RE. 24506

March 12, 1957 J. W. HUMPHREYS 2,784,706

HYDRAULIC TAPPET

Filed Oct. 19, 1955

Fig. 1.

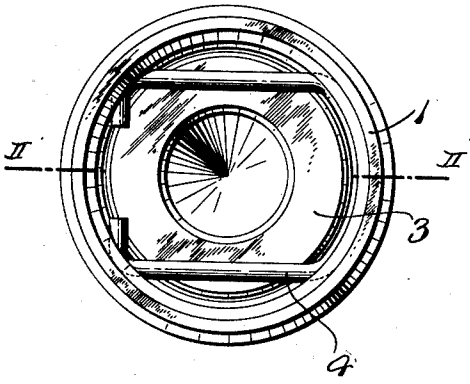


Fig. 3.

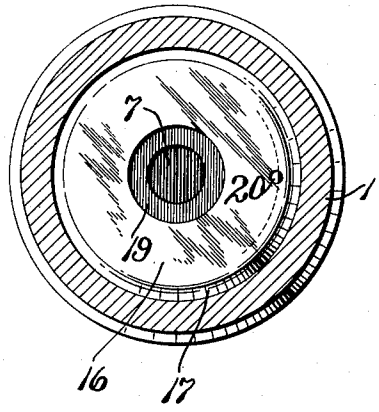


Fig. 2.

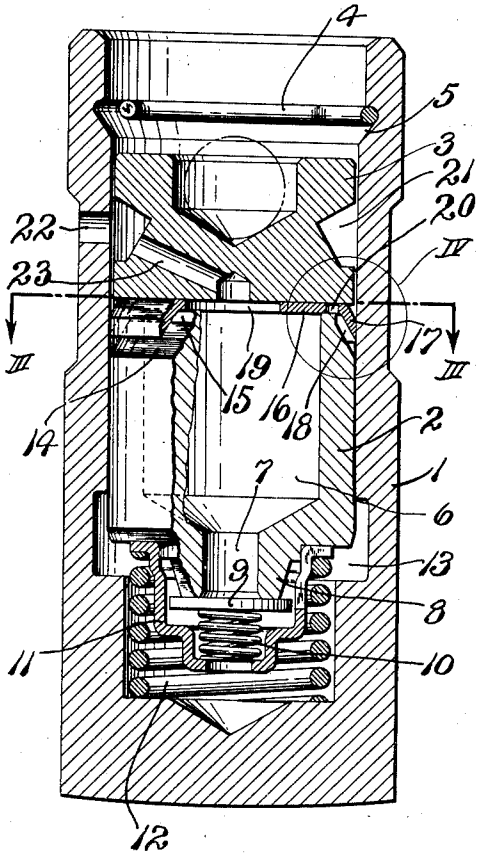
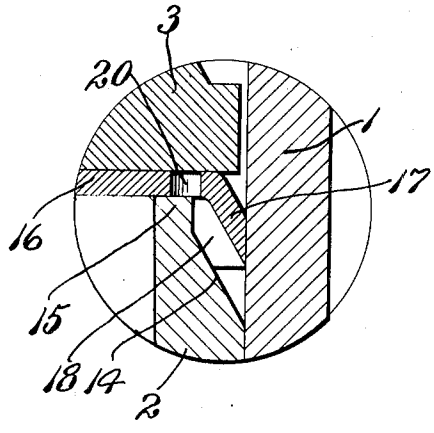


Fig. 4.



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United States Patent Office 2,784,706 Patented Mar. 12, 1957

2,784,706

HYDRAULIC TAPPET

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Application October 19, 1955, Serial No. 541,387

7 Claims. (Cl. 123—90)

This invention is directed to a novel, and very practical hydraulic tappet structure for use in internal combustion engines which, by reason of its novel structure, eliminates the need now present in substantially all hydraulic tappets of machining to very close tolerances with attendant expense. Of even more importance, an elimination is attained of measuring and sorting the tappet bodies and the plungers therewithin in hydraulic tappets, in increments of 33 or 50 millionths of an inch, for assembly of matching sorted bodies and plungers in their proper sizes, to keep the leakage of oil past the plunger to a proper limited amount, thereby preventing a noisy tappet upon reaching a high temperature, and further providing a correct fit of the matching parts which assures a reasonably long life of service of the tappet.

With my invention no sorting of bodies and plungers to fit therewithin is required. The tolerances concerning the dimensions of inner bores of the bodies and outer surfaces of the plungers may be relatively large and vary from .001" to .004", which tolerances permit quantity machining within such .003" variation in fitting. The relatively wide tolerances over what is now required in machining, and the elimination of measuring each body and each plunger and of sorting and fitting greatly reduces the cost of manufacture to an extent reaching approximately ten percent of the total cost of the tappet.

An understanding of the novel structure embodying my invention in its preferred form may be understood from the following description, taken in connection with the accompanying drawing, in which,

Fig. 1 is an upper end or plan view of the hydraulic tappet.

Fig. 2 is a central longitudinal vertical section therethrough on the plane of line II—II of Fig. 1.

Fig. 3 is a transverse horizontal section substantially on the plane of line III—III of Fig. 2, and

Fig. 4 is an enlarged fragmentary vertical section on the same plane as Fig. 2, a fragmentary portion, such as within the indicated circle IV, being shown enlarged.

Like reference characters refer to like parts in the different figures of the drawing.

In the construction illustrated the usual tappet body **1** of cylindrical form is bored downwardly from its upper end toward but short of the lower end which is closed, the under side of the lower end in use bearing against a cam on a camshaft of an internal combustion engine.

The plunger in the present invention includes an inner lower part **2** and an outer upper part **3** above it, the lower parting being inserted into the bore of the body and having a relatively loose fit as compared to the usual hydraulic tappet fit in which the tolerances are as above stated. The upper body part **3** can be even still looser without materially affecting the operation, although in actual practice it is fitted about the same as the lower part **2**.

Such plunger is normally retained within the body against moving out and disconnecting therefrom by a spring retainer **4** above the upper end of the upper part **3** which snaps into an annular groove **5** at the inner side

of the walls of the tappet body **1**, in the usual much used way that the plungers of hydraulic tappets when assembled are thus kept from separation in packing, handling and shipping.

The inner and lower member **2** of the plunger is interiorly bored from its upper end downwardly to provide an oil supply chamber **6** which has an outlet through a reduced lower end passage **7** from the lower end of the chamber **6** to the lower end of a projecting nipple **8** at the lower end of the member **2**. Such passage is normally closed by a flat, thin metal disk valve **9** held against the lower end of the nipple **8** by a light strength coiled compression spring **10** within a cage **11** which has an opening at its lower end and through its side. The cage comes against the lower side of the member **2** at the upper end of the cage and is held snugly in position by a coiled compression spring **12** of much heavier strength than the spring **10**, seated at its lower end against the bottom of the tappet bore. The chamber **13** below the plunger member **2**, in which the valve spring and cage are located, is the pressure chamber of the hydraulic tappet. Such valve structure, including the disk valve, springs **10** and **12** and the cage **11**, is old and well known and has been used in hydraulic tappets for a considerable time.

At the upper end of the lower plunger member **2** a portion is cut away around the outer side thereof making an annular upwardly and inwardly inclined surface **14**, the member **2** at its upper end terminating in a narrowed annular lip **15** as shown in Figs. 2 and 4.

Between the upper end of the member **2** and the lower end of plunger member **3** a thin metallic disk **16** is placed having a downwardly and outwardly inclined annular flange **17**. The peripheral edges of said flange come against the inner sides of the walls of the tappet body and are located outwardly from the annular surface **14** of the member **2** a distance so that, as best shown in Fig. 4, an annular chamber **18** is made which may be filled with oil or other hydraulic liquid used, forced upwardly from the pressure chamber **13** between the lower member **2** and the walls of the body **1** to the chamber **18**.

Preferably at the center of the disk **16** a circular opening **19** is made. Also adjacent an edge of the disk **16** and inwardly from its integral junction with the flange **17** a small opening **20** is pierced which is disposed so that, at its lower end, it is in partial communication with the chamber **18**, the major portion of the lower end of the opening or passage **20** being over the annular rim or lip **15** of the lower plunger member **2**. Such small pierced hole in practice projects over the edge of the upper annular rim **15** of the member **2** in an amount which may vary from .002" to .005". As an equivalent the same effects and results may be obtained by making a small hole, the area of which would be substantially that of the connecting passage between chamber **18** and the opening **20**, through the flange **17**. This however, because of the smallness of the hole made through the flange **17** would be a very difficult and expensive operation and one not practical for high quantity production. The diameter of hole **20** is somewhat greater than the thickness of the disk, making it practical to pierce the hole during the fabrication of the disk.

An annular oil receiving groove **21** is made around the upper plunger member **3**. It receives oil from the lubricating system of an internal combustion engine in the usual manner of all hydraulic tappets through the passage **22** in the body **1** being in registration with the groove **21**. From such groove **21** oil flows through a passage **23** leading to and over the opening **19** in the thin stamped disk **16**. All that is necessary is that there shall be this free communication for flow of oil passing through the inlet at **22** so as to reach the oil supply chamber **6** of

the tappet. Thus while the opening **19** is preferably centrally disposed it is not necessarily so.

With the structure as described the operation of the tappets is the same as with all hydraulic tappets except the metered movement of oil from the pressure chamber upward between the piston plunger and the walls of the body **1** is not controlled by a sorted and selected assembly of the tappet bodies and tappet plungers held within limits considerably less than one-tenth of one-thousandths of an inch. But the oil under the pressure to which the oil in the chamber **13** is subjected may flow much more freely upward and fill the annular chamber **18** and then is restricted, or metered, in its flow through the narrowed small area connection between such chamber **18** and the opening **20** to come against the under side of the upper plunger member **3**. The flange **17** riding against the walls of the tappet body substantially prevents flow of oil from the chamber **18** around the outer edges of said annular flange **17** in an upward direction.

The lower side of the upper plunger member **3** is machined flat so as to lie snugly against the upper side of the thin metal disk member **16**. When on the down stroke of the tappet with the engine valve moving toward closed position, such valve reaches its closed position and the force of the engine valve spring is, for a very short, practically instantaneous time, removed from the upper member **3**, the pressure of oil within the chamber **18** transmitted through the opening **20** against the under side of the upper member **3** will, for an instant, lift such member **3**. This permits a small or metered quantity of oil to pass between the upper plunger member **3** and the disk **16** in the required amount of leakage necessary for the operation of hydraulic tappets; which, heretofore, has been the leakage from the pressure chamber **13**, in very small amounts, because of the close fit of the plunger in the tappet body, only a very small or metered amount passing between such tappet body walls and the plunger.

In the practical operations and tests of the tappet it has been found that while the use of the opening at **20** through the disk **16** with the very small area communication between it and the annular chamber **18** is the most desirable structure from a practical standpoint, both in manufacture and use, the tappet still is operative, though perhaps with a less measure of success, if the hole **20** is eliminated and the edges of the flanges **17** merely rounded or at least reduced in contacting area below that shown in Fig. 4 so that a small and metered quantity of oil will pass between the bearing edges of said flanges and the walls of the tappet body against which they ride. My invention, while disclosed in the best form known to me, is not to be limited other than as required by the claims appended hereto which define the invention.

I claim:

1. A hydraulic tappet plunger adapted to be assembled within a tappet body comprising, a lower plunger member having a liquid supply chamber, open at its upper end, and a valve controlled outlet at its lower end, a thin metal disk over the upper open end of said member having edge portions adapted to bear against the inner sides of the walls of a tappet body in which said plunger is installed, and an upper plunger member having a flat lower side against the upper side of said disk.

2. Structure as defined in claim 1, said disk at its peripheral edge portions having a downwardly and outwardly extending annular flange integral therewith.

3. A hydraulic tappet plunger for assembly within a tappet body comprising, upper and lower plunger members, and a thin metal disk between adjacent ends of said members, the peripheral edges of which extend slightly beyond the outer sides of said members, the lower member having a liquid receiving chamber open at the upper end of said lower member and having a valve controlled outlet at the lower end thereof, said disk being located over the upper open end of said chamber, said disk having an opening therethrough at the upper end of said chamber, and said upper member having a liquid carrying passage from its outer side to and in conjunction with said opening in said disk.

4. In a hydraulic tappet having an elongated, interiorly bored body closed at its lower end and open at the upper end, the improvement comprising, a plunger within the body having a lower member normally spring forced outwardly, an upper member aligned with said lower member, a thin disk between said members having peripheral edges in contact engagement with said body, said members and disk having passages therethrough in conjunction with each other for liquid passage, and said lower member having a valve normally closing the passage therethrough at the lower end thereof.

5. A hydraulic tappet having the elements in combination defined in claim 4, said disk at its peripheral portions having an annular flange inclined to the plane of said disk toward the closed end of said body, and said lower plunger member at its outer end portion having a reduced exterior diameter, thereby providing an annular chamber betweeen said flange and the outer end of said lower plunger member.

6. A hydraulic tappet plunger comprising, upper and lower plunger members, a thin disk between adjacent ends of said members, said disk at its peripheral portions having a downwardly and outwardly inclined annular flange, and the adjacent upper end portion of said lower plunger member being reduced in diameter thereby providing an annular chamber between said flange and upper end of said lower plunger member, said disk having an opening therethrough in conjunction with said annular chamber.

7. Structure as defined in claim 6, said opening in said disk being located partly over the upper end of said lower plunger member, and partly over said chamber.

No references cited.