Nov. 10, 1931. H. M. JONES 1,830,796

INTERNAL COMBUSTION ENGINE

Filed April 7, 1930 2 Sheets-Sheet 1

Fig. 1.

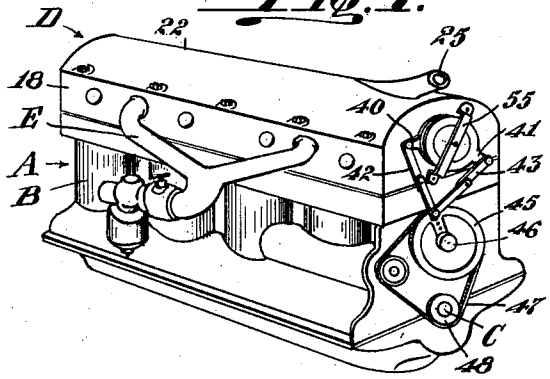


Fig. 2.

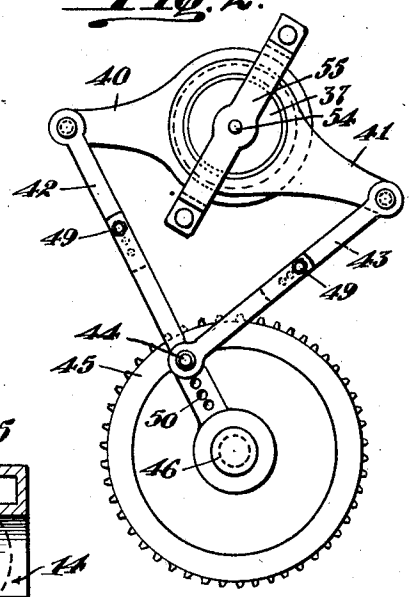


Fig. 3.

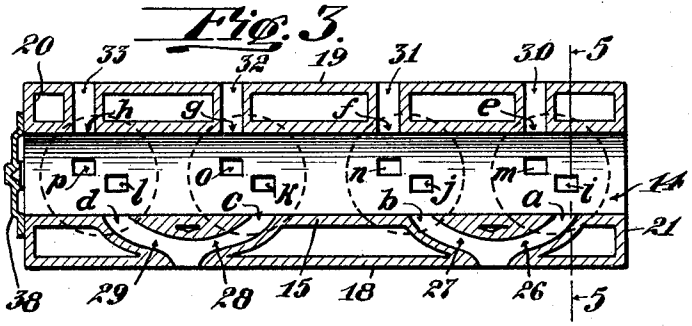


Fig. 4.

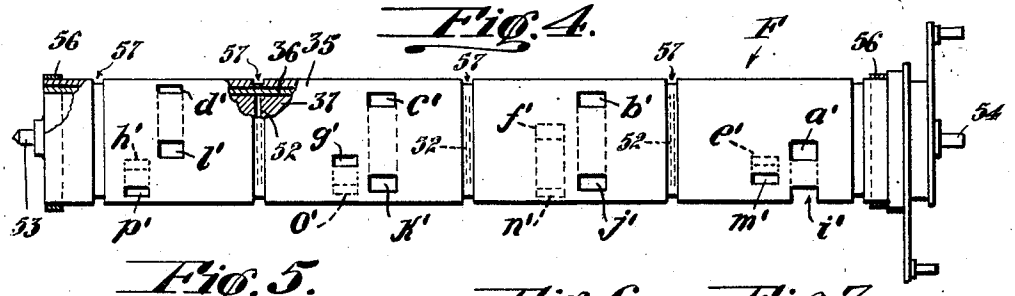


Fig. 5.

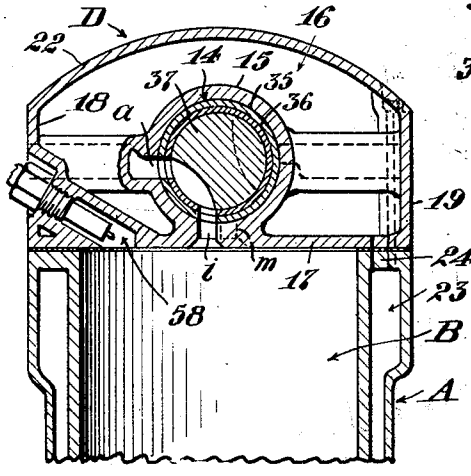


Fig. 6.

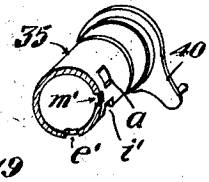


Fig. 7.

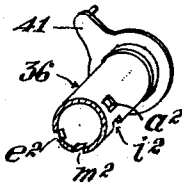
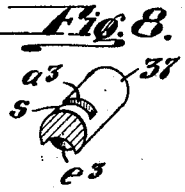


Fig. 8.



Inventor
Herman M. Jones.
By R. S. Burry
Atty.

Nov. 10, 1931. H. M. JONES 1,830,796

INTERNAL COMBUSTION ENGINE

Filed April 7, 1930 2 Sheets-Sheet 2

Fig. 9.

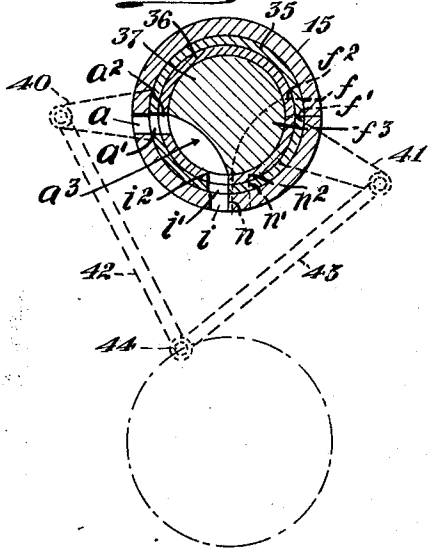


Fig. 10.

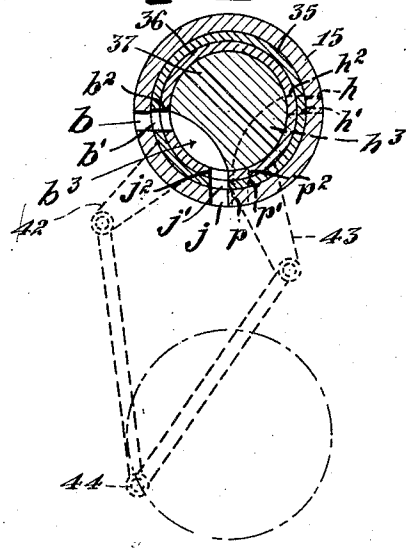


Fig. 11.

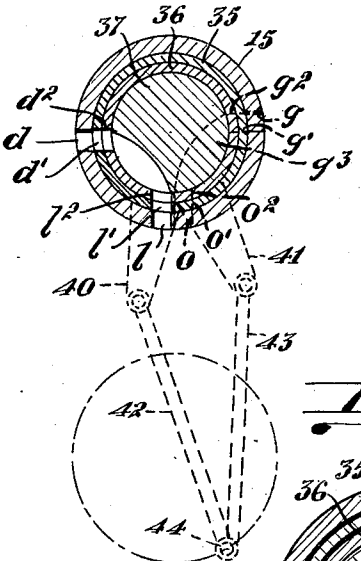


Fig. 12.

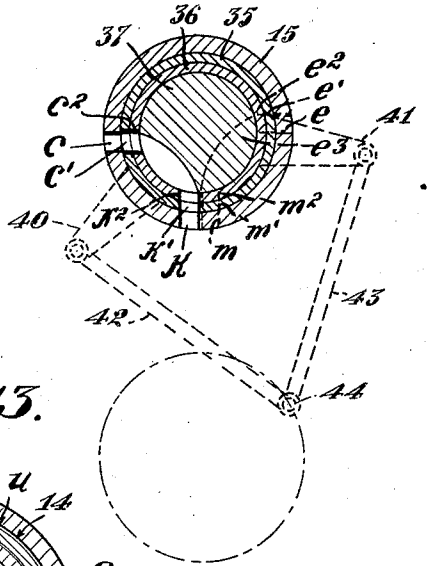
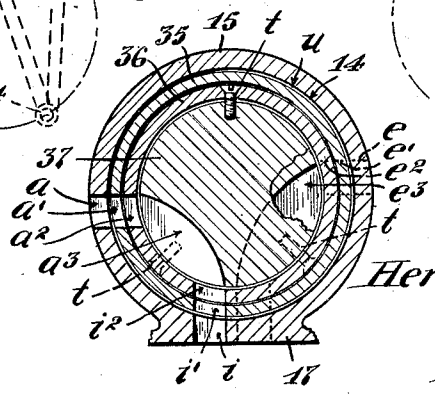


Fig. 13.



Inventor
Herman M. Jones.
By R. S. Bumf
Atty.

Patented Nov. 10, 1931

1,830,796

UNITED STATES PATENT OFFICE

HERMAN M. JONES, OF ALTADENA, CALIFORNIA

INTERNAL COMBUSTION ENGINE

Application filed April 7, 1930. Serial No. 442,079.

This invention relates to an internal combustion engine and particularly pertains to a valve mechanism for controlling the intake and exhaust ports thereof.

An object of the invention is to provide an engine valve and a means for actuating same so constructed and arranged as to render the valve noiseless in operation, which is highly durable, which may be readily installed, which is easily accessible and which will render regrinding of the valve surfaces unnecessary.

Another object is to provide an engine valve embodying a pair of telescoping sleeve valves mounted for relative turnable movement which are so arranged as to be rendered self-seating and self-packing under varying conditions of expansion and contraction.

Another object is to provide an engine valve which is so formed as to eliminate use of cam shaft and similar timing mechanism and in which the employment of springs is avoided.

Another object is to provide a valve for internal combustion engines which is adapted to be operated with a positive movement by a rocker arm arrangement, and which is adapted to be mounted in an engine head and to be so designed as to render it applicable for use on internal combustion engines of the various types now generally in use.

Another object is to provide a valve for internal combustion engines and a means for operating same which is of such character as to obviate any possibility of sticking of the valve.

Another object is to provide a valve arrangement for internal combustion engines which will permit of adequate temperature control of the valve by circulation of a cooling medium around the valve housing.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention resides in the parts and in the combination, construction and arrangement of parts hereinafter described and claimed and illustrated by way of example in the accompanying drawings, in which:—

Fig. 1 is a perspective view of an internal combustion engine showing the invention as applied;

Fig. 2 is an end elevation of the valve-operating gear;

Fig. 3 is a horizontal section and plan view of the engine head showing the valve chamber with its communicating ports;

Fig. 4 is a plan view of the valve with parts broken away;

Fig. 5 is a view of the engine head as seen in section taken on the line 5—5 of Fig. 3 with the valve in place;

Fig. 6 is a detail in perspective of the fragmentary portion of the outer sleeve valve member;

Fig. 7 is a perspective view of a fragmentary portion of the inner sleeve valve member;

Fig. 8 is a perspective view of a fragmentary portion of core member positioned within the inner sleeve valve member;

Figs. 9, 10, 11 and 12 are diagrams illustrating the mode of operation of the invention;

Fig. 13 is an enlarged detail in cross section of the valve and its housing.

Referring to the drawings more specifically, A indicates the block of an internal combustion engine, which is formed with any suitable number of engine cylinders B, being here shown as a four cylinder engine; the cylinders being fitted with pistons connecting with a crank-shaft C in the usual manner.

Mounted on the cylinder block A is a head D which, in carrying out the present invention, is formed with a longitudinally extending bore 14 of equal diameter throughout and opening at the opposite ends of the head. The bore 14 is encompassed by a wall 15 which is partly surrounded by a space 16 constituting a water jacket, and which space is enclosed by the outer walls of the head comprising a bottom wall 17, side walls 18 and 19, end walls 20 and 21, and a top wall 22. The head D is positioned on the cylinder block with the bottom wall 17 thereof extending over the open upper ends of the cylinders to form a top wall therefor and with the water jacket space 16 communicating with water jacket 23 in the en-

gine block, through openings 24, in the usual manner; the head being fitted with a water outlet 25 for connection with a water circulation cooling system as is common in engines of this character. The wall 15 surrounding the bore 14 connects at its lower portion with the bottom wall 17 of the head and has its ends connecting with the end walls 20 and 21 of the latter; the wall 15 being thus nearly surrounded by the water jacket.

Leading to the bore 14 from the exterior of one side of the head D are intake passages 26, 27, 28 and 29 which connect at their outer ends with an intake manifold E and which open at their inner ends to one side of the bore 14 through intake ports *a*, *b*, *c* and *d*; and leading from the opposite side of the bore 14 are exhaust portions *e*, *f*, *g* and *h* which open to exhaust passages 30, 31, 32 and 33 leading through the side wall 19 for connecting with the usual exhaust pipe. The intake ports and exhaust ports are disposed in offset relation longitudinally of the bore 14 and are obviously in spaced relation circumferentially thereof.

Leading from the lower portion of the bore and opening through the bottom wall 17 of the head to the engine cylinders is a series of intake ports *i*, *j*, *k* and *l*, and a series of exhaust ports *m*, *n*, *o* and *p*; the intake ports *i*, *j*, *k* and *l* being disposed in circumferential alignment with the intake ports *a*, *b*, *c*, and *d*, and the exhaust ports *m*, *n*, *o*, and *p* being disposed in circumferential alignment with the exhaust ports *e*, *f*, *g* and *h*.

Mounted for oscillatory movement in the bore 14 and encompassed by the wall 15 which constitutes a valve housing is a cylindrical valve F which embodies an outer sleeve valve 35, an inner sleeve valve 36 arranged within the sleeve valve 35, and a core 37 fixed within the sleeve valve 36; the valve F extending throughout the length of the bore 14 with its rear end bearing on an end plate 38 extending over the rear end of the bore 14, and with its forward end projecting from the front end of the bore.

The outer sleeve valve 35 has an outer diameter slightly smaller than the diameter of the bore 14 to provide a clearance space sufficient to allow for diametrical and circumferential expansion of the valve relatively to the bore wall 15; and the inner sleeve valve 36 is of an external diameter such as to space said valve 36 out of contact with the inner periphery of the encompassing sleeve valve 35. The sleeve valve 36 extends throughout the length of the sleeve valve 35 and projects beyond the outer end thereof, and fixed on the outer ends of the sleeve valves 35 and 36 are arms 40 and 41 respectively to which are pivotally connected links 42 and 43 leading to a wrist pin 44 on a sprocket wheel 45 revolubly carried on a stub shaft 46 on the forward end of the engine block and which sprocket wheel is driven from the crank shaft C through a sprocket chain 47 passing around a sprocket wheel 48 on the crank shaft; the sprocket wheel 45 serving as a speed reduction gear.

The links 42 and 43 may be formed for longitudinal adjustment as by constructing them of two overlapped sections adapted to be disposed in various lengthwise positions relatively to each other and secured together to afford the desired length by fasteners 49. The wrist pin 44 may be disposed on the sprocket wheel 45 in various spaced relations to the axis of the wheel as by engaging the wrist pin with any one of a number of holes 50 formed in the wheel spaced at various distances from the center of the wheel. By varying the position of the wrist pin 44 on the wheel 45 the length of throw may be varied, and by varying the length of the links 42 and 43 the circumferential relation of the sleeve valves may be varied; these adjustments enabling adaptation of the valves and their operating connections to engines of various heights of cylinder blocks and also facilitates positioning of the valve F and its embodied sleeves in proper relation to the engine head ports.

It will now be seen that the arms 40—41, links 42—43 and wrist pin 44 constitute a double rocker arm transmission whereby rotation of the wheel 45 one revolution will act to impart an oscillatory movement of one reciprocation to each of the sleeve valves.

In carrying out the invention the outer sleeve valve 35 is formed with a series of ports *a'*, *b'*, *c'* and *d'* spaced apart longitudinally of the valve to lie in circumferential alignment with the ports *a*, *b*, *c* and *d*, and is also formed with a series of ports *i'*, *j'*, *k'* and *l'* arranged in circumferentially spaced relation to the ports *a'*, *b'*, *c'* and *d'* respectively, a distance apart equal to the distance between the intake ports *a*—*i*, *b*—*j*, *c*—*k*, *d*—*l* respectively.

These pairs of ports in the sleeve valve 35 are positioned in such circumferential relation to each other as to successively effect registration with companion pairs of intake ports in the engine head in an order according to the order of intake of the several engine cylinders, which in the arrangement here shown is in the first, second, fourth and third cylinders, this successive registering being effected during one reciprocation of the outer sleeve valve as will be hereinafter more fully described. The outer sleeve valve is also formed with a series of exhaust ports *m'*, *n'*, *o'* and *p'*, with companion circumferentially spaced exhaust ports *e'*, *f'*, *g'* and *h'*, which pairs of ports are arranged in circumferential alignment with the pairs of exhaust ports *m*—*e*, *n*—*f*, *o*—*g* and *p*—*h*, and are adapted to be moved during one recipro-

cation of the valve in and out of successive register with the pairs of exhaust ports in the engine head to effect exhaust of the second, fourth, third and first cylinders during the intake to the first, second, fourth and third cylinders in the order named.

The inner sleeve valve 36 is formed with a series of intake ports a^2, b^2, c^2, and d^2 arranged with ports a', b', c' and d' of the outer sleeve valve when the latter ports are in register with the intake ports a, b, c and d, and is also formed with ports i^2, j^2, k^2 and l^2 arranged to register with the ports i', j', k' and l' when the outer sleeve valve is positioned with the ports i', j', k' and l' in register with the ports i, j, k and l. In like manner the inner sleeve valve is formed with pairs of circumferentially aligned exhaust ports e^2—m^2, f^2—n^2, g^2—o^2 and h^2—p^2, arranged to register with the pairs of exhaust ports e'—m', f'—n', g'—o' and n'—p' formed in the outer sleeve valve 35 when said valve is positioned with its said exhaust ports in register with the exhaust ports e—m, f—n, g—o, and h—p of the engine head.

The core 37 consists of a series of sections or lengths of said cylinders which are disposed end for end in the inner sleeve valve 36 and are arranged with the ends of adjacent sections slightly spaced apart to afford expansion gaps as indicated at 52 in Fig. 4; there being a section of the core 37 provided for each set of the contiguous intake and exhaust ports of the valve F, and each section being rigidly affixed to the inner sleeve valve 36 to turn with the latter. By thus forming the core 37 in spaced sections they may expand longitudinally without distorting the encompassing sleeve valves. Each of the core sections is formed with transverse peripheral channels to form intake and exhaust passages connecting the circumferentially aligned ports of the several pairs of ports of the inner sleeve valve, there being intake passage a^3, b^3, c^3 and d^3 connecting the intake ports d^2 and i^2, b^2 and j^2, c^2 and k^2 and d^2 and l^2 respectively, and also exhaust passages e^3, f^3, g^3 and h^3 connecting the exhaust ports e^2 and m^2, f^2 and n^2, g^2 and o^2 and h^2 and p^2.

The intake and exhaust passages on each section of the core are spaced apart to form a partition therebetween as indicated at s in Fig. 8. The several sections of the core are each detachably mounted in the inner sleeve valve as by screws t as shown in Fig. 13.

The rear end of the core has a central tapered trunnion 53 which seats in a bearing socket on the end plate 38 and forms an end thrust bearing, and the front end of the core is formed with a trunnion 54 which seats in a strap bearing 55 on the front end of the engine head. The core, with the inner sleeve valve affixed thereto, is thus turnably supported on the plate 38 and bearing 55 through the medium of the trunnions. The outer sleeve valve is turnably supported in the bore 14 as by means of bearing rings 56 which are here shown as encompassing the end portions of the valve, and which rings are of such inside and outside diameters as to have a close sliding fit on the valve and also in the bore 14, and project beyond the outer periphery of the valve such distance as to support the latter within the bore in slightly spaced concentric relation to the peripheral surface of the bore to form an expansion clearance space U as before stated.

It has been found in practice that highly satisfactory results are obtained by providing in a valve F having a diameter of 2⅝", a .005 inch clearance between the core and inner sleeve valve, .01 inch clearance between the inner and outer sleeve valves, and .015 inch clearance between the outer sleeve valve and the walls of the bore 14. The provision of clearances between the core and inner sleeve valve, between the inner sleeve valve and outer sleeve valve, between the outer sleeve valve and its housing and between the ends of adjacent sections of the core, constitute an important feature of the invention, as by this means the valve is protected against binding as might occur by reason of its diametrical expansion and excessive elongation of the valve under expansion is obviated.

The outer sleeve valve 35 may be formed with circumferential ring grooves 57 as shown in Fig. 4 to receive packing rings, to minimize leakage of gases along the clearance space U, but it has been found in practice that such ring grooves are not necessarily essential in some instances as the carbon pack which forms in the clearance space, and for which the latter is in in part provided, affords in some cases the necessary seal between the valve and its encompassing wall 15.

The engine head is formed with spark-plug receiving openings 58 leading to each of the engine cylinders.

In the operation of the invention, rotation of the crank shaft C effects rotation of the wheel 45 through chain 47, and turning of the wheel 45 acts through the wrist pin 44 and the links 42 and 43 to effect oscillation of the sleeve valves 35 and 36 through the arms 40 and 41. In a four cylinder engine, as here shown, the wheel 45 is geared to the crank shaft in such ratio that two revolutions of the crank shaft will effect one revolution of the wheel 45 which in turn will cause the sleeve valves to each move one reciprocation: the sleeve valves moving in opposite directions relatively to each other.

When the wrist pin 44 is adjacent the upper portion of its circular path of travel, the several intake ports of the sleeve valves and the engine head controlling the first engine cylinder will be in communication as shown in full lines in Fig. 9, and the several exhaust

ports of the sleeve valves and the engine head controlling the second engine cylinder will be in communication as shown in dotted lines in Fig. 9 thus effecting intake and exhaust of these cylinders.

When the wrist pin reaches an intermediate position on its downward travel, as shown in Fig. 10, the sleeve valves will be positioned so that the intake ports controlling the second cylinder will be in open communication and the exhaust ports controlling the fourth cylinder will be in open communication, thereby effecting intake and exhaust of these cylinders.

When the wrist pin reaches a point adjacent the lower portion of its path of travel, as shown in Fig. 11, the sleeve valves will be positioned so that the intake ports controlling the fourth cylinder will be in open communication, and the exhaust ports controlling the third cylinder will be in open communication thereby effecting intake and exhaust of the fourth and third cylinders.

When the wrist pin reaches an intermediate portion on its upward travel, as shown in Fig. 12, the sleeve valves will be positioned so that the intake ports controlling the fourth cylinder will be in open communication, and the exhaust ports controlling the first cylinder will be in open communication, thereby effecting intake and exhaust of these cylinders.

It follows that one reciprocation of the sleeve valves will effect opening and closing of all the intake and exhaust ports of the engine.

While the intake and exhaust ports controlling any one of the engine cylinders are in open communication the sleeve valves will be so relatively positioned and so disposed with relation to the other intake and exhaust ports of the engine head, as to effect closing thereof.

It will be understood that when the intake ports are open to a cylinder the piston therein will be moving on its down stroke; that when the exhaust ports are open to a cylinder the piston therein will be moving on its up stroke; and that the intake and exhaust ports of the cylinder in which the pistons are moving up on their compression strokes and down on their explosion strokes will be maintained closed by the valves during at least the major portions of such piston strokes; the various ports being relatively arranged to move in and out of their communicating positions at predetermined points of the travel of the sleeve valves.

During initial operation of an engine newly equipped with my engine head and valves, some leakage of gases may occur through the clearance spaces afforded in the valve and its housing, but on a short run of the engine deposits of carbon, resulting from explosion of the fuel in the engine cylinder and partial combustion thereof, will be caused to accumulate in the circumferential clearance spaces, thereby forming carbon packs which will serve to prevent further leakage. A shell of carbon will thus be caused to form in the gaps between the outer sleeve valve and its housing and between the inner and outer sleeve valves which not only serve as packing but also protect the contiguous surfaces against wear thereby rendering the valves highly durable.

By my construction the only required lubrication of the valve is at the end bearings thereof, which may be accomplished in any desired manner.

I claim:

1. An engine head having a longitudinal bore formed with pairs of circumferentially spaced intake ports and with pairs of circumferentially spaced exhaust ports, a pair of telescoped cylindrical sleeve valves mounted for relative turnable movement within said bore, bearings supporting the outermost of said sleeve valves circumferentially thereof, bearings supporting the ends of the innermost of said sleeve valves axially thereof independent of the outermost sleeve valve, and means for simultaneously oscillating said sleeve valves independently of each other in opposite directions; said sleeve valves embodying cooperating ports for effecting alternate opening and closing of the pairs of intake and exhaust ports in the engine head.

2. An engine head having a longitudinal bore formed with a series of pairs of circumferentially spaced intake ports and a series of pairs of circumferentially spaced exhaust ports, a pair of telescoping cylindrical sleeve valves turnably mounted in said bore, the outer sleeve valve being formed with a series of pairs of circumferentially spaced intake ports and a series of pairs of circumferentially spaced exhaust ports arranged to be positioned in register with the pairs of intake and exhaust ports in the engine head, said inner sleeve valve being formed with pairs of intake ports and pairs of exhaust ports arranged to be positioned in register with the intake and exhaust ports of said outer sleeve valve, a core encompassed by said inner sleeve valve having transverse passages affording separate communications between the pairs of intake ports and between the pairs of exhaust ports in said inner sleeve valve, said core including a plurality of aligned sections arranged with the contiguous ends of adjacent sections spaced apart to form clearance spaces for longitudinal expansion of said sections, and means for oscillating said sleeve valves relatively to each other.

3. The structure called for in claim 2 in which the sleeve valves are spaced apart and the outer sleeve valve is spaced concentrical-

ly from the encompassing inner periphery of the bore to form spaces for the reception of carbon.

4. The structure called for in claim 2 including end bearings on the engine head, trunnions on the ends of the core seated in said bearings to turnably support said core and the inner sleeve valve, and bearings interposed between said engine head and the outer sleeve valve for supporting the latter independent of the inner sleeve valve.

5. In an engine valve, a valve housing, a pair of inner and outer telescoping sleeve valves in said housing, end bearings supporting said inner sleeve valve concentric with the outer sleeve valve independently thereof; bearings for supporting said outer sleeve valve in spaced relation to the inner sleeve valve and to said housing, and means for oscillating said sleeve valves relatively to each other; said sleeve valves and housing having ports arranged to effect a series of communications on oscillation of said sleeve valves.

HERMAN M. JONES.