

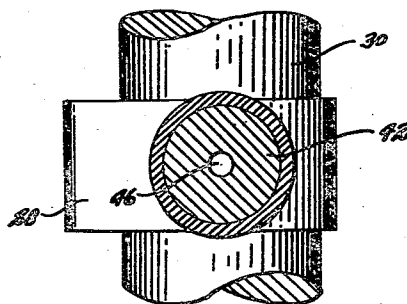
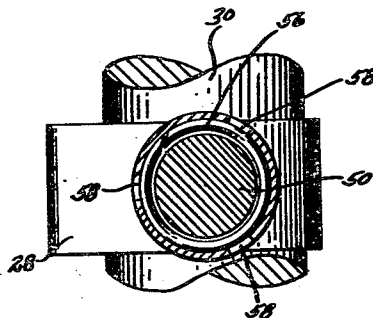
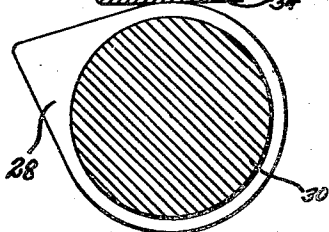
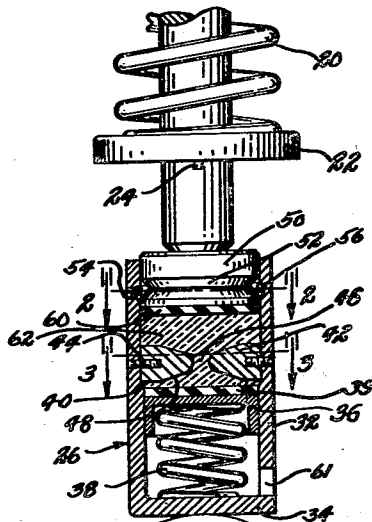
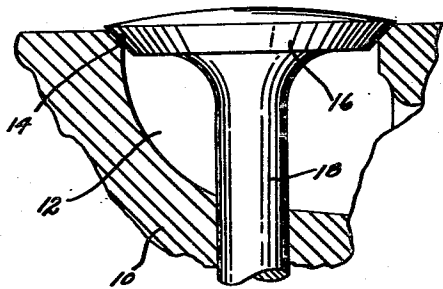
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2,570,853

SELF-ADJUSTING TAPPET FOR INTERNAL-COMBUSTION ENGINES

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SELF-ADJUSTING TAPPET FOR INTERNAL-COMBUSTION ENGINES

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4 Claims. (Cl. 123-90)

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This invention relates to a yielding spacer between two or more relatively movable impact members and more particularly to a spacer for motion transmitting devices, for example, in a valve operating means for engines, commonly referred to as "valve tappets" or dampening and slack adjusting devices such as shock absorbers, door checks or the like.

The invention primarily relates to improvements illustrated and described in United States Patent 2,120,384, issued to Jacob Wohlfeld, June 14, 1938, wherein a yieldable clutching means is disclosed for use in the valve operating mechanism of an internal combustion engine to compensate for the variations in length of the valve stem caused by temperature changes and wear.

An object of the present invention is to provide a structure wherein the relatively movable parts are spaced by a confined, flowable material of viscous quality while loads are applied yet having resistance characteristics when sudden forces or stresses are applied to the material.

Another object of the invention is to provide means for permitting a restricted flow of the material from one chamber of variable capacity to another chamber of variable capacity.

A further object of the invention is provide a movable wall structure for intercommunicating chambers which will permit displacement of the contents of one chamber to the other chamber.

Other objects and advantages of the inventions will more fully appear from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a sectional view of a valve operating mechanism embodying my improved connection between a valve stem and a tappet of an internal combustion engine, parts being shown broken away and in elevation;

Fig. 2 is a cross sectional view taken on line 2-2 of Fig. 1; and

Fig. 3 is a cross sectional view taken on line 3-3 of Fig. 1.

In the drawings I have illustrated the invention as applied to the valve tappet of an internal combustion engine. The cylinder block 10 of the engine is provided with the usual combustion port 12 having a valve seat 14 engageable with the usual poppet valve 16. The valve stem 18 is slidably mounted in the block 10 and urged to valve-closing position by the compression spring 20 surrounding the valve stem 18 and bearing between the block 10 and a washer 22 held on the stem by a key 24.

A tappet member 26 embodying my improved

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construction, is slidably mounted in the cylinder block 10, below and in axial alignment with the valve stem 18. The valve 16 and tappet 26 are periodically lifted by a cam 28 on a cam shaft 30.

In the operation of the valve mechanism the parts are elongated by heat and the valve 16 moves away from the cam, consequently not properly seating on the valve seat 14, unless sufficient clearance is provided between the bottom of the valve stem 18 and the top of the valve tappet 26. This clearance results in noisy operation of the parts as well as wear reducing the overall length of the parts.

The present invention is directed to a self-contained tappet which maintains a constant overall dimension for the moving parts irrespective of temperature or wear conditions.

The plunger body of the tappet 26 is formed as a cylinder having a tubular side wall 32 and a closed bottom portion 34; the upper end of the tube being open. A piston 36 is slidably mounted in the tubular portion 32 and a compression spring 38 bears between the piston 36 and the bottom portion 34, urging the piston 36 outwardly. A sealing disc 39, preferably of a pliable material, such as rubber or the like, is received on the top of the piston 36 to prevent leakage past the piston side walls. The outer end of the tubular portion 32 has its inner periphery of increased diameter providing a shoulder 40. An apertured disc fits the inner periphery of the tube and seats on the shoulder 40. The disc is shown as held in place by screws 44 to prevent axial displacement, but if desired the disc may be pressed into position.

The disc 42 is provided with an aperture 46 of predetermined area and the upper and lower surfaces of the disc converge toward the aperture as at 48. If desired more than one aperture may be provided in the disc.

The open end of tubular portion 32 is provided with a hardened plug 50 to engage the lower end of the valve stem 18. A groove 52 is formed in the outer periphery of the plug and a groove 54 is formed in the inner periphery of the tubular portion 32, radially opposite the groove 52 when the plug 50 is in assembled position. A split spring ring 56 is received in the grooves 52 and 54 to hold the plug in assembled position; the latter being pressed to position against the spring tension. When the compressed spring is opposite the groove 54 it snaps into the groove and holds the plug in position. It will be noted that the groove 52 is larger than the ring 56 so that there

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is limited relative movement of the plug with respect to the tubular member 32.

If it is desired to remove the plug 50, a suitable tool is inserted through radial openings 58 to decrease the diameter of the spring 56 whereupon it is removed from the groove 54 permitting the plug 50 to be withdrawn.

A sealing disc 60, similar to the disc 39 is positioned on the bottom of the plug 50 to prevent leakage past the plug.

When the above parts have been assembled in their proper location, there is provided a cylindrical space between the plug 50 and the piston 36. The disc 42 divides the space into an upper chamber and a lower chamber, interconnected by the aperture 46 in the disc 42.

The plug 50 and the piston 36 are spaced movable plungers in the tappet body which provide a chamber between the plungers.

A vent 61 is provided in the tappet to permit displacement of the air below the piston 36 when the piston is moved downwardly.

Before the plug 50 is inserted, a predetermined quantity of flowable material is placed in the tubular portion 32, resting on the piston 36. The material which I have selected as a suitable means for use between the piston 36 and the plug 50 is illustrated at 62. While the chemical composition of this material is unknown to me at the present time, it is commercially available on the market and is commonly known as "bouncing putty."

The material is a silicone elastic polymer compound commonly called "bouncing putty" and best can be described by reference to its characteristics. It is a material having marked cold flow characteristics. It is a high molecular weight polymer having long chain molecules. The material is highly resistant to sudden or quick changes of its shape, yet will flow when unconfined and given ample time. If the material is in mass form as a ball or confined in a chamber the long chain molecules are held to each other by attraction and resist with considerable force a sudden change in shape. If given more time the molecules tend to readjust themselves to a new shape requiring the least force between the chain molecules; for example, when the material is rolled into a ball it will rebound from a solid surface a distance approximately sixty to eighty percent of its dropped height, indicating a strong resistance to change in shape. If, however, the ball is permitted to rest on the surface for a period of time, it will eventually flatten out into a thin sheet, indicating its ability to flow.

The material is a doughy, rubber-like compound free from vulcanizing agents and is uncured. Its properties are not affected by temperatures far above and below the serviceable limits of natural or synthetic organic rubbers. This material shows no property changes in temperatures ranging from approximately minus 75° F. to plus 450° F. It is therefore suitable for working temperatures in an internal combustion engine.

The plasticity of the material may be defined by A. S. T. M. 72 which is a measurement of depth in mills of a 4 gram sample after one minute using a Scott plasticity tester. Its rebound characteristic is approximately 23.5 inches measured by dropping a four gram ball thirty inches upon a steel plate. This is approximately 78 percent.

When the parts are assembled, the dough-like

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material is placed in the chambers with the spring 38 having a load force on the valve which does not exceed the load of the spring 20. The plunger 50 is then positioned over the material and the tappet is placed between the valve stem 18 and the cam 28. If there is any clearance between the lower end of the valve stem and the plunger 50, the spring 38 forces a portion of the material in chamber B through the opening 46 into the chamber A. This raises the plunger 50 into contact with the valve stem.

In the present design, sudden shock or a blow on the material, caused by the cam 28 lifting the valve, will be transmitted through the material without appreciable flow, but there will be a slight extrusion of the material through the opening 46 transferring the material from one chamber to the other, that is, from chamber A to chamber B.

Assuming that the valve train linkage is in zero lash position, the amount of material extruded from chamber A to chamber B, during the valve lifting period, is exceedingly small but is immediately transferred back to chamber A during the closed position of the valve due to the pressure of the spring 38 exceeding the pressure on the plunger 50. The compensating action causes the plungers, plug 50 and piston 38, to move axially in the tappet bore, increasing or decreasing the over-all length of the valve operating means or tappet assembly.

Assuming that there is a clearance between the end of the valve stem 18 and the plunger 50, the spring 38 will urge the piston 36 axially of the bore and force the material in chamber B through the opening 46 into chamber A thereby raising the plunger 50 to compensate for the clearance.

When the valve operating means lengthens, due to heat expansion or other factors, the effective load on plunger 50, caused by the valve spring 20, exceeds the load on the spring pressed piston 36. The material is then forced from the chamber A to chamber B thereby lowering the plunger 50 to compensate for the over-all length. This action continues until the valve is seated and the forces in opposite directions are substantially balanced.

The impact pressures are from the cam 28, to tappet body 26, to shoulder 40, to disc 42, to dough-like material 62 in chamber A, to plug 50 and to valve stem 18.

In general, the tappet assembly herein described will automatically, when in action, increase or decrease in overall length to suit the variations in distance between the cam and the valve seat, so that the valve will seat positively and at the same time will have zero tappet clearance.

While I have shown and described the invention embodied in a slack adjusted for a valve-operating mechanism, it is also applicable to other motion-transmitting systems wherein it is desired to minimize lost motion, to compensate for variations incident to wear and temperature changes.

The composition of the material may be varied to meet the desired characteristics, that is, its plasticity may be increased or decreased and its property to cold flow may be varied to suit the requirements.

The size of the opening 46 may be varied to increase or decrease the amount of material passing from one chamber to the other during a predetermined time interval, or the number of openings may be varied thus permitting variations in the action of the tappet.

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While I have illustrated and described what I deem to be a preferred embodiment of my invention, it will be understood that various changes including the size, shape, and arrangement of parts may be made without departing from the spirit of my invention and it is not my intention to limit its scope other than by the terms of the appended claims.

I claim:

1. In a valve tappet for a heat engine, a valve-engaging member and a body member, said members having spaced opposed portions relatively movable toward and from each other, a mass of silicone polymer compound between said portions and in engagement with each, said polymer being highly resistant to sudden deformation but freely flowable under sustained pressure whereby to transmit force from said body to said member, means confining said polymer between said portions, said means including a yieldable portion arranged to apply pressure to said mass and urge said body and member apart, said yieldable portion being yieldable to permit limited flow of said mass under the influence of external pressure urging said body and member together.

2. In a valve tappet for a heat engine, the combination of a body having a bore therein, relatively movable opposed plungers in said bore, one of said plungers being engageable with a valve element externally of said body, yieldable means urging the other of said plungers along said bore toward said one plunger, a mass of silicone polymer in said bore between said plungers, said polymer being highly resistant to sudden deformation but freely flowable under sustained pres-

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sure force transmitting means fixedly carried by said body in direct engagement with said mass of polymer and arranged so that forces applied to said body are transmitted directly through said mass to said one plunger.

3. A device as defined in claim 2 wherein said last-named means comprises an apertured partition wall fixed in said bore between said plungers.

4. A device as defined in claim 2 wherein said last-named means comprises a partition wall fixed in said bore between said plungers, an opening through said wall, the opposed faces of said wall tapering inwardly to said opening.

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