Sept. 10, 1929. L. W. SHUTTS 1,727,790

HYDRAULIC SLACK ADJUSTER

Filed April 21, 1927

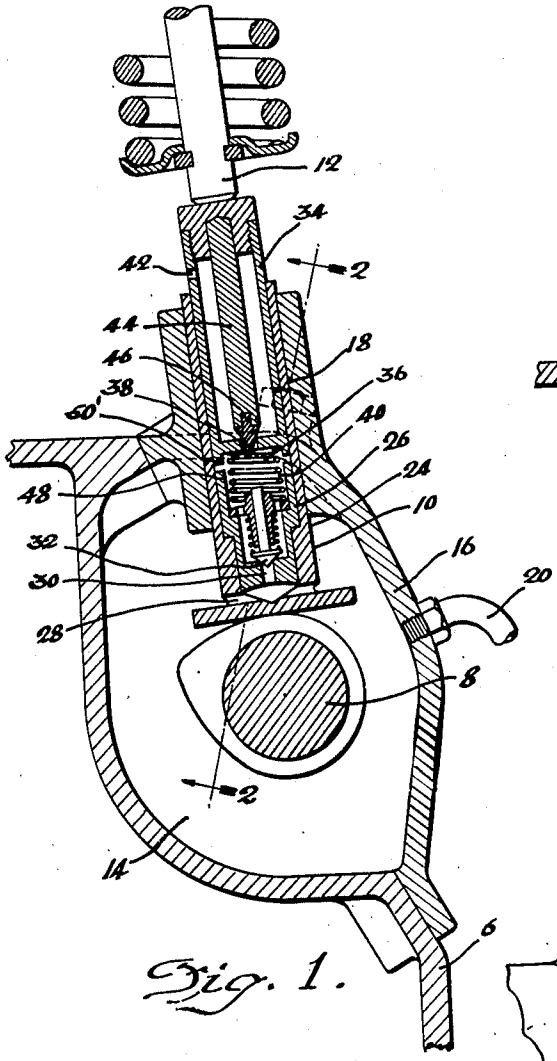


Fig. 1.

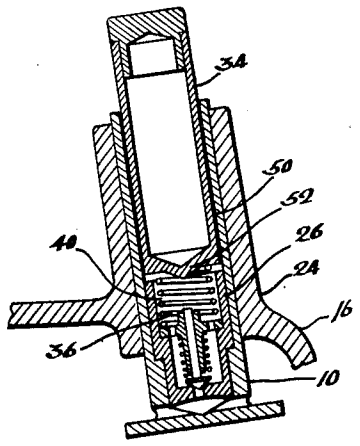


Fig. 3.

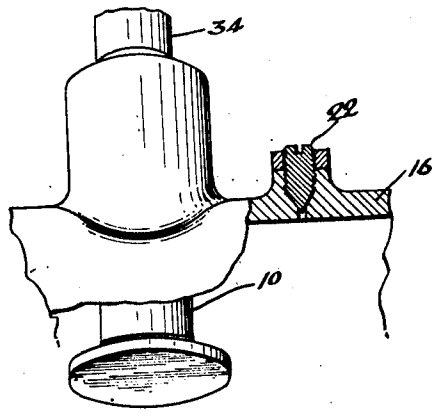


Fig. 2.

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UNITED STATES PATENT OFFICE.

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HYDRAULIC SLACK ADJUSTER.

Application filed April 21, 1927. Serial No. 185,609.

This invention relates to hydraulic mechanism in which motion is transmitted from one member to another through an intervening body of fluid and is particularly concerned with a novel arrangement for replenishing the body of fluid to insure that it is at all times maintained at the proper volume for successful operation. This is accomplished in a manner similar to that disclosed and claimed in the application of George E. A. Hallett, Serial No. 186,447 filed April 25, 1927, in that the tappet is formed in two parts with an hydraulic chamber between them and that chamber is connected with a supply reservoir by means of a passage provided with a non-return valve. A spring is provided tending to separate the members, which may be in the form of a cylinder and piston, and when the parts contract upon cooling or when air finds its way into the chamber a pumping action takes place which draws oil into the chamber from the reservoir. This action may be accelerated by supplying oil to the chamber under pressure. According to my invention the supply reservoir takes the form of a housing surrounding the cam shaft and filled with oil in which the shaft is submerged. By this arrangement not only is the impact of the cam and tappet cushioned by the interposed oil but the sound is muffled so as to be almost inaudible. The oil in the reservoir may be under pressure or not, as preferred.

I have likewise preferably provided a vent for the removal of air from the hydraulic chamber. This may be merely a fixed vent, in which case the clearance between the cylinder and piston will suffice, or it may take the form of a thermostatically controlled vent such as that disclosed and claimed in the application of John O. Almen, Serial No. 241,949, filed Dec. 22, 1927.

In the drawings, Figure 1 is a vertical section showing my invention embodied in the valve gear of an internal combustion engine.

Figure 2 is a view taken on line 2—2 of Figure 1.

Figure 3 is a section corresponding to Figure 1 but showing a modified form of tappet.

Reference character 6 indicates a portion of the crankcase of an internal combustion engine provided with the usual cam shaft 8 for operating the tappet indicated generally by the reference character 10. The tappet, in turn, operates the valve 12. The crankcase 6 is formed to provide a recess or trough 14 which is completed by the cover 16 bolted to the crankcase. The cover 16 is formed to provide a guide 18 in which the tappet reciprocates. The trough 14 may extend the length of the engine and may be supplied with oil from the crankcase thru the conduit 20 under pressure provided by the usual oil pump, not shown. The chamber may be provided with a pressure relief valve, not shown, to prevent the building up of excessive pressures in the trough, the discharged oil being returned to the crankcase.

With the described construction, it is apparent that the cam shaft will at all times be submerged in oil so that the impact between the cams and tappets will be cushioned while the little noise still remaining will be muffled, As air may at times enter the chamber and result in a reduction in the quantity of oil to an amount less than desired, I provide a screw plug 22 in the upper portion of the trough which, when removed, permits the escape of air. If desired, a permanently open vent may be used in place of the screw plug, or some form of automatic vent may be employed, such, for instance, as that used in my improved tappet.

The tappet 10 consists of a cylinder 24 in which is fitted a similar cylindrical member 26. At its lower end the member 24 is provided with a transverse bore 28. The member 26 is provided with a bore 30 communicating with the bore 28 and leading to the interior of the cylinder 26. The bore 30 is controlled by a spring-pressed check valve 32. Except for convenience in manufacture, the part 26 might be made integral with the part 24.

In the upper portion of the member 24 is slidably fitted the piston or plunger 34, the upper end of which engages the stem of the valve. A spring 36 tends to separate the cylinder and piston.

The head of the piston 34 is provided with a

port 38 for the discharge of air from the hydraulic chamber 40 between the cylinder and piston. A port 42 in the upper portion of the member 34 permits the escape of the air.

While the port 38 may take the form of a small fixed vent, it is preferably thermostatically controlled. This I have accomplished in the manner described and claimed in the application of John O. Almen, previously referred to. Thus, 44 indicates an aluminum rod fixed in the upper end of the piston 34, the rod carrying at its lower end a valve part 46 which may be of metal better adapted to resist wear than aluminum. The operation of this valve, as well as the tappet mechanism, will now be described.

I previously explained how the noise caused by the impact of the cam and the tappet is reduced and muffled. However, it is well known that owing to the contraction and expansion of the valve parts during operation of the engine, clearance develops which may cause noise at the point of engagement of the valve stem and tappet, as well as between the valve and its seat. To reduce this noise to a minimum, it is necessary to provide what amounts to a tappet of a size varying in accordance with the state of contraction or expansion of the parts. This is accomplished by the described construction in the following manner:

If it be assumed that the engine has just been assembled and that there is no oil contained in any of the parts, there would be lost motion or clearance in the operation of the tappet which would equal the space between the shoulder 50′ on the plunger 34 and shoulder 48 on member 26. However, the tappet would operate purely mechanically with that amount of lash. The operation would consequently be very noisy during this period. However, as the engine oil pump filled the oil trough 14 through the line 20 to where the oil level reached the opening 28 in the lower end of the tappet 10, the pumping action then within the tappet itself would cause oil to pass through the valve 32 into the hydraulic chamber 40. In this manner, oil will thus be admitted to the chamber until the latter is distended to an extent to take up all clearance. On the subsequent operation of the gear, there will be a slight leakage past the thermostatic valve, the escaping oil being replaced from the reservoir in the manner described. If a fixed vent were used in place of the thermostatic vent, it is apparent that there would be excessive leakage of oil thru the port 38 when the engine is hot and the oil thin. With the thermostatic valve, upon the engine becoming heated the aluminum rod 44 expands at the greater rate than the steel cylinder 34 so that the clearance between the member 46 and its seat is reduced and the flow is correspondingly diminished.

Upon the expansion of the valve stem and parts of the tappet due to heating, the excess oil is forced out of the chamber 40 thru the port 38 until equilibrium of oil flow is again established with the overall length of the tappet reduced to allow for the expansion.

I have described the trough 14 as filled with oil under pressure. However, if preferred, no pressure need be employed, the pumping action of the tappet being sufficient to maintain the chamber 40 filled with oil without the aid of the pressure of the oil in the trough.

The form shown in Figure 3 is identical with the form just described except that the clearance indicated at 50 between the plunger 34 and the member 10 is relied upon to permit the escape of air from the chamber 40. The plunger 34 is provided with a conical extension 52 serving to hold the spring 40 in position.

I claim:

1. The combination of an engine having a cam shaft, a housing for said cam shaft containing oil in which said shaft is submerged, an operating member projecting into said housing and actuated by said cam shaft, an operated member, a body of oil between said members and thru which motion is transmitted between them, and means for replenishing said body from the supply in said housing.

2. In the combination as defined in claim 1, said means comprising a passage provided with a non-return valve leading oil from said housing to said body.

3. In the combination as defined in claim 1, and means tending to separate said members to produce pumping action.

4. In the combination as defined in claim 1, said housing being provided with an air vent at its highest portion.

5. The combination of an engine having a cam shaft, a housing for said cam shaft, a reciprocating member projecting into said housing for engagement by said cam shaft, a second reciprocating member interfitting with said first-named member, said members being arranged to provide an hydraulic chamber between them, a passage leading from said housing to said chamber, a non-return valve in said passage, and means for maintaining a body of oil under pressure in said housing.

6. The combination of an engine having a reservoir of oil under pressure, a cam shaft operating in said reservoir, a multi-part valve tappet in engagement with said cam shaft, hydraulic slack adjusting mechanism associated with said tappet and including a body of fluid interposed between the parts of the tappet and serving to transmit motion from one part to the other and means for supplying oil from said reservoir to said mechanism.

7. The combination of an engine having a reservoir for oil under pressure, a cam shaft operating in said reservoir, a valve tappet in

engagement with said cam shaft comprising a cylinder, a piston in the cylinder, a body of oil interposed between the piston and cylinder and serving to transmit motion from one to the other and a passage leading from said cylinder to said reservoir for admitting oil from said reservoir to the space between said cylinder and piston to replenish the body of fluid.

8. In the combination as defined in claim 7, and a non-return valve in said passage.

9. In the combination as defined in claim 7, and a non-return valve in said passage and means for permitting the escape of air from said space.

10. The combination of an engine having a cam shaft, a housing for said cam shaft containing oil in which said shaft is submerged, a tappet operated by said cam shaft, said tappet being in the form of a cylinder, a piston in the cylinder, said piston being supported by a body of oil in said cylinder, a spring tending to separate said piston and cylinder, and a passage provided with a non-return valve for conducting oil from said housing to said body to replenish the latter.

11. In the combination as defined in claim 10, said cylinder and piston being provided with co-operating stops to effect emergency mechanical operation in the event of failure of said oil supply.

12. In the combination as defined in claim 10, and means for applying pressure to the oil in said housing.

13. The combination of an engine having a cam shaft, a housing for said cam shaft containing oil in which said shaft is submerged, an operating member projecting into said housing and actuated by said cam shaft, an operated member, a body of oil between said members and thru which motion is transmitted between them, and means for rendering said body of fluid self-adjusting to take care of expansion and contraction of the parts upon heating and cooling, said means comprising passages through which the body of fluid may be replenished from the supply in the housing.

In testimony whereof I affix my signature.

LEROY W. SHUTTS.