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EP 0 019 472 B1

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Manufacturing commutator shells for electric rotating machines

The present invention relates to commutators for electric rotating machines and in particular to a method of and an apparatus for making co-called commutator shells for use in the manufacture of commutators.

A common method of manufacturing relatively low price commutators is to form a cylindrical shell of metal which is then moulded full of an electrically insulating material. The shell is then divided parallel to the axis of the cylinder into a plurality of segments which form the segments of the finished commutator. An axial bore is normally provided through the moulding material in the centre of the cylinder for mounting the commutator on the rotor of the machine in which it is to be used.

Normally, the metal cylinder or shell, before it is moulded and divided into segments, is shaped so as to provide some hook like extensions on the interior of the shell which serve as anchor members to hold the finished segments of the commutator to the insulating moulding material. In one known arrangement, axial cuts are made into each end of the cylinder to produce fingers which are then bent inwards back on themselves to point inwards and towards one another on the inside of the cylinder. These fingers then serve as anchor members. However, it is also usual in a commutator shell to provide further axially extending fingers at one end of the cylinder of the shell which are subsequently bent outwards to form the winding hooks or tangs for connecting the windings of the machine to the respective segments of the commutator. Since it is desirable to make anchor members at both ends of the cylinder, it can be appreciated that at the end at which the winding hooks are formed there may not be sufficient material to form both a winding hook and an anchor member. This problem is especially severe for commutators with relatively large numbers of segments.

Accordingly, it has been proposed to provide the interior of the cylinder of the shell with axially extending ribs which can then be undercut or skived at each end and bent inwards to provide the anchor members. Such an arrangement is disclosed in British Patent Specification No. 1,428,054. However, such a ribbed arrangement is relatively more difficult to produce especially for commutators with large numbers of segments. Techniques for making commutator shells are also shown in DE—A—1292736 and DE—A—1955122 as well as in EP—A1—0007186, the content of which is comprised in the state of the art according to rt. 54(3) EPC.

DE—A—1955122 shows a method of marking commutator shells in which a strip of material is rolled to produce on one side only integral ribs extending normal to the length of the strip.

Skiving the ends of the ribs is also described in DE—A—1955122. DE—A—1292736 describes calibrating cylinders formed from strips of material. EP—A1—0007186 describes use of a multiple press machine in the forming of commutator shells from strip.

None of the above referred specifications describes use of a tapered sizing die.

The present invention provides a method of making commutator shells comprising the steps of forming, from strip stock, metal strip ready for use as commutator shells wherein the formed strip is cut into lengths and the lengths are formed into cylinders, said strip forming step including the steps of rolling the strip along its length between a toothed roller and a pressure member, to produce on one side only of the strip integral ribs extending normal to the length of the strip, the teeth of the roller being pressed into said one side of the strip as the roller rotates to displace metal of the strip to form said ribs, and then skiving under the ribs at both ends of the ribs and lifting said ends away from the rest of the strip to form anchor members for the shells, and the method comprising after said strip forming step the further steps of cutting the formed strip into predetermined lengths, bending said lengths into cylinders with the anchor members inwards and forcing the bent cylinders axially through a tapered sizing to form the cylinders with smooth cylindrical outer surface of a desired diameter, all said steps from said strip forming step to said step of forcing the bent cylinders through the sizing die are performed in automatic sequence on a multiple stage slide press machine.

With this method, all the forming steps required to form stock strip into strip suitable for use as a commutator shell are performed before the strip is cut into lengths and bent into cylinders forming the shells. Once the strip is cut, bent into cylinders and forced through the sizing die, no further operations are required on the shell before the shell is used in the moulding step in forming a complete commutator. In this way, the production of commutator shells is very greatly facilitated and is made especially suitable for automation.

Normally, the ribs produced by the rolling step of the method of the invention extend only part way across the width of the strip, the strip having after the rolling step a longitudinally flat portion along one edge of the strip. Then, the strip forming step typically further includes the step of cutting slots through the strip extending into the flat portion from the adjacent edge of the strip so as to leave laterally extending fingers along the length of the strip, with the fingers substantially registering with the ribs produced by the rolling step. These fingers

provide the winding hooks for the finished commutator.

Preferably, after the rolling step the side of the strip opposite to said one side with the ribs is substantially flat right across its width, and said flat edge portion of the strip has, on said one side, a longitudinal step dividing the edge portion into an outer thinner part adjacent the edge of the strip and an inner thicker part which has a thickness not greater than the thickness of the strip between said ribs. Because the thicker part of the flat edge portion of the strip is no thicker than the thickness of the strip between said ribs, it can be seen that both ends of the ribs are accessible to a skiving tool to skive under the ends and lift them away from the rest of the strip. Further, at least the end parts of the laterally extending fingers of the strip are only as thick as said outer thinner part of the flat edge portion, so that the fingers can be relatively easily bent upwards to form the winding tangs. Moreover, the inner thicker part of the flat edge portion of the strip provides a more rigid support for when the windings of the electric machine are being secured to the winding hooks, as will be explained later herein.

Very conveniently, at least said outer thinner part of the flat edge portion of the strip is formed in said rolling step simultaneously with said ribs. Where only the outer thinner part is formed in said rolling step, the strip stock used in the method of the invention may have on one side a longitudinal step between a thicker portion for formation of said ribs and a thinner portion for said flat edge portion of the strip.

Multiple stage slide press machines are known and commercially available and are widely used for manufacuturing articles from metal strip. Such a machine can be tooled to perform in sequence a number of forming operations on the strip such as punching and bending and cutting operations.

The present invention further envisages commutator shells made by the method described above, commutators formed from such shells and electric rotating machines containing such commutators.

A commutator using a commutator shell formed by the method described above is made by moulding insulating material inside said shell to form a commutator blank, and then dividing the shell with axial cuts between said ribs to form separate commutator segments, each with at least one pair of opposed said anchor members. Further, after said moulding step said laterally extending fingers may be bent outwardly to form winding hooks for the commutator.

According to a further aspect of the present invention, there is provided apparatus for making commutator shells, the apparatus comprising a multiple stage slide press machine having a plurality of work stages and being arranged to feed metal strip from stock from one stage to another whereby to perform in automatic sequence a plurality of forming operations on said strip, a first work stage of the machine comprising a toothed roller and a pressure member co-operating therewith, the strip being fed from stock to said roller so that as the roller rotates, the teeth of the roller are pressed into one side of the strip displacing metal to form integral ribs on said one side which extend normal to the length of strip, one or more subsequent work stages being arranged to form the ribbed strip into strip ready for use as commutator shells when the formed strip is only cut into lengths and the lengths are formed into cylinders, the or one of the subsequent work stages comprising skiving means arranged to skive under the ends of the ribs and lift said ends away from the rest of the strip to form anchor members for the shells, and one or more final work stages comprising, in a single or separate stages, means for cutting the formed strip into predetermined lengths, means for bending said lengths into cylinders with the anchor members inwards, and a tapered sizing die and means for forcing the bent cylinders axially through the die to form the cylinders with smooth outer surfaces of a desired diameter.

An example of the invention will now be described with reference to the accompanying drawings in which:

Figures 1 and 2 are corresponding schematic views in plan and elevation respectively illustrating various steps of a method of making commutator shells, referring to a plurality of stages of a multi stage slide press machine by which the method can be put into practice;

Figures 3 to 7 illustrate in greater detail stages 1 to 5 respectively referred to in Figures 1 and 2;

Figure 8 is a cross-sectional view of a complete commutator shell formed by the method or apparatus illustrated in Figures 1 to 7 and

Figure 9 is a partial cross-sectional view of a complete commutator made using the shell of Figure 8 showing a winding hook bent back to connect a winding to a segment of the commutator.

Figures 1 and 2 illustrate in outline the operation of various stages of a multi stage slide press machine which has been tooled up and arranged to make commutators from metal strip in accordance with an embodiment of the present invention. Multi stage slide press machines are well known and are commonly used for shaping and forming strip metal to produce small metal artifacts. Such machines typically have a number of stages and are arranged to transfer metal strip from stock from one stage to the next. A separate forming operation is performed at each stage. Typical forming operations are punching, cutting and bending.

In the example of the present invention illustrated in Figures 1 and 2 a multi stage slide

press machine is adapted to have in effect five stages at which forming operations are performed on metal strip from stock to produce commutator shells. The metal strip normally used for commutators is copper strips. The strip 10 is fed to stage 1 of the machine from the right hand side in Figures 1 and 2. Stage 1 is illustrated in greater detail in Figure 3 and it can also be seen in Figure 3 that the stock strip 10 has a single step profile with a longitudinal step 11 dividing the stock strip into a thicker portion 12 and a thinner portion 13. A strip of such a stepped profile can readily be made by extruding.

The strip 10 is fed to stage 1 which comprises a toothed roller 14 which co-operates with a pressure pad 15. The pressure exerted on the strip 10 by the pressure pad 15 is sufficient to cause the teeth 16 of the roller 14 to penetrate into one side 17 of the strip 10 displacing material of the strip to form alternate grooves and ribs 18 and 19 respectively. The roller 14 is arranged to produce these alternate grooves and ribs 18 and 19 only in the thicker portion 12 of the strip and is arranged also so that the base of the grooves 18 approximately coincide with the level of the thinner portion 13 of the stock strip, i.e. the thickness of the strip in the grooves 18 is substantially equal to the thickness of the thinner portion 13 of the stock strip.

Coaxial with the roller 14 is a step forming wheel 20 which has a diameter slightly greater than the diameter of the circle through the tips of the teeth 16 of the roller 14. The wheel 20 is arranged to engage the thinner portion 13 of the stock strip 10 to produce a second longitudinal step 21 in the strip dividing the portion 13 itself into an outer thinner part 22 adjacent the edge 23 of the strip and an inner thicker part 24.

As can be seen particularly well in Figure 3, the strip 25 emerging from stage 1 of the machine has on the side 17 only ribs 19 which are normal to the length of strip. The ribs 19 extend only part way across the width of the strip 25 and the portions 22 and 24 of the strip from a longitudinally flat portion of the strip adjacent the edge 23.

The strip 25 from stage 1 of the machine, is fed to stage 2. Stage 2 comprises a series of punches 26 which are arranged to punch a corresponding series of slots 27 in the flat portion of the strip 25. The punches 26 co-operate with a die block 28 having a series of cavities 29 for receiving the material punched out of the strip 25 by the punches 26. The punches 26 are spaced apart by amounts equal to the spacing of the ribs 18 of the strip 25. Further, the machine is arranged so that the punches 26 punch the slots 27 at positions accurately corresponding to the grooves 18 between the ribs 19 so that the punched slots 27 leave behind laterally extending fingers 30 which register with the ribs 19. The number of punches 26 depends on the number of segments in the commutator to be made from the shell produced by the machine. Thus, for example, if the shells are to be used in making twenty four segment commutators, then there are twenty five punches 26 arranged to produce twenty four fingers 30 registering with a series of twenty four ribs 19. The machine is conveniently arranged to operate stepwise, transferring the strip from stage to stage in the machine in steps and then halting the transfer for the forming operations of the various stages to be made. Thus, between each punching operation in stage 2, the machine transfers the strip 25 by a distance slightly greater than a length of the strip having the desired number of ribs 18, i.e. twenty four for a twenty four segment commutator.

The slots 27 extend over the full width of the flat portion of the strip, i.e. over both the thinner and thicker parts 22 and 24.

The slotted and ribbed strip 31 from the second stage is then fed to stage 3. Stage 3 comprises a pair of opposed skiving knives 32, 33 arranged approximately in the plane of the strip directed at opposite edges thereof. The machine is arranged to drive the skiving knives 32 and 33 towards the strip in the direction of arrows 34 and 35 when the strip is halted during the stepwise operation of the machine. The skiving knives are positioned so that their cutting edges 36 and 37 engage the ends of the ribs 19 substantially at the level of the grooves 18 between the ribs so as to skive under the ends of the ribs. The knives 32 and 33 are provided with bevels 38 and 39 to lift the ends of the ribs 19 away from the rest of the strip as illustrated in Figure 5 at 40. The knives 32 and 33 are made just long enough to skive simultaneously under the desired number of ribs for a single commutator shell, i.e. twenty four for a commutator of twenty four segments. Furthermore, the knives are positioned so that the ribs which are skived simultaneously are those which correspond to the set of fingers 30 which was formed by a simultaneous punching operation in stage 2. Although the skiving knives 32 and 33 are shown in Figure 5 with straightline cutting edges and plane bevels, the bevels 38 and 39 may in fact be formed slightly corrugated so that the grooves of the corrugation in the bevels correspond with the ribs 19 during the skiving operation and ensure that the lifted end portions of the ribs 19 are retained correctly positioned and spaced relative to one another.

The lifted ends 41 of the ribs 19 produced by the skiving knives 32 and 33 will form anchor members in the finished commutator shell.

The strip 42 emerging from stage 3 is fed by the machine to stage 4. In stage 4, two forming operations are performed on the strip. A crop punch 43 co-operating with a die 44 crops from the leading end of the strip 42 a predetermined length 45 of the strip. The length 45 is selected

to include the desired number of ribs 18 and tongues 30 to produce a commutator shell with the desired number of segments, in the present example 24. The machine automatically positions the strip 42 so that the crop punch 43 cuts off the length 45 at the correct position so that the length 45 can form when bent into a cylinder the desired commutator shell.

In the same stage, before the strip 42 is again moved forward by the machine, but after the crop punch cuts off the length 45, a forming punch 46 is moved in the direction of an arrow 47 towards the face of the strip having the anchor members. Simultaneously, spring loaded bending pad 48 is moved in the direction of an arrow 49 to engage the other plane side of the length 45. The form punch 46 and the bending pad 48 are provided with complimentary shapes so as to bend the ends 50 and 51 of the length 45 of the strip between them as illustrated in Figure 6. After bending, the ends 50 and 51 are directed at right angles to the rest of the length 45 and the bent portion of the length 45 is radiused with substantially the radius of the desired cylinder into which the length 45 is to be bent to produce the complete commutator shell.

After stage 4, the machine transfers the bent strip 45 upwards, in Figure 2, transversely of the length of the strip to stage 5 in which again two forming operations take place.

Firstly, in stage 5, the bent strip 45 is presented to a pair of forming dies 52 and 53. The forming dies 52 and 53 have opposed semi-cylindrical cut-outs 54 and 55 of substantially the same radius as the cylinder into which the length 45 of strip is to be bent. The dies 52 and 53 are brought by the machine together in the directions of the arrows 56 and 57 so that the cut-outs 54 and 55 engage the bent ends 50 and 51 of the length 45 and further bend the length 45 into the complete cylinder shown at 58 in Figure 7.

Also in stage 4, after the length 45 is bent to the cylinder 58, the cylinder is forced axially in the direction of an arrow 59 into the inwardly tapering entrance 60 of a sizing die 61. The upper end 62 of the bore in the sizing die 61, has a minimum diameter equal to the desired outer diameter of the formed commutator shells produced by the machine so that the cylinders 58 pushed through the die 61 in successive stepwise operations of the machine are slightly compressed by the sizing die to have the desired smooth outer diameter. By using the sizing die 61 in this way, any irregularities in the outer peripheral surface of the cylinder 58 are smoothed out. The commutator shells produced by the machine are formed with precisely the desired outer diameters so that no further machining is required after the shells are divided to form the segments of the complete commutator. In this context it will be understood that it is common practice for the manufacturer of the rotating electric machine to provide a final machining of the commutator after the commutator has been mounted on the rotor axis of the machine to ensure that the segment surfaces are perfectly symmetrical relative to the axis of rotation of the machine's rotor. However, commutators made from commutator shells formed as described above require no further machining before being supplied to the electrical machine manufacturer for incorporation in a machine.

A completed commutator shell formed by the machine illustrated in Figures 1 to 7 is illustrated, in schematic form, in Figure 8. As can clearly be seen in Figure 8, each finger 30 at the right hand end of the cylinder of the shell registers with a rib 19 the ends of which are lifted from the rest of the shell to form anchor members 41. Further as also illustrated in Figure 8, the step 21 formed by stage 1 of the machine is clearly visible and the slots 27 between the fingers 30 extend right across the full width of the flat portion of the strip to the adjacent ends of the ribs 18, so that the fingers 30 include outer thinner parts 63, corresponding to the thinner part 22 of the strip 25 after stage 1, and inner thicker parts 64, corresponding to the thicker part 24 of the strip 25.

When the shell illustrated in Figure 8 is used to make a commutator, the interior of the shell is filled with an electrically insulating mouldable material so that the anchor members 41 become completely embedded in this material, indicated at 65 in Figure 9. A bore may be provided through the centre of the mouldable material 65 for mounting the commutator on a suitable shaft. After moulding, the shell is divided into the various segments of the commutator by axial cuts between adjacent ribs and fingers 30, so that in the twenty four segment example described herein, each segment has a single pair of anchor members 41, formed by a single rib 18, with a single finger 30 extending from one end.

The fingers 30 of each of the segments can then be bent outwards to the position shown in ghost in Figure 9 to serve as winding hooks or tangs for connecting the rotor windings to the commutator. This is normally done by locating the winding wire behind the bent up hook and then pressing the hook firmly down onto the winding as shown in Figure 9. The thicker portions 64 of the fingers 30 provide strengthened regions to withstand the axially inward force when the hooks are pressed down onto the wires of the windings.

The entire operation of forming the commutator shells, as described in the above example, is performed automatically on the multi stage slide press machine thereby greatly reducing the cost of producing these shells whilst ensuring that the shells are produced to a relatively tight tolerance and have anchor members enabling the separated segments of the commutator to be firmly anchored to the moulded material of the commutator.

Claims

1. A method of making commutator shells comprising the step of forming, from strip stock, metal strip ready for use as commutator shells wherein the formed strip is cut into lengths and the lengths are formed into cylinders, said strip forming step including the steps of rolling the strip along its length between a toothed roller and a pressure member to produce on one side only of the strip integral ribs extending normal to the length of the strip, the teeth of the roller being pressed into said one side of the strip as the roller rotates to displace metal of the strip to form said ribs, and then skiving under the ribs at both ends of the ribs and lifting said ends away from the rest of the strip to form anchor members for the shells, and the method comprising after said strip forming step the further steps of cutting the formed strip into predetermined lengths, bending said lengths into cylinders with the anchor members inwards and forcing the bent cylinders axially through a tapered sizing die to form the cylinders with smooth cylindrical outer surfaces of a desired diameter, all said steps from said strip forming step to said step of forcing the bent cylinders through the sizing die are performed in automatic sequence on a multiple stage slide press machine.

2. A method of making commutator shells as claimed in claim 1 characterised in that the ribs produced by the rolling step extend only part way across the width of the strip, the strip having after the rolling step a longitudinally flat portion along one edge of the strip, and characterised in that the strip forming step further includes the step of cutting slots through the strip extending into the flat portion from the adjacent edge of the strip so as to leave laterally extending fingers along the length of the strip, with the fingers substantially registering with the ribs produced by the rolling step.

3. A method of making commutator shells as claimed in claim 2 characterised in that after the rolling step the side of the strip opposite to said one side with the ribs is substantially flat right across its width, and said flat edge portion of the strip has, on said one side, a longitudinal step dividing the edge portion into an outer thinner part adjacent the edge of the strip and an inner thicker part which has a thickness not greater than the thickness of the strip between said ribs.

4. A method of making commutator shells as claimed in claim 3 characterised in that at least said outer thinner part of the flat edge portion of the strip is formed in said rolling step simultaneously with said ribs.

5. A method of making commutator shells as claimed in any of claims 2 to 4 characterised in that the strip stock has on one side a longitudinal step between a thicker portion for the formation of said ribs and a thinner portion for said flat edge portion.

6. A commutator shell made by the method of any of claims 1 to 5.

7. A commutator formed from a shell as claimed in claim 6.

8. An electric rotating maching having a commutator as claimed in claim 7.

9. Apparatus for making commutator shells, characterised in that the apparatus comprises a multiple stage slide press maching having a plurality of work stages (1—5) and being arranged to feed metal strip from stock (10) from one stage to another whereby to perform in automatic sequence a plurality of forming operations on said strip, a first work stage (1) of the machine comprising a toothed roller (14) and pressure member (15) co-operating therewith, the strip being fed from stock to said roller so that as the roller rotates, the teeth (16) of the roller are pressed into one side of the strip displacing metal to form integral ribs (19) on said one side which extend normal to the length of the strip, one or more subsequent work stages (2—3) arranged to form the ribber strip (25) into strip (42) ready for use as commutator shells when the formed strip is only cut into lengths (45) and the lengths are formed into cylinders (53), the or one of the subsequent work stages (3) comprising skiving means (32, 33) arranged to skive under the ends of the ribs and lift said ends away from the rest of the strip to form anchor members (41) for the shells, and one or more final work stages (4, 5) comprising, in a single or separate stages, means (43, 44) for cutting the formed strip into predetermined lengths (45), means for bending (46, 48, 52, 53) such lengths into cylinders (58) with the anchor members inwards, and a tapered sizing die (61) and means for forcing the bent cylinders axially through the die to form the cylinders with smooth cylindrical outer surfaces of a desired diameter.

Patentansprüche

1. Verfahren zur Herstellung von Kommutatorschalen, umfassend: den Schritt der Ausbildung von gebrauchsfertigen Metallstreifen für Kommutatorschalen aus einem Streifen-Grundmaterial, wobei die geformten Streifen in Längen geschnitten und die Längen zu Zylindern geformt werden, wobei der Streifenformschritt die Schritte umfaßt: Walzen des Streifens entlang seiner Länge zwischen einer Zahnwalze und einm Druckelement, um nur auf einer Seite des Streifens integrale Rippen zu erzeugen, die sich senkrecht zur Länge des Streifens erstrecken, wobei die Zähne der Walze beim Drehen der Walze in eine Seite des Streifens gedrückt werden, um Metall des Streifens zu verdrängen und die Rippen zu bilden; und anschließendes Spalten unterhalb der Rippen an beiden Enden der Rippen und Abheben der Enden vom Rest des Streifens, um Verankerungsteile für die Schalen zu bilden; worauf das Verfahren nach dem Streifenformschritt

folgende weitere Schritte umfaßt: Schneiden der geformten Streifen in vorbestimmte Längen, Biegen der Längen zu Zylindern, wobei die Verankerungsteile nach innen ragen, und axiales Hindurchdrücken der Zylinder durch ein sich verjüngendes Formwerkzeug, um die Zylinder mit glatten zylindrischen Außenflächen mit tewünschtem Durchmesser auszubilden; wobei alle Schritte, beginnend von dem Streifenbildungsschritt zu dem Schritt, bei dem die gebogenen Zylinder durch das Formwerkzeug gedrückt werden, in einer automatischen Folge auf einer mehrstufigen Band-(Gleit)-Preßmaschine durchgeführt werden.

2. Verfahren zur Herstellung von Kommutatorschalen nach Anspruch 1, dadurch gekennzeichnet, daß die nach dem Walzschritt erzeugten Rippen sich nur teilweise über die Breite des Streifens erstrecken, wobei der Streifen nach dem Walzschritt einen in Längsrichtung flachen Teil entlang dem einen Rand des Streifens hat; und daß der Streifenformschritt folgende Stufen umfaßt: Schneiden von Schlitzen durch den Streifen, die sich vom benachbarten Rand des Streifens in den flachen Teil erstrecken, so daß entlang der Länge des Streifens seitlich abstehende Finger zurückbleiben, wobei die Finger praktisch deckungsgleich mit den durch den Walzschritt erzeugten Rippen sind.

3. Verfahren zur Herstellung von Kommutatorschalen nach Anspruch 2, dadurch gekennzeichnet, daß nach dem Walzschritt die Seite des Streifens, die der einen Seite mit den Rippen gegenüberliegt, über ihre Breite praktisch eben ist, und daß der ebene Randteil des Streifens an der einen Seite eine Längsstufe hat, die den Randteil in einen äußeren, dünneren Teil, der an den Rand des Streifens angrenzt, und einen dickeren, inneren Teil unterteilt, dessen Dicke nicht größer als die Dicke des Streifens zwischen den Rippen ist.

4. Verfahren zur Herstellung von Kommutatorschalen nach Anspruch 3, dadurch gekennzeichnet, daß mindestens der äußere, dünnere Teil des ebenen Randbereichs des Streifens während des Walzschrittes zusammen mit den Rippen geformt wird.

5. Verfahren zur Herstellung von Kommutatorschalen nach einen der Ansprüche 2 bis 4, dadurch gekennzeichnet, daß das Streifengrundmaterial auf der einen Seite eine Längsstufe zwischen einem dickeren Teil zur Ausbildung der Rippen und einen dünneren Teil für den flachen Randbereich hat.

6. Kommutatorschale, hergestellt nach dem Verfahren nach einem der Ansprüche 1 bis 5.

7. Kommutator, der aus einer Schale nach Anspruch 6 geformt ist.

8. Rotierende elektrische Maschine mit einem Kommutator nach Anspruch 7.

9. Vorrichtung zur Herstellung von Kommutatorschalen, dadurch gekennzeichnet, daß die Vorrichtung eine mehrstufige Band-(Gleit)-Preßmaschine mit mehreren Bearbeitungsschritten (1 bis 5) darstellt und so angeordnet ist, daß ein Metallstreifen aus einem Streifen-Grundmaterial (10) von einer zur anderen Stufe gefördert wird, so daß in einer automatischen Folge mehrere Formoperationen am Streifen durchgeführt werden; wobei eine erste Arbeitsstufe (1) der Maschine eine Zahnwalze (14) und ein damit zusammenwirkendes Druckteil (15) enthält, wobei der Streifen vom Streifen-Grundmaterial zu der Walze gefördert wird, so daß beim Drehen der Walze die Zähne (16) der Walze unter Verdrängung von Metall in eine Seite des Streifens gepreßt werden, um integrale Rippen (19) auf der einen Seite zu bilden, welche sich senkrecht zur Länge des Streifens erstreken; wobei eine oder mehrere anschließende Arbeitsstufen (2—3) vorgesehen sind, um den gerippten Streifen (25) zu einem Streifen (42) zu formen, der für Kommutatorschalen geeignet ist, wenn der geformte Streifen nur in Längen (45) geschnitten ist und die Längen zu Zylindern (43) geformt sind, wobei der oder einer der anschließenden Arbeitsschritte (3) Spalteinrichtungen (32, 33) enthält, welche so angeordnet sind, daß sie unterhalb der Enden der Rippen splaten und die Enden vom Rest des Streifens anheben, um Verankerungsteile (41) für die Schalen zu bilden, und wobei eine oder mehrere Endbearbeitungsstufen (4, 5) in einer einzigen oder in getrennten Stufen Mittel (43, 44) zum Abschneiden des geformten Streifens in vorbestimmte Länggen (45), Mittel zum Biegen (46, 48, 52, 53) dieser Längen zu Zylindern (58) mit nach innen weisenden Verankerungsteilen, ein sich verjüngendes Formwerkzeug (61) und MIttel zum axialen Hindurchdrücken der gebogenen Zylinder durch das Werkzeug aufweisen, um die Zylinder mit glatten zylindrischen Außenflächen mit gewünschtem Durchmesser auszubilden.

Revendications

1. Procédé de fabrication de coquilles de collecteur comprenant l'étape qui consiste à former, en partant de matière en bande, une bande de métal prête à servir de coquilles de collecteur, dans laquelle on coupe en tronçons la bande formée et on donne aux tronçons la forme de cylindres, cette étape de formation de bande comprenant les étapes qui consistent à rouler la bande le long de sa longueur entre un rouleau denté et un organe de pression pour réaliser d'un seul côté de la bande des nervures faisant corps avec elle, s'étendant normalement à la longueur de la bande, les dents du rouleau étant poussées dans ledit côté de la bande à mesure que le rouleau tourne pour déplacer du métal de la bande afin de former les nervures, puis à entailler sous les nervures aux deux extrémités des nervures et à lever ces extrémités relativement au reste de la bande pour former des organes d'ancrage pour les coquilles, et le procédé comprenant, après cette étape de formation de bande, les étapes supplémentaires qui consistent à coupler la bande

formée en longueurs prédéterminées, à courber ces longueurs pour en former des cylindres, les organes d'ancrage étant vers l'intérieur, et à pousser axialement les cylindres courbés à travers une filière de calibrage rétrécie pour former sur les cylindres des surfaces extérieures cylindriques lisses d'un diamètre désiré, toutes ces étapes, depuis l'étape de formation de la bande jusqu'à l'étape consistant à pousser les cylindres courbés à travers la filière de calibrage, s'effectuant en succession automatique sur une presse à coulisseau à stades multiples.

2. Procédé de fabrication de coquilles de collecteur selon la revendication 1, caractérisé par le fait que les nervures réalisées par l'étape de roulage s'étendent seulement sur une partie de la largeur de la bande, la bande présentant après l'étape de roulage une partie plane longitudinalement le long d'un bord de la bande, et caractérisé par le fait que l'étape de formation de bande comprend en outre l'étape qui consiste à découper à travers la bande des encoches arrivant dans la partie plane en partant du bord adjacent de la bande, de manière à laisser le long de la longueur de la bande des doigts dirigés latéralement, les doigts s'alignant pratiquement sur les nervures réalisées par l'étape de roulage.

3. Procédé de fabrication de coquilles de collecteur selon la revendication 2, caractérisé par le fait qu'après l'étape de roulate, le côté de la bande qui est opposé audit côté muni des nervures est pratiquement plan sur toute sa largeur et que la partie marginale plane de la bande présente, sur ledit premier côté, un gradin longitudinal divisant la partie marginale en une partie extérieure plus mince adjacente au bord de la bande et une partie intérieure plus épaisse qui a une épaisseur non supérieure à l'épaisseur de la bande entre les nervures.

4. Procédé de fabrication de coquilles de collecteur selon la revendication 3, caractérisé par le fait qu'au moins la partie extérieure plus mince de la partie marginale plane de la bande est formée dans l'étape de roulage en même temps que les nervures.

5. Procédé de fabrication de coquilles de collecteur selon l'une quelconque des revendications 2 à 4, caractérisé par le fait que la matière en bande présente d'un côté un gradin longitudinal entre une partie plus épaisse destinée à la formation des nervures et une partie plus mince destinée à la partie marginale plane.

6. Coquille de collecteur fabriqué par le procédé selon l'une quelconque des revendications 1 à 5.

7. Collecteur formé en partant d'une coquille selon la revendication 6.

8. Machine tournante électrique présentant un collecteur selon la revendication 7.

9. Appareil pour la fabrication de coquilles de collecteur, caractérisé par le fait que l'appareil comprend une presse à coulisseau à stades multiples présentant plusieurs stades de travail (1 à 5) et conçue pour faire avancer d'un stade à un autre une bande de métal tirée d'une matière (10) de manière à exécuter en succession automatique plusieurs opérations de formage sur la bande, un premier stade de travail (1) de la machine comprenant un rouleau denté (14) et un organe de pression (15) coopérant avec celui-ci, la bande étant amenée de la matière au rouleau de sorte qu'à mesure que le rouleau tourne, les dents (16) du rouleau sont poussées dans un côté de la bande, déplaçant du métal pour former sur ledit côté des nervures solidaires (19) qui s'étenent normalement à la longueur de la bande, un ou plusieurs stades de travail suivants (2 à 3) conçus pour donner à la bande nervurée (25) la forme d'une bande (42) prête à servir comme coquilles de collecteur quand on coupe seulement en tronçons (45) la bande formée et que l'on donne aux tronçons la forme de cylindres (53), le stade de travail suivant (3) ou l'un de ceux-ci comprenant des moyens d'entaillage (32, 33) conçus pour entailler sous les extrémités des nervures et lever ces extrémités relativement au reste de la bande pour former des organes d'ancrage (41) pour les coquilles, et un ou plusieurs stades de travail finaux (4, 5) comprenant, en un seul stade ou en des stades séparés, des moyens (43, 44) servant à couper la bande formée en longueurs prédéterminées (45), des moyens servant à courber (46, 48, 52, 53) ces longueurs pour en former des cylindres (58), les organes d'ancrage étant vers l'intérieur, et une filière de calibrage rétrécie (61) et des moyens servant à pousser axialement les cylindres courbés à travers la filière pour former sur les cylindres des surfaces extérieures cylindriques lisses d'un diamètre désiré.

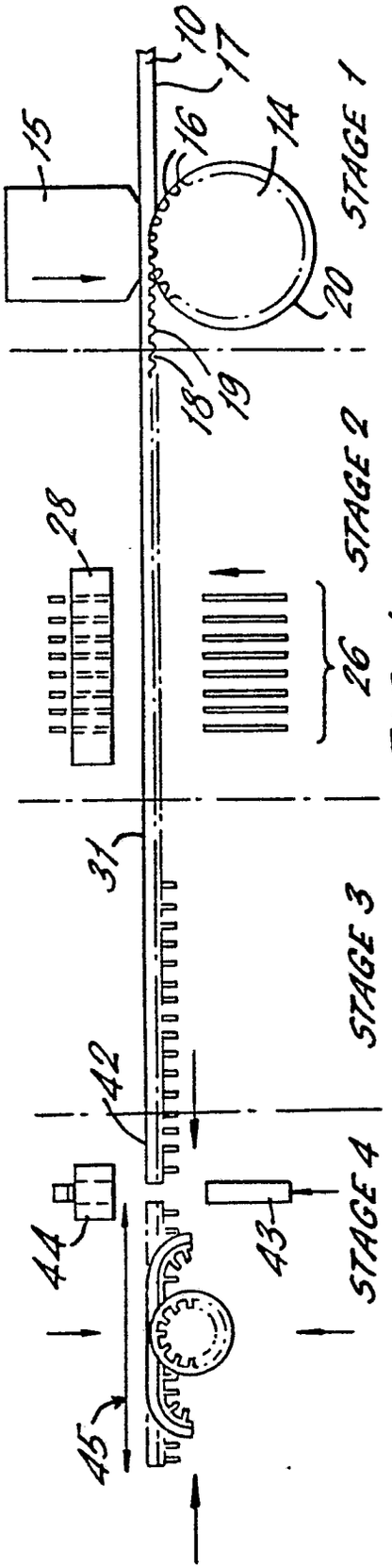

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STAGE 3
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STAGE 4
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FIG. 1.

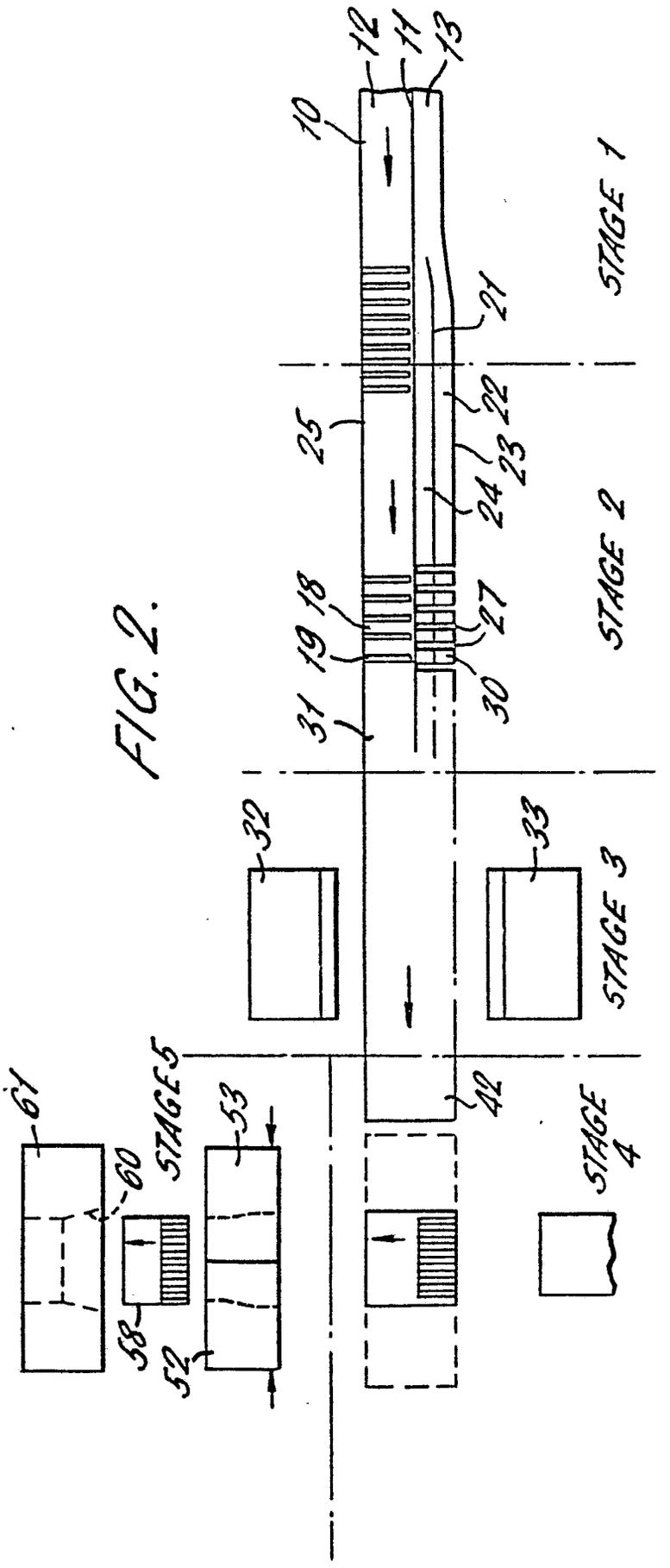

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STAGE 1
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STAGE 2
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STAGE 4

FIG. 2.

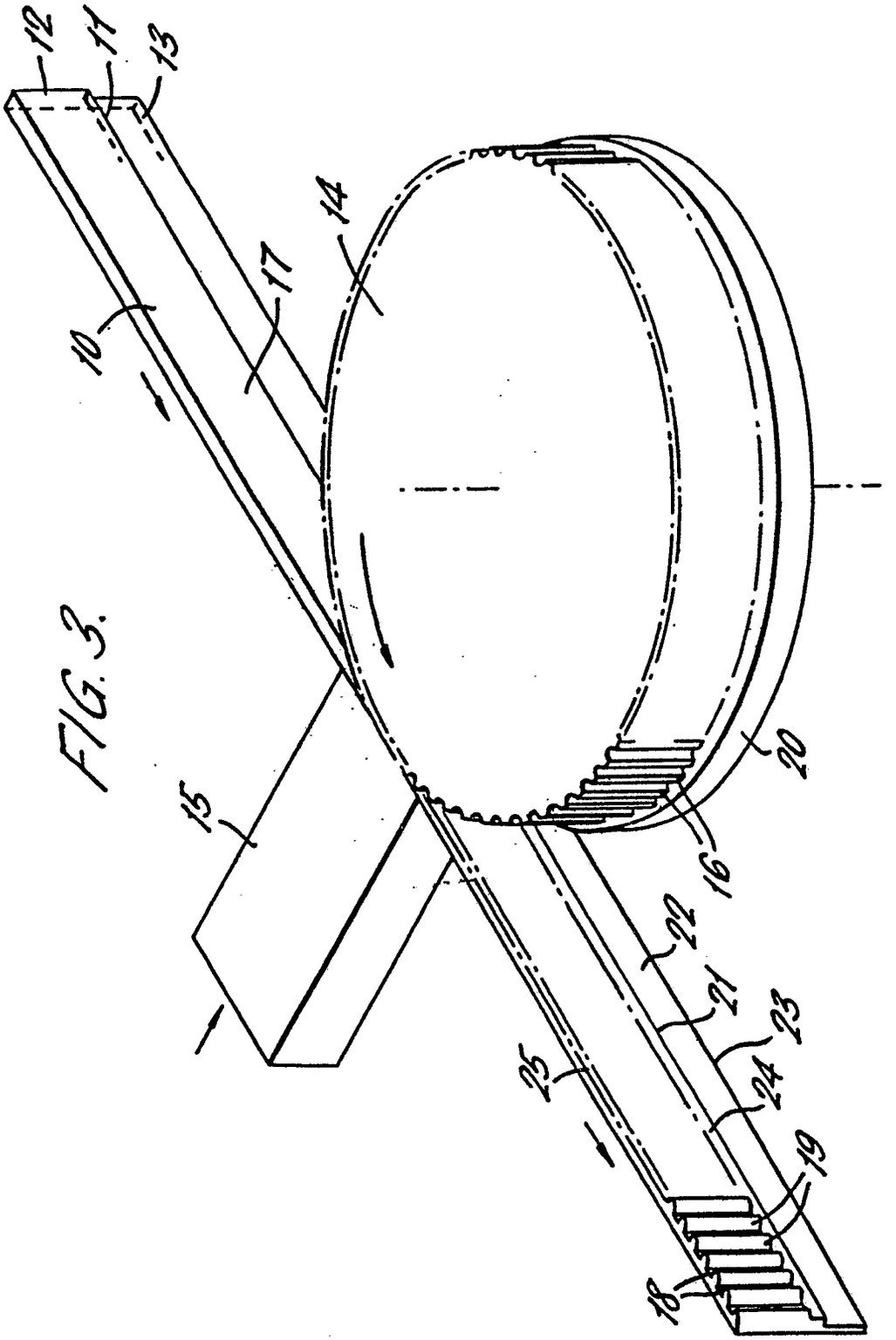


FIG. 3.

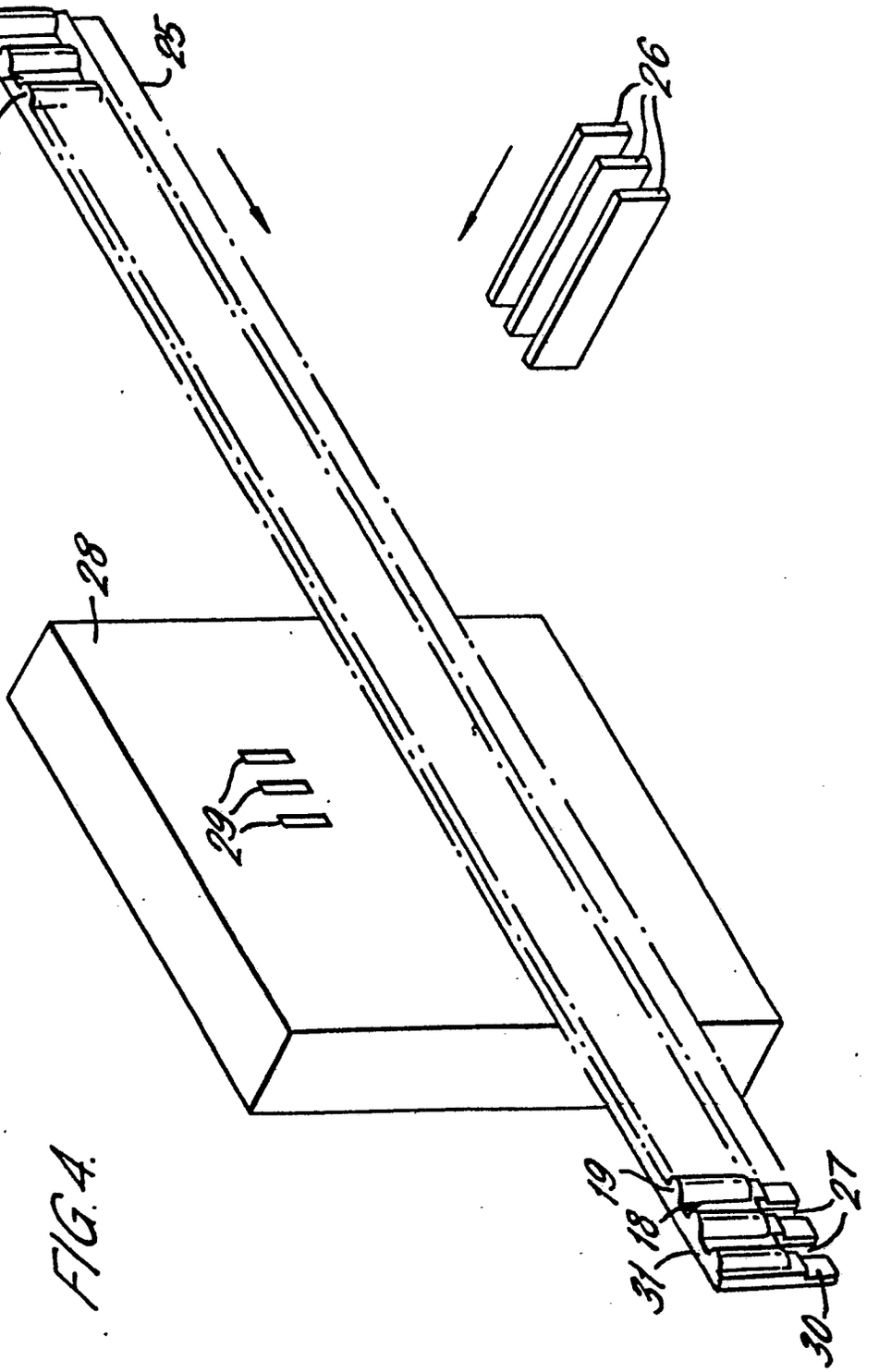


FIG.4

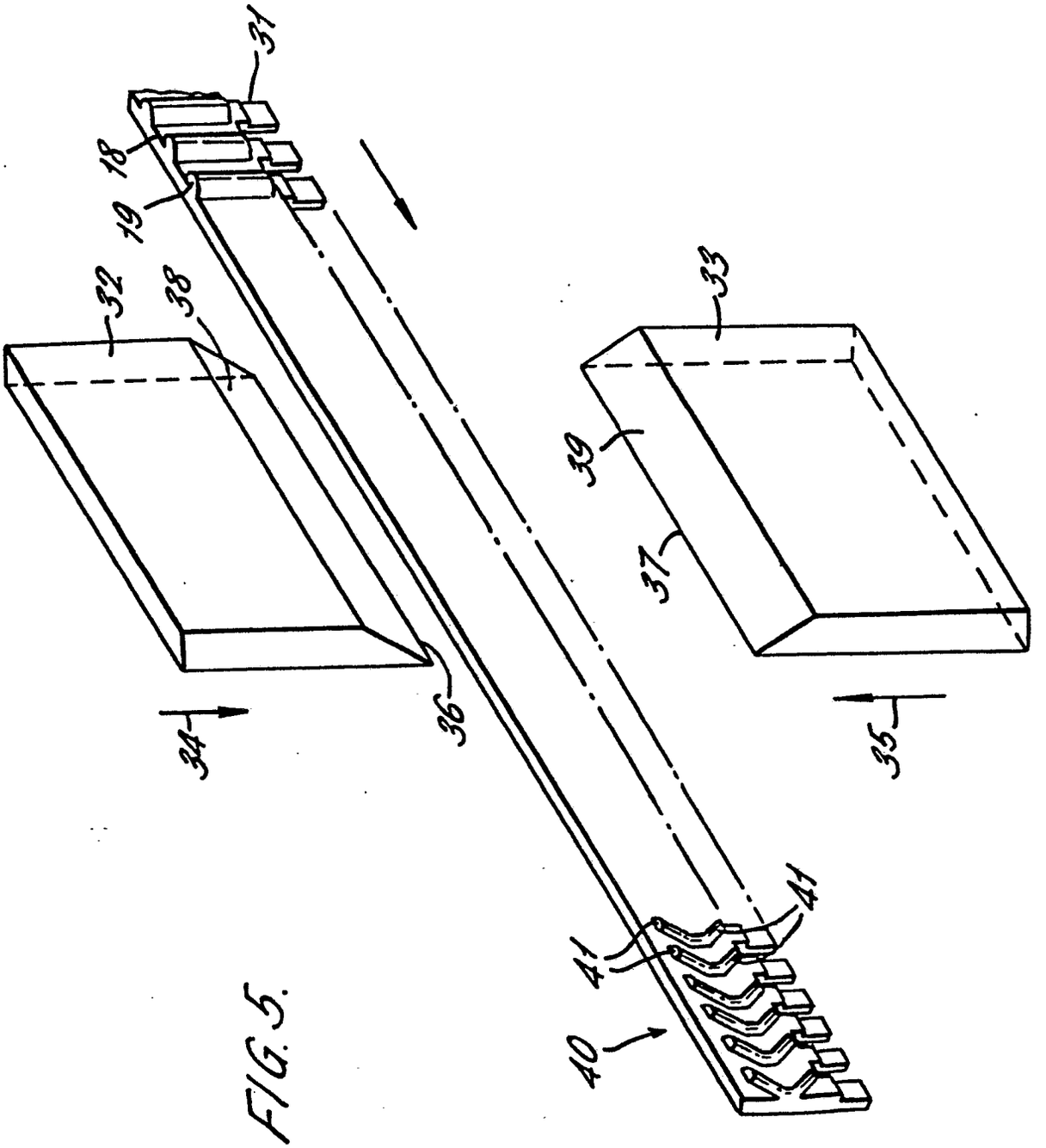


FIG. 5.

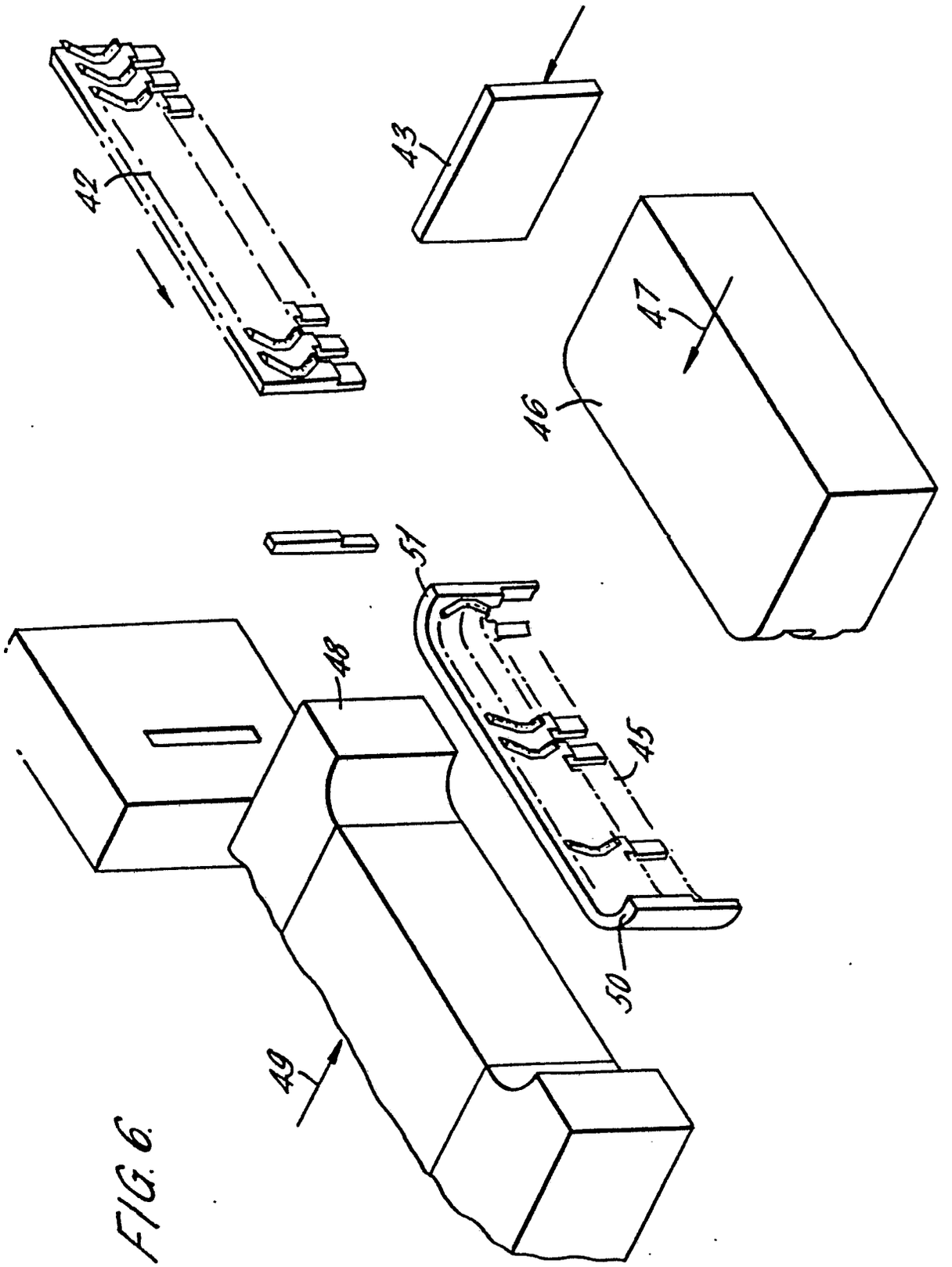


FIG. 6.

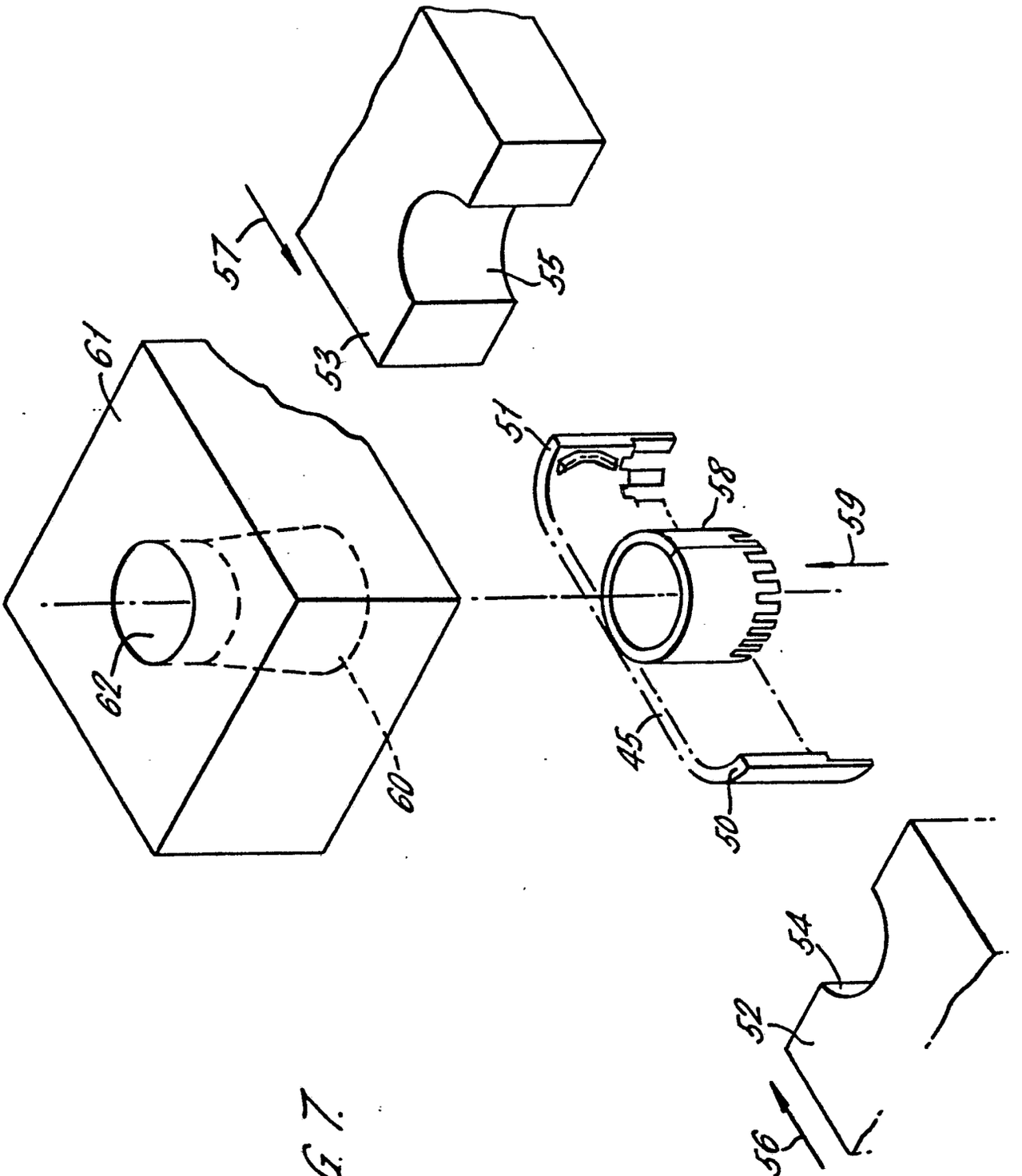


FIG. 7.

FIG. 8.

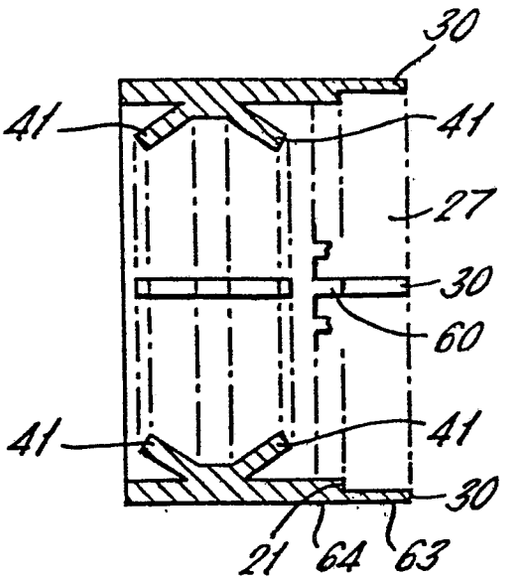


FIG. 9.

