June 10, 1952 P. F. BERGMANN 2,599,886

HYDRAULIC TAPPET

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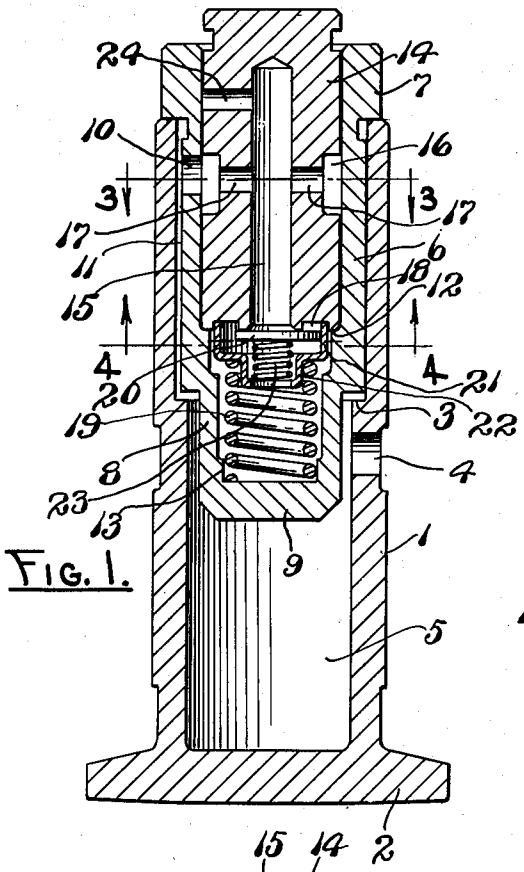


FIG. 1.

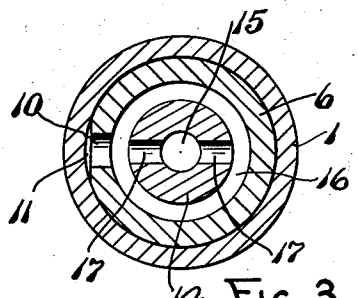


FIG. 3.

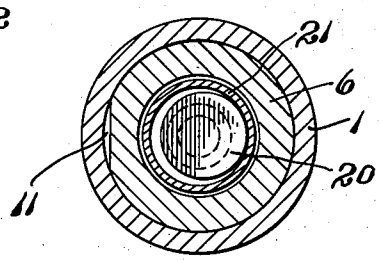


FIG. 4.

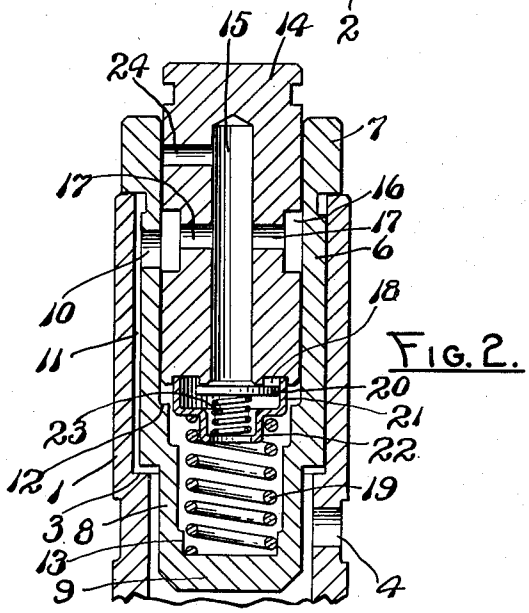


FIG. 2.

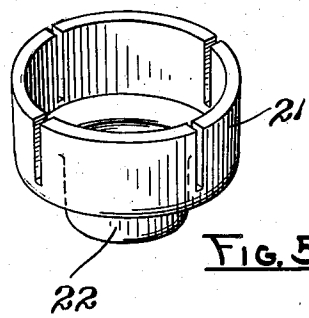


FIG. 5.

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HYDRAULIC TAPPET

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2 Claims. (Cl. 123—90)

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The present invention relates to tappets of the hydraulic type, and is concerned with a novel tappet structure very expeditiously and economically produced and assembled, in which any entrapped air in the liquid used is released and eliminated from the tappet. In general, a perfected, economical, very effective and practical tappet structure is produced.

An understanding of the invention attaining the ends stated may be had from the following description of a preferred embodiment of my invention taken in connection with the accompanying drawing in which,

Fig. 1 is a central vertical section through the novel tappet structure, showing the piston in lowermost position,

Fig. 2 is a similar fragmentary section of the upper portion of the tappet, with piston thereof located in approximately operating position,

Figs. 3 and 4 are, respectively, horizontal sections on the planes of lines 3—3 and 4—4 of Fig. 1, looking in the directions indicated by the arrows, and

Fig. 5 is an enlarged perspective view of the sheet metal element which serves as a cage or housing for the disc valve and which has a press-tight connection with the lower end of the hydraulically operated piston of the tappet.

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

In the disclosure shown in the drawing, the body 1 of the tappet, of a substantially cylindrical form has a head 2 at its lower end, the disclosure being in connection with tappets of the mushroom type, in which in general the cross-sectional area of the tappet bodies is less than tappets of the barrel type. My invention while particularly applicable to mushroom type tappets, is not to be restricted thereto, as it is useful in connection with all of the standard tappet types having varying diameters or cross-sectional areas.

The body 1 has walls surrounding a cylindrical longitudinal opening therein, which is closed at its lower end by the head 2 and is open at its upper end. Said opening is of a larger diameter in the upper portion of the body than in the lower portion, there being an annular horizontal shoulder 3 between the two sections of said opening approximately midway in the length of

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the body. The wall of the body 1 a short distance below said shoulder 3 has a passage 4 for the hydraulic liquid used, which in internal combustion engines is the lubricating oil of the engine, which under the pressure of its pump will pass through the passage 4 and into the lower end portion of the tappet body to fill a chamber 5 with oil, said chamber always being fully supplied with oil under pressure when the engine is running.

Into the upper end of the tappet body 1 a cylinder is inserted. Said cylinder has walls 6, which at their upper ends are thickened to provide a head 7 which rests upon the upper end of the walls of the body 1. The cylinder 6 at its lower end portion is reduced in diameter, providing a lower cylindrical extension 8 which at its lower end is wholly closed by a transverse bottom 9. The wall 6 just below head 7 is reduced in diameter for a short distance, forming an undercut that provides space for air to collect in, that might be carried in the oil. The exterior diameter of the part 8 is appreciably less than the interior diameter of the chamber 5 as shown, and the shoulder between the upper and lower walls 6 and 8 of the cylinder is at a short distance above the previously described annular shoulder 3 of the tappet body, when upon insertion of the cylinder into the body it is stopped by head 7 coming against the upper end of the tappet body. The wall of the cylinder a short distance below the head 7 at one side has a passage 10 therethrough. At such side of the cylinder where the passage 10 is located, a portion of the wall of the cylinder is removed in a shallow segment, leaving a vertical passage 11 between the body 1 and said cylinder (Figs. 3 and 4) which connects said passage 10 with the oil supply chamber 5. The axial opening in the cylinder is reduced in diameter at approximately two-thirds of its length downward in the cylinder, providing an annular shoulder 12, and in the lowermost portion of the cylinder immediately above the bottom 9 a further reduction in diameter is made so that a short length of the lowermost portion of the axial opening in the cylinder at 13, is of a smaller diameter than any other parts of such opening.

A piston 14 is inserted into the cylinder 6 at its upper end, which when in its lowermost position,

bears against the shoulder 12. The piston 14 is axially bored from its lower end upwardly, approaching but stopping short of the upper end of the piston, as at 15. Around the piston substantially midway between its ends an annular groove 16 is provided, and radial passages 17 connect the groove 16 with the interior axial passage 15. The lower end of the piston is also machined to provide an annular groove 18, in the lower end face of the piston, with annular inner and outer ribs, one inside the groove around the opening 15 and the other outside the groove 18 as shown.

A strong coiled spring 19 is received at its lower end within the reduced diameter portion 13 of the cylindrical opening in the cylinder 6, having a tight fit therein, and extends upwardly toward but short of the inner or lower end of the piston 14. A disk 20 of flat metal is located across the lower end of the axial opening 15. A sheet metal cage has an upper cylindrical wall 21 with a partial bottom from which a smaller diameter cylindrical wall 22 extends downwardly concentric with the wall 21, with an opening in the bottom of the cage. A light coiled spring 23 is located within the cage between said bottom and the disk valve 20, being of sufficient strength to hold the valve 20 in its upper closed position when the pressure forces on opposite sides of the valve are equal, but the valve being readily moved downward against said spring upon the pressure forces of the liquid in the passage 15 being but slightly greater than those of the liquid below said valve.

Near the upper end of the axial passage 15 in the piston a radial passage 24 extends outwardly, its outer end coming to the thickened wall of the head 7 of the cylinder described.

It is evident that the oil under pressure of the engine pump filling the chamber 5 will thence pass upwardly in the vertical passage 11 provided as described, and will go through the passage 10 into the groove 16 and thence through passages 17 into the axial opening 15 of the piston 14. And such oil will move the valve 20 downwardly, filling the chamber below the piston 14 and within the lower portion of the cylinder walls 8, until there is a balance of pressure on both sides of the valve 20. In the operation, the lower end of the stem of an engine intake or outlet valve, bearing against the upper end of the piston 14 will, upon lifting such engine valve, transmit the force of the valve spring to the piston and thence to the liquid underneath which, being incompressible, the engine valve will be lifted. When on the rotation of the cam shaft such engine valve is returned to closed position, if the upper end of the piston 14 tends to separate from the lower end of the engine valve, due to leakage of oil past piston 14 during the opening, the heavy spring 19 will force the piston 14 to continue to bear against the lower end of the stem of the engine valve moving the piston 14 upwardly, and thus create a partial vacuum in the chamber below the piston which will be satisfied by oil coming from the passage 15, past the valve 20, to said chamber. Any slack in the valve is immediately taken up and adjustment maintained between the tappet and the engine valve.

As shown in Fig. 5, the sheet metal cage walls at 21 are vertically slit at spaced distances from each other, so that said walls may be contracted and be received within the outer annular rib at the lower end of the piston 14. Thus the assembly of the cage with the piston 14 is not only immediately done by mere pressure, but no machine operations beyond the formation of the cage and the cutting of the groove at 18 are required. Substantially all parts of the tappet structure except the springs, the described cage and the disk valve 20, are performed on an automatic screw machine or other automatic lathe. The springs are purchased from manufacturers of the springs who produce them very economically in large quantities, and the disk valve 20 and the sheet metal cage are produced by rapid punch press operation, leaving only the drilling of the radial and lateral passages in the several parts where needed.

It is further evident that if there is any air in the body of oil chamber 5, it will tend to rise and pass upwardly through the passage provided at 11, and thence into the axial opening 15 of the piston, and further rise to the upper portion of said passage and escape through the radial passage 24, and thence between the upper end portion of the piston 14 and the head portion 7 of the cylinder described; or it will go up past hole 10 to the annular groove under head 7, and gradually out between the top of the tappet body and the shoulder at the bottom of head 7. At the completion of each rotation of the cam there is an opportunity for the air to escape between these surfaces.

The tappet structure disclosed is one very readily and economically produced in large quantities and very easily assembled. The cylinder inserted within the walls of the tappet body is inserted therein by dropping it in till the head 7 of the cylinder interposes a stop against further movement. The spring 19 is merely dropped into place, the assembly of the valve 20, the spring 23 and its enclosing cage is made at the inner or lower end of the piston and the piston then merely inserted until the reduced portion 22 of the cage enters the upper end of the spring 19. A very practical, durable and economically constructed tappet, and one which operates very effectively, is produced.

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. A tappet comprising, an elongated hollow cylindrical body closed at one end and having an opening through a side thereof, a cylinder extending into the open upper end of the body closed at its lower end above the closed lower end of the body providing a chamber within the body below the cylinder and having an opening through a side thereof toward its upper end, there being a vertical passage between said cylinder and the adjacent wall of the tappet body providing communication between said last mentioned opening and said chamber, said cylinder at its upper end portion having a head resting upon the upper end of the body and stopping the cylinder within the body at a predetermined position, a piston in the upper end of said cylinder extending downwardly therein, said cylinder and piston having inter-engaging means limiting the entrance of the piston into the cylinder to a predetermined lower position, said piston having an axial opening therein from its lower end extending toward but terminating short of the upper end of the piston, and said piston having a radial communicating passage joining with said axial opening and said piston having an

annular groove around it in communication with the passage through the wall in the cylinder and radial passage in the piston, a valve across the lower end of the axial opening in the piston, a cage connected with said piston at its lower end and within which the valve is located, said cage having an opening at its lower side, a light strength spring means within said cage normally holding said valve in an upper closing position, and a heavier spring between said cage and the closed bottom of the cylinder.

2. A structure as defined in claim 1, said piston having a radial passage from a side thereof extending inwardly to and communicating with the axial opening in the piston, said radial passage connecting with the upper end portion of said axial opening.

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