

No. 737,610.

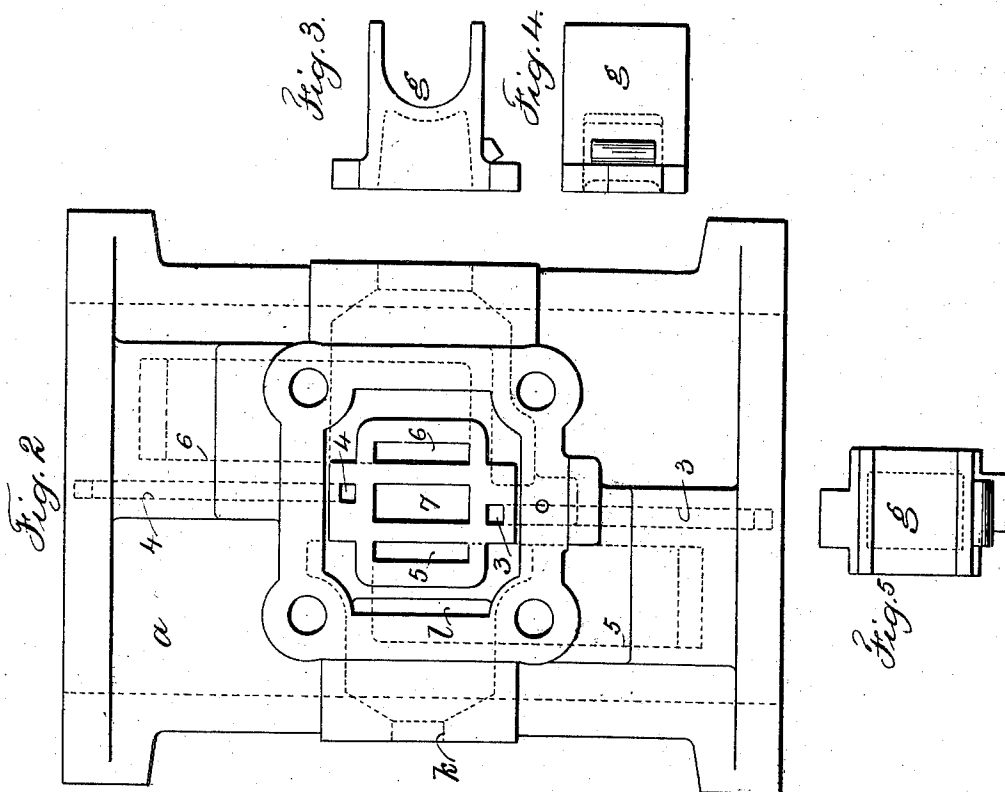
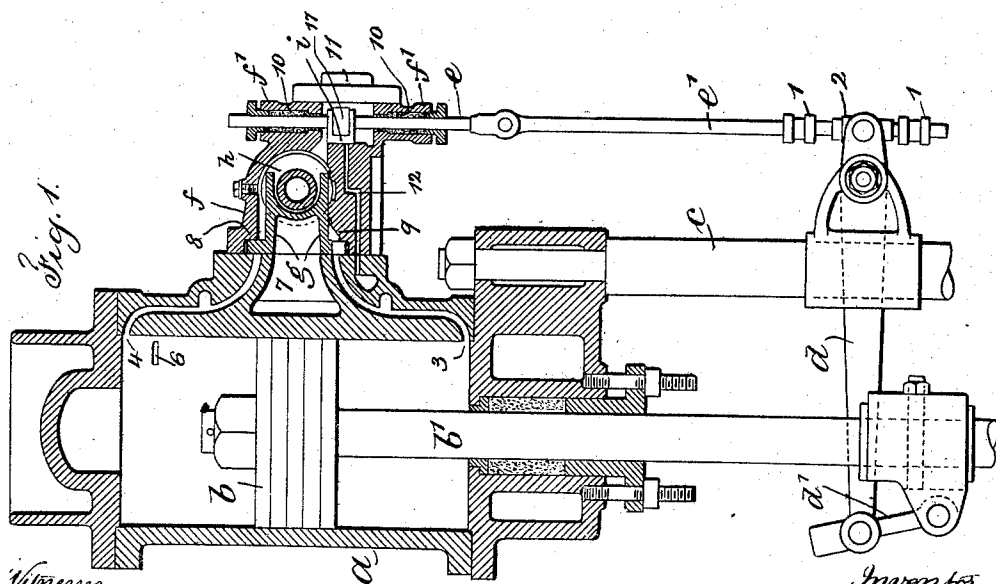
PATENTED SEPT. 1, 1903.

A. F. HALL.
ENGINE.

APPLICATION FILED AUG. 6, 1902.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses
Charles Smith
J. Staib

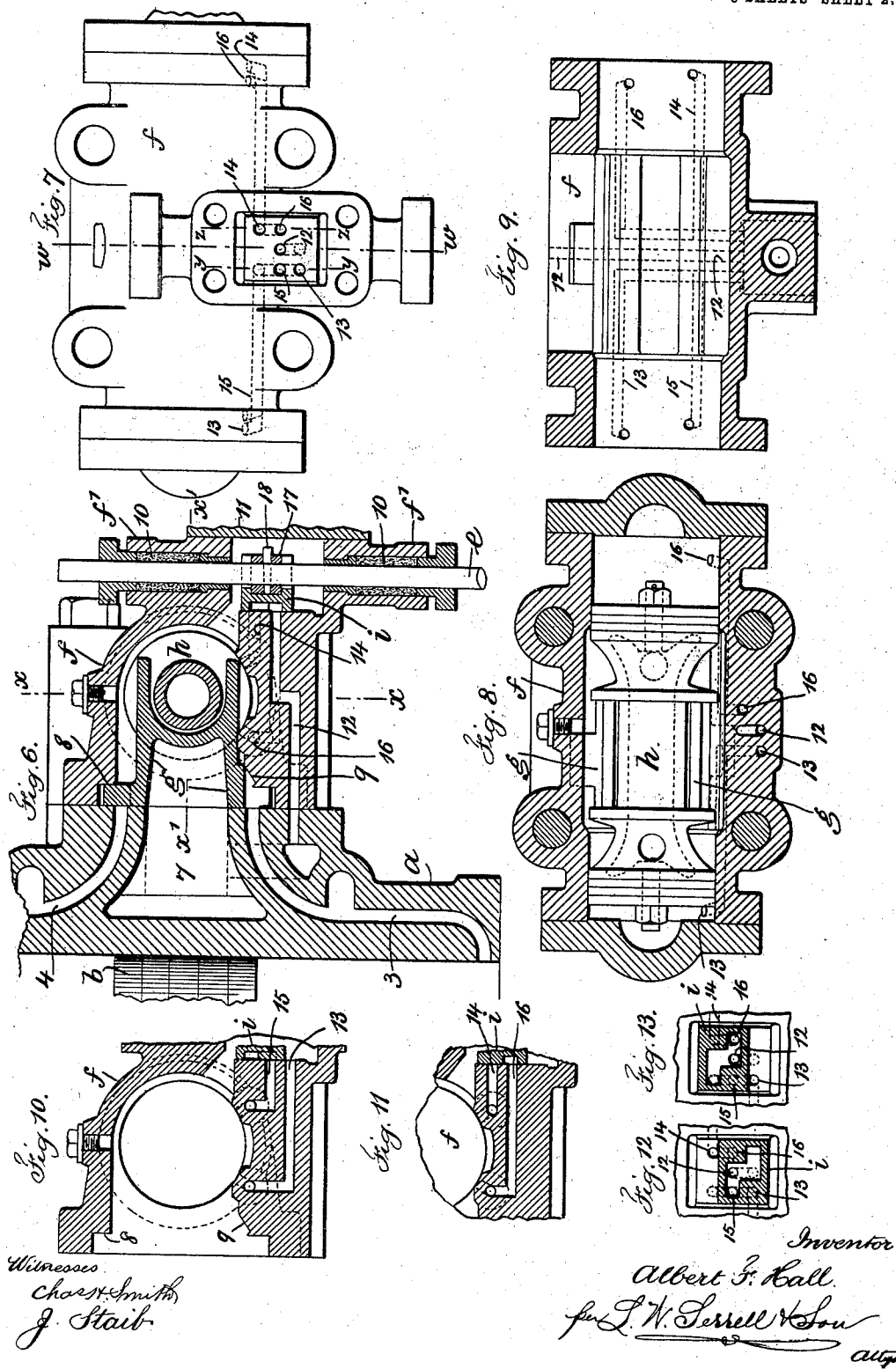
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3 SHEETS—SHEET 2.

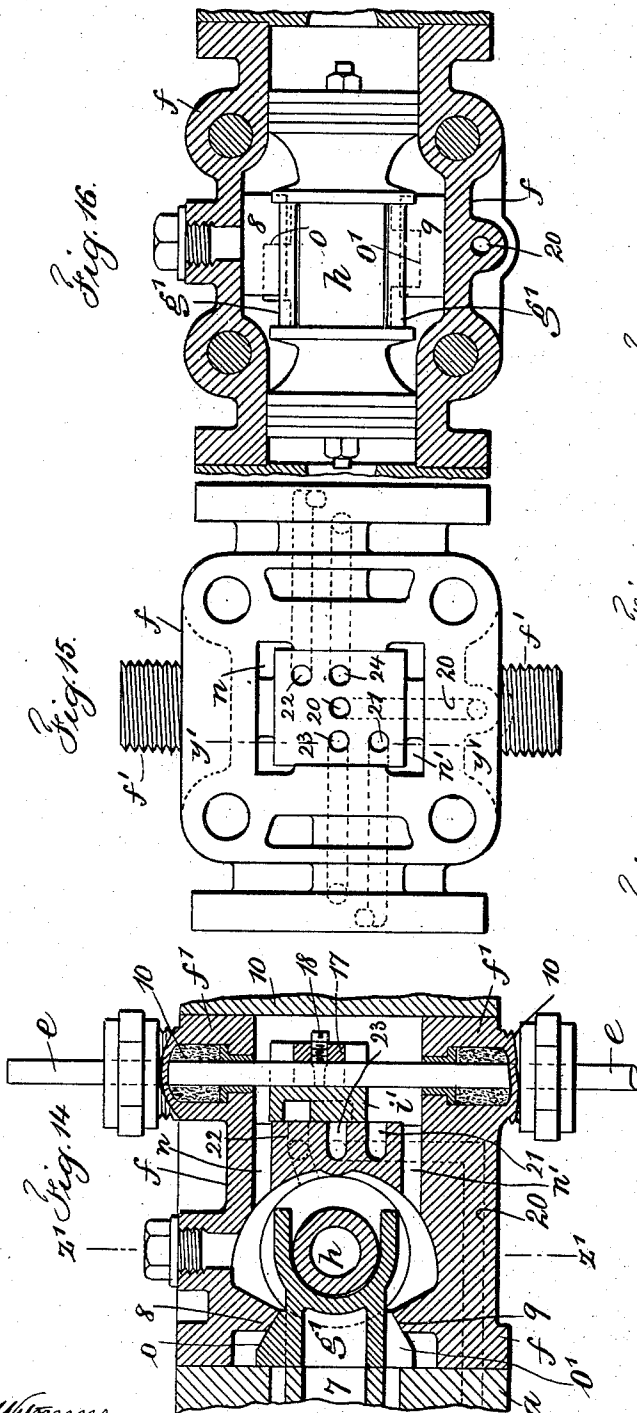
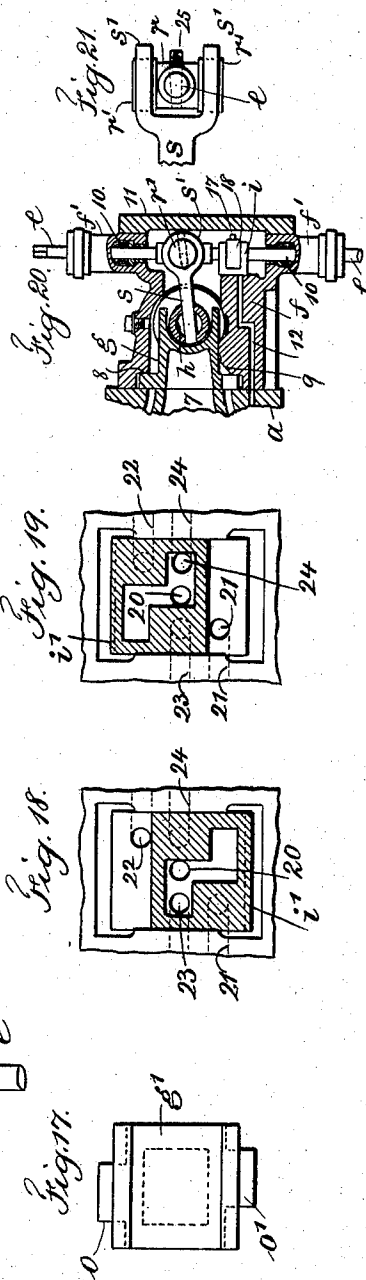


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3 SHEETS—SHEET 3.



Witnesses

Chas. N. Smith
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UNITED STATES PATENT OFFICE.

ALBERT F. HALL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE GEO. F. BLAKE MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 737,610, dated September 1, 1903.

Application filed August 6, 1902. Serial No. 118,577. (No model.)

To all whom it may concern:

Be it known that I, ALBERT F. HALL, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Engines, of which the following is a specification.

My invention relates to the class of engines applicable for actuating fluid-pumps in which the main slide-valve is operated by an auxiliary piston and in which there is an auxiliary valve for controlling the movements of the auxiliary piston. The auxiliary piston is connected with a slide-valve in such a manner that said valve will be moved by and simultaneously with the reciprocating movement of the auxiliary piston.

In carrying out my invention I provide an auxiliary piston coacting with and moving the main slide-valve. This auxiliary piston has a reciprocating longitudinal movement in a steam-chest, and in the steam-chest there are arranged suitable exhaust and steam ports, opening into the steam-chest at the respective ends of the stroke of said auxiliary piston and opening at the valve-seat provided in the outer portion of said steam-chest, where an auxiliary valve actuated by a valve-rod moves over said seat provided in the outer portion of the steam-chest to cover and uncover the steam and exhaust ports, so as to actuate said auxiliary piston and the main slide-valve. The valve-rod is in turn actuated by an auxiliary-valve rod, a rocker arm and link connected to and which parts receive their movement from the main piston-rod.

In the drawings, Figure 1 is a vertical section and partial elevation representing my improvements. Fig. 2 is an elevation of the steam-cylinder and the valve-seat thereof. Fig. 3 is a side elevation. Fig. 4 is an inverted plan, and Fig. 5 is an end elevation, of the main slide-valve. Fig. 6 is a central vertical section at the line *ww* of Fig. 7 through the ports of the steam-cylinder, through the steam-chest, the auxiliary piston, and the auxiliary valve, showing the ports thereof. Fig. 7 is an elevation of the steam-chest with the cap-plate removed, showing the seat for

the auxiliary valve. Fig. 8 is a vertical section at the line *xx* of Fig. 6 and at right angles to the section Fig. 6, showing the auxiliary piston in elevation. Fig. 9 is a horizontal section at *xx'* of Fig. 6 with the main slide-valve and auxiliary piston removed. Fig. 10 is a partial vertical section of the steam-chest at the line *yy* of Fig. 7. Fig. 11 is a partial vertical section of the steam-chest at the line *zz* of Fig. 7. Figs. 12 and 13 are plans of the valve-seat of the steam-chest and sections of the auxiliary valve in its respective extreme positions. Fig. 14 is a vertical section at the line *y'y'* of Fig. 15, illustrating a modified form of the invention. Fig. 15 is an elevation of the steam-chest of Fig. 14 with the cap-plate removed, showing the seat for the auxiliary valve. Fig. 16 is a vertical section at *z'z'* of Fig. 14 through the steam-chest with the auxiliary piston and main slide-valve in elevation. Fig. 17 is an elevation of the main slide-valve. Figs. 18 and 19 are plans of the valve-seat, of the steam-chest, and sections of the auxiliary valve in its respective extreme positions. Figs. 2 to 19, inclusive, are of exaggerated size over Fig. 1 for clearness. Fig. 20 is a vertical section and partial elevation of a form of my invention, and Fig. 21 is a sectional plan, in larger size, of parts connected to the valve-rod.

The steam-cylinder *a*, the piston *b*, and piston-rod *b'* are of ordinary or well-known construction, and the piston-rod *b'*, which in Fig. 1 is shown as broken off, is intended to extend to a structure, such as a fluid-pump, to be actuated by the engine. An arm or support *c* is secured to and extends from the steam-cylinder, and the same forms a support for the rocker-arm *d*, pivoted thereto. The rocker-arm *d* is at one end pivotally connected to the link *d'*, which in turn is pivoted to a head upon the piston-rod *b'*. The opposite end of the rocker-arm *d* is pivoted to a sleeve 2, movable longitudinally upon the auxiliary-valve rod *e'*, and upon and secured to this auxiliary-valve rod are collars 1, with which said sleeve 2 comes into forcible contact with the movements of the piston, piston-rod, link, and rocker-arm, so as to impart

longitudinal reciprocating movements to the auxiliary-valve rod e' and the valve-rod e , connected therewith.

The steam-cylinder a is provided with steam-inlet ports 3 4. These are preferably arranged almost in line, (see Fig. 2,) opening at one end through the valve-seat of the steam-cylinder and at the opposite ends into the ends of the steam-cylinder. There are exhaust-ports 5, 6, and 7 in the valve-seat of the steam-cylinder, the central port 7 extending to the discharge for the exhaust and the ports 5 6 passing through the cylinder and extending in opposite directions and opening near the respective ends thereof. These exhaust-ports 5 and 6 are purposely not continued to the extreme ends of the steam-cylinder, with the object of cutting off the exhaust-steam with the movements of the piston near the respective ends of its stroke, so as to cause the piston to cushion upon the confined steam at its extreme movements.

The steam-chest f is secured in any well-known manner to the steam-cylinder a , preferably by bolts passing through lugs of the steam-chest into lugs of the steam-cylinder. The steam-chest is advantageously provided with stuffing-boxes or guide-sleeves f' , in which are packings 10, and the valve-rod e extends through these parts and moves longitudinally therein. The steam-chest f is interiorly provided with parts 8 9, forming guides for opposite surfaces of the main slide-valve g . This main slide-valve is adapted to move over the valve-seat of the steam-cylinder. It is recessed in the surface adjacent to said valve-seat, and the outer portion of said main slide-valve is of semicylindrical form—that is to say, there are parallel rib edges spaced apart and between which there is a substantially semicircular recess. The several Figs. 3 to 5, inclusive, are views of this main slide-valve g .

The steam-chest f has a main cylindrical aperture and an aperture in the outer portion covered by a cap-plate 11, secured thereto, and the steam enters the steam-chest through the passage-ways kl of the steam-cylinder. (See Fig. 2.) The auxiliary piston is shown as hollow and is fitted to slide in the cylindrical apertures of the steam-chest and to centrally receive the parallel rib portion of the main slide-valve g . (See especially Fig. 8.) The steam-chest is provided with a valve-seat in the surface chamber formed therein, and in said steam-chest there is a central exhaust-port 12, shown of zigzag form, (see Fig. 6,) and extending from said valve-seat through to and communicating with the exhaust-port 6 of the steam-cylinder. In this valve-seat there are steam-ports 13 and 14 and exhaust-ports 15 16, arranged upon opposite sides of the line ww of Fig. 7. The steam-ports 13 14 extend through the steam-chest to the respective ends of the main cylindrical aperture, while the exhaust-ports

15 16 extend almost to the ends of this main cylindrical aperture.

The auxiliary valve i is shown as secured to the valve-rod e by a locking-block 17 and cotter-pin 18, and the same is held to the valve-seat of the steam-chest by said valve-rod and is also moved by said valve-rod with its movements across the face of said valve-seat to cover and uncover the steam and exhaust ports, as hereinafter described. The surface of said valve i bearing upon the valve-seat is recessed to provide a passage between the exhaust-ports for the exhaust-steam, the recesses in the outer surface of the valve providing for the reception of the locking-block and the valve-rod. Figs. 10 and 11 show the auxiliary valve i in the same position as said valve is shown in Fig. 6.

Referring to Figs. 8 and 13, the auxiliary piston has substantially reached the end of its stroke toward the left hand and the auxiliary valve has been shifted to the position shown in Fig. 13. In this position of the auxiliary valve steam enters the port 13 and passes to the left-hand end of the main cylindrical aperture of the steam-chest. Its force is exerted against the end of the auxiliary piston and the same, with the main-slide valve, is moved to the right. In this movement the steam exhausts from the right-hand end through the exhaust-port 16 into the recess of the auxiliary valve and away by the exhaust-port 12, and as soon as the auxiliary piston in moving to the right passes over the orifice of the exhaust-port 16 the steam is shut off and confined and the piston cushions against the exhaust-steam the balance of its stroke. The auxiliary valve is then moved by the movement of the main piston and piston-rod and rocking lever d and the valve-rods $e e'$ into the position Fig. 12, in which position steam enters by the steam-port 14 to the extreme right-hand end of the main cylindrical aperture of the steam-chest f to move the auxiliary piston h toward the left hand to the position shown in full lines, Fig. 8. During this movement the exhaust from the left-hand end is by the exhaust-port 15 to the recess in the auxiliary valve and away by the port 12. Fig. 12 shows the steam-port 13 as covered by the imperforate face of the auxiliary valve i , and Fig. 13, shows the steam-port 14 as covered by the opposite imperforate face of the auxiliary valve i .

In the modification shown by Figs. 14 to 19, inclusive, the location of the steam and exhaust ports of the steam-chest and the valve-seat of the auxiliary valve have been shifted from the position Figs. 1 and 6 below the plane of the main slide-valve and auxiliary piston to a central position in the same horizontal plane. This modified structure is of slightly more compact form than that shown in the preceding figures. In this modification the auxiliary valve i' is connected to the valve-rod in like manner as hereinbefore de-

scribed, and this construction provides, both above and below the solid central portion of the steam-chest having this valve-seat, passage-ways $n n'$ for steam from the inner main central aperture to the outer recess or aperture of the steam-chest. This modification also provides for a difference in the form given to the main slide-valve. (See especially Figs. 14 and 17.) The respective halves or upper and lower portions of this valve g' at either side of a horizontal line are made alike—*i. e.*, the ribs upon the face and guide projections $o o'$. These latter projections have inclined faces, which, as auxiliary seats, bear upon the parts 8 9, while the valve bears upon the valve-seat of the steam-cylinder. From Fig. 17 it will be noticed that the projection o is most to the left of a vertical central line, while the projection o' is most to the right of said line. The valve thus constructed is adapted for the desired operation of the steam and exhaust through the ports provided therefor. It is also alike upon both edges, so that it is reversible and so that the valve can be placed in the engine either side up in assembling the parts, it making no difference which of the edges is placed uppermost in the steam-chest. This is an advantage in the manufacture of the parts for interchangeability, as well as assembling the parts. In the modification, 20 represents a central exhaust-port; 21 and 22, steam-ports extending to opposite ends of the main cylindrical aperture of the steam-chest, and 23 24 exhaust-ports also extending to opposite ends of this main central aperture.

Referring to Fig. 16, it will be noticed that the auxiliary piston h has almost reached its extreme left-hand movement. After such movement the auxiliary valve i' is moved to the position Fig. 19 and steam enters by the port 21 to the left-hand end of the auxiliary piston to move the same to the right, and the exhaust is by the port 24 to the recess of the valve and away by the port 20, the steam-port 22 and exhaust-port 23 being covered. As the auxiliary piston h nears its extreme movement to the right the aperture of the exhaust-port 24 is covered and the steam confined, and the said piston cushions on the steam for the balance of its stroke. After this movement the auxiliary valve i' is shifted to the position Fig. 18, where the exhaust-port 24 and the steam-port 21 are covered by the imperforate portions of the said auxiliary valve, and steam is admitted to the right-hand end by the steam-port 22, and the exhaust is by the exhaust-port 23 to the recess of the valve and away by the port 20, said movements being repeated progressively with the movement of the auxiliary valve to effect the movement of the auxiliary piston and simultaneously the movement of the main slide-valve thereby not only in the modified form, but in the main structure hereinbefore described.

I do not limit myself to the zigzag form of

the exhaust-port 12, Fig. 6, nor do I limit myself to the location in the steam-chest of the valve-seat thereof for the auxiliary valve or valves $i i'$ or to the precise location or direction therein of the steam or exhaust ports.

In the modification illustrated in Figs. 20 and 21 I have shown a sleeve r with trunnions r' , a pin 25 for securing the same to the valve-rod e , and an oscillating tongue s at one end extending through mortises of the auxiliary piston and at the other end having ring-hubs s' receiving the trunnions r' .

In the operation of the engine this structure imparts to the auxiliary piston an oscillatory movement with each up-and-down movement of the valve-rod e , and the object sought is to prevent the auxiliary piston sticking or becoming temporarily fast in the steam-chest, especially after a period of disuse. This movement may be manually effected in starting the engine by moving the valve-rod e up and down, and so swinging the auxiliary piston.

I claim as my invention—

1. In an engine, the combination with the steam-cylinder, piston, piston-rod and the steam-chest, of the main slide-valve, an auxiliary piston for actuating the slide-valve and an auxiliary valve and means for moving the same over the face of a valve-seat upon the steam-chest and at right angles to the movement of the auxiliary piston, there being steam and exhaust ports controlled by the auxiliary valve and extending to opposite ends of the cylindrical aperture receiving the auxiliary piston.

2. In an engine, the combination with the steam-cylinder having a valve-seat and ports, a piston and piston-rod, of the steam-chest having parts 8, 9, forming guides, a main slide-valve having at the outer surface parallel ribs with an intervening recess and with corresponding projections on opposite top and bottom edges of the back face to bear as an auxiliary seat on the parts 8, 9, an auxiliary piston having a central portion receiving said parts of the main slide-valve so that the same may be moved thereby and means for controlling the movements of the steam and exhaust to the respective ends of the auxiliary piston, substantially as and for the purposes set forth.

3. In an engine, the combination with the steam-cylinder, piston, piston-rod and the steam-chest, of a main slide-valve, the outer surface of which is formed as parallel ribs with an intervening recess, an auxiliary piston having a central portion receiving said parts of the main slide-valve whereby the slide-valve is moved simultaneously with and by the movement of the auxiliary piston, and an auxiliary valve and devices to which the same is connected for moving the auxiliary valve across the face of a valve-seat formed upon the steam-chest, there being steam and exhaust ports from said valve-seat to the re-

spective ends of the aperture in which the auxiliary piston moves, substantially as set forth.

4. In an engine, the combination with the
5 steam-cylinder, piston and piston-rod, of a
steam-chest having a main cylindrical aper-
ture, an adjacent and central surface aper-
ture, a valve-seat in the latter aperture with
a central exhaust-passage through said steam-
10 chest, and steam and exhaust ports in pairs
upon opposite sides of said central exhaust-
port and extending to opposite ends of the
main cylindrical aperture, a main slide-valve,
an auxiliary piston for actuating the slide-
15 valve and an auxiliary valve and means for
actuating the latter to control the steam and
exhaust to the respective ends of the auxil-
iary piston, substantially as set forth.

5. In an engine, the combination with the
20 steam-cylinder, piston and piston-rod, of a
main slide-valve, an auxiliary piston for ac-
tuating the slide-valve, a steam-chest inclosing
the main slide-valve and the auxiliary piston
and having a central exhaust-port running
25 from the outer face toward the steam-cylinder,
and pairs of steam and exhaust ports arranged
parallel to one another and at opposite sides
of the central exhaust-port and extending
from a valve-seat upon and near the front
30 portion of the steam-chest toward the steam-
cylinder and along to the respective ends of
the steam-chest communicating with the ap-
erture therein and at the respective ends
thereof, substantially as set forth.

35 6. In an engine, the combination with the
steam-cylinder, piston and piston-rod, of a
main slide-valve, an auxiliary piston engag-
ing and for actuating the slide-valve a steam-
chest inclosing the main slide-valve and aux-
40 iliary piston and having a valve-face adja-
cent to the outer surface of the steam-chest
and substantially between the planes of the
outer face of the steam-chest and the paral-
lel axial plane of the auxiliary piston, a slide-

valve and means for moving the same upon 45
said valve-seat, there being steam and ex-
haust ports controlled by the auxiliary valve,
substantially as set forth.

7. In an engine, the combination with the
steam-cylinder, piston and piston-rod, of a 50
steam-chest having a main cylindrical aper-
ture, a central surface aperture, an integral
solid portion between said apertures with
steam passage-ways at either side thereof
and with steam and exhaust ports in said 55
solid portion and extending to opposite ends
of the main cylindrical aperture and to the
main exhaust of the steam-cylinder, a main
slide-valve, an auxiliary piston engaging and
for actuating the main slide-valve and re- 60
ceived within the steam-chest, and an auxil-
iary valve and means for moving the same
upon the valve-seat of said integral solid por-
tion, substantially as and for the purposes
set forth. 65

8. In an engine, the combination with the
steam-cylinder, piston and piston-rod, of a
steam-chest having a main cylindrical aper-
ture, an adjacent and central surface aper-
70 ture, a valve-seat in the latter aperture and
steam and exhaust ports through the steam-
chest and to opposite ends of the main cylin-
drical aperture, a main slide-valve, an auxil-
iary piston for actuating the slide-valve, an
auxiliary valve and means for actuating the 75
latter to control the steam and exhaust to the
respective ends of the auxiliary piston, a
tongue passing through apertures in the aux-
iliary piston for imparting an oscillatory
movement thereto and a pivotal connection 80
therefor to the rod of the auxiliary valve for
effecting such movement, substantially as
specified.

Signed by me this 25th day of July, 1902.

ALBERT F. HALL.

Witnesses:

ALFRED V. LINCOLN, Jr.,
MRS. ALBERT F. HALL.