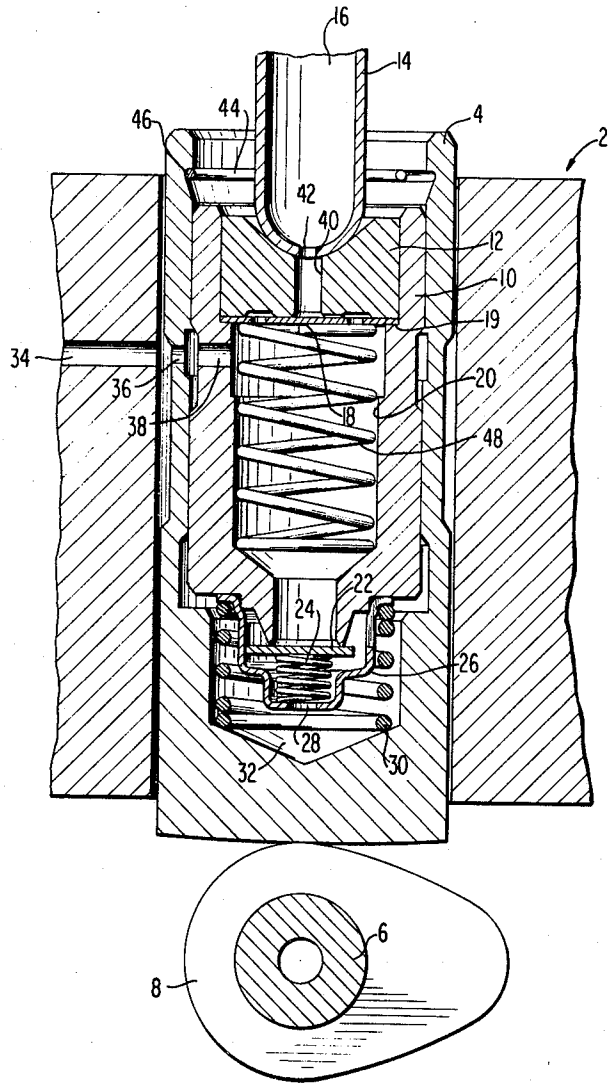
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ANTIPUMP-UP TAPPET

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ANTIPUMP-UP TAPPET

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ABSTRACT OF THE DISCLOSURE

A hydraulic tappet having, in addition to the plunger biasing spring, a spring within the plunger biasing the push rod socket outwardly of the plunger to take up hydraulic lash during valve spring surge to prevent pump-up of the tappet. The latter spring also maintains a lubricant metering plate in engagement with a metering valve seat on the push rod socket.

This invention relates to a hydraulic tappet having antipump-up properties. In one of its aspects, it relates to a hydraulic tappet in which pump-up is minimized by the inclusion of a spring within the plunger cavity to bear against the push rod socket.

Hydraulic tappets in internal combustion engines are designed to take up lash caused by changes in the dimensions of the valve train as the engine operates at various conditions. Compensation for this lash is made in a normal hydraulic tappet by a plunger within a tappet body. This plunger rises in the tappet body so as to effectively increase the length of the tappet when valve train clearance is present. Modern engines, however, operate at higher speeds, which causes troublesome engine valve spring surge to become more pronounced due to the natural harmonics of the spring. When momentary lash caused by valve spring surge is taken up by the hydraulic tappet, during a valve event, the plunger of the tappet does not have sufficient time to return to its normal operating position. The result of this condition is that the intake and exhause valve cannot close at the end of the valve event. This non-closing of the valve results in power loss. The response of the tappet to the valve spring surge is called "pump-up." In other words, the plunger pumps-up or creeps-up into a position where the effective length of the tappet is not proper for permitting the intake or exhaust valves to close.

One solution proposed to this "pump-up" problem is to drill a hole in the side of the tappet body to vent the high pressure chamber to inlet oil pressure as the piston moves upwardly past a certain point. Although this design is relatively effective to stop "pump-up," it is a relatively expensive modification of a conventional hydraulic tappet and makes the tappets very sensitive to initial adjustment.

I have now discovered that valve spring surge in a conventional tappet can be minimized by providing a spring within the tappet plunger which spring bears against the push rod socket, whereby the hydraulic lash will be taken up by momentary separation between the push rod socket and its seat in the plunger.

By various aspects of this invention one or more of the following, or other, objects can be obtained.

It is an object of this invention to provide an improved hydraulic tappet with antipump-up properties.

It is a further object of this invention to provide a simple and inexpensive modification of a conventional tappet to prevent "pump-up" without affecting its initial adjustment requirements.

Other aspects, objects, and the several advantages of this invention are apparent to one skilled in the art from

a study of this disclosure, the drawings, and the appended claims.

According to the invention, a spring is provided within a tappet plunger, which spring bears against a push rod socket seated within the plunger. The push rod socket is adapted to engage or contact a push rod as a portion of a valve train. The plunger is axially biased within a tappet body. Fluid intake means are provided in the body and the plunger. A check valve in the bottom of the plunger permits oil to flow out of the plunger through the valve.

The spring within the plunger body is weaker than the biasing means for the plunger so that the push rod socket is normally seated within the plunger. The spring within the plunger body takes up momentary lash within the valve train due to valve spring surge.

The invention will now be described with reference to the accompanying drawing in which is shown a transverse sectional view of a fragmentary portion of an internal combustion engine showing a portion of a push rod and a hydraulic tappet.

Referring now to the drawings, a tappet body **4** is reciprocable within an engine block **2** and is actuated by a cam shaft **6** and a cam lobe **8**. A plunger **10** is reciprocable within tappet body **4** and has a shoulder **19** for seating an apertured plate **18** and a push rod socket **12**. A push rod having a passageway **16** bears against the push rod socket **12**. At the bottom portion of the plunger **10**, a check valve plate **22** is biased by check valve spring **24** against the bottom portion of the cavity **20** formed within the plunger **10**. A plunger spring **30** and a valve cage **26** hold the check valve plate **22** and check valve spring **24** in place.

A passage **34** is provided to supply oil to the tappet. The oil passes through passage **36**, passage **38**, and into cavity **20** within the plunger **10**. The oil in cavity **20** can flow through the check valve formed by valve plate **22**, and into the pressure chamber **32**. The oil in the pressure chamber **32** can then flow under pressure between tappet body **4** and plunger **10** back to passages **36** and **38**. Also, the oil in cavity **20** is metered through the holes in aperture plate **18** and flows into passage **40**, through hole **42** into passageway **16**.

The plunger and push rod socket are limited in the upward movement within tappet body **4** by the retainer ring **44** seated in annular groove **46**.

The above described portions of the tappet are of conventional design.

According to the invention, an antipump-up spring **48** is positioned within cavity **20**, bearing against the bottom portion of cavity **20** and the bottom of aperture valve plate **18**. Spring **48** is not as strong as spring **30** so that normally the push rod socket **12** is seated in the position shown in the drawing.

With the use of spring **48**, pump-up at surge speed is avoided due to the fact that the hydraulic lash due to surge is taken up by spring **48**. Since cavity **20** is not a high pressure chamber, the valve spring (not shown) can easily push the spring back to the position shown in the drawing after the valve event and the valve can close.

Under high speed engine operating conditions, a separation occurs in the valve train during the engine valve operating event. Separation usually results from valve spring surge at critical speeds. When separation occurs, spring **48** will force push rod socket **12** upwardly relative to plunger **10** before spring **30** can force plunger **10** upwardly relative to tappet body **4**. The faster reaction of spring **48** is due to the freedom of movement of the push rod socket **12** within the plunger **10**. The spring **48** is also aided by the engine oil pressure which is present

in cavity **20**. Movement of the plunger **10** relative to body **4** is opposed by the push rod socket **12** and/or the spring **48**.

Reasonable variation and modification are possible within the scope of the foregoing disclosure and the drawing without departing from the spirit of the invention.

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

1. In a hydraulic tappet having a body, a cylindrical, hollow plunger in said body, means biasing said plunger axially within said body, an annular shoulder within said body, means seated within said plunger for contacting a push rod, fluid intake means in said body and said plunger, check valve means in the bottom of said plunger to permit oil to flow out of said plunger through said valve means, a fluid passage through said contacting means to permit fluid to flow from the interior of said plunger to a push rod seated in said contacting means, a fluid metering plate within said plunger in contact with said push rod contacting means and seated against said annular shoulder for metering fluid in said interior of said plunger to said fluid passage, said fluid metering plate being in contact with said push rod contacting means around the circumference of said fluid metering plate, the improvement which comprises: biasing means within said plunger in forcing relationship to said fluid metering plate and to said contacting means biasing said contacting means and metering plate out of seating engagement with said plunger and to maintain said metering plate in contact with said push rod contacting means at said circumference of said fluid metering plate, thereby preventing pump-up of said tappet during high engine speeds.

2. A hydraulic tappet according to claim **1** wherein said biasing means within said plunger exerts a lesser force than said means biasing said plunger axially with respect to said body.

3. A hydraulic tappet according to claim **1** wherein said plunger has an internal cavity, said biasing means comprising a spring seated with one end against an end of said cavity and the other end abutting said fluid metering plate, said spring being in compression at least when said contacting means and metering plate is seated within said plunger.

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