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M. TIBBETTS

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INTERNAL COMBUSTION ENGINE

Filed March 21, 1932

FIG. 1

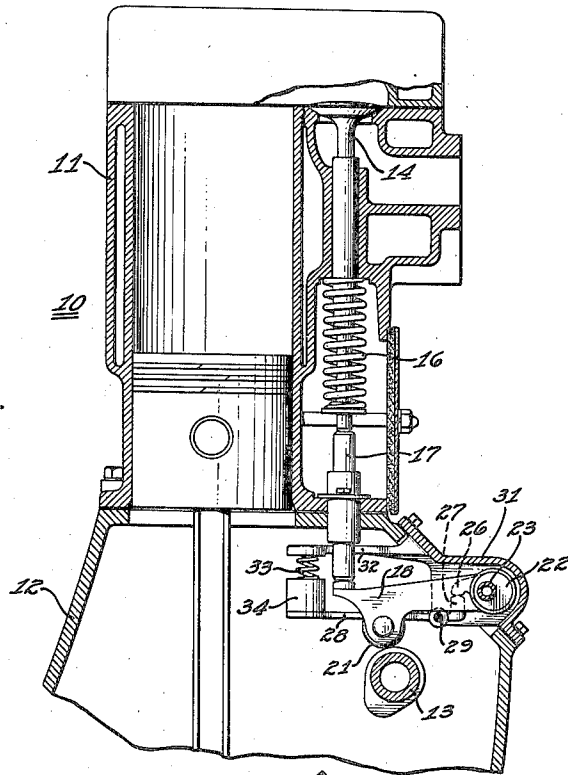
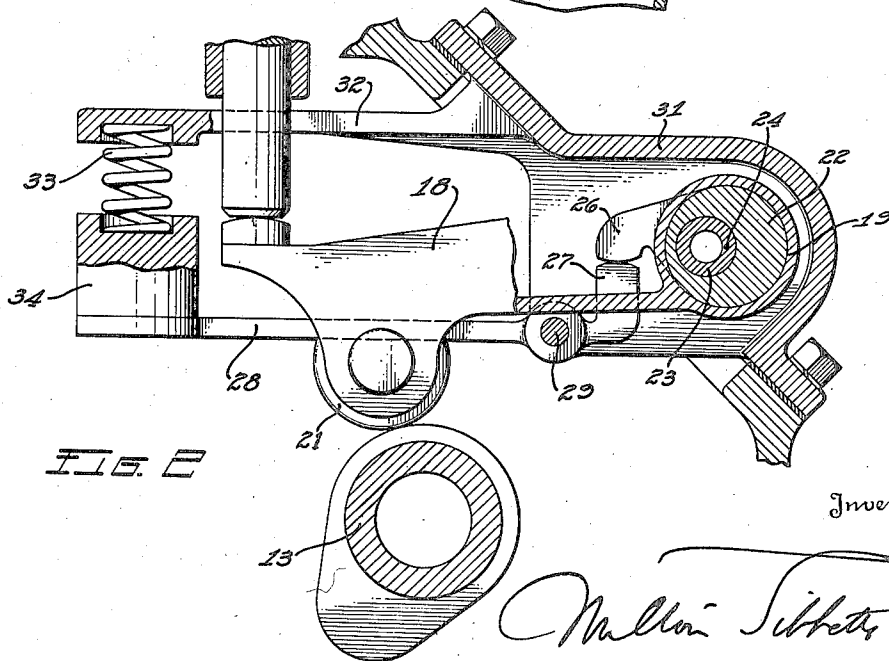


FIG. 2



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INTERNAL COMBUSTION ENGINE

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7 Claims. (Cl. 123—90)

This invention relates to internal combustion engines and particularly to the valve mechanism clearance adjustment.

It has previously been proposed to use a valve mechanism adjuster in which the rocker arms of the valve mechanism are regulated hydraulically to compensate for expansion and contraction due to temperature variations. The prior art shows such a mechanism adapted both to overhead valves and to valves for L-head engines. In each case the take-up device includes a hydraulically controlled piston and a valve located in the piston to permit the venting of air from the oil and to permit replacement of such oil which may have leaked past the piston during operation of the device.

The construction shown in the prior art depends for its operation on the incompressibility of the oil, and consequently it is extremely important that the air be removed therefrom, and that the parts be manufactured so accurately that the amount of oil that leaks past the piston will be reduced to a minimum. Since all oil has some air entrapped therein, and since a leak-proof piston is not inexpensive to manufacture, this construction is not altogether desirable in some types of engines, particularly those in which low cost is an important item.

It is one of the objects of this invention to devise a valve take-up mechanism which will not be subject to the above mentioned objections to a hydraulically controlled mechanism.

Another object is to reduce the number of parts required to maintain a valve mechanism in reduced clearance relationship under all conditions of temperature and wear.

Another object of the invention is to provide a valve take-up mechanism which depends entirely upon inertia to maintain a minimum clearance in the parts of the valve operating system.

Still another object of the invention is to provide a valve take-up mechanism in which a resilient means tends to reduce the clearance between the parts of the valve mechanism, and the inertia of a mass tends to maintain the clearance, both the resilient means and the inertia of the mass permitting an expansion of the parts of the valve mechanism, due to heat, for example, without causing riding of the valve upon its opening mechanism.

A further object of the invention is to provide a valve take-up mechanism in which a mass will assist in reducing the clearance and resist any tendency undesirably to increase the clearance in the valve mechanism.

Other objects of the invention will appear from the following description taken in connection with the drawing, which forms a part of this specification, and in which:

Fig. 1 is a vertical transverse section through an engine which includes an embodiment of the invention, and

Fig. 2 is an enlarged view of a portion of Fig. 1.

Referring to the drawing, 10 illustrates an engine comprising a cylinder block 11, a crank case 12, integrally attached to the cylinder block, and 13 illustrates the cam shaft carried on suitable bearings in the engine. A valve 14 which may be either an intake or an exhaust valve, mounted in the cylinder block, is normally urged to closed position by a spring 16. The drawing also shows a tappet member 17 below the valve for transmitting thereto the opening force from the cam shaft 13. Between the cam shaft and the tappet is located a rocker arm 18 pivoted on a cylindrical surface 19 the nature of which is to be further described. Thus as the cam shaft 13 rotates, it transmits an opening force through the rocker arm roller 21, rocker arm 18, and the tappet 17 to the valve 14, opening the valve and compressing the spring 16. As soon as the cam on the cam shaft has rotated past the roller 21, the spring 16 is then effective to close the valve and cause the rocker arm roller 21 to tend to follow the contour of the cam.

Due to manufacturing variations, the length of the several valve stems in a multi-cylinder engine will not be the same, and due to temperature variations and wear, the length of each stem will not be a constant. Normally, there is a certain clearance between the parts of the valve mechanism just described. An inspection of the drawing will indicate that if the cylindrical surface 19, about which the rocker arm pivots, is moved upwardly, it will tend to tilt the rocker arm and increase this clearance and if it is moved downwardly, such movement will tend to reduce the clearance. It is the purpose of this invention to provide a novel mechanism for accomplishing this movement and for controlling it.

Referring particularly to Fig. 2, it is seen that the cylindrical surface 19 forms the outer surface of an eccentric member 22 which is journaled on a shaft 23 the center of which is removed from the center of the cylindrical surface 19. Thus, rotation of the eccentric member 22 about the shaft 23 will raise or lower the center 24 of the surface 19 and tilt the rocker arm to increase or decrease the clearance. Projecting from the eccentric at one side of the rocker arm 18 is an

arm member 26 against which bears the end 27 of a lever 28. This lever is mounted on a pivot 29 which in turn is supported by a rocker arm box 31 bolted to the side of the crankcase in operative adjacency to the camshaft and valve tappet or stem. The box 31 serves also to support the shaft 23 in suitable bearings, not shown, and has projecting inwardly therefrom an arm 32, the purpose of which will later be evident. The construction shown permits the removal from the engine, as a unit, of the entire rocker arm and the mechanism for automatically maintaining the desired clearance in the valve mechanism.

Between the arm 32 and the lever 28 is located a resilient member, such as a spring 33, which normally tends to oscillate the lever 28 in a counter-clockwise direction about the pivot 29. This rotation of the lever causes the arm 27 thereof to bear upwardly against the nose 26 projecting from the eccentric and tends to cause a clockwise rotation of the eccentric about the shaft 23. This latter rotation in turn tends to move the center 24 of the cylindrical surface 19 downwardly and tends to cause the rocker arm 18 to move to a position in which there is a minimum clearance between the cam shaft, the rocker arm, and the tappet, or valve stem, in case the tappet is omitted. Thus, we have a resilient yieldable member 33 continually urging the parts of the valve operating mechanism into a reduced clearance relationship.

When the cam shaft 13 tries to open the valve, the rocker arm 18 is urged against the end of the valve tappet or valve stem and, because of the resistance due to the valve spring 16, there is a tendency for the right-hand end of the rocker arm to push the cylindrical surface 19 upwardly, rotating the eccentric 22 about its center on the shaft 23. Such upward movement of the surface 19 is, of course, undesirable because it brings a reduction in the valve opening movement. Such upward movement of the surface must be resisted and to provide such a resistance I use a mass 34, the inertia of which is sufficient to resist such movement. In order that a small mass may have sufficient inertia effect, I mount a mass 34 at a considerable distance from the pivot 29 of the lever 28 and I make the arm 27 of the lever as short as is possible. Thus, when the cam shaft 13 tends to rotate the eccentric 22 in a counter-clockwise direction about the center of the rocker arm shaft 23, the nose 26 of the eccentric tends to rotate the lever 28 in a clockwise direction about the pivot point 29. This movement is resisted by the inertia of the weight 34.

It is evident that the only essential element of the arrangement of the parts is that the spring 33 be so located with respect to the nose 26 on the eccentric as to tend to reduce the clearance in the valve mechanism and that the movement of the mass 34, which opening of the valve tends to cause, be resisted by inertia of the mass. Thus, there is no necessity for having the mass 34 located in such a way that gravity will tend to reduce the clearance in the valve mechanism. I have, however, shown the parts arranged in such a way that the gravitational attraction for the mass 34 will assist the spring 33 in reducing the clearance in the valve mechanism when the valve mechanism is at rest, that is to say, after the valve has been opened.

Under certain circumstances, it is conceivable that the spring 33 could be dispensed with if the weight 34 were so located with respect to the pivot point 29 that gravity would be able to effect a

decreased valve clearance. However, in high speed engines, it is preferable to rely primarily on the spring 33 to reduce the clearance in the valve opening mechanism and to rely on the inertia of the mass 34 to maintain this reduced clearance during opening operation of the mechanism.

The above described construction operates, during the closing movement of the valve and during idle operation of the valve mechanism, to decrease the clearance, by means of the lever 28 and the eccentric 22, which latter also may be considered as a lever, both levers being urged by the spring 33 to move the rocker arm 18 into a minimum clearance position. If the engine, and consequently the valve stem 14, is cold, the spring 33 will be able to take up considerable clearance, but as the valve stem 14 warms up and expands axially, it will have a tendency to compress the spring 33 through the several levers. The spring 33 is designed and installed in such a way that its strength is insufficient to overcome the valve closing tendency of the valve spring 16. Thus the eccentric is rotated counter-clockwise upon warming up of the engine and no riding of the valve will occur.

While I have herein described in some detail a specific embodiment of my invention, which I deem to be new and advantageous and may specifically claim, I do not desire it to be understood that my invention is limited to the exact details of the construction, as it will be apparent that changes may be made therein without departing from the spirit or scope of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In an intermittent valve opening mechanism, a valve, a cam actuated means associated therewith to open said valve, means including a plurality of levers to position said opening means in unvarying close relation to said valve after opening thereof, and a mass of sufficient inertia associated with said levers to maintain said parts in said close relation during subsequent opening movement of said mechanism.

2. In a valve gear mechanism, a valve tappet actuating rock lever, and fulcrum means for the rock lever comprising a rotatably mounted eccentric bushing and a weighted control member acting solely as an inertia device disposed in relation with the bushing to retain it in a position whereby the rock lever is maintained in continuous contact with the tappet.

3. In an engine, valve gear mechanism comprising a cam, a tappet spring pressed toward the cam, a rock lever having a free end intermediate the cam and the tappet, a pair of shafts fixed to the engine, a bushing having a projecting arm rotatably mounted eccentrically on one shaft, said rock lever being journaled on the bushing, a lever fulcrumed on the other shaft, said lever having one end engaging the bushing arm, a weight fixed to the other end of the lever, the inertia of said weighted lever co-acting with the arm to retain the bushing in a position to maintain the rock lever in constant contact with the tappet, and a spring carried by the engine and exerting pressure against the lever to apply a force thereto in a direction to have the same effect on the bushing as that resulting from the inertia of the weight.

4. In a valve gear, a cam, a tappet spring pressed toward the cam, a rock lever intermediate the cam and the tappet, a fixed lever supporting shaft, a bushing rotatably mounted eccentrically on the shaft, said lever being mounted

on the bushing, an arm extending from the bushing, a lever having one end engaging said arm, and a mass on the other end of the arm, said weighted lever exerting continuous pressure
5 against the arm in a direction to hold the bearing in a position on its shaft maintaining the rock lever in constant contact with the tappet.

5. In a valve mechanism, the combination of a spring-closed valve, means for opening the valve,
10 reversible take-up means between the valve opening means and the valve, and means including an inertia element tending to resist, solely by its inertia action, the displacement of said take-up
15 mechanism during the opening movement of the valve.

6. In an internal combustion engine, the combination with the engine valve, the cam shaft for operating the valve, and an intermediate device between the cam shaft and the valve, of a clear-

ance take-up mechanism operating in conjunction with said intermediate device and comprising a lever arm, a weight thereon, resilient means associated with the lever arm tending to decrease the valve clearance, and connections between the lever arm and said intermediate device whereby the weight by reason of its inertia forms the principal element maintaining the valve clearance substantially constant.

7. A clearance take-up device for a valve mechanism including a cam shaft and a valve, said device comprising a lever connected to said mechanism, resilient means connected to said lever tending to reduce the clearance in the mechanism, and a mass of sufficient inertia operating in connection with said lever to resist any tendency
15 undesirably to increase said clearance during operation of the mechanism.

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