S. PEARSON.

INTERNAL COMBUSTION ENGINE.

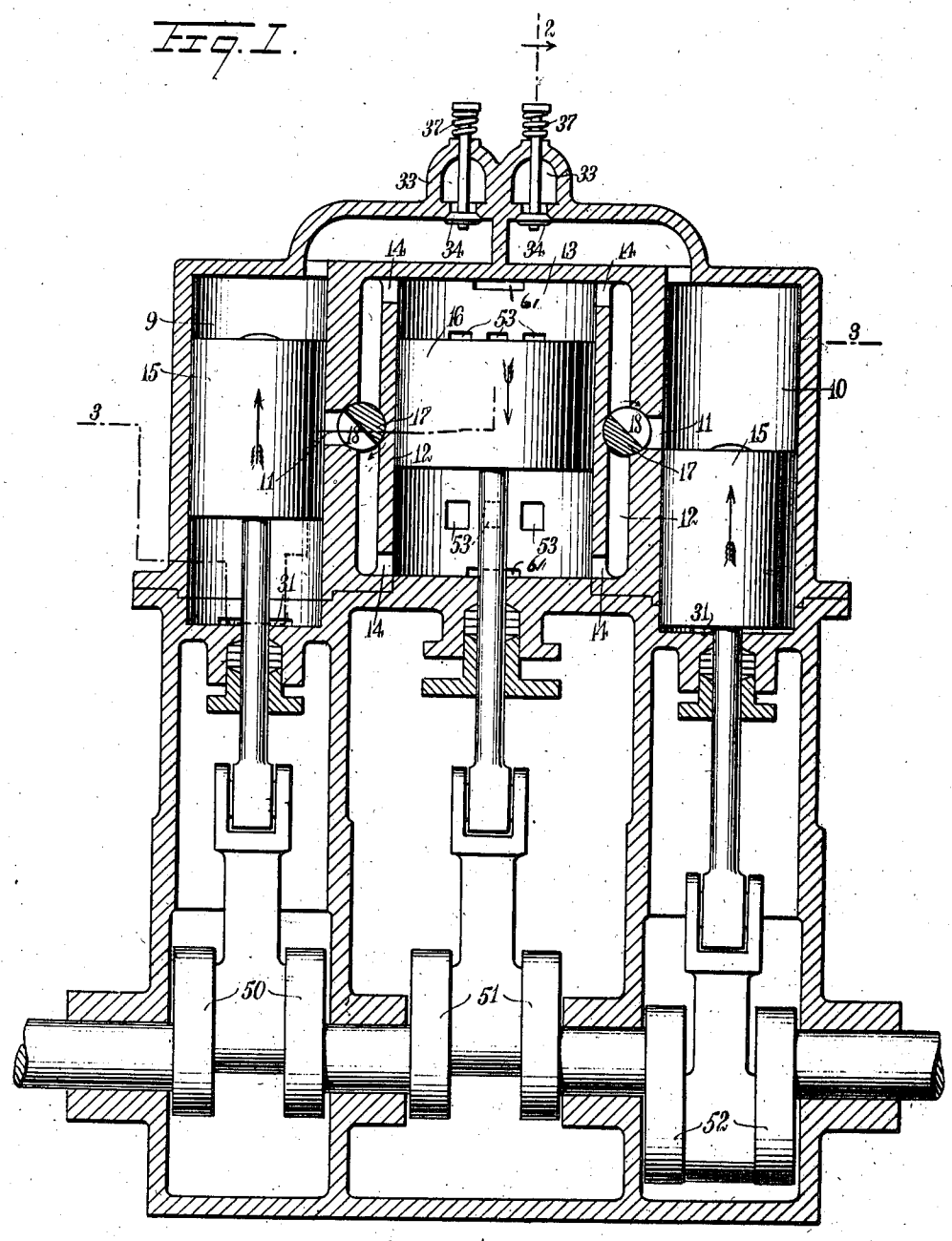
APPLICATION FILED DEC. 14, 1910.

1,014,668.

Patented Jan. 16, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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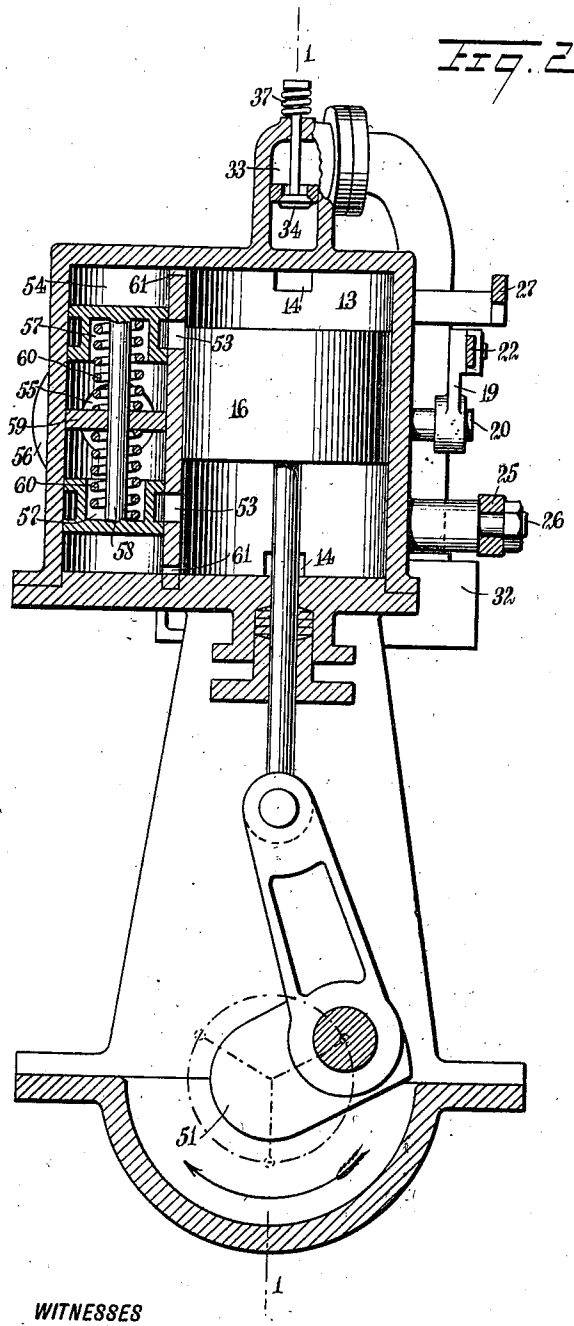
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

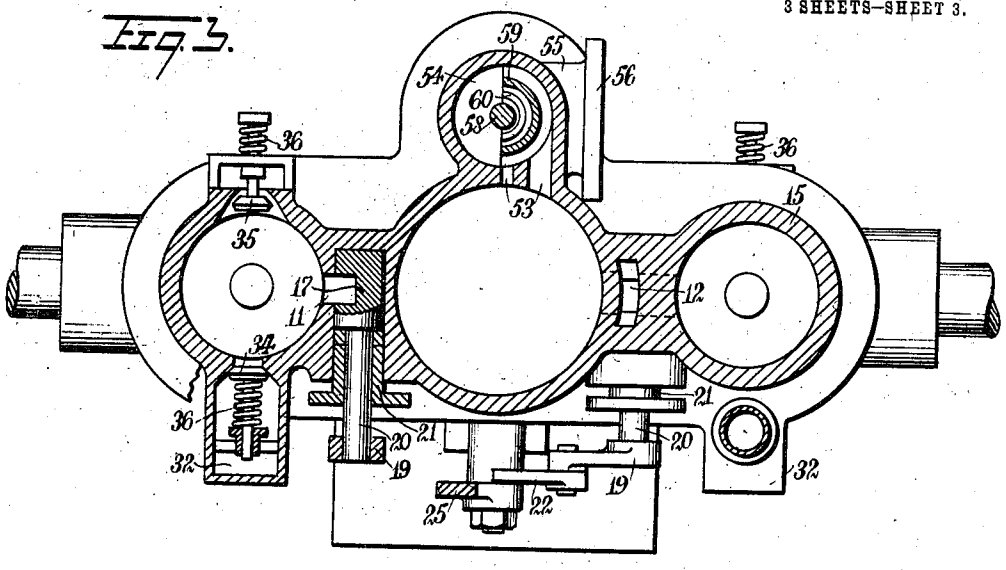
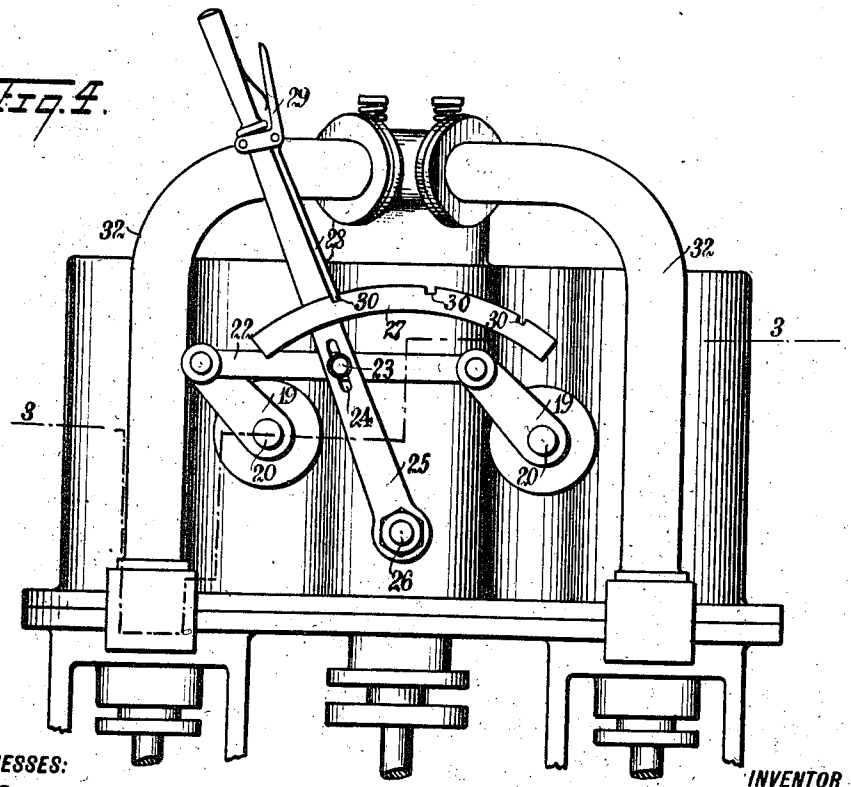


Fig. 4.



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UNITED STATES PATENT OFFICE.

SAMUEL PEARSON, OF KERRVILLE, TEXAS.

INTERNAL-COMBUSTION ENGINE.

1,014,668. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed December 14, 1910. Serial No. 597,210.

To all whom it may concern:

Be it known that I, SAMUEL PEARSON, a subject of the King of Great Britain, and a resident of Kerrville, in the county of Kerr and State of Texas, have invented a new and Improved Internal-Combustion Engine, of which the following is a full, clear, and exact description.

Among the principal objects which the present invention has in view are: to provide means for compounding the expansion effect to obtain the highest possible efficiency; to provide means for automatically operating the exhaust valve from the low pressure cylinder; to provide a plurality of high pressure cylinders united for delivery to a single low pressure cylinder and arranged to deliver the partially expanded gases on opposite sides of the low pressure piston; to provide means for manually and at will reversing the operation of the pistons and the crank shaft connected therewith; and to provide a plurality of high pressure 2-cycle engine cylinders operatively connected to exhaust into a low pressure cylinder and to the opposite sides of the piston therein.

One embodiment of the present invention is disclosed in the structure illustrated in the accompanying drawings, in which like characters of reference denote corresponding parts in all the views, and in which—

Figure 1 is a vertical longitudinal section of a reversible 3-cylinder 2-cycle type of engine, constructed and arranged in accordance with the present invention, the section being taken on the line 1—1 in Fig. 2; Fig. 2 is a vertical cross section taken on the line 2—2 in Fig. 1; Fig. 3 is a horizontal section taken on the line 3—3 in Figs. 1 and 4; Fig. 4 is a side view of an engine constructed and arranged in accordance with the present invention, showing the reversing lever and parts connected therewith.

A preferred form of the invention is illustrated in the drawings, wherein the two high pressure cylinders 9 and 10 are each provided with an approximately centrally disposed exhaust port 11, 11. The exhaust ports open into vertical channels 12, 12, which are extended the full length of the low pressure cylinder 13, and with which the said channels are in open communication through ports 14, 14 at both ends of the said channels. The low pressure cylinder 13 is formed to a diameter to provide a surface area of the piston 16 proportioned to the areas of the pistons 15, 15 in the high pressure cylinders 9 and 10.

The upper and lower extensions of the channels 12, 12 are separated by rotary valves 17, 17. The valves 17, 17 are partially cut away at 18, 18 to form passages for the delivery of the partially expanded gases from the cylinders 9 and 10 to the cylinder 13. The valves 17, 17 are suitably mounted in the casing, and are connected to arms 19, 19 fixedly mounted on the shafts 20, 20. The shafts 20, 20 are held in position by stuffing boxes 21, 21, which are disposed in the frame substantially as shown in Fig. 3 of the drawings.

The arms 19, 19 are connected by a link bar 22, a stud 23 mounted thereon being extended through a slot 24 in the lever 25. The lever 25 is suitably mounted at 26 in the frame of the machine, as shown best in Fig. 4 of the drawings. A detent quadrant 27 is provided to hold the lever 25 in adjusted position, the said lever being held by a detent rod 28 mounted on the lever 25 and operatively controlled by a grip lever 29. The rod 28 is arranged to extend within the nicks 30, 30 provided on the quadrant 27 to hold the lever 25 in adjusted position.

By rotating the shafts 20, 20 and the valves 17, 17 connected therewith, the said valves are rocked within the channels 12 to reverse the passages 18, 18 to successively connect the upper and lower extension of the channels 12 with the cylinders 9 and 10. For example, when the lever 25 and shafts 20, 20 connected therewith and carrying the valves 17, 17, are thrown to the position shown in Fig. 4 of the drawings, the valves 17 are in the position shown in Fig. 1. If the lever 25 be now moved to the extreme right, as seen in said Fig. 4, the shafts 20 and valves 17 connected therewith will be rotated one-quarter of a revolution, which will dispose the solid portions of the valves 17 on the left of Fig. 1 between the port 11 and the lower extension of the channel 12, and dispose the solid portion of the valve at the right of Fig. 1 between the port 11 and the upper extension of the channel 12. In this described position the delivery of the gases from the cylinders 9 and 10 to the cylinder 13 would exactly reverse the delivery illustrated in the drawings in Fig. 1.

In the preferred form of adaptation of the present invention the 2-cycle type of

engine is employed in the high pressure cylinders. As shown in the accompanying drawings, the lower or crank ends of the cylinders 9 and 10 are closed to form air compression chambers below the pistons 15, 15 for clearing the cylinder of burned gas and for supplying air for the explosive mixture as and in the manner usual to this type of engine. The openings 31, 31 at the crank ends of said cylinders deliver into ducts 32, 32, which ducts are each in open communication with a valve chamber 33, which is closed by a valve 34. At the lower end of each of the cylinders is provided an air intake valve 35, constructed to open inward and to seat by the pressure of a spring 36. The valves 34 are seated by springs 37, and are lifted from their seat by the pressure of the fuel in the ducts 32, when the same overbalances the pressure of the expanding gases in the cylinders 9 and 10.

Suitable fuel supply mechanism and ignition mechanism are provided to operate in the upper end of the cylinders 9 and 10. The admission valves, and timing mechanism for the operation of the ignition mechanism, may be constructed and arranged in accordance with any approved type.

In the operation of the engine, the cranks 50, 51 and 52 are disposed in such manner that each of the cranks 50 and 52 is disposed at an angle of 120° in advance of the crank 51, the piston 16 of the low pressure cylinder 13 being connected with the said crank 51. The valves 17, 17 are arranged with reference to the lead of the cranks 50 and 52 to deliver the partially expanded gases from the leading cylinder behind the piston 16 in the low pressure cylinder. In this manner the expansion of the low pressure cylinder follows the expansion of one of the high pressure cylinders on the outward power stroke of the piston in the said high pressure cylinder, and reaches the dead center on the outer stroke as the expansion occurs in the other or second high pressure cylinder. The partially expanded gas is transferred from the second high pressure cylinder to the low pressure cylinder on the under or crank side of the piston 16 while the said piston is lifting, the said gases expanding to lift the crank 51 as the second explosion occurs in the former high pressure cylinder. Thus the partially expanded gases delivered from each of the two high pressure cylinders coöperate with the newly expanding gases at the moment of explosion in the opposite high pressure cylinder. The totally expanded gases are exhausted from the cylinder 13 by way of ports 53, 53. The ports 53, 53 open into the valve chamber 54, which is provided with an exhaust pipe 55. The exhaust pipe 55 is provided with a bolting flange 56 to receive a duct for carrying away the gases to the open air or through a muffler, as the case may be. The ports 53, 53 are controlled by spool valves 57, 57 which are mounted at each end of a single valve stem 58. The stem 58 is disposed in sliding relation to a bridge 59, and between said bridge and the heads of said spool valves are disposed spiral springs 60, 60, the operation whereof normally disposes the valves 57, 57, over the ports 53, 53.

At each end of the cylinder 13 and the chamber 54 is provided a passage 61, which passage is constantly open. In the operation of the engine, when the gas is delivered from either of the cylinders 9 or 10 to the cylinder 13, the same is admitted through one or other of the passages 61 behind the valve 57 disposed adjacent to the portion of the cylinder 13 receiving the charge. The pressure of the expanding gas thus admitted to the chamber 54 moves the spool valve 57, 57 out of alinement with the port 53, opening communication between the said port and the exhaust pipe 55. It will be seen that the port 53 thus open is on what may be termed the dead side of the piston 16, and in the cylinder 13 where the said gases have been fully expanded. The barrel or side wall of the piston 16 covers the other of said ports 53 during the expansion of the gases in the end of the cylinder to which they have just been admitted. In this manner when and as the piston 16 is moved by a fresh charge of expanding gases, the escape for the old or dead charge is provided. In the reciprocation of the piston 16 sufficient of the dead charge is trapped to form a cushion at the far end to cushion the stroke of the piston, thereby relieving the crank from the strain, as in ordinary constructions.

When in the operation of an engine constructed and arranged in accordance with the present invention as disclosed in the accompanying drawings and herein described, it is desired to reverse the engine, it is only necessary that the lever 25 shall be thrown to the one or other extreme position on the quadrant 27, thereby rotating one-quarter of a revolution the valves 17, 17, and disposing the passages 18, 18 to deliver the partially expanded gases from the two high pressure cylinders 9 and 10 in directions relative to the cylinder 13 the reverse of that previously followed, and this with reference to the direction in which the engine has been previously moving.

While I have herein described a type of engine which may be reversed in the manner as set forth, a form of construction may be employed wherein the engine is not reversed. In such construction one or other of the upper or lower sections of the channel 12 is omitted, and the said channel 12 is

constantly open between each of the cylinders 9 or 10 and the cylinder 13, and at the upper or lower end or port 14, 14 thereof.

It will be understood that the non-reversible type of engine operates in all particulars, as far as the explosion of the fuel charge and the transference of the expanding gases from the high pressure cylinders to the low pressure cylinder are concerned, as the engine above described.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof; an exhaust chamber mounted on said cylinder and in communication therewith through said ports; a valve mounted in said chamber arranged to close said ports alternately; a piston mounted in said cylinder adapted to close said ports; a plurality of explosion cylinders connected with said low pressure cylinder to exhaust into said low pressure cylinder and at the opposite ends thereof, said cylinders having exhaust ports disposed in the wall thereof about midway the length thereof; a plurality of pistons, one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; and a plurality of piston rods connecting said cranks and said pistons.

2. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof; an exhaust chamber mounted on said cylinder and in communication therewith through said ports; a valve mounted in said chamber arranged to close said ports alternately; a piston mounted in said cylinder adapted to close said ports; a plurality of explosion cylinders connected with said low pressure cylinder and at the opposite ends thereof, said cylinders having exhaust ports disposed in the wall thereof about midway the length thereof; a plurality of pistons, one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; a plurality of piston rods connecting said cranks and said pistons; and means for shifting said valve in said exhaust chamber in timed relation with the movement of the pistons in said explosion cylinders.

3. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof; an exhaust chamber mounted on said cylinder, being in communication therewith through said ports and through passages formed at the ends of said cylinder and said chamber to admit the expanding gas from said cylinder to said chamber; a slide valve mounted in said chamber arranged to close said ports alternately; a plurality of springs arranged to normally maintain the said valve in closed relation to said ports; a piston mounted in said cylinder adapted to close said ports; a plurality of explosion cylinders connected with said low pressure cylinder to exhaust into said low pressure cylinder and at the opposite ends thereof, said cylinders having exhaust ports disposed in the wall thereof about midway the length thereof; a plurality of pistons, one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; and a plurality of piston rods connecting said cranks and said pistons.

4. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof and intake ports disposed at the ends of said cylinder; an exhaust chamber mounted on said cylinder and in communication therewith through said ports; a valve mounted in said chamber arranged to close said ports alternately; means for shifting said valve in said exhaust chamber in timed relation with the movement of the pistons in the explosion cylinders of said engine; a piston mounted in said low pressure cylinder adapted to close said ports; a plurality of explosion cylinders connected with said low pressure cylinder to exhaust into said low pressure cylinder through said intake ports; a plurality of pistons one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; and a plurality of piston rods connecting said cranks and said pistons.

5. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof and intake ports disposed at the ends of said cylinder; an exhaust chamber mounted on said cylinder and in communication therewith through said ports; a valve mounted in said chamber arranged to close said ports alternately; a piston mounted in said cylinder adapted to close said ports; a plurality of explosion cylinders, each connected with said low pressure cylinder through an exhaust port disposed midway the length of each explosion cylinder and through the intake ports at the opposite ends of said low pressure cylinder; deflecting valves disposed in the passage connecting the exhaust ports in said explosion cylinders and the intake ports in

said low pressure cylinder, a plurality of pistons, one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; and a plurality of piston rods connecting said cranks and said pistons.

6. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof; an exhaust chamber mounted on said cylinder and in communication therewith through said ports; a valve mounted in said chamber arranged to close said ports alternately; a piston mounted in said cylinder adapted to close said ports; a plurality of explosion cylinders having exhaust ports formed in the side wall thereof about midway the length thereof; a plurality of pistons, one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; a plurality of piston rods connecting said cranks and said pistons; means for shifting said valve in said exhaust chamber in timed relation with the movement of the pistons in said explosion cylinders; a connecting structure interposed between said explosion cylinders and low pressure cylinder, having formed therein passages for the gases exhausted from said explosion cylinders, said passages being extended lengthwise of said low pressure cylinder; a plurality of valves arranged to deliver alternately the said gases to the one end and to the other end of said low pressure cylinder; and means for shifting the said valves to control the passage of said gases.

7. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof; an exhaust chamber mounted on said cylinder, being in communication therewith through said ports and through passages formed at the ends of said cylinder and said chamber to admit the expanding gas from said cylinder to said chamber; a slide valve mounted in said chamber to close said ports alternately; a plurality of springs arranged to normally maintain the said valve in closed relation to said ports; a piston mounted in said cylinder adapted to close said ports; a plurality of explosion cylinders connected with said low pressure cylinder to exhaust into said low pressure cylinder and at the opposite ends thereof, said cylinders having exhaust ports disposed in the wall thereof midway the length thereof; a plurality of pistons, one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; a plurality of piston rods connecting said cranks and said pistons; a connecting structure interposed between said explosion cylinders and low pressure cylinder, having formed therein passages for the gases exhausted from said explosion cylinders, said passages being extended lengthwise of said low pressure cylinder; a plurality of valves arranged to deliver alternately the said gases to the one end and to the other end of said low pressure cylinder; and means for shifting the said valves to control the passage of said gases.

8. An internal combustion engine, comprising a low pressure cylinder having exhaust ports formed in the side wall thereof near the ends thereof and intake ports disposed at the ends of said cylinder; an exhaust chamber mounted on said cylinder and in communication therewith through said exhaust ports; a valve mounted in said chamber arranged to close said exhaust ports alternately; means for shifting said valve in said exhaust chamber in timed relation with the movement of the pistons in the explosion cylinders of said engine; a piston mounted in said low pressure cylinder adapted to close said exhaust ports; a plurality of explosion cylinders connected with said low pressure cylinder to exhaust into said low pressure cylinder through said intake ports; a plurality of pistons one mounted in each of said explosion cylinders, adapted to close the exhaust ports formed therein; a crank shaft having a plurality of cranks disposed at angles of near 120°; a plurality of piston rods connecting said cranks and said pistons; a connecting structure interposed between said explosion cylinders and low pressure cylinder, having formed therein passages for the gases exhausted from said explosion cylinders, said passages being extended lengthwise of said low pressure cylinder; a plurality of valves arranged to deliver alternately the said gases to the one end and to the other end of said low pressure cylinder; and means for shifting the said valves to control the passage of said gases.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

SAMUEL PEARSON.

Witnesses:
A. C. SCHREINER,
A. W. HENKE.