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(11) **EP 0 806 549 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
18.07.2001 Bulletin 2001/29

(51) Int Cl.7: **F01L 1/14**

(21) Application number: **96303151.3**

(22) Date of filing: **03.05.1996**

(54) **Tappet in an internal combustion engine and a method of manufacturing it**

Ventilstößel einer Brennkraftmaschine und Herstellungsverfahren

Poussoir de moteur à combustion interne et méthode de fabrication

(84) Designated Contracting States:
DE FR GB IT

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(43) Date of publication of application:
12.11.1997 Bulletin 1997/46

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(60) Divisional application:
00200571.8 / 1 004 753

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US-A- 3 715 790

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a tappet in an international combustion engine and a method of manufacturing it.

[0002] For example, to increase wear and resistance of a conventional tappet, as shown in Fig. 8, a helical groove 13 is formed on the outer circumferential surface of raw material for a tappet to make a core material 15, the surface of which is thermally sprayed by wear resistant material such as Fe metal to form a coating layer 17 which covers the helical groove 13. The outer circumferential surface of the coating layer is ground to form a cylindrical portion 18, the end 19 of which is chamfered.

[0003] However, at the chamfered end of the tappet, as clearly shown in Fig. 9, the cylindrical wear resistant coating layer 17 in which the groove 13 of the core material 15 is embedded is slightly left as a fine string-like portion 16, which is likely to peel off as small pieces.

[0004] US-A-4,909,198 discloses a valve lifter having an Al-Si alloy body with an Fe-C coating sprayed on a cylindrical portion of the body, which is formed with keying grooves to receive part of the spray coating.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to provide a tappet in an internal combustion engine in which a core material which has a helical groove on the outer circumferential surface is covered with wear resistant material, thereby preventing a fine string portion of a coating layer from peeling off at the chamfered end.

[0006] It is another object of the present invention to provide a method of manufacturing a tappet in an internal combustion engine economically.

[0007] According to the present invention, there is provided a tappet in accordance with Claim 1.

[0008] According to another aspect of the present invention, there is provided a method of manufacturing a tappet in accordance with Claim 3.

[0009] In some embodiments of the invention the helical groove gradually may become smaller in diameter toward the end in the vicinity of the end of the core material, thereby preventing the helical groove from being exposed over the coating layer even if the upper and lower ends of the coating layer are chamfered.

[0010] The end of the helical groove is stopped before the end of the core material, and is connected with the annular groove, thereby preventing removal even if the chamfered portion is exposed owing to corrosion.

[0011] The tappet according to the present invention comprises the core material in which the helical groove is formed on the outer circumferential surface, and the wear resistant coating layer with which the outer circumferential surface is covered and the ends are chamfered, thereby providing a light weight body and relatively small

inertia force, so that response and followability to reciprocal movement is improved. Furthermore, owing to wear resistance in frictional portion, durability will increase.

[0012] The groove of the core material is completely covered with the coating layer other than upper and lower ends, thereby avoiding thinner string portions as in conventional ones and removal thereof.

[0013] Instead of metal thermal spraying, it is suggested that the core material is immersed in melted metal, or plating is applied, but metal thermal spraying is more convenient and economical.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The features and advantages of the invention will become more apparent from the following description of embodiments with respect to appended drawings wherein:

Fig. 1 is a partially sectioned front view of the first embodiment of a tappet according to the present invention;

Fig. 2 is a partially sectioned front view which shows a core material in which a helical groove is formed on the outer circumferential surface;

Fig. 3 is a partially sectioned front view in which a coating layer is applied by metal thermal spraying on the outer circumferential surface of the core material in Fig. 2;

Fig. 4 is a partially sectioned front view of the first embodiment of a finished tappet in which the outer circumferential surface is ground and the upper and lower ends are chamfered to the one in Fig. 3;

Fig. 5 is an enlarged sectional view of the lower portion of the section in Fig. 4;

Fig. 6 is an enlarged sectional view of the lower portion in the second embodiment of the present invention;

Fig. 7 is an enlarged sectional view of the lower portion in the third embodiment of the present invention;

Fig. 8 is an enlarged sectional view of the lower portion of a conventional tappet; and

Fig. 9 is perspective view which is seen from one end of the conventional tappet.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] A cylindrical raw material 1 of light metal such as Al as shown in Fig. 1 is rotated on an axis, while a cutting tool contacts the outer circumferential surface 2. Feed is axially given by the cutting tool to form a helical groove 3 on the outer circumferential surface of the raw material 1. At the same time, adjacent to the raw material 1, additional feed is given to the cutting tool toward the axis so that the helical groove 3 gradually decreases

in diameter toward the end of the raw material 1.

[0016] When the helical groove 3 reaches to a predetermined position which is close to the end of the raw material 1, the feed of the cutting tool is stopped to form an annular groove 3a at the end of the helical groove 3, thereby forming a core material 5.

[0017] Then, as shown in Fig. 3, Fe metal is thermally sprayed to all over the outer circumferential surface of the core material 5 to form a wear resistant coating layer 7. Thereafter, as shown in Fig. 4, the outer circumferential surface 8 is ground to form a circumference, and the upper and lower ends are chamfered, thereby forming a tappet as shown in Fig. 5 in the first embodiment. Therefore, peaks 10 in the helical groove 3 of the material 5 are not exposed over the outer circumferential surface 8 of the coating layer 7.

[0018] Fig. 6 illustrates the second embodiment of a tappet according to the present invention. In the second embodiment, in the vicinity of the end of the raw material 1, feeds are given to the cutting tool in an axial direction and toward the axis, and the raw material 1 is immediately ground to the end thereof without stopping the feeds at near the end of the material 1, so that the helical groove 3 is formed all over the outer circumferential surface 1, and similar way to the first embodiment is then made. The peaks 10 in the helical groove 3 of the material 5 are not exposed over the outer circumferential surface 8 of the coating layer 7. The same numerals are allotted to the same members and parts in the first embodiment, and the details thereof are omitted.

[0019] Fig. 7 illustrates the third embodiment of a tappet according to the present invention. In this embodiment, feed is given to the cutting tool only in an axial direction, not toward the axis, so that the raw material is ground. When the cutting tools reaches to a predetermined position in the vicinity of the end of the raw material, feed of the cutting tool is stopped, and terminates at a position slightly spaced from the end of the material 1. thereby forming a helical groove 3 having an annular groove 3a at the terminating end then a tappet is made by a way similar to the first embodiment.

Claims

1. A tappet of an internal combustion engine, the tappet comprising a core material (5) having a helical groove (3) on the outer circumferential surface (8) and a wear resistant coating layer (7) which covers the outer circumferential surface (8) of the core material (5), the end of the outer circumferential surface (8) being chamfered, characterised in that:

the end of said helical groove (3) is terminated at a position slightly spaced from the end of the core (5), and an annular groove (3a) being formed at the end of the helical groove (3), thereby preventing peaks (10) of the helical groove (3) from being exposed over the outer circumferential surface (8) of

said coating layer (7).

2. A tappet as claimed in Claim 1 wherein said helical groove (3) gradually becomes smaller in diameter towards the end.
3. A method of manufacturing a tappet of an internal combustion engine, the method comprising the steps of:

contacting the outer circumferential surface (8) of a cylindrical core material (5) with a cutting tool to give feed in an axial direction to form a helical groove (3) on the outer circumferential surface (8) of the core material (5) while the core material (5) is rotated on the axis; stopping the feed of the cutting tool when the helical groove (3) reaches in the vicinity of the end of the core material (5) to form an annular groove (3a) at the end of the helical groove (3); covering the outer circumferential surface (8) of the core material (5) with wear resistant coating layer (7), and finishing the outer circumferential surface (8) to a cylindrical surface, at least the end of the cylindrical surface being chamfered.

4. A method as claimed in Claim 3, further comprising the step of giving the feed to the cutting tool toward the axis in the vicinity of the end of said core material (5) to form the helical groove (3) which gradually becomes smaller in diameter as it becomes closer to the end of the core material (5), next to the step of contacting the outer circumferential surface (8) of the cylindrical core material (5).

Revendications

1. Poussoir d'un moteur à combustion interne, le poussoir comprenant un matériau de coeur (5) ayant une rainure hélicoïdale (3) sur la surface périphérique externe (8) et une couche de revêtement résistant à l'usure (7) qui couvre la surface périphérique externe (8) du matériau de coeur (5), l'extrémité de la surface périphérique externe (8) étant chanfreinée, caractérisé en ce que :

l'extrémité de ladite rainure hélicoïdale (3) se termine à une position légèrement écartée de l'extrémité du coeur (5), une rainure annulaire (3a) étant formée à l'extrémité de la rainure hélicoïdale (3), en empêchant, par conséquent, l'exposition des pics (10) de la rainure hélicoïdale (3) sur la surface périphérique externe (8) de ladite couche de revêtement (7).
2. Poussoir selon la revendication 1, caractérisé en ce que ladite rainure hélicoïdale (3) devient progressi-

vement plus petite au diamètre vers l'extrémité.

3. Méthode de fabrication d'un poussoir d'un moteur à combustion interne, la méthode comprenant les étapes consistant à procéder à:

la mise en contact de la surface périphérique externe (8) d'un matériau de coeur cylindrique (5) avec un outil de coupe pour fournir une avance dans une direction axiale, afin de former une rainure hélicoïdale (3) sur la surface périphérique externe (8) du matériau de coeur (5), alors que le matériau de coeur (5) tourne autour de l'axe ;

l'interruption de l'avance de l'outil de coupe quand la rainure hélicoïdale (3) parvient au voisinage de l'extrémité du matériau de coeur (5) pour former une rainure annulaire (3a) à l'extrémité de la rainure hélicoïdale (3) ;

la couverture de la surface périphérique externe (8) du matériau de coeur (5) à l'aide d'une couche de revêtement résistant à l'usure (7), et la finition de la surface périphérique externe (8) pour former une surface cylindrique, l'extrémité de la surface cylindrique au moins étant chanfreinée.

4. Méthode selon la revendication 3, comprenant en outre l'étape de fourniture de l'avance à l'outil de coupe en direction de l'axe au voisinage de l'extrémité dudit matériau de coeur (5), pour former la rainure hélicoïdale (3), qui devient progressivement plus petite au diamètre au fur et à mesure qu'elle se rapproche de à l'extrémité du matériau de coeur (5), et ensuite l'étape de mise en contact de la surface périphérique externe (8) du matériau de coeur cylindrique (5).

Patentansprüche

1. Ventilstößel einer Brennkraftmaschine, umfassend einen Kern (5) mit einer schraubenförmigen Nut (3) auf seiner Außenmantelumfangsfläche (8), und eine verschleißfeste Überzugsschicht (7), welche die Außenmantelumfangsfläche (8) des Kerns (5) bedeckt, wobei das Ende der Außenmantelumfangsfläche (8) angefast ist, dadurch gekennzeichnet, dass das Ende der schraubenförmigen Nut (3) sich an einer von dem Ende des Kerns (5) etwas beabstandeten Position befindet, und dass an dem Ende der schraubenförmigen Nut (3) eine ringförmige Nut (3a) angeformt ist, so dass im Bereich der schraubenförmigen Nut (3) keine Erhebungen über die Außenmantelumfangsfläche (8) der Überzugsschicht (7) hervorsteht.

2. Ventilstößel nach Anspruch 1, dadurch gekennzeichnet, dass der Durchmesser der schraubenförmigen Nut (3) zu deren Enden hin allmählich abnimmt.

3. Verfahren zur Herstellung eines Ventilstößels einer Brennkraftmaschine, gekennzeichnet durch die folgenden Schritte:

- Ansetzen eines Schneidwerkzeugs an der Außenmantelumfangsfläche (8) eines zylindrischen Kerns (5) unter axialem Vorschub zwecks Bildung einer schraubenförmigen Nut (3) auf der Außenmantelumfangsfläche (8) des Kerns (5), während dieser um seine Achse rotiert wird;
- Unterbrechen des Werkzeugvorschubs, wenn die schraubenförmige Nut (3) in die Nähe eines Endes des Kerns (5) reicht, um an dem Ende der schraubenförmigen Nut (3) eine ringförmige Nut (3a) zu bilden;
- Bedecken der Außenmantelumfangsfläche (8) des Kerns (5) mit einer verschleißfesten Überzugsschicht (7), sowie
- Nachbearbeiten der Außenmantelumfangsfläche (8) in eine zylindrische Oberfläche, wobei wenigstens das Ende der zylindrischen Oberfläche angefast ist.

4. Verfahren nach Anspruch 3, weiterhin gekennzeichnet durch den Schritt, dass bei dem Ansetzen eines Schneidwerkzeugs an der Außenmantelumfangsfläche (8) des zylindrischen Kerns (5) dem Schneidwerkzeug in der Nähe des Endes des Kerns (5) ein Vorschub in Richtung zu dessen Achse erteilt wird, so dass der Durchmesser der schraubenförmigen Nut (3) allmählich kleiner wird, wenn sie sich dem Ende des Kerns (5) nähert.

FIG.1

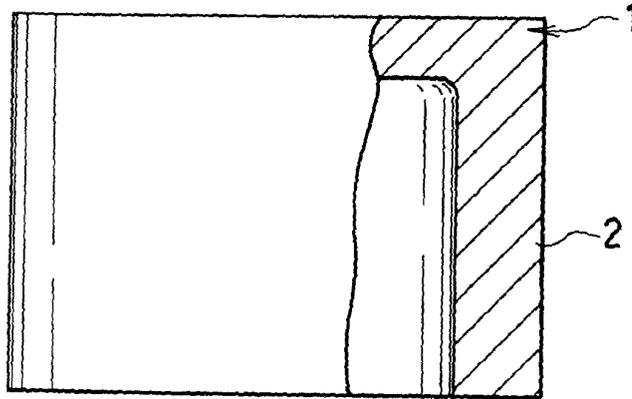


FIG.2

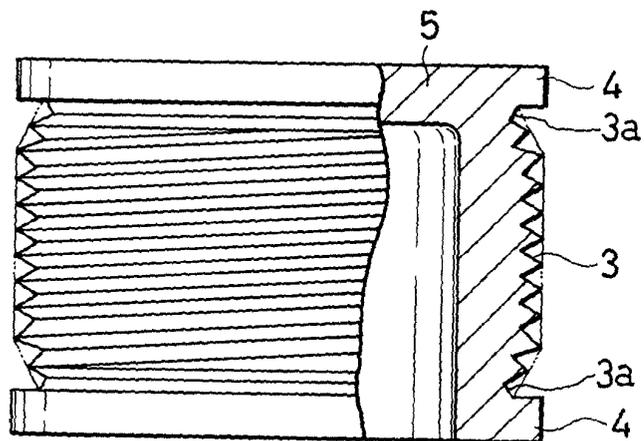


FIG.3

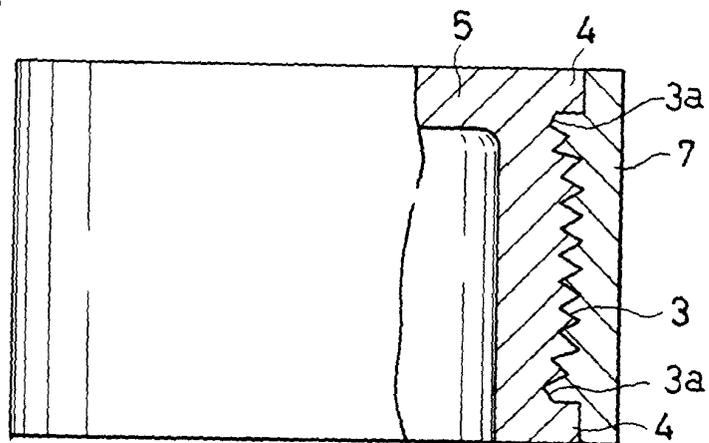


FIG. 4

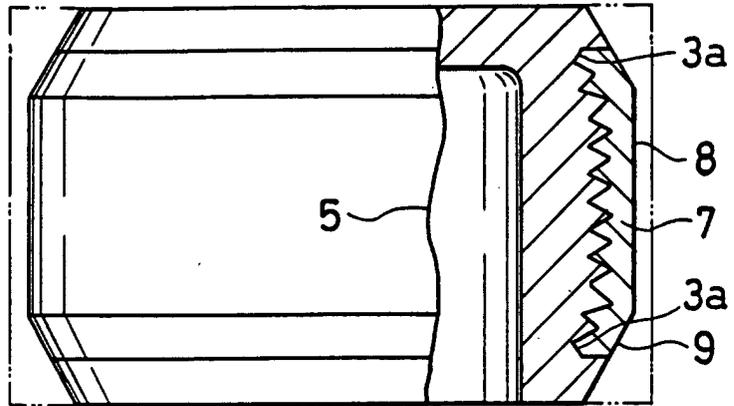


FIG. 5

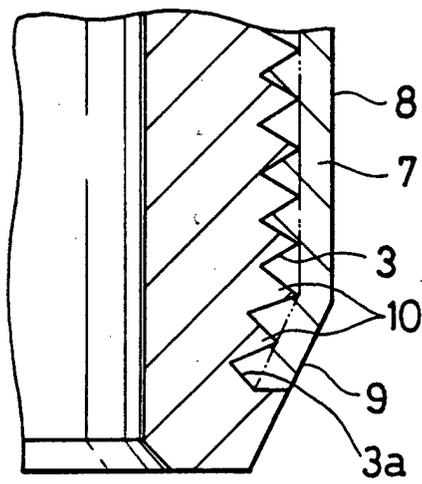


FIG. 6

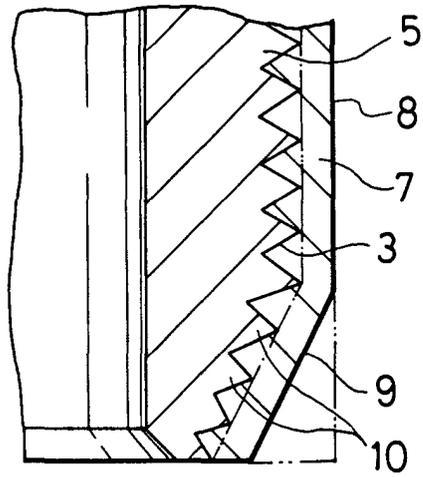


FIG. 7

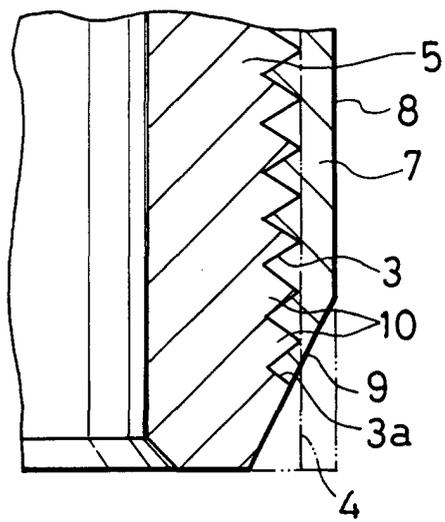


FIG. 8

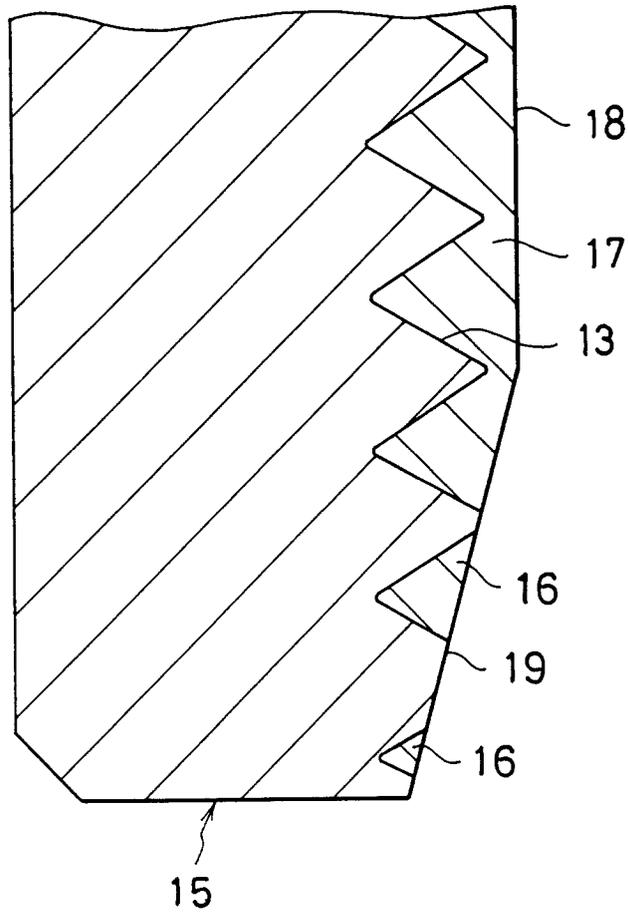


FIG. 9

