

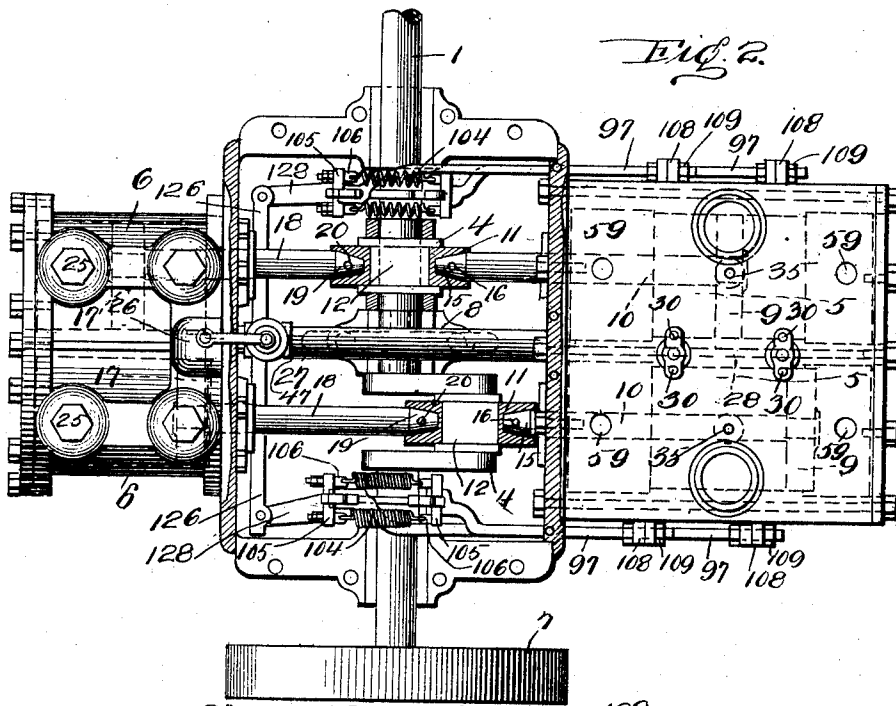
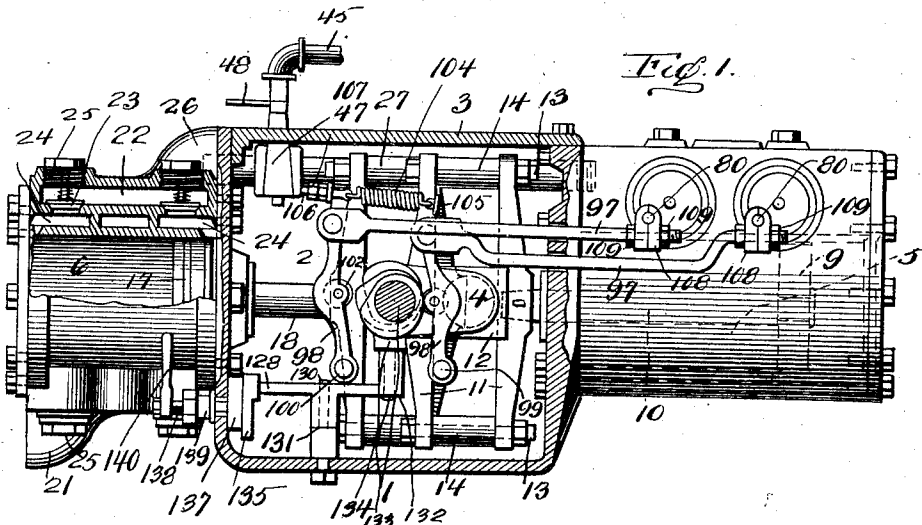
J. D. FERRY.
ENGINE.

APPLICATION FILED AUG. 16, 1906.

965,094.

Patented July 19, 1910.

4 SHEETS—SHEET 1.



Witnessed by
Samuel O. Payne
A. H. Butler

Fig. 3.

Inventor
Joseph D. Ferry
A. C. Evans & Co.
 Attorneys.

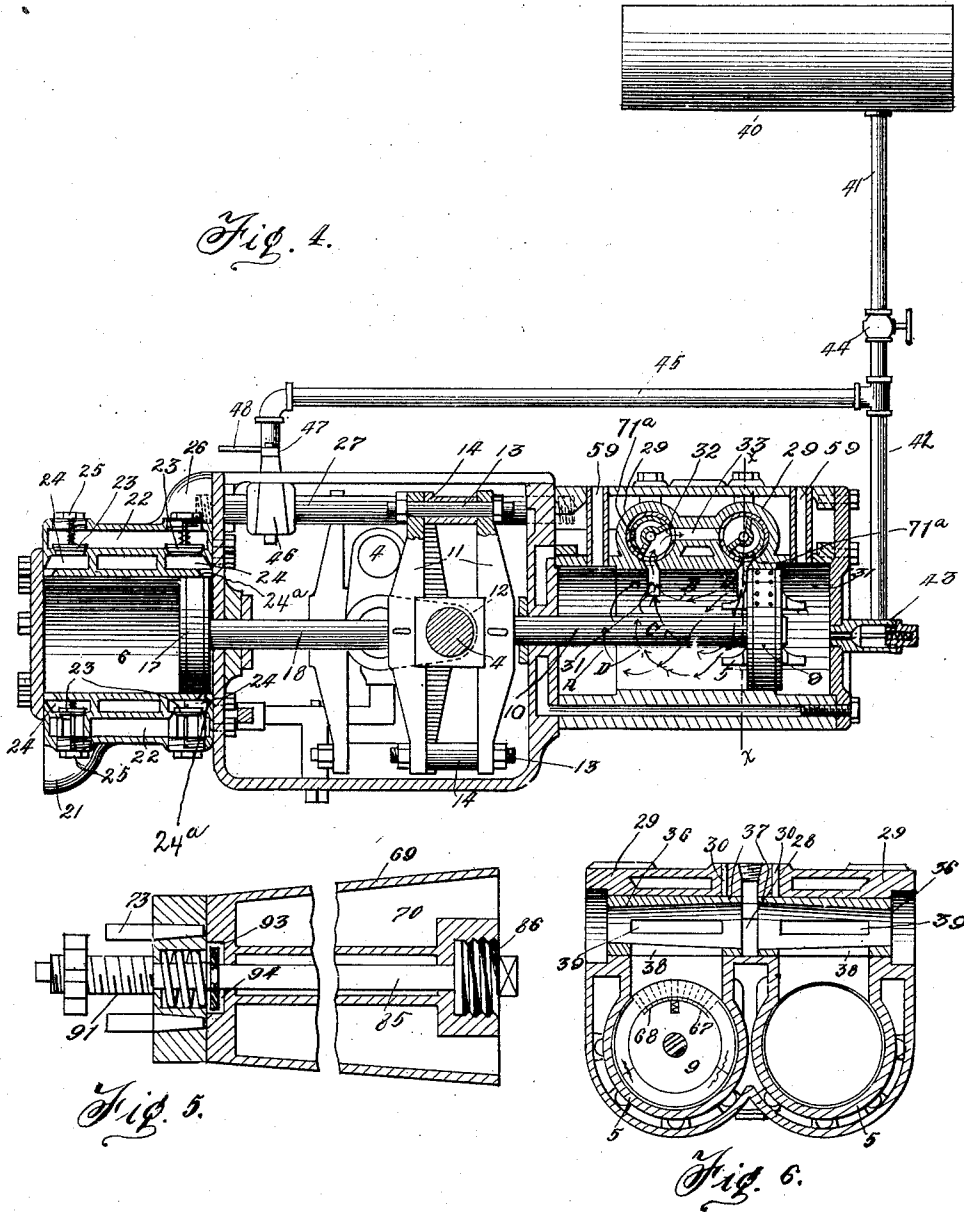
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4 SHEETS—SHEET 2.



Witnesses
R. L. Farrington.
R. H. Butler

Inventor
Joseph D. Ferry.

By *H. C. Evans & Co.*
 Attorneys

J. D. FERRY.

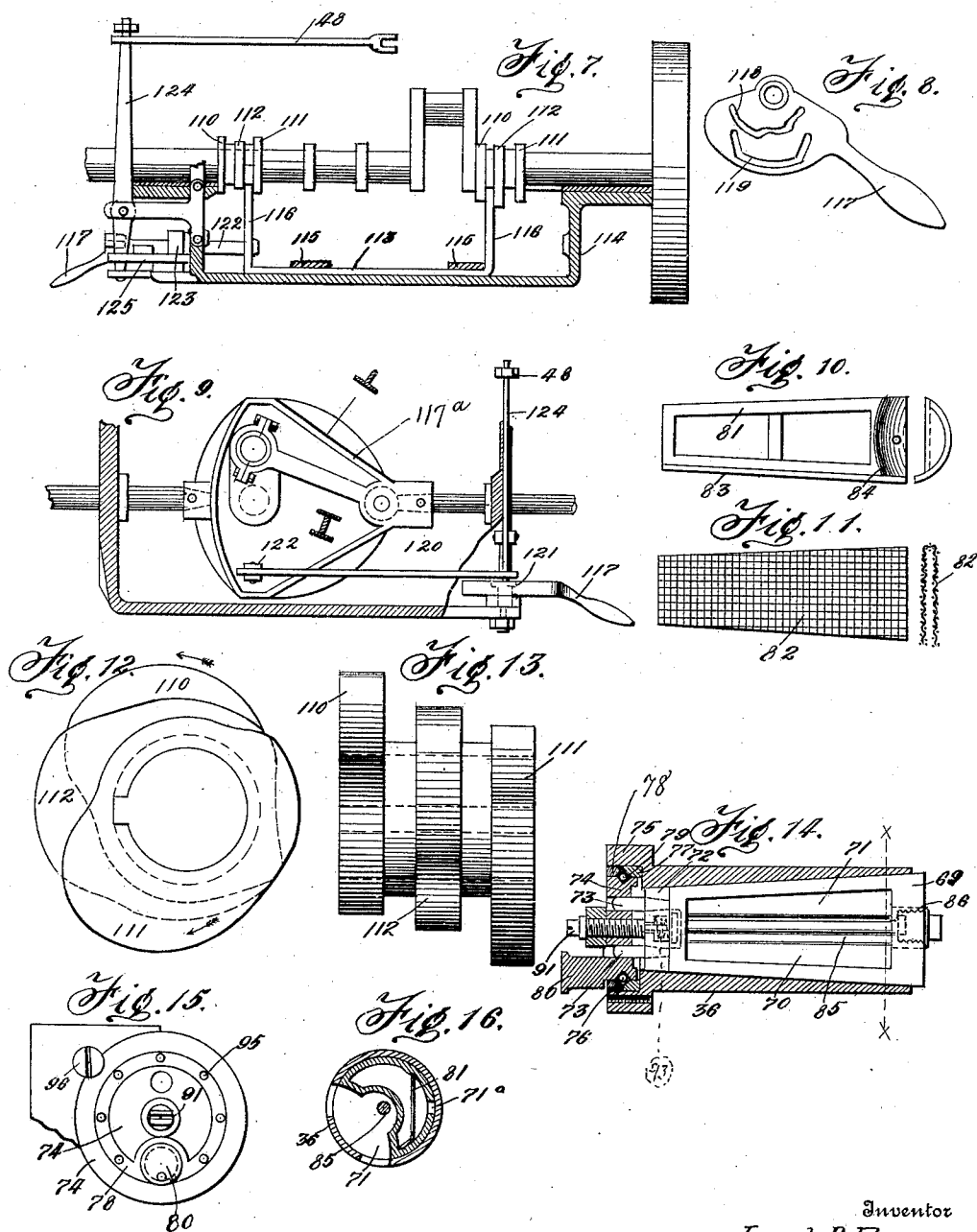
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4 SHEETS—SHEET 3.



Witnesses

L. L. Farrington.

W. H. Butler

Inventor

Joseph D. Ferry.

By

N. C. Evert & Co.

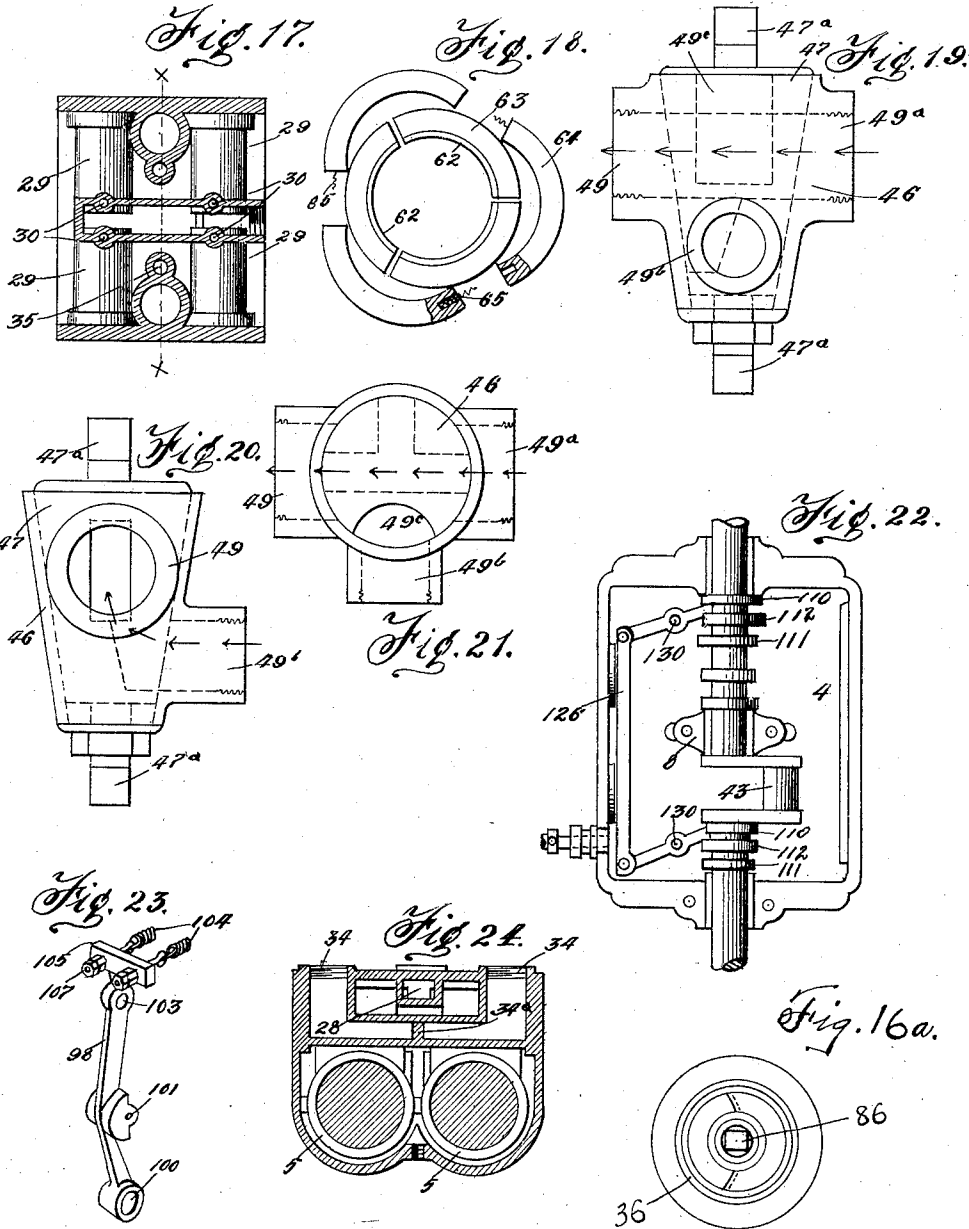
Attorneys

J. D. FERRY.
ENGINE.
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Patented July 19, 1910.

4 SHEETS—SHEET 4.



Witnesses
R. L. Farrington.
A. H. Butler

Inventor
Joseph D. Ferry

By H. C. Everett & Co.
Attorney.

UNITED STATES PATENT OFFICE.

JOSEPH D. FERRY, OF EAST McKEESPORT, PENNSYLVANIA.

ENGINE.

965,094.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOSEPH D. FERRY, a citizen of the United States of America, residing at East McKeesport, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to engines, particularly to a structure adapted to be used with an explosive charge or with a continuous pressure of steam, air or other motive agents, and is designed primarily as an improvement upon the construction of explosive engines disclosed in Letters Patent #773,490 granted to me October 25th, 1904, and one of the objects of the present invention is to provide an engine of the type of that disclosed in the patent referred to with means in a manner as hereinafter set forth whereby the piston of the power cylinder will be caused to pass over both the inlet and exhaust ports at each stroke, to insure the scavenging of the cylinder of the products of combustion after each explosion.

A further object of the invention is to provide in a manner as hereinafter set forth means for automatically shifting the power cylinder valves in a longitudinal direction so that the valves will snugly engage their seats to prevent leakage in case of wear, the power cylinder valves being mounted in tapering sleeves, and the said means automatically moving the valves toward the larger ends of the sleeves giving the valves more clearance and preventing them from sticking or binding. Said means furthermore is adapted when the engine slows up to automatically return the power cylinder valves to their normal position.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown the preferred embodiment of the invention, but it is to be understood that variations, changes and modifications can be resorted to which come 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 side elevation of the engine with parts in

vertical section, Fig. 2 is a sectional plan, Fig. 3 is a detail elevation of the shifting bar shown in Fig. 2, Fig. 4 is a central vertical longitudinal section through one side of the power and compression cylinders, with the fluid tank for the reception of the spent gas from the engine and its connections shown in elevation, Fig. 5 is a longitudinal sectional view of one form of an operating valve used in connection with the engine, Fig. 6 is a section on line X—X, Fig. 4, Fig. 7 is a view partly in section and partly in elevation of a mechanism for shifting the cams and moving the inlet pipe valve by a single lever, Fig. 8 is an elevation of the shifting lever, Fig. 9 is an elevation of a modified form of cross head and part of the cam shifting mechanism, Fig. 10 is a detail elevation of a plate arranged within the operating valve, Fig. 11 is a detail view of a wired gauze covering for the plate shown in Fig. 10, Fig. 12 is a side elevation of the cams mounted on the crank shaft of the engine, Fig. 13 is an edge view of the cams, Fig. 14 is a longitudinal sectional view of one of the power cylinder valves, Fig. 15 is an elevation of one end of the same, Fig. 16 is a transverse section of the valve on line X—X Fig. 14, Fig. 16^a is an end view of the valve, Fig. 17 is a plan of the top of the valve chambers for the power cylinder, the casing being shown in section, Fig. 18 is a detail elevation of a packing with the parts disassembled, Figs. 19, 20 and 21 are respectively side views and a top plan view of the valve for controlling the supply of fluid from the tank, Fig. 22 is a plan illustrating the shifting mechanism for the cams, Fig. 23 is a detail in perspective of the valve lever, and Fig. 24 is a vertical sectional view on line X—X Fig. 17.

Referring to the drawings in detail, 1 designates a power shaft supported within a suitable housing or casing 2 closed by a cover plate 3, which is omitted from Fig. 2 to allow the mechanism to be seen. The shaft 1 is provided with one or more crank arms 4, the number depending upon the number of cylinders employed in connection with the engine. Two power cylinders 5 are illustrated in the drawing together with two cooperating compression cylinders 6 in which carbureted air is first compressed, after which it is compressed in the cylinders 5. These two compressions will tend to gasify all the gasoline before the explosion. How-

ever, it will be understood that a single power and a single compression cylinder could be used, or a greater number if desired. The shaft 1 is provided at one end with the usual balance or fly-wheel 7 and may be supported centrally through the medium of a standard and bearing 8.

Within each of the power cylinders 5 is arranged a piston 9 connected by means of a piston rod 10 to a sectional cross head 11 which carries a bearing block 12 journaled upon the crank arm 4. The cross head 11 is formed of two sections or members arranged in parallelism with respect to each other and which are connected together at their ends by bolts 13 extending through spacing sleeves 14 positioned below the ends of said sections.

The piston rods may be connected to the cross head 11 in any suitable manner, but as shown, the outer end of each of the piston rods 10 is tapered and fits in a socket formed in that section of the cross head which is connected through the walls of the sockets and tapering ends of the rods thereby securing the rods to the cross head.

It will be understood that the compression cylinders are of like construction and that the pistons are similar in construction and hence a description of one will apply for the other.

Upon the opposite side of the power shaft from the power cylinders are the compression cylinders, each of which is provided with a piston 17, connected by a piston rod 18 through the medium of the tapered end 19 and cotter pin 20 to the cross head 11, whereby the movement of the cross head produces a simultaneous movement of the power and compression pistons.

Each of the compression cylinders 6 is formed with an inlet port 21 communicating with a chamber 22 provided with check valves 23. The chamber 22 communicates with its respective cylinder at the ends thereof through the medium of a passage 24 and ports 24^a.

The casing opposite each of the valves 23 is provided with an opening to permit of access being had to said valves. These openings are closed by plugs 25. A set of inlet and outlet valves 23 is provided at each end of a compression cylinder so that the compressing operation is performed during both strokes of the piston therein, while the compressed fluid is discharged from the outlet 26, disposed between the two cylinders and conducted by a pipe 27 to the power cylinders 5.

The pipe 27 communicates with a longitudinally extending passage 28 disposed between the two power cylinders, and the said passage 28 communicates at each end with the valve casings 29 which extend transversely of the cylinders 5. Extending

downwardly in the walls of the inlet passage 28 are lubricant tubes 30 which communicate with the valve chambers as shown in Fig. 17 for the purpose of supplying a lubricant to said chambers. The valve casings 29 are formed with inlet ports 31 and exhaust ports 32, these latter communicating through the passage 33, which extends transversely of the cylinders 5, with the exhaust port 34, the latter being closed at 34^a. Tubes 35 are provided for supplying a lubricant to the power cylinders 5.

Within each of the valve casings 29 is secured a sleeve 36 having its inner face tapering, the inner face of the sleeve 36 being larger at its inner end. The sleeve 36 may be secured in any suitable manner, by way of example, threads 37 are provided on the inner end of the sleeve and which engages with threads on the casing adjacent to the inlet passage 28. Each of the sleeves 36 is formed with an inlet port 38 and an exhaust port 39, which when the sleeves 36 are secured in place register or are in alignment with similar ports in the casing. Within each of the sleeves 36 is arranged a tapering valve, the construction of which will be hereinafter referred to.

The reference character 40 designates a fluid storage tank which can either contain a pressure of air or the spent gases from the engine, as shown the tank receives the spent gases from the engine. The tank 40 used for both starting and reversing the engine is supported in any suitable manner and connected by a pipe 41 and branch pipes 42 with valve casings 43 secured in the outer heads of the power cylinders. The pipe 41 is provided with a cut-off 44 whereby the pipe 41 can be closed when it is desired to cut off the supply or to prevent the discharge of fluid from the tank 40 when the engine is not operating thereby maintaining pressure within the tank. The pipe 41 is connected to a fluid inlet pipe 27 by a pipe 45 which opens into a three-way valve casing 46 containing a valve 47, the latter is connected by a rod 48 with the cam shifting mechanism of the engine to be hereinafter referred to. The valve casing 46 is illustrated in detail in Figs. 19 to 21 and is formed of a plurality of internally threaded sockets 49, 49^a, and 49^b which receive respectively, the pipe 27, a short pipe connection 50 communicating with the outlet 26 of the compression cylinder, and the pipe 45. The shifting of the valve 47 controls the admission of fluid from the tank 40 to the inlet pipe 27. The pipe connection 50 is secured in position through the medium of the nut 51 on opposite sides of the casing of the crank case.

The arrows on Figs. 19 to 21 show the direction of the fluid from the compression cylinder to the power cylinder, the inlet 49^b

from tank being closed. By turning the valve 47 a quarter of a revolution, the pressure from the tank is admitted to the pipe 27 and the admission of fluid to the inlet 49^a is cut off, the flow from the compression cylinder escaping through the port 49^c which is shown at the top. The valve 47 has a squared stem 47^a at each end.

Vertically disposed tubes 59 are fitted into openings in the casing 2 and the cylinders 5 to receive sparking plugs, see Fig. 4.

The ports 31 of each of the power cylinders are so disposed that the piston 9 travels over them at each end of a stroke, the power cylinder valves taking the position shown in Fig. 4 and the incoming charge will scavenge the cylinder of the products of combustion. When the piston reaches the opposite end of the cylinder, the power cylinder valves take the opposite position and the cylinder is also scavenged as will be evident. The deflectors 60 intercept the inflowing charge of fluid and direct it in streams along the paths indicated by the arrows in Fig. 4. The row of arrows marked "A" represents that portion of the main charge which does not reach the deflectors. The arrows "B" indicate that portion of the charge which is deflected by the upper deflector, the arrows "C" the direction of that portion of the charge which passes through the openings in the upper deflector and is deflected by the lower deflector, and the arrows "D" represent that portion of the charge which passes through the openings in the lower deflector and is deflected by the bottom of the cylinder 5.

The piston 9 is formed with a circumferential groove to receive an angular circular plate composed of segment-shaped sections 62. Upon the flange 63 of the plate are disposed segmental section 64 of the bearing ring. Between the ends of the section 64 coil springs 65 are interposed to insure a close fit of the pistons with the walls of the cylinders.

Each of the power cylinder valves 69 is tapering and is adapted to fit the sleeves 36, see Figs. 14 and 15. Each of said valves 69 is provided with a concave peripheral portion 70 by which communication may be established between the inlet port and exhaust passage. The exhaust port 71 is shown in Fig. 16 and the inlet port 71^a in Fig. 15. At the outer end of the valve 69 is an end plate 72 riveted to the valve after guide pins 73 are fitted through openings in the said plate 72. A bearing disk 74 is secured within the annular flange 75 of the sleeve 36 and is provided with a peripheral groove 76. The disk 74 is retained in position by a beveled ring 77 and a threaded beveled ring 78. The rings 77 and 78 in connection with the groove 76 provide a race-way for anti-friction balls 79. A crank pin 80 projects from

the disk 74. A plate 81 is supported behind the concave portion 70 and is provided with a covering 82 of wire gauze which is soldered or otherwise connected along the projecting flanges 83. The covered plate 81 constitutes a guard and prevents back firing. The plate 81 is inserted within the valve 69 and held by a screw 84. An expansible metallic bolt 85 is fitted through the valve 39 from its inner end and the inner end of said bolt is secured in position by a plug 86. The bolt serves as an automatic adjusting device for the valve 69. The bolt being formed of expansible metal, or metal softer than that of the valve, the bolt will expand by the heat more quickly than would the valve, causing the bolt to lengthen proportionately to move the valve toward the larger end of its tapering sleeve giving the valve more clearance and preventing it from sticking or binding. As the engine slows up, the bolt will contract and return the valve to normal position.

The pins 73 constitute means for guiding the valve in its adjusting longitudinal movement as well as oscillating the valve with the bearing plate. A coil spring 93 cushions the movement of the bolt. The threaded ring 78 which clamps the rings 77 in position is formed on its outer face with a plurality of spanner holds 95 to receive a spanner through the medium of which the rings 77 can be secured in position or removed. The valve device is secured in position through the medium of the head 96 of a screw which extends in the casing 2. The head 96 overlaps the flange 75 of the valve sleeve and removably secures the valve device in position, see Fig. 15.

The power cylinder valves are oscillated by means of rods 97 suitably connected at one end to the crank pins 80 and at their opposite ends to levers 98 pivotally mounted through the medium of the bearing collars 100 upon lugs 99 projecting from the engine frame, see Fig. 23. Above the bearing collars 100 of each of said levers is a bearing 101 adapted to receive an anti-friction roller 102 which has contact with the operating cams on the power shaft while at the upper portion of the lever 98 is formed an eye 103 for the attachment of the valve operating rod 97.

Each of the levers 98 carries a cross plate 105. Attached to one of the cross plates are the springs 104. The cross plate of the other lever is provided with threaded bolts 106 adjustable therein and held in adjusted position by means of the nuts 107. The bolts 106 are connected to the springs 104.

A rod 97 is connected to and extends from each lever 98 and a set of levers 98 is arranged at each side of the engine so as to independently control each of the four valves used in connection with the two cylinders.

As shown the valve rods 97 are connected to the crank pins 80 by the clip plate 108 (see Fig. 1) embracing the pin and held upon the threaded end of the rod by means of opposing nuts 109.

In Figs. 12 and 13 are shown the cams for operating the oscillatory power cylinder valve. These cams are indicated by the reference characters 110, 111, and 112, are independent of each other and so disposed upon the power shaft 1 as to adapt them to operate in the following manner: the cams 110 and 111 can start the engine in either a forward or reverse direction on expansive fluid, while cam 112 can continue the operation of the engine in either direction as an explosive engine. The three-way valve 46 is so linked with the cam shifting mechanism that when cam 112 is in operation, communication is shut off from the expansive fluid tank 40 and the compression cylinders are thrown into circuit through this valve, to supply explosive fluid to the power cylinders.

The cams 110, 111, and 112 are splined to the power shaft to permit of a longitudinal adjustment with respect to the said shaft. The shifting mechanism for such purpose is shown in Figs. 7, 8 and 9 and comprises a yoke 113 slidably supported in the crank case 114 by the keepers 115. The upper ends of the frames 116 of the yoke are forked to engage between the cams. The shifting of the yoke and the turning of the valve 47 controlling pressure from the storage tank are effected simultaneously by a lever 117 having two irregular grooves 118, 119. The lever 117 operates a lever 120 having a projecting pin upon which is mounted a roller 121 working in the groove 118 of the lever 117. A rod 122 is connected to the end of the lever 120 and moves through a stuffing box 123 into the crank case and is there riveted or bolted to the yoke 113. The wall of the groove 119 of the lever 117 operates the lever 124 connected to the valve rod 48, the lower end of said valve lever 124 being actuated by the bifurcated end of a bracket 125 secured to the crank case 114. While the roller 121 at the end of the lever 120 is stationary in the groove 118 of the lever 117, the cam 112 is in alinement with the valve rod lever and the valve 47 is in the position shown in Figs. 19 and 21. A further movement will cause the valve 47 to assume the position shown in Fig. 20 allowing pressure from the tank to start the engine. By shifting the lever 117 a sufficient distance to the right, the cams are brought into alinement and start the engine in the opposite direction. As heretofore stated the intermediate cam 112 will drive the engine in either direction, and the reverse cam can be thrown in at any instant, acting as a powerful brake for stopping or for reversing quickly.

In Fig. 9 is shown a modified form of cross head which may be employed in lieu of that illustrated in Figs. 1 and 2. The cross head is indicated by the reference character 117^a and is of triangular form. This construction does not offer as much friction as that illustrated in Figs. 1 and 2, but requires a somewhat larger crank case.

In Figs. 2, 3, and 22, a shifting bar 126 is illustrated; this shifting bar is the same as the bar and for the same purpose shown in the patent hereinbefore referred to. The bar 126 has sockets 127 at its opposite ends within which the ends of levers 128 are pivotally secured by pins 129. The levers 128 extend beneath the power shaft 1 and are mounted upon a pivot 130 secured to the base through the medium of a stud 131 bolted thereto. The ends of the levers 128 beneath the shifting device are provided with a sleeve 132 adapted to receive a pintle 133 extending downwardly from the yoke 134 which is adapted to be secured to the shifting device. For shifting the bar 126 an angularly disposed solid arm 135 is provided, at one end thereof and which is adapted to engage a crank pin 136 carried upon a crank disk 137; the shaft 138 of the latter extends beyond the frame through a stuffing box 139 and is provided with an operating lever 140. This shifting device may be also employed in connection with the present construction, where the shifting of the cams alone is to be effected, but I prefer to employ the shifting mechanism shown in Fig. 7 and hereinbefore referred to, as it simultaneously shifts the cams and operates the valve which controls the tank pressure.

What I claim is:

1. An engine comprising a power cylinder, a power shaft, a piston operating within the cylinder and connected to the shaft, said cylinder provided with a plurality of ports, said ports being so disposed with respect to the piston that the latter will pass the ports at each stroke to expel the spent gases, oscillatory valves for opening and closing said ports, said valves tapering in contour, tapering sleeves for the reception of said valves, means for automatically shifting the valves to the larger ends of said sleeves during the operation of the engine and for automatically returning said valves to normal position when the engine closes down, actuating means for imparting oscillatory movement to said valves, and valve controlling devices carried by the power shaft for operating said actuating means at predetermined intervals.

2. An engine comprising a power cylinder, a power shaft, a piston operating within the cylinder and connected to the shaft, said cylinder provided with a plurality of ports, said ports being so disposed with respect to the piston that the latter will pass

the ports at each stroke to expel the spent gases, oscillatory valves for opening and closing said ports, said valves tapering in contour, tapering sleeves for the reception of said valves, means for automatically shifting the valves to the larger ends of said sleeves during the operation of the engine and for automatically returning said valves to normal position when the engines close down, actuating means for imparting oscillatory movement to said valves, valve controlling devices carried by the power shaft for operating said actuating means at predetermined intervals, a compression cylinder communicating with the power cylinders, and a piston operating in the compression cylinder and connected to the power shaft.

3. An engine comprising a power cylinder, a piston operating therein, means for supplying a combustible charge to the power cylinder, said cylinder provided with ports, oscillatory valves for opening and closing said ports, means for automatically shifting said valves in a longitudinal direction during the operation of the engine, said ports being so disposed that the piston will pass them at each of its strokes, and deflectors secured to the opposite faces of said pistons.

4. An engine comprising a power cylinder, a piston operating therein, means for supplying a combustible charge to said cylinder, said cylinder provided with a plurality of ports, oscillatory valves for opening and closing said ports, means for automatically shifting said valves in a longitudinal direction during the operation of the engine, and deflectors secured to opposite faces of said piston.

5. An engine comprising a power cylinder provided with a plurality of ports, a piston operating in said cylinder and passing both the ports at each of its strokes, oscillatory valves for opening and closing

said ports, and expansible and contractible means connected with the valves for automatically shifting them in a longitudinal direction during the operation of the engine, and deflectors provided on each of the faces of said pistons.

6. An engine comprising a power cylinder provided with a plurality of ports, a piston operating in said cylinder and passing both the ports at each of its strokes, oscillatory valves for opening and closing said ports, and expansible and contractible means connected with the valves for automatically shifting them in a longitudinal direction during the operation of the engine.

7. An explosive engine comprising a power cylinder provided with ports, a piston operating in said cylinder, means for supplying a combustible charge to said cylinder, valves for controlling said ports, actuated means for imparting an oscillatory movement to said valves, an expansible and contractible means connected to the valves for automatically shifting them in a longitudinal direction during the operation of the engine, a power shaft connected to the piston, a series of shiftable cams mounted upon said shaft and adapted to independently engage said actuating means causing thereby the oscillation of the valves, a yoke engaging the cams for shifting them, a lever formed with a cam groove, a roller adapted to travel in said grooves, a lever carrying said roller and connected between the last mentioned lever and the yoke for causing the shifting of the latter when the first mentioned lever is operated.

In testimony whereof I affix my signature in the presence of two witnesses.

JOSEPH D. FERRY.

Witnesses:

WILLIAM McDONALD,
GEORGE A. FULLIPP.