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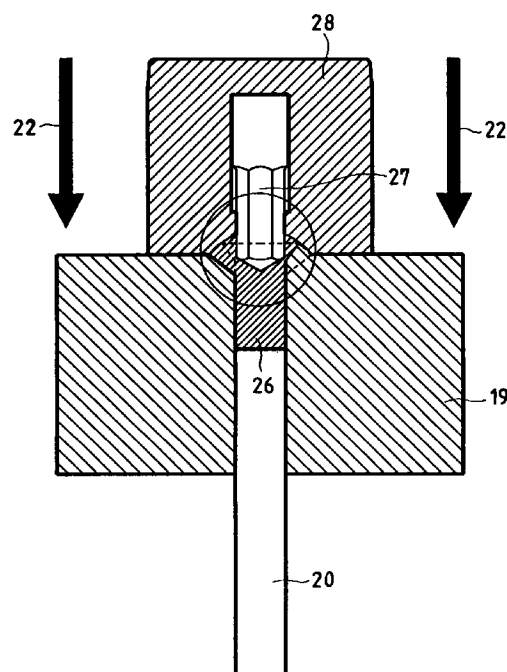
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(54) **Cold extrusion method for forming a bevel gear integral with a rotation pivot, and the gear obtained by said method**

(57) The invention provides a method and mould for forming, by cold extrusion of a metal blank, a small-dimension bevel gear (34) integral with a rotation pivot (26) extending from the roots of the teeth (33) of said gear (34).

Fig.9



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Description

This invention relates to a method for forming, by the cold extrusion of a metal blank, a small-dimension bevel gear integral with a rotation pivot, the pivot extending from the root of the teeth of said gear.

The invention also relates to the gear obtained by said method, and the mould for its implementation.

In various applications it would be desirable to use a bevel gear integral with a rotation pivot for transmitting motion between two mutually perpendicular axes.

A non-limiting example of such application are mechanisms for adjusting the height of concealed connections for wall-mounted kitchen furniture. See EP-A-389054.

However the application of bevel gear pairs for this purpose is extremely limited because the relatively small dimensions required of the gears complete with their rotation pivot result in very high production costs, especially if said bevel gears are to be applied to products of wide consumption.

The general object of the present invention is therefore to provide an economical method which enables, by cold extrusion, a small-dimension bevel gear integral with a rotation pivot to be formed, as part of a bevel gear pair for transmitting motion between mutually perpendicular axes.

A further object of the invention is to provide a mould for implementing the method.

Said objects are attained by the use of the method and mould having the characteristics defined in the accompanying claims.

The characteristics of the extrusion method according to the invention will be more apparent from the description thereof given hereinafter with reference to the accompanying schematic drawings, in which:

Figures 1 to 13 show schematically the steps of said method; and

Figure 14 is an enlarged view of the bevel gear complete with rotation pivot, obtained by the method and mould of the invention.

With reference to Figure 1, the method of the invention for extruding a small-dimension bevel gear integral with a rotation pivot starts with a metal wire 10 which is made to advance stepwise, guided by a head 12, in the direction of the arrow 11 until it abuts against a mechanical stop 13, which determines the exact length "l" of the end piece 14 of wire 10 to be used.

Said piece 14 is cut from the wire 10, as shown in Figure 2, by a blade 15 which advances in the direction of the arrow 16, so as to obtain a pin 17 forming the blank to be used for the cold extrusion of a small-dimension bevel gear with an integral rotation pivot extending from the root of the teeth of said gear.

The pin 17 obtained in this manner is inserted into a die 18 of configuration corresponding to that of the finished article to be obtained.

The die 18 is formed within a so-called anvil 19 of a mould provided with an extractor 20 for the extruded article (Figure 3).

The pin 17 is only partly inserted into the die 18, an end portion projecting from the die as clearly seen in Figure 3, to be deformed by a first hammer 21 of said mould (Figures 4-7), which moves in the directions of the arrows 22, 23.

To effect a controlled first deformation of the pin 17, the hammer 21 is provided with a cavity 24 arranged to engage the projecting free end of the pin 17 (Figure 5), so as to define on the pin 17 a terminal head 25, serving as the base blank for the definitive extrusion of the bevel gear, the remaining part of the pin 17 defining a rotation pivot 26 for said gear (Figures 5-7).

As can be clearly seen from the enlarged view shown in Figure 6 of the drawings, sections 32 of the gear teeth 33 are already formed in the terminal head 25 in correspondence with the roots of the teeth 33.

The gear is formed from the head 25 by a punch 27 provided in a second hammer 28, the punch 27, by being lowered from the position shown in Figure 8 to the position shown in Figure 9, deforming said head 25 so as to further expand the material and cause it to completely fill the empty spaces in the die 18 with precision (see Figures 9 and 10, and Figure 11 which represents an enlargement of Figure 9 in correspondence with the extrusion region for the gear teeth, so as to obtain a bevel gear 34 integral with the pivot 26.

For this purpose the second hammer 28 has a partly spherical cavity 29 which correspondingly shapes the summit of the teeth 33 of the gear 34.

It should be noted that said cavity 29 closes the top of the die 18 with great precision and in a sealed manner, so preventing inadmissible escape of material from the closed mould.

Preferably, but not necessarily, the punch 27 is of polygonal shape, for example hexagonal, so as to define in the bevel gear a seat 30 for an operating key.

As shown in Figures 12, 13, the bevel gear 34 complete with rotation pivot obtained by the method of the invention is extracted from the anvil 19 by moving the extractor 20 in the direction of the arrow 31.

The economy of the method of the invention for large-scale production will be apparent to the expert of the art.

The object stated in the introduction to the description is hence attained, namely forming, by cold extrusion of a metal blank, a small-dimension bevel gear with an integral rotation pivot extending from the root of the gear teeth, and possibly also provided with a seat for an operating key.

Claims

1. A method for forming, by cold extrusion of a metal blank, a small-dimension bevel gear integral with a rotation pivot, comprising the following steps:

- inserting a pin (17) into a die (18) in an anvil (19), said die having a configuration corresponding to that of the finished article to be obtained, a terminal portion of said pin (17) projecting from said die (18); 5
 - deforming the free end of said pin (17) by a first hammer (21), to define a terminal head (25) acting as the base blank for extruding the bevel gear teeth (33), the remaining part of the pin (17) defining a rotation pivot (26) for said gear; 10
 - deforming said head (25) by a punch (27) provided in a second hammer (28), said punch being inserted a certain distance into said head (25) so as to expand the material and oblige it to completely fill the empty spaces of the die (18) with precision; and 15
 - extracting the bevel gear (34) formed in this manner, and integral with its rotation pivot, from said anvil (19). 20
2. A method as claimed in claim 1, characterised in that sections (32) of the gear teeth (33) are already formed in said head (25), in correspondence with the roots of said teeth (33). 25
3. A mould for implementing the method of claims 1 and 2, characterised by comprising an anvil (19), and a first and a second hammer (21, 28), said anvil (19) being provided with said die (18) and with an extractor (20), the first hammer (21) being provided with a cavity (24) arranged to form said head (25), the second hammer (28) being provided with the punch (27) and with a second cavity (29) arranged to shape the summit of the teeth (33) of the bevel gear, and to perfectly close the die (18) in a sealed manner. 30 35
4. A bevel gear (34) complete with rotation pivot (26) extending from the root of the teeth (33) when obtained by the method and with the mould of claims 1-3. 40
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- 55

Fig.1

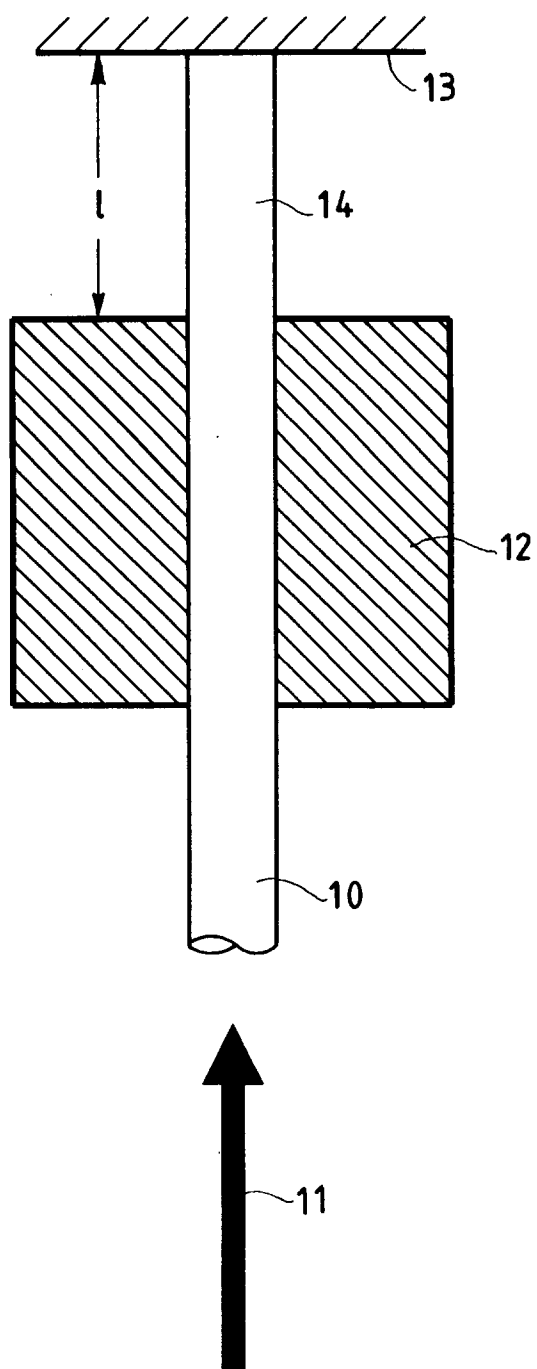


Fig.2

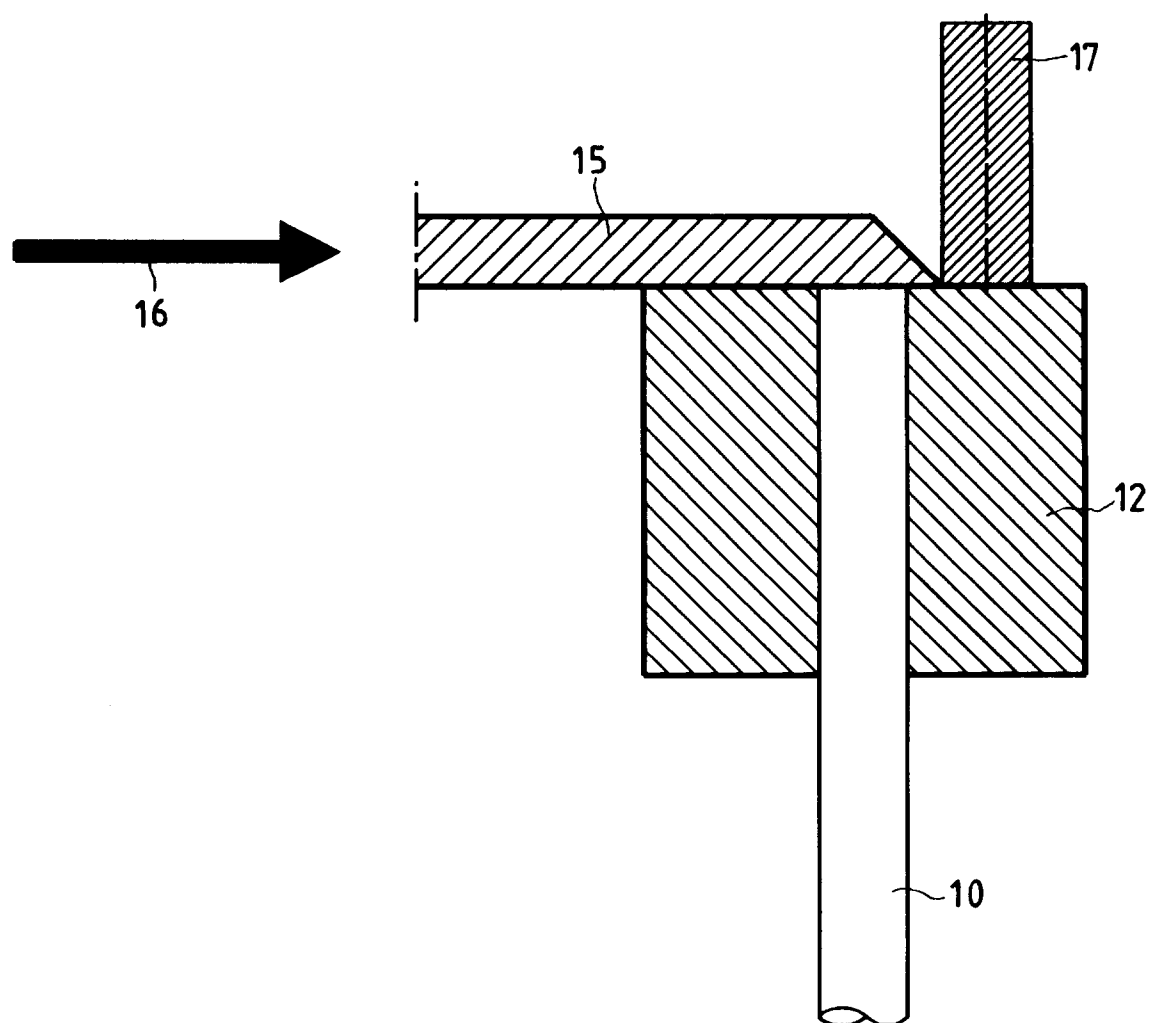
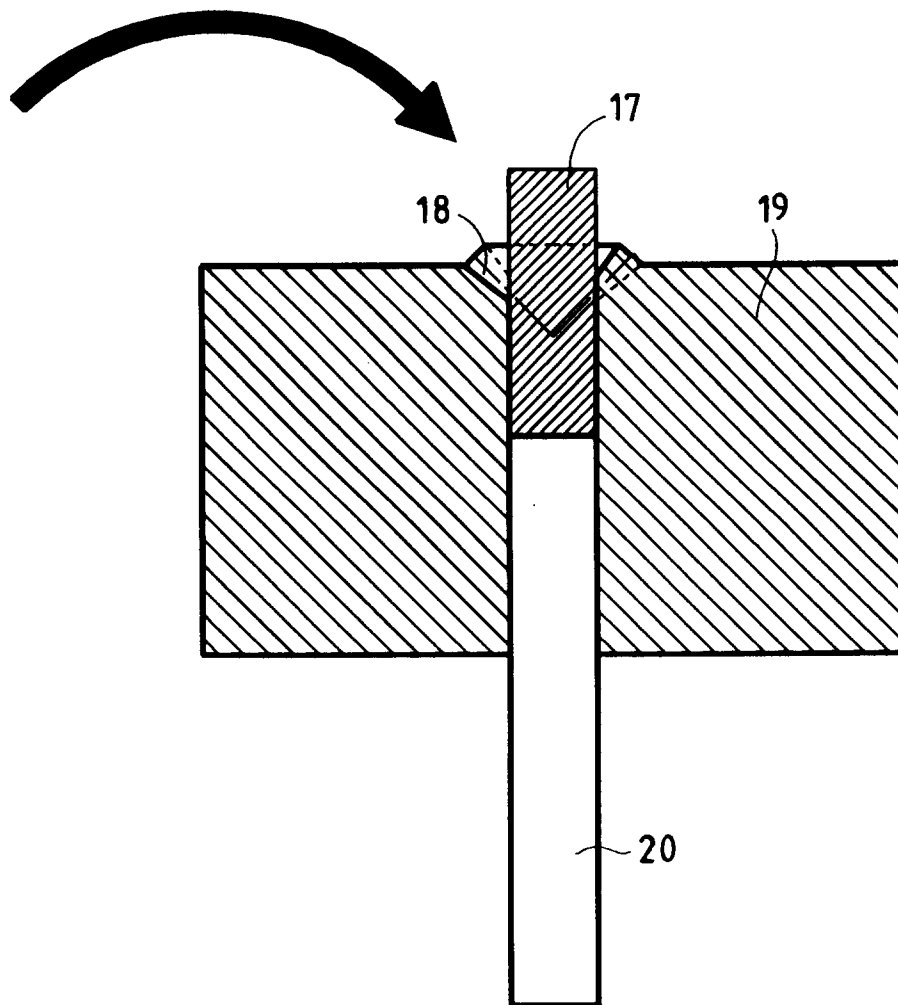


Fig.3



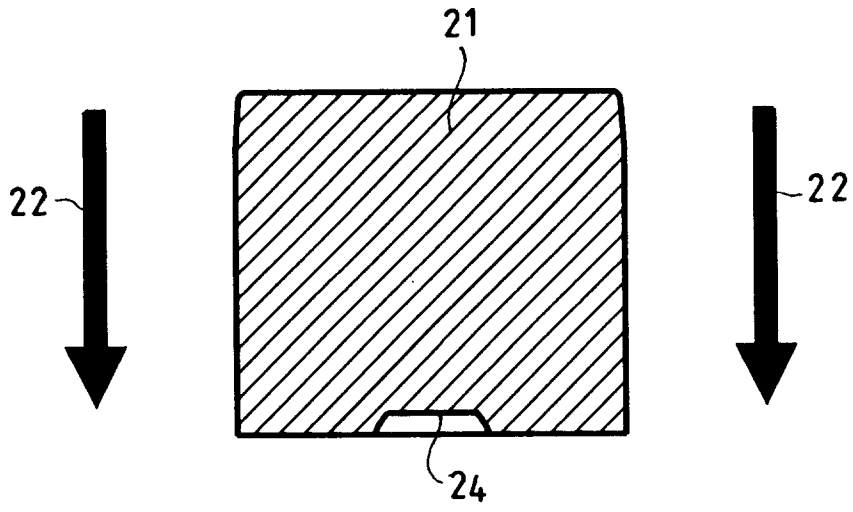


Fig.4

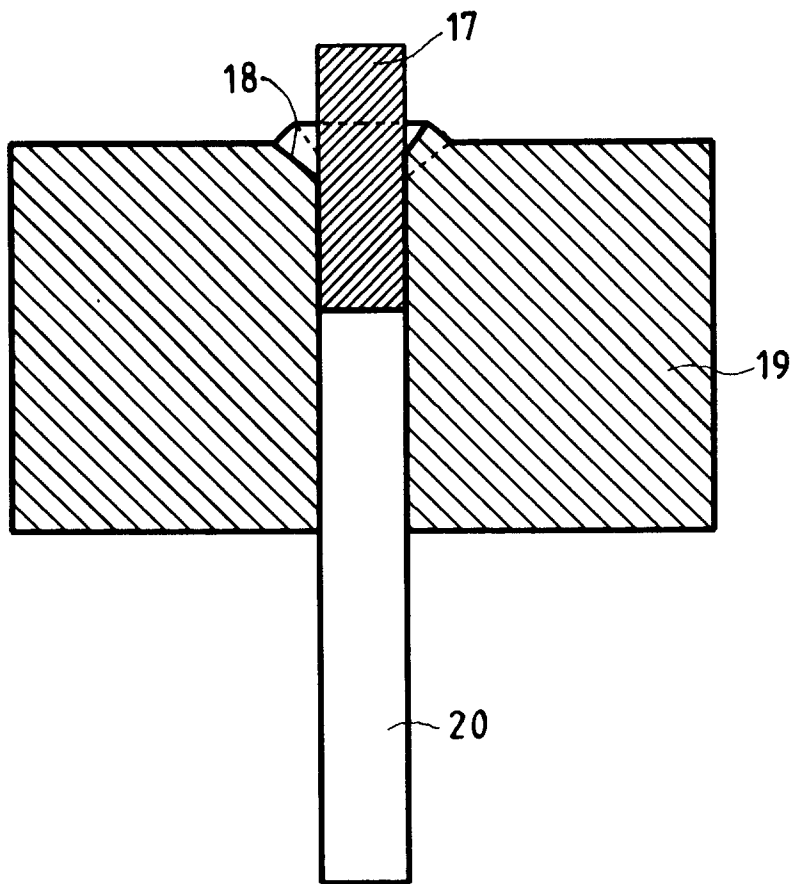


Fig.5

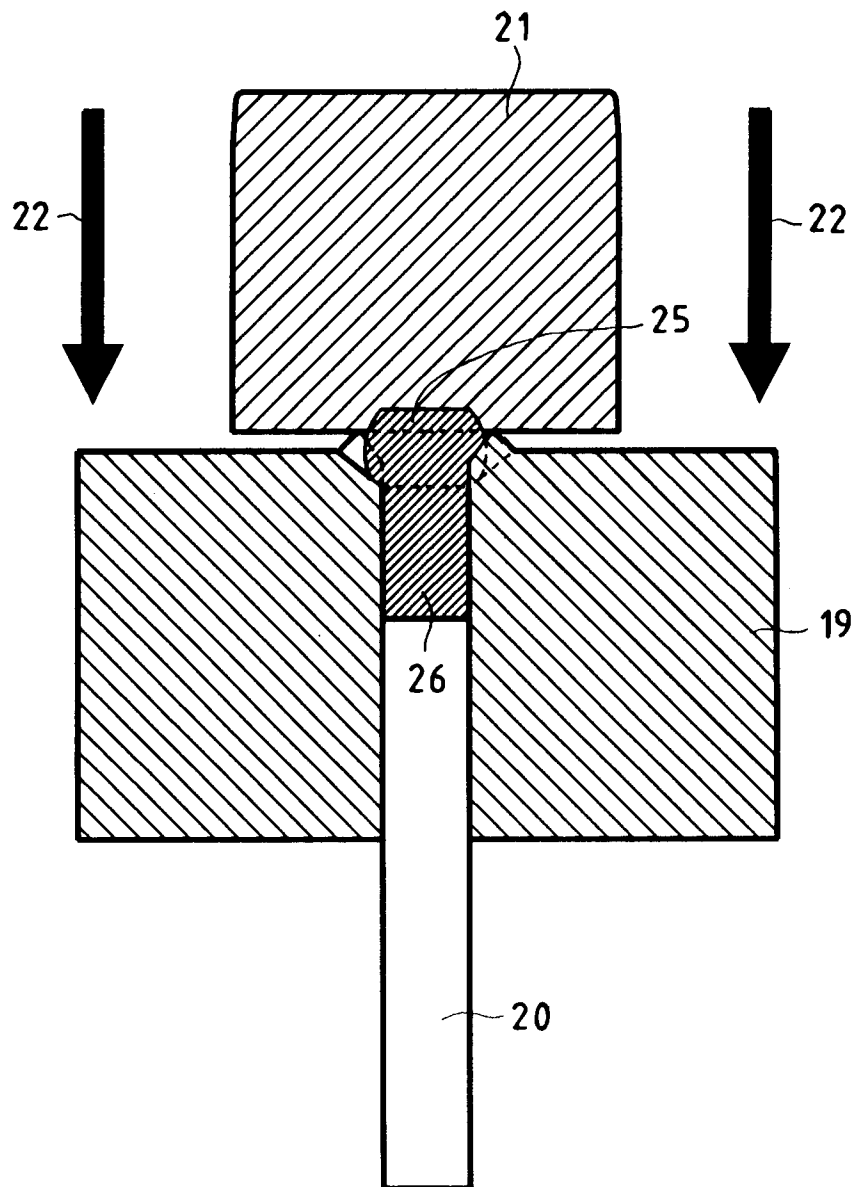
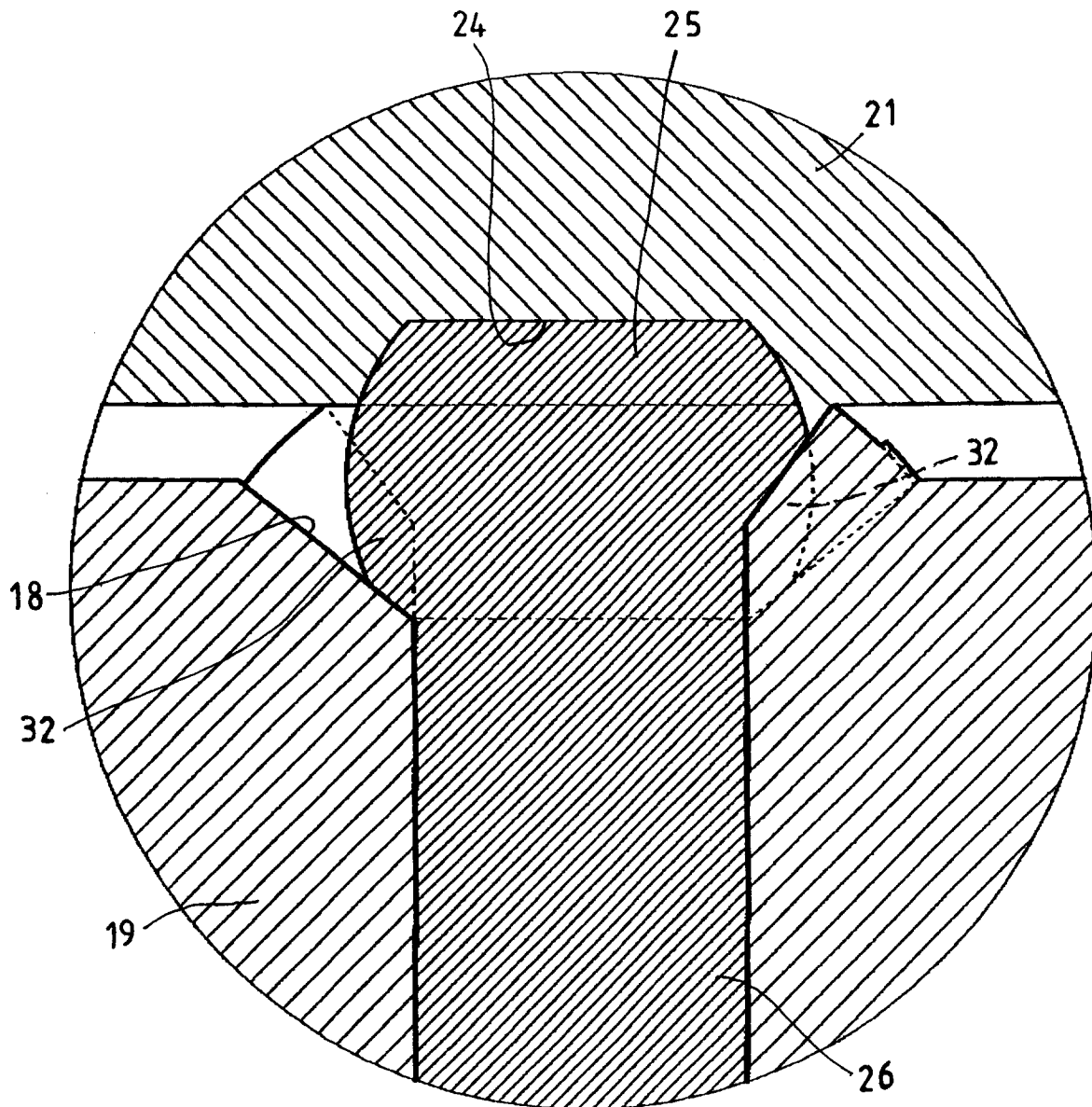


Fig.6



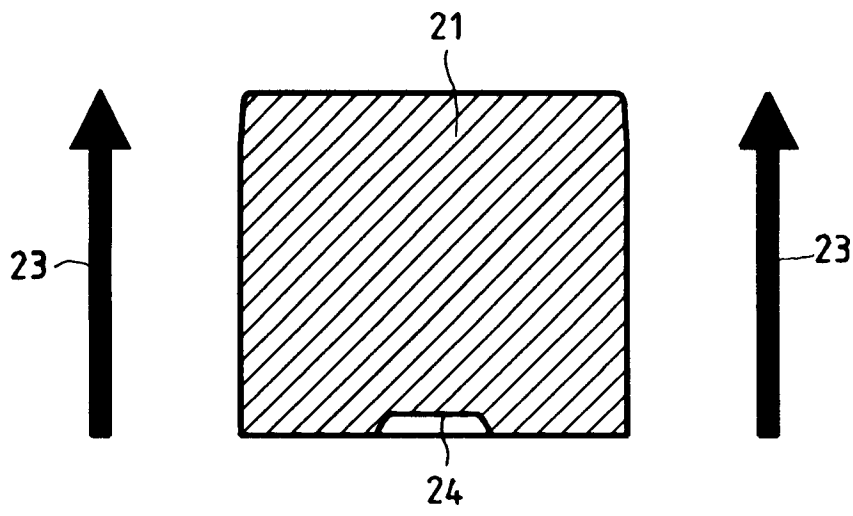
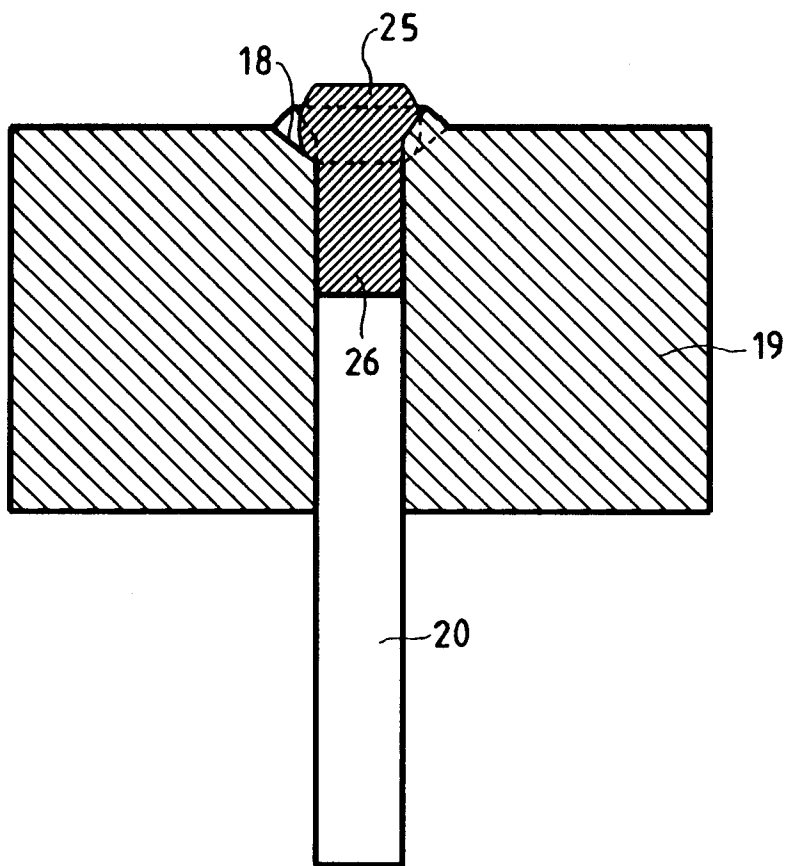


Fig.7



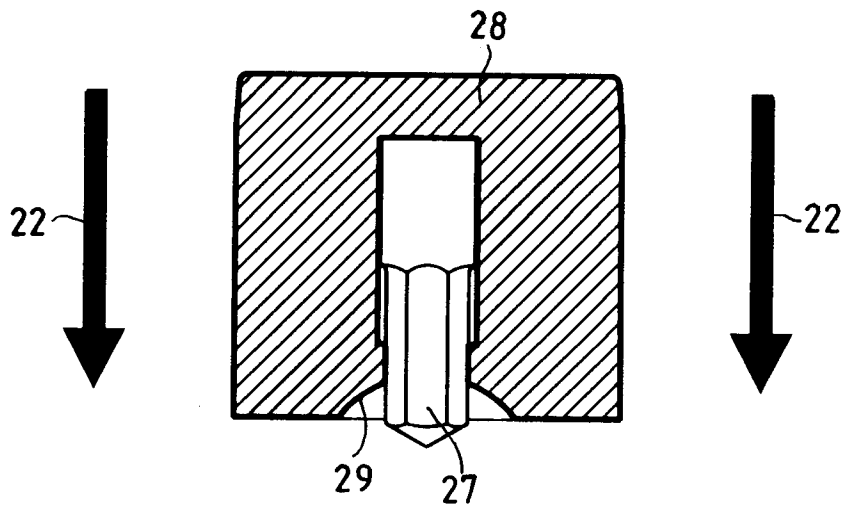


Fig.8

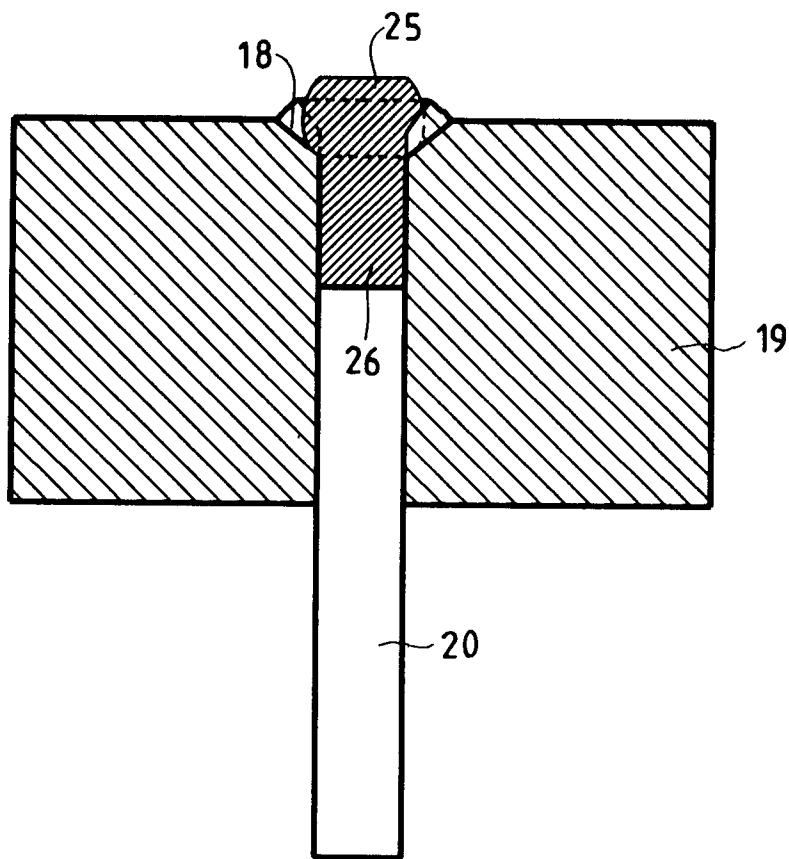
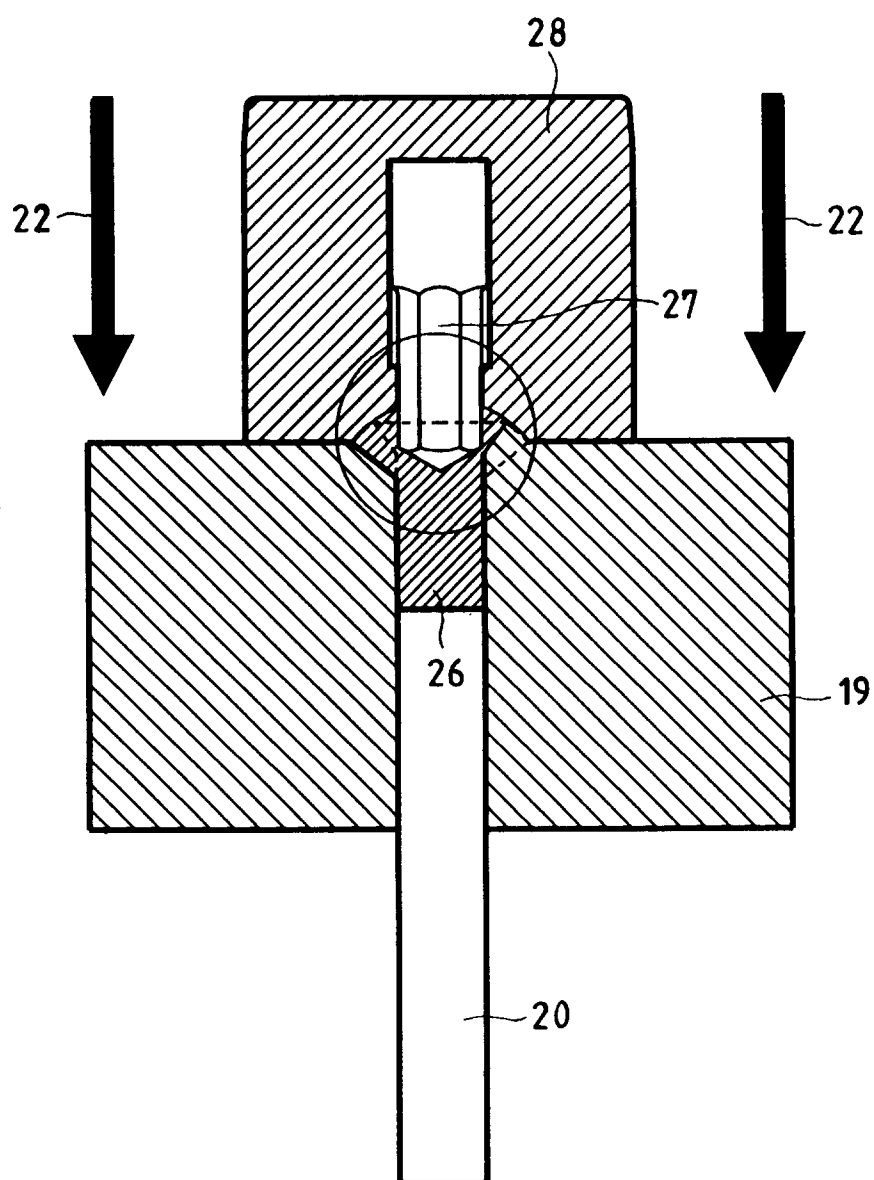


Fig.9



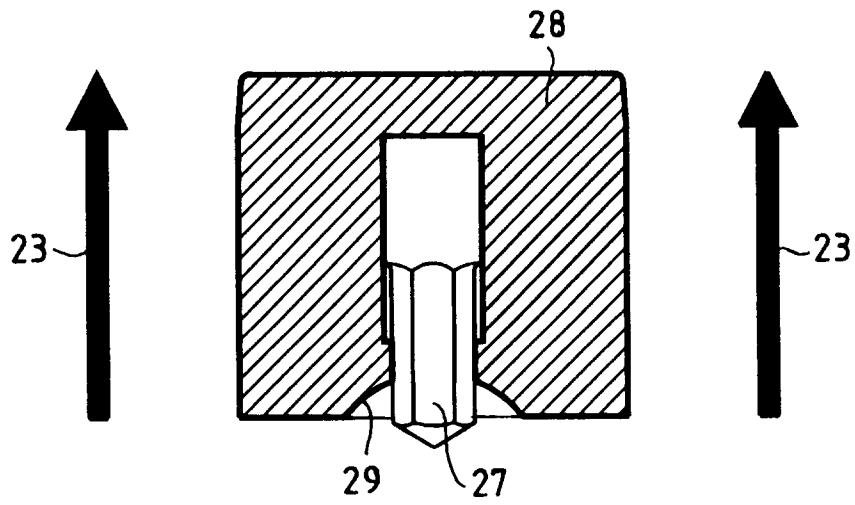


Fig.10

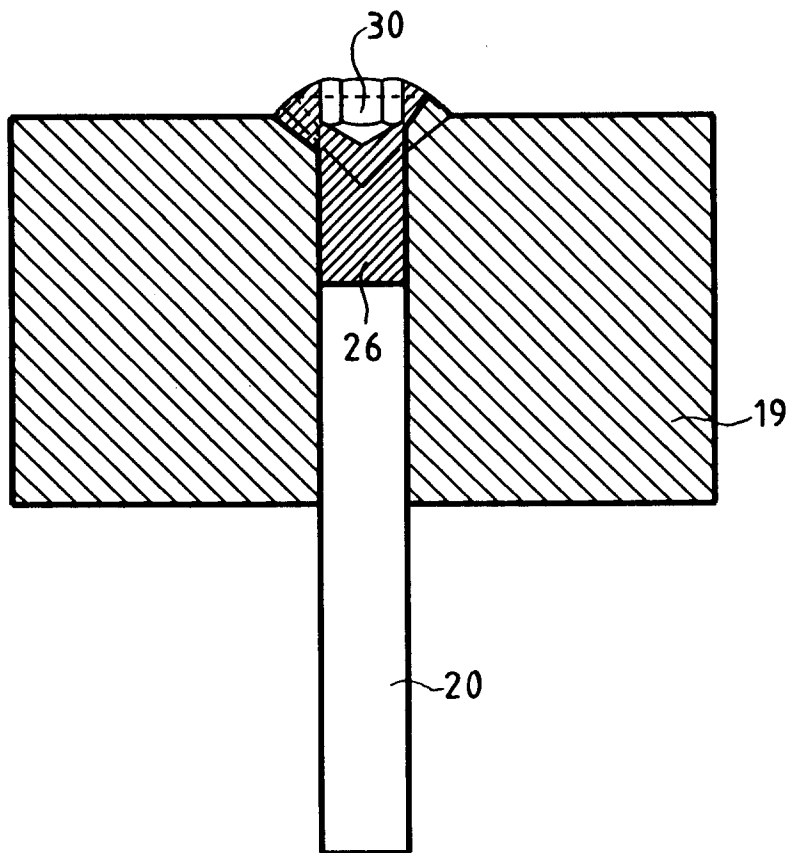


Fig.11

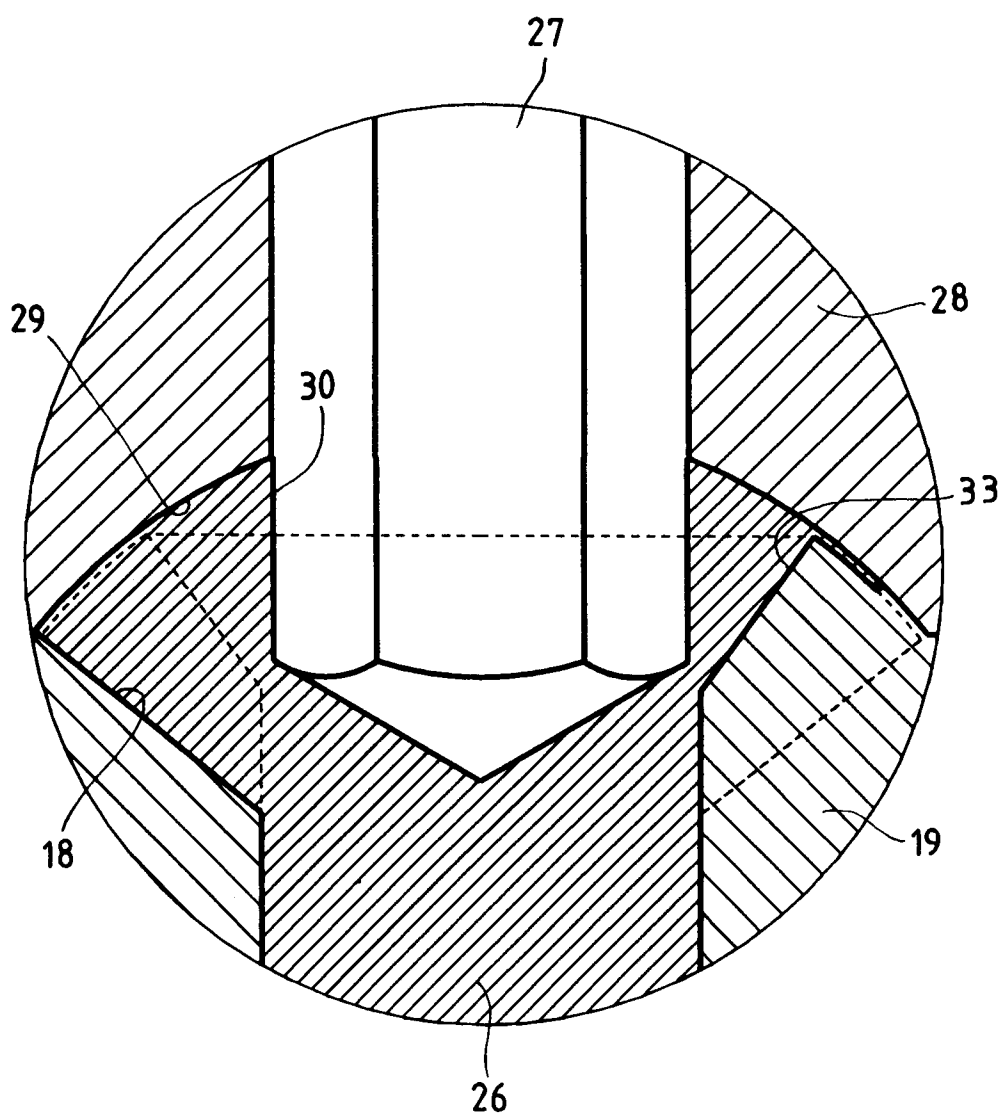


Fig.12

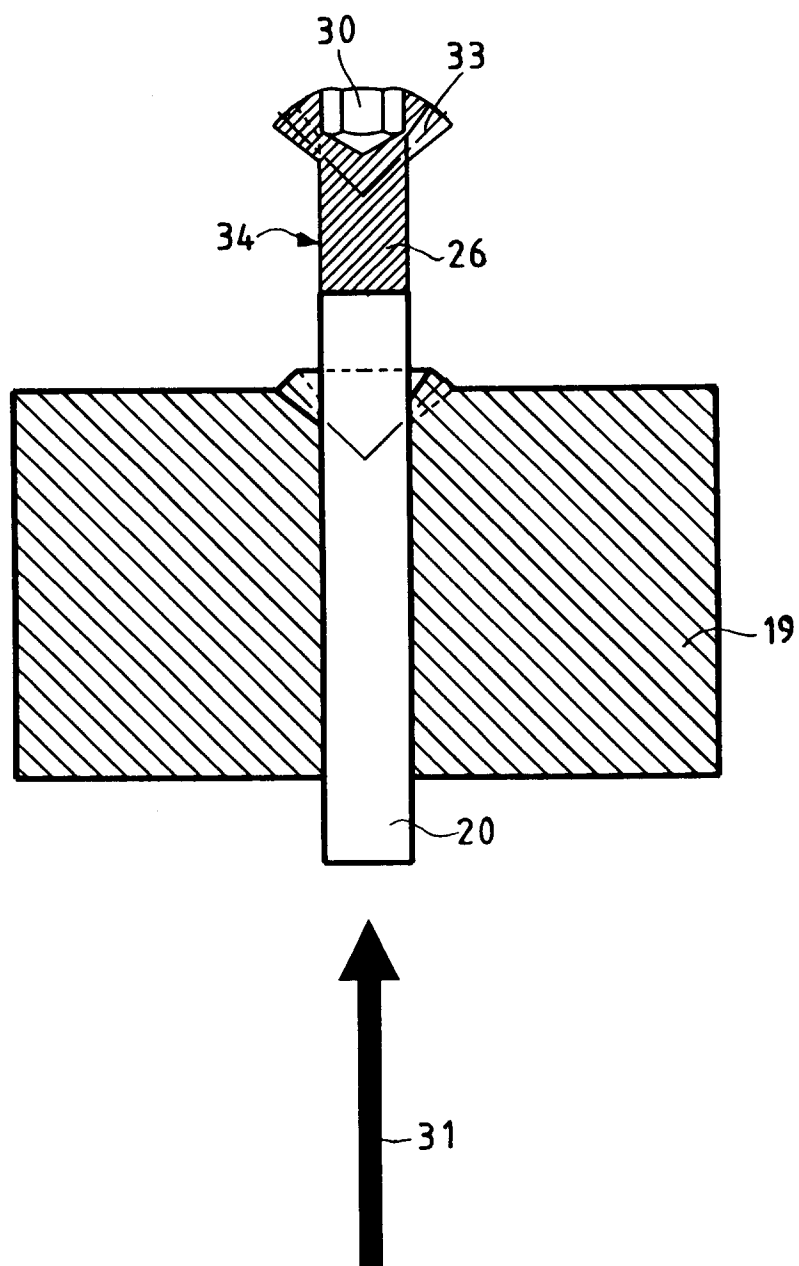


Fig.13

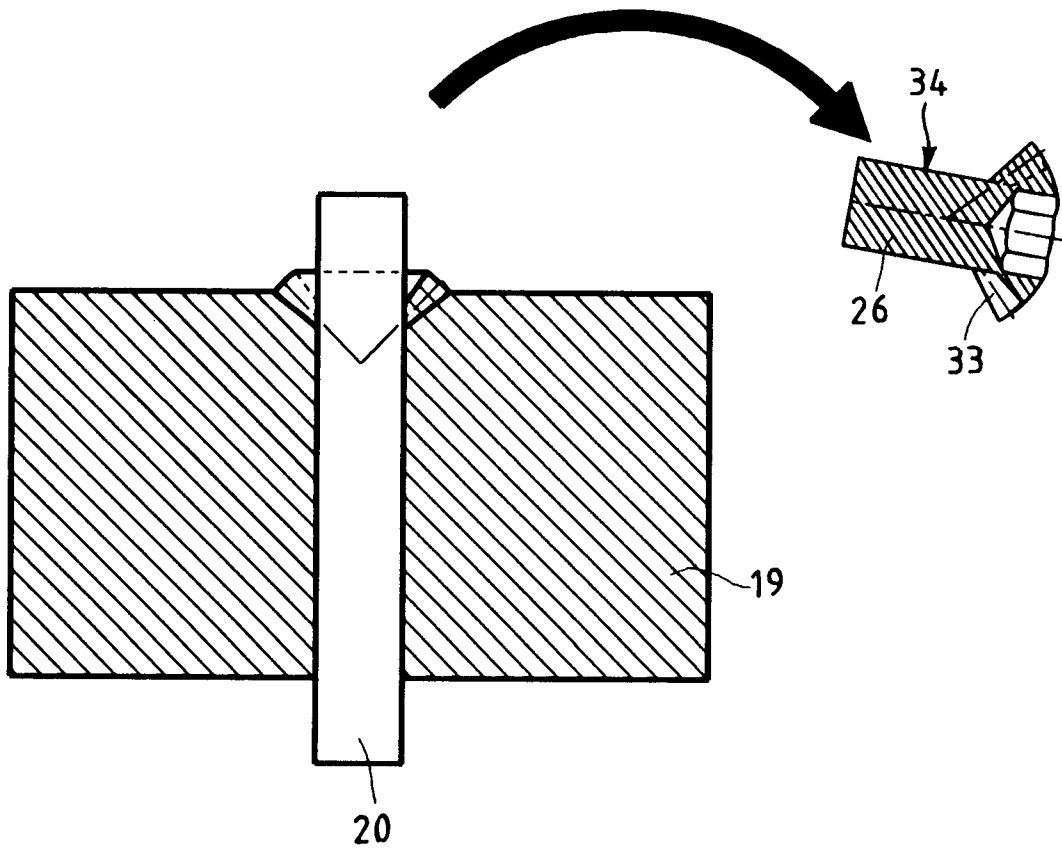
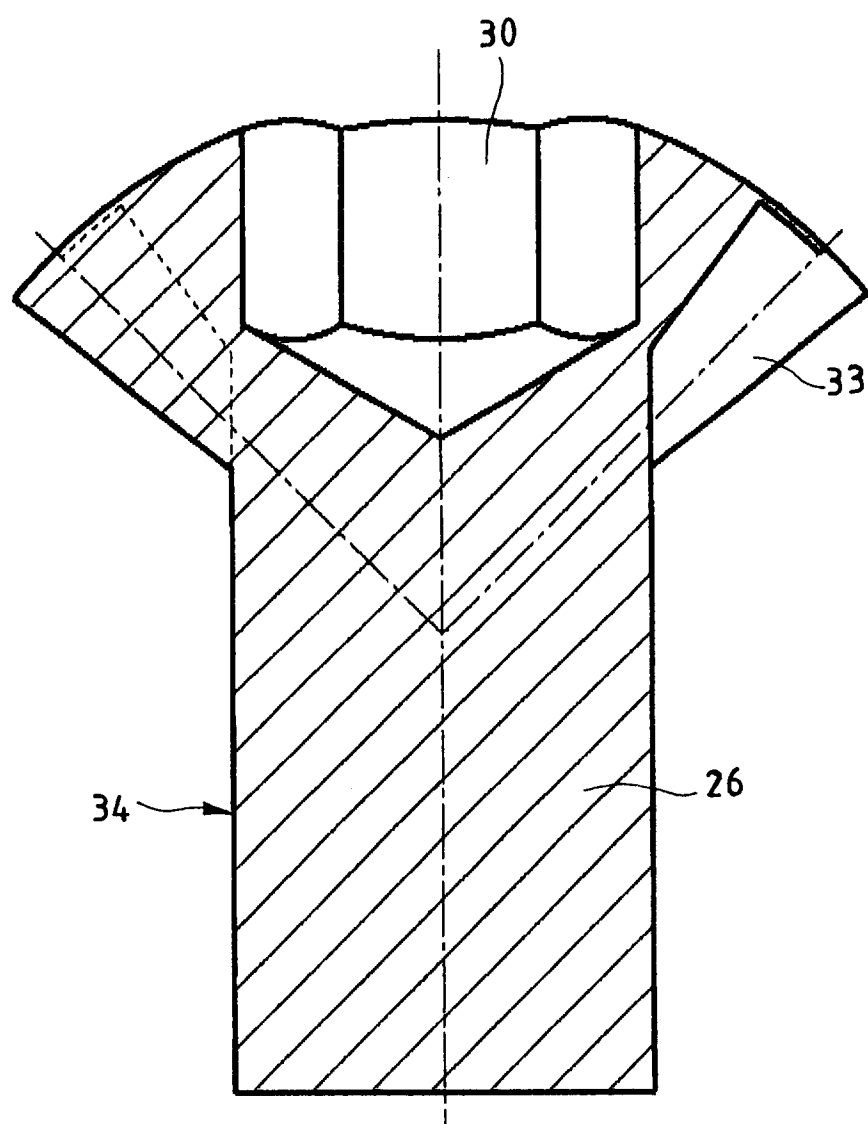


Fig.14





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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1948

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	PATENT ABSTRACTS OF JAPAN vol. 013, no. 163 (M-816), 19 April 1989 & JP-A-64 002756 (MUSASHI SEIMITSU IND CO LTD), 6 January 1989, * abstract *	1-4	B21K1/30
X	--- PATENT ABSTRACTS OF JAPAN vol. 010, no. 025 (M-450), 31 January 1986 & JP-A-60 184444 (FUJI JUKOGYO KK), 19 September 1985, * abstract *	1-4	
X	--- US-A-3 429 172 (LIERSE KURT F ET AL) 25 February 1969	1	
A	* figures 1-4 *	1-4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B21K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 5 November 1996	Examiner Barrow, J
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