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CONCENTRIC VALVE MECHANISM FOR INTERNAL COMBUSTION MOTORS.

APPLICATION FILED MAR. 18, 1912.

1,054,970.

Patented Mar. 4, 1913.

2 SHEETS—SHEET 1.

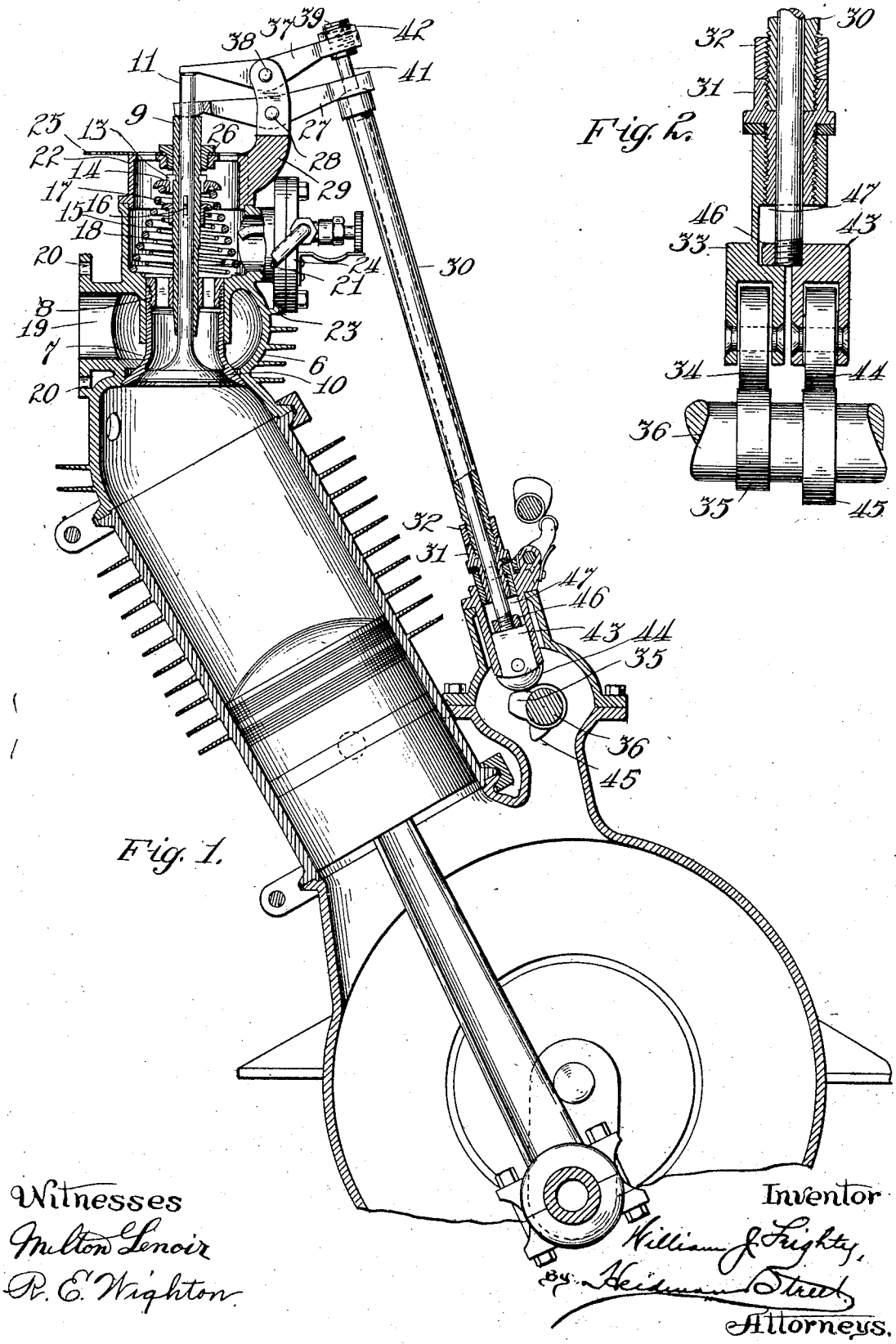

Fig. 1.

Fig. 2.

Witnesses

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Fig. 3.

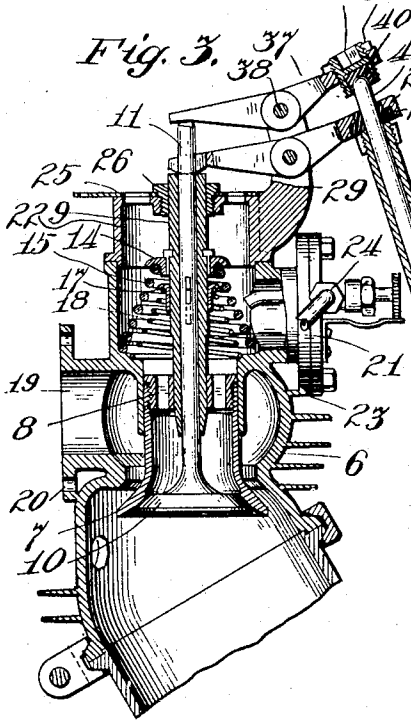


Fig. 4.

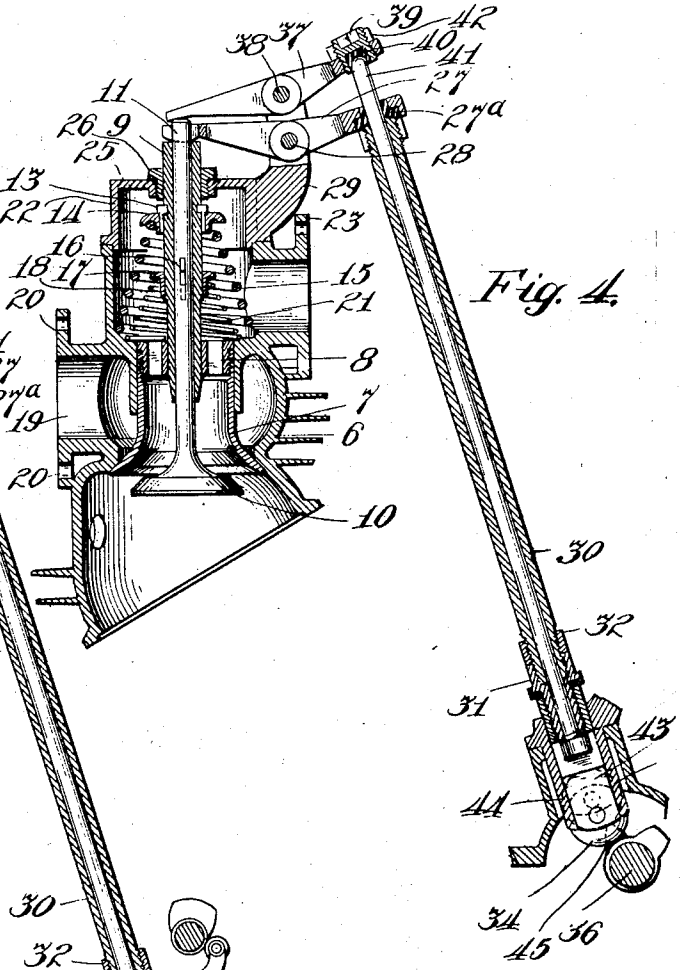
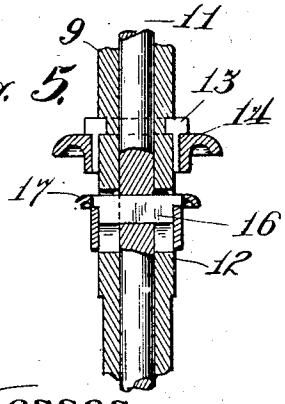


Fig. 5.



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UNITED STATES PATENT OFFICE.

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CONCENTRIC-VALVE MECHANISM FOR INTERNAL-COMBUSTION MOTORS.

1,054,970. Specification of Letters Patent. Patented Mar. 4, 1913.

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To all whom it may concern:

Be it known that I, WILLIAM J. LEIGHTY, a citizen of the United States, and a resident of Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Concentric-Valve Mechanism for Internal-Combustion Motors, of which the following is a description, reference being had to the accompanying drawings, which form a part of my specification.

My invention relates to the valve construction of an internal combustion motor and the method of controlling the same; having for its object the provision of a construction which may be employed in connection with any method of fuel injection.

One object of my invention is to provide a simple, economical and effective concentric valve construction adapted for use in connection with four-cycle type of combustion motors, whether water or air cooled; the construction being applicable for use in connection with such motors, whether direct injection of fuel be employed or a carbureter used.

Another object of my invention is to provide a concentric valve construction in which both the intake and the exhaust valves are independently lifted or returned to their seats by their own respective mechanisms.

A further object of the invention is the provision of a concentric valve construction so located with reference to the exhaust port or chamber of the cylinder that the exhaust valve may be utilized as a conduit for the intake charge of explosive mixture, whereby the heating of the exhaust valve by the exhaust gases will thoroughly vaporize the intake charge passing through the conduit formed by the exhaust valve, while at the same time, the intake charge is employed to effectively cool the valves and valve seats.

Other advantages inherent in the construction will be more fully understood from the following detailed description wherein reference is had to the accompanying drawings, in which:—

Figure 1 is a partial longitudinal sectional view through an internal combustion motor, illustrating the valve mechanism in closed position; the cylinder of the motor being shown provided with a fuel injecting device. Fig. 2 is a detail longitudinal sectional view of the push rod cam roller yoke and the means for securing the parts together. Fig. 3 is a longitudinal sectional view of one end of the cylinder illustrated in Fig. 1, showing the valve mechanism with the exhaust valve in open position. Fig. 4 is a similar view showing the valve mechanism with the intake valve in open position; the cylinder being shown adapted to have a carbureter attached thereto. Fig. 5 is a partial longitudinal sectional view taken through the valve stems, to more clearly illustrate the means employed for securing the springs to the valve stems.

In the exemplification of my invention, as illustrated in Fig. 1, I provide the exhaust end of the cylinder with an exhaust valve chamber 6, in which is mounted a hollow cylindrical valve 7, the upper end whereof is preferably provided with a spider 8, secured to the hollow stem in any suitable manner; and secured to the spider 8 is a hollow stem 9; these parts forming a complete exhaust valve in a simple manner.

Concentrically mounted in the exhaust valve is an intake valve 10, provided with an elongated stem 11, which extends through the hollow stem 9 and slightly beyond the outer end thereof, as clearly shown in Fig. 1. By extending the stem 11 of the intake valve 10 through the elongated hollow stem 9, the latter will act as a guide for the intake valve, keeping the same in direct alinement with the exhaust valve and therefore also insuring the proper seating of said valve.

I provide separate springs for the intake and exhaust valves, and these springs are preferably secured to the valve-stems in the manner more clearly shown in Fig. 5, wherein the exhaust valve-stem 9 is provided with an elongated slot 12 into which the two pieces or semi-cylindrical bushings 13 take. The two-piece bushing 13, is held in place by a collar 14, which is slipped up onto the bushing; and this collar 14 also engages the upper end of the exhaust valve spring 15 and forms a stop for the spring.

The intake valve stem 11 is provided with a slot into which is fitted a key 16; and this key 16 extends through the elongated slot 12 formed in the exhaust valve-stem 9. It will be understood, of course, that the elongated slot 12 in the exhaust valve-stem 9 is of greater width than the key 16, so as to allow for the independent movement of

the intake valve 10 and at the same time give sufficient clearance at either end for adjustment of the valve lift in case of wear through the grinding of the valves, etc. A collar 17, the upper end whereof is provided with a slot to receive the key 16, engages the upper end of the intake valve-spring 18 and forms a stop therefor. This collar 17 fits loosely around the valve-stem 9 and is governed therefore entirely by the key 16 and the intake valve-spring 18.

It is apparent from the foregoing description, that the intake valve 10 is lifted or held on its seat by the spring 18, and the exhaust valve 7 is lifted or held on its seat by the spring 15, thus eliminating a disadvantage heretofore encountered, where concentric valves were used as a result of employing a heavy intake valve-spring of sufficient strength to lift both valves which resulted in a heavy hammer blow when the exhaust valve would close.

In addition to overcoming the objection just mentioned, my improved valve stem construction has the advantage in that, should one of the springs break, the remaining spring will hold the valve with the broken spring and prevent its falling into the cylinder which would, of course, cause considerable trouble. This advantage is obtained by having the key 16 pass through both valve-stems as heretofore described.

As previously described, the exhaust valve chamber 6 surrounds the cylindrical stem of the exhaust valve 7, and allows the escaping or exhaust gases to pass out through orifice 19 into the atmosphere, or into a suitable exhaust pipe which may be secured to the flange coupling face 20. The exhaust chamber 6, as clearly shown in the drawings, is placed immediately outside of the cylinder head: and I also arrange the intake, or mixing chamber 21 immediately above the exhaust chamber 6.

The intake or mixing chamber 21 is preferably provided with a removable upper portion or cap 22, secured to the chamber in any suitable manner, thus permitting of easy access to the valve springs which are located within the mixing chamber 21. The side wall of the mixing chamber 21 is provided with a flanged coupling 23, through which the direct fuel injecting mechanism 24 is secured, or to which a suitable intake pipe leading from a carbureter may be attached, thus permitting of both methods of fuel injection being employed.

Where the direct method or fuel injecting device 24 is used, the top of the cap portion 22 is provided with suitable perforations, with which similar perforations in the plate or disk 25 are intended to register. The disk or plate 25 is suitably secured to the top 22, as for example by the flanged collar 26, so that the disk or plate may be rotated, whereby the size or number of registered perforations will be varied, thereby controlling the amount of air admitted to the mixing chamber 21. Where a carbureter is employed, the top of the cap portion 22 is left solid, or all of the perforations closed off, so that all of the intake mixture will enter through the carbureter.

From the construction shown and heretofore described, it will be seen that the exhaust gases discharged into chamber 6 tend to heat the walls of exhaust valve 7, so that when the intake charge passes through the exhaust valve 7, it will become heated and therefore thoroughly vaporized; the intake charge will also in turn act as a cooling medium for the valves and the valve seats.

The valves may be actuated by any suitable tappet levers and push rods in conjunction with the cam-shaft of the motor. I prefer, however to employ the construction shown, in which the exhaust valve is operated by the tappet lever 27 which works about the fulcrum pin 28 secured in the bifurcated arm or bracket 29 which may be formed integral with the cap portion 22. I provide the outer or push rod end of tappet lever 27 with a fiber cushion 27ª, see Figs. 3 and 4, which is adapted to receive the impulse from the push rod 30. The inner end of tappet lever 27 is so formed as not to interfere with the operation of the intake valve push-rod.

Push rod 30 is in the nature of a hollow stem or tube and is secured to a guide extension 31, preferably by being screwed thereon as shown, thus enabling the length of the push rod to be adjusted; and after the push rod has been adjusted to proper length, it is securely clamped in place by a lock nut 32. The guide extension 31 is secured to a yoke 33, which, in the construction illustrated, constitutes the exhaust cam roller yoke: the connection between the guide extension 31 and the cam roller yoke 33 may be made in any suitable manner. The yoke 33 carries the cam roller 34 which is adapted to be engaged by the exhaust cam 35 secured to the cam shaft 36.

The intake valve is actuated by means of the tappet lever 37, which operates about the fulcrum pin 38, which latter is secured in the bifurcated arm or bracket 29. The tappet lever 37 is preferably provided at its outer or push rod end with an adjusting nut 39, which is provided with a fiber cushion 40. This cushion 40 is adapted to receive the impact from the push rod 41, which latter extends through the hollow push rod 30. The adjusting nut 39 is securely locked in place by a suitable lock nut 42. Through the adjustment of nut 39, the proper length of push rod 41 is effected.

Push rod 41 is secured to the intake cam roller yoke 43 in any suitable manner, as

for example by screwing the same to the yoke as clearly shown in Fig. 2. The yoke 43 carries a cam roller 44 which is adapted to be engaged by the intake cam 45 secured to the cam-shaft 36.

With the push rod 41 taking through guide extension 31 and the fiber cushion 27^a on tappet lever 27, it will be seen that the extension 31 and the cushion 27^a serve as guides or bearings for the intake push rod. With the push rod 41 taking through the fiber 27^a, the latter serves as a guide to hold both push rods 30 and 41 in proper alinement.

In order that the construction may be made as noiseless in its operation as possible, especially when the exhaust valve opens and carries the intake valve with it, I prefer to construct the cam roller yokes 33 and 43 in the manner more clearly illustrated in Fig. 2, where the cam roller yoke 43 is shown provided with a lug 46 which extends into a recess 47 formed in the yoke 33; the lug 46 engaging with the shoulder 48 when the exhaust cam 35 raises the yoke 33. The slot or recess 47 is, of course, made of sufficient depth to permit of the proper upward movement of yoke 43, independently of the exhaust cam roller yoke 33. It is apparent from the construction shown and described, that when cam roller yoke 33 rises, it will carry yoke 43 upward with it, thus keeping push rod 41 always in contact with the end of tappet lever 37, so as to allow no play or lost motion.

With the construction shown and described, it is apparent that the cylinder or cylinder head may be readily removed by simply disconnecting the fuel injecting device or the carbureter intake pipe and the wire to the spark plug, thus permitting ready access to the respective parts being had.

I have shown and described what I believe to be the simplest and best form of my invention, which is applicable for use in connection with a motor employing either the direct injection or carbureter method of supplying explosive mixtures, wherein the various parts are so arranged as to be free from any undue or unnecessary vibration, and wherein one of the concentric valves forms a vaporizing conduit or channel for the intake charge; but the construction illustrated and described may be modified in certain details without however departing from the spirit of my invention, and I do not wish to be understood, therefore, as limiting myself to the exact construction shown and described, but

What I claim as my invention and wish to secure by Letters Patent is:—

1. In concentric valve mechanism of the class described, a cylinder having an exhaust chamber surrounding the exhaust port, a second chamber located above the exhaust chamber, a pair of concentric valves located intermediate of the second chamber and the cylinder, one of said valves constituting a conduit for conveying the intake charge from the second chamber to the cylinder, a slot and key connection whereby the valves are locked together but permitted to have independent movement, a pair of concentric springs located within the second chamber whereby the valves are independently lifted to closed position, and means whereby the valves are operated.

2. Concentric valve mechanism of the class described, comprising a hollow cylindrical valve arranged to act as the exhaust valve and as a conduit for the intake charge, a second valve arranged within said exhaust valve and constituting the intake valve, a slot and key connection between said valves whereby the valves are locked in their concentric relation but permitted to have independent movement, separate means for maintaining the valves in closed position, a pair of concentric push rods having operative connection with the stems of said valves, and a pair of roller carrying yokes secured to said rods and in operative engagement with the cam shaft of the motor, the relation between the yokes being such that they may have joint movement or one yoke may have independent movement.

3. Concentric valve mechanism of the class described, comprising a hollow valve arranged to act as the exhaust valve and as a conduit for the intake charge, a second valve arranged within the first mentioned valve and constituting the intake valve, the hollow valve being provided with an elongated stem arranged to act as a guide for the second or intake valve, means whereby the valves are locked in their concentric relation but permitted to have independent movement, a pair of concentric push rods, the outer rod having operative connection with the exhaust valve stem, while the inner rod has operative connection with the intake valve stem, and a pair of roller carrying yokes secured to the opposite ends of said rods, the yoke secured to the outer push rod being arranged to carry the other yoke, while the yoke secured to the inner push rod is arranged to have independent movement.

4. Concentric valve mechanism of the class described, comprising a hollow cylindrical valve arranged to act as the exhaust valve and as a conduit for the intake charge, a second valve arranged within said exhaust valve, means whereby the valves are locked together but permitted to have independent movement, a spring for each of said valves whereby they are independently returned to closed position, a pair of concentric push rods, a pair of roller carrying yokes secured at one end of each rod and arranged in op-

erative engagement with the cams of the cam shaft of the motor, said yokes being arranged to move in unison through the action of the exhaust cam, while one yoke is independently moved through the action of the intake cam, and means intermediate of the push rods and the valve stems whereby both valves are moved in unison through the action of the exhaust cam and the intake valve is independently moved through the action of the intake cam.

5. In combination with a cylinder provided with an exhaust chamber, a second or mixing chamber arranged above said exhaust chamber, said second chamber being provided with a removable top, of a hollow cylindrical valve extending through the exhaust chamber, adapted to establish communication between said second chamber and the cylinder for the intake charge and acting as an exhaust valve, a second valve arranged within the first mentioned valve and acting as an intake valve, said valves being provided with elongated concentric stems having slot and key connection whereby the valves are locked together but permitted independent movement, a spring for each of said valves whereby they are independently returned to closed position, a pair of concentric push rods, roller carrying mechanism intermediate of the ends of said rods and the cam shaft of the motor whereby both of said rods are moved through the action of the exhaust cam while a portion of said mechanism is independently moved through the action of the intake cam on the cam shaft of the motor.

6. Concentric valve mechanism of the class described, comprising a hollow valve arranged intermediate of the intake charge supplying mechanism and the cylinder of the motor, said valve constituting a conduit for the intake charge and acting as an exhaust valve, a second valve concentrically mounted in the exhaust valve and acting as an intake valve, a pair of concentric springs whereby said valves are independently maintained in closed position, and means intermediate of the cam shaft of the motor and the valve stems whereby the valves are operated, said means being arranged so as to maintain constant engagement with the cam shaft of the motor and the valve stems and move when the exhaust cam is operated, while a portion of said means is adapted to have independent movement.

7. Concentric valve mechanism of the class described, comprising a cylinder having an exhaust chamber surrounding the exhaust port, a second chamber located above the exhaust chamber, a pair of concentric valves located intermediate of the second chamber and the cylinder, one of said valves constituting a conduit for conveying the intake charge from the second chamber to the cylinder and forming the exhaust valve, means whereby the valves are locked together but permitted to have independent movement, a pair of concentric springs located in the second chamber whereby the valves are independently lifted to closed position, a pair of levers engaging the stems of said valves, and a pair of concentric push-rods having independent operative connection with the cam shaft of the motor and so arranged that both levers will be jointly operated when the exhaust valve push-rod is lifted.

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