F. A. BOWMAN & J. E. BRIGGS.

SLIDE VALVE MECHANISM FOR ENGINES.

APPLICATION FILED MAY 20, 1913.

1,123,986. Patented Jan. 5, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

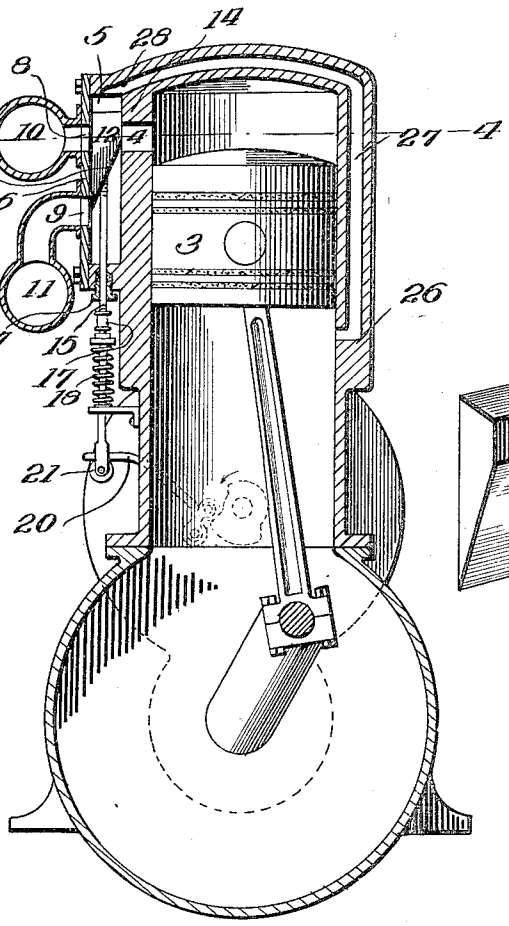


Fig. 6.

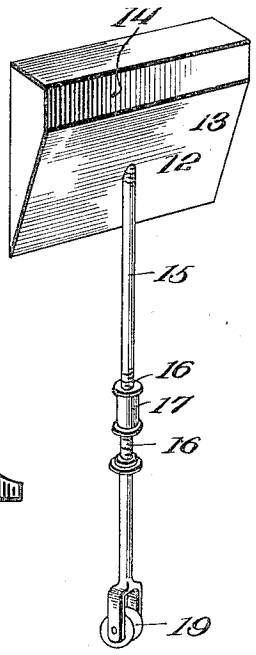
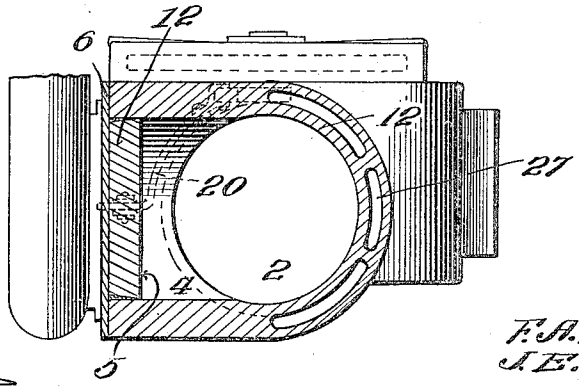


Fig. 4.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 2.

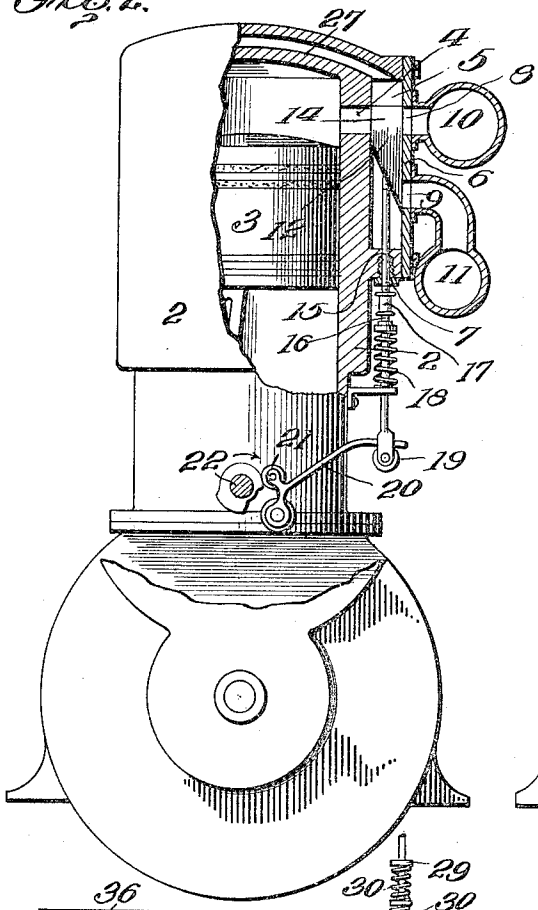
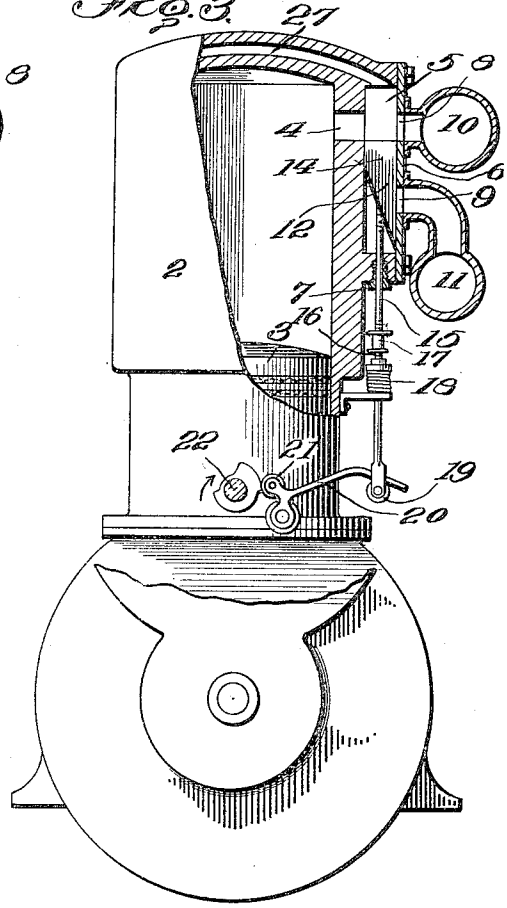


Fig. 3.



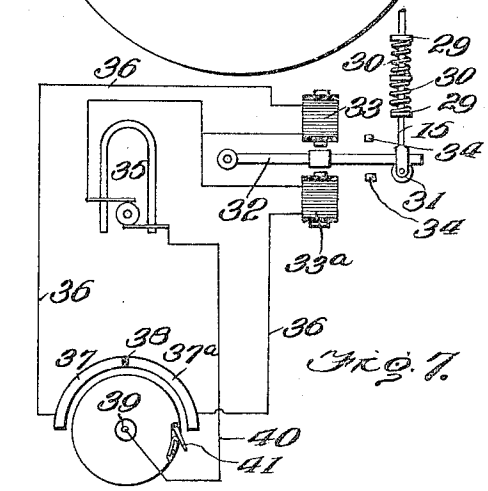


Fig. 7.

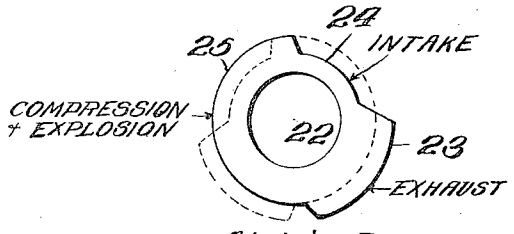


Fig. 5.

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UNITED STATES PATENT OFFICE.

FRANK A. BOWMAN AND JOHN E. BRIGGS, OF GILBERT, MINNESOTA.

SLIDE-VALVE MECHANISM FOR ENGINES.

1,123,986. Specification of Letters Patent. Patented Jan. 5, 1915.

Application filed May 20, 1913. Serial No. 768,881.

To all whom it may concern:

Be it known that we, FRANK A. BOWMAN and JOHN E. BRIGGS, citizens of the United States, residing at Gilbert, in the county of St. Louis and State of Minnesota, have invented certain new and useful Improvements in Slide-Valve Mechanism for Engines, of which the following is a specification.

Our invention relates to engine valves, and particularly to a valve designed and intended to be used with internal combustion engines, though not limited to such use.

The primary object of our invention is the provision of a slide valve which may be used not only for controlling the inlet of fuel into the engine cylinder, but also the outlet therefrom.

A further object is to so construct the valve that it is positive in its operation, both as regards the inlet of a charge and the outlet thereof.

A further object is to provide mechanism conducive to the simplicity of valves of this character and the simplicity of the operating mechanism therefor.

A further object is to provide means whereby the pressure of the fluid within the cylinder of the engine may be used to assist in opening the exhaust valve.

A further object is to provide means whereby the valve may be readily adjusted.

A still further object is to so construct and arrange the valve and valve mechanism that a large area of port opening may be secured and an unobstructed outlet for the explosive gases be provided.

Other objects will appear in the course of the following description.

Our invention is illustrated in the accompanying drawings wherein:

Figure 1 is a vertical section of an internal combustion engine constructed in accordance with our invention showing the valve in elevation and moving upward to establish communication between the intake manifold and the port 4. Fig. 2 is an elevation of the engine shown in Fig. 1 partly in section and showing the valve in the position taken during compression and explosion. Fig. 3 is a like view to Fig. 2 but showing the valve in the position taken when the exhaust port is open. Fig. 4 is a section on the line 4—4 of Fig. 1. Fig. 5 is a diagram of the cam. Fig. 6 is a perspective view of the valve used by us separate from the valve casing. Fig. 7 is a view of a modified valve operating mechanism, the view being partly in elevation and partly diagrammatic.

Corresponding and like parts are referred to in the following description and indicated in all the views of the accompanying drawings by the same reference characters.

Referring to these drawings, 2 designates the cylinder of an explosive engine of any usual or ordinary type but illustrated as the cylinder of a four-cycle internal combustion engine. Disposed within the cylinder is the piston 3 connected by a wrist pin to the piston rod as is usual. The cylinder is jacketed and is in all respects like any other cylinder except that it is provided with a relatively large port 4 at its upper end which forms not only the inlet port but also the exhaust port. This port 4 opens into a valve chest or chamber 5 formed with or attached to the outer face of the cylinder, this valve chest being preferably rectangular in form and the face of the valve chest being closed by means of a plate 6. The valve chest extends somewhat above the port 4 and at its lower end is provided with a stuffing box 7. The valve chest is formed with two openings 8 and 9, the opening 8 leading into an exhaust manifold 10 and the opening 9 leading into the gas manifold 11.

Disposed within the valve chest 5 is a valve 12 of the character illustrated in Fig. 6. This valve is preferably rectangular in section as illustrated in Fig. 4 and is of a length just sufficient to cover both of the ports 8 and 9 when the valve is in the position shown in Fig. 2 and at its lowest point of movement. The outer face of the valve is flat while the inner face is beveled as at 13 for a portion of its length, the upper portion of the valve having a face 14 parallel to the outer face of the valve. The cutaway portion 13 of the valve is so proportioned that

when the valve is in the position shown in Fig. 1, the flat face 14 will just close the port 4 and extend on each side slightly beyond this port. When the valve commences to move upward, however, the upper corner of the cutaway portion will move beyond the port 4 and permit the charge to pass from the gas manifold through the port 4 and to the upper end of the cylinder. The valve 12 has a screw threaded socket for the reception of a valve stem 15, this stem passing down through the stuffing box 7. The valve stem 15 is formed in two sections, the adjacent portions of the two sections being reversely screw threaded as at 16 and engaged by a collar 17 so that by rotating the collar and lock nuts in one direction or the other, the stem sections may be moved apart from each other or drawn together to thereby adjust the valve stem and thereby adjust the position of the valve with relation to the valve chest. A spring 18 acts to urge the valve and the valve stem upward, the valve stem being drawn down by means of a cam or like mechanism but urged upward by means of the spring.

The means whereby we preferably secure the downward movement of the valve is as follows: The lower end of the valve rod is bifurcated and carries a transversely extending roller 19. Pivotally mounted in any suitable manner is a lever 20 which is angular in form, the extremity of the lever extending over the roller 19 and engaging therewith. Above the pivot of the lever there is provided a cam roller 21. The spring 18 drawing upon the valve stem will act to urge the lever 21 into position to bring the roller thereon in contact with a cam 22. This cam is formed with three faces. The outermost face designated 23 acts to cause the drawing down of the valve so as to open the exhaust port 8. The face 24 is that portion of the cam which permits the valve to move upward so as to establish communication between the inlet manifold and the port 4. After this has occurred, the valve is moved down to a certain extent by means of the face 25 of the cam and it is during this period that the compression and explosion takes place. In order to provide means whereby the pressure within the cylinder will assist in moving the valve down, we may provide the cylinder wall with a port 26 adapted to be uncovered by the piston when the piston is moving downward and just before the exhaust port is uncovered so that the exploded gases can pass through this port and be conducted by means of a passage 27 into the upper end of the valve chest at 28, thus acting to urge the valve downward. Thus the pressure would assist in starting the valve and tend to overcome the side friction due to the pressure within the cylinder. It will be understood that the port 26 would not be opened to the exhaust during the suction stroke and would therefore have no effect in diluting the charge.

One of the main advantages of our invention resides in the fact that one large port is used for both the inlet of the charge and the passage of the exhaust. It will further be seen that the passage of the gases is entirely unobstructed.

While we have illustrated a mechanical means for shifting the valve, we wish it understood that the valve could also be operated electrically by means of solenoids and springs, and further it will be obvious that by modifying the cam it could be used for a two-cycle engine. This electrical means for actuating the valve is illustrated in Fig. 6. In this figure, 15^a designates the valve stem constructed in the same manner as previously described. This valve stem is provided with spaced collars or shoulders 29 between which are disposed the operating springs 30 which act to bring the valve stem back to a neutral position. The lower end of the valve stem is bifurcated and provided with a roller 31. Pivotally mounted adjacent to the valve stem is an arm 32, the free end of which extends between the ears formed on the lower end of the valve stem 15^a and rests upon the roller 31.

Disposed above and below the arm 32 are the solenoids 33 and 33^a whose cores engage with the arm 32. Disposed above and below the arm 32 are the rubber bumpers 34 for limiting the movement of the arm and cushioning the arm so as to prevent noise. Each of these solenoids is connected on one side to a magneto or battery designated 35 and each solenoid on its other side is connected by means of a wire 36 to an armature, these armatures being designated 37 and 37^a. These armatures are insulated from each other by insulation 38. The armatures are curved so as to surround a shaft 39, this shaft being connected by a wire or other connection 40 to the source of current 35. The shaft 39 is formed with the outwardly projecting contact point 41 which is resiliently urged outward and is adapted as the shaft rotates to contact successively with the inner faces of the armatures 37, 37^a. This shaft is operatively connected to the crank shaft of the engine so as to be operated one-half as fast as the crank shaft.

It will be obvious now that as the shaft 39 rotates in the direction of the arrow, the spring supported contact member 41 will come in contact first with one of the armatures 37, thereby sending current through

the solenoid magnet 33ª. This will draw downward upon the coil of the solenoid thus drawing the valve to the exhaust position.

As soon as the contact point 41 has passed the armature 37ª, the opposite solenoid 33 will be energized and the valve will be drawn up to its fully raised position thus establishing communication between the cylinder and the inlet port from the carbureter. The valve will remain in this position until the contact point has passed the armature 37. As soon as it has so passed, the circuit through the solenoid 33 will be broken and the springs 30 will then draw the valve to its neutral position at which time compression and expansion will take place after which the operation is repeated. The figure shows the shaft 39 at such position that the contact point is just about to engage the armature 37ª to permit the exhaust of the exploded gases.

It is obvious that ignition would be secured by means of a timer operated by the half time shaft. Neither the timer nor the half time shaft are shown as these elements are well known and need no description. It will be noted that the rubber buffer and the springs take up the shock of the valve and prevent the metal striking when the solenoids operate. By providing two extra commutators, these making another set, and making provision for shifting the shaft carrying the contact point laterally to make contact with the second set of commutators, the electrically operated valve may be reversed in its action and so reverse the engine. This is also true of the construction shown in Figs. 1 to 6 as it is obvious that a second cam like that shown in Fig. 6 but reversely arranged could be mounted upon the cam shaft and these cams shifted so as to bring one or the other into position to coact with the valve operating lever 20. The construction whereby this may be accomplished is an obvious one to any one skilled in the art.

What we claim is:

1. The combination with a cylinder having a port, of a valve casing having a pair of ports, and a single slide valve within the valve casing adapted to establish or cut off alternately communication between the cylinder port and either of the ports in the valve casing, the cylinder being provided with a duct leading from the lower portion of the cylinder into the upper end of the valve casing, whereby the pressure within the cylinder will assist in moving the valve downward.

2. The combination with a cylinder having a port, of a valve casing having a pair of ports disposed, one opposite the cylinder port and one in offset relation to the cylinder port, and a slide valve moving in the valve casing and having a flat outer face adapted to simultaneously close both of the valve casing ports, the face of the valve toward the cylinder being beveled for a portion of its length, the remainder of the face being flat and of an area adapted to close the cylinder port.

3. The combination with a cylinder having a port at one end, of a valve casing having a port opposite the cylinder port and a port below the cylinder port, a slide valve mounted in the casing, the outer face of the valve being flat and having a length sufficient to close both of the casing ports, the inner face of the valve being flat at its upper end and inclined outward and downward at its lower end, the flat upper end of the inner face having an area equal to the area of the cylinder port and being adapted to close the same, and means for reciprocating said valve.

4. The combination with the cylinder of an explosive engine having a port at its upper end, of a valve casing disposed on said cylinder and having an exhaust port disposed immediately opposite the cylinder port and an inlet port disposed in offset relation to the cylinder port, a slide valve mounted in the casing and having a flat outer face of a length sufficient to close both of said valve casing ports, the inner face of the valve at its upper end being flat and of an area sufficient to close the cylinder port, the inner face of the valve below the flat portion being downwardly and outwardly inclined, and means for causing reciprocation of the valve.

5. The combination with the cylinder of an explosive engine having a port at one end, of a valve casing having a pair of ports disposed, one opposite the cylinder port and the other in offset relation thereto, the cylinder being provided with a duct leading from the lower portion of the cylinder into the upper end of the valve casing, and a slide valve in the valve casing adapted to establish communication between the cylinder port and either one of the valve casing ports.

6. The combination with a chamber having a port at one end, of a valve casing having a pair of longitudinally spaced ports, one of said ports being disposed directly opposite the port in the valve casing, of a valve movable within said valve casing to three positions, and means for successively shifting the valve in one direction to open the inlet port, shifting it in the opposite direction for a portion of its stroke to close the inlet port and the port entering said chamber and then shifting it a further distance in the same direction to establish communication between the port entering the

chamber and the exhaust port and then retracting the valve to its original position to cut off both the inlet and exhaust ports.

7. The combination with a cylinder having a port at one end, of a valve casing having a pair of ports, a slide valve moving in the valve casing adapted to establish or disestablish communication between either one of the valve ports and the cylinder port, a valve-stem adjustably arranged to increase or decrease the distance between the extremity of the valve-stem and the valve, and mechanism for reciprocating the valve-stem and the valve.

In testimony whereof we affix our signatures in presence of two witnesses.

FRANK A. BOWMAN. [L. S.]
JOHN E. BRIGGS.

Witnesses:
VAINO HILL,
H. E. MACINNIS.