

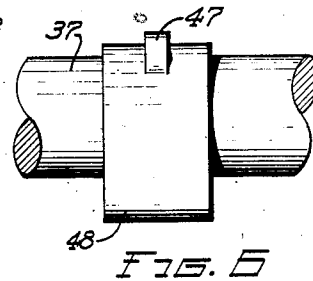
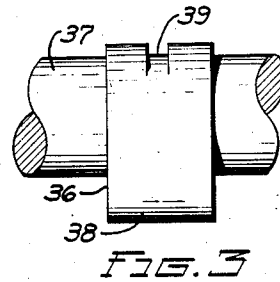
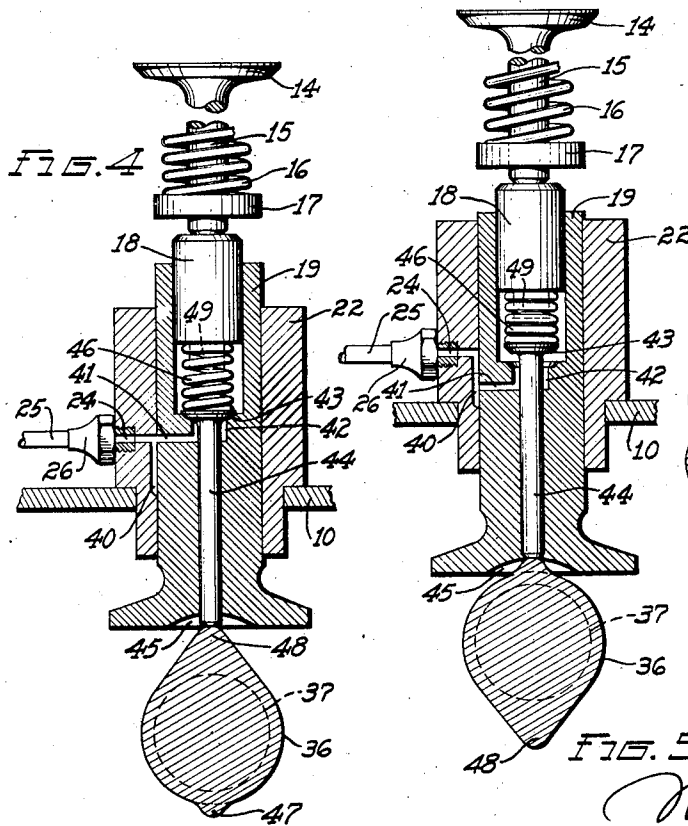
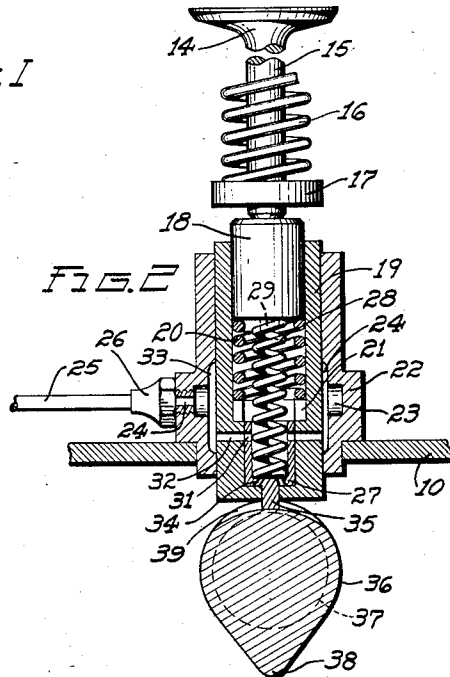
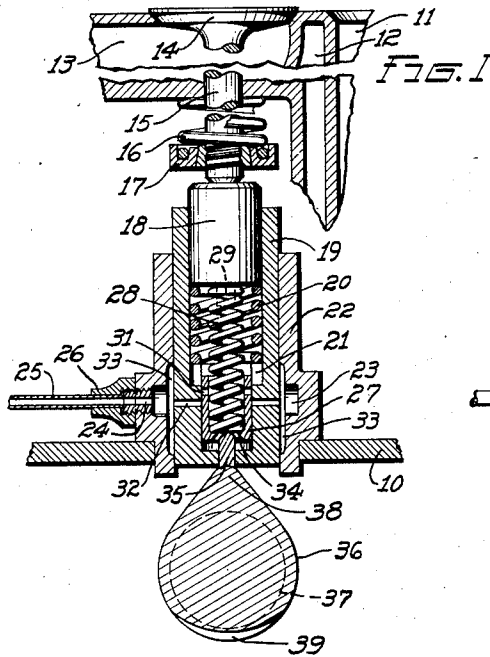
Aug. 6, 1935.

M. TIBBETTS

2,010,167

INTERNAL COMBUSTION ENGINE

Filed May 21, 1931



Inventor

Mullen-Tibbets

UNITED STATES PATENT OFFICE

2,010,167

INTERNAL COMBUSTION ENGINE

Milton Tibbetts, Detroit, Mich., assignor to Packard Motor Car Company, Detroit, Mich., a corporation of Michigan

Application May 21, 1931, Serial No. 539,033

8 Claims. (Cl. 123—90)

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

With conventional poppet valve operating mechanism, it is necessary to provide a certain amount of clearance between the valve stem and the push rod, because of the differences in the expansion of the various parts of the engine upon becoming heated. Such methods, however, are frequently unsatisfactory due to the frequent adjustments which must be made in order to maintain the proper clearance. If the clearance is too small the valve will not seat properly, resulting in unsatisfactory performance of the engine, and if the clearance is too great, an undesirable noise attends the contacting of the push rod with the valve stem. It is therefore desirable that mechanism be provided to automatically compensate for the variations in clearance which occur. Such mechanism must be somewhat flexible and at the same time insure positive movement of the valve.

An object of the present invention is to provide a tappet mechanism which eliminates the above objections to the conventional constructions now in general use.

Another object of the invention is to provide automatic mechanism which will compensate for the variations in clearance between the valve stem and its push rod, will be positive in its action and will eliminate the objectionable noises attending the contact of the push rod with the valve stem, common in the conventional constructions now in general use.

A further object of the invention is to provide a flexible tappet mechanism for automatically adjusting the clearance between a valve stem and its push rod, which comprises telescoping reciprocable members, one of which rests on a fluid column within the other, the volume of the fluid column being variable to provide the necessary flexibility.

A further object of the invention is the provision of means to actuate the reciprocating members of a tappet device for moving a valve stem and which will also actuate other mechanisms to control the volume of a fluid column within one of the reciprocating members.

Still a further object of the invention is to provide a cam, to be operated by a cam shaft of conventional design, which has diametrically disposed cam surfaces thereon, one of which is adapted to engage two of the reciprocable members and the other adapted to engage only one of such members.

A still further object of the invention is to provide a valve lifting mechanism of the character specified which is positive in action, highly efficient in operation, and yet of marked simplicity as a whole and in respect to each of its component parts, so that its manufacture may be economically facilitated, both as regards its parts and their assembly.

Other objects and advantages of the invention will become apparent from a reading of the following description taken in connection with the accompanying single sheet of drawing, in which:

Fig. 1 is a vertical sectional view taken through the valve actuating mechanism forming the subject hereof, certain parts being shown in elevation. The mechanism is here shown in the position in which the engine valve is fully open.

Fig. 2 is a similar view showing the mechanism in the position in which the engine valve is fully closed.

Fig. 3 is a side elevational view of the cam which actuates the reciprocating member and the valve which controls the fluid column.

Fig. 4 is a view similar to Fig. 1, but showing a modified form of the invention.

Fig. 5 is also a view of the modified form which this invention may assume, this view being similar to that of Fig. 2.

Fig. 6 is a side elevational view of the cam shown in Figs. 4 and 5.

Reference may be had to Figs. 1, 2 and 3 of the drawing wherein 10 is a fragmentary portion of a motor base for an internal combustion engine comprising a cylinder 11, a water jacket 12 therefor and a valve chamber 13 of a type for either admitting a combustible mixture to the cylinder or serving to allow exhaust gases to escape therefrom. A poppet valve 14 of conventional construction having a stem 15 is provided for intermittently establishing communication between the cylinder and the valve chamber 13. The valve stem 15 has a spring 16 associated therewith, one end of which rests on a support 17, secured to the valve stem 15 in the conventional manner, and the other end of which bears against the lower wall of the valve chamber 13 for normally urging the valve 14 to closed position.

A tappet mechanism is provided for actuating the valve stem and comprises a plurality of telescoping reciprocable members, one of which rests on a fluid column within another, and another of which controls the volume of the fluid column. These reciprocating members are actuated by a cam to be hereinafter more fully described.

The push rod for the valve stem is a cylindrical

reciprocating plunger 18 which is adapted to fit in a hollow reciprocable member 19 in telescopic relation thereto and to be supported on a fluid column therein. A compression spring 20, resting on a pair of shoulders or lugs 21 formed on the interior of the reciprocable member 19, is provided to urge the plunger 18 upwardly with respect to the reciprocable member 19, so that contact is maintained between the valve stem 15 and the plunger 18 at all times. A sleeve or casing 22 is suitably fixed upon the motor base 10 and is designed to receive the member 19 in telescopic relation for reciprocating movement therein. The sleeve 22 is provided with an annular fluid chamber 23 which communicates with a port 24 therein. A fluid supply conduit 25 leading from a pressure pump or other suitable source of supply (not shown) is suitably secured to the casing 22 as at 26 in registry with the port 24.

Means are provided for controlling the volume of the fluid column in the reciprocable member 19 and, as shown in Figs. 1 and 2, comprise a slidable valve 27 positioned for reciprocation in the lower end of the hollow member 19 and being open at its upper end so as to communicate with the interior thereof. A compression spring 28 is interposed between the valve 27 and the lower face of the plunger 18 and is adapted to normally urge the slidable valve 27 to its lowermost position within the reciprocable member 19. A suitable retainer or guide member 29 for the upper end of the spring may be formed on the lower face of the plunger 18. It may be here noted that the spring 28 is of lighter construction than the spring 20, it being sufficiently strong to urge the valve 27 to its closed position, but being insufficient to have any effect on the plunger 18 when the valve 27 is moved upwardly.

The valve 27 is provided with ports 31 which register with passage-ways 32 in the reciprocable member 19 when the valve 27 is in its lowermost position therein. The passage-ways 32 are in continuous communication with an enlarged portion 33 of the fluid chamber 23. Ports 34 are also provided in the lower face of the valve 27 so that the fluid may flow to the under side thereof, thus forming a fluid pressure balancing means therefor and obviating the possibility of any suction being created in the space between the valve 27 and the lower floor of the member 19 which would impair the quick action of the valve. The valve 27 is provided with a stem 35 which protrudes through the lower face of the reciprocable member 19, in operative relation to a rotating driving member which may be a cam 36 having diametrically disposed cam faces arranged on the peripheral surface thereof.

The cam 36 is adapted to be mounted on and rotated by a cam shaft 37 of any conventional design commonly employed in internal combustion engines and comprises a lobe 38 and a diametrically disposed arcuate depression 39 formed on the periphery of the cam 36. The lobe 38 is adapted to engage the lower faces of the reciprocable member 19 and the valve stem 35 of the valve 27, and the other cam face or depression 39 is adapted to receive the valve stem 35 only. The arrangement of these parts is such that the lobe 38 will raise both the member 19 and the valve stem 35 when engaged therewith, while only the valve stem will drop into the recess 39 once every revolution of the cam, thus lowering the valve 27 relative to the member 19 so that the ports 31 register with the passage-ways 32 in the reciprocable member 19. It may be here

noted that the cam 36 is formed continuously in an axial direction throughout the major portion of its peripheral surface, it being divided only at the portion thereof in which the depression 39 is formed.

The operation of the device shown in Figs. 1, 2 and 3 is as follows:

The compression spring 20 normally urges the push rod or plunger 18 upwardly so that it is always in contact with the lower face of the valve stem 15. Fluid under pressure from the conduit 25 is admitted to the fluid chambers 23 and 33 through the port 24, and to the interior of the hollow reciprocable member 19 through passage-ways 32 when the ports 31 of the slidable valve 27 are in registry therewith. As the cam shaft 37 rotates, the cam 36 will engage the lower faces of the reciprocable member 19 and the valve stem 35, and when the lobe 38 on the cam 36 comes in contact with the face of the members, they will be moved upwardly. The slidable valve 27 being in its uppermost position at this time, the ports 31 thereof will be closed so that there will be no communication between the interior of the reciprocable member 19 and the fluid chambers 23 and 33. As the reciprocable member 19 is moved upwardly by the action of the cam, the push rod 18, supported on the closed fluid column therein, will likewise be moved upwardly raising the engine valve 14 therewith. As the cam 36 continues in its rotation, the reciprocable member 19 will be lowered, and the engine valve will move downwardly until it reaches the point of full closure, such action being caused by the spring 16. The engaging cam surface at this time will be at a point directly opposite the lobe 38 thereon, at which time the stem 35 of the slidable valve 27 will drop into the depression 39 in the periphery of the cam, allowing the compression spring 28 to force the valve 27 downwardly so that the ports 31 thereof will register with the passage-ways 32, and thus communication will be established between the interior of the reciprocable member 19 and the fluid chambers 23 and 33. The fluid column will now be permitted to adjust itself and the plunger or push rod 18 will thus be adjusted to compensate for any clearance which may exist between it and the stem 15 of the engine valve. As the cam 36 continues to rotate, the valve stem 35 will be forced out of the depression 39 on the cam and the valve 27 raised against the action of the spring 28 so that the ports 31 are moved out of registry with the passage-ways 32, thus closing the interior of the reciprocable member 19. The lobe 38 of the cam again moves to engagement with the lower face of the reciprocable member 19 and the cycle is repeated.

In Figs. 4, 5 and 6, a modified form of the invention is shown. In this form of the invention, a fluid chamber 40 in the sleeve 22 is supplied from an oil pressure pump through conduit 25 and port 24 in the same manner as in the embodiment shown in Figs. 1 and 2. A passage-way or duct 41 in the reciprocable member 19 registers with the chamber 40 at all times and terminates in a port 42 in the interior of the reciprocable member 19. A small poppet valve 43 is provided to form a closure for this port and has a valve stem 44 extending axially of the reciprocable member 19 to the lower face thereof and registers with an arcuate depression 45 therein. A compression spring 46 is interposed between the top face of the poppet valve 43 and the lower face of the push rod 18 to normally urge the poppet valve to closed position. A guide

member 49 for the lower end of the spring 46 similar to the member 29 on the plunger 18 is provided on the upper face of the valve 43.

The cam shown in this embodiment of the invention is provided with an auxiliary lobe or boss 47 on the periphery thereof disposed substantially diametrically opposite the large lobe 48 thereon and which is adapted to register with the recess 45 in the reciprocable member 19 once every revolution of the cam to engage the lower face of the stem 44 of the poppet valve 43. The peripheral surface of this cam is also formed continuously in an axial direction thereof, it being broken only by the boss 47.

The operation of this embodiment is similar to the embodiment previously described. The cam face engages the lower face of the reciprocable member 19 and as the lobe 47 registers with the recess 45 and engages the stem 44 of the poppet valve 43, the valve is raised to admit fluid to the interior of the reciprocable member 19 or to permit pressure to be relieved therefrom. This action occurs at the point of full closure of the engine valve 14. As the cam continues in its rotation, the large lobe 48 thereof contacts the lower face of the reciprocable member 19 which is raised, exerting a pressure on the push rod 18 to raise the engine valve 14.

It will be obvious that the invention is susceptible of numerous changes in construction and design without departing from the spirit or scope thereof, which is to be limited only as defined by the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a self-adjusting valve lifter for internal combustion engines, a fixed casing having a fluid chamber therein, telescoping reciprocable members arranged for movement within the casing, one of said members having a duct therein in continuous communication with the fluid chamber throughout the range of movement thereof and connecting said first chamber with a second chamber and another of said members being arranged to open and close said duct during the operation of said first member, and a cam having a plurality of cam surfaces thereon, one of said cam surfaces being adapted to engage more than one of the reciprocable members and another of said cam surfaces adapted to engage only one of such members once every revolution of the cam.

2. In a self-adjusting valve lifter for internal combustion engines, a fixed casing, a reciprocable member having a depression in an end face thereof, and adapted to slide in the casing, other reciprocating members in the said reciprocable member, one of which extends through the end face thereof to register with said depression therein, and a cam for actuating said reciprocable member having a boss thereon to register with the depression in the end face and adapted to engage the said extended reciprocating member.

3. In a self-adjusting valve lifter for internal combustion engines having an engine valve, a valve stem and actuating means therefor, reciprocating members interposed between the actuating means and the engine valve stem, one of said reciprocating members being adapted to move within the other of said members and to rest on a fluid column therein, and a sleeve valve in the lower end of the outer reciprocating member to automatically seal and unseal said last mentioned member to make and break the fluid column, said valve having means associated there-

with for conducting fluid to one side thereof to oppose the pressure exerted on the other face thereof by the fluid column and thereby substantially balance the valve.

4. In a self-adjusting valve lifter for internal combustion engines having an engine valve, a valve stem and a cam shaft, a fixed casing having a fluid chamber therein, a hollow telescoping reciprocable member adapted to slide in the casing and having a passage-way therein registering with the said chamber and communicating with the interior of the reciprocable member, said reciprocable member also having an arcuate depression in an end face thereof, a plunger in the reciprocable member adapted to be supported on a fluid column therein and to operatively engage the stem of the engine valve, a poppet valve in the reciprocable member associated with the passage-way therein and adapted to control the volume of fluid in said fluid column, the stem of said valve protruding through the end face of the reciprocable member and registering with the arcuate depression therein, a spring interposed between the poppet valve head and the plunger to normally urge the plunger against the engine valve stem and the poppet valve against its seat, and a cam on the cam shaft having a plurality of diametrically formed cam surfaces, one of said cam surfaces comprising a boss formed on the periphery of the cam and adapted to register with said depression and to operatively engage the poppet valve stem.

5. In a self-adjusting valve lifter for internal combustion engines, having a spring-pressed engine valve, a valve stem and actuating means therefor, a plurality of telescoping reciprocating members interposed between the actuating means and the valve stem, one of said reciprocating members being adapted to move within the other of said members and to rest on a fluid column therein, a valve in one end of the outer reciprocating member adapted to automatically seal and unseal said last mentioned member for making and breaking the fluid column, yieldable means positioned between the inner reciprocating member and the said outer member, and separate and independent yieldable means between the inner reciprocating member and the said fluid control valve.

6. In a self-adjusting valve lifter for internal combustion engines, having a spring-pressed engine valve, a valve stem and actuating means therefor, reciprocating members interposed between the actuating means and the valve stem, one of said reciprocating members being adapted to move within the other of said members and to rest on a fluid column therein, a valve in one end of the outer reciprocating member adapted to automatically seal and unseal said last mentioned member for making and breaking the fluid column, a spring positioned between the inner reciprocating member, and the said outer member, and a spring between the inner reciprocating member and the said fluid control valve.

7. In a self-adjusting valve lifter for internal combustion engines, having a spring-pressed engine valve, a valve stem and actuating means therefor, a fixed casing mounted above said actuating means having a fluid chamber therein, a hollow reciprocating member between the actuating means and the valve stem adapted to move in said casing and having ducts adapted to connect the interior thereof with the fluid chamber, a reciprocating plunger between the reciprocating member and the valve stem adapted

- to rest on a fluid column in the hollow reciprocating member, a hollow slidable valve in the lower end of the hollow reciprocating member having ducts adapted to connect the interior thereof with the ducts in the reciprocating member, yieldable means between the slidable valve and the reciprocating plunger, and yieldable means between the hollow reciprocating member and the plunger.
- 5 the ducts in the reciprocating member, yieldable means between the slidable valve and the reciprocating plunger, and yieldable means between the hollow reciprocating member and the plunger.
8. A self-adjusting valve lifter for internal combustion engines having a spring-pressed engine valve and a valve stem, a cam having diametrically disposed cam surfaces comprising a lobe and a depression formed on the periphery thereof, a fixed casing mounted above said cam and provided with an annular fluid chamber, a hollow reciprocating member riding on said cam and arranged to slide in said casing, said reciprocating member having ducts therein which communicate with said fluid chamber, a plunger in the reciprocating member arranged to ride on a fluid column and to reciprocate in one end of the reciprocating member, a spring arranged to retain said plunger in contact with the engine valve stem, a slidable valve in the other end of the latter reciprocating member arranged to reciprocate therein, said valve having ports therein which communicate with the ducts in the reciprocating member when said valve and said reciprocating member are in their lowermost position, a spring between said valve and said plunger, and a stem on said valve extending through a face of the outer reciprocating member and adapted to register with the depression on the said cam once every revolution thereof.
- 10 combustion engines having a spring-pressed engine valve and a valve stem, a cam having diametrically disposed cam surfaces comprising a lobe and a depression formed on the periphery thereof, a fixed casing mounted above said cam and provided with an annular fluid chamber, a hollow reciprocating member riding on said cam and arranged to slide in said casing, said reciprocating member having ducts therein which communicate with said fluid chamber, a plunger in the reciprocating member arranged to ride on a fluid column and to reciprocate in one end of the reciprocating member, a spring arranged to retain said plunger in contact with the engine valve stem, a slidable valve in the other end of the latter reciprocating member arranged to reciprocate therein, said valve having ports therein which communicate with the ducts in the reciprocating member when said valve and said reciprocating member are in their lowermost position, a spring between said valve and said plunger, and a stem on said valve extending through a face of the outer reciprocating member and adapted to register with the depression on the said cam once every revolution thereof.
- 15

MILTON TIBBETTS.