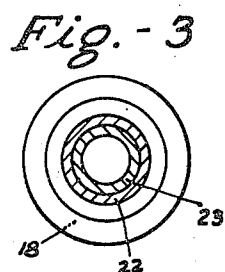
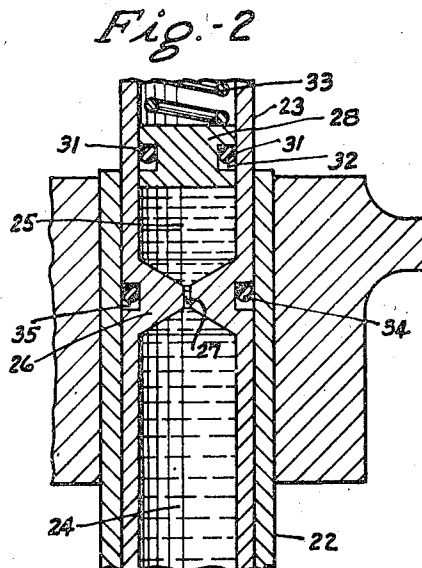
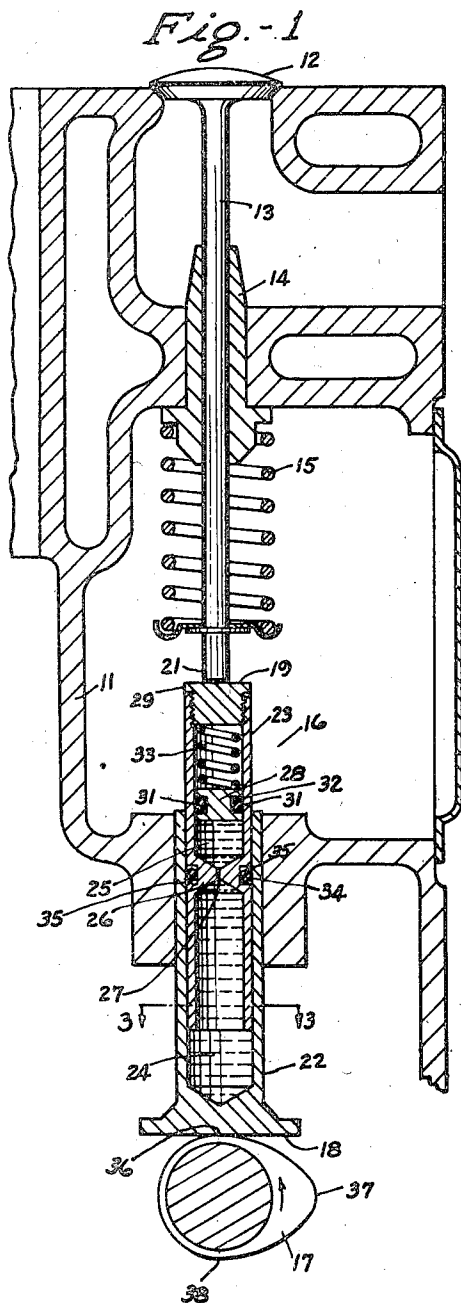


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SELF-ADJUSTING TAPPET
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SELF-ADJUSTING TAPPET

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1 Claim. (Cl. 123—90)

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My invention relates to tappets and concerns particularly valve tappets for gas engines.

One of the objects of my invention is to provide a self-adjusting valve tappet.

The principal object of the invention is to compensate for variations in length of valve stems, valve rods or other operating rods for communicating reciprocating motion.

It is an object of the invention to overcome lost motion in internal combustion engines and to avoid variation of period and timing of valve opening as well as to avoid noise and wear of loose parts.

Another object is to compensate for the effect of variations in temperature on length of the valve rod and to avoid undue loss of efficiency of an internal combustion engine when the engine is still cool.

More specifically, an object is to provide for close adjustment of tappets while the engine is cool as well as when heating up.

A further object is to provide self-elongation and contraction of a tappet without external connections or controls.

Still another object is to provide reliable self-contained hydraulic compensation for tappets in which paths for uncontrolled leakage of hydraulic fluid are eliminated.

A further object is to provide hydraulic compensation for a tappet in which passage of hydraulic fluid from one part to another of the tappet is limited to predetermined means for metering the flow.

An object of my invention is to provide a self-adjusting tappet which will take up clearance between the valve stem and cam regardless of the operating temperature of the engine.

Other and further objects, features and advantages of my invention will become apparent as the description proceeds.

In carrying out the invention in accordance with a preferred embodiment thereof a tappet is formed in two relatively movable parts, one comprising a hollow cylinder and the other, a sleeve adapted to slide in the cylinder with a hydraulic fluid such as oil contained in the cylinder and in a reservoir formed in the sleeve. Means are provided for causing the hydraulic fluid to be transferred from the reservoir to the cylinder tending to push the sleeve out from the cylinder and to extend the tappet to take up any clearance occurring between the valve stem and the cam.

A better understanding of the invention will be afforded by the following detailed description considered in conjunction with the accompany-

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ing drawing and the scope of the invention will be set forth in the claims appended hereto.

In the drawing:

Fig. 1 is a longitudinal sectional view of an embodiment of my invention;

Fig. 2 is an enlarged detailed fragmentary view of a portion of the apparatus shown in Fig. 1; and

Fig. 3 is a view of the cross section represented as cut by a plane in Fig. 1.

Like reference characters are utilized throughout the drawings to designate like parts.

Referring to Fig. 1 the arrangement shown therein by way of illustration comprises a portion of a casing 11 for an internal combustion engine such as a gasoline engine for example, having a conventional poppet valve 12 controlled by a valve stem 13 or controlled by a valve rod represented by the rod 13 slidable in a suitable guide or bushing 14. A valve spring 15 is provided for normally closing the valve 12 by moving the stem 13 in the downward direction. A tappet 16 is provided for transferring the action of a valve operating cam 17 to the valve rod 13. As in conventional constructions the tappet 16 has a hardened portion 18 adapted to ride on the cam 17 and a hardened surface 19 adapted to contact the lower end 21 of the rod 13.

The tappet 16 comprises two parts 22 and 23 which are relatively movable longitudinally, although, as will be explained hereinafter, the extent of movement required is relatively limited. One of these parts, for example, the part 22, takes the form of an hydraulic cylinder and the other which is the part 23 takes the form of a sleeve. A suitable relatively incompressible hydraulic fluid 24 such as oil, for example, is provided for filling the cylinder 22, and a reservoir 25 is formed in the sleeve 23 for supplying oil to the cylinder 22 to extend the tappet length.

The sleeve 23 has a substantially cylindrical outer surface adapted to fit the inner surface of the cylinder 22 and is provided with an inner transverse wall 26 having a very small aperture, orifice, or constricted opening 27 therein for permitting transfer of hydraulic fluid between the cylinder 22 and the reservoir 25. The opening 27 is so minute that the passage of oil or other fluid is metered or accurately controlled.

For closing the upper end of the sleeve 23 above the reservoir 25 a piston 28 is provided and to facilitate manufacturing and assembling operation a screw cap 29 having the hardened top surface 19 may be provided at the upper end of the sleeve 23 to form the top of the tappet

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16. The cylinder 22 is closed at the lower end. Suitable means are provided for sealing the piston 28 in the sleeve 23 such as an O-ring 31 composed of resilient material such as rubber or synthetic composition fitted in an annular groove 32 around the piston 28 of greater cross section than the sealing ring 31. In unflexed or uncompressed condition the resilient ring 31 has a diameter greater than the depth of the groove 32.

A similar seal is formed between the sleeve 23 and the cylinder 22 which may take the form of an O-ring 34 in an annular groove 35 around the portion of the sleeve 23 at which the transverse wall 26 is located.

Suitable means are provided for resiliently expelling or tending to expel hydraulic fluid from the reservoir 25 into the cylinder 22. This may be accomplished by means of the piston 28.

For forcing the piston 28 downward upon the top surface of the body of oil in the reservoir 25 suitable means are provided such as a compression spring 33 between the screw cap 29 and the piston 28. The spring 33 is preferably weaker than the valve spring 15.

If there should be any clearance between the cam 17 and the valve rod 13 the spring 33 forces the piston 28 downward expelling hydraulic fluid from the reservoir 25 through the orifice 27 into the cylinder 22. This action extends the tappet 16 and takes up any clearance. Upon the pressure stroke of the cam 17 the cam follower 18 is lifted and the oil pressure forces the sleeve 23 up together with the cylinder 22.

The rate of flow of hydraulic fluid through the minute orifice 27 is restricted by the size of the orifice and therefore prevents any appreciable contraction of the tappet. Nevertheless, gradual contraction of the tappet is permitted in case it should be necessary in order to enable tight seating of the valve 12 when changes in temperature of the engine or operating conditions tend to increase the length of the valve rod or push-rod 13 in relation to other parts of the structure.

It will be observed that the cam 17 is so constructed that the power or pressure stroke exists only during the time required for a quarter revolution of the cam 17 to be made, namely during the time required for the cam to advance from the point 36 to the point 37, in contacting the cam-follower 18. During this time the cam pressure opposes the pressure of the spring 33 and there is a tendency for transfer of oil back through the orifice 27 from the cylinder 22 into the reservoir 25.

The cam follower 18 is permitted to fall during the time required for the cam 17 to rotate through the 90 degrees from the point 37 to the point 38, and the cam follower dwells during the 180 degrees of rotation from point 38 to the point 36; consequently, during three-quarters of the revolution of the cam 17 the spring-pressed piston 28 is free to expel oil from the reservoir 25 into the cylinder 22 for the purpose of taking up any clearance. Thus the cylinder 22 is at all times kept adequately filled to extend the tappet 16 the amount required to overcome any clearance between the push rod 13 and the cam 17.

It is understood by those skilled in the valve art that due to inertia of the valve and main spring, the valve tends to resist the closing action of the main spring on its down stroke, but the main valve spring is often made strong enough to overcome the inertia of the parts and cause the valve stem to engage the tappet during the

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closing stroke of the valve. Since, as described above, the tappet will lengthen during three-quarters of a revolution of the cam, i. e., during closing of the valve as well as during the dwell period, it is obvious that the tappet spring 33 should be such that the force tending to lengthen the tappet is greater than any force that may be exerted by the valve stem on the tappet as the valve closes. Thus the tappet 16 constantly

hunts for its correct length and any changes in operating conditions, temperature, or wear of the parts which might cause clearance to be increased or decreased in the case of a tappet of fixed length are compensated by the self-compensating or self-adjusting tappet arrangement.

While I have described my invention as embodied in concrete form and as operating in a specific manner in accordance with the provisions of the patent statutes, it should be understood that I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claim.

What is claimed is:

In a self-adjusting tappet for interposition between a spring closed valve and a valve lifter, cylinder and piston members in sealed telescoping relationship with each other for operative association with the valve and valve lifter, respectively, said members cooperating to form a hydraulic chamber, a hydraulic fluid reservoir chamber formed in one of said members, a sealed spring pressed plunger slidable in said reservoir chamber and urged to reduce the reservoir volume, said hydraulic chamber and reservoir chamber having a common wall portion, restricted fluid transfer passageway means in said common wall portion providing the sole means of fluid communication between said chambers and arranged so that the area of the restriction to fluid transfer between said chambers is the same in either direction, there being a quantity of fluid transferred from said hydraulic chamber to said reservoir chamber by relative motion between said members during the lift stroke to shorten the tappet, said relative motion of the said members being hydraulically restrained during the entire lift stroke, the spring pressed piston in said reservoir transferring a sufficient quantity of fluid from said reservoir chamber to said hydraulic chamber during the balance of the cycle to lengthen the tappet and take up the clearance between the tappet and the associated valve and valve lifter.

GEORGE H. HUFFERD.

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