This invention relates to internal combustion engines and more particularly relates to a valve mechanism for controlling the intake and exhaust of fuel to and from the combustion chambers of such engines.

It is an object of this invention to provide a valve of the type above described, which can be manufactured out of flat stock and which will be cheaper and easier to produce than conventional valves.

It is a further object of this invention to provide a means to lessen the chances of spark plug fouling due to dampness or carbonization.

It is a still further object of this invention to provide a rotatable valve for internal combustion engines in which the spark plug within the combustion chamber is protected from the combustible gases within the combustion chamber during both the intake and exhaust strokes of the engine cycle.

These and other objects of the invention will appear from time to time as the following specification proceeds, and with reference to the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view of a valve mechanism constructed in accordance with the present invention;

Fig. 2 is a sectional view taken along line A-A of Fig. 1;

Fig. 3 is a view similar to Fig. 2, but showing the inlet valves in an open position;

Fig. 4 is a side elevational view of the driving mechanism for a valve constructed in accordance with the present invention; and

Fig. 5 is a plan view of the valve driving mechanism illustrated in Fig. 4.

Referring now particularly to Fig. 1 of the drawings, a portion of an internal combustion engine is shown as comprising a cylinder block 10 having a head gasket 11 sealing on the upper surface thereof, and having a cylinder head 12 seated on the head gasket 11 and secured thereto as by head bolts 13. Mounted on the cylinder head 12 by bolts 14 there is shown an inlet duct 15 which openly communicates with a port 16 in the cylinder head 12. Similarly, an exhaust duct 17 communicates with exhaust port 18, and is mounted on the cylinder head 12 as by bolts 19. A gasket 20 is provided between the cylinder head 12 and the inlet and exhaust ducts 15 and 17, respectively, to form a tight sealing engagement therebetween.

A piston 21 having the usual oil and/or compression rings 22 and 23 is shown, in conjunction with the cylinder head 12, as forming a combustion chamber 24. A spark plug 25 is also shown as being threadedly mounted in the cylinder head 12 and as having its gapped end portion 56 recessed slightly for reasons which will hereinafter become obvious.

Rotatable valves 31, 32, 33 and 34 are shown as being rigidly mounted on and supported by valve shafts 35, and as being secured to the shafts as by pins 36. It should here be noted that a rib 37 has been provided in the ports 16 and 18 to assure a complete sealing engagement of the valves when the valves are in the closed position as shown in Fig. 2. As seen in Fig. 3, when the inlet valves 31 and 32 are rotated in opposite directions, the inlet port 16 is communicated with the combustion chamber 24.

The driving mechanism 40 for the rotating inlet and exhaust valves 31, 32, 33 and 34 is illustrated in Figs. 4 and 5. A driving shaft 41 is shown journaled for rotatable movement within a driving shaft bracket 32, and as being rigidly connected to a gear 42. As is well known in the art, one end of the rocker arm 44 abuts a spring member 45 which tends to bias the rocker arm 44, and the shaft 41 to which it is connected, in a clockwise direction as viewed in Fig. 4. The other end of the rocker arm 44 abuts a push rod 46. The lower end of the push rod 46 is in engagement with a cam member 47 which is rigidly connected to a rotatable cam shaft 48. Vertical reciprocal movement of the push rod 46 causes a rocking motion of the rocker arm 44 and the rocker arm shaft 41, as is well known in the art.

Referring now more particularly to Fig. 5, it may be seen that a connecting link 49 engages at one end a pivot pin 50 journaled in the pivot arm 43 and engages, at the other end portion, a pivot pin 51 journaled in the gear 52. The gear 52 is arranged to drive the gear 53 by means of gear teeth 54 and 55 on the gears 53 and 52, respectively.

Since the gears 52 and 53 are rigidly connected to the valve driving shafts 35 which are connected to the inlet valves 31 and 32, oscillatory movement of the gear 52 and the gear 53 will cause oscillatory movement of the inlet valves 31 and 32. It may now be seen that when the high point of the cam 47 engages the lower end of the push rod 46, the rocker arm 44, rocker arm shaft 41 and pivot arm 43 will be rotated in a counterclockwise direction, thus causing the driving link 49 to move toward the left as viewed in Fig. 5. Since the gear 52 is pivoted about driving shaft 35, leftward movement of the driving link 49 will cause clockwise movement of the valve 52 and counterclockwise movement of the valve 53. Such clockwise movement of the gear 52 and counterclockwise movement of the gear 53 will cause the inlet valves 31 and 32 to move to their closed position, as shown in Fig. 2. Similarly, when the push rod 46 comes in contact with the low part of the cam 47, the rocker arm shaft 44 will be moved in a clockwise direction by the spring member 45 and the inlet valves 31 and 32 will be rotated into their open position as shown in Fig. 3. It should here be noted that the driving mechanism described above has been used for illustrative purposes only and forms no part of the present invention.

It may now be seen that when the inlet valves 31 and 32 are in their open position, as shown in Fig. 3, combustible gases will be admitted from the port 16 into the combustion chamber 24, and the gapped end portion 56 of the spark plug 25 will not be in communication with the combustion chamber 24, due to the position of the inlet valve 31. This will, of course, protect the gapped end portion 56 of the spark plug 25 from dampness, which might be encountered if the spark plug were exposed to the intrusion of combustible vapors. As soon as the inlet stroke is completed, of course, the inlet valves 31 and 32 will swing into the closed position shown in Fig. 2, and the gapped end portion 56 of the spark plug 25 will be momentarily exposed to the combustion chamber 24, in order to ignite the gases therein. Similarly, when the exhaust stroke begins, the exhaust valves 33 and 34 will oscillate to their completely open position, and the gapped end portion 56 of the spark plug 25 will again be protected from the gases within the com-
bustion chamber. This will, of course, lengthen the life of the spark plug 25, since it will lessen the amount of carbonization on the gapped end portion 56.

It is readily apparent that applicant's valves are so designed and constructed that the extremely high pressures within the combustion chamber encountered during the power and compression strokes tend to tightly seal the valves in their closed position.

Furthermore, it will be apparent that since there is no valve stem within the inlet or exhaust ports the volumetric efficiency or breathing capacity of the engine is greatly increased for any given port size.

It will be understood that this particular embodiment of the invention has been used for illustrative purposes only, and that various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

I claim as my invention:

1. In an internal combustion engine, including a cylinder block, a cylinder head mounted on said cylinder block, a combustion chamber formed in said cylinder block and said cylinder head having an inlet and an outlet, a spark plug mounted in said cylinder head having its gapped end portion in communication with the interior of said combustion chamber, a plurality of cooperating horizontally movable valve members for controlling gaseous flow through said inlet and said outlet, means operatively connected with the operating parts of the engine for simultaneously oscillatory movement to control communication through either said inlet or said outlet with said combustion chamber, and then repeating said simultaneous oscillatory movement in inverse order to control communication through the other of said ports, wherein at least one of said valve members covers and protects the gapped end portion of said spark plug during both the inlet and exhaust strokes.

2. In an internal combustion engine including a combustion chamber, an inlet port and an exhaust port opening into said combustion chamber, an igniting device periodically communicable with the interior of said combination chamber, a plurality of cooperating horizontally movable valve members for controlling gaseous flow through said inlet port and said outlet port, means operatively connected with the operating parts of the engine for simultaneously oscillating said valve members to control gaseous flow through said inlet and outlet ports wherein one of said valve members is arranged to cover and protect said igniting device from the atmosphere within said combustion chamber wherein one of said ports is in communication with said combustion chamber.

3. In an internal combustion engine including a cylinder block and a cylinder head mounted on said block, a combustion chamber formed within said cylinder block and head having inlet and exhaust ports opening thereinto through one wall thereof, a spark plug mounted within said one wall of said combustion chamber having its gapped end communicable with the interior of said combustion chamber, the improvement of means for controlling gaseous flow through said ports and for selectively covering the gapped end of said spark plug comprising a plurality of rotatable shafts journaled within said one wall of said combustion chamber, a plurality of valve members connected to said shafts for rotatable movement therewith slidably engageable with said one wall of said chamber and cooperate with said ports to control fluid flow therethrough, and means for oscillating said shafts in timed relation with respect to one another to alternately open and close said ports, the several parts herein recited being so arranged that the gapped end of said spark plug is covered by one of said valve members whenever one of said ports is uncovered and being so constructed that the total chamber wall engaging area of said valve members is only slightly greater than the total area of said ports.

4. In an internal combustion engine including a cylinder block and a cylinder head mounted on said block, a combustion chamber formed within said cylinder block having a port wall defining one end thereof, inlet and exhaust ports opening to said chamber through said port wall, a spark plug mounted within said port wall having its gapped end communicable with the interior of said combustion chamber, the improvement of means for controlling gaseous flow through said ports and for selectively covering the gapped end of said spark plug comprising a plurality of movable valve members slidably engageable with said port wall and cooperate with said ports to control fluid flow therethrough, and means for oscillating said valve members in timed relation with respect to one another to alternately open and close said ports, the several parts herein recited being so arranged that the gapped end of said spark plug is covered by one of said valve members whenever one of said ports is uncovered and being so constructed that the total port wall engaging area of said valve members is only slightly greater than the total area of said ports.

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