(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 817 332 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.01.1998 Bulletin 1998/02

(51) Int. Cl.[6]: **H01R 43/08**

(21) Application number: **97110639.8**

(22) Date of filing: **30.06.1997**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV RO SI

(30) Priority: **05.07.1996 IT TO960580**

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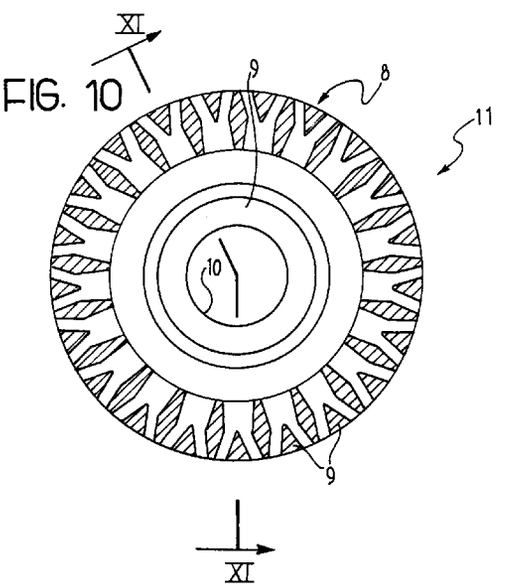
(54) A method of manufacturing a commutator for electrical machines

(57) The method comprises the steps of providing a strip (1) of conductive material, particularly copper, subjecting the strip (1) to plastic deformation so as to form therein parallel grooves (2) between which a plurality of equally-spaced transverse segments (3) is defined, the segments being interconnected by connecting bridges (4), bending a portion of the strip (1) so as to form a ring (7) with the segments (3) spaced equiangularly, incorporating the ring (7) in an insulating material (9) which extends into the grooves (2) defined between the segments (3) so as to form a monolithic annular structure (11) the axis of which coincides with the axis of the ring (7), and machining the structure (11) with the removal of material, to remove the connecting bridges (4) so that the segments (3) are separated and insulated from one another.

FIG. 10



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Description

The present invention relates to a method of manufacturing a commutator for electrical machines.

Known methods provide for the preparation of preforged or sintered conductor bars which are then incorporated in an electrically-insulating plastics material by moulding so as to form a monolithic annular structure.

Other known methods provide for the production of the bars by extrusion and subsequent blanking, cold forming, and calibration operations, etc.

The object of the present invention is to provide a method which can be implemented easily and cheaply and which requires the use of materials which are inexpensive and easily-obtained.

This and other objects are achieved, according to the invention, by a method, characterized in that it comprises the steps of:

providing a strip of electrically-conducting material, particularly copper,

subjecting the strip to a plastic deformation step so as to form therein a plurality of parallel grooves between which a corresponding plurality of equally-spaced transverse segments is defined, the segments being interconnected on a principal face of the strip by thinner integral connecting bridges,

bending a portion of the strip thus deformed so as to form a ring with the segments spaced equiangularly,

incorporating the ring in an electrically-insulating material which extends into the grooves defined between the segments so as to form a monolithic annular structure the axis of which coincides with the axis of the ring, and

machining the surface of the structure with the removal of material to remove the bridges so that the segments are separated and are electrically insulated from one another.

Further characteristics and advantages of the invention will become clearer from the following detailed description given purely by way of non-limiting example, with reference to the appended drawings, in which:

Figure 1 is a perspective view of a strip of electrically-conducting material, such as copper, used in the implementation of the method according to the invention,

Figure 2 is a perspective view of the strip of Figure 1 after a plastic deformation step,

Figure 3 is a perspective view which shows a segment of the strip of Figure 2, after an incision step,

Figure 4 is a side view of a ring formed by the bending of a strip according to Figure 2,

Figure 5 is a section view taken on the line V-V of Figure 4,

Figure 6 shows the ring of Figure 4 after a step for bending its segments at one end,

Figure 7 is a section view taken on the line VII-VII of Figure 6,

Figure 8 shows the ring of Figure 6 after a further machining step,

Figure 9 is a section view taken on the line IX-IX of Figure 8,

Figure 10 shows the ring of Figure 8 incorporated by moulding in a structure of electrically-insulating material,

Figure 11 is a section view taken on the line XI-XI of Figure 10,

Figure 12 shows the ring of Figure 10 after further machining, that is, the commutator produced by the method according to the invention, and

Figure 13 is a section view taken on the line XIII-XIII of Figure 12.

The method according to the invention provides for a strip of electrically-conducting material, typically metal, such as copper in particular, as the starting material. This strip can be obtained, for example from a coil, suitably straightened.

In Figure 1 of the appended drawings, the initial metal strip is generally indicated 1.

The strip 1 is subjected to a plastic deformation step (coining) so as to form therein (Figure 2) a plurality of parallel grooves 2 between which a corresponding plurality of equally-spaced transverse segments 3 is defined, the segments being interconnected on a principal face of the strip by thinner integral connecting bridges 4.

A loop 5 and a tongue 6 are advantageously formed by an incision step in the top face of each segment 3, projecting from the surface of this face (Figure 3).

After this step, the strip 1 is cut into portions each of which includes a number of transverse segments 3 equal to the desired number of bars of the commutator to be produced.

Each portion of strip thus produced is then bent so as to form a ring 7 (Figure 4) with the segments 3 spaced equiangularly. The connecting bridges 4 extend

on the periphery of the ring 7 and the loops or hooks 5 and tongues 6 extend radially inwardly of the ring (see also Figure 5).

After this step, end portions of the segments 3 are bent radially outwardly as can be seen in Figures 6 and 7, possibly after preliminary partial cutting of the connecting bridges 4.

The bent portions of the segments are indicated 3a in Figures 6 and 7.

As shown in Figures 8 and 9, the bent ends 3a of the segments 3 of the ring are then cut and opened out so as to form a corresponding plurality of essentially coplanar forks 8.

The ring 7 is then incorporated in an electrically-insulating plastics material, for example, by injection moulding. The electrically-insulating material, indicated 9 in Figures 10 and 11, extends particularly into the grooves or spaces 2 defined between adjacent segments 3 of the ring. The moulded insulating material, together with the ring 7, forms a monolithic annular structure with a central axial duct 10, the axis of which coincides with the axis of the ring 7 (see Figures 10 and 11).

The insulating material is advantageously but not necessarily moulded so as also to fill the spaces defined between adjacent forks 8 of the ring 7 as well as between the prongs of the forks (Figure 10).

As can be appreciated, in particular from Figure 11, the hooks 5 and the tongues 6 of the segments 3 of the ring 7 advantageously act as elements for anchoring the segments firmly in the structure of moulded plastics material.

The surface of the ring thus produced, now indicated 11 in Figures 10 and 11, is then machined with the removal of material, for example, by turning, to give the ring 11 a perfectly smooth outer surface. In particular, this machining also removes the connecting bridges 4 so that, upon completion of the machining, the segments 3 are separated and are electrically-insulated from one another.

Recesses 13 are hollowed out in the forks 8, also by further machining with the removal of material (Figure 12), to act as seats for the anchorage of the terminals of the windings of the electrical machine for which the commutator is intended.

Figures 12 and 13 thus show the final appearance of the commutator upon completion of the method described above.

Naturally, the principle of the invention remaining the same, the forms of embodiment and details of construction may be varied widely with respect to those described and illustrated purely by way of non-limiting example, without thereby departing from the scope of the present invention as defined in the attached claims.

Claims

1. A method of manufacturing a commutator for electrical machines, characterized in that it comprises the steps of:

   providing a strip (1) of electrically-conducting material, particularly copper,

   subjecting the strip (1) to a plastic deformation step so as to form therein a plurality of parallel grooves (2) between which a corresponding plurality of equally-spaced transverse segments (3) is defined, the segments being interconnected on a principal face of the strip (1) by thinner, integral connecting bridges (4),

   bending a portion of the strip (1) thus deformed so as to form a ring (7) with the segments (3) spaced equiangularly,

   incorporating the ring (7) in an electrically-insulating material (9) which extends into the grooves (2) defined between the segments (3) so as to form a monolithic annular structure (11) the axis of which coincides with the axis of the ring (7), and

   machining the surface of the structure (11) with the removal of material to remove the connecting bridges (4) so that the segments (3) are separated and electrically insulated from one another.

2. A method according to Claim 1, characterized in that the portion of the strip (1) is bent into a ring with the connecting bridges (4) in its radially outermost portion.

3. A method according to any one of the preceding claims, characterized in that, before the strip portion (1) is bent into a ring, projections (5, 6) are formed in the opposite faces of the segments (3) to the connecting bridges (4) to improve the anchorage of the segments (3) in the electrically-insulating material (9).

4. A method according to any one of the preceding claims, characterized in that, before the ring (7) is incorporated in the insulating material (9), homologous end portions (3a) of the segments (3) are bent radially outwardly and are then cut so as to form a corresponding plurality of forks (8) for defining seats for the anchorage of the terminals of the windings of the electrical machine for which the commutator is intended.

5. A commutator for electrical machines produced by the method according to one or more of the preceding claims.

FIG. 1

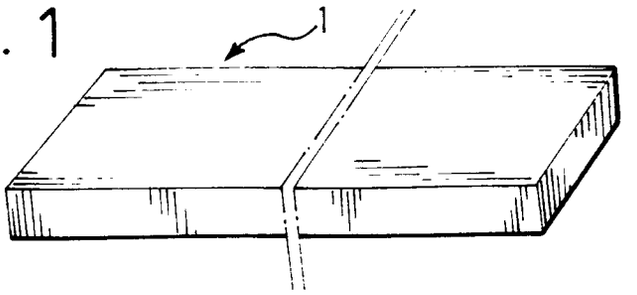


FIG. 2

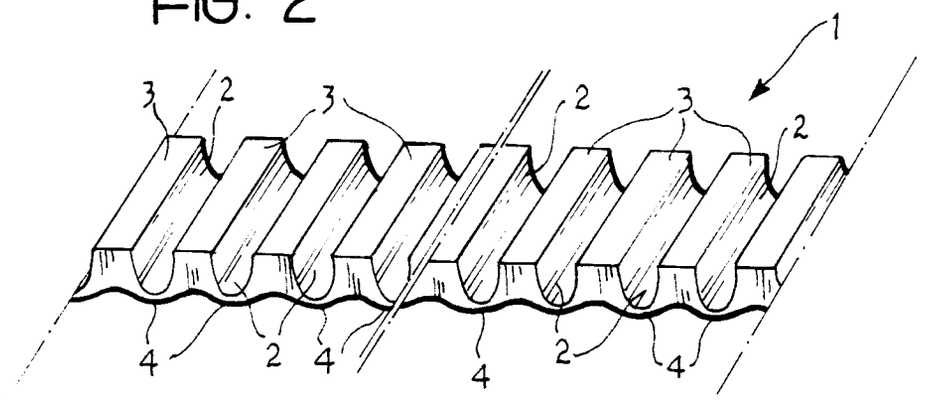


FIG. 3

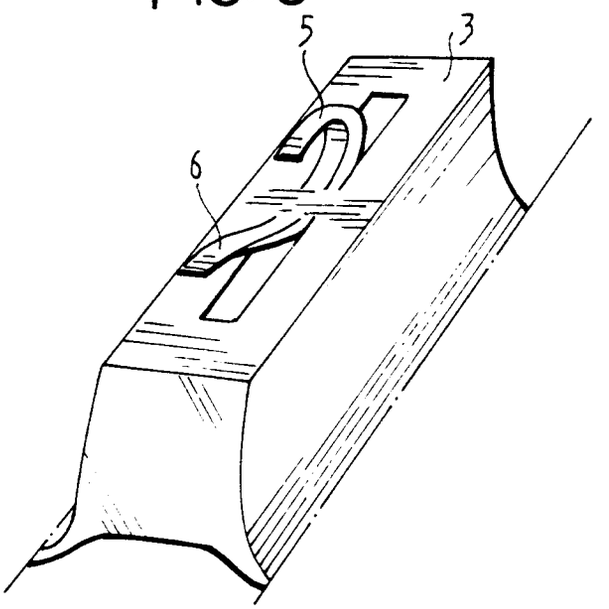


FIG. 4

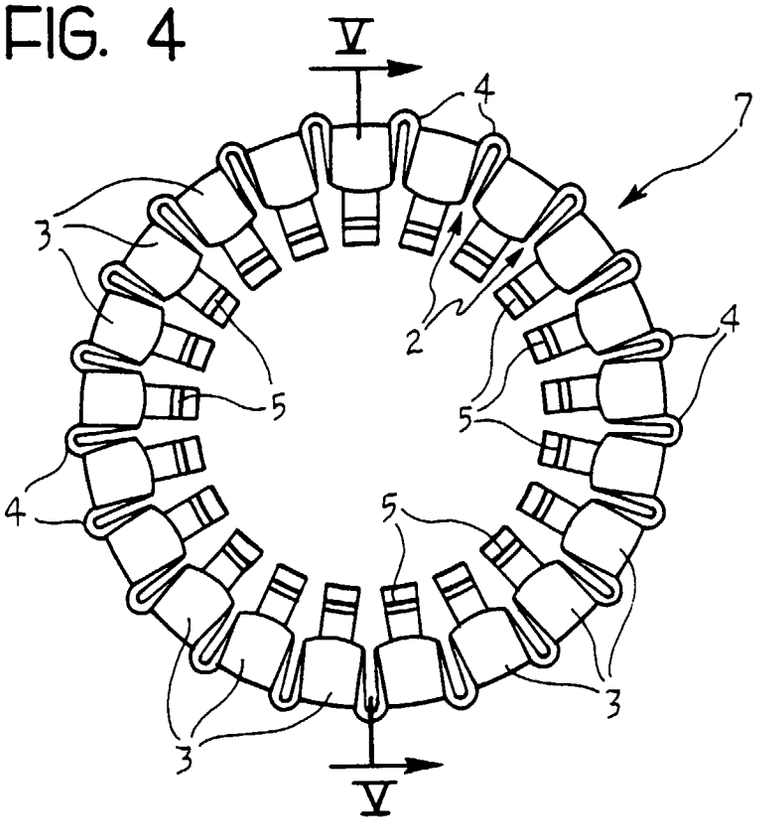


FIG. 5

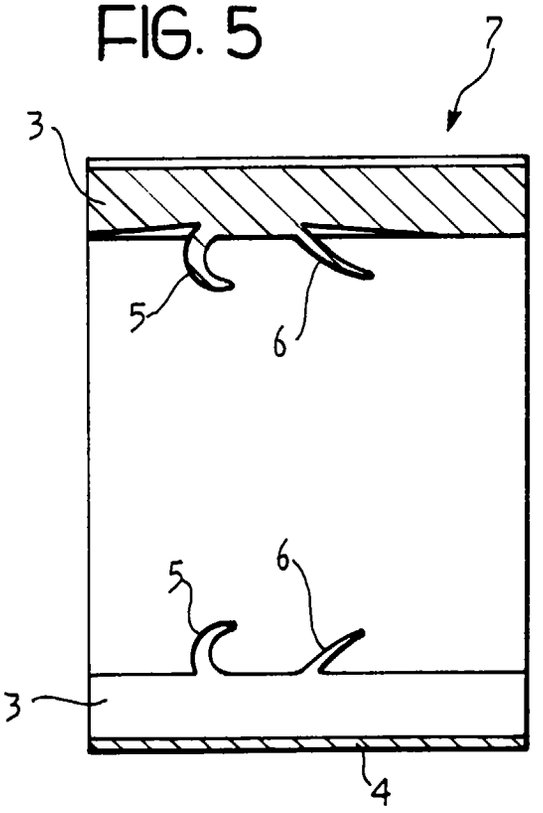


FIG. 6

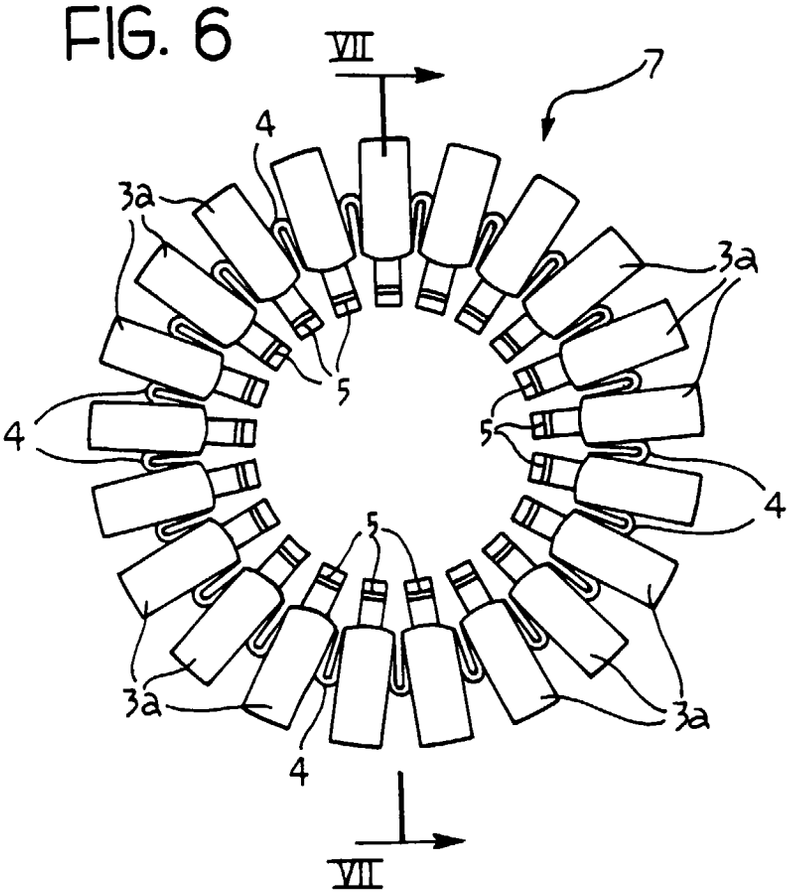


FIG. 7

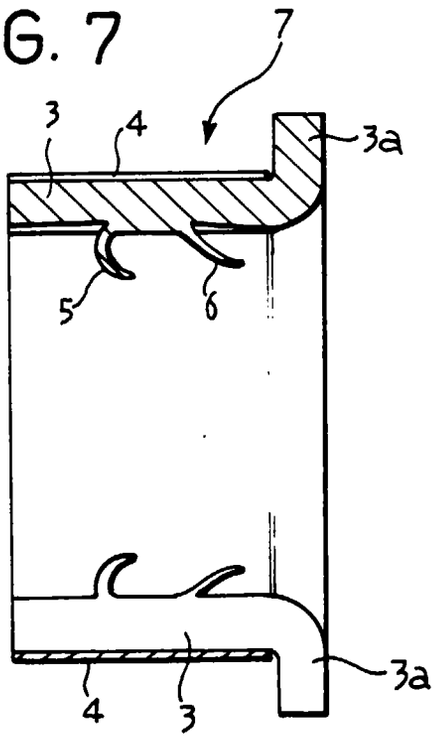


FIG. 8

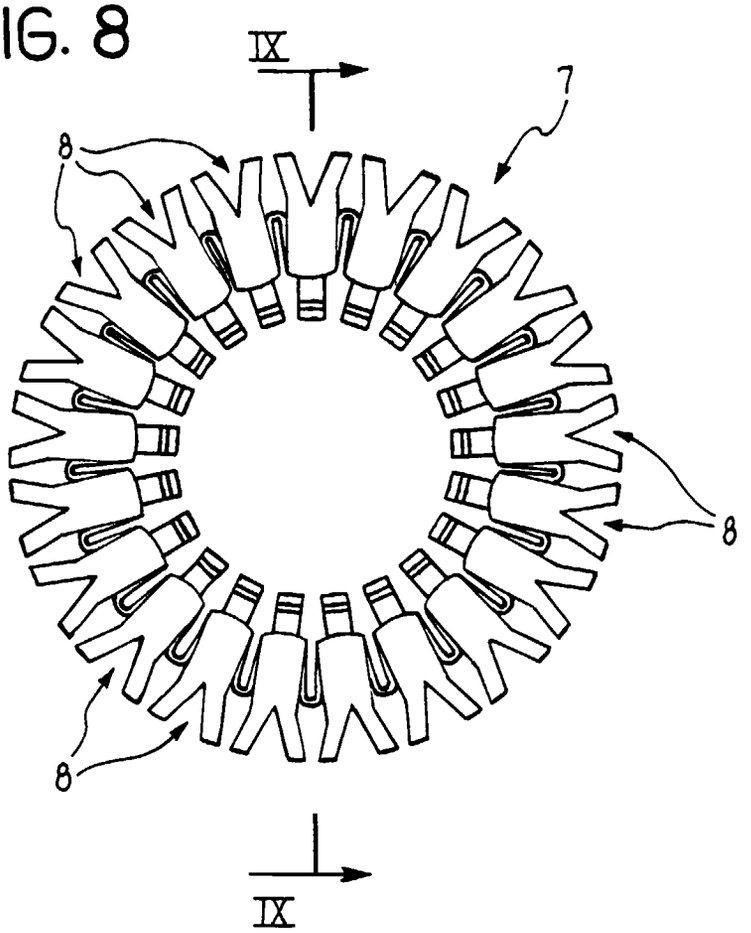


FIG. 9

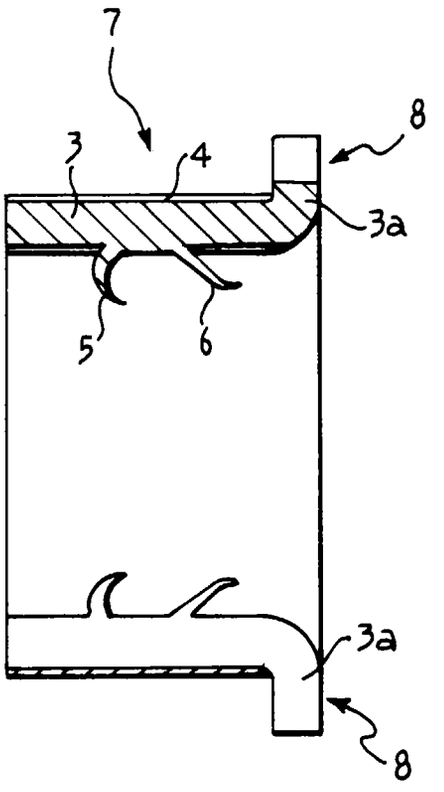


FIG. 10

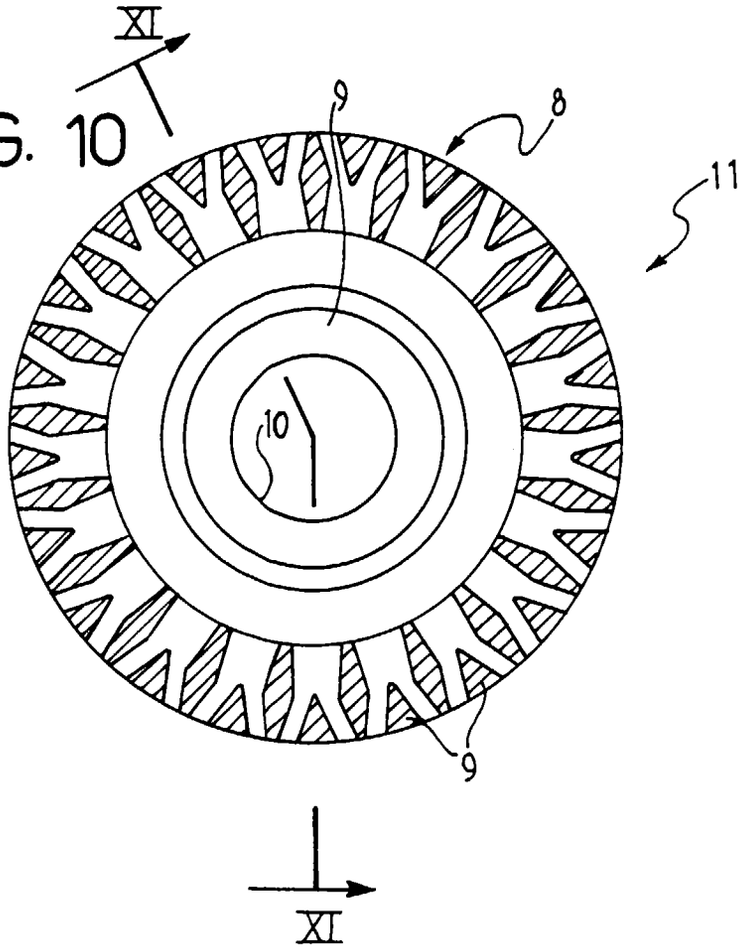


FIG. 11

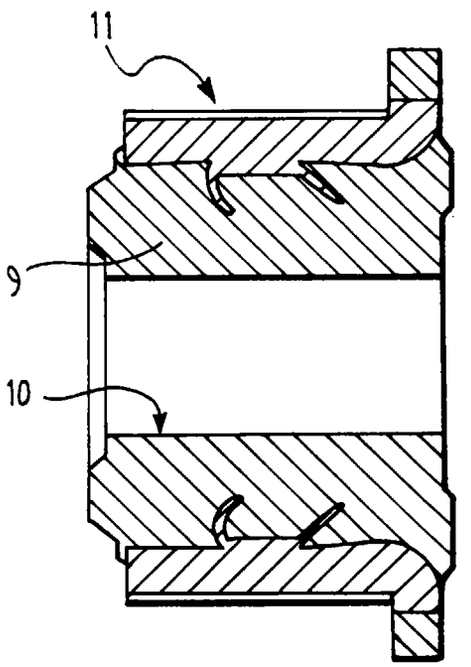


FIG. 12

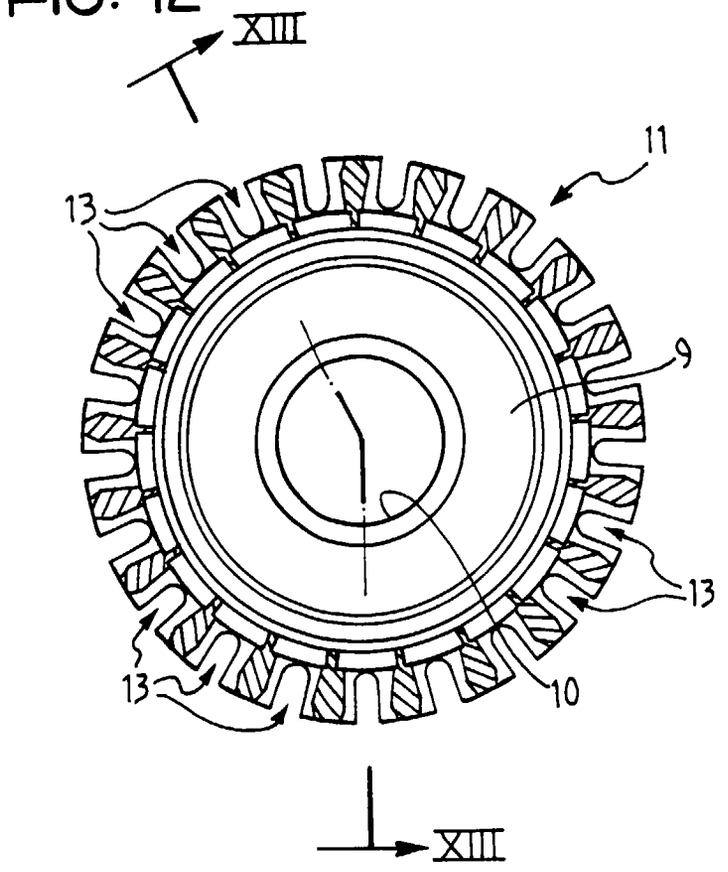
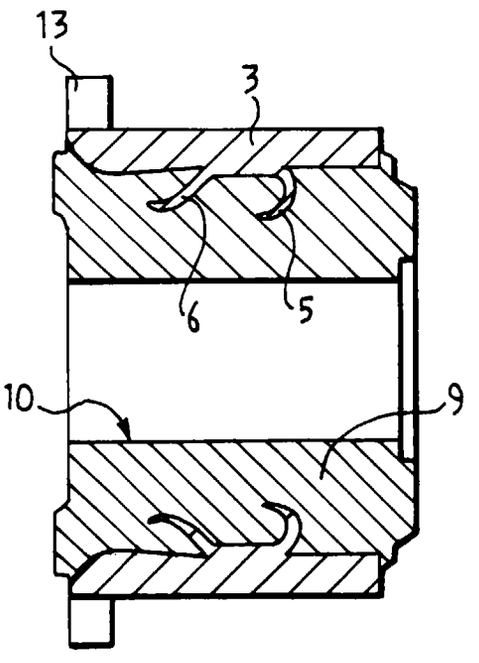


FIG. 13



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EUROPEAN SEARCH REPORT

Application Number
EP 97 11 0639

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	FR 2 458 156 A (SOCIATA COMMERCIALE DES FABRICATIONS PAUL DAHL) 26 December 1980 * claim 5; figures 1-11 * ---	1-5	H01R43/08
X	US 4 559 464 A (STOKES VIJAY K) 17 December 1985 * column 6, line 37 - column 7, line 51; figures 9-12 * ---	1-5	
X	DE 19 51 208 U (ROBERT BOSCH GMBH) 24 October 1966 * the whole document * -----	1-5	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 September 1997	Criqui, J-J

CATEGORY OF CITED DOCUMENTS

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