any desired lines may be utilized in this connection. While the laminations are shown provided with a central opening 10 for assembly, the laminations may be produced without any such central opening, and the laminations assembled by stacking in any desired way. For this purpose if desired, a number of wires corresponding to the number of slots in the laminations may be utilized in spaced parallel relation to receive and stack the laminations. Such wires may be tensioned to give them sufficient rigidity when used as a supporting and stacking medium. Further the placing of the elongated commutator segment bars in the slots of the laminations and over the tensioned wires provides further and sufficient rigidity to the stack to enable them to be passed through the rollers of the machine that permanently staples the copper bars in position.

Further the slots 11 of the laminations or of an unlaminated core need not be dovetailed but may be parallel and radially arranged. The wire 16 in the slots will cause the fins of the inserted portion of the legs of the elongated commutator segments bars to spread and penetrate into the material of the laminations when sufficient pressure is applied to the commutator segment bars as they pass through the rollers.

If the laminations are made of material that is sufficiently rigid, the wires themselves can be eliminated but desirably in this case a central assembly rod such as that shown at 13 is employed.

The grooves 3 on the elongated commutator segment bar provide a number of purposes: they serve to centralize the bars by cooperation with a bead on the rollers during the assembly and they provide a slot for receiving the wire terminals of a coil of the armature thus eliminating the necessity for slotting the commutator for this purpose after the commutator element is fabricated.

This feature of utilizing a groove in the commutator may be applied to conventional commutators formed as punchings from an elongated copper bar.

The commutator stock emerges from the rolls

or other pressing operation in condition as a finished assembly from which the necessary commutator elements may be cut or removed as desired. The commutator segment elements are spaced from each other. If desired the finished assembly may be passed through the rollers a second time to get a closing in effect in which event the ridge on the roller may be positioned between the bars to produce a better spacing of the bars; but such second rolling operation is not essential.

If desired the commutator bars may be coated with an insulation varnish such as "Formvar" or any other insulation material coating or varnish or they may be dipped in an insulation composition so that when assembled the bars themselves are electrically insulated from each other. Or the slots between the bars may be filled with an insulation varnish such as "Sterling" varnish or any analogous material either before or after assembly. It is also possible to insert elongated thin strips of fiber insulation material or any other analogous material between the bars at the time that they are assembled and before the rolling operation so that during the process of rolling, such fiber insulation material between the bars becomes incorporated into the assembly. Or if desired a wire may be inserted in the spaces between the bars and after rolling, such wire may be removed to leave the space between the bars.

The present invention enables a very simple operation to be carried out to produce commutator stock material and commutators quite economically without requiring extensive finishing and cleaning operations.

Having thus set forth my invention, I claim:

1. Commutator stock from which a number of commutator elements may be formed by cutting transversely through the stock, said stock comprising an elongated central core of insulating material having a series of peripheral slots therein the core length being sufficient to provide a number of commutators, each slot carrying an elongated commutator segment bar of length sufficient to provide a number of commutators, each bar having an outer brush contacting portion and inwardly projecting legs, the legs of each bar lying intermediate the ends of the bar, the legs of each bar being anchored within a single slot only, and a wedging element in each slot to wedge the legs within such slot to hold each bar individually in a single slot in position on the core.

2. Commutator stock as set forth in claim 1, in which each commutator segment bar is provided with a longitudinal groove therein.

3. Commutator stock from which a number of commutator elements may be formed by cutting transversely through the stock, said stock comprising an elongated central core of insulating material having a series of peripheral slots and projections the core length being sufficient to provide a number of commutators, each slot carrying a wedging element within the slot at the base thereof engaging the innermost wall of the slot and an elongated commutator segment bar of length sufficient to provide a number of commutators, each bar having an outer brush contacting portion and inwardly projecting legs, the legs of each bar lying intermediate the ends of the bar, the legs of each bar being anchored within a single slot only by said wedging element and in piercing engagement with the sides of said projections to hold each bar in a single slot individually in position on the core.

4. Commutator stock from which a number

of commutator elements may be formed by cutting transversely through the stock, said stock comprising an elongated central core of insulating material having a series of peripheral slots and projections the core length being sufficient to provide a number of commutators, spaced elongated commutator segment bars of length sufficient to provide a number of commutators having inwardly projecting legs intermediate the width of the bars and disposed within said slots, the legs of said bars being wedged in said slots against walls thereof by a wedging element engaging walls of the slot and in pressure contact relation with the sides of said projections to hold the bars in position on the core.

5. A commutator comprising an elongated central core of insulating material having a series of peripheral slots therein, each slot carrying a wedging element within the slot at the base thereof engaging the innermost wall of the slot an elongated commutator segment bar, each bar having an outer brush contacting face and inwardly projecting legs, the legs of each bar lying intermediate the ends of the bar, the legs of each bar being anchored within a single slot only, and a wedging element in each slot to wedge the legs within such slot to hold each bar individually in a single slot in position on the core.

6. A commutator comprising an elongated central core of insulating material having a series of peripheral slots therein, a wire within each slot at the base of the slot engaging the innermost wall thereof, each slot carrying an elongated commutator segment bar, each bar having an outer arcuate brush contacting face and inwardly projecting legs, the legs of each bar lying intermediate the ends of the bar, the legs of each bar being anchored within a single slot only, and a wedging element in each slot to wedge the legs within such slot to hold each bar individually in a single slot in position on the core.

7. A commutator as set forth in claim 5, in which the outer brush contacting face is provided with a longitudinal groove intermediate the width thereof.

8. A commutator segment bar comprising an elongated bar of a length to provide a number of commutator elements, said bar having a body portion carrying an elongated outer brush contacting arcuate face portion thereon, said body portion having a longitudinal projecting anchoring bifurcated leg portion intermediate the width thereof and extending for the length of the bar, and a longitudinal groove in the arcuate base portion intermediate the width thereof extending the length of the bar.

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