

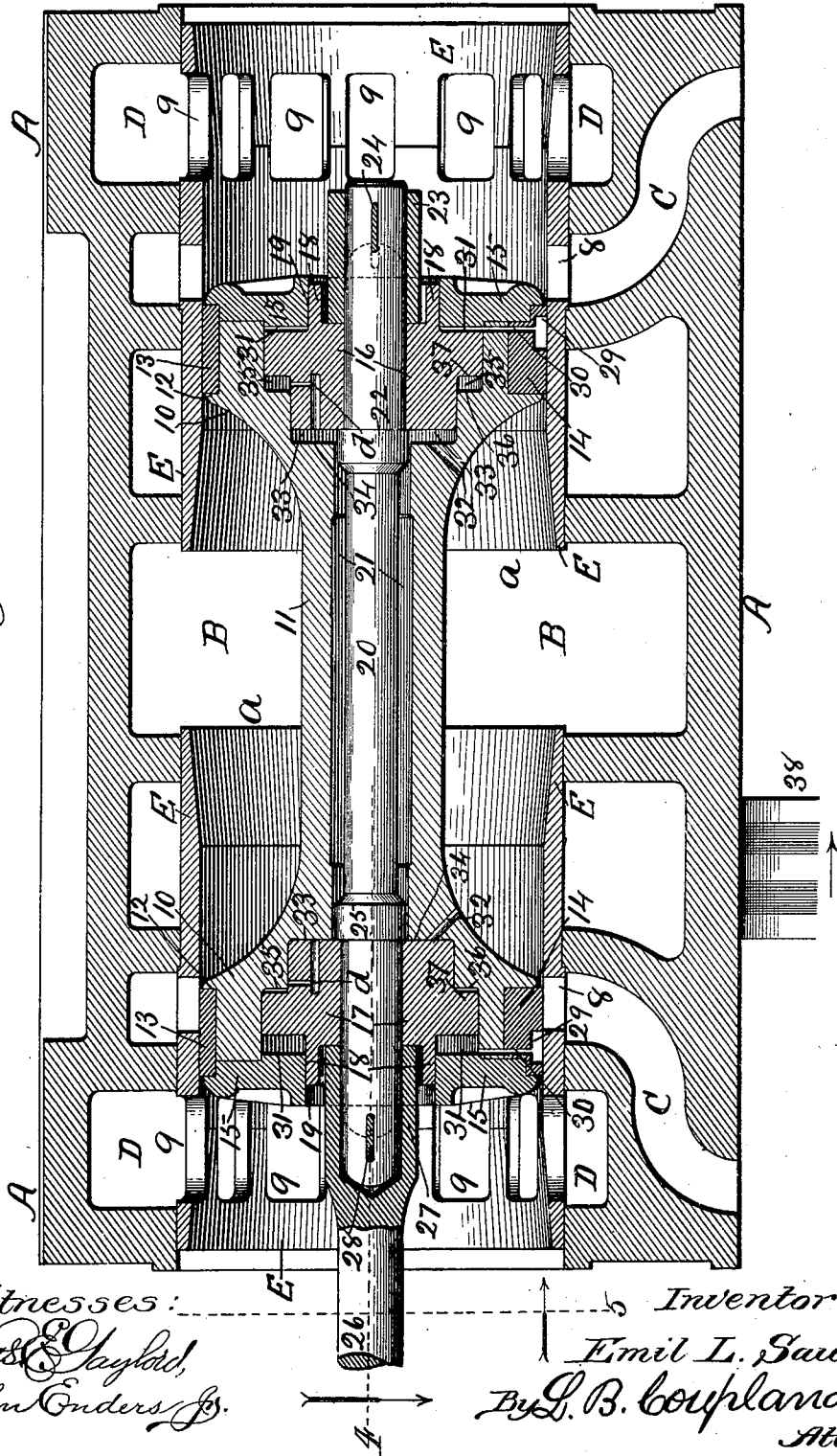
E. L. SAUER.
STEAM ENGINE VALVE.

(No Model.)

(Application filed Oct. 25, 1900.)

3 Sheets—Sheet 1.

Fig. 1.



Witnesses:
Carl E. Claydon,
John Anders, Jr.

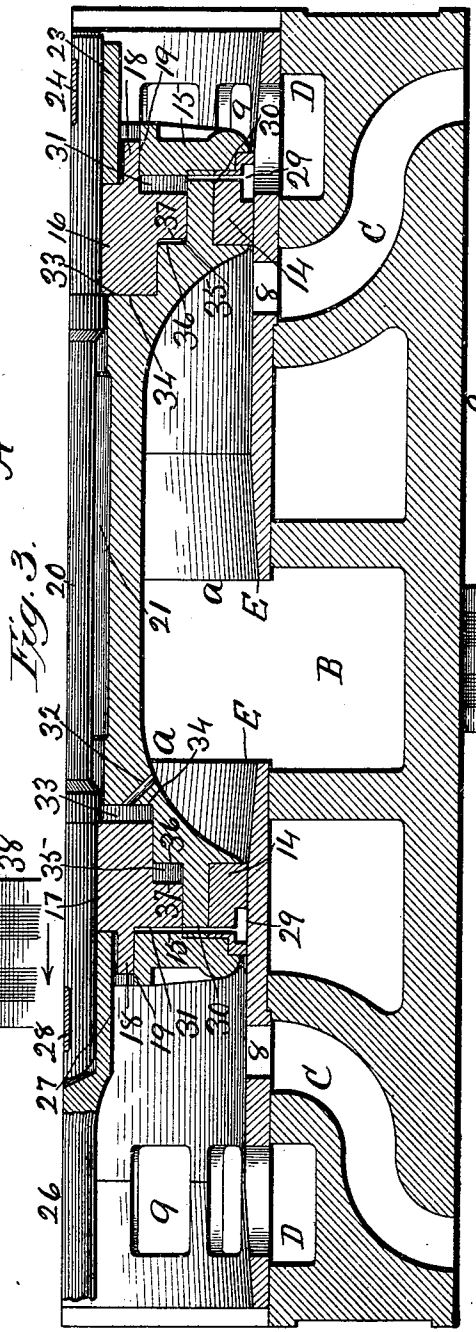
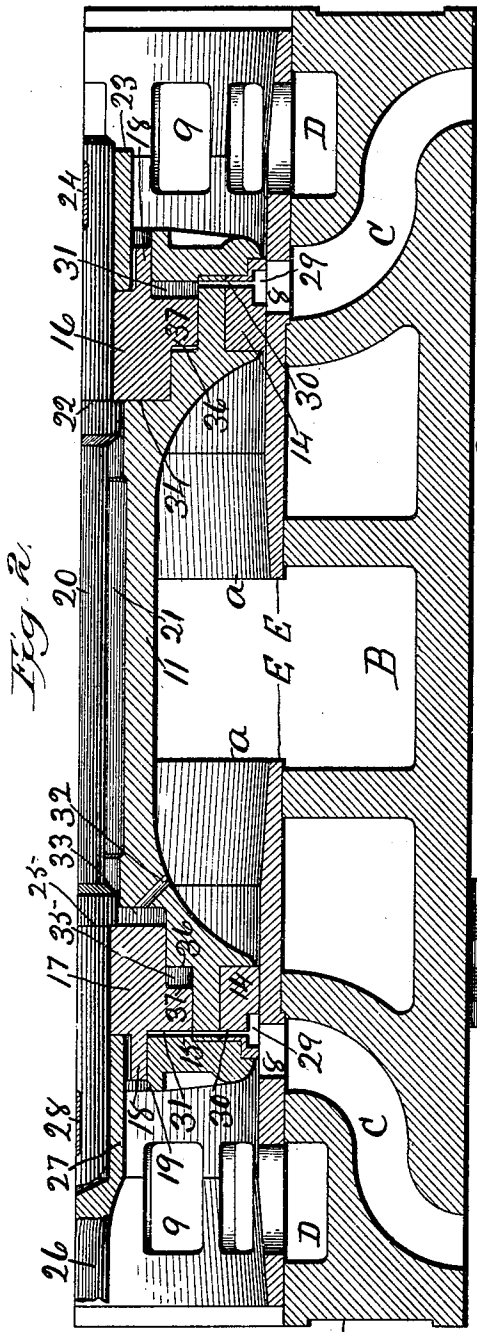
Inventor:
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E. L. SAUER.
STEAM ENGINE VALVE.

(Application filed Oct. 25, 1900.)

(No Model.)

3 Sheets—Sheet 2.



Witnesses:
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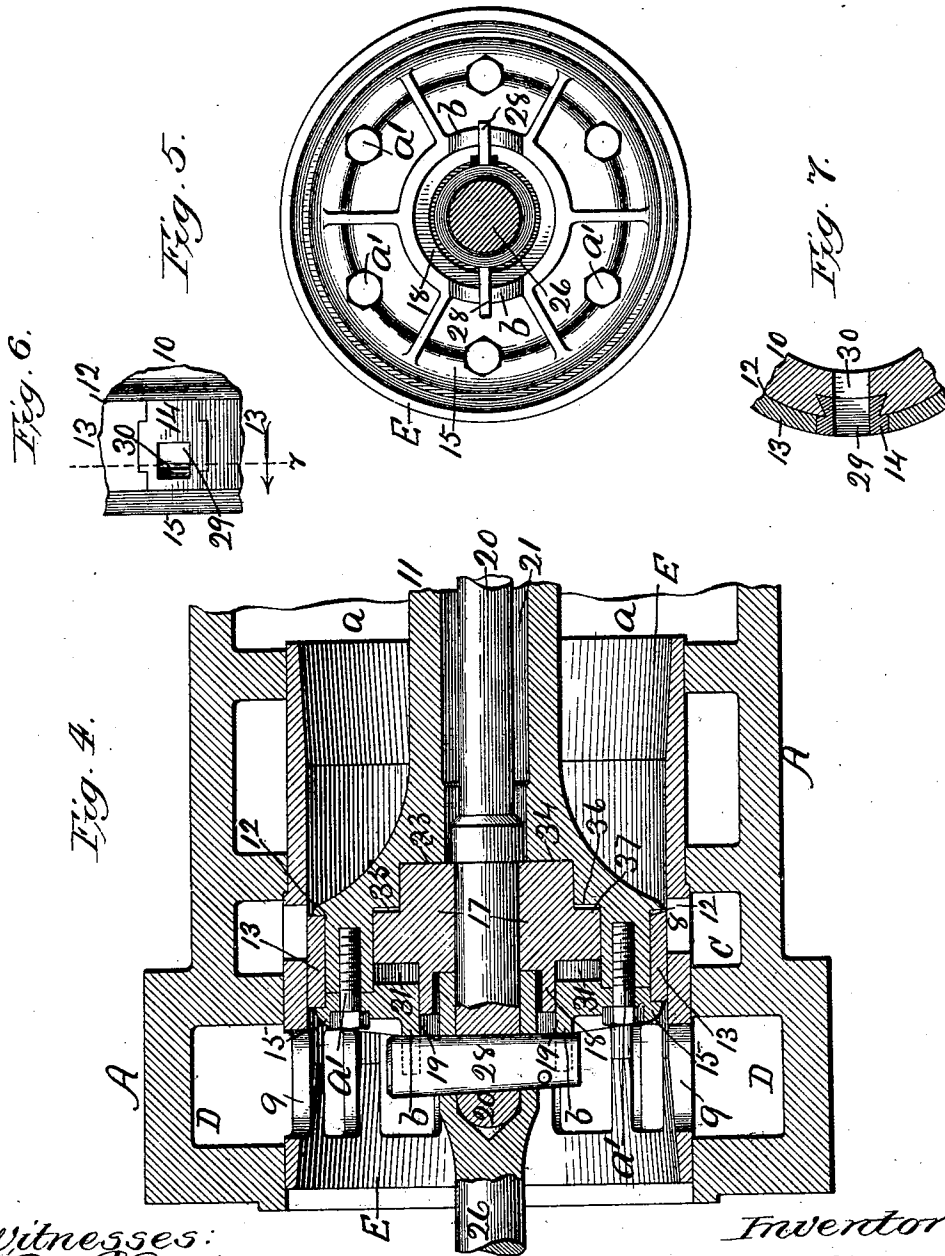
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(Application filed Oct. 25, 1900.)

(No Model.)

3 Sheets—Sheet 3.



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Inventor:
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UNITED STATES PATENT OFFICE.

EMIL L. SAUER, OF CHICAGO, ILLINOIS.

STEAM-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 678,984, dated July 23, 1901.

Application filed October 25, 1900. Serial No. 34,258. (No model.)

To all whom it may concern:

Be it known that I, EMIL L. SAUER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Engine Valves; 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.

This invention relates to steam-engine valves of the piston type and is more especially intended for use on locomotive-engines running at high speed.

The object is to provide a device of this character having an unusually quick admittance of the live steam and an equally quick release at the proper time, so as to afford the greatest possible efficiency with proportionate economical results. This efficiency is attained by having the steam-pressure follow the engine-piston expansively for a greater length of the cylinder than is possible under ordinary arrangements and then providing for a quick release that will relieve the piston from any undue back pressure or compression on the exhaust side. The valve parts, located in the steam-chest, comprise a main piston-valve and companion auxiliary valve loosely supporting the piston-valve in its working position. The piston-valve controls the admission and escape of the steam into and from the engine-cylinder, but has no direct connection with a driving or moving part of the engine. The auxiliary valves have a direct connection with the usual valve-rod, in turn connecting with an actuating rocker-arm or eccentric. For a part of its stroke in its longitudinal reciprocating movement the piston-valve travels in unison with its auxiliary supports and then has a quick intermittent steam-actuated movement in advance thereof in suddenly opening the induction and eduction ports alternately at each end of the stroke. This valve device may be termed "double-acting" and is as equally well adapted for use on engines other than those of the locomotive type whether running at a high or low speed.

In the drawings, Figure 1 is a longitudinal section of the valve parts and inclosing

steam-chest. Figs. 2 and 3 are half longitudinal sections with reference to Fig. 1, showing the valve parts in different positions. Fig. 4 is a broken-away longitudinal section on line 4, Fig. 1, looking in the direction indicated by the arrow. Fig. 5 is an end elevation of the main piston-valve, the valve-rod being sectioned on line 5, Fig. 1. Fig. 6 is a broken-away bottom plan of the piston packing-ring and a dowel-segment connecting the respective ends thereof; and Fig. 7 is a broken-away section on line 7, Fig. 6.

A represents the steam-chest; B, the supply steam-chamber; C C, the usual steam-passages, communicating with the respective ends of the engine-cylinder, and D D the exhaust-chambers, located in the ends of the steam-chest.

The steam-chest is provided interiorly with the cylindrical casing-sections E E, the inner adjacent ends *a* of which are wide apart to allow for the admission of the live-steam supply. The respective ends of the valve parts have their reciprocating movement in the casing-sections. These sections are provided in the under side with ports 8, in line with the steam-passages C C, through which the steam enters and escapes from the engine-cylinder in accordance with the direction in which the piston is moving and the position of the piston-valve.

9 indicates the annularly-disposed exhaust-ports in the casing E opening into exhaust-chambers D D.

The main double piston-valve is spoon-shaped and consists of the companion piston heads or ends 10 and the integral connecting tubular stem 11, which is of a greatly-reduced diameter with reference to the piston-heads, so as to provide for the required steam-space. The piston-heads 10 are provided exteriorly with an annular recess 12 for the reception of the companion packing or bull rings 13. That portion of the packing-rings that would come directly over the steam-ports 8 is cut out, forming open rings, the space between the adjacent ends being filled by the insertion of thickened dowel-segments 14, dovetailed into place, as more clearly illustrated in Figs. 6 and 7. These segments extend into the stock of the piston-heads and prevent the possibility of the packing-rings turning and insure a

steam-tight joint. The packing-rings are retained in position against a lateral movement by the cap ends 15, removably secured to the piston-valve heads by a number of bolts a' , as shown in Figs. 4 and 5. The respective piston-heads are chambered for the reception of the companion auxiliary valve parts 16 and 17. These valves are cylindrical in form and are provided on their outer ends with an annular neck extension 18. The caps 15 have each a central opening 19 in line with the neck 18, the surrounding walls of which have a frictional contact therewith and form a steam-tight joint and a supporting-guide for the piston-valve at each end and prevent the steam from escaping out into the exhaust-chambers.

A solid stem 20 is inserted through the longitudinal center of the piston-valve and projects from each end thereof. This stem and the piston-valve stem 11 are loose with reference to each other and are separated by an annular space 21. The auxiliary valves are rigidly mounted on the stem 20, near each end thereof. The inner side of valve 16 comes to a stop against a shoulder 22, formed on the stem 20. A sleeve 23 is slipped on over the inner projecting end of this stem and bears against valve 16 inside of the neck extension. A locking-key 24 is inserted through the sleeve and stem and rigidly secures valve 16 in place and prevents the same from having an independent movement from that of the stem upon which it is mounted. The companion auxiliary valve 17, mounted on the opposite or outer end of the stem 20, abuts against the shoulder-bearing 25. The valve-rod 26 is provided with the socket end 27, which slips on over the outer end of stem 20 and bears against the outer side of valve 17. A locking-key 28 is inserted through the rod-socket and stem 20 and secures these parts together in their proper working relation. The outer end of the valve-rod 26 will have the usual operative connection with an eccentric or rocker-arm of the engine. The piston-cap at the back end is provided with (see Figs. 4 and 5) oppositely-located lugs $b b$, which are slotted in the ends for the engagement of locking-key 28, as indicated by dotted lines in Fig. 4. This prevents the main piston-valve from turning in either direction.

The auxiliary valves form a carrying-support for the piston-valve and serve to always retain the same in its proper working position and limit its reciprocating longitudinal movement.

The companion dowel-segments 14 are each provided in the under side with a cavity 29, from the bottom of which a live-steam passage 30 extends upwardly through the wall of the piston-valve and opens into the annular space 31, between the auxiliary valves and the adjacent cap-surfaces of the piston-valve.

A number of apertures 32 open through the respective heads of the piston-valve from the steam side into the companion chambers 33, walled by the bottom 34 of the chamber

formed in the bored-out ends of the piston-valve and the adjacent sides of the auxiliary valves.

From the chambers 33, Fig. 1, angular orifices d in the auxiliary valves open into cushioning-chambers 35, formed between the graduated shoulders 36 of the piston-valve and the corresponding shoulders 37 on the auxiliary valves. The annular chambers 33 and 35, duplicated on the respective ends of the valve parts, alternately open and close when in operation, as will be described farther along.

The steam-cavities 29, formed in the under side of the companion dowel-segments 14, will retain a greater or less volume of steam, which to a certain extent will cushion the movement of the piston-valve and lessen the greater friction on the under side due to the weight, and thereby equally balance the valve parts. The space between the solid and hollow valve-stems will always contain a certain volume of steam or the product thereof and assist in the balancing feature. It will be understood by this arrangement that the piston-valve which controls the induction and eduction ports is carried along for a part of each stroke by the mechanical movement of the auxiliary valve, and when a certain point is reached before the end of the stroke steam enters between the outer sides of the auxiliary valves and the adjacent cap-surfaces of the piston-valve and automatically forces the latter in advance of the auxiliary valves and has the effect of quickly uncovering the steam and exhaust ports.

The chambers 35 will always receive sufficient steam to cushion the independent reciprocating movement of the piston-valve with reference to the auxiliary valves and prevent jarring or hammering.

The operation is as follows: In Fig. 1 the engine-piston 38 (the cylinder not shown) is supposed to be traveling in the direction indicated by the arrow, the piston-valve parts moving in the same direction. It will be noted that the steam-space 31, between the outer side of the auxiliary valve 16 and the cap of the piston-valve, is closed, while the companion steam-space at the opposite end is open. The steam-chamber 33 and the cushion-chamber 35 in the forward end are also open, as shown on the right in Fig. 1. In the opposite back end these chambers are shown closed, the inner side of auxiliary valve 17 bearing or bottoming against the adjacent surface of the piston-valve, in which position the valve parts all move along together at the same speed. This relative position of the valve parts is maintained on the forward end of the stroke until the wall-line 39 of the packing-ring gradually begins to uncover the steam-port, when steam will fill the cavity in the dowel-segment and rush up through passage 30 into space 31 and by the excess of pressure will suddenly force the piston-valve ahead at a much greater speed than that at which the auxiliary valves

are traveling and instantly open the steam-
port leading into the engine-cylinder at the
forward end to give the full pressure at once
in advance of what could be obtained if the
5 main valve were alone actuated by a moving
part of the engine. When the main valve is
given this advance movement just described,
a corresponding change of the relative posi-
tion of the main valve and the auxiliary valve
10 17 takes place at the same time at the oppo-
site end, and the exhaust-port is also sud-
denly thrown open and the annular chambers
33 and 35 opened and closing the companion
chambers in the opposite end. The piston-
15 valve holds the advanced position at this end
until nearing the back end of the stroke, when
the same operation takes place and the pis-
ton-valve receives the advance impulse in
the opposite direction, and so on continuously.

20 The valve-parts are shown in different po-
sitions in Figs. 2 and 3 with reference to an
approximate relative position of the engine-
piston, which will be readily understood in
connection with the described operation.

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

1. In a steam-engine valve, the combina-
tion with a supporting-carrier, of a piston-
30 valve, loosely mounted on said carrier and
adapted to periodically have an automatic
movement in advance thereof, alternately at
each end of the stroke, substantially as de-
scribed.

35 2. In a steam-engine valve, the combina-
tion with the companion auxiliary valves,
forming a supporting-carrier, of a piston-
valve, loosely mounted thereon and having
periodically an independent automatic move-
40 ment in advance of said auxiliary valves al-
ternately at each end of the traveled stroke,
substantially as described.

3. In a steam-engine valve, the combina-
tion with the companion auxiliary valves,
45 rigidly connected by a stem, of a piston-
valve, loosely mounted on said auxiliary
valves and having a steam-actuated move-
ment in advance thereof, alternately, at each
end of the stroke, substantially as described.

50 4. In a steam-engine valve, the combina-
tion with the companion auxiliary valves, of
a piston-valve, loosely mounted thereon,
means for periodically imparting an inde-
pendent movement to said piston-valve in ad-
55 vance of the auxiliary valves, and the opera-
tive connection with a moving part of the
engine, substantially as described.

5. In a steam-engine valve, a double piston-
valve, having chambered heads joined by an
60 integral tubular stem and loosely retained in
its working position, the companion auxiliary
valves, seated in said chambered heads; the
solid stem, inserted longitudinally through
the piston-valve and having the auxiliary
65 valves rigidly mounted thereon, the operative
connection, and means for periodically im-

parting a movement to the piston-valve in
advance of the auxiliary valves, substantially
as described.

6. A steam-engine valve, comprising a 70
double piston-valve loosely retained in place;
the companion piston-heads being connected
by an integral tubular stem, the companion
auxiliary valves, seated in said pistons and
rigidly mounted on a solid stem inserted lon- 75
gitudinally through said piston-valve and
projecting from each end thereof, the opera-
tive driving connection, and means for im-
parting a movement to said piston-valve in
advance of its carrying-support, alternately 8c
at each end of the stroke, substantially as
described.

7. In a steam-engine valve, the combina-
tion with a steam-chest, of a cylindrical cas- 85
ing, inclosed therein and divided into two
sections transversely, the inner separated
ends opening into the live-steam space, the
double piston-valve, loosely inserted in said
casing and having its respective piston-heads
chambered, a solid stem, extending longitu- 90
dinally through said piston-valve, the auxil-
iary valves, rigidly mounted on said stem and
seated in the chambered piston-heads, the
operative connection, with a moving part of
the engine and means for imparting a move- 95
ment to the piston-valve in advance of the
auxiliary valves at each end of the stroke,
substantially as described.

8. In a steam-engine valve, the combina-
tion with a steam-chest, of a cylindrical cas- 100
ing, rigidly secured in said steam-chest and
divided transversely into two equal sections
opening into the live-steam chamber, a double
piston-valve, inserted in said casing and hav-
ing its respective ends chambered and pro- 105
vided therein with annular shoulders, the
companion auxiliary valves seated in the
chambered piston-heads, cushioning-cham-
bers, formed between said annular shoulders
and the adjacent surfaces of the auxiliary 110
valves and having an alternate opening and
closing action in accordance with the direc-
tion in which the valve parts are moving, and
steam-passages, communicating with the
cushioning-chambers, substantially as de- 115
scribed.

9. In a steam-engine valve, the combina-
tion with a piston-valve, loosely retained in
its working position and having chambers
formed in its respective heads, of the com- 120
panion auxiliary valves, seated in said cham-
bered heads, the packing-rings, having a
cavity formed in the under side thereof, a
steam-passage, leading upwardly therefrom
and opening into an annular space between 125
the outer sides of the auxiliary valves and the
closed ends of the piston-valve, whereby an
independent advance movement is imparted
to the piston-valve ahead of the auxiliary
valves, alternately at each end, substantially 130
as described.

10. In a steam-engine valve, the combina-

tion with a double piston-valve, having cham-
bered heads connected by a tubular stem, a
solid stem, extending loosely through the
longitudinal center thereof, the companion
5 auxiliary valves, seated in the chambered
piston-heads and mounted on the respective
ends of said solid stem, means for locking
said auxiliary valves rigidly in place, and the
removable cap ends closing the piston-heads,
10 substantially as described.

11. In a steam-engine valve, the combina-
tion with a double piston-valve, of the pack-
ing or bull rings, having a portion cut out on
the under side, the dowel-segments, inserted
15 in place of said cut-out portion, the steam-
cavities, formed in said dowel-segments, and
the steam-passages leading upwardly there-

from into the respective ends of the piston-
valve, substantially as described.

12. In a steam-engine valve, the combina- 20
tion with the companion auxiliary valves, of
the stem, connecting said valves, the double
piston-valve, loosely mounted on the auxil-
iary valves and provided on one of its ends
with lugs, *b b*, and the locking-key, engag- 25
ing said lugs and preventing a rotary move-
ment of the piston-valve, substantially as de-
scribed.

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

EMIL L. SAUER.

Witnesses:

L. M. FREEMAN,
L. B. COUPLAND.