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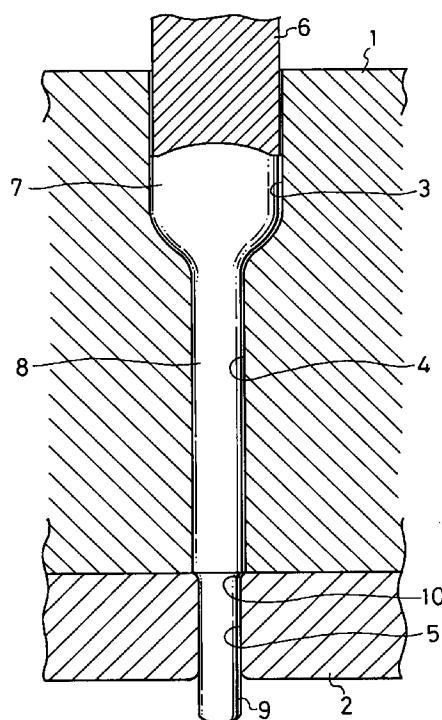
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(54) Method of molding a poppet valve having a smaller diameter portion

(57) Heated material (101) is filled into a cavity (3) which has three portions having different diameter. By compressing the material in the cavity (3) by a punch (6), there is formed a poppet valve which comprises a valve head (7), a valve stem (8) and a smaller diameter portion (9) which is provided at the end of the valve stem (8).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

The present invention relates to a method of molding a poppet valve by hot forging, and particularly, to a method of molding a poppet valve having smaller diameter portion at the end of a valve stem, the poppet valve being used in an internal combustion engine for an automobile.

A poppet valve is conventionally molded by hot forging as shown in Fig. 2 (A) to (C). Fig. 2 (A) shows cylindrical steel material 101 (slag), which is heated to a certain temperature and filled into a drag 102 in a primary step as shown in Fig. 2 (B). The drag 102 in the primary step has a cavity which corresponds to a larger diameter valve head 104 and a smaller diameter valve stem 105. The heated material 101 is forged under compression by a punch 106 (cope) to make an intermediate molded material 103, which is then filled into a drag 107 in a secondary step as shown in Fig. 2(C). In the drag 107 of the secondary step, there is a cavity which corresponds to a valve head 109 and the valve stem 105 of a poppet valve 108 finally molded. The valve head 104 of the intermediate molded material 103 is compressed by a punch 110 to mold the valve head 109 to make the poppet valve 108.

As shown in Fig. 3, a smaller diameter portion 114 may be formed in a poppet valve 111. In order to mount the poppet valve in an engine, the smaller diameter portion 114 has a cotter groove 115 in which a pair of coters (not shown) are engaged.

To form the smaller diameter portion 114 at the end of the valve stem 113 of the poppet valve 111 as shown in Fig. 3, the valve head 112 and the valve stem 113 are formed by the step in Fig. 2(C), and then it is worked by mechanical means such as by a centerless grinder, thereby increasing time for the mechanical processing and reducing productivity to increase cost for manufacturing. It may arise a problem that the life of the grinding wheels becomes shorter and replacement thereof is often made.

SUMMARY OF THE INVENTION

To overcome the disadvantage, it is an object of the present invention to provide a method of molding a poppet valve to form a smaller diameter portion at the end of a valve stem at the same time.

According to the present invention, there is provided a method of molding a poppet valve having a smaller diameter portion, the method comprising the steps of filling heated material into a drag having a cavity for forming a valve head, a cavity for forming a valve stem and a cavity for forming the smaller diameter portion, the cavities communicating with one another; and compressing an upper end of the material in the cavities by a punch to conduct hot forging to form the poppet valve.

In the method of forming the poppet valve according to the present invention, the smaller diameter portion is not mechanically formed, but is formed by hot forging process, thereby decreasing the number of mechanical steps after forging, and increasing productivity and duration of tools. The portion ground in a grinding process may be reduced to save the amount of material, thereby decreasing cost for manufacturing. The smaller diameter portion is hardened by forging, and the strength thereof, especially tensile strength, is significantly increased compared with a product mechanically worked.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the present invention will become more apparent based on the following description with respect to accompanying drawings:

Fig. 1 is a sectional view of a hot forging device by which the present invention is carried out;

Fig. 2 is a schematic view which illustrates the conventional steps of forming a poppet valve, (A) showing material, (B) being a primary step, (C) being a secondary step; and

Fig. 3 is a perspective view of a poppet valve having a smaller diameter portion at the end.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

There are two hot forging steps which comprises a primary step for forming an intermediate product from original material and a secondary step for molding a poppet valve from the intermediate product. Fig. 1 illustrates a device which is applied to the primary step. A drag for the primary step comprises an upper die 1 and an upper die insert 2 under the upper die 1. The upper die 1 has a cavity 3 which corresponds to a larger diameter valve head 7 in the intermediate product, and a cavity 4 for forming a valve stem 8. The upper die insert 2 has a cavity 5 which is smaller than the cavity 4 in diameter.

The cavity 5 for forming the smaller diameter portion communicates with the cavity 4 of the upper die 1 via a curved circumferential edge 10, so that the smaller diameter portion 9 is smoothly connected with the valve stem 8.

Heated material (not shown) is supplied into the cavity 3 through an upper opening of the upper die 1, and is forged under compression by the punch 6, so that the material flows downwards while it is elastically deformed, thereby forming the valve head 7 and the valve stem 8. The pressurized deformation is continued, and the end of the valve stem 8 flows into the cavity 5 of the upper die insert 2 to form the smaller diameter portion 9. The smaller diameter portion 9 is connected with the valve stem 8 via a concave surface by the upper circumferential edge 10 of the cavity 5, thereby forming the

intermediate molded product comprising the valve head 7, the valve stem 8 and the portion 9 having diameter smaller than the valve stem 8.

Then, a desired poppet valve is formed in the secondary step, and a groove for a cotter is mechanically 5
formed at a desired position of the smaller diameter portion, thereby manufacturing a final poppet valve as shown in Fig. 3.

In the embodiment, the smaller diameter portion 9 is formed in the primary step, but may be formed in the 10
secondary step. The upper die insert 2 may be integrally formed with the drag 1.

The foregoing merely relate to an embodiment of the present invention. Various changes and modifications 15
may be made by person skilled in the art without departing from the scope of claim therein:

Claims

1. A method of molding a poppet valve having a 20
smaller diameter portion, the method comprising the steps of:

filling heated material into a drag having a cavity for forming a valve head, a cavity for forming 25
a valve stem and a cavity for forming the smaller diameter portion, the cavities communicating with one another; and
compressing an upper end of the material in the cavities by a punch to conduct hot forging to 30
form the poppet valve.

2. A method as defined in claim 1 wherein the cavities for forming the valve head and stem are provided in 35
an upper die of the drag, the cavity for forming the smaller diameter portion being provided in an upper die insert under the upper die.

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FIG. 1

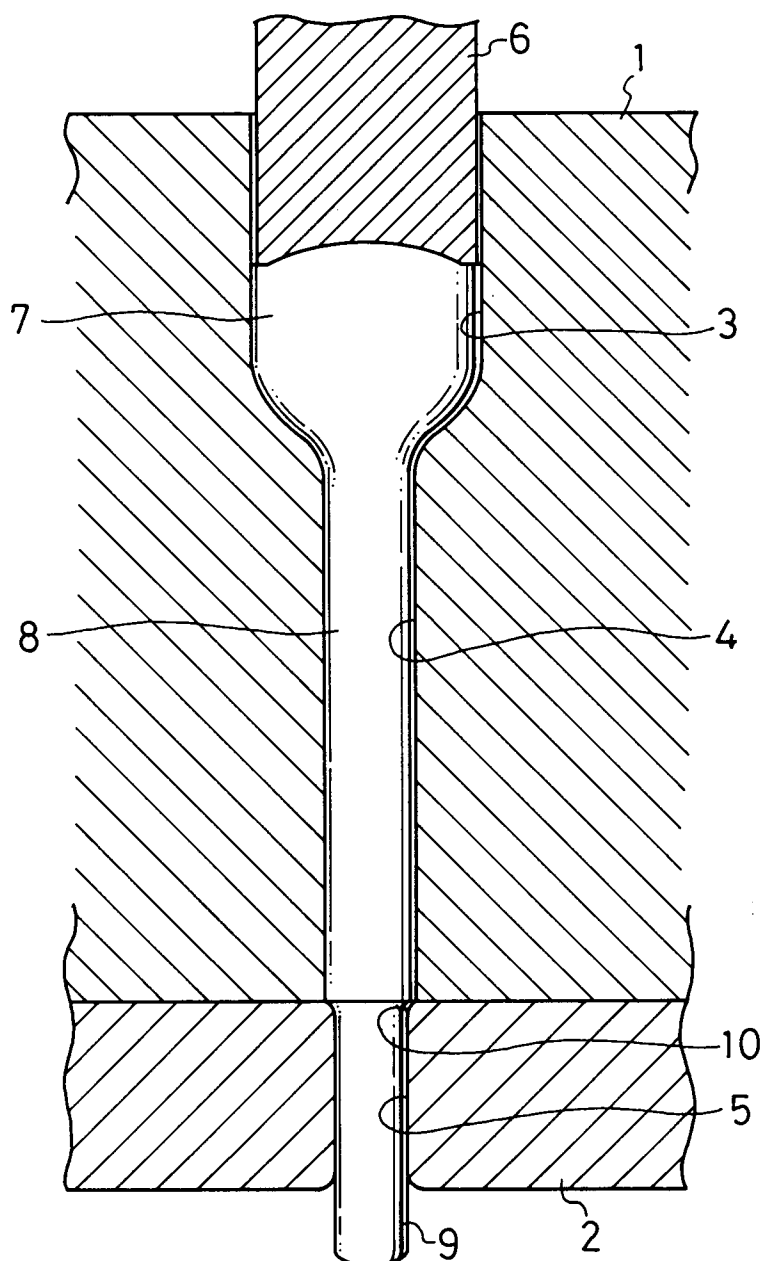


FIG. 2

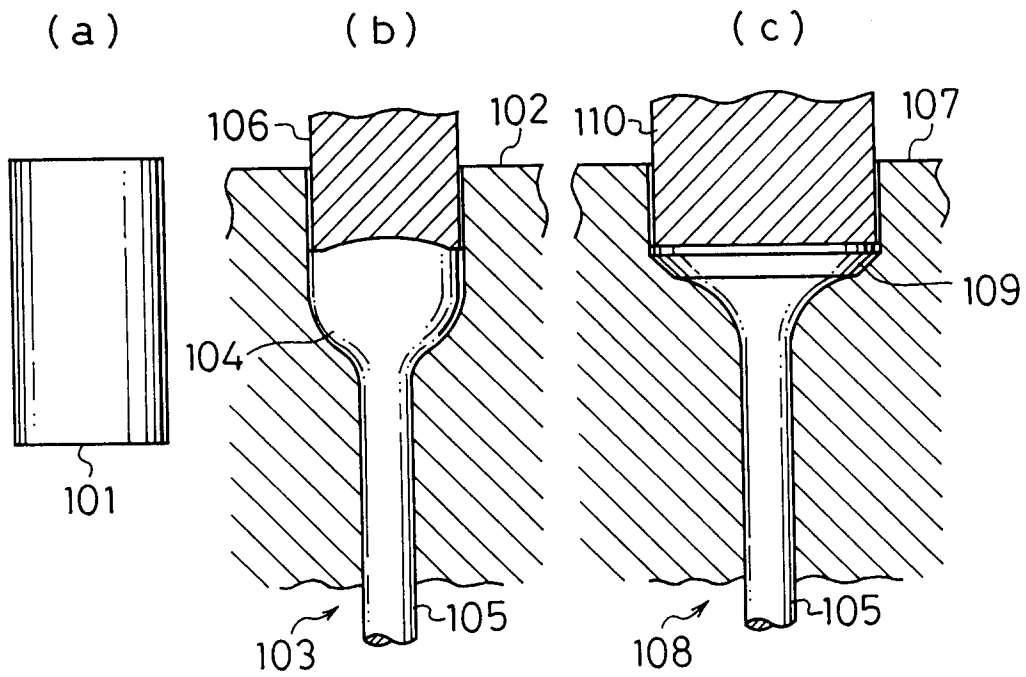
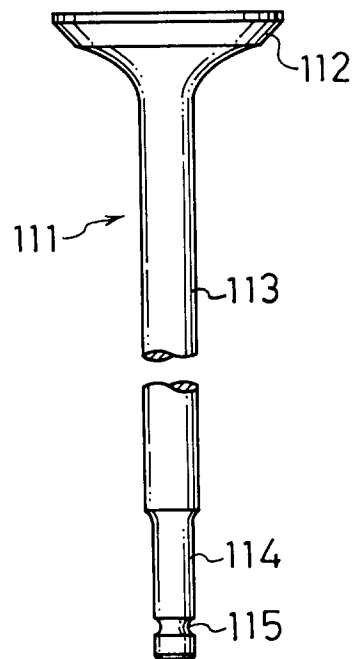


FIG. 3





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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 0190

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	US-A-3 587 157 (MUNDT)	1	B21K1/22
A	* figures *	2	
Y	--- PATENT ABSTRACTS OF JAPAN vol. 12 no. 21 (M-661) ,22 January 1988 & JP-A-62 179846 (FUJI VALVE KK) 7 August 1987,	1	
A	* abstract *	2	
Y	--- PATENT ABSTRACTS OF JAPAN vol. 14 no. 540 (M-1053) ,29 November 1990 & JP-A-02 229640 (FUJI VALVE KK) 12 September 1990,	1	
A	--- DE-C-906 777 (RUHRTALER GESENKSCHMIEDEREI F.W.WENGELER KG) * claim 2; figure *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B21K B23P
Place of search THE HAGUE		Date of completion of the search 28 November 1995	Examiner Barrow, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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