

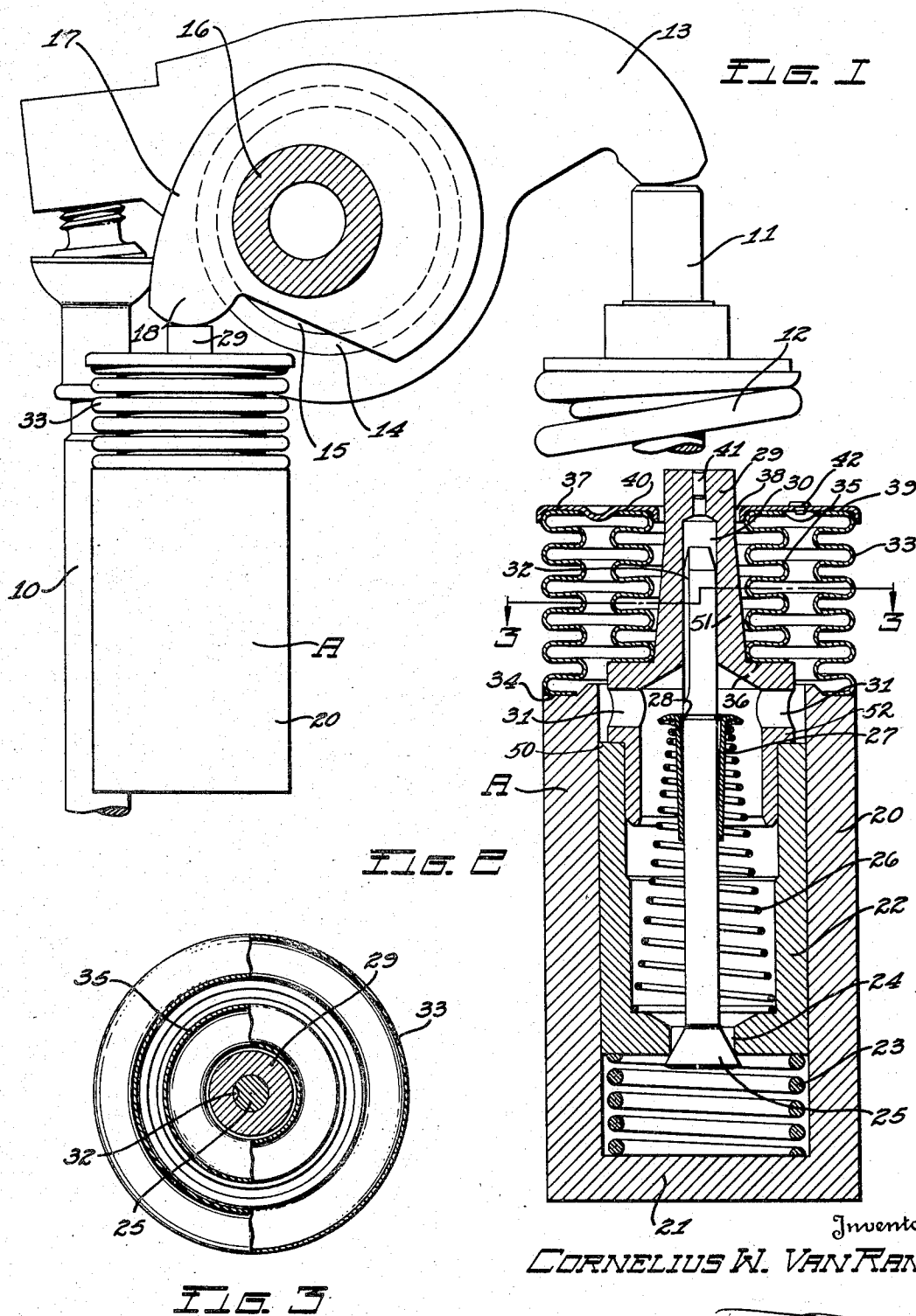
March 1, 1938.

C. W. VAN RANST

2,109,809

INTERNAL COMBUSTION ENGINE

Filed June 22, 1932



Inventor
CORNELIUS W. VAN RANST.

By *Millon Tiffet*
Attorney

UNITED STATES PATENT OFFICE

2,109,809

INTERNAL COMBUSTION ENGINE

Cornelius W. Van Ranst, Detroit, Mich., assignor
to Packard Motor Car Company, Detroit, Mich.,
a corporation of Michigan

Application June 22, 1932, Serial No. 618,653

9 Claims. (Cl. 123—90)

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

The invention is an improvement upon such valve take-up mechanisms as are shown in British patent to Almen No. 289,468, U. S. patent to Bollee No. 1,062,580, and U. S. patent to Favary No. 1,669,161. In the Almen patent the cylinder must be constantly supplied with oil or other liquid and it must be used in an upright position with the open end of the cylinder at the top. In the Bollee patent there is no sealing of the device and air is necessarily present within it. It also can be used in an upright position only as otherwise the liquid would leak out or the air would reach the high pressure side of the piston and make the device useless. In Favary a diaphragm of large diameter is used and is impracticable for the extremely high pressures necessary for a device of this sort.

One of the objects of this invention is to overcome the deficiencies of the various prior art patents and to provide a take-up device that will operate without liquid replenishment and preferably in any position.

Another object of the invention is to provide a valve take-up device that will occupy very little room in its operative connection with an eccentrically mounted rocker arm sleeve.

Another object of the invention is to provide a valve take-up mechanism having its chamber completely filled with liquid and having an expansible chamber capable of compensating for piston movement and for differences in internal pressure due to changes in temperature.

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 an elevation view showing a valve rocker arm of an internal combustion engine together with its mounting and a take-up device made in accordance with this invention;

Fig. 2 is an enlarged detail sectional view through the take-up device shown in Fig. 1, and

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

Referring to the drawing, 10 represents a push rod, 11 a valve and 12 the valve spring, of an internal combustion engine. 13 is a rocker arm which interconnects the push rod and valve and is the means through which the push rod operates the valve against the action of its spring 12.

The rocker arm 13 is supported through a bearing 14 upon a bearing sleeve 15, which sleeve in

turn is eccentrically mounted upon a hollow shaft 16. Lubrication may be supplied to the parts through the opening in the shaft. The sleeve 15 is formed with a flange 17 at one end and this flange has an arm or extension 18 by which the sleeve may be turned on the shaft 16.

It will be seen that if the arm 18 is pushed upwardly, thus tending to rotate the sleeve 15 in a clockwise direction as shown in Fig. 1, there will be a tendency to bodily move the rocker arm 13 downwardly, thus closing any gap that may exist between the ends of the rocker and the push rod 10 and valve 11 respectively. Conversely, any upward pressure on either end of the rocker 13 will tend to push the arm 18 downwardly and if this pressure is not resisted the eccentric mounting will permit of a gap between the end of the rocker arm and the valve 11 when the latter is closed on its seat.

But the downward pressure of the arm 18 is resisted and a constant upward pressure is applied to said arm 18 by a take-up mechanism indicated generally at A in Figs. 1 and 2. This mechanism is preferably mounted on any suitable part of the engine adjacent to the sleeve 15 so that its operating end may be in contact with the arm 18 and thus constantly press the arm to rotate the sleeve 15 in the desired direction, with a pressure, however, less than that exerted by the spring 12 of the valve 11 so that there will be no tendency on the part of the take-up mechanism to open that valve.

This take-up mechanism A is in the form of a self-contained unit and it comprises a cylinder 20 closed at one end as at 21 and open at the opposite end. This part of the device is mounted on the engine as suggested above.

Within the cylinder is a piston 22 preferably fitted to the cylinder so that there is slight leakage when there is heavy pressure on the lower end of the piston. In this way the piston forms a dash-pot in the cylinder.

Between the closed end of the piston and the end 21 of the cylinder is a spring 23 which tends to constantly press the piston upwardly as shown in Fig. 2. The lower end of the piston has a passage or by-pass 24 controlled by a valve 25 which opens downwardly or into the lower end of the cylinder. A light spring 26 tends to keep the valve 25 closed, the upper end of the spring 26 abutting against a flanged sleeve 27 held in place by a split ring 28 in an annular groove in the stem of the valve 25.

Seated upon a shoulder 50 at the open end of the piston is a piston stem 29 having a guide

passage 30 for the upper end of the valve 25. This piston stem has a shank part 51 and a flange part 52, the latter resting on the shoulder 50 of the piston. There are openings 31 in the flange part 52 of the piston stem 29 to open communication between the upper end of the piston and the upper end of the cylinder, and there is a small passage 32 formed in the upper end of the valve stem to permit the passage of air or liquid as the case may be. This piston stem 29 in effect forms the upper end or extension of the piston 22.

An expansible liquid tight connection is provided between the upper end of the cylinder and the upper end of the piston, and in the form shown this connection comprises a longitudinally expansible tube 33 having one end connected to the upper end of the cylinder as at 34. This tube is substantially the same diameter as the cylinder and thereby forms an expansible extension of the cylinder. A similar but smaller expansible tube 35 has its lower or inner end connected to the piston or to the piston stem as at 36. The upper adjacent ends of the tubes 33, 35 are interconnected by a plate 37 which has a central opening 38 to fit over the upper end of the stem 29. Thus the plate 37 is connected to the tube 33 as at 39 and to the tube 35 as at 40.

The device is intended to be completely filled with a liquid such as oil or glycerine, a plugged opening 41 being shown in the stem 29 and a plugged opening 42 being shown in the plate 37, for this purpose. The liquid is pumped in through one opening and the air is ejected through the other.

It will be seen that the stem 29 projects slightly above the plate 37 and the take-up device is so mounted that the upper end of this stem is in contact with the arm 18 as shown in Fig. 1. In this position the spring 23 pressing against the lower end of the piston 22, constantly presses the arm 18 upwardly and consequently tends to rotate the sleeve 15 in a clock-wise direction, thus tending to take up any play that may exist between the rocker arm 13 and the push rod 10 and valve 11. In case of expansion of the parts so that there is abnormal downward pressure on the arm 18 through the eccentric mounting, the stem 29 and consequently the piston 22 are pushed downwardly against the spring 23 and there is some leakage of oil past the piston. Later, when the parts are cold, so that contraction has taken place, the spring 23 will push the piston upwardly and the valve 25 will open and permit the free passage of oil from the upper part of the piston and cylinder into the lower part of the cylinder. Thus an equilibrium is established. The flexible connection between the upper ends of the cylinder and piston not only permits the relative movement between those parts but it also takes care of the expansion and contraction of the oil within the device.

It is essential for most efficient operation that the parts be assembled in such manner as to exclude air from the device. Thus if air enters the closed end of the cylinder, even in extremely small quantity, downward movement of the piston accompanied by compression of this air is likely to occur on the transmission of thrust through the device, thus defeating the purpose of the fluid system. If air is present at any point in the fluid system, it is likely that an emulsion of air and liquid will form which will result eventually in the introduction of air into the closed end of the cylinder in the form of minute

bubbles, the quantity of bubbles thus introduced being eventually sufficient to adversely affect the operation of the device. It will be appreciated, however, that the structure disclosed herein offers other advantages and that the invention is not to be construed as limited to devices completely filled with liquid in the absence of specific language to that effect in the claims.

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 a valve take-up device, the combination of a cylinder, a piston in the cylinder, a valved passage means for the piston, and a flexible liquid-tight connection between the cylinder and the piston comprising a longitudinally expansible tube connected at one end to the open end of the cylinder, a similar tube within the first said tube and having one end connected to the piston, and means connecting the free ends of said tubes, said device being filled with liquid such as oil, for the purpose described.

2. In a valve take-up device, the combination of an open-ended cylinder, an open-ended piston therein, a valved passage means for the piston, a piston stem resting on the open end of the piston and having an operating shank, and a flexible liquid-tight connection between the cylinder and said piston head comprising a longitudinally expansible tube connected at one end to the open end of the cylinder, a similar tube of smaller diameter within the first said tube and having one end connected to said piston stem, and means connecting the free ends of said tubes, said device being filled with liquid such as oil, for the purpose described.

3. In a valve take-up device, the combination of a cylinder, a piston in the cylinder, said piston having a stem extending from the open end of the cylinder, a valved passage means extending between the interior of the piston and the cylinder beyond the piston, a flexible liquid-tight connection between the cylinder and the piston comprising longitudinally expansible tubes connected respectively to the cylinder and the piston, said piston stem and said flexible connection having openings for filling and air ejection, and means for closing said openings.

4. In a valve take-up device, the combination of a cylinder having a closed head end and an opposite open end, a piston operating in the cylinder, said piston having a port therein, being closed at the end adjacent the closed end of the cylinder except for said port and being open at the other end, said piston having a shoulder, said piston separating the cylinder space into two compartments communicating by leakage fit and by said port, a valve for said port opening towards the closed end of said cylinder, a piston stem having a shank part and a flange part with the flange part resting on the shoulder of the piston, said stem having openings through its flange part, a longitudinally expansible tube surrounding the shank part of said piston stem and having its inner end sealed to the flange part thereof, means forming a sealed connection between the outer end of said tube and the open end of said cylinder, said tube and connection

compensating for relative movement of the piston and cylinder and for expansion within the cylinder, and a liquid such as oil within said device, for the purpose described.

5 5. In a valve take-up device, the combination of a cylinder having an open end, a piston therein having a stem formed with a shank extending from the open end of the cylinder and with a flange inwardly of the shank, a valved passage
10 means extending between the interior of the piston and the cylinder beyond the piston, and a flexible liquid-tight connection between the cylinder and piston comprising a longitudinally expandible tube surrounding said shank and having
15 its inner end sealed to said flange and having its outer end connected by means forming a sealed connection with the open end of the cylinder.

6. In a valve take-up device, the combination of a cylinder having an open end, a piston therein having a stem formed with a shank extending
20 from the open end of the cylinder and with a flange inwardly of the shank, a valved passage means extending between the interior of the piston and the cylinder beyond the piston, and a
25 flexible liquid-tight connection between the cylinder and piston comprising telescoped longitudinally expandible tubes surrounding said shank and having their outer ends connected together
30 and their inner ends connected one to said flange and the other to the open end of the cylinder.

7. In a valve take-up device, the combination of a cylinder having a closed head end and an opposite open end, a piston operating in the cylinder, said piston having a port therein, being
35 closed at the end adjacent the closed end of the cylinder except for said port, and being open at the other end, said piston separating the cylinder space into two compartments communicating by leakage fit and by said port, a valve for said port opening towards the closed end of said cylinder,
40 a piston stem having a shank part and a flange

part with the flange part resting on the piston, said stem having openings through its flange part, a longitudinally expandible tube surrounding the shank part of said piston stem and having
5 its inner end sealed to the flange part thereof outwardly of said openings, means forming a sealed connection between the outer end of said tube and the open end of said cylinder, said tube and connection compensating for relative movement of the piston and cylinder and for expansion
10 within the cylinder, and a liquid such as oil within said device, for the purpose described.

8. In a valve take-up device, the combination of a cylinder having an open and a closed end, a piston therein having a stem formed with a
15 shank extending longitudinally of the cylinder and away from the closed end thereof and with a flange inwardly of the shank, a valved passage means extending between the interior of the piston and the cylinder beyond the piston, and a
20 flexible liquid-tight connection between the cylinder and piston comprising a longitudinally expandible tube surrounding said shank and having its inner end sealed to said flange, and means forming a sealed connection between the outer
25 end of said tube and the open end of the cylinder.

9. In a valve take-up device, the combination with a cylinder, of a piston displaceable within said cylinder, piston stem means operatively associated with said piston, said stem means including an annular ported flange engaging said
30 piston, said piston including a head portion having a port therein, a one-way valve controlling said piston port to oppose discharge of fluid from the head end of said cylinder, and a flexible fluid-tight connection between said cylinder and said
35 piston stem outwardly of said ported flange, said connection including a longitudinally expandible tube surrounding a portion of said stem.

CORNELIUS W. VAN RANST.