ABSTRACT

A metered mechanical tappet utilizing a push rod seat permanently retained by a separate retainer or by a press-fit within the cavity of the tappet upon an annular shoulder of the latter. Oil flow is obtained by a slot in the surface of the seat supported by said shoulder, the slot at least extending radially from the oil reservoir directly below the seat to the outer wall of the seat, from whence it passes to the interior of the seat and to the push rod by means of an annular path between the outer seat wall and the cavity along at least a portion of the axial extension of the seat. The actual metering is accomplished by either the slot, in which case the annular path has a substantial radial thickness; or by the annular path, in which case its thickness is considerably less than any of the dimensions of the slot.

4 Claims, 9 Drawing Figures
METERED MECHANICAL TAPPET WITH SLOTTED PUSH ROD SEAT

CROSS REFERENCE TO RELATED APPLICATION

This is a divisional application of parent application Ser. No. 29,915, filed Apr. 20, 1970, now U.S. Pat. No. 3,614,942, and entitled METERED MECHANICAL TAPPET WITH SLOTTED PUSH ROD SEAT.

BACKGROUND OF THE INVENTION

Although mechanical tappets do not require hydraulic fluid for their operation in contrast with the hydraulic tappets, nevertheless oil in many cases must be supplied to the rocker arms for lubrication thereof. A conventional way of accomplishing this is by supplying the oil through the push-rod. Most prior constructions so utilizing the push-rod have resulted in improper control of the flow of the oil through the push-rod, and attempts to meter the flow have been unable to overcome the problem of blockage due to foreign particles and at the same time not waste oil by having too much metering.

A very satisfactory metering device has been recently developed for use in mechanical tappets and is disclosed in application Ser. No. 853,741, filed Aug. 28, 1969, now U.S. Pat. No. 3,618,575, owned by the same assignee as the instant application. However, the construction disclosed in that application necessitates the use of a flat disc upon which the push rod seat rests. To reduce cost, it would be advantageous to obtain a construction which would not necessitate the use of the flat disc.

SUMMARY OF THE INVENTION

The invention relates to a mechanical tappet utilizing continuous precision metering without the necessity for a flat disc positioned immediately below the push-rod seat. Specifically, the invention provides an improved mechanical tappet operatively connected to a push-rod and comprising an oil reservoir, a push-rod seat positioned within a cavity of the tappet, the seat having a central opening communicating with the push-rod and means for metering oil from the reservoir through the seat and into the rod; the improvement comprising the metering means including a slot in one of the surfaces of the seat engaged by the tappet, the slot extending to the reservoir, and a passageway from the slot to the central opening.

Accordingly, it is an object of the invention to provide a mechanical tappet utilizing precision metering without the necessity for a flat disc positioned immediately adjacent to the metering surface of the push-rod seat.

It is a further object of the invention to provide a tappet of the above character wherein oil is supplied dependably and continuously to the push-rod regardless of the cycle of the camshaft, the lack or the presence of lash, or the amount of the oil pressure.

A related object of the invention is to provide a tappet of the above character which is inexpensive to manufacture.

Other objects and advantages will become apparent upon reference to the following drawings and detailed discussion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, side elevation partially in section of a tappet constructed in accordance with the invention;
FIG. 2 is a plan view of the retainer utilized in FIG. 1;
FIG. 3 is a cross-sectional view of the push-rod seat and tappet body taken along the plane III—III of FIG. 1;
FIG. 4 is an elevational view, partially in section, illustrating the tappet body only;
FIG. 5 is a fragmentary side elevational view partially in section similar to FIG. 1 but illustrating an alternate embodiment;
FIG. 6 is a fragmentary elevational view, partially in section, of still another alternate embodiment of the invention;
FIG. 7 is a sectional view of the push-rod seat of the embodiment shown in FIG. 6;
FIG. 8 is a plan view of the tappet of FIG. 6 but without the push-rod; and
FIG. 9 is a cross-sectional view of a modified push-rod seat.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention relates to an improved mechanical tappet 10 utilized in a conventional engine block having a crankcase 11 and a passageway 12 connecting the tappet 10 to an oil gallery. The tappet includes the tappet body in which is seated a push-rod seat 16 supporting a push-rod 14, the entire combination being reciprocated in a conventional fashion by a cam 18 on camshaft 20. The tappet body 24 is conventionally provided (FIG. 4) with an oil reservoir 22 in the lower part and a groove 30 in the outer part thereof. The upper portion is provided with an enlarged cavity 25 having the following configuration. A shoulder 26 is formed by an annular undercut 50. Spaced above the undercut 50 is still another undercut in the form of a groove 29. The shoulder 26 serves to accommodate and support the seat 16, while the functions of the undercut and the groove are hereinafter described.

In accordance with the invention, a metering means 36 is constructed in the push-rod seat 16 so as to not need a flat disc as was utilized in the aforesaid U.S. Pat. No. 3,618,575. The elimination of this element is made possible by utilizing, in the embodiment illustrated in FIGS. 1-4, a metering slot 40 (see FIG. 3) in the bottom surface of the push-rod seat 16, the slot 40 being positioned within the surface 42 which rests upon the annular shoulder 26. The slot 40 extends radially from the outer wall 17 of the push-rod seat at least to a point at which it is in communication with the oil reservoir 22.

To carry the metered oil from the slot 40 to a central opening 27 in the seat 16, a non-metering passageway comprising an annular path between the outer wall 17 of the push-rod seat 16 and the wall of the cavity 25 extending along at least a portion of the outer wall 17 is provided. Specifically, in the embodiment shown in FIG. 1, the annular path comprises the annular undercut 50 in the interior wall of the cavity 25, the undercut extending approximately half-way up the surface of the wall 17. A cross hole 52 is provided within the push-rod seat 16, extending radially from the center opening 27 to the wall 17 and thus communicating with the annular undercut 50. Thus, the flow of the oil from the reservoir 22 is through the metering slot 40, into the annular
path defined by the annular undercut 50, thence through the cross hole 52 and into the central opening 27 where it passes through the opening 28 in the push-rod.

The push-rod seat 16 having the preceding features can be manufactured by any conventional technique, such as by machining a suitable metal blank. The metering slot can be coined to insure proper size.

As in the case of the earlier aforesaid U.S. Pat. No. 3,618,575, to allow this metering device to be utilized, it is necessary to insure that the push-rod seat 16 is bisected at all times against the shoulder 26. To accomplish this, a resilient retainer 60 is pressed into the housing 24 so as to prevent the surface 42 of the push-rod seat from separating from the shoulder in the direction of reciprocation of the tappet. That is, tendency to separate will be caused by lash, and this tendency is prevented by the frictional retention of the retainer 60 within the cavity 25. The retainer 60 comprises a flexible metallic piece which is dish-shaped (FIG. 2) so as to provide an upstanding edge 62 formed by a bend 64. A central hole 66 accommodates the push-rod 14. To insure positive retention of the retainer 60 within the cavity 25, the groove 29 may be provided within the cavity wall. (See FIG. 4.) However, it has been found that the groove 29 is not essential to the proper retention of the retainer 60. It will be readily appreciated that the aforesaid construction allows the push-rod seat 16 to rotate within the cavity 25 with the surface 42 pressed upon the shoulder 26 so as to lessen the tendency of the slot 40 to become plugged. At the same time, this construction prevents any axial movement of the push-rod seat 16 so as to unseat and thereby enlarge the slot 40 allowing too much oil to meter through the cross hole 52 and thence into the push-rod 14.

In operation, the oil flow to the rocker arm through the push-rod 14 is from the passageway 12, reservoir 22 defined by the tappet body 24, through metering means 36, and thence through the central opening 27 in the push-rod seat to the hole 28 in the bottom of the push-rod 14. The oil in the reservoir 22 is replenished each time the groove 30 of the housing 24 reciprocates past the opening to the passageway 12.

FIG. 5 illustrates an alternate embodiment of the invention wherein a different construction is utilized to retain the push-rod seat from axial movement within the tappet. Similar parts which correspond to those utilized in the previous embodiment utilize the same numerals to which the distinguishing suffix a has been added. Thus, as shown in FIG. 5, a tappet 10a is operated by a cam 18a within a crankcase 11a, the oil flowing from a passageway 12a through a reservoir 22a, slot 40a and up into a push-rod 14a. The metering means 36a is identical in all respects with that described in the previous embodiment except that the annular path between the outer wall 17a of the push-rod seat and the inner wall of the cavity 25a is formed by reducing the diameter of the outer wall 17a for almost the entire length of the push-rod seat. Thus, there is no annular undercut in the inner wall of the cavity 25a. The reduced diameter of the outer wall 17a terminates at a point just below the top surface 70 of the push-rod seat, thereby forming an annular lip 72, the outer diameter of which exceeds the diameter of the inner wall of the cavity 25a. This construction insures that the push-rod seat 16a will be press-fit into the cavity 25a and retained in the position wherein its surface 42a is constantly supported by the annular shoulder 26a of the cavity 25a.

It will be readily appreciated that because in the embodiment illustrated in FIGS. 1 through 5, the metering is done by the slot rather than the annular path, that the radial thickness of the annular path is substantial and the tolerances in forming the path are not important or significant.

FIGS. 6 through 8 illustrate still another embodiment wherein the metering is accomplished by the annular path between the walls of the push-rod seat and the cavity of the tappet, rather than by the slot, so that the slot merely conveys ample oil to the annular path under all conditions of operation of the device. Similar parts which correspond to those utilized in the previous embodiments bear the same reference numerals to which the distinguishing suffix b has been added. Thus, as shown in FIG. 6, a tappet 10b reciprocates within a crankcase 11b, the oil flowing from a passageway 12b, into a reservoir 22b and through a conveying means 36b into a central opening 27b and thence up into a push-rod 14b by means of the hole 28b therein. Unlike the previous embodiments, the metering in this embodiment is accomplished by the annular path between the wall 17b of the push-rod seat 16b in the wall of the cavity 25b, a slot 80b being provided in the bottom of the push-rod seat 16 in the surface which rests upon the annular shoulder 26b solely for the purpose of supplying continuously a flow of oil to the annular path. Thus, it will be readily appreciated that the radial thickness of the annular path is substantially less than any of the dimensions of the slot 80, the thickness being controlled by strict tolerance requirements on the dimensions of the walls of the push-rod seat and the cavity. The particular dimensions vary with the amount of metering desired, and are readily determinable.

The embodiment shown in FIGS. 6 through 8 also illustrates that the cross hole 52c can extend the full diameter of the push-rod seat so as to provide the central opening 27b by two different locations in the annular path. Or, in the alternative, the cross hole 52c need extend only as a radius of the push-rod seat. Further variations are to make the push rod seat in two parts, the lower part being a disk as shown in FIG. 9 with slots 80c, 52c and 52d in opposite sides thereof, and the upper part being the seat 17c. This construction permits shallower slots and reduces flow characteristics.

Although the invention has been described in connection with several preferred embodiments, it will be recognized that other embodiments equivalent in nature can be utilized. Thus, the invention is intended to include equivalent embodiments, unless the scope and wording of the following claims expressly states otherwise.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a mechanical tappet operatively connected to a push rod and comprising a tappet body having an oil reservoir, a push rod seat positioned within a cavity of said tappet and movable into and out of engagement with an annular shoulder of said tappet body, said seat having an opening communicating with said push rod, and means located between said reservoir and said opening for metering oil from said reservoir into said
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5 rod; the improvement comprising a passageway for said oil between said reservoir and metering means including a slot means in one of the engaging surfaces of said seat and said tappet body, said slot means extending at least to the reservoir and providing a means for permitting oil to flow continuously from said reservoir to said metering means and into said push rod regardless of whether said rod seat is bearing against said annular shoulder.

2. The improvement as defined in claim 1 wherein said passageway includes an annular path between at least a portion of the outer wall of said seat and the concentric wall of said tappet body, and said slot extends from the outer diameter of said seat wall at least to a point in communication with said reservoir.

3. The improvement as defined in claim 2 wherein said annular path has a predetermined radial thickness which is substantially less than any of the dimensions of said slot, whereby said annular path defines the metering function.

4. The improvement as defined in claim 2 wherein said slot extends across the entire supported surface of said seat.

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