

No. 760,122.

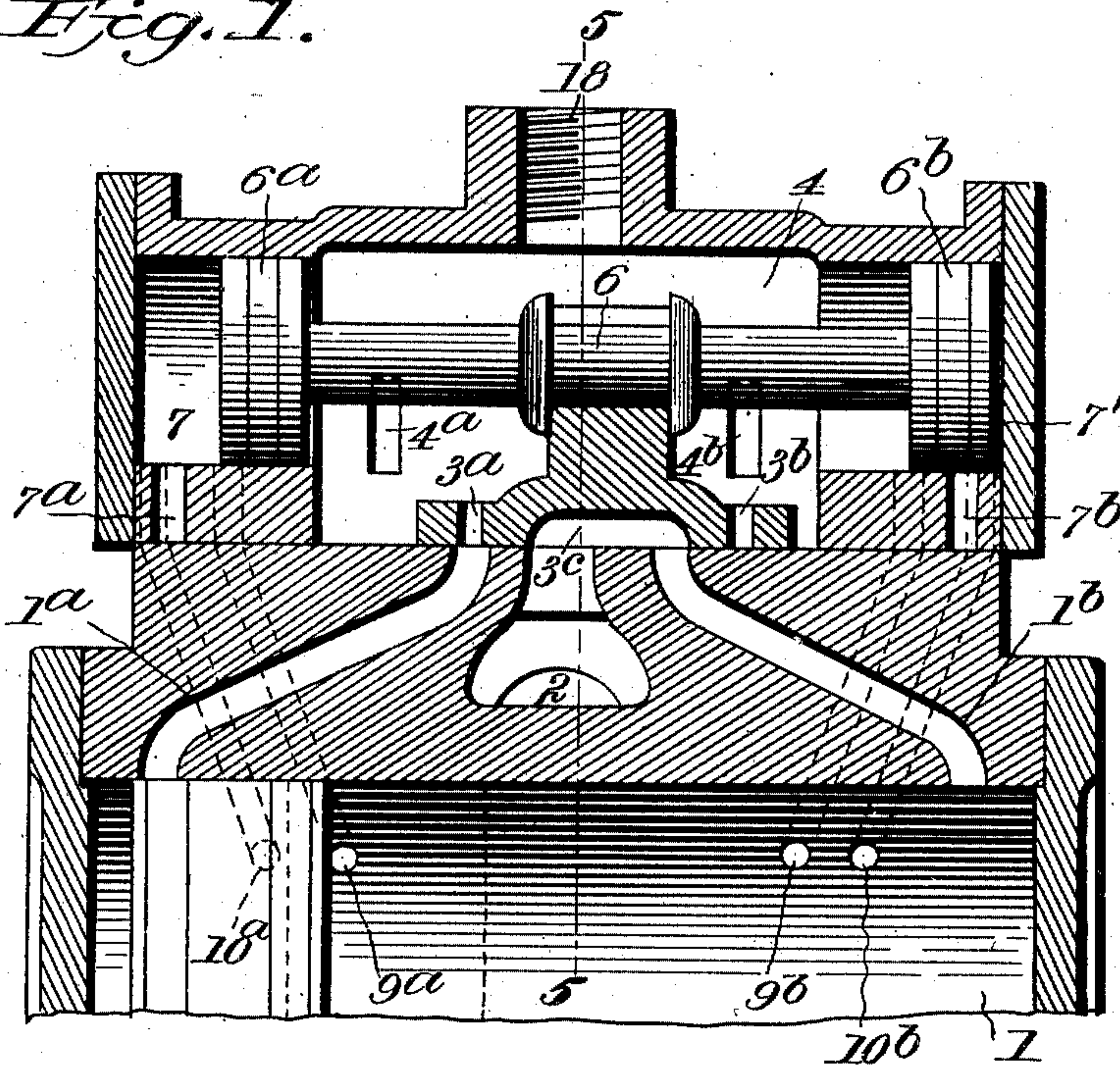
PATENTED MAY 17, 1904.

A. J. HOLMBERG.
STEAM ACTUATED VALVE.
APPLICATION FILED SEPT. 29, 1903.

NO MODEL.

2 SHEETS—SHEET 1

Fig. 1.



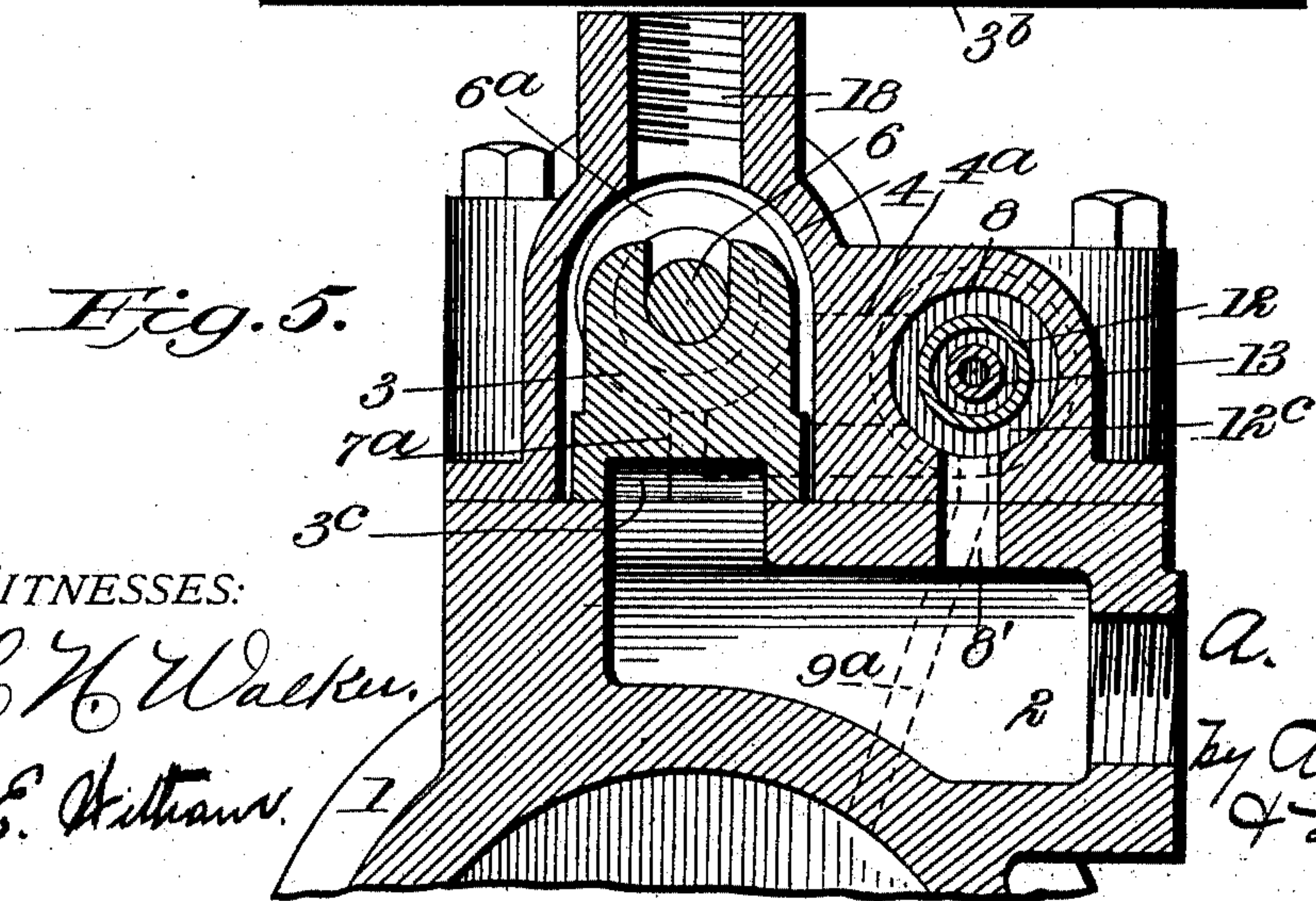
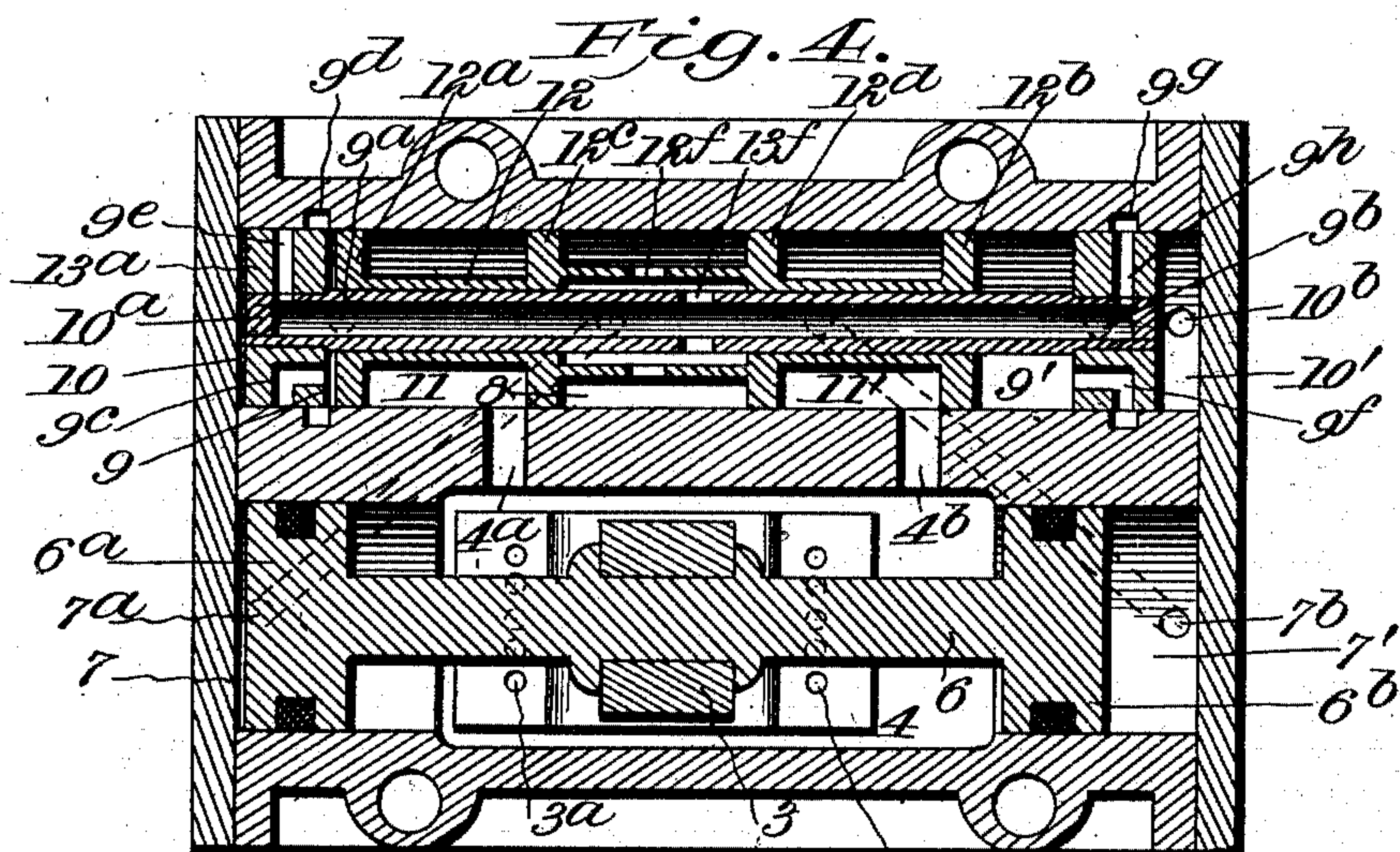
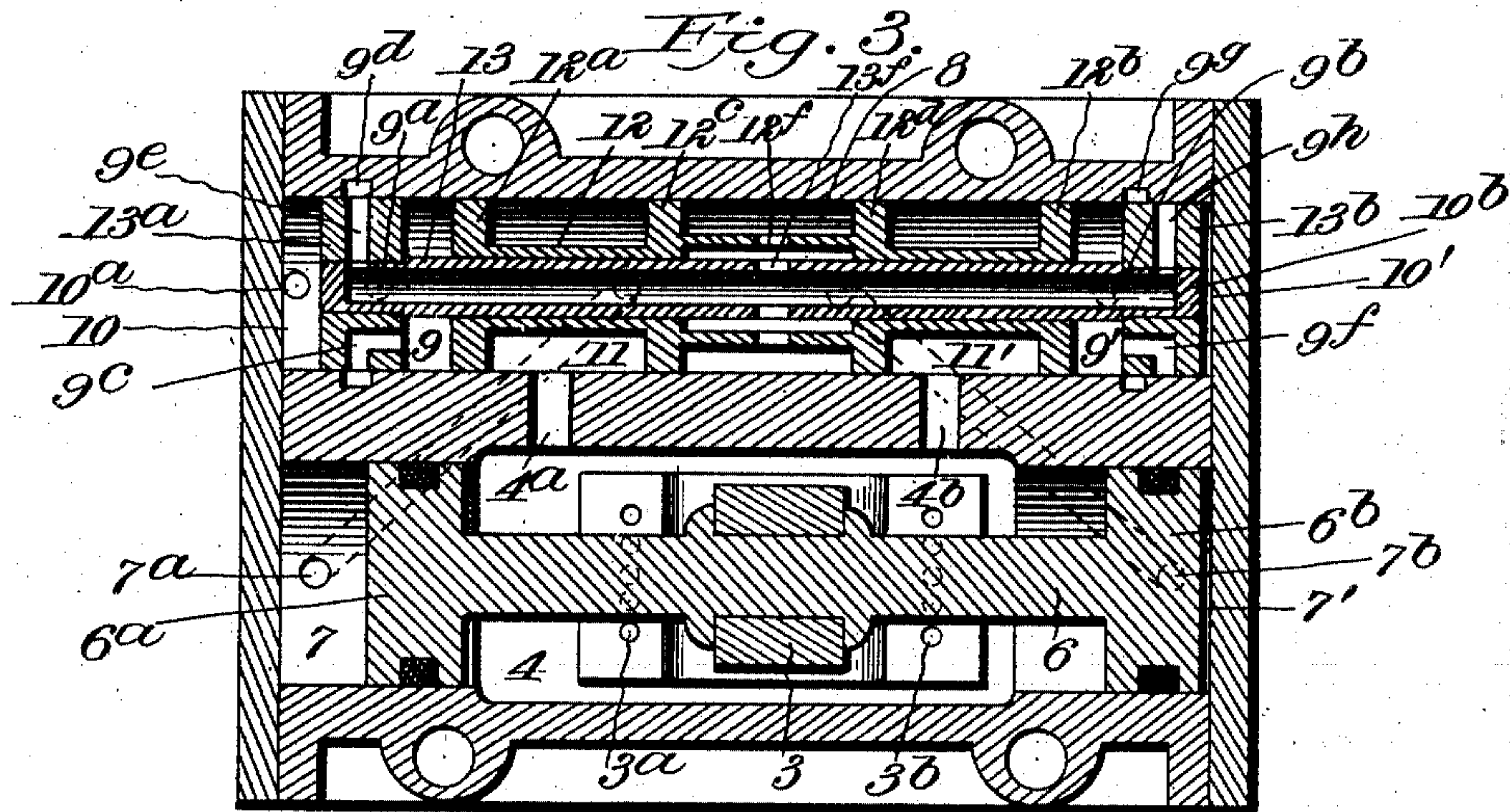
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2 SHEETS—SHEET 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

ARVID J. HOLMBERG, OF BATTLECREEK, MICHIGAN.

STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 760,122, dated May 17, 1904.

Application filed September 29, 1903. Serial No. 175,035. (No model.)

To all whom it may concern:

Be it known that I, ARVID J. HOLMBERG, of Battlecreek, in the county of Calhoun and State of Michigan, have invented certain new and useful Improvements in Steam-Actuated Valves; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

This invention is an improvement in steam-actuated valves for engines, pumps, &c.; and its object is to produce a simple, compact, and reliable valve mechanism whereby the main valve of the engine will be shifted automatically at the proper times by steam-pressure, the shifting of the main valve being controlled by subsidiary valves operated by live steam and by exhaust-steam alternately and controlled by the position and movements of the main piston.

The invention dispenses with shafting, gearing, eccentrics, and mechanical valve-operating mechanism, and may be compactly contained in a small cylinder adjacent to or formed in the main-valve casing and communicating therewith.

The invention will be clearly understood from the following description, in connection with the accompanying drawings, which illustrate the invention as applied to the main slide-valve of a reciprocating piston-engine.

I refer to the claims for summaries of the constructions and combinations of parts for which protection is desired.

In the drawings, Figure 1 is a sectional elevation of the main-valve chest, valve, and main ports of a reciprocating piston-engine, showing the piston at the end of its left-hand stroke in full lines and partly advanced on its return stroke in dotted lines. Fig. 2 is a horizontal section through the main valve and the controlling-valves, showing the position of the valves when the piston is in the position shown in full lines, Fig. 1. Fig. 3 is a view similar to Fig. 2, showing the valves in positions assumed when the main piston has moved (toward the right) to the position indicated in dotted lines, Fig. 1. Fig. 4 is a similar view showing the valves in the position assumed

when the piston has reached the right-hand end of its stroke. Fig. 5 is a transverse section on line 5 5, Fig. 1.

The cylinder 1 is provided with the usual main steam-ports 1^a and 1^b, which lead to the main-valve chamber 4, in which is a D-slide valve 3, having ports 3^a 3^b in its ends adapted to alternately register with ports 1^a and 1^b and also having a central passage 3^c, adapted to alternately establish communication between ports 1^a and 1^b and the exhaust port or passage 2. The main valve 3 has a yoke on its upper end embracing a rod 6, which is flanged at each side of the yoke and is connected at its opposite ends to piston-valves 6^a and 6^d, which operate in chambers 7 and 7' at opposite ends of the main-valve chamber. Live steam is admitted into chamber 4 at 18 from any suitable generator. I here remark that while describing the engine as a steam-actuated engine any other motive fluid may be employed, liquid or gaseous "steam" being used merely as descriptive, and not as restrictive of the invention. The controlling-valves are housed beside but in proximity to the main-valve chamber. Said controlling-valves comprise two sets of connected piston-valves arranged in axial alinement. The two outermost piston-valves 13^a 13^b are connected by a hollow valve-rod 13, so that they move synchronously.

The space or chamber 10 between valve 13^a and end of the casing is connected by a port 10^a with the adjacent end of cylinder 1, while the space or chamber 10' between 13^b and adjacent end of casing is connected by a port 10^b with the adjacent end of cylinder 1. The valves 13^a 13^b alternately close and open these ports 10^a and 10^b, respectively.

Surrounding stem 13 is a sleeve 12, which is shorter than the stem and has on its ends piston-valves 12^a and 12^b and intermediate the latter two separated piston-valves 12^c and 12^d. The part of sleeve 12 intermediate valves 12^c and 12^d may be of larger diameter than stem 13 for a purpose hereinafter described.

The space or chamber 9 between valves 12^a and 13^a is connected by a port 9^a with the adjacent end of cylinder 1, while the space or chamber 9' between valves 13^b and 12^b is con-

nected by a port 9^b with the adjacent end of
 cylinder 1. The ports 9^a 9^b open into cylin-
 der 1 between the ports 10^a and 10^b. The
 space or chamber 11 between pistons 12^a and
 12^c is connected at times by port 7^a with the
 chamber 7. The space or chamber 11' be-
 tween valves 12^d and 12^b is connected at times
 by port 7^b with the chamber 7'. Chamber 11
 always communicates with the main-valve
 chamber by a port 4^a, and chamber 11' is simi-
 larly always in communication with chamber
 4 through a port 4^b. The space or chamber
 8 between valves 12^c and 12^d communicates
 alternately with chambers 7 and 7' through
 ports 7^a and 7^b, according to the position of
 the valves. Said chamber 8 also always com-
 municates by a port 8' with the exhaust-pas-
 sage 2, as shown in Fig. 5. The valve 13^a
 alternately opens and closes the ports 10^a
 and 9^a, and valve 13^b alternately opens and
 closes the ports 9^b and 10^b. The valve 12^c al-
 ternately establishes communication between
 port 7^a and chamber 11 and port 7^a and cham-
 ber 8. The valve 12^d alternately establishes
 communication between port 7^b and chamber
 11^b and port 7^b and chamber 8. Chamber 9
 at times communicates with the chamber 8
 when valve 13^a is in its innermost position by
 means of a port 9^c in the body of valve 13^a,
 adapted to communicate with an annular port
 9^d in the wall surrounding the valve, port 9^d
 communicating with the hollow stem 13
 through a radial port 9^e in valve 13^a, and the
 hollow stem communicates with chamber 8
 through openings 13^f and 12^f, as shown in
 Fig. 4. Chamber 9' similarly communicates
 at times with chamber 8 when valve 13^b is in
 its innermost position by ports 9^f, 9^g, 9^h, 13^f,
 and 12^f, as shown in Fig. 2.

40 Operation: Assuming the piston to have just
 moved to the position shown in full lines,
 Fig. 1, exhaust-steam passes through port 9^a
 into chamber 9, driving pistons 12^a 12^c 12^d 12^b
 to the right to the position shown in Fig. 2,
 valve 12^c uncovers port 7^a and permitting live
 steam to pass from chamber 4 through ports
 4^a, chamber 11, port 7^a to chamber 7, forcing
 the main valve 3 to the right, as shown in
 Fig. 1. At same time valve 12^d establishes
 communication between port 7^b and chamber
 8, so that steam escapes from chamber 7'
 through port 7^b, chamber 8, and port 8^a to
 exhaust 2. At same time steam escapes from
 chamber 9' through ports 9^f 9^g 9^h, stem 13,
 port to chamber 8 and port 8^a to exhaust 2.
 As the main piston moves to the right it first
 closes port 9^a and then opens port 10^a when
 it reaches the position indicated in dotted
 lines, Fig. 1. Live steam then passes through
 port 10^a to chamber 10 and drives valves 13^a
 13^b to the right, valve 13^a closing port 9^a and
 establishing communication between ports 9^c
 and 9^d, so that steam in chamber 9 can pass
 to the exhaust. Valve 13^b closes port 10^b and

cuts off communication between ports 9^f and
 9^g, the position of parts during the princi-
 pal part of the right-hand stroke of main pis-
 ton being shown in Fig. 3. When main pis-
 ton has moved to the right sufficiently to close
 port 10^b and uncover port 9^b, steam passes
 from the cylinder and through port 9^b into
 chamber 9', driving valves 12^a 12^b 12^c 12^d to
 the left. Valve 12^d then establishes com-
 munication between port 7^b and chamber 11',
 so live steam passes from chamber 4 through
 port 4^b, chamber 11', port 7^b to chamber 7',
 driving the main piston-valve to the left.
 Valve 12^c simultaneously closes communi-
 cation between port 7^a and chamber 11 and es-
 tablishes communication between chamber 7
 and the exhaust through port 7^a, chamber 8,
 and port 8^a. The parts are then in the posi-
 tion shown in Fig. 4. On the initial return
 movement of the main piston to the left the
 valves are shifted back to the positions shown
 in Fig. 2 by the action of the steam, as first
 above described. I thus have a steam-actu-
 ated valve system by which the main valve is
 shifted automatically and at proper times,
 and it will be noted that valves 13^a 13^b are
 moved in the same direction as the main pis-
 ton after the latter has started on its stroke,
 while valves 12^a, 12^b, 12^c, and 12^d are moved
 in a direction opposite to that of the main pis-
 ton just as or before the latter reaches the
 ends of its strokes; also, that the main valve
 is shifted by direct live-steam pressure, the
 valves 13^a 13^b by high-pressure steam in the
 cylinder, and the other valves by low-pres-
 sure steam from the cylinder.

Valves 13^a and 13^b should not close ports 10^a
 and 10^b entirely. There should be a sufficient
 communication between these ports and ends
 of the steam-chambers to allow steam behind
 valves to start them and small enough to cause
 a slight cushioning of the valves in closing.
 It is never necessary to close wholly either
 port 10^a or 10^b with valves 13^a or 13^b, because
 when steam enters one from main cylinder the
 other end of main cylinder is exhausting.

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

1. In combination with the main cylinder
 and piston, the main valve, and piston-valves
 connected thereto; a pair of controlling-valves,
 ports leading from the main cylinder to the
 controlling-valve chambers; a set of inner
 valves interposed between the controlling-
 valves; the space between the set of valves
 being divided into an inner chamber commu-
 nicating with the exhaust, and two outer cham-
 bers communicating with the steam-supply;
 ports leading from the main cylinder to the
 spaces between the controlling-valves and the
 adjacent inner valves; and ports leading from
 the piston-valve chambers adapted to be re-
 spectively and alternately put into communi-

cation with the exhaust, and with the live steam, by the shifting of said inner valves, substantially as and for the purpose described.

2. In combination with the main cylinder and piston, the main valve, and piston-valves connected thereto for shifting it; a pair of connected controlling-valves; ports leading from the main cylinder to the controlling-valve chambers; a series of connected valves interposed between the controlling-valves; the space between the connected valves being divided into three chambers, the inner one communicating with the exhaust, and the outer ones communicating with the live-steam supply; ports leading from the main cylinder to the spaces between the controlling-valves and the adjacent connected valves; and ports leading from the piston-valve chambers adapted to be respectively and alternately put into communication with the exhaust, and with the live steam, by the shifting of said connected valves, substantially as and for the purpose described.

3. In combination with the main cylinder and piston, the main valve, and piston-valves connected thereto; a pair of controlling-valves, ports leading from the main cylinder to the controlling-valve chambers; a set of inner valves interposed between the controlling-valves, the space between the set of valves being divided into an inner chamber communicating with the exhaust, and two outer chambers communicating with the steam-supply; ports leading from the main cylinder to the spaces between the controlling-valves and the adjacent inner valves; and ports leading from the piston-valve chambers adapted to be respectively and alternately put into communication with the exhaust, and with the live steam, by the shifting of said inner valves; ports leading through the controlling-valves and their connecting valve-stem adapted to establish communication between the exhaust and the spaces between the controlling-valves and adjacent connected valves.

4. In combination, the main engine-cylinder, its main piston, and main valve, the piston-valves connected to said main piston for shifting it; a pair of controlling-valves; four connected valves slidably arranged between said controlling-valves, the space between the two innermost connected valves communicating with the exhaust; the spaces between the outer pairs of connected valves communicating with the live-steam chamber continually; ports leading from the cylinder to the controlling-valve chambers; ports leading from the cylinder to the spaces between the controlling-valves and the adjacent connected valves; ports adapted to establish communication between the said spaces and the exhaust; and ports leading from the piston-valve chambers and adapted to be alternately and respectively put into communication with one of the

steam-chambers; and with the exhaust-chamber between the connected valves.

5. In combination, the main cylinder, its piston, and main valve, and piston-valves for shifting the same; a pair of connected valves, steam-ports leading from the chambers of said valves to the main cylinder; a second pair of connected valves intermediate the first-mentioned valves, steam-ports leading from the chambers between the adjacent valves of the first and second sets to the main cylinder; a third pair of valves interposed between and moving with the second pair of valves, the space between the third valves communicating with the exhaust and the spaces between the adjoining valves of the second and third sets respectively communicating with the live-steam supply; and ports leading to the piston-valve chambers, and controlled by the third set of valves, and adapted to be alternately put in communication with the live-steam space and the exhaust-space by said third valves, substantially as described.

6. The combination of a pair of valves, a set of valves intermediate the first-mentioned valves and movable independently thereof, and dividing the space between said valves into five chambers, the central chamber communicating with the exhaust; the two adjacent chambers communicating with the steam-supply space; and the two outer chambers adapted to communicate alternately with the main cylinder, and with the exhaust, through said hollow stem; with ports leading from the main cylinder to the first valve-chambers, ports leading from the main cylinder to the two outer chambers; the main-valve-operating pistons; and ports leading from said piston-chambers adapted to be alternately put in communication with one of the steam-chambers, and with the exhaust, according to the positions of the valves, substantially as described.

7. In combination, the main engine-cylinder, its main piston, and main valve, the piston-valves connected to said main piston for shifting it; a pair of controlling-valves, connected by a tubular stem, four connected valves slidably arranged upon the stem of said controlling-valves, the space between the two innermost connected valves communicating with the exhaust and with the hollow stem; the spaces between the outer pairs of connected valves communicating with the live-steam chamber continually; ports leading from the cylinder to the controlling-valve chambers; ports leading from the cylinder to the spaces between the respective controlling-valves and the adjacent connected valves; ports in the controlling-valve and adjacent wall, adapted to establish communication between the said spaces and the tubular stem, and therethrough to the exhaust; and ports leading from the piston-valve chambers and adapted to be al-

ternately and respectively put into communication with one of the steam-chambers, and with the exhaust-chamber between the connected valves, all substantially as and for the
5 purpose described.

8. In a steam-actuated valve mechanism for engines, the combination of the main cylinder, the main piston, the main valve, and its actuating valve-pistons; a pair of valves act-
10 uated by high steam-pressure in the cylinder and moving in the direction of the main piston after the latter has moved; a series of valves

intermediate the first valves, actuated by low steam-pressure in the cylinder, and controlling the admission and exhaust of live steam to the
15 main-valve pistons.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

ARVID J. HOLMBERG.

In presence of—

WILL. A. CADY,
E. W. LUNN.