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Erickson et al.

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[45] **Jan. 1, 1974**

[54] **METERED MECHANICAL TAPPET WITH SLOTTED PUSH ROD SEAT**

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[73] Assignee: **Johnson Products, Inc.,** Muskegon, Mich.

[22] Filed: **June 3, 1971**

[21] Appl. No.: **149,483**

Related U.S. Application Data

[62] Division of Ser. No. 29,915, April 20, 1970, Pat. No. 3,614,942.

[52] **U.S. Cl.**..... **123/90.35,** 123/90.48, 184/6.9

[51] **Int. Cl.**..... **F011 1/14,** F01m 9/10

[58] **Field of Search**..... 123/90.35, 90.43, 123/90.46, 90.55; 184/6.9

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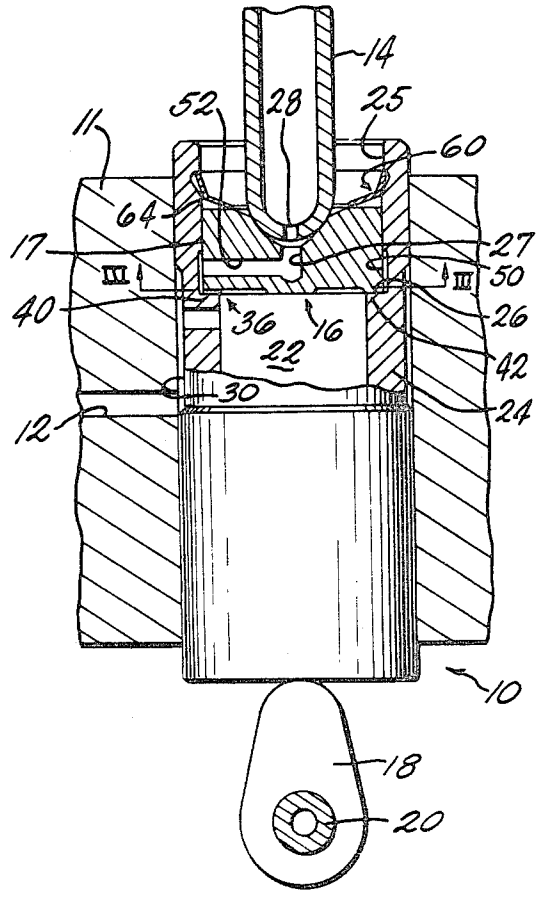
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Attorney—Price, Heneveld, Huizenga & Cooper

[57] **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 t he 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



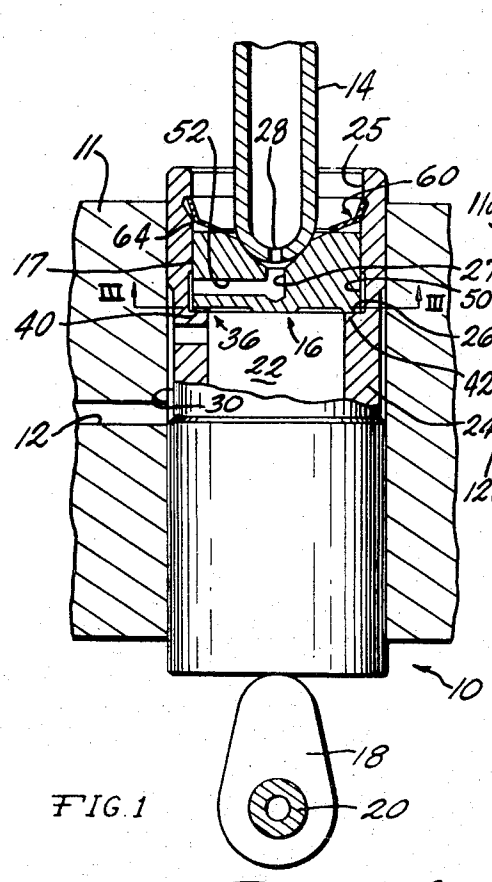


FIG. 1

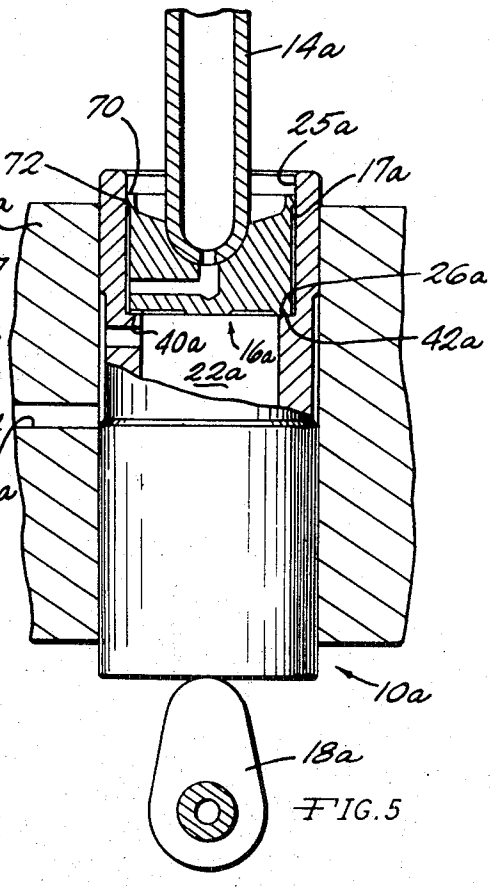


FIG. 5

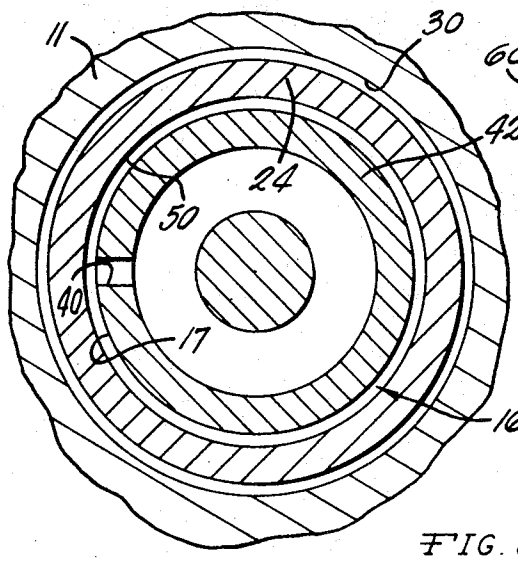


FIG. 3

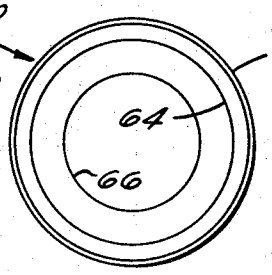


FIG. 2

FIG. 4

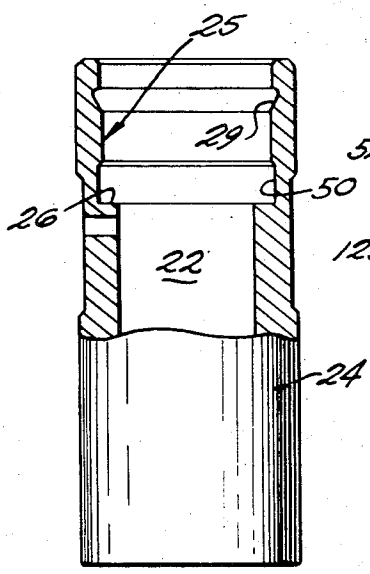
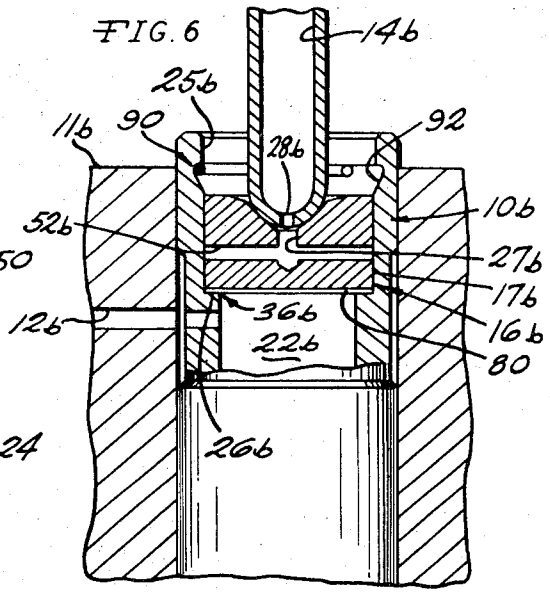


FIG. 6



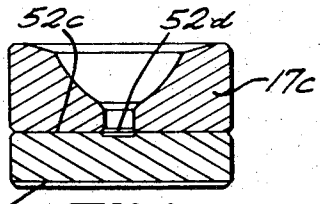


FIG. 9

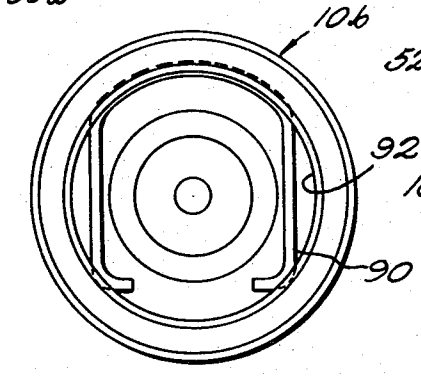


FIG. 8

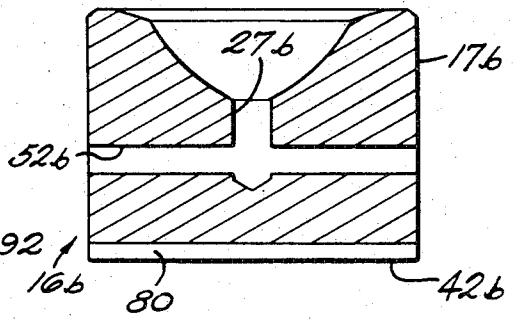


FIG. 7

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 **40** 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 accomodate 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 biased 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 aforegoing 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 into 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 **10***a* is operated by a cam **18***a* within a crankcase **11***a*, the oil flowing from a passageway **12***a* through a reservoir **22***a*, slot **40***a* and up into a push-rod **14***a*. The metering means **36***a* is identical in all respects with that described in the previous embodiment except that the annular path between the outer wall **17***a* of the push-rod seat and the inner wall of the cavity **25***a* is formed by reducing the diameter of the outer wall **17***a* for almost the entire length of the push-rod seat. Thus, there is no annular undercut in the inner wall of the cavity **25***a*. The reduced diameter of the outer wall **17***a* 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 **25***a*. This construction insures that the push-rod seat **16***a* will be press-fit into the cavity **25***a* and retained in the position wherein its surface **42***a* is constantly supported by the annular shoulder **26***a* of the cavity **25***a*.

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 **10***b* reciprocates within a crankcase **11***b*, the oil flowing from a passageway **12***b*, into a reservoir **22***b* and through a conveying means **36***b* into a central opening **27***b* and thence up into a push-rod **14***b* by means of the hole **28***b* therein. Unlike the previous embodiments, the metering in this embodiment is accomplished by the annular path between the wall **17***b* of the push-rod seat **16***b* in the wall of the cavity **25***b*, a slot **80** being provided in the bottom of the push-rod seat **16** in the surface which rests upon the annular shoulder **26***b* 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 **52***b* can extend the full diameter of the push-rod seat so as to provide access to the central opening **27***b* by two different locations in the annular path. Or, in the alternative, the cross hole **52***b* 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 **80***a*, **52***c* and **52***d* in opposite sides thereof, and the upper part being the seat **17***c*. 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

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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