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HYDRAULIC TAPPETS

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Fig. 1.

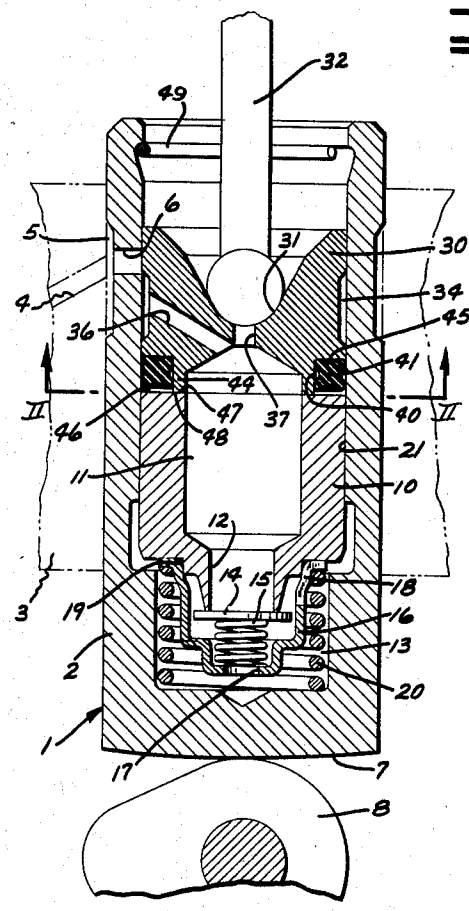



Fig. 2.

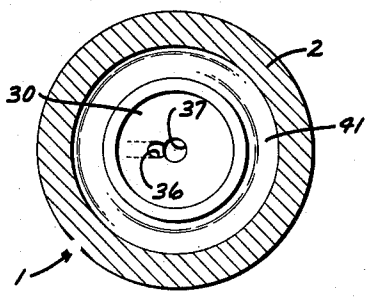
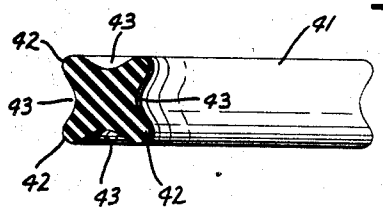



Fig. 3.

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# HYDRAULIC TAPPETS

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11 Claims. (Cl. 123—90)

This invention relates to tappets and more particularly to hydraulic tappets.

Hydraulic tappets are used in combustion engines as a means of adjusting the effective length of the valve train mechanism by compensating for the expansion or contraction of the different parts thereof under different temperature conditions.

Hydraulic tappets are usually disposed between a valve actuating cam member and a valve stem or valve actuating push rod member of the valve train mechanism. The tappet transmits the energy of the valve actuating cam through hydraulic fluid trapped in a chamber behind a plunger. During each operation of the cam, as the length of the valve actuating mechanism changes due to temperature changes, small quantities of hydraulic fluid are permitted to pass from or into the chamber and, thus, effect a relative, axial adjustment of the plunger and consequently an overall adjustment of the total effective length of the valve train mechanism.

In conventional hydraulic tappets the escape of hydraulic fluid from the pressure chamber is generally between the plunger and the walls of the tappet body or housing. Such escape, or "leakdown" as it is referred to, is controlled solely by the fit of the plunger within the tappet body or housing. Effective operation of a hydraulic tappet requires that the leakdown be precisely controlled and thus the fit between the plunger and the tappet body must be held to very close clearances, normally limited to 0.0002–0.00023 of an inch. Such close clearances require selective fitting of the plunger to the tappet body and is a very expensive operation. Even though considerable care is taken in making the selective fit, a certain percentage of the assembled tappets have a leakdown which is either too fast or too slow and, as a result, the tappet will not operate satisfactorily. The necessity of controlling leakdown and the complexity of the manufacture of tappets to regulate leakdown, solely by the fit of the parts, greatly increases tappet costs.

A hydraulic tappet is here proposed which does not require the precise machining, measuring, sorting, and selective fitting of plungers and tappet bodies that has been previously required. This is accomplished by providing for the escape of small quantities of hydraulic fluid from the pressure chamber by means other than the selective fitting of a plunger within a tappet body member.

It is here proposed to have the respectively engaged ends of the plunger member and the valve lifter or push rod seat member formed or machined to provide a leakdown or other type control therebetween. An effective fluid pressure sealing means is disposed about the push rod seat member above the leakdown or other type control to prevent the escape of hydraulic fluid other than over the control seat.

The proposed seal comprises an annular ring of resilient material so formed that it will not twist or roll nor crawl or creep under the high pressures incident to hydraulic tappet operation.

The advantages of the use of the proposed type of hydraulic tappet and of the disclosed type sealing ring will be more apparent to those acquainted with the design and construction of hydraulic tappets upon a reading of the following specification and an examination of the accompanying drawings.



In the drawings:

Fig. 1 is a cross sectional view of the proposed hydraulic tappet.

Fig. 2 is a cross sectional view of the hydraulic tappet shown by Fig. 1 as seen in the plane of line II—II and looking in the direction of the arrows thereon.

Fig. 3 is an enlarged view of a part of the annular sealing ring shown in Fig. 1.

In executing the objects and purposes of this invention a hollow tappet body is provided. The tappet body is closed at one end. A hollow plunger is disposed within the tappet body and forms a pressure chamber with the blind end of the tappet body. A push rod seat or valve lifter member is received within the tappet body above the plunger. The hollow interior of the plunger forms a hydraulic fluid reservoir closed by the push rod seat member. The reservoir of the tappet is in free communication with a source of hydraulic fluid from the engine through passageways formed in the push rod seat member and through the tappet body. A check valve is provided in the lower end of the plunger and permits the one-way flow of hydraulic fluid from the reservoir into the pressure chamber. The end of the push rod seat member, which is engaged with the upper end of the plunger member, includes an open step shoulder recess within which is received a sealing ring. The engaging ends of the plunger and push rod seat members are formed to provide an annular control surface for the escape of hydraulic fluid therebetween. When the hydraulic fluid pressure in the pressure chamber exceeds a predetermined value, such pressure provides a force separating the plunger and push rod seat members sufficiently to allow an escape of hydraulic fluid from the pressure chamber and into the reservoir.

Referring specifically to the drawings, the proposed hydraulic tappet 1 includes a tappet body 2 reciprocally disposed within a housing 3, such as would be provided by an engine block. The housing 3 has an oil supply passageway 4 communicating with a wide external and circumferential groove 5 formed about the tappet body 2. The height of the groove 5 assures communication between the groove and the passage 4 as the tappet body reciprocates within the housing 3. An aperture 6 is formed through the tappet body and communicates with groove 5 to provide access for hydraulic fluid to the interior of the tappet body member.

The tappet body 2 is closed at one end 7 and is open at the other end. The closed end 7 is engaged by a timing cam 8.

A plunger 10 is slidably disposed within the tappet body 2. The plunger 10 is hollow and forms a hydraulic fluid reservoir 11. A passage 12 extends through the lower end of the plunger to provide a means of communication between the reservoir 11 and the pressure chamber 13. The pressure chamber 13 is between the end of the plunger and the blind end of the tappet body 2. A check valve 14 is biased, by a spring 15, into closed position against the end of the plunger and over the end of the passage 12. The check valve 14 allows for one-way fluid flow communication between the fluid reservoir 11 and the pressure chamber 13.

The lower end of the check valve spring 15 bears against a valve retainer member 16. The retainer member 16 is engaged to the end of the plunger 10 about a wall 19 formed on the lower end of the plunger. An aperture 17 in the terminal end of the retainer, and apertures 18 in the sides thereof, permit the flow of hydraulic

fluid through and about the retainer 16. The plunger 10 is biased away from the closed end of the tappet body by a plunger return spring 20.

The fit of the plunger 10 within the tappet body 2 is such that the pressure chamber 13 is to be considered to extend to the top edge of the plunger and to be inclusive of the annular space 21 between the outer walls of the plunger and inner walls of the tappet body. This clearance is not sufficient to allow unrestricted flow of the hydraulic fluid between the plunger and tappet body walls. However it is sufficient to permit a more substantially uniform fluid pressure condition to exist within the pressure chamber and about the plunger than in conventionally known tappets. In a tappet constructed according to this invention, the clearance between the plunger and the inside surface of the tappet body may be as much as .005 or .006 of an inch as compared to the 0.0002–0.00023 of an inch clearance permissible in conventional tappets.

The upper end of the plunger 10 is engaged by the push rod seat member 30. The push rod seat member 30 is slidably disposed within the tappet body 2 above the plunger 10. A generally spherical depression 31 is formed within the upper surface of the push rod seat member and receives the end of a push rod 32. The push rod 32 forms a part of the valve train linkage.

The outer peripheral surface of the push rod seat member 30 is formed to provide a sliding and liquid restraining seal with the inner walls of the tappet body 2. A wide annular passage or groove 34 is formed about the push rod seat member and communicates with the opening 6 provided through the tappet body member 2. An angular passage 36 formed through the push rod seat member and in communication with the groove 34 provides the means of communication for hydraulic fluid to the reservoir 11. Passage 37 extends through the spherical seat 31 as a manufacturing aid in forming the seat. The passage 37 is sealed against fluid leakage by the engagement of the end of the push rod 32 therein.

A circumferential recess 40 is formed within the end of the push rod seat member next adjacent the plunger 10. The recess 40 is formed within the peripheral surface of the push rod seat member and is open to the tappet body walls. The recess 40 receives a sealing ring 41 therein and provides a pressure chamber space 46 below the sealing ring. The pressure chamber space 46 is in open communication with the annular pressure chamber space 21 about the plunger.

The sealing ring 41 comprises an annular member of resilient material such as neoprene suitable for use in the presence of hydraulic fluid and related liquid hydrocarbons. The annular ring is preferably formed to include what may be described as either an X-shape in cross section, providing on each face thereof divergent spaced annular lips 42 having an annular pocket or groove 43 therebetween, or may be described as being rectangular in cross section and having the corner edges 42 thereof slightly rounded and including fluid receptive pockets or grooves 43 formed in each face thereof (Fig. 3). The sealing ring 41 has a smaller internal diameter than the part 44 of the push rod seat member 30 about which it is engaged. It also has a larger external diameter than the internal diameter of the tappet body member 2. Thus the sealing ring is in slight radial compression as disposed about the push rod seat member within the tappet body. The sealing ring is backed against the end wall 45 of the push rod seat member and accordingly provides the pressure chamber space 46 between the lower end face of the sealing ring and the upper end face of the plunger member.

Although a preferred form of sealing ring has been described it should be appreciated that certain aspects of the invention herein described are obtainable with other forms of sealing rings.

The extreme end face 47 of the rod seat member and the part of the end face 48 of the plunger member engaged thereby, are machined to provide leakdown controlling faces which together form the annular leakdown control between the pressure chamber spaces 13, 21 and 46 and the reservoir chamber space 11 within the disclosed hydraulic tappet.

Upon assembly the various components are retained in place for packing, handling and shipping by a spring retainer 49 which snaps into an annular groove in the inner side of the upper end of the wall of the tappet body 2.

*Operation*

The cam actuating mechanism and valve train linkage has not been shown in the illustrated embodiment of this invention since such mechanism and linkage is of conventional design and its relation to parts shown is considered to be adequately known and understood without illustration.

In commencing the description of the operation of the hydraulic tappet of this invention, the tappet 1 is to be assumed as in the position illustrated in Fig. 1. The reservoir chamber 11 is filled with hydraulic fluid, under pressure, from the engine supply source through the passageways 4, 5, 6, 34 and 36 formed in the engine block, through the tappet body, and through the push rod seat member. The plunger return spring 20 serves to bais the plunger 10 into engagement with the push rod seat member 30 and the push rod seat member in turn into engagement with the push rod 32. The pressure chamber spaces 13, 21 and 46 are filled with hydraulic fluid at substantially the same pressure condition as exists within the reservoir chamber 11. The sealing ring 41 prevents the escape of hydraulic fluid around the push rod seat member 30. The check valve 14 prevents the escape of fluid from the pressure chamber spaces therethrough. The seating of the plunger end surface 48 against the push rod seat bottom end surface 47 prevents the escape of hydraulic fluid therebetween.

As the cam 8 is rotated so that the eccentric portion thereof acts against the closed end 7 of the tappet body 2, the tappet body tends to rise within its housing 3. The upward force exerted on the lower end of the tappet body 2 is transmitted directly to the push rod 32 due to the incompressible nature of the hydraulic fluid trapped in the pressure chamber 13. This lifting force is resisted by the engine valve spring which tends to keep the engine valve closed and acts through the push rod 32 against the push rod seat member 30.

During the rise of the tappet 2 to lift the engine valve against the resisting force of the engine valve spring, an increasingly higher fluid pressure condition is built up in the pressure chamber 13 to overcome the increasing resistance of the engine valve spring. This pressure build up works to obtain an equality of fluid pressure within the pressure chamber spaces 13, 21 and 46. The build up of pressure within the pressure chamber spaces also serves to fill the lowermost pocket portion 43 of the seal 41 which is next adjacent the pressure chamber spaces. This causes the seal to be compressed axially. The axial compression of the seal 41 effects a radial expansion thereof forcing it into tighter fluid pressure sealing engagement with both the push rod seat member 30 and the tappet body member 2. Thus the effectiveness of the seal is increased as the pressure increases.

Under the high fluid pressure condition in the pressure chamber spaces the control end surfaces 47 and 48 of the push rod seat 30 and plunger 10, respectively, may provide for the controlled escape of hydraulic fluid therebetween. This may occur as a controlled leakage of fluid between the control surfaces. If there has been a leakage of fluid between the control surfaces of the push rod seat and plunger members, the plunger member will assume a lower relative position in the tappet body when the tappet returns to the base circle of the actuating cam

8 due to the loss of fluid from the pressure chamber spaces. In such event, spring 20 will force the plunger upward and fluid will flow from the reservoir to the pressure chamber through check valve 14.

The proposed tappet will operate in another manner, if the control end surfaces 47 and 48 of the push rod seat 30 and plunger 10, respectively, do not permit the leakdown of fluid therebetween as just mentioned.

In this regard it is to be remembered that while the annular space 21, between the plunger and tappet body, is of a much greater clearance than in conventional tappets, and such as provides for more nearly equal pressure conditions within the pressure chamber spaces, that there is still a gradient of pressure between the ends of the annular space.

During the rise of the tappet the pressure condition in the pressure chamber space 13 will be greater than that existing in the space 46. As the pressure condition increases in space 13 it will also increase in space 46, though not as rapidly, due to the flow restriction through the annular space 21. When the pressure condition in space 13 begins to fall off, during the closing of the engine valve, it will begin to fall off in space 46. However, the pressure condition in space 46 will not be reduced as rapidly as it is in the pressure chamber space 13; again, due to the flow restriction through the annular space 21. As a result the pressure condition in space 46 may exceed the pressure condition in space 13 sometime during the closing of the engine valve.

As the tappet returns to the base circle of the actuating cam 8, the load of the engine valve spring is removed due to the seating of the valve. Accordingly, the pressure condition in the pressure chamber space 13 falls off. At this moment the pressure in space 46 exceeds that on either the push rod seat member 30 or the plunger member 10 and the control end surfaces 47 and 48 are separated and hydraulic fluid is bled from the pressure chamber spaces into the reservoir 11. Only an incremental separation of the control surfaces is required for the minute exchange of fluid necessary to affect an adjustment of the plunger member 10 due to any expansion of the valve train parts occurring as the engine warms up, particularly during one engine cycle. The inherent resiliency of the valve train parts alone will allow sufficient relief of the load on the push rod seat to permit the separation of the control surfaces that is required.

The control surfaces 47 and 48 are separated only long enough to allow the pressure condition in space 46 to be relieved. Once space 46 is vented the plunger return spring 20 forces the plunger upward and the control surfaces are reengaged.

The leakdown or valving action just described may occur during each cycle of the tappet. The check valve 14 will open to replenish the lost fluid in the pressure chamber spaces and balance the pressure conditions therebetween to the extent that the flow of fluid from the pressure chamber spaces to the reservoir 11 during such action requires. Thus a continuous slack adjustment is afforded in the valve operating mechanism.

An expansion or contraction of the valve train parts, changing their effective length, is not apparent when the engine valve is open. That is, except for an increased or decreased resistance in the final effort of the engine valve spring to allow the engine valve to be opened. Since the expansion or contraction is small, on the order of .0004 of an inch, the pressure differences in chambers 13 and 46 are but slightly affected. However, the change in the valve train length will be apparent when the engine valve is closed. At such time the push rod seat 30 will tend to occupy a different axial position within the tappet body 2.

If the valve train parts have expanded the push rod seat 30 is returned to a lower axial position in the tappet body 2. This reduces the volumetric space of the pressure chambers and requires less fluid exchange from the reservoir chamber.



If the valve train parts have contracted then the push rod seat 30 need not return to as low an axial position in the tappet body 2 as it previously occupied. In such case the volume of the pressure chamber spaces is increased. In such event more fluid will flow through check valve 14 to effect a volume increase in the pressure chambers.

While there has been described a preferred embodiment of this invention and certain modifications have been suggested, it will be understood and appreciated that other modifications and improvements may be made within the spirit and teachings of the invention herein set forth. Such of these modifications and improvements as incorporate the principles of this invention are to be considered as included in the hereinafter appended claims, unless these claims by their language expressly state otherwise.

I claim:

1. A hydraulic tappet comprising: a hollow tappet body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; spring means in said pressure chamber urging said plunger member towards said open end of said tappet body member; check valve means in combination with said passageway for permitting flow of hydraulic fluid only from said reservoir to said pressure chamber whenever the hydraulic pressure in said pressure chamber falls below the hydraulic pressure in said reservoir by a predetermined difference; a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member; a peripheral seal between said rod seat member and said hollow tappet body member in the region of the end of the rod seat member adjacent the hollow plunger member; and means for retaining said rod seat member in said tappet body member.

2. A hydraulic tappet comprising: a hollow tappet body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; spring means in said pressure chamber urging said plunger member towards said open end of said tappet body member; check valve means in combination with said passageway for permitting flow of hydraulic fluid only from said reservoir to said pressure chamber whenever the hydraulic pressure in said pressure chamber falls below the hydraulic pressure in said reservoir by a predetermined difference; a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member, said end comprising an outer peripheral recess for receiving hydraulic fluid passing between said plunger member and said hollow tappet body member from said pressure chamber; a peripheral seal between said rod seat member and said hollow tappet body member in the region of the end of the rod seat

member adjacent the hollow plunger member; and means for retaining said rod seat member in said tappet body member.

3. A hydraulic tappet comprising: a hollow tappet body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; spring means in said pressure chamber urging said plunger member towards said open end of said tappet body member; check valve means in combination with said passageway for permitting flow of hydraulic fluid only from said reservoir to said pressure chamber whenever the hydraulic pressure in said pressure chamber falls below the hydraulic pressure in said reservoir by a predetermined difference; a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member, said end of said rod seat member comprising an outer peripheral recess for receiving hydraulic fluid passing between said plunger member and said hollow tappet body member from said pressure chamber; a peripheral seal between said rod seat member and said hollow tappet body member in the region of the end of the rod seat member adjacent the hollow plunger member; and means for retaining said rod seat member in said tappet body member.

4. A hydraulic tappet comprising: a hollow tappet body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; spring means in said pressure chamber urging said plunger member towards said open end of said tappet body member; check valve means in combination with said passageway for permitting flow of hydraulic fluid only from said reservoir to said pressure chamber whenever the hydraulic pressure in said pressure chamber falls below the hydraulic pressure in said reservoir by a predetermined difference; a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member, said end comprising an outer peripheral recess for receiving hydraulic fluid passing between said plunger member and said hollow tappet body member from said pressure chamber; a peripheral seal between said rod seat member and said hollow tappet body seated in the upper portion of said peripheral recess; and means for retaining said rod seat member in said tappet body member.

5. A hydraulic tappet comprising: a hollow tappet body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; spring means in said pressure chamber urging said plunger member towards said open end of said tappet body member; check valve means in combination with said passageway for permitting flow of hydraulic fluid only from said reservoir to said pressure chamber whenever the hydraulic pressure in said pressure chamber falls below the hydraulic pressure in said reservoir by a predetermined difference; a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member, said end comprising an outer peripheral recess for receiving hydraulic fluid passing between said plunger member and said hollow tappet body member from said pressure chamber; a peripheral, X-ring seal between said rod seat member and said hollow tappet body seated in the upper portion of said peripheral recess; and means for retaining said rod seat member in said tappet body member.

6. A hydraulic tappet according to claim 5 wherein said hollow tappet body and said rod seat member comprise hydraulic fluid passageways for introducing hydraulic fluid to said reservoir.

7. A hydraulic tappet according to claim 5 wherein said means for retaining said rod seat member in said tappet body member comprise a push rod.

8. A hydraulic tappet comprising: a cylindrical tappet body member having a generally cylindrical, hollow interior, a closed end and an open end; a cylindrical plunger member slidably disposed within said interior of said tappet body and having a generally cylindrical, hollow interior forming a hydraulic fluid reservoir, an open end and a closed end, said closed end being disposed in the region of the closed end of said interior of said tappet body member and displaced therefrom whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; spring means in said pressure chamber urging said plunger member towards said open end of said tappet body member; check valve means in combination with said passageway for permitting flow of hydraulic fluid only from said reservoir to said pressure chamber whenever the hydraulic pressure in said pressure chamber falls below the hydraulic pressure in said reservoir by a predetermined difference; a cylindrical rod seat member slidably disposed within said interior of said tappet body member between said plunger member and said open end of said tappet body member with one end thereof having an annular portion normally abutting only an inner annular portion of the end of the cylindrical wall of said plunger member, said end of said rod seat member comprising an outer annular recess; an X-ring seal in radial compression seated in the upper portion of said recess and bearing radially against the inner wall of said tappet body member; and means for retaining said rod seat member in said tappet body member.

9. A hydraulic tappet comprising: a hollow tappet body closed at one end, a plunger member slidably disposed within said tappet body and forming a pressure chamber with the closed end and the inner peripheral wall thereof, a reservoir chamber formed within said plunger, a rod seat member slidably disposed within said tappet body and engaged with the end of said plunger member for closing said reservoir chamber, a passage means formed through said plunger between said reservoir and pressure chambers, a check valve closing said last mentioned passage means and opening only in response to certain pressure conditions within said reservoir, and a peripheral recess provided at the engaging ends of said plunger and rod seat member for receiving hydraulic fluid passing between said plunger member and said hollow tappet body from said pressure chamber for the controlled bleeding of hydraulic fluid from said pressure chamber into said reservoir.

10. A hydraulic tappet comprising: a hollow tappet

body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; a check valve closing said last mentioned passage means and opening only in response to certain pressure conditions within said reservoir, a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member, said end comprising an outer peripheral recess for receiving hydraulic fluid passing between said plunger member and said hollow tappet body member from said pressure chamber.

11. A hydraulic tappet comprising: a hollow tappet body member having a closed end and an open end; a hollow plunger member slidably disposed within said hollow tappet body and having an open end and a closed end, the interior of said plunger member comprising a hydraulic fluid reservoir, said closed end being disposed in the region of the closed end of said hollow tappet body



member and displaced therefrom, whereby a pressure chamber is formed, said closed end comprising a passageway from said reservoir to said pressure chamber; a check valve closing said last mentioned passage means and opening only in response to certain pressure conditions within said reservoir, a rod seat member slidably disposed in said hollow tappet body member between said plunger member and said open end of said tappet body member with one end thereof normally abutting only an inner peripheral portion of the end of the peripheral wall of said hollow plunger member, said end comprising an outer peripheral recess for receiving hydraulic fluid passing between said plunger member and said hollow tappet body member from said pressure chamber; a peripheral seal between said rod seat member and said hollow tappet body member in the region of the end of the rod seat member adjacent the hollow plunger member.

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