No. 836,186. PATENTED NOV. 20, 1906.

A. G. HEGGEM.

ENGINE.

APPLICATION FILED NOV. 26, 1905.

3 SHEETS—SHEET 1.

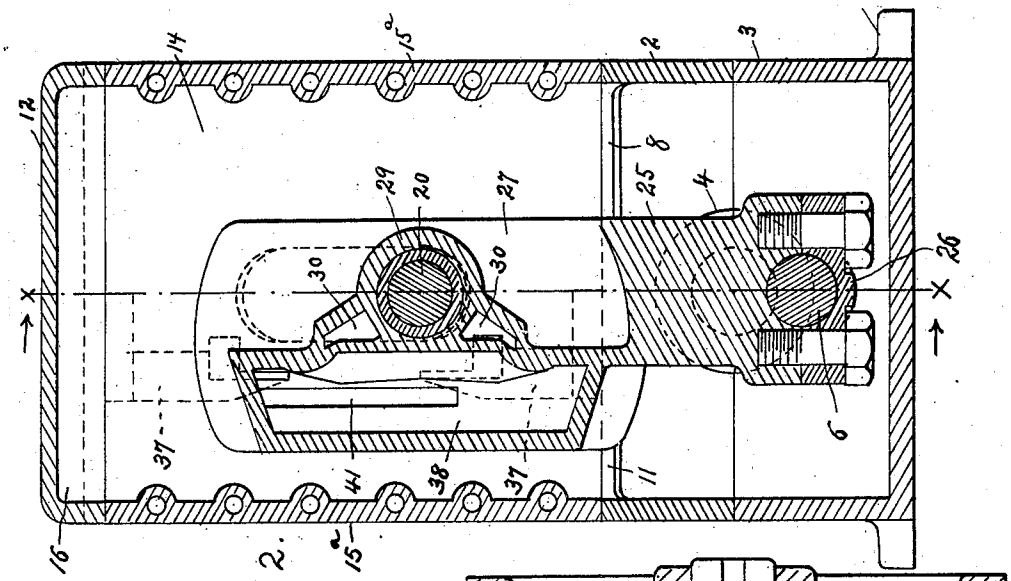

FIG. 2.

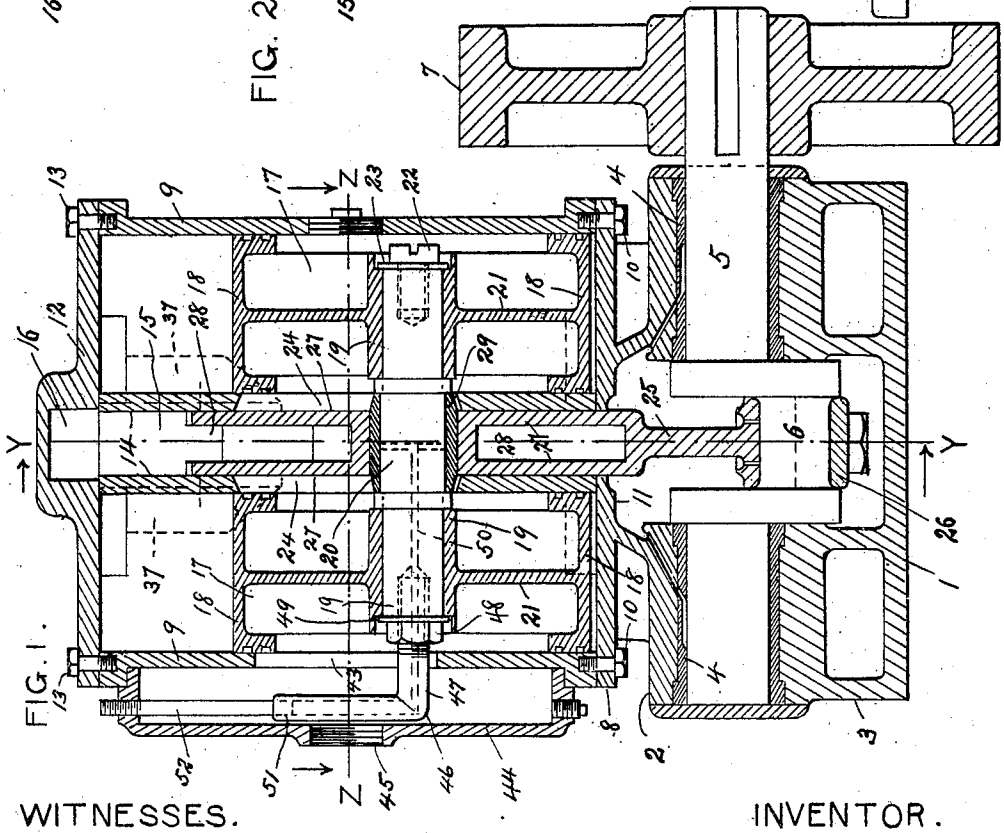

FIG. 1.

WITNESSES.

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No. 836,186. PATENTED NOV. 20, 1906.

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APPLICATION FILED NOV. 25, 1905.

3 SHEETS—SHEET 2.

FIG. 3.

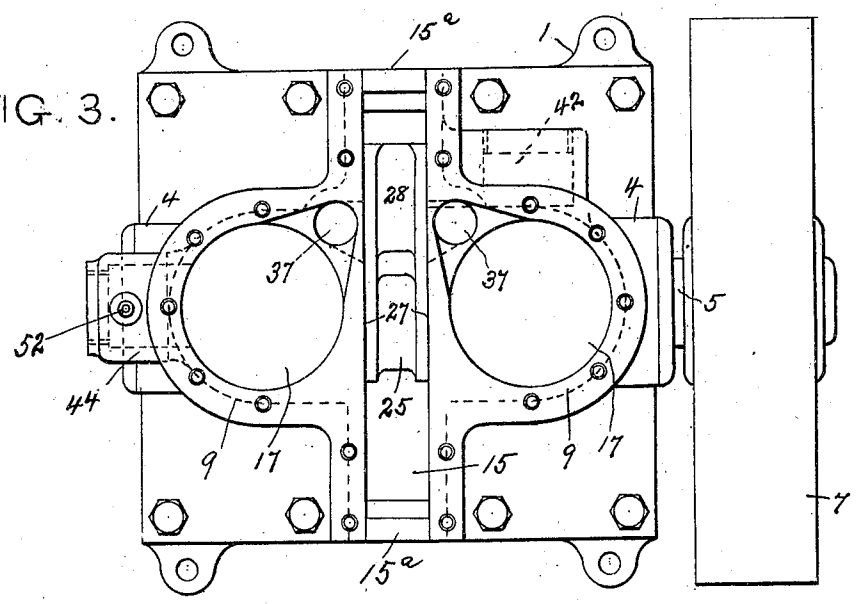
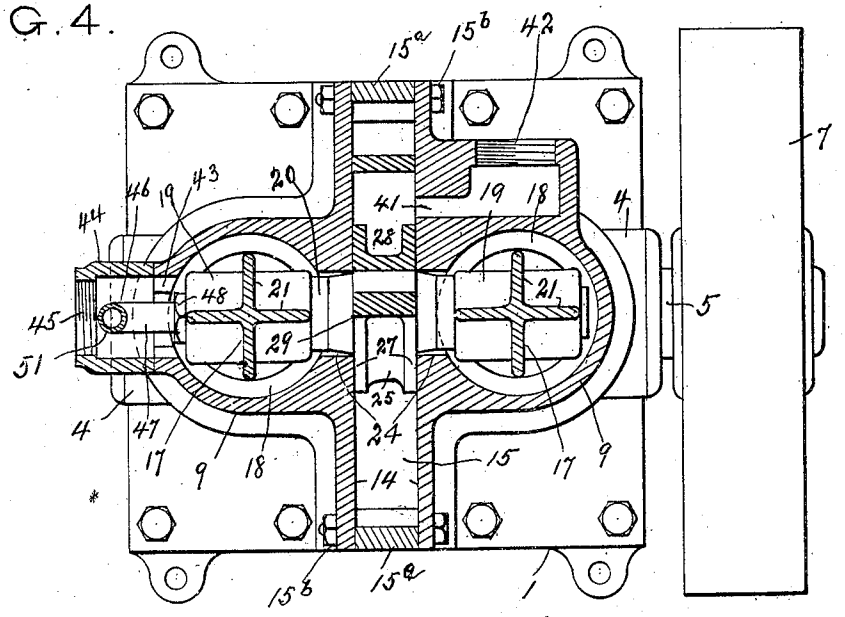


FIG. 4.



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3 SHEETS—SHEET 3.

FIG. 8.

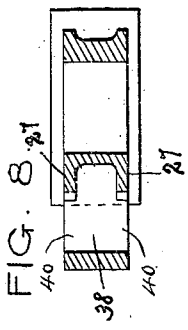


FIG. 6.

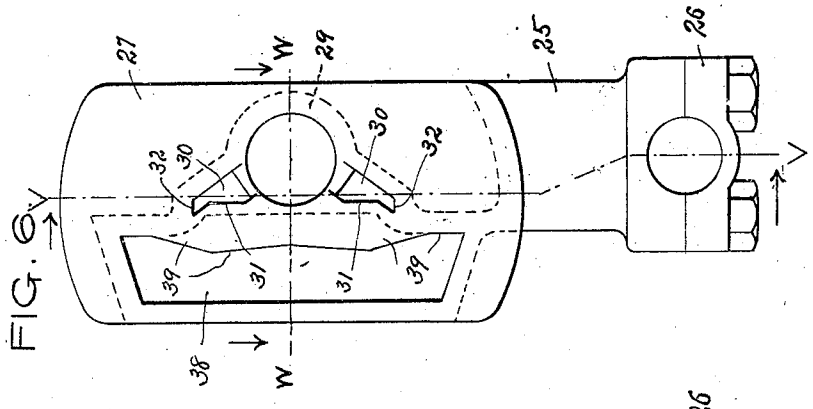


FIG. 7.

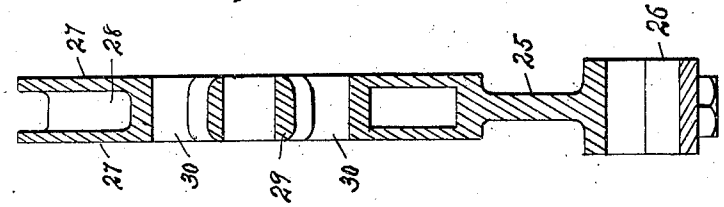
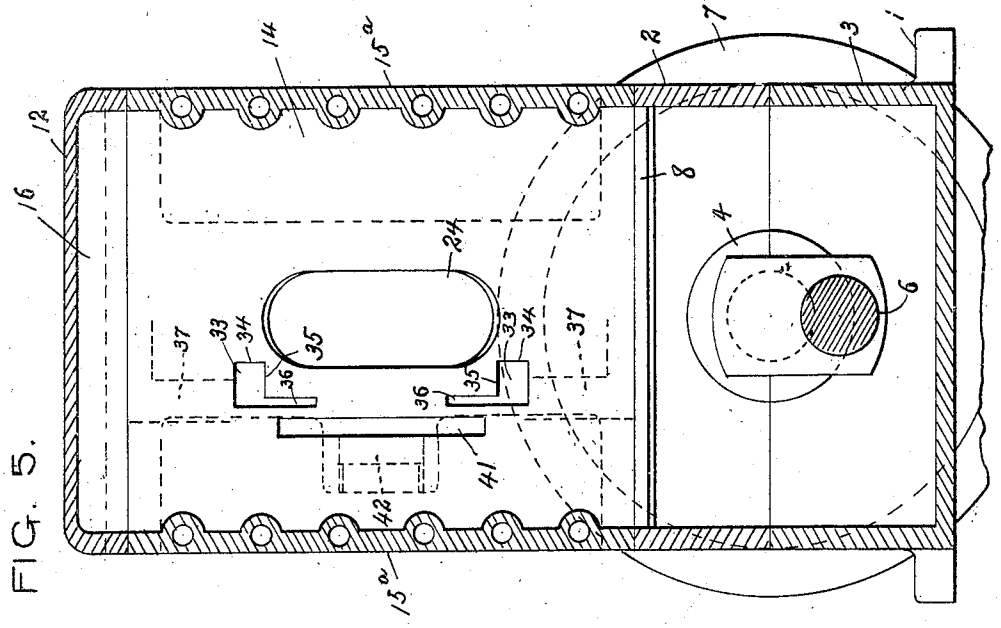


FIG. 5.



WITNESSES.

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UNITED STATES PATENT OFFICE.

ALFRED G. HEGGEM, OF IRONTON, OHIO.

ENGINE.

No. 836,186. Specification of Letters Patent. Patented Nov. 20, 1906.

Application filed November 25, 1905. Serial No. 289,021.

To all whom it may concern:

Be it known that I, ALFRED G. HEGGEM, a citizen of the United States, residing at Ironton, in the county of Lawrence and State of Ohio, have invented certain new and useful Improvements in Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to engines, and more particularly to that class used as motors or prime movers furnishing power derived from fluid under pressure.

The object of the invention is to provide a simplified construction, reducing the number of moving parts to a minimum, and obtaining compactness.

A further object is to do away with the stuffing-boxes usually required in structures of this class with their attendant wear and friction.

To these and other ends my invention consists in certain novel features which I will now proceed to describe and will then particularly point out in the claims.

In the accompanying drawings, Figure 1 is a central vertical sectional view of the structure embodying my invention in one form, the plane of section being indicated by the line *x x* of Fig. 2 and the direction in which the same is viewed by the accompanying arrows. Fig. 2 is a vertical sectional view at right angles to that shown in Fig. 1, taken on the line *y y* of Fig. 1 and looking in the direction of the arrows. Fig. 3 is a plan view with the top plate or upper cylinder-heads removed. Fig. 4 is a plan section taken on the line *z z* of Fig. 1 and looking in the direction of the arrows. Fig. 5 is a view similar to Fig. 2, but with the moving parts omitted, with the exception of the crank-shaft and fly-wheel. Fig. 6 is a side elevation of the combined connecting-rod and valve detached. Fig. 7 is a sectional view of the same, taken on the line *v v* of Fig. 6 and looking in the direction of the arrows; and Fig. 8 is a sectional view of the same, taken on the line *w w* of Fig. 6 and looking in the direction of the arrows.

In the said drawings I have shown my invention as embodied in an engine particularly designed for use in connection with steam as a motor fluid; but I wish it to be understood that my invention is not limited in its application to steam-engines, being adapted for use in connection with engines employing other fluids under pressure.

Referring to the particular embodiment of my invention chosen for purposes of illustration, it may be further stated that I have chosen to illustrate the same as an upright or vertical engine, although this arrangement is not essential, and the terms of direction hereinafter used, as "top," "bottom," "up," and "down," are used solely for the convenience of reference.

In the said structure, 1 indicates a suitable base, preferably closed or box-like in form, as shown, being divided horizontally about midway of its height into two parts 2 and 3. This base is provided with bearings 4 for the crank-shaft 5, which has the central crank 6, said crank-shaft being inclosed within the base and projecting therefrom at one end to receive the fly-wheel 7. The upper member 2 of the base has formed thereon a plate 8, which receives and supports the cylinders 9, the lower ends of which said plate tightly closes to form the cylinder-heads which are imperforate, being without the usual openings for the piston-rods and also without the usual stuffing-boxes required for such openings. This bottom plate of the cylinders is provided with screw-bolts 10, by means of which the cylinders are secured in position thereon, and has a central slot 11 for the passage of the connecting-rod, hereinafter referred to. The cylinders are closed at their upper ends by a top plate 12, secured in position by screw-bolts 13, said top plate being also imperforate, so that the cylinders are entirely closed at both ends. The cylinders are arranged in parallelism side by side, their adjacent faces being somewhat separated and being in the form of parallel flat or plane-surfaced plates 14, the space thus formed between said parallel plates being indicated by the reference-numeral 15 and being the space in which the combined connecting-rod and valve travels. This space at its lower end merges into or communicates with the slot 11, while its upper end is closed by the top plate 12, which latter has a central internal recess 16, forming an extension in said space 15. The space 15 is inclosed as to those vertical sides thereof lying between the vertical margins of the parallel plates 14 by means of vertical strips or plates 15^a, secured to the margins of the plates 14 by bolts 15^b.

In each cylinder there is located a piston, (indicated as a whole by the reference-numeral 17.) Each piston comprises a suitably packed head 18 at each end and an open

body connecting said heads and having a central sleeve 19 arranged transversely of the piston and adapted to receive a cross-pin 20, which connects the two pistons. Each piston-body is of less diameter than the cylinder in which it travels, their structure being preferably cruciform, as shown more particularly in Fig. 4, being composed of two webs 21, crossing each other at right angles and connecting the heads 18 with the central sleeve 19. There is thus formed a free steam-space in each piston between the heads thereof, the spaces being connected with each other and with the source of supply of steam under pressure in the manner hereinafter described, so that the live steam is free to circulate through and occupy these steam-spaces. Its pressure being equal at each end or head of each piston, the live-steam thus admitted has no effect upon the movements of the pistons. The cross-pin 20 is secured in the sleeves 19 in any suitable manner, being shown in the present instance as secured at one end by a screw-bolt 22 and washer 23 and at the other end by a similar construction, to be hereinafter referred to. The two pistons and the cross-pin thus move in unison, the cross-pin extending across the space 15. To this end and for the purpose of connecting the steam-spaces in the two pistons the inner or adjacent walls of the cylinders are provided with longitudinal slots 24, in which the cross-pin 20 travels.

25 designates as a whole the combined connecting-rod and valve, which serves not only to transmit the reciprocating motion of the pistons to the crank-shaft and there convert it into rotary motion, but also to control the steam-distribution. To this end its lower extremity has a bearing 26 on the crank-pin 6, while its upper portion is formed into two parallel plates 27, having an intervening space 28 between them. These plates 27 fit against the plates 14 with a steam-tight fit and support between them a bearing 29, in which the cross-pin 20 is mounted, so that the connecting-rod is free to vibrate or rock upon said cross-pin. The body of the upper end of the rod constitutes the steam-distributing valve, and the plates 27 keep the slots or openings 24 covered at all times. Said body and plates are provided, however, with transverse live-steam ports or passages 30, extending through the body and plates from side to side thereof and having the form in cross-section shown more particularly in Fig. 6. The defining features of each of these ports are the wall or edge 31, which determines the admission of steam to the cylinder, and the defining wall or edge 32 at right angles thereto, which determines the cut-off. Coöperating with the ports 30, which are constantly supplied with live steam in the manner hereinafter set forth, are the cylinder-ports 33. (Shown in detail in Fig. 5.) It is the passage of the wall or edge 31 of each valve-port beyond the wall or edge 34 of the corresponding cylinder-port that admits steam to the cylinder, and it is the passage of the wall or edge 32 of the valve-port beyond the wall or edge 35 of the corresponding cylinder-port which cuts off the supply of live steam to the cylinder. Each cylinder-port is provided with an extension 36, which permits the exhaust of the steam to begin at the proper moment, when the crank is on center, as will be seen from an inspection of Fig. 2, where the parts are shown in such a position that steam is just beginning to be admitted at the lower end of the cylinder and just beginning to be exhausted from the upper end. It will be understood, of course, that the ports 33 are connected with the respective ends of their cylinders, the connecting-passages being shown in dotted lines in Figs. 1, 2, and 5 and in full lines in Fig. 3 and being indicated by the reference-numeral 37. The valve portion of the connecting-rod has an exhaust-space 38 therein communicating alternately with the cylinder-ports 33, said valve portion being provided with marginal portions 39, which control the communication between the exhaust-space 38 of the valve and the cylinder-ports 33. The combined oscillating and reciprocating movement of the valve portion of the connecting-rod serves to open one of the ports to the exhaust when the other port is opened to the live steam, maintaining this connection with the exhaust until just before the admission of live steam to the same port, when the valve cuts said port off from the exhaust connection. The exhaust remains open through one-half the stroke, while the admission occurs only during the initial portion of each stroke, being varied, as desired, by the design of the ports. The exhaust-space 38 extends through the plates 27 at each side, as indicated at 40, and one of the plates 14 has formed therein an exhaust-passage 41, which is in constant communication with the exhaust-space 38 of the valve, said port leading to an outlet 42 for the exhaust-steam, to which outlet an exhaust-pipe may be connected.

Steam is admitted to one of the cylinders 9 through an opening 43 in the side thereof, and I have shown a steam-chest 44 as mounted on the side of the cylinder where the opening 43 is located, said steam-chest having a tapped opening 45 to receive a steam-supply pipe. It will be seen that the steam thus admitted into the steam-chest passes through the opening 43 and through the open piston of the adjacent steam-cylinder, passing through the slotted opening 24 into the ports 30 and through these latter into the piston of the adjacent cylinder, entering the same through the slot 24 in the wall of said

cylinder. Thus the ports 30 are always supplied with live steam, which is distributed to the ends of the cylinders in the manner just described, the exhaust-steam escaping in the manner just set forth.

From an examination of Figs. 1 and 5 it will be seen that the slotted openings 24 are of greater length than the travel of the pin 20 and its bearing 29, so that when the piston is at the end of its stroke in either direction the end of the opening 24 adjacent to which the bearing 29 lies still presents a space for the passage of steam, as shown in Fig. 1. Each port 30 at each of its ends has its discharge-mouth made flaring or of increasing width toward the bearing, as shown in Fig. 6, so that when the parts are in the position shown in Figs. 1 and 2 the lower port 30 is in communication with the steam space or passage at the lower end of each of the slotted openings 24. The same is true of the upper port 30 when the piston is at the upper end of its stroke, and of course both ports 30 are always in communication with both of the slotted openings 24 throughout all of the intermediate positions. Therefore the ports 30 are, as already stated, always supplied with live steam, and in the position of the parts shown in Figs. 1 and 2 the lower port 30 serves to admit the live steam from the interior of the pistons, through which it circulates freely, to the lower ports 33 of both cylinders, while the upper port 30 maintains the steam communication between the interiors of the two pistons. On the downstroke the upper port 30 serves to conduct the steam from the interior of the pistons to the upper cylinder-ports, while the lower port 30 serves in its turn to maintain the steam communication between the interiors of the pistons. After the cut-off at either end and during the intermediate portion of each stroke both of the ports 30 serve as communicating-passages between the cylinder-interiors.

I have illustrated a provision which I have made for lubricating the bearing of the connecting-rod upon the cross-pin 20. This comprises a tube 46, having two portions bent or formed at right angles to each other. One of these portions 47 is threaded externally and screws into a correspondingly-threaded opening in one end of the cross-pin 20, being the end opposite that which receives the screw-bolt 22. A nut 48 and washer 49, mounted on this threaded portion, serve, in conjunction with the screw-bolt 22 and washer 23, to secure the cross-pin in position in the pistons. An oil passage or conduit 50, formed in the body of the cross-pin, extends first axially inward from the end of the tube 46 and then radially outward to the bearing-surfaces, as indicated in dotted lines in Fig. 1. The other portion of the tube 46 (indicated at 51) extends in the direction of travel of the pistons and fits and slides over a fixed tube 52, mounted in the steam-chest 44, through the wall of which it extends, so as to receive a suitable lubricant reservoir or connection. A supply of the lubricant is thus assured to the bearing between the cross-pin and connecting-rod. The opening 43 is elongated into the form of a slot to accommodate the travel of the part 47 of the tube 46, thus giving also a more extensive steam-outlet from the steam-chest.

It will be observed that the engine is extremely compact in its structure, being also entirely inclosed, so that the only moving part exposed is the fly-wheel, which may also serve as a driving-pulley. The structure is exceedingly simple in character, requiring no separate valve or valve-rod, the valve being formed on or constituting a part of the connecting-rod and the combined reciprocating and oscillating motions of said rod serving to move the valve to the various positions which it must assume in order to properly control the distribution of the steam. The connecting-rod is located between the two cylinders, where it is entirely concealed and protected and where it can be most efficiently connected to the two pistons with the embodyment of a minimum of material and weight. Moreover, this position of the combined connecting-rod and valve permits the use of a single valve to directly control the distribution of the steam for the two cylinders between which it lies. No stuffing-boxes are required, and the wear and friction due to their use are thus avoided.

As I have already stated, my invention is not restricted in its application to engines using steam as a motor fluid, as it is obvious that the same principles may be employed in connection with other fluids under pressure. Moreover, although I prefer the double-cylinder construction shown, it will be apparent that one of the cylinders and pistons may be omitted and steam may be supplied directly to the valve without passing through an intermediate part, such as the piston lying between it and the steam-chest. In such a construction, of course, the presence of a plate similar to the plate 14 on the receiving side of the valve will be required. Other modifications will readily suggest themselves, and I therefore do not wish to be understood as limiting myself strictly to the precise details of construction hereinbefore described, and shown in the accompanying drawings.

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

1. In an engine, a cylinder having a lateral opening and fixed lateral ports, a piston adapted to reciprocate in said cylinder and having a pin projecting through the lateral opening thereof, a crank-shaft, and a connecting-rod between the crank and pin, said con-

necting-rod having thereon a valve moving in unison therewith and, by its combined reciprocating and oscillating motion, controlling the ports, said valve being outside the piston and cylinder and sliding directly over the ports, substantially as described.

2. In an engine, two parallel cylinders having openings in their adjacent sides, a piston in each cylinder, a cross-pin connecting said pistons, a crank-shaft, and a connecting-rod having one end pivoted on the crank and the other end pivoted on the cross-pin between the cylinders, substantially as described.

3. In an engine, two parallel cylinders provided on their adjacent sides with lateral openings and ports, a piston in each cylinder, a cross-pin connecting said pistons, a crank-shaft, and a connecting-rod having one end pivoted on the crank and the other pivoted on the cross-pin, said connecting-rod having a valve thereon moving in unison therewith and controlling the ports, substantially as described.

4. In an engine, two parallel cylinders, having their adjacent sides formed in parallel planes and provided with longitudinal openings and ports, a piston in each cylinder, a cross-pin connecting said pistons through the longitudinal openings, a crank-shaft, and a connecting-rod having one of its ends pivoted on the crank and its other end pivoted on the cross-pin, said connecting-rod having a valve portion at its cross-pin end fitting between the parallel surfaces of the cylinders and controlling the ports thereof, substantially as described.

5. In an engine, two parallel cylinders having their adjacent faces formed in parallel plane surfaces with longitudinal openings and ports, a piston in each cylinder, a cross-pin connecting said pistons, a crank-shaft, and a connecting-rod between the crank and cross-pin, the cross-pin end of said connecting-rod fitting between the parallel surfaces of the cylinders and constituting a valve having transverse ports or openings therethrough which are successively brought into and out of registry with the cylinder-ports by the combined reciprocating and oscillating movements of the connecting-rod, substantially as described.

6. In an engine, two parallel cylinders having longitudinal openings in their adjacent parallel walls, and admission-ports adjacent to said openings, one of said cylinders being provided with an exhaust-port in its said wall, a piston in each cylinder, one of said pistons having a hollow body for the free passage of pressure fluid, and its cylinder being provided with means for the admission of pressure fluid to the interior of said piston, a cross-pin connecting said pistons, a crank-shaft, and a connecting-rod between the crank and cross-pin, said connecting-rod having its cross-pin end fitting between the parallel cylinder-walls and provided with transverse ports always in connection with the longitudinal opening of the cylinder to which the pressure fluid is admitted, said ports alternately registering with the admission-ports, substantially as described.

7. In an engine, an inclosing base having crank-shaft bearings, a crank-shaft mounted therein, two parallel cylinders mounted on said base, closed externally at their tops, bottoms and sides and having between them a parallel walled space communicating with the interior of the base, the parallel walls of said cylinders having longitudinal openings and ports, a piston in each cylinder, a cross-pin connecting said pistons through the longitudinal openings, and a connecting-rod having its lower end pivoted on the crank of the crank-shaft within the base and its upper end pivoted on the cross-rod between the cylinders, said connecting-rod having a valve portion controlling the ports and inclosed and fitting between the parallel walls of the inclosed space between the cylinders, substantially as described.

8. In an engine, two parallel cylinders having longitudinal openings in their adjacent parallel walls, and admission-ports adjacent to said openings, one of said cylinders having an exhaust-port in its said wall, a piston in each cylinder, each piston having a hollow body always in communication with the longitudinal opening of its cylinder, and terminal heads always located beyond the ends of the longitudinal opening, one of said cylinders being provided with means for the admission of pressure fluid to the interior of its piston, a cross-pin connecting said pistons, a crank-shaft, and a connecting-rod between the crank and cross-pin, said connecting-rod having its cross-pin end fitting between the parallel cylinder-walls and provided with transverse ports always in communication with the longitudinal cylinder-openings, said ports also alternately registering with the admission-port, substantially as described.

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

ALFRED G. HEGGEM.

Witnesses:
FRANK M. POE,
GRACE JONES.