July 7, 1953 C. E. JOHNSON 2,644,437

SELF-ADJUSTING TAPPET

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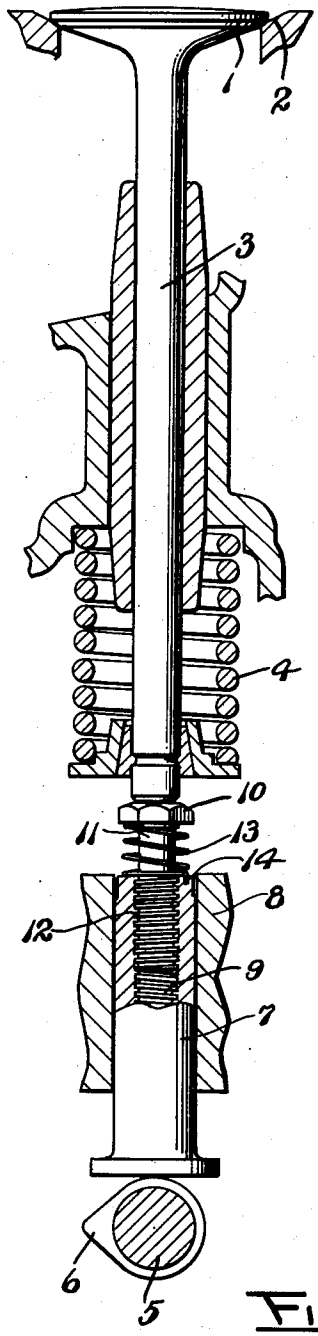


FIG. 1.

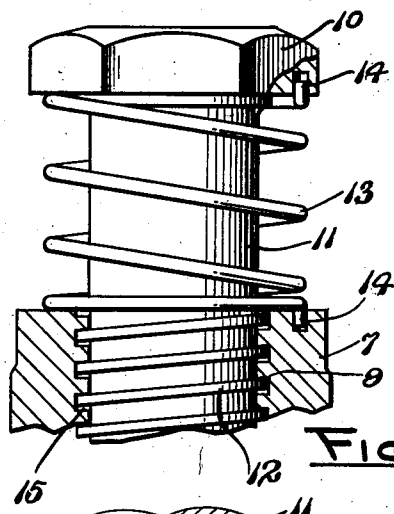


FIG. 2.

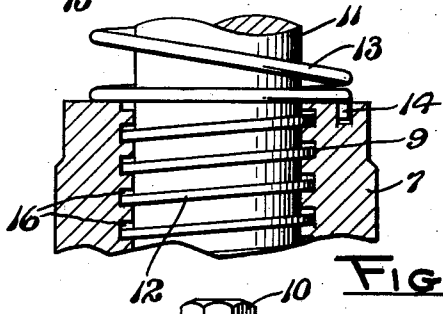


FIG. 3.

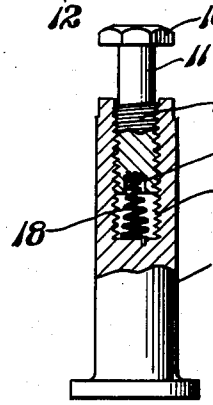


FIG. 4.

INVENTOR
CHARLES E. JOHNSON
BY Lawrence and Van Antwerp
ATTORNEYS

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SELF-ADJUSTING TAPPET

Charles E. Johnson, North Muskegon, Mich., assignor to Johnson Products, Inc., Muskegon, Mich., a corporation of Michigan

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2 Claims. (Cl. 123—90)

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This invention relates to a self-adjusting mechanical tappet which, at all times when installed between a cam on a camshaft and the lower end of a valve stem of a valve in internal combustion engines, is in contact with said cam and valve stem at all temperatures of the engine. With my invention, novel structure is provided for maintaining such described contact yet containing therein a short predetermined gap normally known as the lash or clearance between the end of the valve stem and the tappet, when the various parts, affected by increasing temperature of the engine when it is running, expand longitudinally, is reduced so that the valve will properly close on its seat at all times, and not be lifted from the seat because of such expansion.

It is a primary object and purpose of the present invention to provide a novel, yet simple and very practical, mechanical tappet which is self-adjusting at all times and with which tappet noises are eliminated and not heard. It is a further object and purpose of the present invention to provide a tappet which may be interchanged with and replace hydraulic tappets, or other mechanical tappets, and which is workable with the differently designed cams now in use for hydraulic and mechanical tappets. Therefore, the tappet of my invention is not only available for use in new installations but, as a replacement, may be used in old engines whether equipped with mechanical or hydraulic tappets, no extra work or change of camshafts being necessary.

It is of course to be understood that my invention is also usable in conjunction with overhead valves, in which the tappets are located between cams on the camshaft and push rods which actuate rocker arms, such rocker arms in turn being operatively associated with the engine valves to open them and permit their closing as the camshaft is rotated.

An understanding of the invention may be had from the following description, taken in connection with the accompanying drawing, in which

Fig. 1 is a central vertical section through an engine valve and tappet assembly, the tappet being in accordance with my invention.

Fig. 2 is a fragmentary enlarged central vertical section through the upper end of the tappet body, the tappet screw and the spring between the head of the screw and the body being in elevation, with the parts in the position which they occupy when the engine valve is closed.

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Fig. 3 is a fragmentary section and elevation similar to Fig. 2 illustrating a different position of the parts when a valve is lifted, and

Fig. 4 is a partial elevation and central vertical section through a tappet serving the same purposes, in accordance with the same operative principles, but in which the spring used is housed and concealed.

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

In conventional internal combustion engine structure, the valve 1, shown as closed against a seat 2 formed in the engine block, has an elongated stem 3 extending downwardly, associated with which is a heavy spring 4, the normal action of which is to move the valve to its closed position against the seat 2. In internal combustion engines camshafts 5 are driven, normally from the engine crankshaft, on which are cams 6, one for each valve, the cams being located directly below and spaced from the lower ends of the valve stems 3. It is between the cams and the lower ends of the valve stems in internal combustion engines having valves of the type illustrated that the tappets are located. In overhead valve engines, the tappets are between the cams and the lower ends of push rods which, through rocker arms, actuate the valve against their strong closing springs.

In the disclosure of the present invention, the tappet body 7 of conventional form, is mounted for vertical reciprocating movement in a guide 8 therefor this also being an old, well known and conventional structure. The body 7 is interiorly bored and threaded from its upper end downwardly toward but short of its lower end, the lower end resting upon the cam 6. The interior threading at 9, broadly, is old in tappets, but with my invention, with respect to the threads on the adjusting screw which is screwed into the upper end of the tappet, such interior threads on the tappet body are wider than the threads on the screw making a very loose fit of the screw in the tappet body, permitting a relative longitudinal movement of the screw with respect to the length of the tappet body of a distance which may be approximately ten to twenty thousandths of an inch. Such distance is the designed or predetermined distance selected by the engine designer for the regular gap or space between the upper end of a tappet screw and the lower end of a valve stem for an engine for normal adjusting of valve tappets, in which the adjusting screws, threaded into the upper ends of the tappet bodies, have a snug fit.

The tappet screw has the usual head 10, shank 11, extending downwardly therefrom, and threads 12 at the lower portion of the shank to adjustably screw into the upper end of the tappet body. The turning of the screw into the body is very easy because of the designed difference in dimensions of the interior threads of the body and the exterior threads 12. Around the shank 11, between the upper end of the tappet body 7 and the lower side of the head 10, a coiled spring 13 is located, having its ends 14 anchored in suitable recesses or sockets in the upper end of the body 7 and the lower side of the head 10. The spring 13 in use is both a compression and a torsion spring. Its torsional strength is light; its compression strength is greater than the torsional strength.

In the assembly of the body, screw and spring, the screw is threaded into the body with the spring out of contact or engagement with either one or both such body 7 and head 10, until the screw approaches a position such that the over all length of the tappet is the distance between the engine cam and the lower end of the valve stem where the tappet is to be installed. Before such over all length has been reduced to such distance between cam and valve stem, the spring is anchored at both ends to the tappet body and screw head. Thus, when installed, the screw must be turned against the torsional resistance of the spring a short distance, usually not more than two complete turns, in order that it may be located longitudinally between the cam and lower end of the valve stem, with the body 7 bearing against the cam in the lowest position which the tappet will take, and with the valve 1 against its seat 2.

In threading the screw into the body 7 with the spring between the body and head of the screw, not connected at least at one end, the spring is compressed. A force is stored in the spring the tendency of which is to move the screw outward in the direction of its length and thus cause the threads 12 of the screw to come against the upper sides of the threads 9 in the body leaving the spaces indicated at 15 in Fig. 2 between the lower sides of the threads on the screw and tappet body. The spring 13 also having been wound by approximately two turns of the screw or the like after the spring has been anchored at both ends as described, has a tendency to turn the screw in reverse, and will do so until the upper side of the head 10 comes against the lower end of the valve stem 3. The relatively light torsional strength of the spring 13 compared to the heavier compression strength of the spring will insure that such torsional force will not only overcome the compression force and cause the threads 12 to move downwardly against the threads 9 of the body, but that in the closed position of the valve 1 as shown in Fig. 1, the threads will occupy the position shown in Fig. 2, when the engine is comparatively cold, and the parts of the tappet and the valve stem have not been longitudinally expanded as will occur on increasing temperatures of the engine when it is running.

When the engine is newly started, that is, when it is relatively cold, on the rotation of the cam shaft 5 a cam 6 lifting the tappet, and the tappet lifting the valve, the first action will result in a compression of the spring 13 and a moving of the threads 12 downwardly and against the threads 9 until the position shown in Fig. 3 is reached. This takes place immediately before the valve is lifted. The lower sides of the threads 12 rest upon the upper sides of the threads 9 of the tappet and with spaces 16 between the upper sides of such threads.

In Fig. 4 the tappet screw at its lower end is interiorly bored upwardly to form a socket, as indicated at 17, into which the upper end of the spring 18 is inserted and anchored to the screw, the lower end of the spring being anchored to the body 7. This spring, like the spring 13, serves the same purposes, being both under torsional and compressive strain when installed.

Normally, with the usual mechanical tappet now used, in adjusting the tappets the head of the tappet screw is brought close to but spaced a short distance from the lower end of the valve stem, with the valve in closed position, a shim of a predetermined thickness being inserted between such screw head and valve stem to insure the proper gap. When the engine is cold, the rapidly repeated separations of the screw head from the lower end of the valve stem, and repeated striking against the valve stem causes metallic noises, known as tappet noises, which can be heard until the engine well warms up, such tappet noises decreasing progressively until they stop when the expansion has brought the upper side of the screw head into substantially closer contact with the lower end of the valve stem, and remains in such close position at all times until after the engine has stopped and separation occurs upon longitudinal contraction because of decreasing temperatures. Such contact, being in effect out in the open, the noises made are clearly heard, and are, to many, annoying. With the present structure, while the lower sides of the screw 12, when the valve is closed, come to the upper sides of the threads 9 periodically with each revolution of the cam shaft, and there seemingly will be metallic contact of the screw threads, inasmuch as the screw threads are filled with lubricant, oil or the like, and as the contacts take place within the relatively heavy body 7, such noises are not heard, if they occur, and their occurrence is largely done away with because of the cushioning performed by the oil lubricant.

It is to be understood that while square screw threads 9 and 12 are shown in Figs. 1 to 3 inclusive, any other threads, such as the usual V thread shown in Fig. 4, or acme threads may be used quite as well, the action being the same in all cases.

The tappet is interchangeable with all tappets, mechanical or hydraulic, and works with the cams, whether the cams are designed for hydraulic or for mechanical tappets. The changes made by the dimensional variations in threading of the tappet screw and body, for a longitudinal play of the screw of a predetermined amount, with respect to said body, makes no addition in the machining cost of cutting the threads. The only additional part in connection with this tappet is the short spring which is used, and the only additional machine work is the provision of the sockets or recesses for anchoring the ends of the spring. The cost of the tappet, therefore, closely approximates that of the ordinary mechanical tappet, and may be even more economical than the ordinary mechanical tappet which, unless it has a special self-locking screw structure, more expensive to make than the screw in the present invention, will require a locking nut to bear at the upper end of the

tappet body, the cost of which will at least equal if not exceed that of the spring 13 or 18.

With the tappet of the present invention all of the desirable results of eliminating noise of tappet operation which hydraulic tappets are designed to suppress are attained, at very much less cost and with far simpler tappets, not subject to getting out of order, as can frequently occur with hydraulic tappets.

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, a body having an interiorly threaded opening longitudinally thereof from one end of the body toward but short of the other, a screw threaded into said opening, the interior threads of the body and the exterior threads of the screw being loosely fitted whereby the screw, relative to the body, is adapted to have a free longitudinal movement equal to the predetermined adjusting clearance between the tappet and the engine valve stem of an engine in which the tappet is adapted to be installed, and a coiled spring anchored at one end on the body and at the other end on the screw, said spring being adapted to be compressed and put under torsional strain when thus anchored, the torsional spring force being less than the compression force produced on threading said screw into the body after anchoring of the spring has taken place.

2. A tappet comprising, a tappet body having an interiorly threaded opening from one end thereof toward but short of the other, a screw loosely threaded into said opening, relative dimensions of the interior threads of the body and exterior threads on the screw permitting a short longitudinal movement of the screw relative to the body when free to do so equal to the predetermined designed adjusting clearance between the tappet and an engine valve stem of an engine in which a tappet is adapted to be installed, and a yielding compressible and torsion spring connected with said screw and body at opposite ends and adapted to be simultaneously compressed and placed under torsional strain on threading said screw into the body, with the torsional force less than the compression force produced when said spring is connected to both the body and screw.

CHARLES E. JOHNSON.

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