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VALVE MECHANISM FOR INTERNAL COMBUSTION ENGINES

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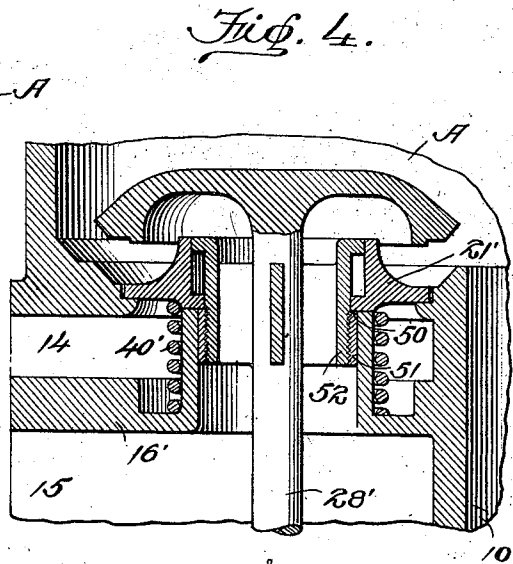
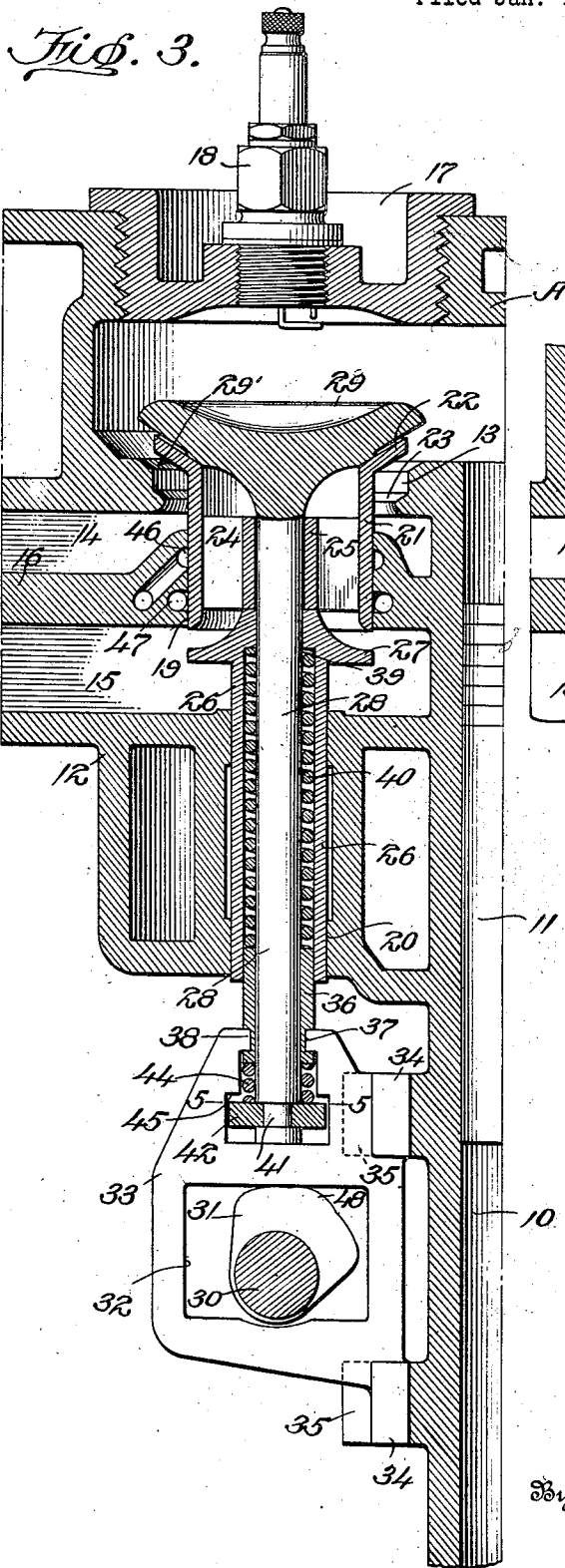
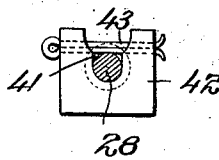


Fig. 5.



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UNITED STATES PATENT OFFICE.

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VALVE MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

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To all whom it may concern:

Be it known that I, DORSEY F. ASBURY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Valve Mechanism for Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable those skilled in the art to which it appertains to make and use the same.

My present invention relates to improvements in valve mechanisms for internal combustion engines, and, as in my former application filed October 9, 1919, and serially numbered 329,495 for like improvements, my present invention aims at the provision of a simply constructed valve mechanism which will permit an engine to run equally as efficient in either a clock-wise or counter-clockwise direction.

In my present valve mechanism I have retained important advantages present in my prior valve mechanism above referred to such as the elimination of waste of explosive mixture, the utilization of the impulse produced by the exhaust for opening the exhaust valve and at the same time to maintain the intake passage closed, and smooth operation irrespective of the speed at which the engine is run.

In addition to the foregoing it has been my aim to further improve my former valve mechanism by providing a positively reciprocable puppet valve acting to positively move a combined intake and exhaust valve in one direction and spring means for moving the latter in its other direction, the arrangement of parts being such that the puppet valve is maintained against its seat under spring pressure, the exhaust controlling portion of the combined valve is maintained against its seat by spring pressure and the intake controlling portion of said combined valve is maintained against its seat by exhaust pressure, or, better stated, by exhaust products.

As a further purpose it has been my aim to provide means to prevent any leakage around the combined intake and exhaust valve from the intake passage to the exhaust passage and vice versa.

So far as I have been able to determine a valve mechanism of the type I have disclosed has not been heretofore produced which will prevent waste of explosive mix-

ture when the engine is run by means independent of combustion therein, as in the case of an engine associated with a motor vehicle when the engine is utilized as a brake by cutting off its ignition means when the vehicle is travelling down an incline. In such instances the present types of valves permit the explosive mixture to be sucked in and then exhausted to the atmosphere with each exhaust cycle of each piston in each cylinder of the engine, resulting in a tremendous loss of fuel. In producing my present valve mechanism it has been an exceedingly important consideration to eliminate this unnecessary waste and retain the advantages aforementioned.

Other important details of construction, combinations and arrangement of parts will be referred to more particularly hereinafter in connection with the accompanying drawings and then specifically defined in the appended claims. These combinations and arrangements of parts are herein disclosed in the best form known to me at present, but are susceptible to modification and change and I therefore reserve the right to make such changes as may be advantageous and as are included within the scope of my claims.

In the accompanying drawings:—

Fig. 1 is a vertical section through a portion of an internal combustion engine and illustrating the application of one form of my improved valve mechanism, the parts thereof being shown in the position they occupy during compression and firing periods of the engine;

Fig. 2, a similar view showing the relative positions of the valve parts during exhaust periods of the engine;

Fig. 3, a similar view showing the relative positions of the valve parts during intake periods of the engine;

Fig. 4, a similar view of a modified arrangement of valve parts operating in the same manner as the mechanism disclosed in the first three figures and being shown in exhaust permitting positions; and

Fig. 5, a section on the line 5—5 of Fig. 3. Referring to the drawings in detail, a portion of an internal combustion engine is indicated generally by A and as usual comprises a cylinder 10, piston 11 and valve housing 12. The housing 12 is disposed laterally with respect to the cylinder and a port 13 therein provides a means of com-

munication between the cylinder and intake and exhaust passages 14 and 15, respectively, which are relatively separated by a dividing wall or partition 16. A cap 17 is threaded
5 in the upper wall of the engine and enables access to be had to the valve mechanism for assembly, repairs etc. Carried by the cap 17 is the usual spark plug 18.

Formed in the wall 16 is an opening 19
10 disposed in alignment with the port 13, and below this opening and also in alignment with the port 13 the housing 12 has formed therethrough an opening 20 of somewhat smaller diameter than the opening 19. Slid-
15 able in the opening 19 is a tubular valve member 21 which is open at both of its ends so that an unobstructed passage is provided therethrough and at its upper end is provided with an outwardly extending flange 22,
20 the under face of which is adapted, at predetermined times to seal against a seat 23 surrounding the port 13. Interiorly this valve member is provided with a spider 24 which centrally carries a tube 25.

Slidable in the opening 20 is an elongated tubular member 26 the upper end of which is provided with a lateral flange 27 whose upper face is preferably dished or curved and which is spaced from the lower
30 end of the valve 21 when both the tubular member 26 and the valve 21 are at their limits of downward movement.

Extending through the tube 25 and through the tubular member 26 is the stem
35 28 of a puppet valve 29 a portion of the under face of which is adapted to seal at predetermined times with the upper face of the flange 22 of the valve member 21 while another portion of its under face is adapted
40 to seal at predetermined times with a second valve seat 29, surrounding the port 13. Disposed below the housing 12 is a cam shaft 30 carrying a cam 31 operating in a substantially rectangular opening 32 in a
45 cam follower 33 which is guided in its movement by lugs 34 thereon sliding in guides 35 on the cylinder wall.

Throughout the major portion of its length the tubular member 26 is of greater
50 internal diameter than the stem 28 of the puppet valve, the latter being guided in its movement by a reduced opening in the member 26 near its upper end and by a sleeve 36 slidable in the lower portion of the
55 tubular member and through which the stem slidably extends. Slots 37 in the sleeve are engaged by fingers 38 on the cam follower 33 whereby the sleeve is connected to and moves with the cam follower.

Within the tubular member 26 and surrounding the stem 28 of the puppet valve with its upper end abutting a shoulder 39
60 on the member 26 and its lower end resting on the upper face of the sleeve 36 is an expansion spring 40 which constantly exerts a

pressure tending to move the member 26 upward.

The lower end of the stem 28 extends into a recess in the cam follower and near its lower end is provided with an annular
70 groove 41. Fitting this groove and secured to the stem by a cotter 43 is a bifurcated plate 42, and between the upper face of this plate and the lower face of the sleeve 36 is arranged an expansion spring 44 exerting an
75 influence tending to move the stem 28 downward with respect to the cam follower, any such downward movement of the stem being limited by its lower end abutting the cam
80 follower. Upward movement of the stem relative to the cam follower is limited by shoulders 45 on the cam follower engaging with the upper face of the plate 42.

Provided in the wall defining the opening 19 are upper and lower annular grooves or
85 cavities 46 and 47, respectively, which are relatively separated and communicate with the atmosphere.

Operation of the mechanism is as follows:—Suitable gearing (not shown) rotates the cam shaft 30 half as fast as the
90 crank shaft (not shown) of the engine. With the parts of the valve mechanism in the position shown in Fig. 1 let it be assumed that a compressed charge of explosive
95 mixture fills the cylinder head and that the same has been ignited by a spark from the plug 18. Expansion of the exploded gases forces the piston downward during which movement the cam shaft is rotated. Just
100 prior to completion of the downward stroke of the piston, however, a portion of the cam 31 operates to initiate upward movement of the cam follower 33, and because of the
105 connection of the cam follower with the stem of the puppet valve, unseat the puppet valve. The products of combustion under pressure are now permitted to reach the upper surface of the flange 22 of the
110 combined intake and exhaust valve member 21 and act on the flange to force its lower face into sealing contact with the seat 23. As the piston moves upwardly in the cylinder the cam operates to continue opening
115 movement of the puppet valve and at the same time compress the spring 40 for the reason that the tubular member 26 is held at its limit of downward movement by the impulse of the exhaust acting on the dished
120 upper surface of the flange 27 as the exhaust passes through the tubular valve member on its way to the atmosphere through the exhaust passage 15, the spring being compressed by the sleeve 36 moving upward
125 relatively to the member 26 (see Fig. 2). When the piston completes its upward or exhaust stroke and the pressure in the cylinder substantially vanishes the spring overcomes the weakened exhaust impulse acting
130 on the flange 27 and automatically forces

the tubular member 26 upward. After a slight amount of movement (sufficient to allow the under face of the flange 22 to seal against the seat 23 when the member 26 is at its limit of downward movement) the upper end of the tubular member 26 contacts with the lower face of the tube 25 so that continued upward movement of the tubular member under the influence of the spring causes the combined valve 21 also to be moved upward until the upper face of the flange 22 seals against the under face of the puppet valve 29. This occurs immediately preceding the next downward or intake stroke of the piston and opens the intake passage into communication with the port 13 and the cylinder so as to permit a fresh charge of explosive mixture to be sucked into the cylinder. Just prior to completion of the downward stroke of the piston a portion of the cam engages the lower wall of the opening 32 and initiates a downward movement to the cam follower which movement is in turn transmitted to the puppet valve through the spring 44, bifurcated plate 42 and stem 28, the puppet being moved to closed position or with its under face in sealing contact with the seat 29' at a time when the piston again begins to move upward upon its compression stroke at the end of which a spark from the plug explodes the charge and the operations just recounted are repeated.

It will be observed that when the engine is operating at high speed the inertia of the puppet valve will cause a compression of the spring 44 during downward movement of the cam follower and that the upper face of the plate 42 will then engage the shoulders 45 so that the puppet under all conditions is positively operated by the cam to both open and closed positions. When the engine is operating at low speed the spring 44 would be but slightly if at all compressed, but the puppet would be equally as positively moved to closed position and when in engagement with its seat will be resiliently maintained in such engagement by the spring 44, as is obvious.

By the provision of the cavities 46 and 47 I am enabled to fit the combined valve 21 in the opening 19 so that it is freely slidable and yet any explosive mixture escaping therearound is prevented from passing entirely through the opening 19 and intermingling with the exhaust for the reason that it will escape to the atmosphere through the cavity 46. Likewise the intake passage is maintained free of exhaust products by the cavity 47. In the event, however, that the valve 21 should at any time tend to stick in the opening 19 I provide a bulge 48 on the cam 31 designed to impart at the proper instant an upward "kick" to the cam follower 33 which in turn imparts this "kick"

to the member 26 and thence to the valve 21 to loosen the same.

It will be further observed that the combined intake and exhaust valve 21 is movable in unison with the puppet valve 29 to maintain the intake passage open and the exhaust passage closed and that on the other hand these two valves are movable relatively to each other to close the intake passage and open the exhaust passage. With a structure having such a mode of operation I am enabled to prevent considerable waste of fuel under conditions where the types of valve mechanisms now in common use under like conditions would operate with a vast waste. It has been shown that in order to operate the valve 21 to a position to permit communication between the exhaust passage 15 and the cylinder it is necessary that the pressure in the cylinder be raised considerably above the normal pressure in the intake and exhaust passages because it is the impulse resulting from an increased pressure in the cylinder acting on the impulse surfaces of the flanges 22 and 27 that moves the valve 21 to open the exhaust. If a high pressure in the cylinder is not present then the exhaust is constantly maintained closed by the spring 40 forcing the valve 21 into sealing contact with the under face of the puppet valve regardless of whether the puppet valve is either open or closed. Accordingly, if for any reason the charge in the cylinder fails to explode the valve 21 will be maintained closed against exhaust by the spring 40 and upon the ensuing exhaust stroke of the piston the charge in the cylinder will be forced back into the intake passage and again sucked into the cylinder as the piston moves down upon its intake stroke. This operation will continue so long as the engine continues to operate by means independent of combustion in the cylinder and obviously will prevent considerable waste of fuel in association with motor vehicles under conditions where the engine is utilized as a brake, as when the ignition means is cut out during travel of the vehicle down a hill.

Furthermore, it will be observed that maximum dimensions across the cam are equal. Consequently the engine may be started and run equally as efficient in either a clock-wise or counter-clock-wise direction.

In Fig. 4 of the drawings the combined valve 21' is held closed against intake during exhaust by exhaust products and is closed against exhaust and opened to permit intake by a spring 40' bearing at one end against the valve and at its other end against the partition 16'. This valve is given a "kick" by the bulge 48 on the cam similarly to the valve 21, but in the latter instance this "kick" is transmitted to the valve 21' by a shoulder 50 formed by

threading a ring 51 on a tube 52 forming an integral part of the stem 28' of the puppet valve. The operation of the form of valve illustrated in Fig. 4 is the same as the operation set forth in connection with the first form of valve.

I claim:

1. In a valve mechanism for internal combustion engines, an intake valve, spring means for opening said valve, and spring means independent of said first means acting to hold said valve to its seat when closed.

2. In a valve mechanism for internal combustion engines, an intake valve held closed during exhaust by exhaust products, spring means moving said valve to open position after exhaust, and means for then returning the valve to closed position.

3. In a valve mechanism for internal combustion engines, an exhaust valve held open by exhaust products, means for moving the valve to closed position following exhaust, and means for then moving the valve to the position it occupies during exhaust while the exhaust is closed by said valve.

4. In a valve mechanism for internal combustion engines, an exhaust valve held open by exhaust products, spring means for moving the valve to closed position following exhaust, and means for then moving the valve to the position it occupies during exhaust while the exhaust is closed by said valve.

5. In a valve mechanism for internal combustion engines, a puppet valve, and a combined intake and exhaust valve sealing against the puppet valve at all times except during exhaust.

6. In a valve mechanism for internal combustion engines, a puppet valve, and a combined intake and exhaust valve sealing against the engine during exhaust and at all other times against the puppet valve.

7. In a valve mechanism for internal combustion engines, a puppet valve, and a combined intake and exhaust valve sealing against the engine during exhaust under the influence of exhaust products and at all other times against the puppet valve.

8. In a valve mechanism for internal combustion engines, a puppet valve, a combined intake and exhaust valve, and spring means sealing said combined intake and ex-

haust valve against said puppet valve at all times except during exhaust.

9. In a valve mechanism for internal combustion engines, a puppet valve, an exhaust valve held open by exhaust products, a member independent of the exhaust valve, spring means operating said member to close the exhaust valve, and impulse receiving means on said member acted upon by exhaust products to prevent operation of said member by the spring means to close the exhaust valve until exhaust substantially ceases.

10. In a valve mechanism for internal combustion engines, a puppet valve, an exhaust valve held open by exhaust products, a member independent of the exhaust valve, spring means energized by opening movement of the puppet valve for operating said member to close the exhaust valve, and impulse receiving means on said member acted upon by exhaust products to prevent operation of said member by the spring means to close the exhaust valve until exhaust substantially ceases.

11. In a valve mechanism for internal combustion engines, a puppet valve, means for operating the puppet valve, an intake valve moved towards closed position by closing the puppet valve, and then moved to completely closed position by exhaust products when the puppet valve is opened.

12. In a valve mechanism for internal combustion engines, an exhaust valve held open by exhaust products, an intake valve, and spring means for opening the intake valve.

13. In an explosive engine having intake and exhaust ports, means for opening the intake port and for maintaining the exhaust port closed during the exhaust period when the engine fails to fire.

14. In an internal combustion engine having intake and exhaust passages, means for maintaining the intake passage open during intake and exhaust period when the engine is operated by means independent of combustion therein.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

DORSEY F. ASBURY.

Witnesses:

HENRY T. BRIGHT,
FLORENCE A. BLING.