

Nov. 27, 1928.

1,693,484

H. M. JOHNSON

ROTARY VALVE

Filed Feb. 24, 1927

4 Sheets-Sheet 1

Fig. 1.

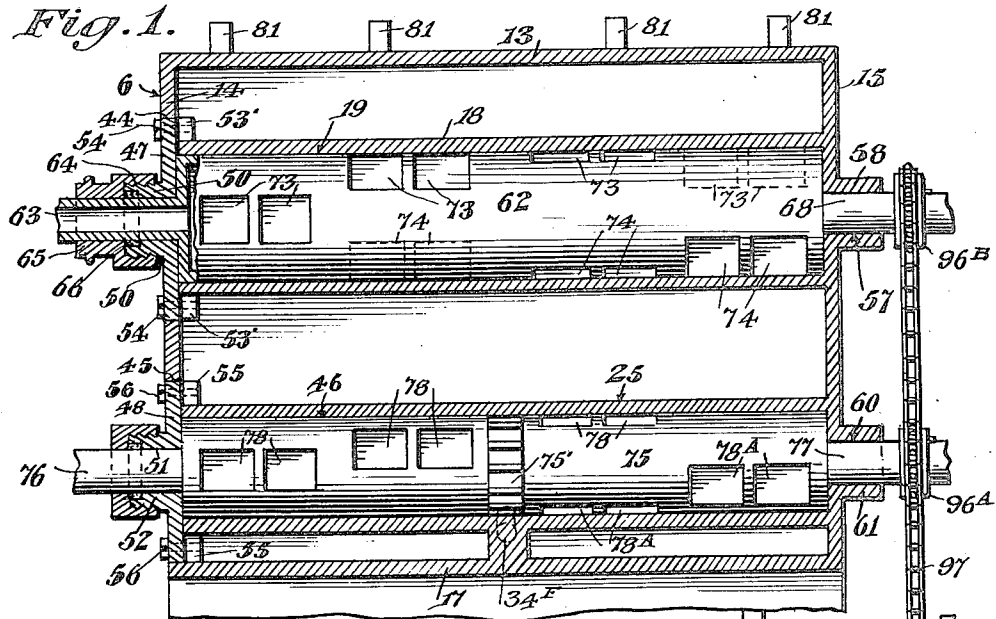
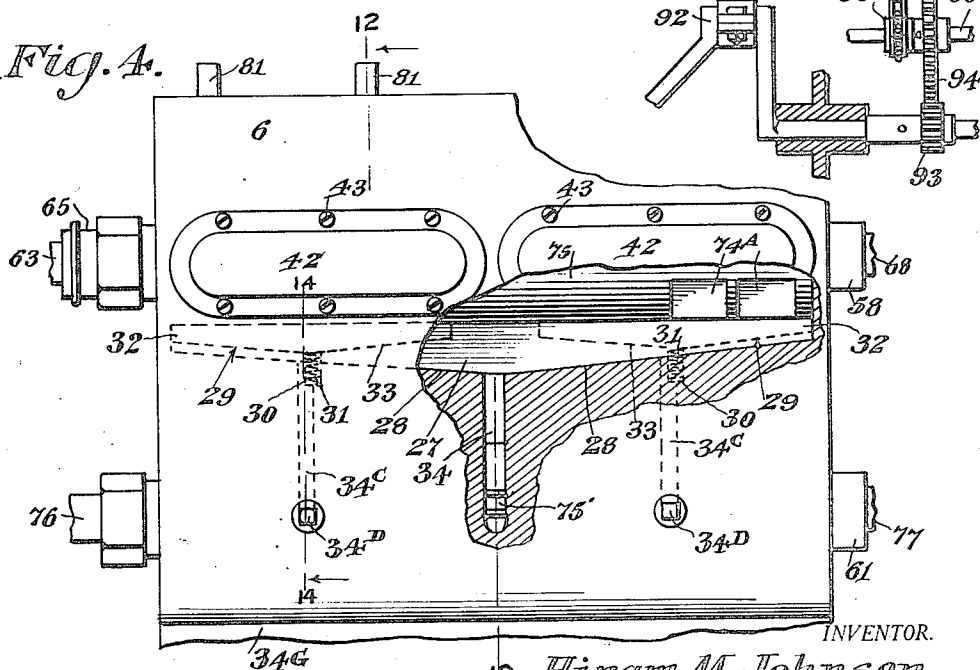


Fig. 4.



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Fig. 2.

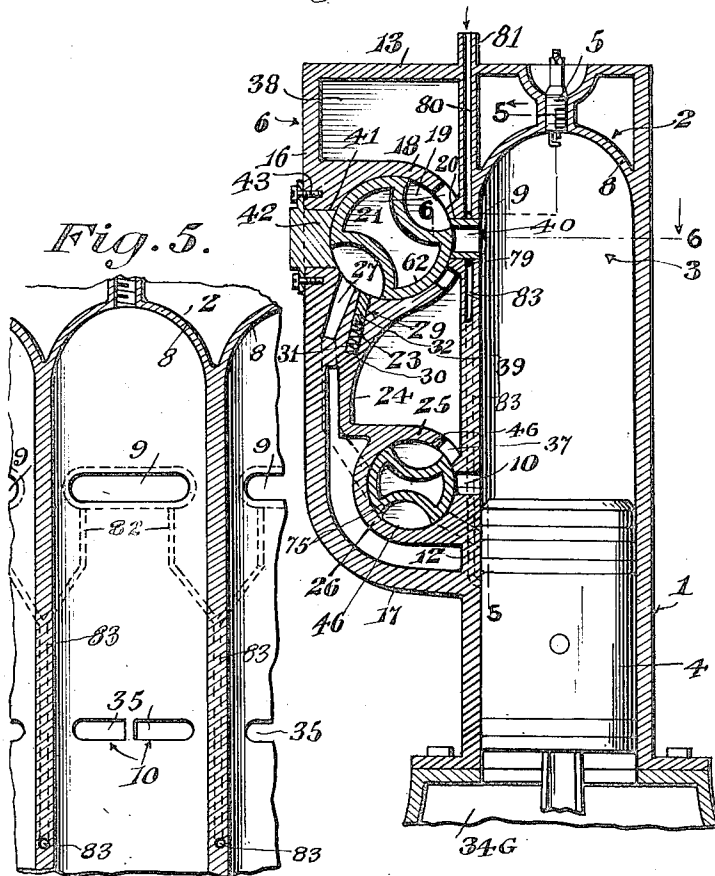


Fig. 5.

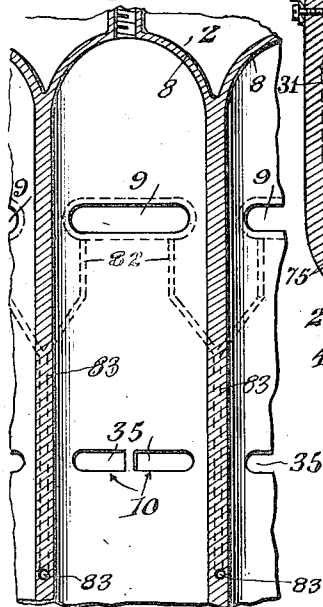


Fig. 6.

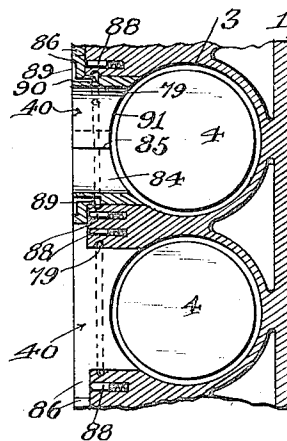


Fig. 9.

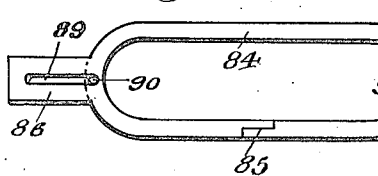
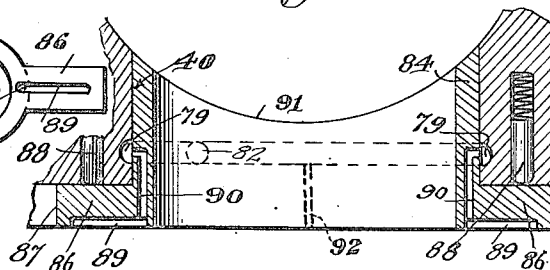


Fig. 10.



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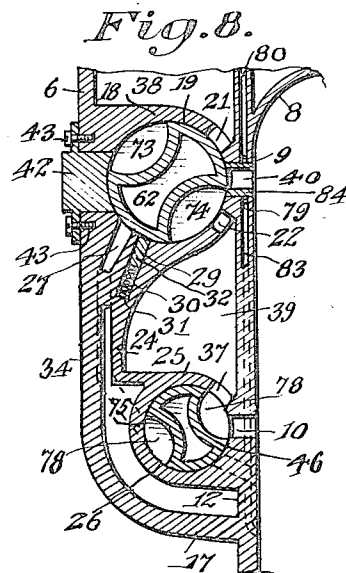
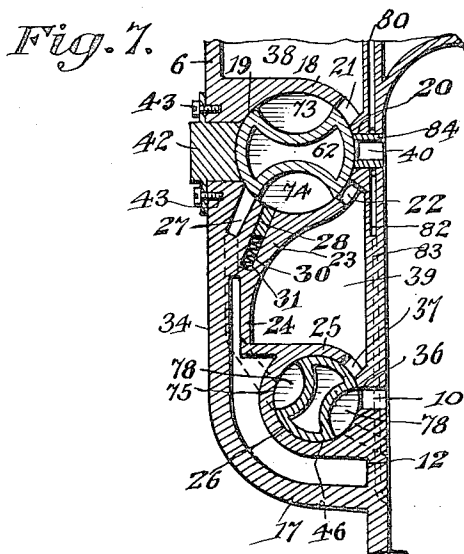
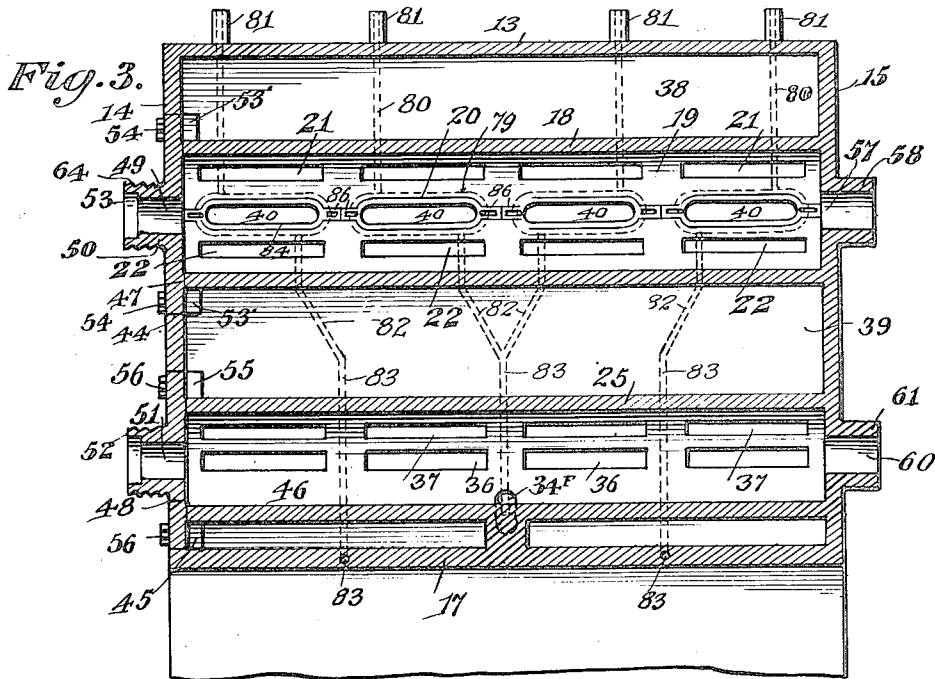
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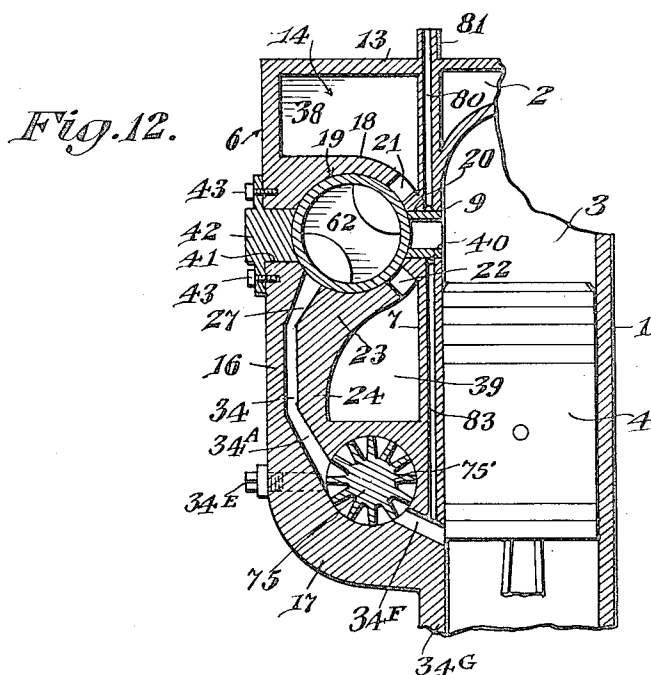


Fig. 11.

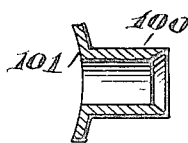


Fig. 13.

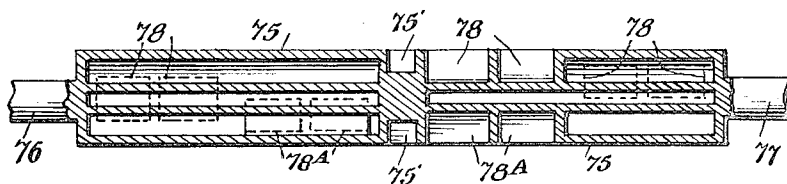
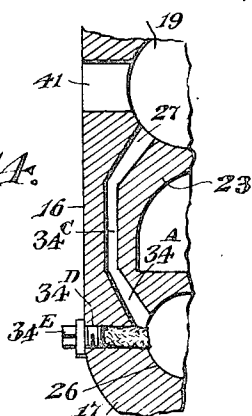


Fig. 14.



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ROTARY VALVE.

Application filed February 24, 1927. Serial No. 170,665.

This invention relates to a rotary valve mechanism for internal combustion engines and has for its object to provide, in a manner hereafter set forth, an engine with a single port in the head of the cylinder which performs the functions both of intake and exhaust, and which is opened and closed by a primary rotor or rotating member having depressions in its surface which act as communicating passageways between this port and the intake and exhaust manifolds respectively. In this port, which may be called the primary port, is placed a sealing ring for the purpose of more perfectly sealing the cylinder during the compression and firing strokes.

A further object of the invention is to provide, in a manner hereafter set forth, an auxiliary exhaust port placed at the bottom of the combustion chamber, and operated by an auxiliary rotor or rotating member and which port functions only on the exhaust stroke.

A further object is to provide, in a manner hereafter set forth, a rotary valve mechanism for internal combustion engines wherein the exhaust gases will be discharged from the cylinder at two points thereby lessening the amount of heat going through the primary port which contains the sealing ring, and providing a quicker and more complete scavenging of the burned gases than is provided by the mechanisms now generally employed.

A further object of the invention is to provide, in a manner hereafter set forth, an internal combustion engine including a valve mechanism and a lubricating mechanism therefor.

A further object of the invention is to provide, in a manner hereafter set forth, a rotary valve mechanism for internal combustion engines including a sealing ring associated with the primary or combined intake and exhaust port at the head of the cylinder, and means for decreasing the amount of heat passing through such port whereby the life of such ring will be prolonged, and at the same time providing for the burned gases to be more quickly discharged from the cylinder.

A further object of the invention is to provide, in a manner set forth, a rotary valve mechanism for an internal combustion engine, and a lubricating mechanism therefor by means of which any excess lubrication that may by chance get onto the rotor may be removed and returned to the crankcase, and fur-

ther whereby the lubricating mechanism will provide a seal for the valve structure during the intake stroke, as will hereinafter be described.

A further object of the invention is to provide, in a manner hereinafter set forth, an internal combustion engine including a rotary valve mechanism and a lubricating mechanism, and which is simple in construction and arrangement, strong, durable, compact, thoroughly efficient in use, and comparatively inexpensive to set up.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as hereinafter more specifically described, and illustrated in the accompanying drawings wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which fall within the scope of the claims hereunto appended.

In the drawings wherein like reference characters denote corresponding parts throughout the several views:

Figure 1 is a sectional elevation of a rotary valve mechanism for internal combustion engines in accordance with this invention.

Figure 2 is a fragmentary view, in vertical section of an engine, showing the adaptation therewith of a valve structure and lubricating means in accordance with this invention.

Figure 3 is a longitudinal sectional view of the valve housing.

Figure 4 is a fragmentary side elevation of the housing.

Figure 5 is a section on line 5—5 Figure 2.

Figure 6 is a section on line 6—6 Figure 2.

Figure 7 is a vertical sectional view of the rotary valve mechanism showing the position thereof at the moment of firing.

Figure 8 is a vertical sectional view of the valve mechanism showing the position thereof with the auxiliary valve open and the primary valve beginning to open, on the exhaust stroke.

Figure 9 is an elevation of the sealing ring.

Figure 10 is a sectional plan illustrating the position of the sealing ring in the primary port.

Figure 11 is a vertical transverse section of a modified form of sealing ring for high compression engines.

Figure 12 is a section on line 12—12 Figure 4.

Figure 13 is a view of the auxiliary rotor showing cog-wheel-like middle section of same

Figure 14 is a vertical section of same on line 14—14, Figure 4.

The rotary valve mechanism is illustrated by way of example, in connection with a four cylinder engine, but it is to be understood that the rotors or valves of the mechanism can be extended or shortened so as to enable the mechanism to be used with an engine having a greater or smaller number of cylinders.

The body portion of the engine is indicated generally by the reference character 1, the cylinder by the reference character 2 and the combustion chambers generally by the reference character 3. The piston in the combustion chamber 3 is indicated at 4. The spark plug at the head of the combustion chamber 3 is indicated at 5. Projecting from one side of the body portion 1, is the housing 6 of the mechanism and said housing may be connected to or formed integral with the body portion 1 of the engine, as illustrated.

The wall of each chamber 3 near the head thereof is formed with a port 9 of oval contour, and said port 9 is what may be termed an upper combined intake and exhaust port. The port 9 communicates with the rotor chamber 19. In the wall of each chamber 3, and positioned an appropriate distance below the port 9 is an auxiliary exhaust port 10, which communicates with the auxiliary rotor chamber 46. In operation the port 10 opens in advance of the port 9 and closes as port 9 becomes fully opened.

The side of the body portion 1 with which the housing 6 is formed integral is indicated at 12.

The housing 6 includes a top wall 13, a pair of end walls 14, 15, an outer side wall 16, and a bottom 17. The walls 13, 14, 15 and 17 are integral with the side 12 of the body portion 1. The walls of the housing are formed integral with each other. The inner side wall of the housing 6 is formed by the side 12 of the body portion 1. The top wall 13 is positioned a substantial distance above the port 9 and the bottom wall 17 is arranged a substantial distance below the port 10.

Arranged within the housing 6 and formed integral with the inner face of the end wall 15, inner face of the outer side wall 16 and side 12 of the body portion 1, is a lengthwise extending tubular member 18, which forms a rotor chamber 19. The member 18 is provided with openings 20 which correspond in number with the number of ports 9. Each port 9 registers with an opening 20. The member 18 above the openings 20 is formed with a series of spaced lengthwise extending rectangular intake openings 21 which correspond in number to the number of combustion chambers 3. The member 18 below the openings 20 is formed with a series of exhaust

outlet openings 22 which correspond in number with the number of chambers 3. The openings 21 and 22 are arranged in proximity to the openings 20.

Formed integral with the bottom of the member 18, inner face of the outer side wall 16 and inner face of the end wall 15 is a depending partition member 23, which terminates in an angle shaped web 24, and the latter merges into a lengthwise extending tubular member 26 of less diameter than the member 18. The web 24 is spaced from the inner face of the outer side wall 16.

Arranged within the housing 6 and opening into the chamber 19 is a V-shaped lubricant trapping recess 27, which extends through the body of the tubular member 18, through the partition 23 and into the wall 16, and which extends from one end wall to the other end wall of the housing. The recess 27 is in the form of a groove with the side walls diverging, and the middle portion of the groove is bridged by that portion of the member 18 forming the middle bearing of the rotor 62. Extending from this middle portion of the groove 27, and leading downwardly is a channel 34, which terminates in the rotor chamber 46, as shown at 34^A Figure 13. Also on either side of the channel 34 and leading downwardly from the groove 27, and positioned about midway between the channel 34 and each end of the groove 27, is an oil channel 34^C, which terminates in a pocket 34^D. The purpose of each pocket 34^D is to receive an oil wick which supplies oil to the auxiliary rotor 75. Each pocket 34^D is closed by the threaded plug 34^E. The channels 34^C are formed in the outer side wall 16 of the housing. Leading from the rotor chamber 46, at a point opposite the opening 34^A, is a channel 34^F which opens into the crankcase 34^G.

Arranged within the housing 6 are two lengthwise extending pockets 29, positioned inwardly with respect to the recess 27 and which open into the chamber 19. Opening into each of the pockets 29 is a socket 30, in which is arranged a coiled controlling spring 31 for a scraper member 32 mounted in the pocket 29. The function of each scraper member 32 is to scrape the oil from the primary rotor 62, into the recess 27, from which it will be conducted by channels 34 and 34^F into the crankcase.

When the auxiliary rotor 75 is in position in the chamber 46, the cog-wheel-like middle portion 75' thereof lies between the channels 34 and 34^F, and operating as a gear pump, draws the oil out of channel 34 into the mesh of its teeth and discharges it into the channel 34^F. This cog like mechanism at the same time provides a seal so that the oil in channels 34 and 34^F cannot be drawn backward, upward and around the outer side of the primary rotor 62 during the intake stroke.

The scraper members 32 are held in contact with the rotor 62 by the coiled springs 31, and extends from the middle bearing of the rotor to the end bearing thereof, and in addition to their function as oil scrapers, they perform the function of sealing the exhaust channel so that exhaust gases cannot pass around the outer side of rotor 62 back into the intake passageways.

The sealing rings 40 mounted in the ports 9 perform the function, by the juxtaposition of their ends forming a seal from the middle bearing to the end bearing, of preventing the exhaust gases in the exhaust channel from passing upward by the inner side of the rotor 62 into the intake passages during the intake stroke.

That part of the housing 6 above the member 18 forms a passage 38 which leads from the intake manifold and communicates with the openings 20. That part of the housing 6 between the web 24 and the wall 12, and between the members 18 and 25 provides an exhaust passage 39 which leads to the exhaust manifold of the engine. The openings 37 are adapted to communicate with this passage-way 39.

The end wall 14 is formed with a pair of openings 44, 45, Figure 3, and the former permits of access being had to the chamber 19, and the latter permits of access being had to the chamber 46. The openings 44 and 45 are normally closed by removable plates 47, 48 respectively. The plate 47 is formed with an opening 49 and a collar 50 on its outer face which registers with the opening 49, and which is countersunk as at 53. The plate 48 is formed with an opening 51 which registers with a collar 52 projecting from the outer face of said plate 48, and which collar is also countersunk.

The tubular member 18 at that end which opposes the end wall 14, is provided with apertured bosses 53', with which are engaged hold-fast devices 54, extending through the plate 47 for securing the latter in position.

The tubular member 26 at that end which opposes the end wall 14 is provided with apertured bosses 55 which are engaged by hold-fast devices extending through the plates 48 for securing the latter in position. The plate 48 has a countersunk projecting collar 52.

The end wall 15, at a point opposite the opening 49 in the end wall 14, is provided with an opening 57 which registers with a collar 58 formed integral with the outer face of the end wall 15. The end wall 15 at a point opposite the opening 51 formed in the end wall 14, is provided with an opening 60 which registers with a collar 61 formed integral with the outer face of the end wall 15.

Mounted in each port 9 is a sealing ring referred to generally by the reference character 40, and which will be hereinafter more specifically described.

The outer side wall 16 of the housing 6 is provided with openings 41 normally closed by removable plugs 42. The openings 41 are provided so that access may be had to the chamber 19 as well as to the sealing rings 40. The plugs 42 are detachably secured in position by the holdfast devices 43.

Each of the ports 10 is bridged at the center, as indicated at 35 Figure 5, and registers with an opening 36 formed in the tubular member 26, and the latter above and in proximity to the opening 36 is formed with a series of spaced outlets 37.

Arranged within the chamber 19 is a hollow tubular primary rotor or valve 62 provided with hollow spindles 63 and 68, Figure 1, and which communicate with the interior of the body of the rotor. The spindle 63 is journaled in the collar 50. A packing collar 64, retains a packing 66 in place, and provides a means of attaching a water hose. The spindle 68 is journaled in the collar 58. The spindle 68 has attached to it a sprocket pinion 96^A, and distal to that the distributor gear 99 which operates a distributor not shown. Beyond the distributor gear 99 the spindle 68 is journaled in a sleeve in the gear housing, not shown, and which is provided with a packing collar similar to the collar 64.

The rotor 62 has disposed circumferentially of its periphery a series of pairs of depressions 73, 74 and which are so arranged that one pair of depressions will be diametrically opposed to another pair of depressions. Two pairs of depressions associate with each combustion chamber 3. Each pair of depressions 73 is diametrically opposed to a pair of depressions 74. A pair of depressions 73 or 74 is employed for establishing communication between the intake and the port 9, and between the exhaust passage 39 and the port 9. The pairs of depressions 73 are arranged out of alinement and the pairs of depressions 74 are arranged out of alinement.

As seen from in front of the engine the rotor 62 rotates in a counter clock-wise direction and at one fourth crankshaft speed. It has pressure lubrication supplied to its two end bearings and to its middle bearing through appropriate oil channels.

Arranged within the chamber 46 is a hollow cylindrical auxiliary rotor or exhaust valve 75, very similar in design to the primary rotor 62, and having disposed circumferentially of its periphery a series of pairs of depressions 78, 78^A and which are so arranged that one pair of depressions will be diametrically opposed to another pair. The pairs of depressions associate with each of the combustion chambers 3. Each pair of depressions 78 is diametrically opposed to a pair of depressions 78^A. The pairs of depressions are arranged out of alinement, and a pair of depressions 78 or 78^A is employed for establishing communication between the ex-

haust passage 39 and the port 10. The auxiliary rotor is provided at each end with a spindle indicated at 76, 77. The spindles are journaled in appropriate bearings and have provisions for packing so that water may be circulated through the rotors while they are in rotation.

Also in the wall of the chamber 46, between the port 10 and the passageway 37 there is a lengthwise extending pocket and in which is positioned a sealing bar which has beneath it a tension spring, not shown, the purpose of which is to hold the sealing bar snugly against the rotor. The purpose of the sealing bar is to seal the exhaust passage so that the exhaust gases cannot flow back through port 10 during the intake stroke. It also has the purpose of scraping off any oil or carbon that might accumulate on the rotor 75.

The wall of each port 9 is formed with a continuous groove 79 which is closed by a sealing ring 40. Leading to each groove 79 is a lubricant supply channel 80 which is formed in the side 12 of the body portion 1, and the latter is formed with nipples 81 adapted to be connected by suitable pipes to the oil pump, not shown. The nipples 81 open into the channels 80. Extending from the grooves 79 are lubricant conducting channels 82, which open into channels 83 discharging into the crankcase.

The sealing ring 40 which is shown in an enlarged view in Figures 9 and 10 is a salient part of this invention. The body portion 84 may be solid or it may be split as indicated at 85 and the edges thereof overlap making it expansible to snugly engage the walls of the port 9. One end of the body portion 84 is formed with a pair of oppositely extending lugs 86 which seat in the wall of the rotor chamber, as pockets 87 are provided in the latter for such purpose. The lugs 86 bear against spring controlled plungers 88 for maintaining the sealing ring 40 in contact with the rotor during the rotation thereof. The outer faces of the lugs 86 are formed with grooves 89 which open into short channels 90 provided in the body portion 84. The channels 90 communicate with the groove 79 whereby lubricant is conducted to the groove 89 and to the surface of the rotor. The other end of the body portion 84, as indicated at 91. In the middle section of the lower wall of the port 9 and extending from the groove 79 to the chamber 19 is a very small groove 92, shown in Figure 10, which is converted into an oil channel when the sealing ring is in position. This groove 92 supplies oil to that portion of the rotor constituting the bridges between the pairs of depressions on the rotor 62.

Figure 11 shows a cross section of a modification of the sealing ring 100 for high compression engines. In this form the face 101 thereof presents more bearing surface to the

rotor whereby the amount of wear due to the higher compression will be reduced.

The crankshaft 92 of the engine is provided with a gear 93, and the latter is employed to drive a larger gear 94 which is keyed onto the countershaft 95. The ratio of speed between these two gears is one to four. On the countershaft 95 is a sprocket pinion 96, which operates a chain 97 which in turn drives the two rotors cynchronously by means of two sprocket pinions 96^A and 96^B.

Figure 2 illustrates the position of the rotors at the end to the intake stroke. Figure 7 illustrates the position of the rotors at the moment of firing, and Figure 8 illustrates the position of the rotors when the piston is on lower center at the beginning of the exhaust stroke. It will be seen that the auxiliary exhaust port 10 opens a little in advance of the upper exhaust port 9, thus allowing a considerable portion of the heat to escape at the port 10 whereby the sealing ring in the upper port 9 is subjected to less heat.

The function of the narrow bridge between the pairs of depressions, as illustrated in Figure 1, is to make it impossible for the sealing ring to catch on the edge of the depressions during the operation of the rotor. In like manner it prevents the scraping bars from catching on the edges of the depressions in both rotors. The bridging of the port 10 as at 35 prevents the piston rings from catching or binding against the edges of the port.

The depressions are formed in the periphery of the rotor 62 in pairs placed diametrically opposite each other, so that the pairs operate alternately to open the port 9 of the cylinder to exhaust and intake manifolds. The pairs of depressions are positioned in a circumferential manner on the rotor so as to provide for a proper timing of the valve.

The function of the auxiliary rotor in connection with port 10 opening 37 and passage 39 is to provide a passageway for a portion of the exhaust gases to escape from the cylinder without going through the port 9, thus lessening the amount of heat to which the sealing ring is exposed. The remaining gases left in the cylinder after the piston on its upward travel has closed the auxiliary port 10 are of course expelled through the port 9 and into the exhaust manifold. Both of the ports 9 and 10 act on the exhaust stroke to allow for a free scavenging of the burned gases. The employment of the auxiliary rotor will greatly facilitate the expulsion of the burned gases from the cylinder and as the amount of heat going through the port 9 which contains the sealing ring is materially reduced, the result is that the expansion ring will retain its expansive properties for a longer time.

It is thought the many advantages of a rotary valve mechanism in internal combustion engines in accordance with this inven-

tion can be readily understood, and although the preferred embodiment of the invention is as illustrated and described, yet it is to be understood that changes in the details of construction can be had which fall within the scope of the invention as claimed.

What I claim is:

1. A rotary valve mechanism for internal combustion engines including rotors, primary and exhaust ports controlled by the rotors, sealing rings for the primary ports, a lubricating mechanism formed with channels and grooves whereby oil is conducted to, around, and from the sealing rings and rotors, and means whereby the excess oil on the rotors is removed and returned to the crankcase, said means also providing a seal of the intake passageways on the intake stroke, and preventing the exhaust gases in the exhaust manifold from being forced by back pressure into the intake passageways.

2. In a rotary valve mechanism for internal combustion engines, the combination with an engine cylinder provided with a main and an auxiliary exhaust port both leading to the exhaust manifold of the engine, and with the main port arranged forwardly of the auxiliary port, of a pair of synchronously revoluble rotors, one solely coacting with and controlling the opening and closing of the main port and the other solely coacting with and controlling the opening and closing of the auxiliary port, that rotor associated with the auxiliary port having means for establishing communication between such port and the exhaust manifold of the engine, and the other having means for establishing communication between the main port and the exhaust and intake manifolds of the engine.

3. In an exhaust mechanism for internal combustion engines the combination with the engine cylinder provided with a main and auxiliary exhaust ports both leading to the exhaust manifold of the engine and with the main port leading from the exhaust manifold of the engine and arranged in advance of the auxiliary port, a sealing ring mounted in that main port, of a main and an auxiliary rotor, said rotors revolving synchronously, said main rotor coacting with and controlling the opening and closing of said main port and having means for establishing communication between said main port and the intake and exhaust manifolds of the engine, and

said auxiliary rotor coacting with and controlling the opening and closing of said auxiliary port and having means for establishing communication between the auxiliary port and the exhaust manifold of the engine.

4. In internal combustion engines a structure including a piston chamber and a primary rotor chamber for communication with the intake and exhaust manifolds of an engine, a port for establishing communication between said chambers and common to intake and exhaust with respect to the piston chamber, said structure further including an exhaust port leading from the piston chamber, an auxiliary rotor chamber for communication with the exhaust manifold of the engine and in which said exhaust port opens, a primary rotor in said primary rotor chamber for controlling said port common to intake and exhaust, an auxiliary rotor in said auxiliary chamber for controlling said exhaust port and operating in advance with respect to the primary rotor, and an expansible sealing ring mounted in the port common to intake and exhaust and forming a part of the wall of said primary rotor chamber and said piston chamber.

5. In internal combustion engines constructed in accordance with claim 4, said structure including channels and grooves for conducting lubricant to and from said port opening into the primary rotor chamber, ring and the said primary rotor chamber and for conducting lubricant from such port, ring and primary chamber to the crank case of the engine.

6. In internal combustion engines a structure including a piston chamber and a pair of parallel rotor chambers, said structure further including a port for establishing communication between said rotor chamber and said piston chamber, one of said ports being common to intake and exhaust and the other for exhaust, a rotor within one of said rotor chambers and provided with means for controlling that port common to intake and exhaust, a rotor within the other rotor chamber for controlling the port with which it associates for exhaust, and an expansible sealing ring mounted in that port common to intake and exhaust.

In testimony whereof, I affix my signature hereto.

HIRAM M. JOHNSON.