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INTERNAL COMBUSTION ENGINE

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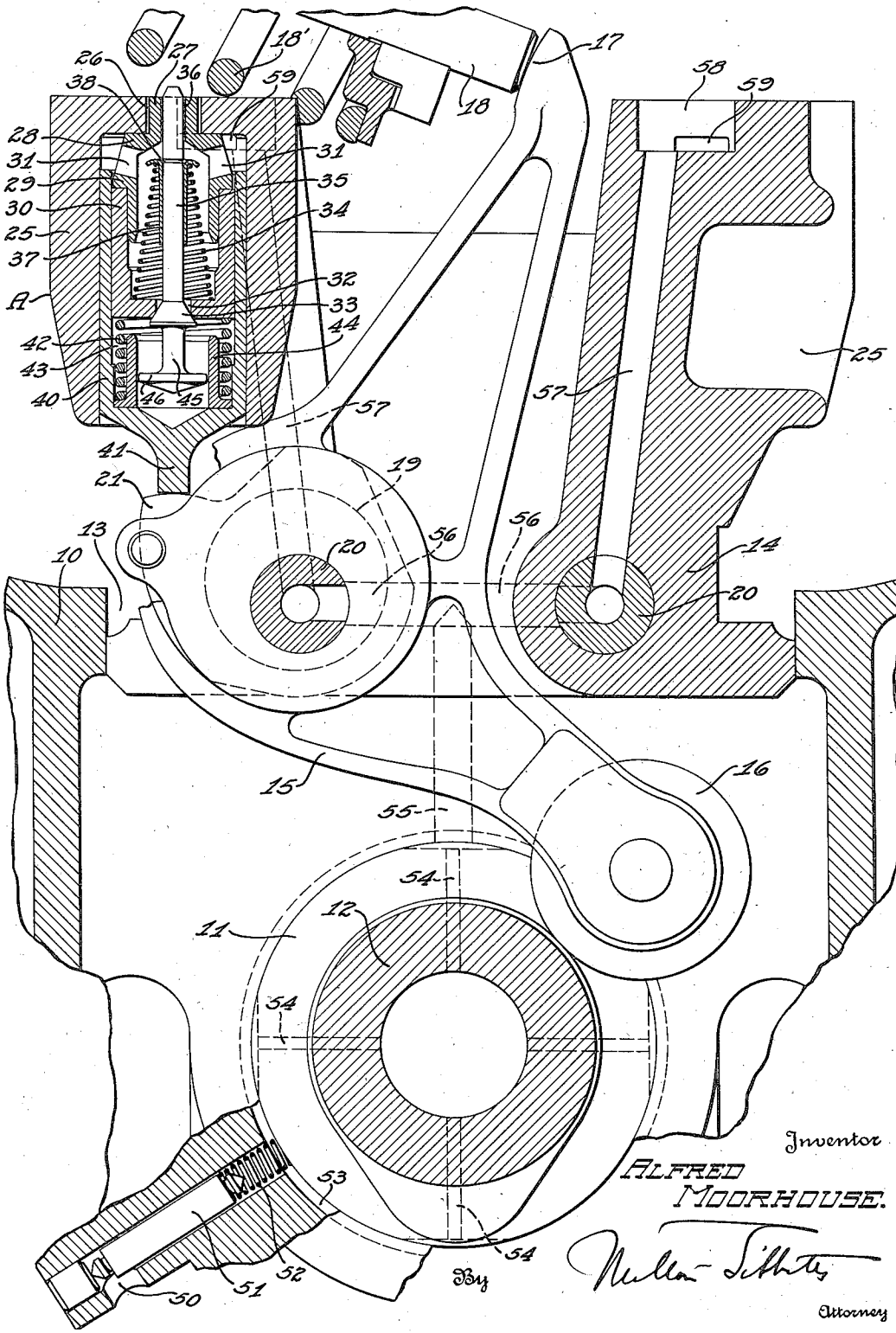

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INTERNAL COMBUSTION ENGINE

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

The invention is in some respects an improvement upon the valve mechanism shown in British Patent No. 289,468, and U. S. patent application to Edwin F. Storey, Ser. No. 574,795, filed November 13, 1931. In said British patent and in said application there is described a valve mechanism for internal combustion engines in which the rocker arms are provided with a take-up mechanism to compensate for expansion and contraction due to temperature variations. In the British patent the take-up device is mounted below the pivot of the rocker arm and the piston of the device presses upwardly, thus leaving the cylinder of the device open at its upper end so that any air in the device may escape upwardly around the piston. There is a spring pressed valve in the movable piston.

In the Storey application the take-up device is mounted above the pivot and the piston presses downwardly, the upper end of the cylinder being closed except for a spring operated valve.

While the British patent indicates that its spring pressed valve will be opened by the vacuum created by the upward movement of the piston, it is found in practice and it is recognized by Storey that a contributing factor to the opening of this valve is the inertia of the parts and that the sudden movement of the piston causes the opening of the valve to permit escape of air or inflow of oil.

This matter of escape of air from the working parts of the cylinder is of utmost importance because if air is trapped below the piston the valve mechanism will not operate quietly since the air will be compressed instead of forming a solid wall and the eccentric mounting will then cause a clearance between the rocker arm and the engine valve. Hence the necessity for providing means for completely eliminating the air from the high pressure space of the device.

It is one of the objects of the present invention to improve upon the devices of the British patent and the Storey application, particularly in this matter of eliminating the air from the high pressure chamber of the device.

It is an object of the invention that the device shall not only have its valve at the upper part of the high pressure chamber, but that the leakage or clearance between the movable part and the stationary part of the device shall extend upwardly from the upper part of the high pressure chamber so that the air in the device will be forced out at that point when the device is under compression.

Another object of the invention is to provide for circulation of the oil in the device itself, downwardly through the spring pressed valve into the high pressure chamber, and upwardly from the upper end of the compression chamber into a chamber at the upper part of the device which is open to the atmosphere. Thus the air will escape from the oil and after all of the air has been eliminated from it this same airless oil will continue to be used in the device and thus improve its operation.

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 the figure is a vertical transverse section through the central portion of a V-type internal combustion engine embodying the invention.

Referring to the drawing 10 represents generally a cylinder block casting which may or may not be a single casting, as shown in the drawing. Mounted in bearings 11 in the casting is a cam shaft 12 and above the cam shaft is an opening 13 in which is mounted a casting or support 14 which supports the valve operating mechanism. One of the rocker arms for the valve mechanism is indicated at 15, and this rocker arm is provided with a roller 16 which contacts with a cam on the cam shaft 12, and the other end of the arm has a contact point 17 operating on the end of the engine valve 18. The latter valve is closed by a spring 18'. The rocker arm is mounted upon an eccentric sleeve 19 on a pin 20, which sleeve has a lever arm 21 extending radially therefrom for the purpose of rotating it slightly on the pin 20 and thereby adjusting the clearance between the roller 16 and the cam shaft and the point 17 of the rocker arm and the valve 18. There is a similar pin 20 on the opposite side of the center line of the engine and it is understood that similar rocker arms are mounted thereon, there usually being one rocker arm and take-up mechanism for each engine valve.

Mounted above the lever arm 21 is the take-up device of this invention. It is indicated generally at A and it comprises an inverted cylinder 25 which may be formed directly in the casting or support 14 as shown in the drawing. This is a stationary cylinder and it is integrally closed at its upper end except for an opening 26 into which is fitted the stub end 27 of a piston 28. This is a stationary piston and in effect forms a part of the cylinder 25. It is somewhat smaller than the

interior diameter of the cylinder **25** and it abuts against the closed upper end of that cylinder.

The piston **28** is in two parts for convenience in manufacture and assembly, the parts being indicated at **29** and **30**, but these parts remain together after the device is assembled and there is no relative movement between them. The interior of the piston **28** is open to the interior of the cylinder **25** at its upper end by reason of passages **31**, and the piston **28** has its lower end closed except for a passage or opening **32** which is closed by a spring pressed valve **33**, the valve opening downwardly and being held to its seat by a light spring **34**. The valve stem **35** of the valve **33** extends upwardly through an opening **36** in the upper end of the stub end of the piston, the fit being loose so that the valve may readily find its seat. The lower end of the spring **34** rests against the end of the piston **28** and the upper end operates against a flanged sleeve **37** held on the valve stem **35** by a split ring **38** in a groove in the valve stem.

A movable hollow cylinder **40**, which may be called the working cylinder, extends up into the stationary cylinder **25** and surrounds the lower part **30** of the piston **28**, the fit between the outer wall of the piston part **30** and the inner wall of the cylinder **40** being such that leakage may occur under high pressure and thus form a dashpot as liquid is expelled from the cylinder under pressure. The fit between the outer surface of the movable cylinder **40** and the inner surface of the stationary cylinder **25** is fairly close so that there may be very little leakage and the stationary cylinder may form an adequate guide for the movable cylinder.

The lower end of the cylinder **40** is formed with an extension or nose **41** which rests against the lever arm **21** of the sleeve **19**, and a spring **42** between the lower end of the piston **28** and the movable sleeve tends to constantly press the latter against the lever arm **21**, for the purpose above described.

The space between the lower end of the piston **28** and the head of the cylinder **40** is a high pressure chamber indicated at **43**, the high pressure being caused by the operation of the valve mechanism in which the cam tends to rock the rocker arm **15** against the valve spring **18'**, thus constantly pushing upwardly on the lever arm **21**. As the rocker arm **15** drops off of the cam and the valve **18** is closed, the spring **42** returns the cylinder **40** to its original position and takes up the clearance at either end of the rocker arm. During this latter movement, if the liquid within the high pressure chamber **43** has been pressed out to any extent between the cylinder **40** and the piston **28**, it will be drawn back in again by reason of the partial vacuum created therein, the valve **33** opening to permit the liquid to again enter the high pressure chamber.

But it is found that the partial vacuum created is not always sufficient to open the valve **33** and consequently a small cylinder **44** is formed within the cylinder **40**, and an extension **45** is provided on the lower end of the valve **33**, and a piston **46** forms the lower end of said extension **45**. This piston **46** is just slightly smaller than the inner diameter of the cylinder **44** but the fit is sufficiently close so that when the cylinder **44** is suddenly pushed outwardly by the spring **42** it will carry with it the piston **46** and consequently open the valve **33**, thus facilitating the flow of oil back to the high compression chamber. But the movement of the cylinder **40** is brief and when it comes to a stop the spring **34** of the valve **33** returns the valve **33** to its seat by reason of the oil passing around the piston **46**. Also, by reason of this relatively loose fit of the piston **46** in the cylinder **44**, and the loose fit of the upper end of the valve stem **35** in the opening **36**, the valve **33** is permitted to find its seat and thereby make a good close fit to prevent leakage of oil at that point.

With the valve take-up device A substantially filled with oil as will be hereinafter described, it will be seen that the escape of oil from the high pressure chamber **43** is from the extreme upper end of that chamber around the piston part **30** and between the latter and the inner wall of the movable cylinder **40**. Thus if there is any air in the oil it will readily escape under the high pressure referred to, whereas, if the escape for oil was at the lower part of the chamber when the chamber was under high pressure, the air would remain at the upper end of the chamber and would not escape with the oil. The entrance of oil to the high pressure chamber is at the bottom of the piston part **30** where there is not likely to be much air in the oil, this entrance being through the opening **32** which is controlled by the valve **33**. Since this valve **33** is open only during the time of low pressure or partial vacuum in the chamber **43**, this passage is of no value in permitting the escape of air.

At the lower part of the drawing it will be observed that there is an oil intake passage at **50** and it will be understood that oil under pressure is supplied to this passage by any suitable means, not shown. In this passage **50** is a metering pin **51** which is made slightly smaller than the passage to permit a definite amount of oil to pass. A spring **52** causes a movement of the pin **51** with the fluctuations in the pressure of oil against it, thus keeping the passage clean. The oil is led to a groove **53** surrounding the bearing **11** and grooves **54**, shown in dotted lines in the bearing **11** and in the cam shaft **12**, lead the oil to the interior of the cam shaft where it is carried to other bearings. A conduit **55** with branches **56** carry the oil from the groove **53** to the hollow pins **20** upon which the eccentric sleeves **19** are mounted. This provides lubrication for the sleeves and the rocker arms. A conduit **57** adjacent each of the cylinders **25** carries the oil upwardly to a pocket **58** at the tops of the cylinders. From this pocket openings **59** lead into the upper part of each of the cylinders **25**. Thus the oil fed to the pins **20** is carried upwardly through the conduits **57** and delivered to the upper end of the cylinder **25** so that the latter is always filled with oil. The overflow from the pocket **58** falls back into the crank case of the engine and is recirculated.

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. A valve take-up mechanism comprising a lever arm, a support, a stationary piston extending downwardly from the support, a spring pressed cylinder movable on said piston and closed at its lower end, said cylinder operating on said lever arm, said piston having a port in its head, a spring

closed valve for said port, and means operated by the movable cylinder for controlling the valve action.

2. A valve take-up mechanism comprising a piston having a ported head at its lower end, a spring closed valve for said port, a spring pressed cylinder slidably mounted on said piston and means operated by the movable cylinder for controlling the valve action.

3. A valve take-up mechanism comprising a piston having a ported head at its lower end, a spring closed valve for said port, a spring pressed cylinder slidably mounted on said piston, and means including a hydraulic connection between said valve and said cylinder for controlling the operation of said valve.

4. A valve take-up mechanism comprising a lever arm, an inverted cylinder mounted adjacent thereto, a downwardly extending piston within said cylinder and stationary with relation thereto, a second cylinder within the first cylinder and operating upon said piston with leakage clearance between the piston and second cylinder, said second cylinder having a closed lower head operating on said lever arm, a spring between the piston and second cylinder, and a valved passage means in the piston head.

5. A valve take-up mechanism comprising a lever arm, an inverted cylinder mounted adjacent thereto, a downwardly extending piston, a second cylinder within the first cylinder and operating upon said piston, a valved passage means in the piston, and means including a hydraulic device forming a connection between said valve and said second cylinder.

6. A valve take-up mechanism comprising a lever arm, a cylinder having a head operating against said arm, a stationary piston extending downwardly into said cylinder and having a port at its lower end, a valve for said port, and means including a hydraulic device forming a connection between said valve and said cylinder.

7. A valve take-up mechanism comprising an inverted cylinder, a second cylinder moving in the first cylinder, a piston stationary with relation to the first cylinder and comprising two parts telescoped together, one of said parts extending into the movable cylinder and the other of said parts abutting against the closed end of the stationary cylinder and means for supplying oil to both cylinders.

8. A valve take-up mechanism comprising a stationary member having a port therein, a cylinder sliding on said member, a valve for said port, a spring for closing said valve, said valve having a hydraulic connection with the cylinder and having at its opposite end a stem guided by said member, said connection and said stem guiding means being sufficiently loose to permit free seating of the valve.

9. A valve take-up mechanism comprising a stationary cylinder substantially closed at its upper end and open at its lower end, a second cylinder operating in the first cylinder and having a closed lower end, a stationary piston abutting against the closed end of the first cylinder and extending inside the second cylinder, and means for supplying oil to the stationary cylinder below its closed head and to the second cylinder below the stationary piston.

10. In a valve take-up mechanism, the combination of a supporting cylinder open at its lower end, a working cylinder within the first cylinder and extending operatively beyond the lower end of the first cylinder, means within the cylinders comprising a high pressure chamber with air and oil escape at the top of said chamber only, and valved passage means in connection with said high pressure chamber.

11. In a valve take-up mechanism, the combination of a supporting cylinder open at its lower end, a working cylinder within the first cylinder and extending operatively beyond the lower end of the first cylinder, means within the cylinders comprising a high pressure chamber with air and oil escape at the top of said chamber only, valved passage means in connection with said high pressure chamber, and means including a hydraulic device forming a connection between the valve of said passage means and said working cylinder.

12. A valve take-up mechanism comprising a stationary hollow piston, a working cylinder surrounding said piston and spring pressed relative thereto, a valved passage means between the interior of the cylinder and the interior of the piston and means controlling the valve action.

13. A valve take-up mechanism comprising a stationary hollow piston, a working cylinder surrounding said piston and spring pressed relative thereto, a valved passage means between the interior of the cylinder and the interior of the piston, and means including a hydraulic device forming a connection between the valve of said passage means and said cylinder.

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