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HYDRAULIC VALVE TAPPET

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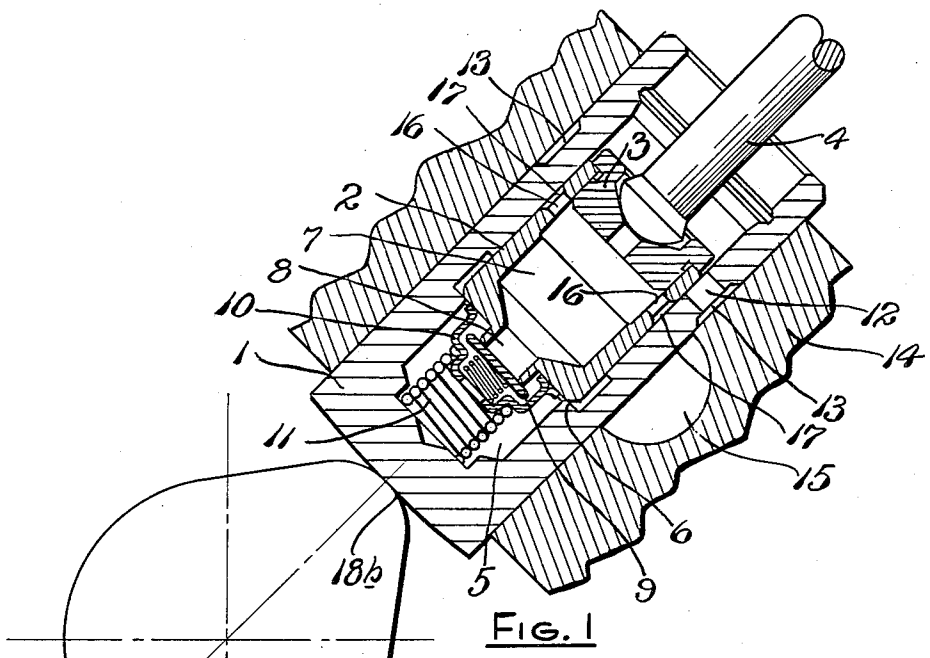


FIG. 1

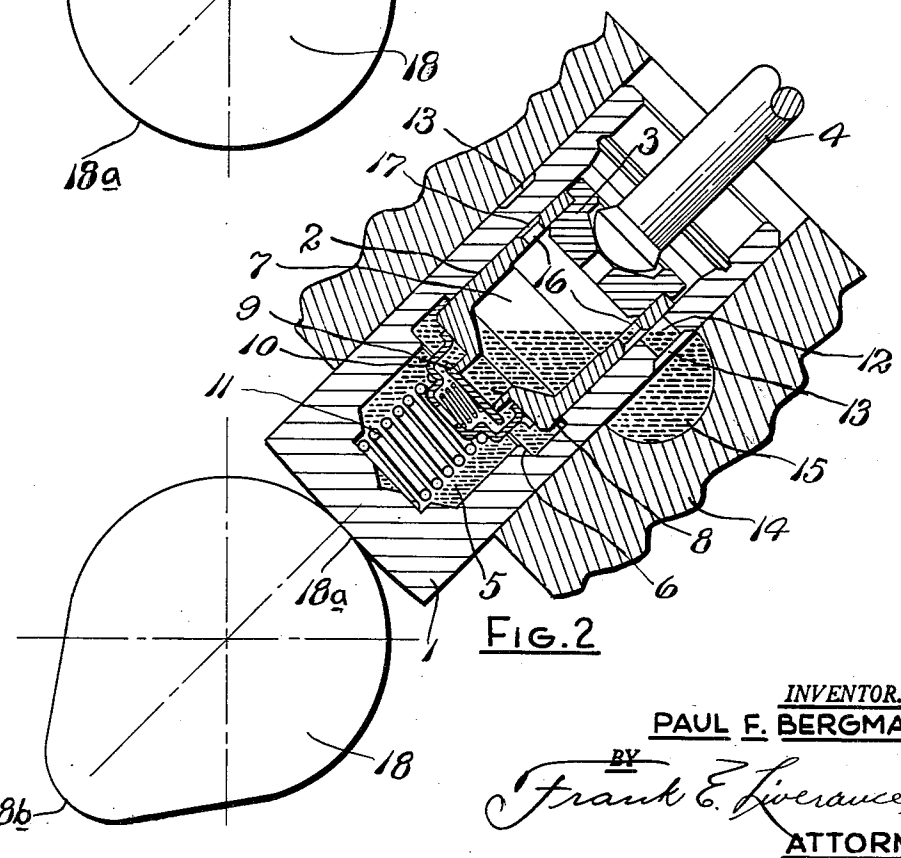


FIG. 2

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HYDRAULIC VALVE TAPPET

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3 Claims. (Cl. 123—90)

This invention relates to an exceptionally simple and useful, inexpensively produced hydraulic tappet structure for internal combustion engines, the primary object and purpose of which is to avoid or, in practice, substantially eliminate any passage of air to the compression chamber of a hydraulic tappet when it is installed at an angle to the vertical. If such air passes and gets into a hydraulic tappet below the piston thereof, undesired and annoying tappet noises take place for considerable periods of time, usually when an engine is started, and it continues until the air which has entered the compression chamber is forced out completely from such compression chamber.

Such tappet noises are particularly prone to take place in internal combustion engines known as V-engines. Such engines have two banks of cylinders at opposite sides of a central vertical plane, inclining downwardly and inwardly toward each other and toward such central plane. The tappets are usually located at approximately the same angle to the vertical as are the axes of the engine cylinders with which associated.

There is a tendency for the oil from which supply to the compression chamber of the tappet is furnished to drain from the tappet at those times when, with an engine stopped, cams which raise and lower the tappets are stopped at positions such that a valve or valves are lifted from their seats. Under such conditions the heavy weight of the engine valve springs serve to push the hydraulic tappet pistons down with a slow and gradual depleting of the supply of oil within the compression chambers. Upon starting an engine, tappets with pistons in lower position, due to having been forced thereto by the strength of associated valve springs, when the cams affecting such tappets and valves move to permit the engine valves to reach their seats, a considerable quantity of oil flows into the tappet compression chambers, upon enlargement thereof when the engine valves reach their seats and the force of valve springs is removed from the tappet pistons. With engines of the V-type, it is possible for the supply of oil within a tappet to be drained out and back into the engine due to the angle of inclination of the tappet so that the supply to replenish the oil in a compression chamber below the piston is liable to become exhausted, and air pass into the compression chamber with the tappet noise effects previously noted taking place.

With my invention, through exceptionally simple and novel structure, an insurance is provided that whenever an engine valve is lifted above its valve seat by its operating cam and is held in such lifted position while the engine is stopped, an ample supply of oil to re-supply that which has been forced out from the compression chamber is always at hand within the tappet piston, and that drainage of oil from the tappet piston shall not take place so as to deplete the oil necessary to prevent passage of air to the tappet compression chamber.

An understanding of the invention may be had from

the following description taken in connection with the accompanying drawing, in which,

Fig. 1 is a sectional view through a tappet having my invention therein, showing the position of the tappet parts while the engine is stopped when the cam operating the tappet is in a position to hold the engine valve associated therewith from its seat, and

Fig. 2 is a similar view, showing the position of the tappet parts when the engine is stopped and with the tappet bearing against the base circle of the cam.

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

The hydraulic tappet to which my invention is applied is not new but is manufactured and sold extensively. In its structure, it includes a tappet body **1** of cylindrical form which is axially bored from its upper end downwardly toward but short of its lower end, the lower end being closed. Within the tappet body a hollow piston **2** is mounted and has reciprocating movements therein. Such piston is closed at its upper end by a head **3**, against which a lower end of a valve stem or push rod **4** engages, the upward movement of the tappet body and piston serving to lift an engine valve and the downward movement permitting closure and seating of an engine valve on its seat. As later described, the hollow piston **2** has an outlet at its lower end, such lower end being closed except for said outlet.

Below the piston and above the closed lower end of the tappet body is a chamber **5** for receiving oil. Such chamber is a pressure chamber, the oil being under pressure when its associated engine valve is lifted. The interior diameter of the pressure chamber **5** is less than the diameter of the bore of the tappet body above it, thereby providing an annular shoulder **6** at the upper end of the pressure chamber **5**.

In the operation of the tappet, the interior oil supply chamber **7** of the hollow piston receives oil which may pass downwardly as needed through an outlet passage **8** at the lower end of the piston, which passage is normally closed by a spring actuated flat disk valve **9**. The valve **9** and its actuating spring are carried by a cage **10** enclosing them and bearing against the lower end of the piston **2**. Between the cage and the lower end of the pressure chamber **5** a coiled compression spring **11** of considerable strength is located, the action of which is to force the piston **2** upwardly when free to do so.

An inlet passage **12** is made through the wall of the tappet body **1** communicating with a shallow annular groove **13** around the tappet body which is closed completely when the tappet is installed in the fixed tappet guide **14**, which is either integral with or secured to the engine block and provides a plurality of guides for a like number of tappets. The oil is supplied to the groove **13** and thence through the passage **12** in the tappet body from the lubricating system of the engine, a conduit **15** for the oil being located so that it is normally in communication with the groove **13** when the engine is in operation.

The oil passes from the inlet passage **12** in the wall of the tappet body **1** through passages **16** in the wall of the hollow piston **2** which in turn, at their outer ends, communicate with an annular groove **17** around the piston. When the oil supply conduit **15** and groove **13** are in conjunction and, at the same time, the passage **12** and the groove **17** likewise in conjunction, oil may flow into the oil supply chamber **7** of the piston. When the engine has stopped with such conjunction and communication as described, oil can drain out of the oil supply chamber **7** until it is in a horizontal plane within the chamber **7**, as indicated in Fig. 2.

The tappets are reciprocated by the rotation of cams

18 of usual and well known structure, each of which has a base circle 18*a* and a nose 18*b* generally diametrically opposite each other.

When the engine is operating and the tappets are properly filled with oil, the relative position of the various parts of a tappet is as shown in Fig. 2, whether the cam is in the position shown in Fig. 1 or Fig. 2. During the lift and fall of the cam, in one revolution of the cam shaft, the force of the engine valve spring causes the tappet piston 2 to move downwardly a few thousandths of an inch, by forcing some of the oil in chamber 5 out past the tappet between it and the walls of the piston. If, however, the engine is stopped, and a cam is in the position shown in Fig. 1, the downward pressure exerted by the very heavy weight valve spring acting upon the valve stem or push rod 4 will slowly force piston 2 downwardly from its position relative to the tappet body 1 shown in Fig. 2 to that shown in Fig. 1. Such downward movement of the piston 2 continues until the lower end thereof comes against the shoulder 6. The oil is forced upwardly between the outer surfaces of the piston and the inner surfaces of the walls of the tappet body. But if, when an engine is stopped from operation, the lower end of the tappet body is on the base circle 18*a* of the cam 18, the tappet and the valve actuated thereby being in lowermost position with the engine valve closed, the valve spring force acting on the rod 4 is not transmitted to the piston 2 and it remains in its upper position shown in Fig. 2. In such upper position, as in Fig. 2, oil may drain out of the oil supply chamber within the piston to the lever shown. However, in Fig. 1 when the piston 2 has moved downwardly until stopped by engaging against the shoulder 6, not only is the flow of oil through the passage 12 to the supply conduit 15 closed, but also the groove 17 is below the inner end of the passage 12 through the wall of the tappet body, interrupting any outward flow or draining from the oil supply chamber 7.

The desirable result and function which follows from such relation of the passages 12 and 16, grooves 17 and 13 and the oil supplying conduit 15 is that, with the piston 2 in its lowermost position in Fig. 1, the chamber 7 is sealed against any outward drainage of the oil and retains its full supply. Thereupon, when the engine is started and the nose 18*b* of the tappet moves away from the lower end of the body 1, the immediate downward movement of the tappet body, and upward relative movement of piston 2 moves the shoulder 6 away from the lower end of the piston 2, with a consequent enlargement of the pressure chamber 5 requiring additional oil to fill such chamber. Sufficient oil is in the piston 2 to fill such enlarged pressure chamber without uncovering the passage 8 for air to pass by the valve 9 into the pressure chamber.

On the other hand, when an engine is stopped with the tappet against the base circle 18*a* of cam 18 as in Fig. 2, there being no force of the engine valve spring pressing against the piston 2, such piston remains in its upper position (Fig. 2); and though oil may drain from the chamber 7 to the level indicated, there is not any requirement for an appreciable addition of oil to the pressure chamber. Thus, upon starting the engine, the tappet has its pressure chamber 5 substantially completely filled and again no air will go through the passage at 8 into the pressure chamber 5.

The invention which has been made is one which accomplishes the same general result as that disclosed in application, Serial No. 374,214, filed by John W. Humphreys on August 14, 1953. It eliminates the thin

transverse partition thereof located at the upper portion of the oil supply chamber of the piston and is, accordingly simpler and less expensive to make, and eliminates any possibility of such partition becoming defective in any way. The invention is particularly practical and useful in connection with tappets used with V-type engines, in which the axes of the cylinders and also of the tappets are at an angle of approximately 45° to both the horizontal and vertical.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. In a tappet adapted to be used in an engine positioned at an angle inclined to the vertical, said tappet having a cam engageable tappet body and a hollow piston within and movable lengthwise of said body, stopped against further movement toward the cam engageable end of said body upon reaching a predetermined lower position, there being a pressure chamber under the lower end of said piston adapted to be supplied with liquid from said hollow piston, the improvement comprising, a liquid passing opening through the wall of said body and a liquid passing opening through a side of said piston, said openings being located in relation to each other so they are out of liquid passing conjunction when said piston is stopped at said predetermined lower position, and in liquid passing conjunction when the piston is a predetermined distance above such lower position.

2. In a tappet adapted to be used in an engine positioned at an angle inclined to the vertical, said tappet having an axially bored body, closed at its lower end, and having an annular shoulder within the body a distance above the lower end of the boring in said body, and also having a hollow piston within and movable lengthwise of said body, said piston engaging said shoulder with its lower end when in lowermost position in the body, the improvement comprising, liquid passage means in each, the wall of said tappet body and of said hollow piston, in conjunction when the piston is a predetermined distance above its lowermost position and out of conjunction when said piston is at its lowermost position against said shoulder.

3. In a tappet adapted to be used in an engine positioned at an angle inclined to the vertical, said tappet having an axially bored body, closed at its lower end, and having an annular shoulder within the body a distance above the lower end of said boring in said body, and also having an upwardly spring moved hollow piston, with a valve controlled outlet in its lower end, within and movable lengthwise of said body, said piston being stopped in movement toward the lower end of said body by said shoulder, the improvement comprising, an annular groove around and at the outer side of said body and a liquid carrying passage from said groove through the wall of the body, and an annular groove around the piston and a liquid carrying passage therefrom to the interior of the piston, said first mentioned groove and passage being located above the second mentioned groove and passage a distance whereby, at lowermost position of the piston, liquid flow from the tappet body groove and passage to and through the piston groove and passage to the interior of the piston is stopped, and liquid flow is permitted upon lifting said piston a predetermined distance above its lowermost position.

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