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(72) Inventors:
• **Hara, Nobuo**
Fujisawa-shi, Kanagawa-ken (JP)
• **Abe, Makoto**
Fujisawa-shi, Kanagawa-ken (JP)

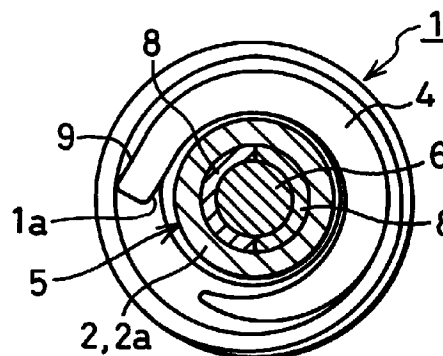
(71) Applicant: **FUJI OOZX INC.**
Fujisawa-shi, Kanagawa-ken (JP)

(74) Representative:
Ben-Nathan, Laurence Albert et al
Urquhart-Dykes & Lord
91 Wimpole Street
London W1M 8AH (GB)

(54) **Valve spring in an internal combustion engine**

(57) A valve spring (1) is used in a valve operating mechanism for moving a poppet valve (6) up and down in an internal combustion engine of an automobile. The terminal end of the uppermost portion (9) of the valve spring (1) extends in a tangential direction to go away from an axis of the valve spring (1), thereby avoiding contact with a retainer (2) to prevent wear.

FIG. 1



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a valve spring used in a valve operating mechanism of an internal combustion engine for a vehicle such as an automobile.

[0002] As illustrated in Fig. 3, to decrease inertia mass of the valve operating mechanism, a coil valve spring 1 used in a valve operating mechanism of an internal combustion engine is formed like a frustum.

[0003] The upper and lower surfaces of the valve spring 1 are flat to contact the lower surface of a retainer 2 and the upper surface of a cylinder head 3 respectively, as shown in Fig. 3. In the frusto-conical valve spring 1, a diameter of an uppermost winding is smaller, so that a horizontal distance with a tubular portion of the retainer 2 becomes smaller. Thus, as illustrated in Fig. 3, the valve spring 1 vibrates in a lateral direction owing to surging, so that an inner circumferential edge 1a vigorously comes in contact with an inner corner 5 between the tubular portion 2a and a receiving surface 2b, thereby causing wear. As the inner corner 5 between the tubular portion 2a and the receiving surface 2b is subjected to large bending stress, wear thereon is unsuitable. The numerals 6, 7 and 8 denote a poppet valve, a valve guide and a pair of cotters respectively.

SUMMARY OF THE INVENTION

[0004] In view of the disadvantage, it is an object of the present invention to provide a valve spring in which the terminal end is changed in form, thereby preventing wear of a retainer.

[0005] According to the present invention, there is provided a valve spring in an internal combustion engine, said valve spring comprising a coil which is tapered upward, an upper surface of the coil being formed flat, a terminal end of said coil extending in a tangential direction to go away from an axis of the coil.

[0006] The terminal end of the coil extends away from the axis of the coil, thereby decreasing possibility of contact of the inner circumferential edge with a retainer to keep wear at minimum.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The features and advantages of the present invention will become more apparent from the following description with respect to embodiments as shown in the drawings wherein:

Fig. 1 is a sectional plan view of the first embodiment of a valve spring according to the present invention taken along the surface which contacts a retainer;

Fig. 2 is a sectional plan view of the second embodiment

of a valve spring seen from the same position as in Fig. 1;

Fig. 3 is a vertical sectional view of a valve operating mechanism which contains a conventional valve spring; and

Fig. 4 is a sectional plan view taken along the line IV-IV in Fig. 3.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0008] Fig. 1 illustrates the first embodiment of the present invention, in which the uppermost surface 4 of a frusto-conical valve spring 1 is flat, and a terminal end 9 extends in a tangential direction to go away from an axis of the valve spring. Thus, a distance between an inner circumferential edge 1a and a tubular portion 2a of a retainer 2 is increased, thereby decreasing possibility that the terminal end 9 comes in contact with a corner 5 between the tubular portion 2a and a receiving surface (not shown) and keeping wear thereon at minimum.

[0009] Fig. 2 illustrates the second embodiment of the present invention, in which a terminal end 9 extends at almost the same curvature as the lowermost portion of a valve spring 1, thereby improving yield of the valve spring 1. After a valve spring 1 is wound up, a wire is cut off at the terminal end. To begin to wind a next wire, it is necessary to cut off the beginning end by a predetermined length in the tangentially ending wire as illustrated in the first embodiment, but the second embodiment saves the wire since it is possible to begin to wind up a next valve spring at once.

[0010] The foregoing merely relate to embodiments of the present invention. Various changes and modifications may be made by persons skilled in the art without departing from the scope of claims wherein:

Claims

1. A valve spring in an internal combustion engine, said valve spring comprising a coil which is tapered upward, an upper surface of the coil being formed flat, a terminal end of said coil extending in a tangential direction to go away from an axis of the coil.
2. The coil spring as defined in claim 1 wherein the terminal end of the coil extends at almost the same curvature as a lowermost portion of the coil spring.

FIG. 1

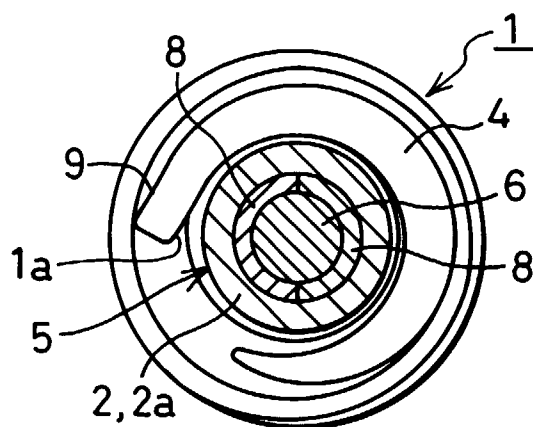
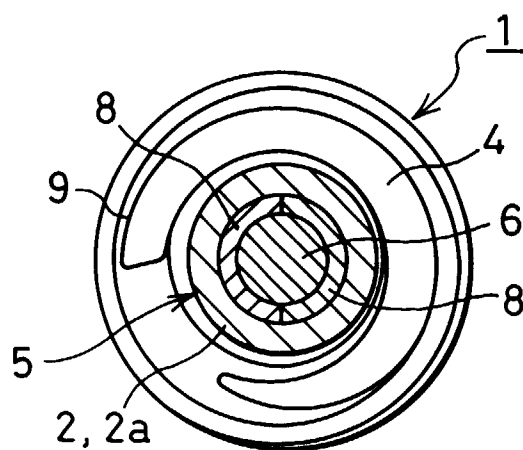


FIG. 2



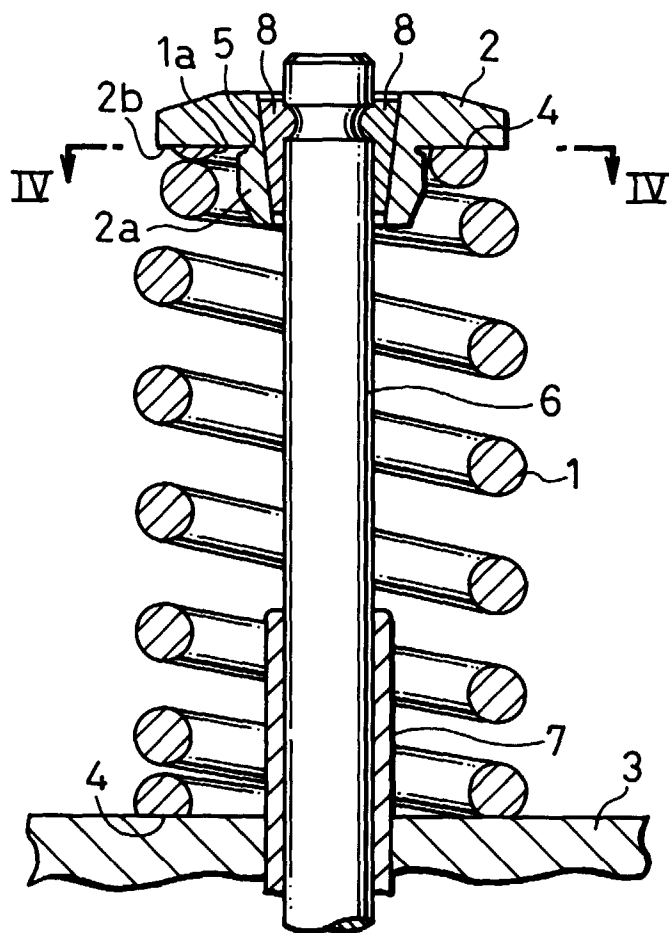


FIG. 3

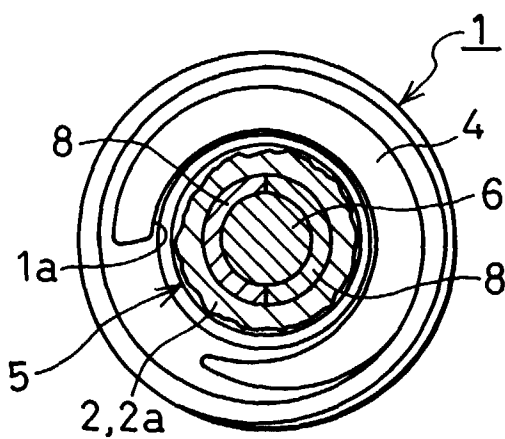


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 3772

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)
A	PATENT ABSTRACTS OF JAPAN vol. 006, no. 071 (M-126), 6 May 1982 & JP 57 010720 A (NHK SPRING CO LTD), 20 January 1982 * abstract *	1	F01L1/46
A	DE 11 74 576 B (FORD-WERKE) * column 2, line 46 - column 3, line 5 * * figures 1,2 *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 096, no. 005, 31 May 1996 & JP 08 028223 A (FUJI OOX INC), 30 January 1996 * abstract *	1	
A	US 4 017 062 A (ZWIRNER ECKHARD) 12 April 1977 * column 5, line 40 - column 6, line 3 * * figures 6-8 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F01L
Place of search	Date of completion of the search	Examiner	
THE HAGUE	11 September 1998	Lefebvre, L	
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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 98 30 3772

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11-09-1998

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 1174576 B		NONE	
US 4017062 A	12-04-1977	DE 2521646 A	02-12-1976
		DE 7431415 U	16-01-1975
		BR 7506004 A	03-08-1976

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