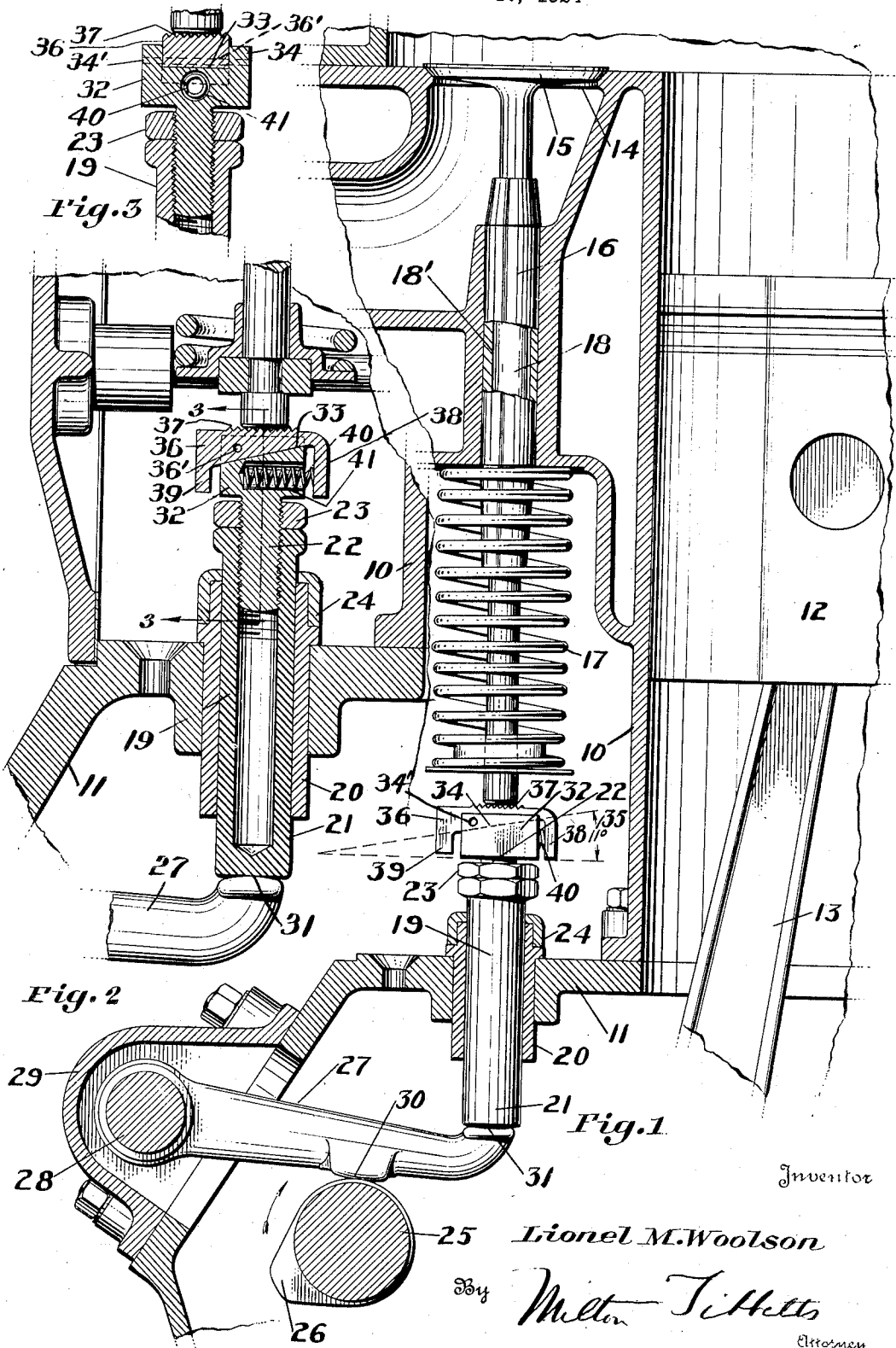


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INTERNAL COMBUSTION ENGINE

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INTERNAL-COMBUSTION ENGINE.

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This invention relates to internal combustion engines and more particularly to valve mechanisms.

The valve mechanism of an internal combustion engine usually comprises poppet valves and a camshaft together with means such as tappet mechanisms for operating the valves from the camshaft. Each valve is usually closed by a spring and the cam operates to open it against the spring action. There must be a slight clearance between the tappet mechanism and the valve or between the camshaft and the tappet mechanism in order that the valve may be certain to close on its seat. If this clearance is not provided the valve will "ride" and consequently will not close tightly with the result that the port will leak and the valve be burned. The horsepower of the engine will also fall off due to the fact that full compression cannot be obtained.

If the tappet mechanism is adjusted for the proper clearance when the engine is cold, this clearance will sometimes be taken up entirely by elongation of the valve stem when the engine gets hot. This necessitates a greater amount of clearance being provided when the motor is cold with the result that this greater clearance causes a clicking action and thus makes the engine disagreeably noisy. Various means have been provided for automatically taking up this clearance or damping its action to mitigate the noise difficulty but none of these have proven entirely satisfactory due to the complication involved and the inoperativeness of some of them.

One of the objects of the present invention is to provide an automatic means for taking up the clearance between the valve and its operating mechanism while at the same time providing for a firm closure or seating of the valve.

Another object of the invention is to provide a clearance take-up mechanism that is retracted during each opening and closing cycle of the valve, so that the valve may be insured of a firm seating.

Another object of the invention is to provide an automatic take-up for a valve mechanism together with means for retracting the take-up means immediately before the valve is opened, thus insuring a firm seating of the valve when it closes.

Another object of the invention is to provide an automatic take-up means for a valve

mechanism operating through lateral movement of the valve stem.

Another object of the invention is to provide an automatic take-up means for a valve mechanism operating with a limited movement in combination with adjusting means for normally positioning the parts.

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

Fig. 1 is a transverse section through an internal combustion engine embodying the invention;

Fig. 2 is a somewhat enlarged similar section showing part only of the mechanism illustrated in Fig. 1, with the take-up mechanism in section, and

Fig. 3 is a section on the line 3—3 of Fig. 2.

Referring to the drawings, 10 represents an engine cylinder mounted on the crankcase 11 and having a piston 12 and a connecting rod 13. The cylinder is also provided with a cylinder port 14 which may be either an inlet or an exhaust port, and this port is closed by a poppet valve 15 of usual construction. The valve is movable in a guide 16 secured in the cylinder casting and a spring 17 yieldingly retains the valve in closed position as shown in the drawing.

The valve stem is indicated at 18 and it is shown as having some clearance between it and the interior of the guide 16 as indicated at 18'. In exhaust valves this clearance is frequently as much as six or eight thousandths of an inch so that the valve will not stick when it become hot. This clearance also allows for slight lateral movement of the valve in the guide as will hereinafter more fully appear.

The valve stem 18 is operated upon to open the valve by a tappet mechanism indicated generally at 19. This mechanism comprises a guide 20 mounted in the crankcase 11, a sliding tappet 21 mounted in the guide, a tappet bolt 22 threaded into the tappet for longitudinal adjustment therein, and a nut 23 for locking the bolt 22 in adjusted position. A cap 24 is also provided to prevent oil from working up around the tappet 21.

In the crankcase 11 is mounted a camshaft 25 which is operated in the usual way from the motor crankshaft, not shown in the drawing. There is a cam 26 for each of the valves of the engine, which cams are posi-

tioned to open and close the valves on the usual four-stroke cycle.

Arranged between the camshaft 25 and the tappet mechanism 19 is a rocker arm 27 which is pivoted at 28 to a bearing member 29 of the crankcase. This rocker arm bears against the camshaft at the point 30 and at its outer end it bears against the tappet 21 as at 31. From this it will be seen that as the cam 26 passes under the arm 27 the latter is rocked and the tappet 21 is lifted or moved upwardly against the stem 18 of the poppet valve 15, thus raising the valve from its seat. As the cam 26 rides out from under the arm 27 the spring 17 returns the valve 15 to its seat.

Mounted upon or formed as a part of the tappet mechanism 19 is the device for taking up the clearance between the valve operating means and the valve. As shown herein, this comprises an enlarged head 32 on the bolt 22, and this head has an inclined upper surface 33 with side walls or flanges 34 on each side thereof. It has been found that this inclined surface should be about eleven degrees from a horizontal plane when the valve mechanism is arranged vertically as shown in the drawings, this position of the inclined surface being indicated at 35 in Fig. 1.

A contact piece or wedge 36 is positioned on the head 32 between the flanges 34 so that this wedge is arranged between the upper end of the bolt 22 and the stem 18 of the valve. The lower face of the wedge is inclined to fit the surface 33 as shown and its upper face is horizontal and arranged to bear against the lower end of the valve stem 18. In order to increase the friction between the upper surface of the wedge and the lower end of the valve stem the wedge is preferably roughened as at 37.

The wedge 36 is formed with down turned flanges 38 and 39 at its respective ends and the distance between these flanges is a little more than the width of the head 32 so that the wedge 36 has a limited sliding movement in two directions on the inclined surface 33. A spring 40 preferably seated in a recess 41 in the head 32, as shown in Fig. 2, yieldingly presses against the flange 38 so that the wedge is constantly urged towards the right in Figs. 1 and 2 of the drawing thus taking up any clearance that may exist between the upper end of the bolt 22 and the lower end of the valve stem 18, within the limits of movement of the wedge.

Since the take-up device is mounted on the head 32 of the bolt 22 it will be seen that the device may be adjusted vertically or longitudinally of the valve stem 18 by simply turning the bolt 22 relative to the tappet 21, and it may be locked in adjusted position by the lock nut 23. In adjusting the mechanism, therefore, with the valve 15 seated, the tappet 21 and bolt 22 will be relatively adjusted up-

wardly against the valve stem until the wedge 36 is substantially in mid-position between its limits of movement and with its upper face in contact with the lower end of the valve stem. After such adjustment, when the engine is operated the cam 26 will move the tappet 21 upwardly and the initial movement thereof, due to the strong tension of the valve spring 17, will cause the wedge 36 to slide down the incline 33 or move laterally relative to the tappet mechanism, and this will cause a lateral movement of the lower end of the valve stem 18, this being because of the slight clearance between the valve and its guide, the valve stem being carried laterally with the wedge 36. This slight cocking of the valve will make it easier to open the valve, if it is an exhaust valve, because this cocking of the valve will slightly relieve the pressure in the engine cylinder and consequently relieve the pressure against the head of the poppet valve 15. Even though the clearance between the valve stem and its guide is not sufficient to thus crack the valve open, yet it will always be enough to permit sliding action of the wedge 36 for thus retracting the wedge from its full take-up position.

In the further operation of the engine, as the cam 26 passes from under the arm 27 and thus permits the tappet mechanism 19 to descend, the valve spring 17 will close the valve and, because of the retracted position of the wedge 36 the valve will firmly seat. After the valve has become fully seated and the cam 26 is entirely out from under the arm 27, the spring 40 will operate to move the wedge 36 towards the right and thus take up the clearance between the tappet mechanism and the valve stem 18. Again as the valve is lifted this retraction of the wedge 36 again takes place and as the valve closes the take-up action of the wedge is repeated, and so on for each opening and closing operation of the valve.

The vertical adjustment of the take-up device as described above is usually required only after the engine valves have been ground or the valves have otherwise been changed relative to the tappet mechanism. In order to make the adjustment more readily, the wedge 36 is formed with a transverse hole 36' therein and the flanges 34 have corresponding holes 34', and these holes are relatively arranged so that when they are aligned the wedge 36 will be in its midposition. Thus, when the take-up device is to be adjusted, a pin may be inserted in the aligned holes or openings 36', 34', which will thereby hold the wedge in its mid-position, and the bolt 22 will then be adjusted relative to the tappet 21 until the upper surface of the wedge 36 is in contact with the lower end of the seated valve. The pin will then be removed and the adjustment will be complete.

While I have herein described in some de-

tail 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 engine, in combination, a valve guide, a valve having a stem in said guide, said stem being slightly smaller in diameter than the interior of the guide whereby said valve is adapted to move therein, means for operating the valve having a clearance with respect to said valve, and means adapted to move within limits defined by the clearance between said valve stem and guide, for automatically taking up the clearance between said operating means and the valve stem.

2. In an engine, in combination, a valve guide, a valve having a stem therein with clearance between the stem and guide, and means for operating the valve, including an automatic take-up device adapted to move the valve stem both longitudinally and transversely in its guide.

3. In an engine, in combination, a poppet valve adapted to move transversely and longitudinally, a tappet for opening the valve, and a device between the tappet and the valve for causing transverse movement of the valve as the tappet starts to lift the valve.

4. In an engine, in combination, a valve guide, a valve having a stem therein with clearance between the stem and guide, and means for operating the valve including an automatic take-up device adapted to move the valve stem transversely in its guide.

5. In an engine, in combination, a valve guide, a valve having a stem therein with clearance between the stem and guide, means

for operating the valve, and an automatic take-up device between said means and the valve stem adapted to move the valve stem transversely in its guide.

6. In an engine, in combination, a valve guide, a valve having a stem therein with clearance between the stem and guide, means for operating the valve, and an automatic take-up device between said means and the valve stem comprising a tappet, a bolt adjustably mounted in said tappet and having an inclined surface, a wedge device cooperating with the inclined surface on the bolt adapted to move in two directions, and means for yieldingly moving the wedge device in one direction.

7. In an engine, in combination, a valve guide, a valve having a stem therein with clearance between the stem and guide, means for operating the valve, and an automatic take-up device between said means and the valve stem comprising a tappet, a bolt adjustably mounted in said tappet and having an inclined surface, a wedge device cooperating with the inclined surface on the bolt having limited movement in two directions and adapted to move the valve stem transversely in its guide, and means for yieldingly moving the wedge device in one direction.

8. In an engine, in combination, a valve having a stem, means for opening the valve, and a take-up device between the valve stem and said opening means for causing a transverse movement of the valve stem.

9. A clearance take-up device comprising a tappet, a bolt adjustably mounted in said tappet and having an inclined surface, a wedge device cooperating with the inclined surface on the bolt and having means limiting movement of said device in two directions, and a spring operating to yieldingly move said wedge device in one direction.

In testimony whereof I affix my signature.

LIONEL M. WOOLSON.