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ZERO LASH VALVE LIFTER

Filed Nov. 27, 1931

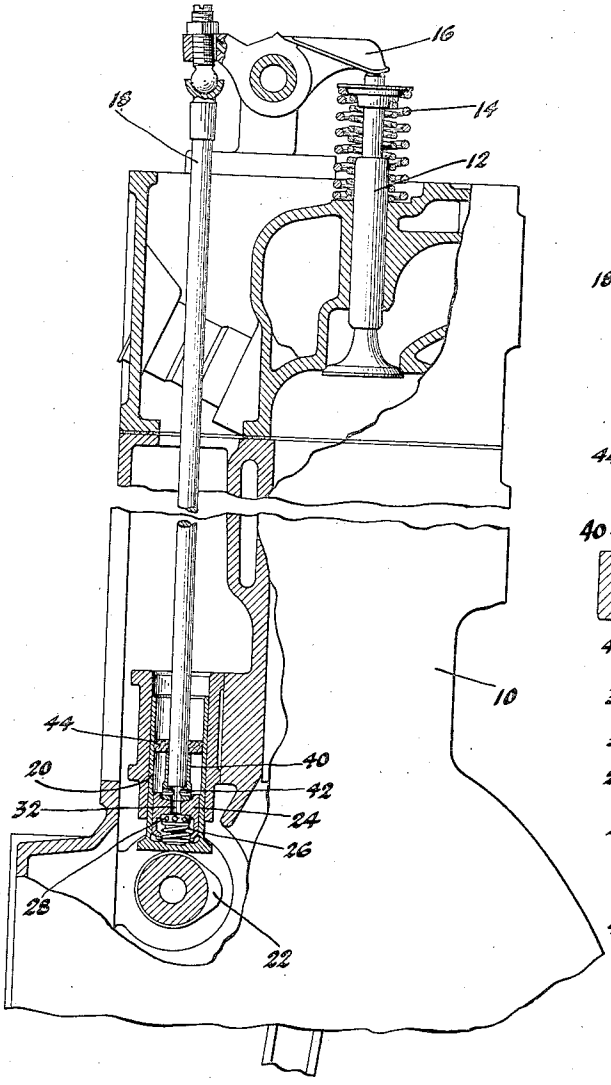

Fig. 1

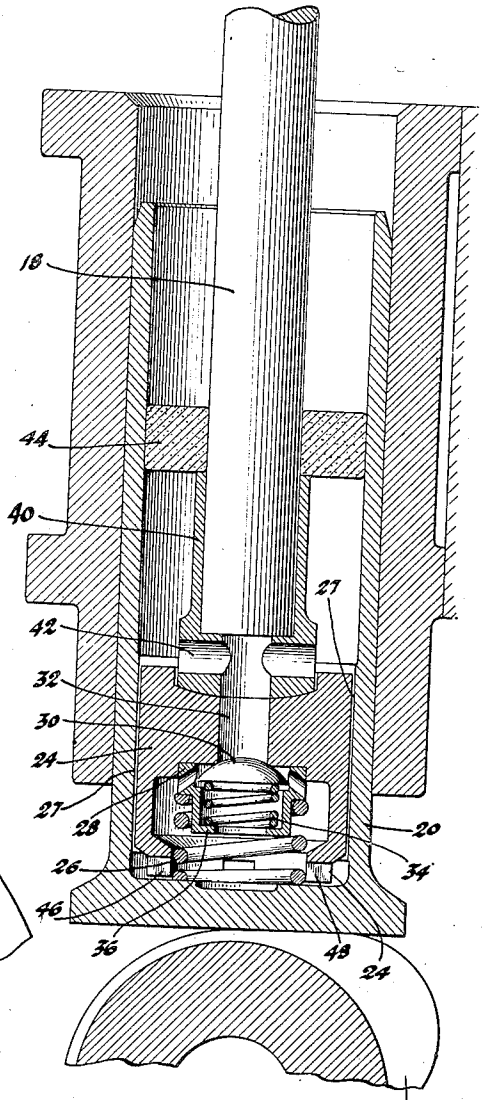

Fig. 2

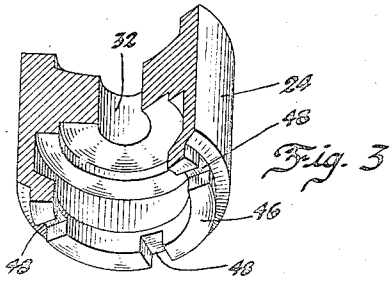

Fig. 3

Inventor

Otto Burkhardt

By Blackmore, Spencer & Flint

Attorneys

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OTTO BURKHARDT, OF FLINT, MICHIGAN, ASSIGNOR TO GENERAL MOTORS CORPORATION, OF DETROIT, MICHIGAN, A CORPORATION OF DELAWARE

ZERO LASH VALVE LIFTER

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This invention has to do with improved valve operating gear for internal combustion engines. The improvement is preferably embodied in the usual valve tappet although this is but one place it may be used. My improved tappet is characterized by the fact that there is incorporated in it a fluid dash pot through which motion is transmitted from the tappet to the usual push rod or valve stem. For convenience the tappet may itself constitute the dash pot cylinder. To permit replenishment of oil in the dash pot to care for leakage between the piston and cylinder, I have preferably provided the dash pot piston with a valved passage. The construction, as so far described, is more or less conventional except for detail improvements which will be pointed out later in the description. However, the main point of novelty in my construction consists in employing for the dash pot a piston of metal, such as aluminum, having a high rate of expansion, in a cylinder made of some other metal, such as chilled cast iron, which does not expand as rapidly. The advantage of this is that as the engine becomes hot, and the viscosity of the oil becomes reduced, the expansion of the piston will reduce the clearance between it and its cylinder, and thereby prevent excessive escape of oil. This will tend to keep the leakage from the dash pot substantially constant so that the tappet will be self-adjusting, and will at all temperatures take up the lash, insuring quiet performance, and also permitting the use of cams with shorter ramps, permitting quicker opening of the valves, and hence better scavenging as well as better feeding of fuel to the cylinders.

In the drawing:

Figure 1 is a vertical section through a portion of the engine embodying my improved tappet.

Figure 2 is an enlarged section of the tappet.

Figure 3 is a perspective view of a portion of the piston.

10 indicates a cylinder of an internal combustion engine equipped with an overhead valve 12 retained on its seat by suitable springs 14. The mechanism for operating the valve is illustrated as of the overhead type, but my invention is equally applicable to valve gear of the L-head type. The valve mechanism comprises a rocker arm 16 having one end engaging the valve stem, and the other end engaged by push rod 18, actuated by tappet 20 which, in turn, is actuated by cam 22. The tappet 20 is in the form of a hollow cup, preferably made of chilled cast iron. Within the cup is slidably mounted a piston 24 which is made of some metal that expands more rapidly than the metal of which the tappet is made. I prefer to use aluminum. A coil spring 26 tends at all times to move the piston 24 outwardly of the tappet, the upper end of the spring bearing against a valve cage 28 which may, if desired, be a press fit in a recess in the piston. Within the cage there is provided a valve 30 normally urged to close passage 32 in the piston by means of a light coil spring 34 bearing at its other end against a flange 36 formed at the bottom of the cage.

Upon the lower end of the push rod 18 there is telescoped a fitting 40 which is suitably bored as at 42 to provide communication between the passage 32 and the portion of the tappet chamber, above the piston. The lower end of the member 40, may, as shown, have a universal sliding fit in a socket in the piston. 44 indicates a washer of any suitable fibrous material sleeved upon the push rod 18 above the fitting 40.

Operation

The space beneath the piston 24 is filled with oil as are also the passages 32 and 42, and to some extent the interior of the tappet above the piston and below the washer 44. The valve 30 is seated as shown. Upon each lifting of the tappet by the cam the spring 26 yields, and some of the oil below the piston is forced out of the chamber through the clearance 27 between the piston and tappet. When the tappet again comes down on the base circle of the cam the valve mechanism is relieved of pressure, and the spring 26 forces the piston 24 outwardly of the tappet creating a slight vacuum in the chamber beneath the piston, causing oil to be drawn in to the

chamber past the valve 30. This operation is repeated every time the valves are actuated, and it is obvious that this continual adjustment of the position of the piston likewise takes care of the variations in clearance produced by the expansion of the parts of the valve gear as a result of heating. As the engine becomes hotter the viscosity of the oil in the dash pot is reduced so that if the piston 24 and the tappet were made of the same kind of material there would be increased leakage of oil, and consequently too much slack would develop causing the valve operation to be noisy. By employing a piston having a high coefficient of expansion the clearance between the piston and cylinder is reduced when the engine becomes hot. Thus while the reduced viscosity of the oil tends to increase leakage the reduced clearance between the piston and tappet tends to decrease leakage and the net result is maintenance of substantially constant leakage under all operating conditions. It will be noted that should there be no oil in the tappet the valve gear will nevertheless function, although noisily, by engagement of the tappet by the downwardly projecting flange 46 formed on the piston 24. This flange is provided with radial passages 48 to permit free flow of fluid toward the clearance between the piston and cylinder.

Many modifications will suggest themselves, for example, the valved passage 32—42 could be provided in the tappet instead of in the piston, but this would be inconvenient in manufacture. Obviously, also, the tappet 20 could be made of such material as invar metal which does not expand appreciably with increased temperature, and in such event the piston 24 could be of any metal having normal expansion. The dash pot could, of course, be located at the upper end of the push rod or even in the rocker arm, if desired.

I claim:

1. In valve mechanism for internal combustion engines the combination of an operating part, an operated part, a dash pot interposed between said parts comprising a cylinder and a piston in the cylinder, means yieldingly urging the piston out of the cylinder, a passage establishing communication between the opposite sides of the piston, a valve controlling flow through said passage and preventing escape of fluid from beneath said piston, but permitting admission of fluid thereto, said piston being composed of a material having a higher coefficient of expansion than said cylinder so that as the engine temperature increases the clearance between the piston and cylinder decreases to compensate for the increased viscosity of the oil in the dash pot.

2. A tappet comprising a cylinder having one end closed and the other open, a piston in the cylinder having higher coefficient of expansion than the cylinder, a spring normally urging the piston out of the cylinder, a passage connecting the spaces on opposite sides of the piston, a non-return valve in said passage permitting flow into the chamber beneath the piston.

In testimony whereof I affix my signature.

OTTO BURKHARDT.