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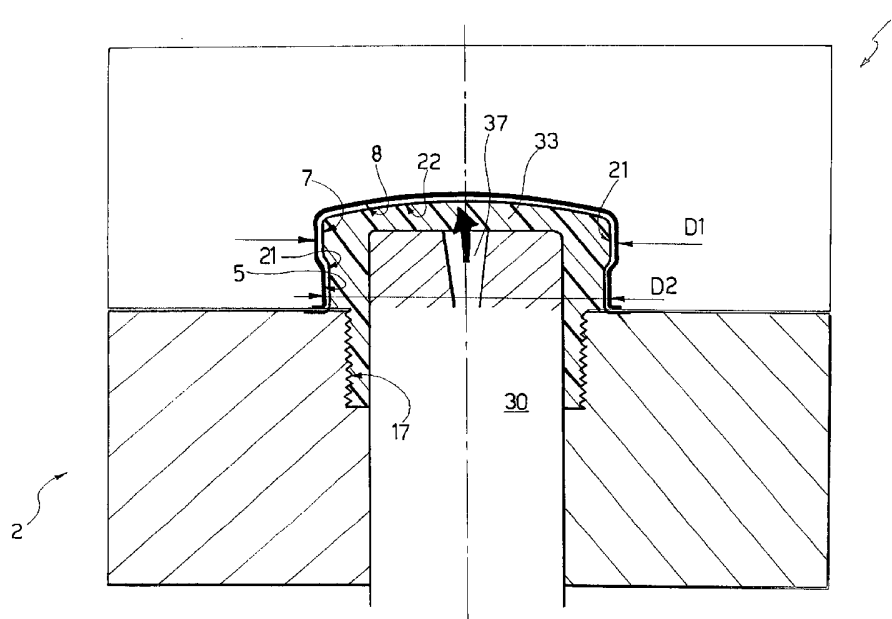
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF INJECTION MOLDING A PART OF PLASTIC MATERIAL



(57) Abstract: A molding method including the steps of: providing at least one mold (1, 2) having at least one inner cavity (4); placing inside the cavity (4) a body (20) defined by a sheet of deformable metal material; injecting plastic material (33) under pressure inside the cavity (4) to deform the sheet towards the walls of the cavity, so that the sheet rests on the walls (5, 7, 8) and assumes the shape of at least part of the cavity (4); allowing the injected material to set, and extracting a body of plastic material formed in one piece and having one portion covered with a shaped sheet of metal.

METHOD OF INJECTION MOLDING A PART OF PLASTIC MATERIAL

TECHNICAL FIELD

10 The present invention relates to a method of molding
a part of plastic material.

BACKGROUND ART

Methods of molding parts of plastic material are known in which liquid plastic material is injected under
15 pressure into a mold cavity; and the molds comprise a
number of component parts, which can be disassembled to
remove the part from the mold once the plastic material
has set and cooled.

In many applications, a portion of the molding is
20 coated with metal for aesthetic and/or structural
reasons.

The metal coating is normally deposited
electrochemically, e.g. by chromium or nickel plating.

Known methods, however, fail to provide for
25 obtaining a metal coating of appropriate thickness and
consistency, so that the coating is easily removed, e.g.
by wear.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a method of molding parts of plastic material, designed to eliminate the drawbacks of known methods.

According to the present invention, there is
5 provided a method of molding a part of plastic material, **characterized by** comprising the steps of: providing at least one mold having at least one inner cavity; placing inside said cavity a body defined by a sheet of deformable metal material; injecting plastic material
10 under pressure inside said cavity to deform said sheet of metal material towards the walls of said cavity, so that said sheet of metal material rests on said walls and assumes the shape of at least part of said cavity; allowing said plastic material to set, and extracting a
15 body of plastic material formed in one piece and having at least one portion covered with a shaped sheet of metal.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred, non-limiting embodiment of the
20 invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a longitudinal section of a mold which may be used to implement the method according to the present invention;

25 Figure 2 shows a first step in the method according to the present invention;

Figure 3 shows a second step in the method according to the present invention;

Figure 4 shows a third step in the method according to the present invention;

Figure 5 shows, by way of example, a view in perspective of a part molded from plastic material and which can be produced using the method according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Figure 1 shows a mold which can be used to implement the method according to the present invention.

10 More specifically, the mold comprises a first top half-mold 1 defined by a number of parts (detailed later on); and a second bottom half-mold 2 also defined by a number of parts (not detailed for the sake of simplicity).

15 Top half-mold 1 defines a first cavity 4 defined by a cylindrical wall 5 coaxial with an axis 6, by an annular, substantially C-shaped wall 7 radially larger than cylindrical wall 5, and by a substantially flat wall 8 connected to annular wall 7 and crosswise to axis 6.

20 More specifically, half-mold 1 comprises a first and a second portion 10 and 11 facing each other and defining opposite portions of walls 5 and 7; and a third portion 13 defining wall 8 and the adjacent edge of annular wall 7.

25 Half-mold 2 defines a substantially cylindrical second cavity 16 coaxial with axis 6, communicating with cavity 4, and in turn defined by a wall portion 17 having a thread or similar (e.g. a profile forming a bayonet

connection).

In a first step in the method according to the present invention, a cup-shaped body 20 defined by a roughly 0.4-0.6 mm thick sheet of deformable metal material (e.g. aluminium) is inserted inside first cavity 4.

In the example shown, cup-shaped body 20 comprises a tubular portion 21 closed on a first side by an integral dome-shaped portion 22, and having a peripheral annular edge 24 extending radially outwards from a second side of tubular portion 21.

Cup-shaped body 20 is positioned coaxially with axis 6, with tubular portion 21 facing cylindrical wall 5 and annular wall 7, and with dome-shaped portions 22 facing wall 8; and half-molds 1 and 2 are positioned so that peripheral annular edge 24 is gripped in fluidtight manner between half-molds 1 and 2 in the closed position.

In a second step in the method according to the present invention, a male cylindrical member 30 is inserted inside second cavity 16 and a large portion of first cavity 4. More specifically, member 30 is positioned coaxially with axis 6, with an end portion 30a facing cup-shaped body 20, which is thus interposed between the walls defining cavity 4 and member 30.

In a third step in the method according to the present invention (Figure 4), thermoplastic material 33 is injected under pressure inside the gap 34 (Figure 3) defined by cup-shaped body 20 and member 30. The

injection pressure may conveniently be roughly 1200-2500 bars, and the injection temperature roughly 180-350 °C.

The injected thermoplastic material 33 exerts pressure (Pascal's law) on the sheet of metal material forming cup-shaped body 20, and pushes the sheet of metal material towards the walls of cavity 4 so that it rests on cylindrical wall 5, annular wall 7, and wall 8, thus assuming the shape of cavity 4. The thermoplastic material 33 injected into cavity 4 thus fills all the space between the deformed sheet of metal material and member 30.

The thermoplastic material 33 also penetrates second cavity 16 having no sheet of metal material, e.g. penetrates a cylindrical tubular gap between wall 17 and member 30.

Preferably, though not exclusively, member 30 has a nozzle 37 on end portion 30a, by which the liquid thermoplastic material 33 is expelled.

In a fourth step in the method according to the present invention, the injected thermoplastic material is allowed to set.

In a fifth step in the method according to the present invention, the mold is opened to extract the finished part. In the example shown, third portion 13 is detached and removed from first and second portion 10, 11.

First and second portion 10, 11 are then withdrawn in opposite directions to extract the part of plastic

material, complete with the cup-shaped body shaped by the operations described above, from half-mold 1.

Bottom half-mold 2 is then opened to extract the whole part.

5 Figure 5 shows, by way of a non-limiting example, a view in perspective of a part which can be produced using the method according to the present invention. The part shown is a fuel tank cap of a prestige vehicle (e.g. a limited-number sports car), which comprises a threaded
10 tubular portion made of plastic material and closed at one end by an integral portion covered with a shaped sheet of metal.

Obviously, the method described and illustrated herein also provided for producing parts other than the
15 one shown in Figure 5. For example, the method according to the present invention may be used to advantage for producing:

- a vehicle gear lever knob;
- a vehicle door handle body;
- 20 - an electric torch body;
- an umbrella handle;
- a handbag handle.

The finished part has a shaped metal layer of considerable thickness, which is not deposited, and which
25 is firmly retained on the part of plastic material; and the resulting mechanical consistency and look are far superior to those achievable using known methods.

The molding method also provides for so shaping the

sheet of metal material that, in section, it comprises at least a first portion of transverse dimensions D1 (Figure 4) greater than the transverse dimensions D2 of a second portion, so that the shaped sheet firmly envelopes the
5 underlying portion of plastic material.

Clearly, changes may be made to the method as described herein without, however, departing from the scope of the present invention.

CLAIMS

1) A method of molding a part of plastic material,
characterized by comprising the steps of:

- 5 - providing at least one mold (1, 2) having at least
one inner cavity (4);
- placing inside said cavity (4) a body (20) defined
by a sheet of deformable metal material;
- injecting plastic material (33) under pressure
10 inside said cavity (4) to deform said sheet of metal
material towards the walls of said cavity, so that said
sheet of metal material rests on said walls (5, 7, 8) and
assumes the shape of at least part of said cavity (4);
- allowing said plastic material to set, and
15 extracting a body of plastic material formed in one piece
and having at least one portion covered with a shaped
sheet of metal.

2) A method as claimed in Claim 1, wherein a cup-
shaped body is placed inside said cavity.

- 20 3) A method as claimed in Claim 2, wherein
peripheral edges (24) of said cup-shaped body are
disposed in fluidtight manner between mating portions (1,
2) of said mold.

- 4) A method as claimed in Claim 2 or 3, wherein a
25 member (30) is inserted inside a portion of said cavity
(4), with the cup-shaped body (20) interposed between the
walls defining the cavity (4) and said member (30); said
plastic material being injected into the space between

the cup-shaped body (20) and said member (30).

5) A method as claimed in any one of the foregoing Claims, and comprising the step of so shaping said sheet of metal material that, in section, it comprises at least a first portion having transverse dimensions (D1) greater than the transverse dimensions (D2) of a second portion, so that the shaped sheet firmly envelopes the underlying portion of plastic material.

6) A method as claimed in any one of the foregoing Claims, wherein said part alternatively defines any one of the following elements:

- a vehicle fuel tank cap;
- a vehicle gear lever knob;
- a vehicle door handle body;
- 15 - an electric torch body;
- an umbrella handle;
- a handbag handle.

7) A method of molding a vehicle fuel tank cap, **characterized by** comprising the steps of:

- 20 - providing at least one mold (1, 2) having at least one inner cavity (4);
- placing inside said cavity (4) a cup-shaped body (20) defined by a sheet of deformable metal material;
- injecting plastic material (33) under pressure
- 25 inside said cavity (4) and said cup-shaped body to deform said sheet of metal material towards the walls of said cavity, so that said sheet of metal material rests on said walls (5, 7, 8) and assumes the shape of at least

part of said cavity (4);

- allowing said plastic material to set, and
extracting a cap of plastic material formed in one piece
and having an end portion covered with a shaped sheet of
5 metal.

8) A method as claimed in Claim 7, wherein said
cavity (4) is defined by a cylindrical first wall (5)
coaxial with an axis (6), by an annular second wall (7)
radially larger than said cylindrical first wall (5), and
10 by a substantially flat third wall (8) connected to said
annular second wall (7) and crosswise to said axis (6).

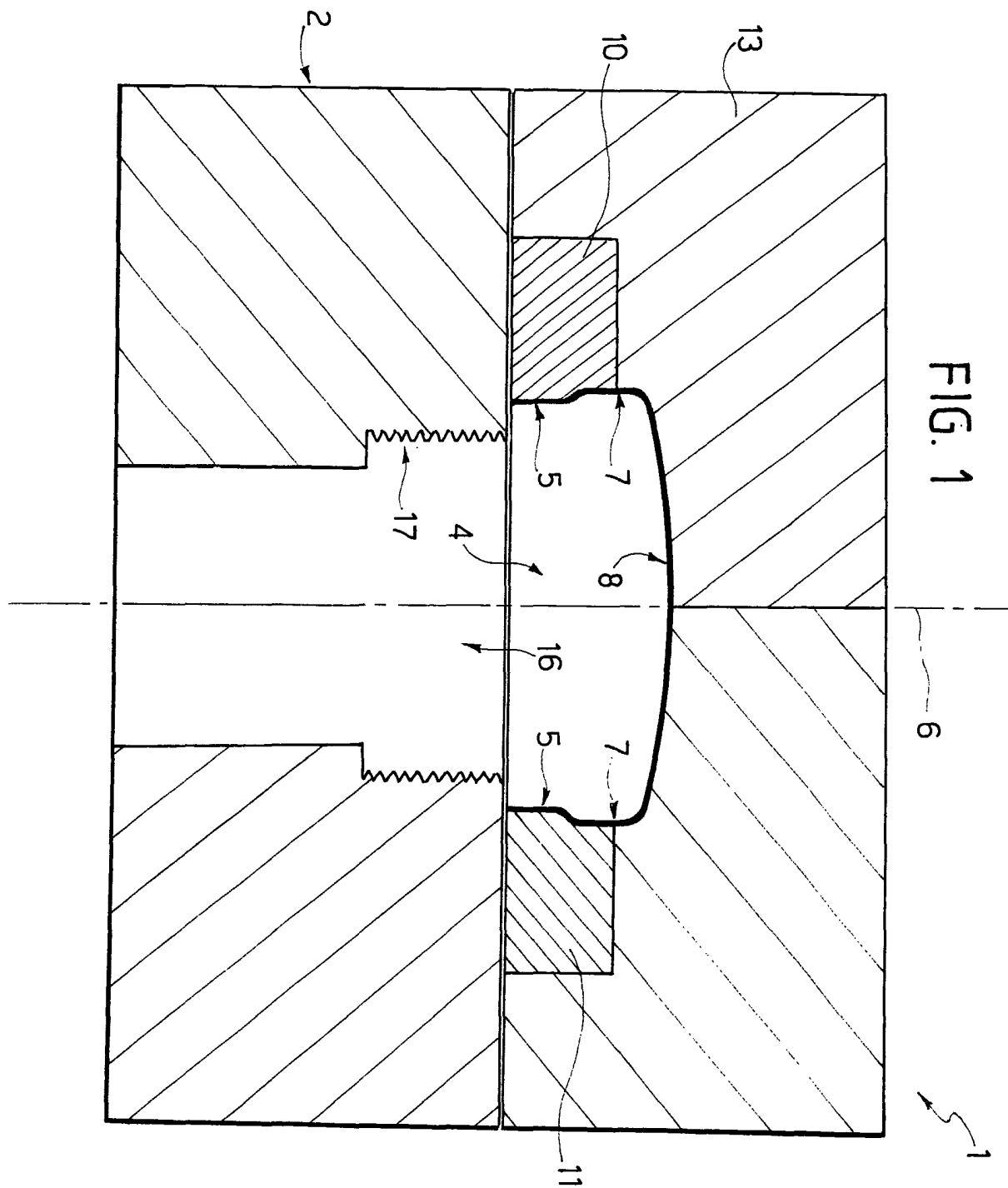
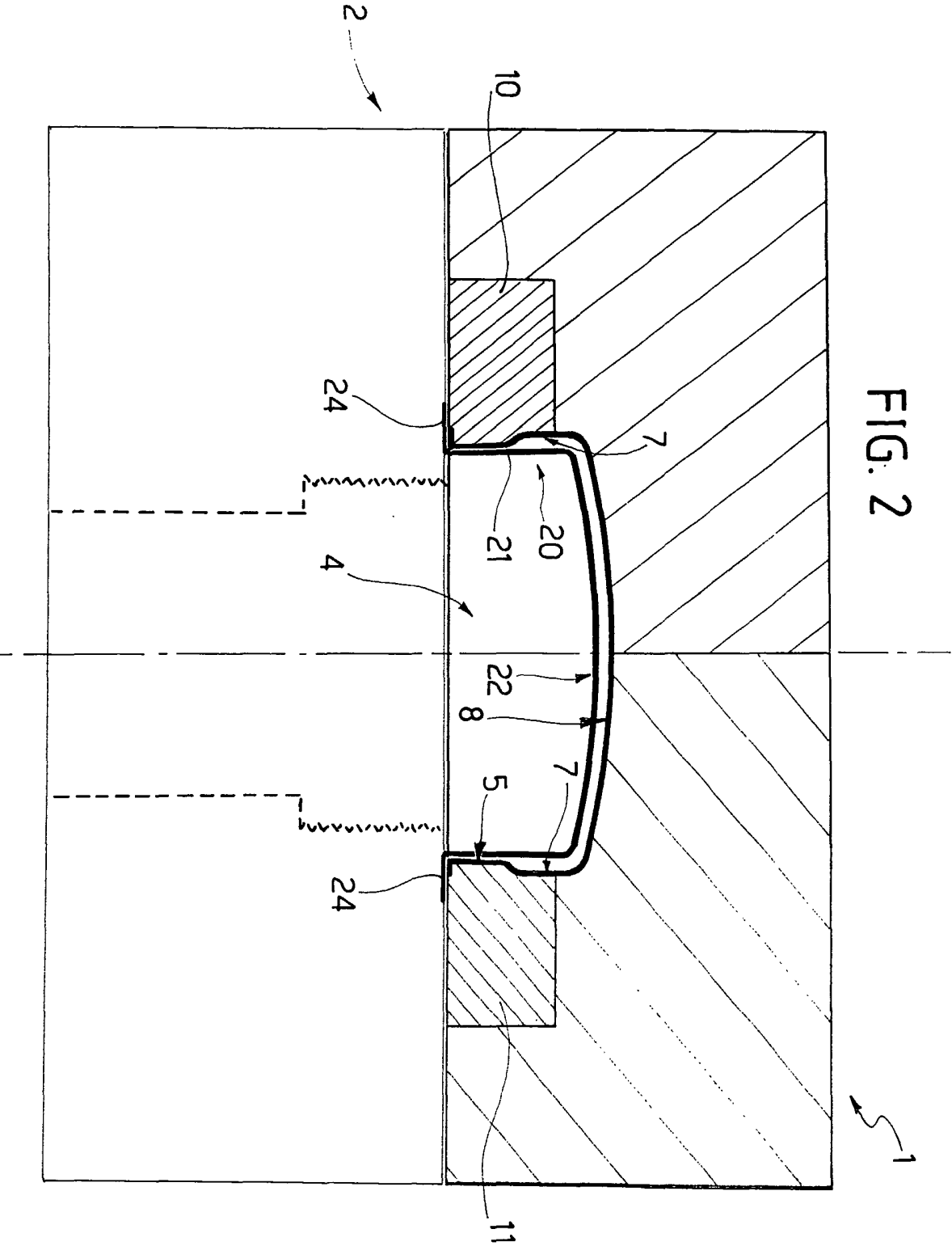


FIG. 2



FILE 3

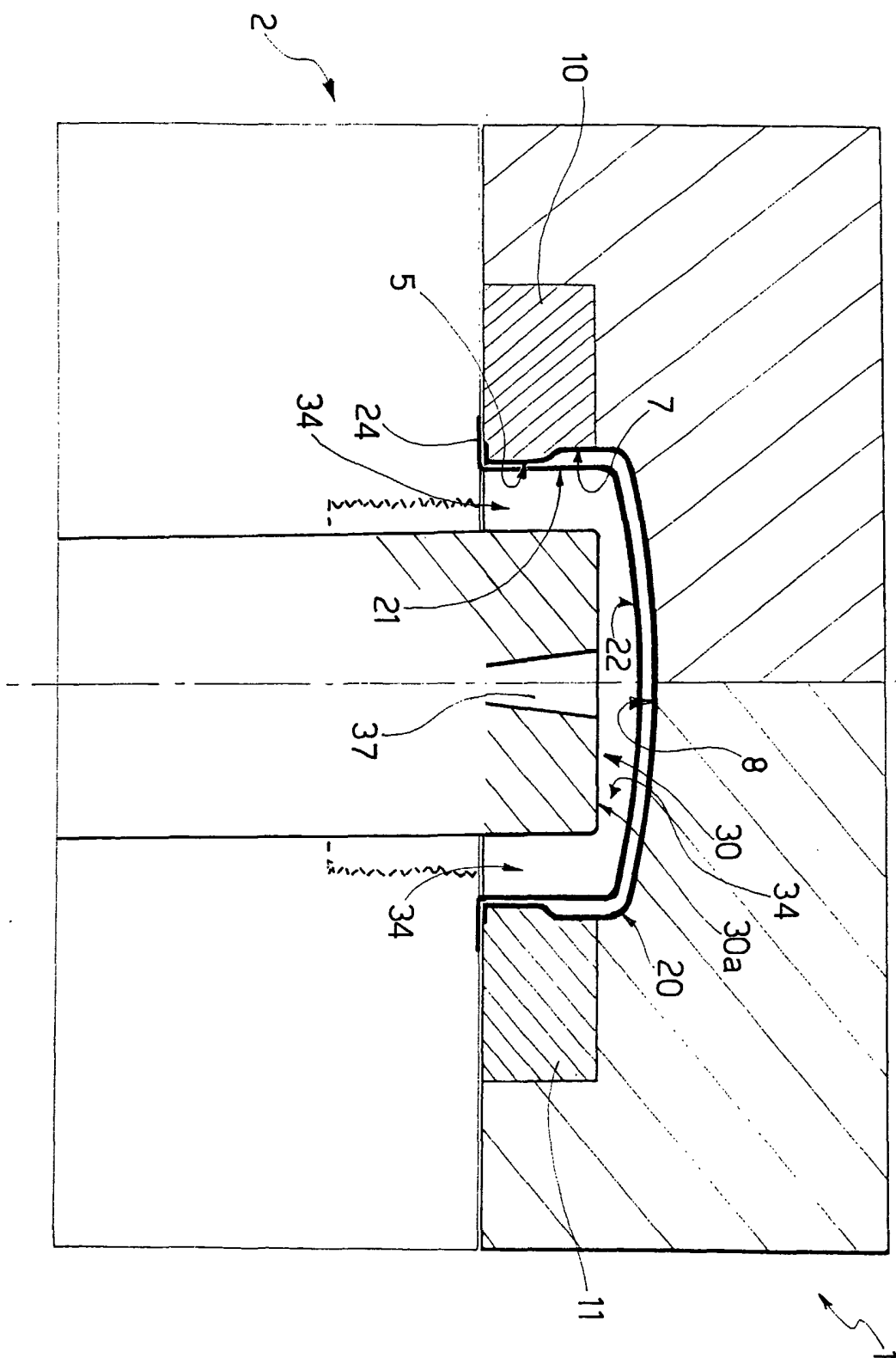
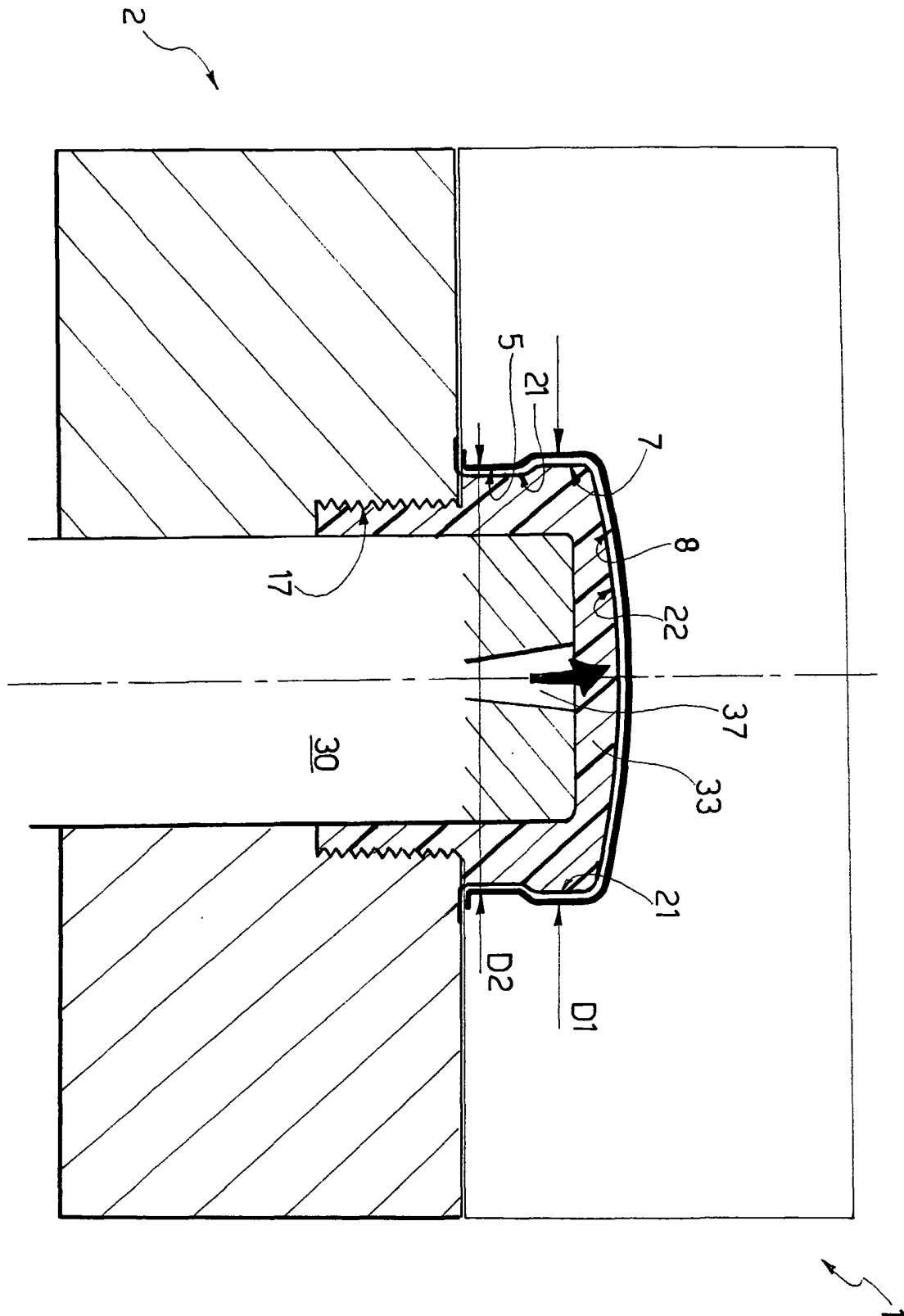


FIG. 4



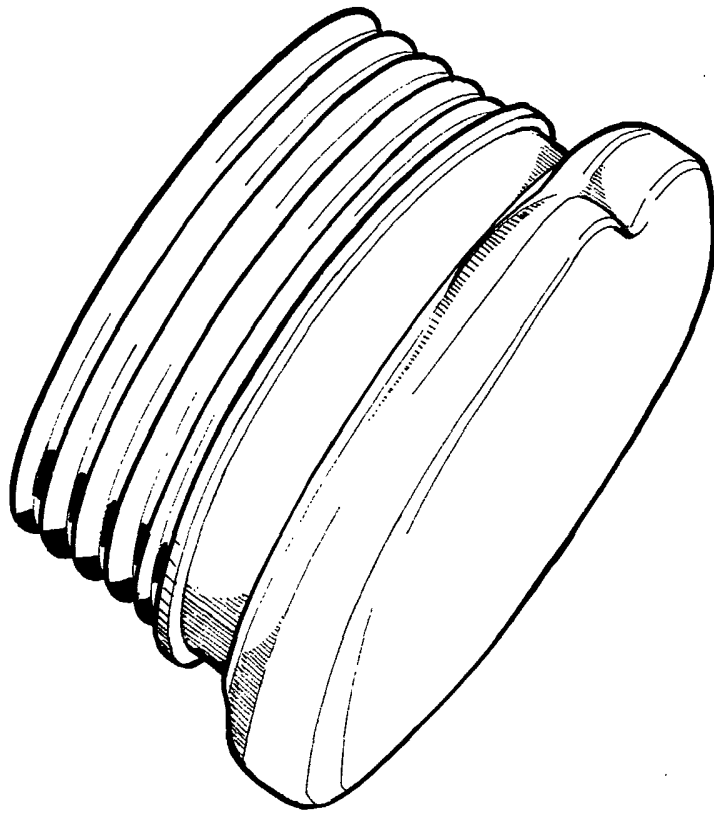


FIG. 5

INTERNATIONAL SEARCH REPORT

PCT/IT 03/00355

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C45/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B29C B60K H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 1 578 138 A (LE BOUCHAGE MECANIQUE) 14 August 1969 (1969-08-14) page 1-4; figures 1-3 ---	1-8
X	EP 0 867 334 A (SCHMIDT GMBH R) 30 September 1998 (1998-09-30) column 1 -column 4; figures 1-4,18-20 ---	1-5
X	PATENT ABSTRACTS OF JAPAN vol. 005, no. 043 (M-060), 23 March 1981 (1981-03-23) -& JP 56 000137 A (YOSHIDA KOGYO KK), 6 January 1981 (1981-01-06)	1,2,4-8
Y	abstract --- -/--	3

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 016, no. 153 (M-1235), 15 April 1992 (1992-04-15) -& JP 04 007113 A (YOSHINO KOGYOSHO CO LTD), 10 January 1992 (1992-01-10)	3
A	abstract; figures 1-9 ---	1,2,4-8
X	US 2 131 319 A (ENKUR EDWARD M ET AL) 27 September 1938 (1938-09-27)	1,2,4,7, 8
Y	the whole document ---	5,6
Y	US 2 158 044 A (HALLER CYRUS W) 9 May 1939 (1939-05-09) the whole document -----	5,6

INTERNATIONAL SEARCH REPORT

PCT/IT 03/00355

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 1578138	A	14-08-1969	NONE	
EP 0867334	A	30-09-1998	DE 19713074 A1	01-10-1998
			DE 59806660 D1	30-01-2003
			EP 0867334 A1	30-09-1998
			ES 2189012 T3	01-07-2003
JP 56000137	A	06-01-1981	NONE	
JP 04007113	A	10-01-1992	JP 2954651 B2	27-09-1999
US 2131319	A	27-09-1938	NONE	
US 2158044	A	09-05-1939	GB 331991 A	17-07-1930
			DE 596830 U	
			US 2288735 A	07-07-1942
			US 2317963 A	27-04-1943
			US 2431393 A	25-11-1947