A. D. BAKER.

ENGINE.

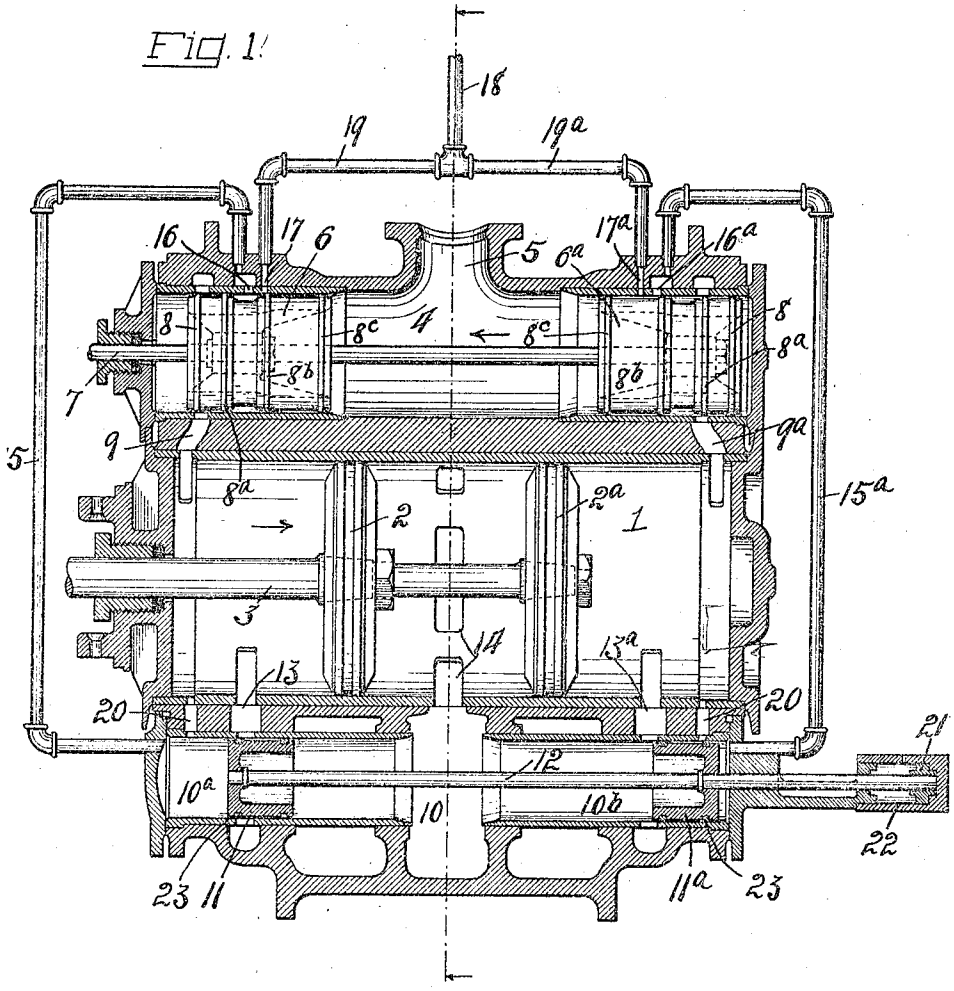
APPLICATION FILED JUNE 20, 1914

1,145,177.

Patented July 6, 1915.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:-

R. G. Allen.

E. E. Thomas

INVENTOR.

Abner D. Baker.

By Owen, Owen & Crampton.

His attys.

A. D. BAKER.

ENGINE.

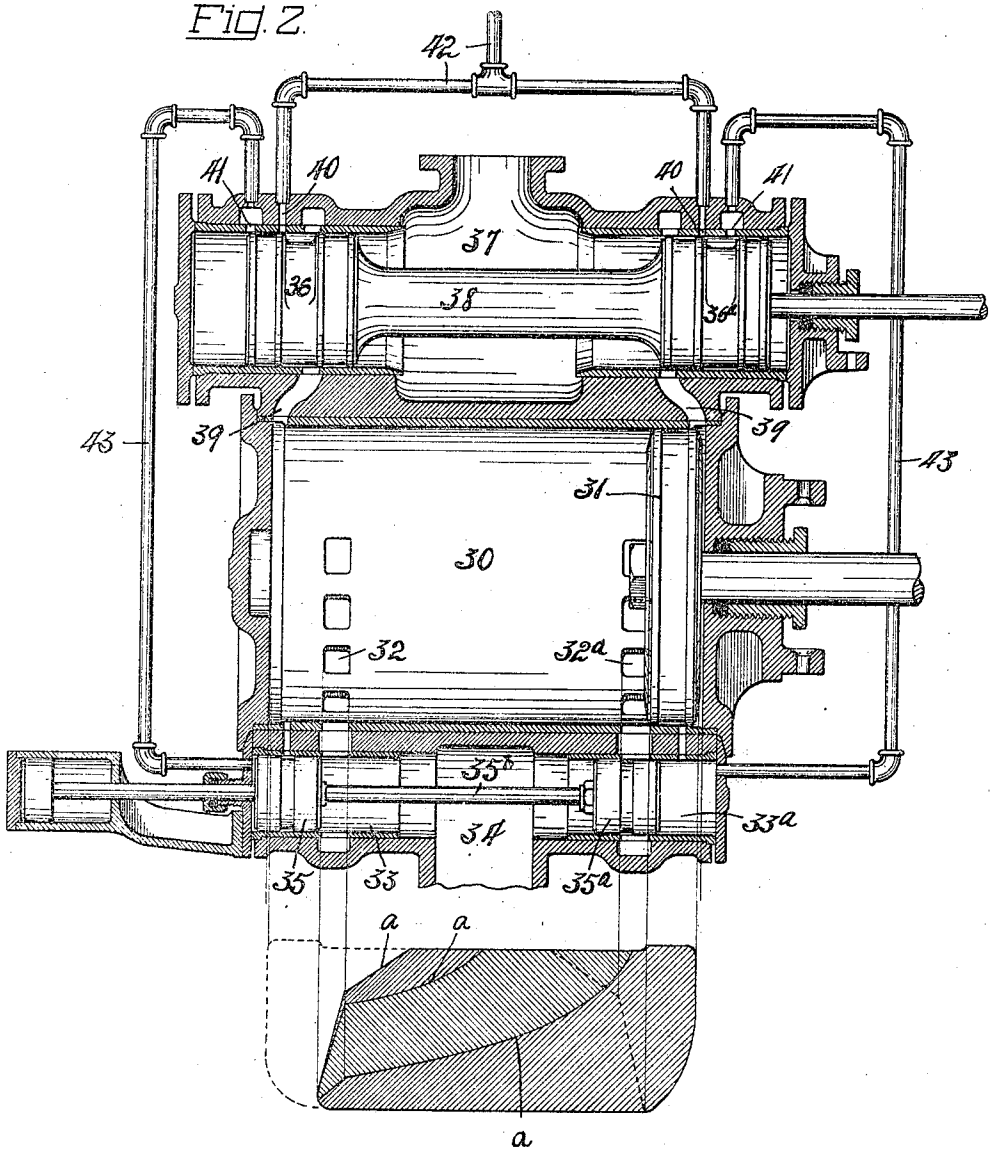
APPLICATION FILED JUNE 20, 1914.

1,145,177.

Patented July 6, 1915.

3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:-

R. G. Allen.

E. E. Thomas.

INVENTOR.

Abner D. Baker,

By Owen, Owen & Crampton,

His attys.

A. D. BAKER.

ENGINE.

APPLICATION FILED JUNE 20, 1914.

1,145,177.

Patented July 6, 1915.

3 SHEETS—SHEET 3.

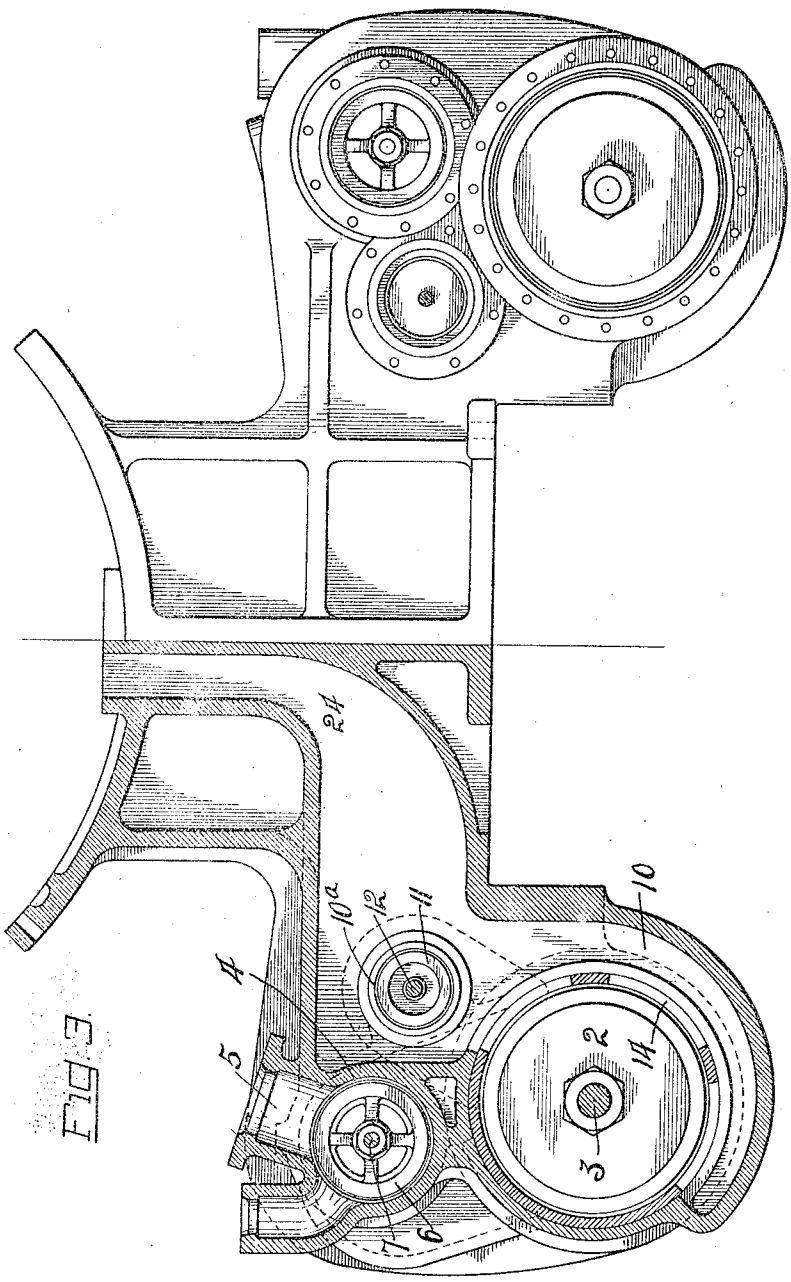


Fig 3

WITNESSES:-

R. G. Allen.

E. E. Thomas.

INVENTOR.

Abner D. Baker,

By Owen, Owen & Crampton

His attys.

UNITED STATES PATENT OFFICE.

ABNER D. BAKER, OF SWANTON, OHIO.

ENGINE.

1,145,177. Specification of Letters Patent. Patented July 6, 1915.

Application filed June 20, 1914. Serial No. 846,316.

To all whom it may concern:

Be it known that I, ABNER D. BAKER, a citizen of the United States, and a resident of Swanton, in the county of Fulton and State of Ohio, have invented a certain new and useful Engine; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to means for using steam, air or gas as a motive power and has particular reference to locomotive and traction engines of the reversible type.

The primary object of my invention is the provision of an engine having a main valve for controlling the inlet of an operating fluid to its cylinder and a valve for controlling the exhaust of fluid from the cylinder, of simple and efficient means for controlling the movement of the exhaust valve from the main or inlet valve, whereby the two valves must work in synchronism, and the complicated mechanisms heretofore employed to accomplish such purpose are rendered unnecessary, thereby increasing the efficiency and commercial practicability of engines of the character described.

A further object of the invention is the provision of simple and efficient means for rendering machines of this character reversible without the use of the complicated mechanisms heretofore employed for such purpose.

A further object of the invention is to overcome the loss in efficiency incident to the use of mechanically driven exhaust valves on account of the small valve travel choking the exhaust opening when the engine is running on short cut-off.

The invention is fully described in the following specification, and while, in its broader aspect, it is capable of embodiment in numerous forms, only two embodiments thereof are illustrated in the accompanying drawings, in which,—

Figure 1 is a diagrammatical section of the long type of engine embodying my invention with the main valve, piston and exhaust valves disposed in the same plane. Fig. 2 is a similar view of a short type of engine with an indicator card associated therewith, and Fig. 3 is a cross-section of the engines of a locomotive with one in cross-section and with the end plates removed from the valve chambers and cylinders of the other, such figure being applicable to both types of engines.

Referring particularly to Fig. 1 of the drawings, 1 designates the cylinder of the engine in which the piston 2 works, such piston being shown, in the present instance, as comprising two axially spaced parts, but may be of the solid or single type as shown in Fig. 2 if desired. The piston 2 is carried by the piston rod 3, which projects through one end of the cylinder, as is customary.

At one side of the cylinder 1, above the same in the present instance, is disposed a valve chamber or fluid chest 4 having a fluid inlet 5 for communication with a suitable source of fluid pressure supply, as for instance, with the boiler of a locomotive. In the opposite end portions of the valve chamber 4 are mounted valves 6, 6^a, respectively, of the piston type, in the present instance, said valves being fixed in spaced relation to a valve rod 7, which has one end projecting without an end of the chamber and is operated in any suitable manner as well understood in the art. Each of the valves 6, 6^a, in the present instance, is of the outside admission type, the center thereof being of spider form to permit the passage of fluid therethrough to the respective outer ends of the chamber 4, and is provided with four packing rings 8, 8^a, 8^b and 8^c. When each valve 6, 6^a is at or near the limit of its instroke the packing ring 8 thereof uncovers the admission port 9 to the respective end of the cylinder 1 to admit steam to such end of the cylinder from the valve chamber 4. While the valves 6, 6^a, in the present instance, are of the piston type, it is evident that any other suitable form of valve may be used as desired.

Located at some convenient point around the cylinder 1 is a chamber 10 in the opposite end portions 10^a and 10^b of which are mounted exhaust or compression valves 11, 11^a, respectively. These valves are connected in fixed relation by a valve rod 12 and operate to alternately open and close the auxiliary exhaust ports 13 and 13^a, respectively, which open communication between the valve chambers 10^a and 10^b and the respective end portions of the cylinder 1,

When steam or other fluid is being admitted to one end of the cylinder 1, the exhaust valve 11 or 11ª, which is disposed at the end of the cylinder, away from which the piston is moving, stands in position to close its ports 13 or 13ª, respectively, while the other exhaust valve stands in open position with relation to its port, as shown in Fig. 1, thus confining the steam within the power end of the cylinder and permitting an exhaust of the spent steam from the opposite end of the cylinder. When the piston has reached the limit of its stroke the main exhaust port 14, which opens into the chamber 10, will stand open to permit exhaust from the end of the cylinder 1 into which steam was last admitted, as is common in steam engines of this character. The amount of compression at the end of each stroke of the piston is determined by the distance between the outer edge of the port 13 or 13ª, as the case may be, and the limit of outward movement of the piston, as exhaust occurs through the port 13, 13ª toward which the piston is moving until the adjacent end packing ring 2ª of the piston has passed the outer edge of the port.

The means employed for controlling the movements of the compression valves 11, 11ª will now be described. The outer end of each valve chamber 10ª, 10ᵇ is in communication with the main valve chamber 4 through pipes 15, 15ª, respectively, and ports 16, 16ª in the wall of the main valve chamber. Opening into each end portion of the valve chamber 4 in adjacent relation to the ports 16 and 16ª are ports 17 and 17ª, respectively, which may connect with a common source of fluid pressure supply through a pipe 18 having branches 19 and 19ª leading to the respective ports 17, 17ª. If air pressure is used, the pipe 18, in case of use in connection with a locomotive, is preferably connected to the main air reservoir thereof, and if steam is used it is preferable to connect said pipe to the cab turret, whereby a pressure is maintained in the ports 17 and 17ª at all times. The packing rings 8ª and 8ᵇ of each piston 6, 6ª are so disposed as to open communication between the respective ports 16—17 and 16ª—17ª during predetermined portions of the travel of said valves. The relative positions of the packing rings 8 and 8ᵇ of each main valve is preferably such that the ring 8ᵇ will uncover the associated port 17, 17ª slightly in advance of the uncovering of the associated admission port 9, 9ª by the packing ring 8, thereby admitting fluid pressure to the end of the chamber 10, which is adjacent to the end of the cylinder 1 to which steam is next to be admitted, slightly in advance of the admission of steam to the associated cylinder end, thereby forcing the valves 11 and 11ª toward the opposite end of the engine to cover the port 13 and 13ª disposed at the admission end of the cylinder and opening the other of said ports. A port 20 is provided between each end of the respective valve chamber 10ª, 10ᵇ to admit steam from the admission end of the cylinder 1 into the associated exhaust valve chamber to assist the pressure in the respective line 15, 15ª to maintain the valves 11, 11ª in shifted position. The ports 20 also serve to release the pressure in the outer end portion of the respective valve chamber 10ª, 10ᵇ on the outstroke of the valve therein.

One end of the valve rod 12 is extended without the chamber 10 and carries a piston 21, which works in a dash-pot 22 and serves to cushion the outstroke of each valve to prevent the pounding which would otherwise be present. It is not necessary to use such cushioning means if a packing ring 23 is provided on the outer end portion of each valve in position to pass over and close the associated port 20 before the valve has completed its outstroke, thus creating a compression space between the valve and the outer end of the valve chamber.

The operation of this type of engine is as follows: Supposing steam is to be admitted to the left end of the cylinder 1 to drive the piston 2 to the right, the main valve 6 will have opened communication between the ports 16 and 17 just prior to the ring 8 thereof uncovering the cylinder admission port 9, thereby admitting fluid pressure to the outer end of the exhaust valve chamber 10ª from the pressure line 18 and effecting a movement of the valves 11, 11ª to the right for the valve 11 to close the exhaust port 13 and for the valve 11ª to uncover its port 13ª to permit an exhaust therethrough. The time of cut off of the steam from the left end of the cylinder may be varied as desired, as is well understood in the art, and takes place, in the present instance, when the piston 2 is in the position shown. When the piston has already completed its stroke it will have uncovered the main exhaust port 14 to the right hand end of the cylinder to permit the expanded steam to exhaust therethrough into the chamber 10, the exhaust passing from such chamber through a passage-way 24 into the stack, as indicated in Fig. 3, as is common in locomotive engines.

In the short type of engine shown in Fig. 2 the construction is practically the same as above described for the long type of engine, except that the cylinder, valve chambers and pistons are not so long and the main or center exhaust ports 14 are omitted from the cylinder, the exhaust taking place only at the ends of the cylinder. In this figure, 30 designates the cylinder; 31 the piston working therein; 32 and 32ª the exhaust ports from the cylinder located ad-

jacent to the opposite ends thereof; 33 and 33ª the valve chambers into which the ports 32 and 32ª, respectively, open, said chambers having communication at their inner ends with a common exhaust passage 34; and 35 and 35ª the exhaust valves which are connected by the rod 35ᵇ and work in the respective chambers 33, 33ª to alternately close the respective exhaust ports 32, 32ª. The main valves 36 and 36ª are mounted for movements in the respective ends of the main valve chamber 37, being fixedly connected by a stem 38, and each controls the associated cylinder admission port 39 and the two ports 40 and 41, which open communication between the pressure line pipe 42 and the pipe 43, which latter leads to the outer end of one or the other of the exhaust valve chambers 33, 33ª, as shown. The valves 36 and 36ª, in the present instance, are of the inside admission instead of the outside admission type and the arrangement of the admission ports 39 and the ports 40—41 are therefore reversed, as indicated, this being the only difference between the two types of engines illustrated so far as the control means for the exhaust valves is concerned. In changing the main valves from the outside to the inside admission type requires a reversing of the action of such valves over the outside admission type, so that the valves move in the same direction as the piston, instead of in the opposite direction, as illustrated in Fig. 1.

The operation of this form of engine is as follows: The piston being at the limit of its right hand stroke, the valve 36 will stand in position to close the associated admission port 39 and also to close the communication between the ports 40 and 41, and the right hand valve 36ª will stand in position to uncover the right hand admission port 39 to the cylinder and to open communication between the associated ports 40—41, so that steam is admitted to the right end of the cylinder and communication between the fluid pressure line 43 and the right hand exhaust chamber 38 is opened. The lap of each main valve with respect to the associated admission port 39 and port 41 is such that the port 41 will be uncovered to open communication between it and the port 40 slightly in advance of the uncovering of the admission port 39, thus admitting pressure to the associated end of the exhaust chamber in time to shift the positions of the valves 35, 35ª to the left before steam is admitted to the cylinder to reverse the movement of the piston. The shifting of the position of the exhaust valves 35, 35ª in this manner opens the left hand exhaust ports 32 and closes the right hand exhaust ports 32ª so that exhaust takes place through the ports 32 during approximately the full left hand stroke of the piston, or until such ports have been closed by the piston passing over the same. The inward exhaust from the live end of the cylinder also takes place through this set of ports when the piston has moved a sufficient distance thereover to uncover the ports to the left end of the cylinder. When the piston has approximately reached the limit of its stroke the valve 38 will have moved to first open communication between the left hand set of ports 40—41 to admit pressure from the line 42 to the outer end of the exhaust chamber 33 to effect a shifting of the positions of the exhaust valve to close the ports 32 and open the ports 32ª, and the left hand admission port 39 will then be opened to reverse the movements of the piston.

The provision of the independent steam or fluid pressure line for controlling the action of the exhaust or compression valves adapts the invention for use in connection with reversible as well as with non-reversible engines, as the exhaust or compression valves are thereby always moved at the proper time relative to the piston, regardless of whether the piston is being driven by steam from the boiler or by a drifting of the engine, as is commonly the case with locomotives, or the piston may be driven forward and back in the cylinder by the momentum by the band or fly wheel of the engine without getting the compression or exhaust valve out of time with the piston. It will therefore be seen that the exhaust valve is an automatic reversible valve and also that the piston is always moving toward a wide open exhaust port. In addition to my improved exhaust valve doing its work more effectively than a mechanically driven valve it is free from complications and wearing parts.

I wish it understood that my invention is not limited to any particular arrangement, form or constructions of the parts and location of ports except in so far as such limitations are specified in the claims.

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

1. In an engine, a cylinder having an exhaust port adjacent to each end thereof, a valve chamber in communication with each exhaust port and forming a part of an exhaust passage, connected valves mounted in said chambers, one valve standing in open position with relation to its port when the other valve is in closed position with relation to its port, and vice versa, a fluid pressure line in communication with said valve chambers for admitting fluid pressure into first one and then the other of the chambers to shift the positions of said valves, said line being separate from the fluid admission line of the cylinder, and means operable during a running of the engine to con-

trol the admission of fluid pressure to said chambers.

2. In an engine, a cylinder having exhaust ports which are spaced longitudinally of the cylinder, a fluid supply line in connection with the cylinder, a valve for each exhaust port, and a fluid line for supplying fluid to control the movements of said valves, and means operable to control the admission of fluid to the cylinder from said first line and the passage of fluid through said second line to control the movements of said valves.

3. In an engine, a cylinder having an exhaust port adjacent to each end thereof, means operable to open one port when the other is closed, and vice versa, a fluid supply line having communication with the cylinder, a second fluid supply line for introducing a fluid in different positions with respect to said means to move the same to alternately open and close said ports at predetermined intervals in a running of the engine, and means operable to control the passage of fluid through said second line to operate said first means and to control the admission of fluid to the cylinder from said first line.

4. In an engine, a cylinder having exhaust ports arranged near opposite ends thereof, valves for controlling the exhaust from said ports, two fluid pressure lines, one having communication with the cylinder and the other introducing fluid in position to intermittently move said valves to open and close said exhaust ports in alternate relation, and valve means common to both of said lines for controlling the passage of fluid through each.

5. In an engine, a cylinder having exhaust ports in opposite end portions thereof, a main valve chamber having communication with a source of fluid pressure supply and with said cylinder, an exhaust valve chamber having communication with said exhaust ports and with a source of fluid pressure supply, valves working in said latter chamber to control the exhaust through said ports, means for introducing fluid into said latter chamber, and means operable to control the admission of fluid pressure to the cylinder from said main valve chamber and to control the admission of fluid to said exhaust valve chamber to periodically move the exhaust valves to open and close the respective exhaust ports.

6. In an engine, a cylinder having exhaust ports in opposite end portions thereof, a main valve chamber having communication with a source of fluid pressure supply and with the interior of the cylinder, an exhaust chamber having communication with said exhaust ports and with a source of fluid pressure supply, and a valve working in said main valve chamber and operable to control the predetermined timed admission of fluid to the cylinder and to control the predetermined timed admission of fluid to different portions of said exhaust chamber to operate the exhaust valves to alternately open and close said exhaust ports, each port being closed when the other is open.

7. In an engine, a cylinder, a main valve chamber having communication with a source of fluid pressure supply and with the interior of the cylinder, an exhaust chamber having multiple communication with a source of fluid pressure supply and having an exhaust and a release port at each end in communication with the respective end of the cylinder, valves working in said exhaust chamber and operable in unison to alternately open and close said exhaust ports, means operable to control the admission of fluid to said exhaust chamber to move the exhaust valves first in one and then the opposite direction to alternately cover and uncover the respective ports in predetermined timed relation to the running of the engine and also operable to control the admission of fluid to the cylinder, said release ports serving to admit fluid from the cylinder to the exhaust chamber to assist in the control of said valves.

8. In an engine of the character described, a cylinder having inlet ports, and exhaust ports arranged adjacent to the inlet ports, a valve for controlling the inlet ports, and means for controlling the exhaust ports including a shiftable element and a supply line for fluid for operating said element, said line being controlled by said valve, substantially as described.

9. In an engine of the character described, a cylinder having inlet ports at opposite ends thereof and exhaust ports also arranged adjacent its ends and in advance of the inlet ports, a valve for controlling the inlet ports, and means for controlling the exhaust ports including a shiftable element, a fluid pressure passageway having branches communicating with opposite parts of said element, each of said branches being located in coöperative relation with said valve whereby the passage of fluid through the branches is controlled by said valve.

10. In an engine of the character described, a cylinder having an inlet port adjacent one end thereof, an exhaust port also located adjacent the said end and in advance of the inlet port, a valve for controlling the inlet port, a valve for controlling the exhaust port, a fluid pressure conduit in cooperative relation at one end with the last named valve, and in coöperative relation intermediate of its ends with the first named valve, the aforesaid parts being coördinated for effecting an opening of the conduit by the movement of the first named valve in a direction for opening the inlet port, said opening of the conduit occurring slightly in

advance of the opening of the inlet port whereby the valve associated with the exhaust port will close the same prior to the opening of the inlet port.

11. In an engine, a cylinder having an exhaust port near each end thereof, a double exhaust valve controlling the exhaust from said ports, a main steam admission valve for the cylinder, and means controlled by said main valve and including a fluid pressure line for alternately introducing fluid under pressure to opposite ends of said valve to move same in first one and then the opposite direction to alternately uncover and cover the respective exhaust ports.

12. An engine having a cylinder, a main valve chamber and an exhaust valve chamber, said cylinder having an exhaust port near each end thereof opening into the exhaust valve chamber, a double exhaust valve working in the exhaust valve chamber and operable to permit an alternate exhaust through said valve ports, a fluid admission valve in said main valve chamber, and means controlled by said main valve for introducing fluid under pressure to said exhaust valve chamber to periodically move the exhaust valve to cover first one and then the other of said exhaust ports, and vice versa.

13. An engine having a cylinder, a main valve chamber, and an exhaust passage, the cylinder being provided with an exhaust port near each end thereof opening into said passage, means mounted in said exhaust passage for controlling the alternate exhaust of fluid from the cylinder through said ports, independent fluid lines, one for introducing fluid into said passage to control the movements of the valve to alternately uncover the exhaust ports, and vice versa, and the other for introducing fluid through said main valve chamber and into the cylinder, and common means for controlling the admission of fluid to the cylinder and the admission of fluid to said passage, the exhaust valve being moved to close the ports adjacent to the admission end of the cylinder in advance of the admission of fluid to such end, and to uncover the port at the opposite end of the cylinder.

14. An engine having a cylinder, a main steam chamber and an exhaust valve chamber, the cylinder having admission ports in communication with the main valve chamber and having both an exhaust port and an auxiliary port near each end thereof in communication with the exhaust chamber, a double exhaust valve in said exhaust chamber for controlling the exhaust and auxiliary ports at respective ends of the cylinder, a fluid line for introducing fluid under pressure to said exhaust chamber alternately at opposite ends of said valve to shift the valve to periodically cover and uncover the respective ports, each exhaust port being open when the other is closed, and a main valve disposed in said main valve chamber for controlling the admission of fluid to said cylinder and having portions disposed in said fluid line and operable to alternately direct fluid to first one then the other end of the exhaust valve chamber, said main valve being operable to admit fluid to the ends of the exhaust valve chamber in advance of the admission of fluid to the respective ends of the cylinder, said auxiliary ports permitting fluid to pass between the cylinder and the exhaust valve chamber without the respective ends of the exhaust valve at predetermined intervals.

In testimony whereof, I have hereunto signed my name to this specification in the presence of two subscribing witnesses.

ABNER D. BAKER.

Witnesses:
F. E. AUL,
R. G. ALLEN.