

No. 712,744.

Patented Nov. 4, 1902.

J. VORRABER.
VALVE GEAR FOR ENGINES.

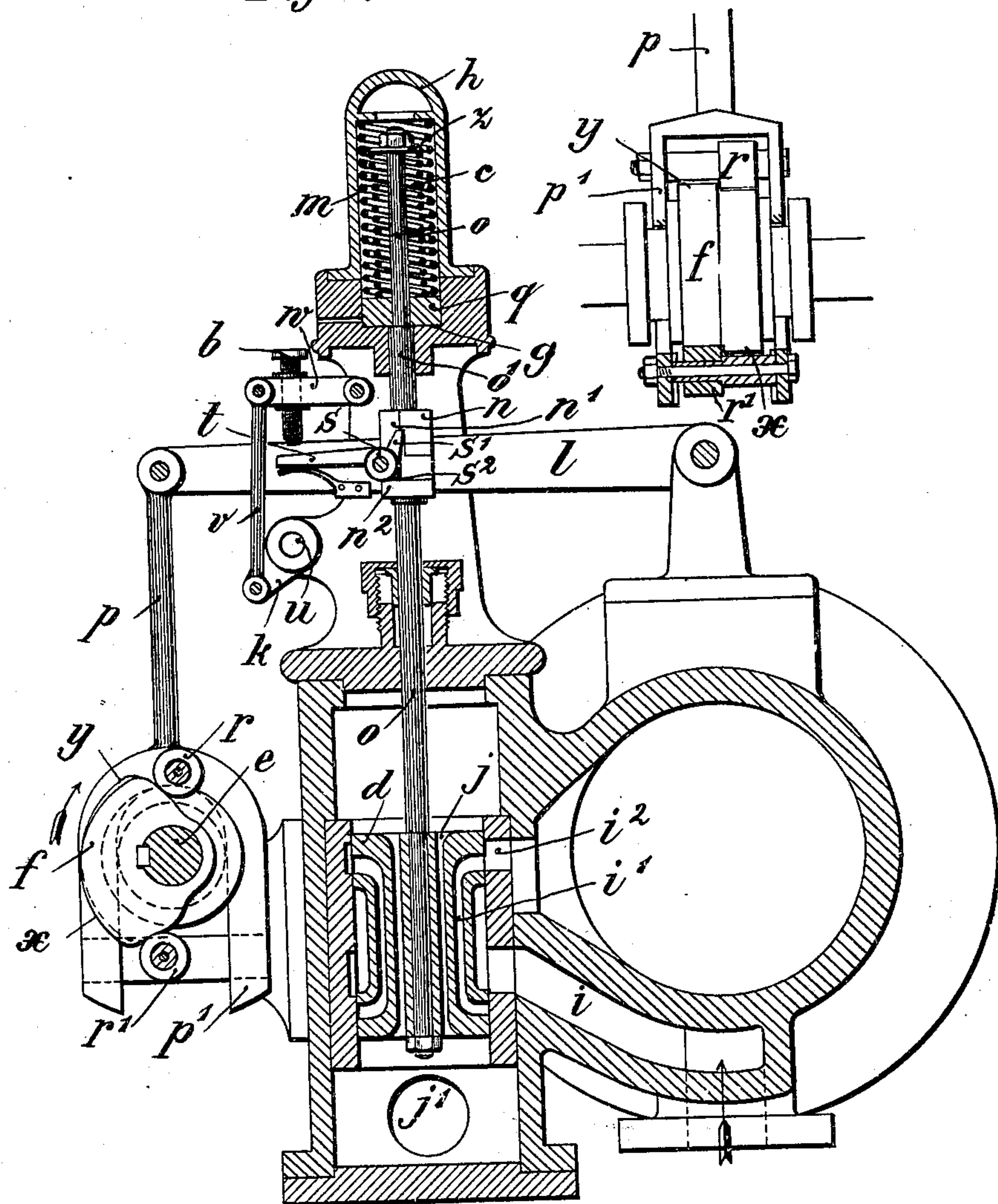
(Application filed May 15, 1902.)

2 Sheets—Sheet 1.

(No Model.)

Fig. 1.

Fig. 2.



Witnesses

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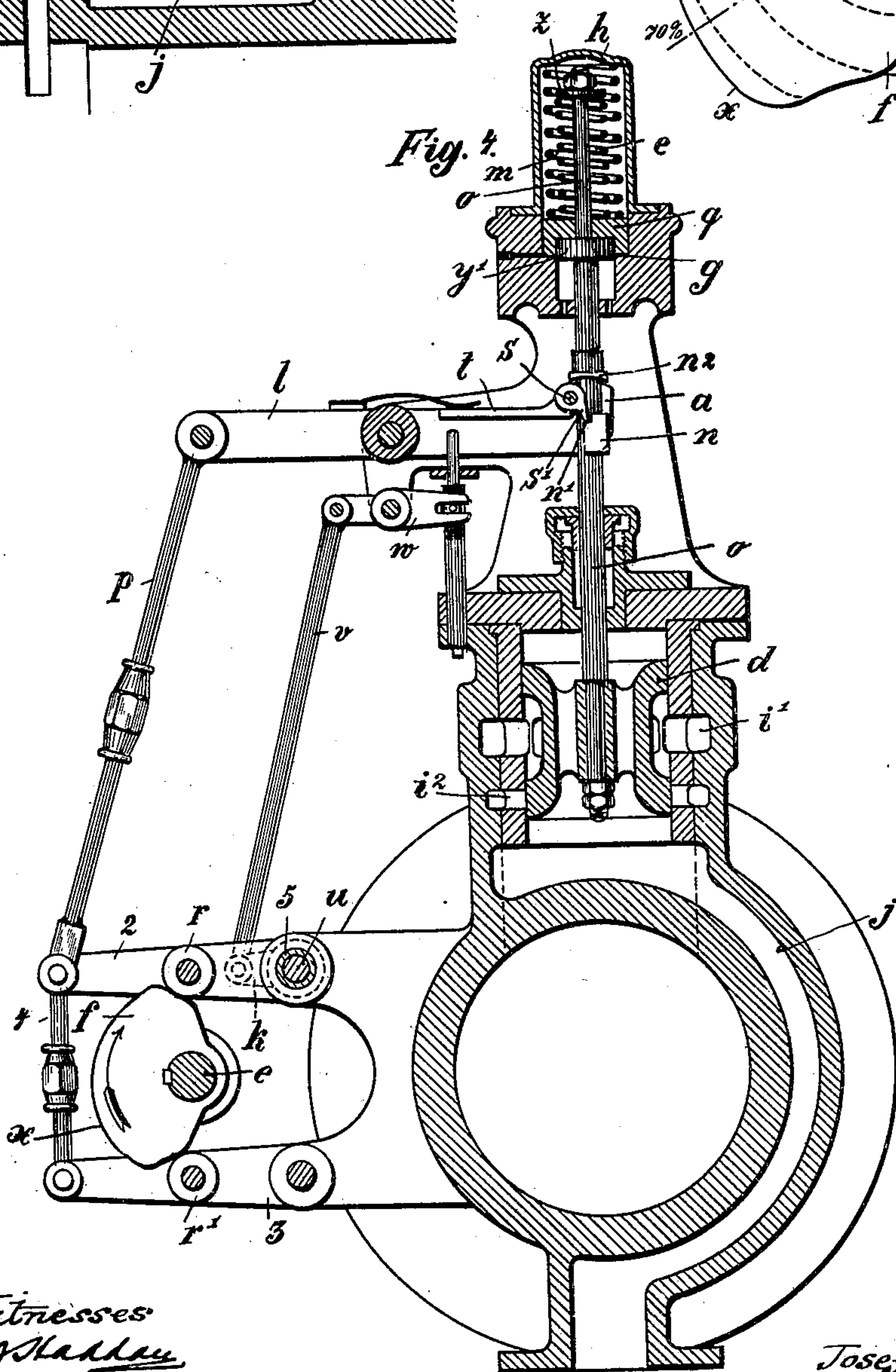
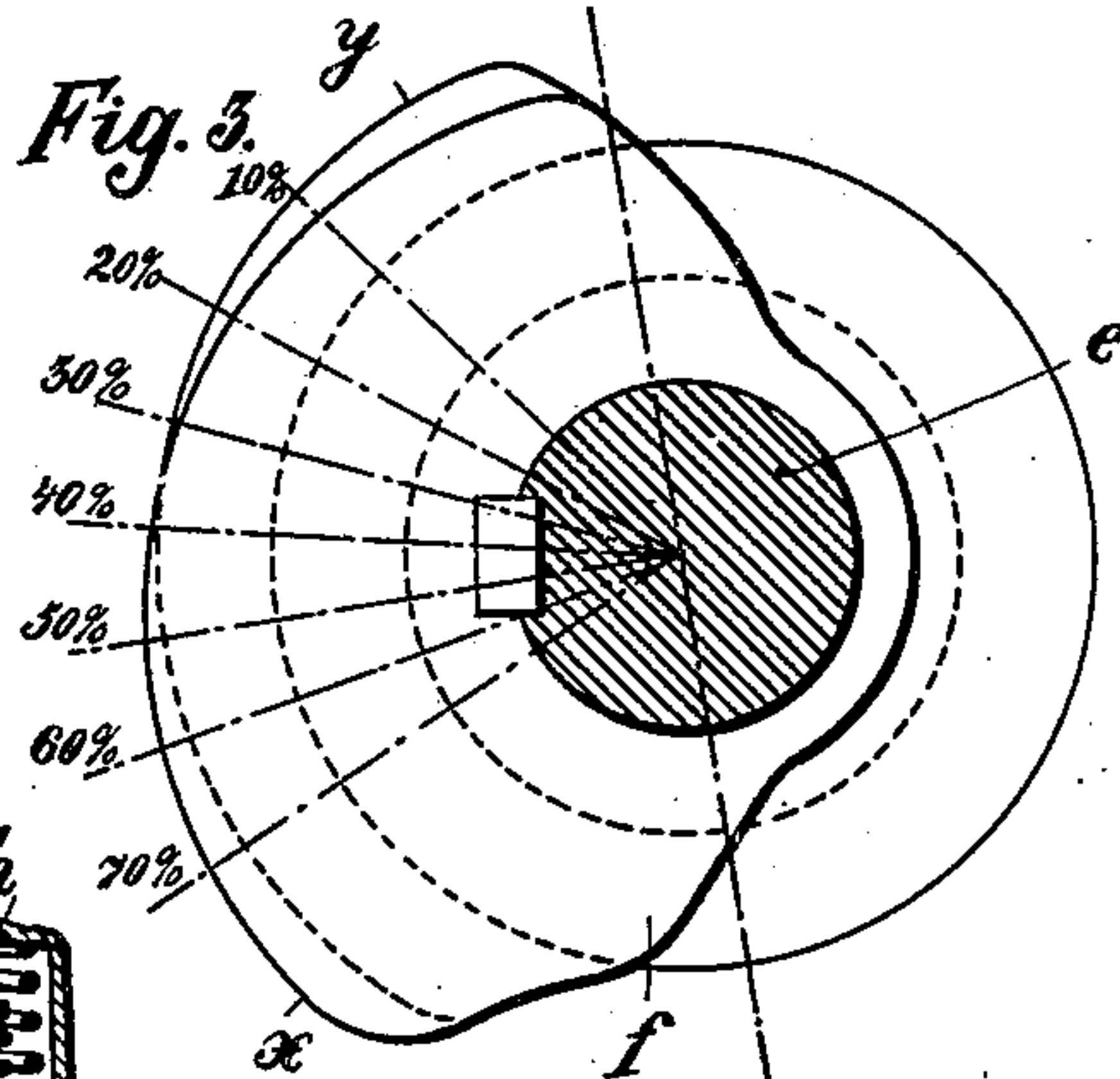
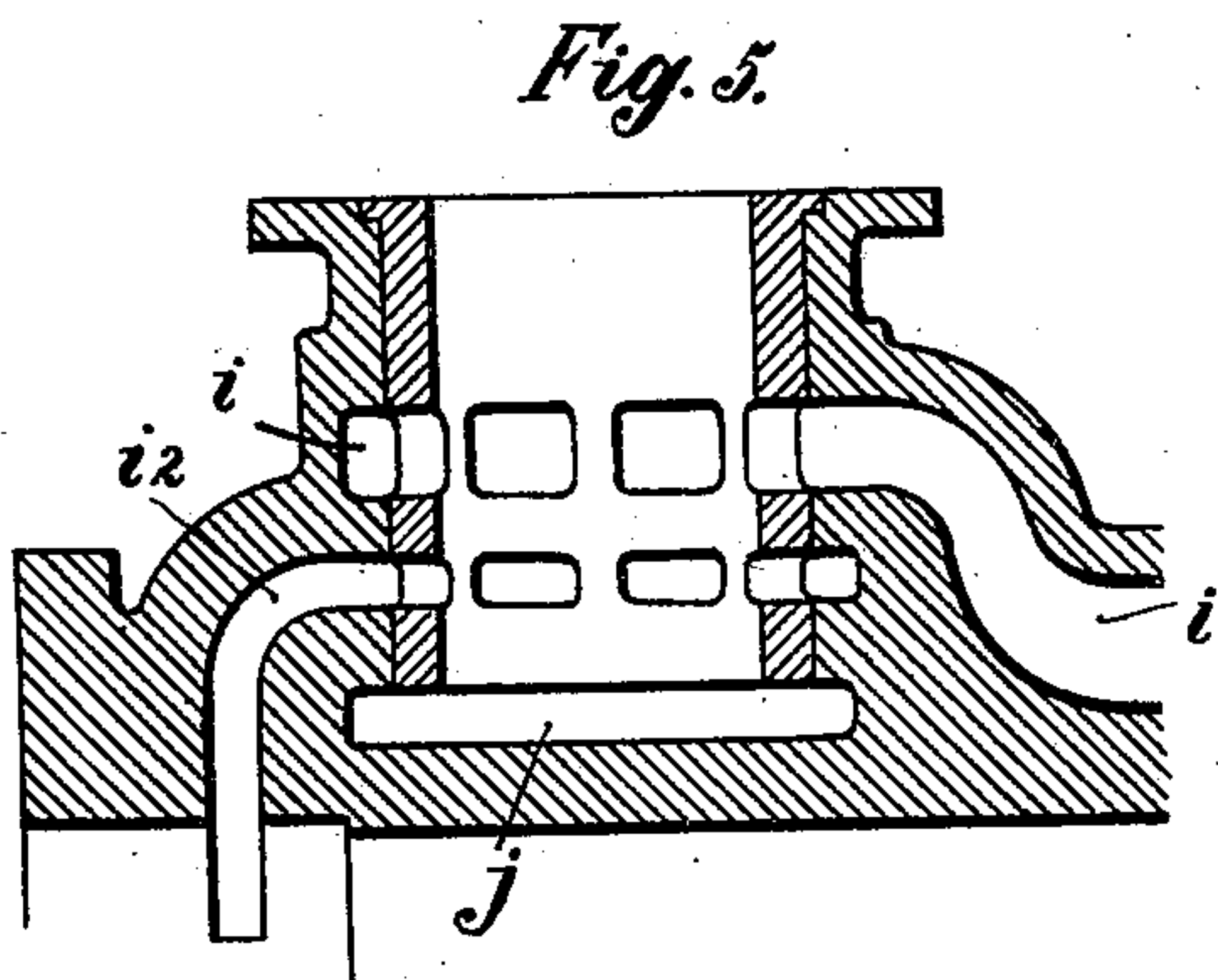
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2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

JOSEF VORRABER, OF SCHÖNINGEN, GERMANY.

VALVE-GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 712,744, dated November 4, 1902.

Application filed May 15, 1902. Serial No. 107,517. (No model.)

To all whom it may concern:

Be it known that I, JOSEF VORRABER, a subject of the Emperor of Austria-Hungary, residing and having my post-office address at Prinzenstrasse 7, Schöningen, in Braunschweig, Germany, have invented certain new and useful Improvements in Valve-Gear for Steam and Similar Power Engines, of which the following is a specification.

10 The present invention relates to that class of valve-gears in which a valve-shaft, coupled to the main shaft and rotating at the same speed as the latter, opens the valves by means of cams and levers in such a manner that a
15 boss on a lever raises the valve-rod when the lever-arm carrying the said boss ascends and is disengaged by the governor or regulator by means of another lever when said governor ascends, so that the valve is immediately closed again.

20 The object of the invention is to render it possible to use this system of valve-gear in connection with which the valve is not to fall back to its end position when the governor ascends, but only to its middle position, in order to prevent the immediate exhaust of the steam.

It is also the purpose of the invention to secure the most advantageous distribution
30 of steam, so that at the steam-inlet side the opening position of the valve remains constant, and all charges from naught to seventy per cent. can be obtained, whereas the commencement of compression can take place at
35 from eighty to eighty-six per cent., so that from fourteen to twenty per cent. compression is obtained. The first-named purpose is obtained by arranging loosely on the valve-rod an air-buffer piston, which is continuously depressed by a spring, and by suspending the valve-rod itself from another spring, which prevents it from being driven by inertia and gravity farther than its central position, where the before-mentioned boss is dis-
45 engaged. The second purpose is obtained by providing cams on the governor-shaft which move the operating-levers, said cams having curves determined by a certain rule.

Two forms of the invention are represented
50 in the annexed drawings.

Figure 1 is a cross-section of the steam-cylinder and one form of the valve-gear, and

Fig. 2 is an end view of the cam belonging to this form. Fig. 3 is a side elevation of the same cam on a larger scale. Fig. 4 is a cross-
55 section of the steam-cylinder and the other form of valve-gear, and Fig. 5 is a longitudinal section of the inlet-port of the cylinder shown in Fig. 4.

As shown in Figs. 1 to 3, in the first form
60 of construction a valve-shaft e is arranged parallel to the cylinder-axis and driven in the known manner from the crank-shaft by bevel-wheels of equal size. To this shaft e two cams f are keyed at an angle of one hun-
65 dred and eighty degrees to each other and provided with a curve x for the steam-inlet and another curve y for the exhaust. Above each cam a double fork p , provided with rollers r and r' , is arranged—that is to say, the
70 part p terminates in a four-legged frame p' , which has the form of a fork, both in the direction of the axis of the shaft and in the direction perpendicular to the said axis. In the upper part of this frame the roller r is revo-
75 lvably arranged in the lower part of the roller r' , so that r runs on the curve x , and r' on the curve y . A lever l is pivoted to the stem of the fork p and carries a boss s , provided with tappets which operate the valve. The said
80 lever l consists of two parallel flat bars, between which the collar n on the valve-rod o passes and the boss s is pivoted. The said collar n is provided with projections n' and n'' at its upper and lower part, respectively.
85 When the valve-rod o is moved upward, the tappet s' on the boss s bears against the projection n' , and when the valve-rod is moved downward the tappet s'' , also on the boss s , bears against the projection n'' .
90

The regulator adjusts the shaft u , to which the lever k is fixed, and when the lever l is moved upward the adjustment-screw b is brought into contact with the arm t on the boss s by means of the connecting-rod v and
95 the lever w , so that the tappet s' on the boss s is removed from the projection n' of the collar n . At the same moment the valve d is moved downward by the pressure of the outer spring m on the piston q . Inertia and
100 gravity would cause the valve to descend to its lowest position, since the air-piston q is only mounted loosely on the rod o , and the steam just admitted to the cylinder through

the passages $i i'$ and the port i^2 would immediately be exhausted again through the port i^2 and the passages $j j'$ before it had completed its work. To prevent this, the valve-rod o is provided with a flange z , which rests on the inner spring e , which only allows the valve to descend into the central position shown in Fig. 1, so that no further steam can enter the cylinder; but the steam in the latter cannot pass out. Vibration of the valve in this position is prevented by the fact that the outer spring m , the upper end of which bears against the upper edge of the spring-box h , presses the piston q tightly against the seat g , while the inner spring c , one end of which bears against the piston q and the other against the before-mentioned flange z , pulls the sleeve o' on the piston-rod o tightly against the under side of the piston q . This method of suspending the valve-rod o in the spring-case h still allows of the valve being moved by the cam f into its lowest or exhaust position and its highest or inlet position, the latter of course only when the screw b is sufficiently raised by the regulator.

For the low-pressure cylinder of a compound engine and the intermediate cylinder of a triple-expansion engine the screw b may be arranged on a fixed arm, and the charge of the cylinder can be regulated by screwing it up or down.

The commencement and end of each of the curves x and y are so arranged that at the end of the cylinder at which steam is to enter the opening position of the valve remains constant, since while the roller r is moving on the ascending curve x all charges from nothing to seventy per cent. can be obtained, according to the position of the screw b . The curve y being concentric with the shaft e allows of the opening position of the valve remaining constant, and, on the other hand, the curve y of that cam f which moves the valve at the other end of the cylinder allows of arranging the commencement of compression at from eighty to eighty-six per cent., so that fourteen to twenty per cent. compression can take place.

In the form of the apparatus represented in Figs. 4 and 5 the same effect is obtained by means of only one cam f , and the forked frame p' can be replaced by a simple parallelogram of levers 2 3 4. Even the lever 3, the roller r' , and the rod 4 can be dispensed with if the cam f is cut away parallel to the curve x and the roller r is caused to travel on the lower curve thus formed. The valve is in the case illustrated arranged on top of the cylinder, but can equally well be placed underneath the latter and is moved by the cam f in the reverse sense—that is to say, to admit steam the valve moves downward and to open the exhaust-port the valve moves upward. By this arrangement the valve d can be caused to automatically return to its central position after a completed period. For this purpose the one-armed lever l , shown in the first

form of construction, is replaced by a double-armed lever l , and the valve-rod o is provided with two air-buffer pistons q and y' , acting in opposite directions. The valve d is not in this case moved into the exhaust position by the projection s^2 of the boss s , but by the rounded end a of the lever l itself—that is to say, said end a lifts the valve-rod until the port i^2 communicates with the passage j and the exhaust steam can pass out. (See also Fig. 5.) In the meantime the piston y' of the valve-rod o moves the piston q and the latter compresses the spring m . When the stroke is completed, the spring m moves the valve d back into its middle position, moving the lever l and lifting the rods 2 4 3. As soon as the cam f lifts the roller r the tappet s' on the boss s depresses the collar n on the valve-rod o , so that the steam-ports $i i'$ i^2 are put into communication with each other and steam can enter the cylinder. (See also Fig. 5.)

The shaft u , connected with the regulator, is in this case arranged in the hollow pivot 5 of the lever 3 and transmits the movement given it by the regulator to the adjustable screw b by means of the lever k , the rod v , and the lever w , as in the previous form of construction. The said screw is in this case arranged in vertical guides and abuts against the arm t of the boss s when the regulator moves upward, as in the previously-described construction, but not when the lever l , carrying the boss s , ascends, but when it descends.

What I claim is, in a valve-gear—

1. The combination with a cylinder, piston-valve and valve-rod, of a valve-shaft, a cam mounted on said shaft, a train of levers operated by said cam, a stop controlled by the regulator, a device carried by one of the levers of the train against which the stop abuts during the period of inlet, means for controlling the piston-valve, so that on release of the aforesaid stop the valve can only move into its middle position, and means for moving the valve to exhaust position, substantially as described for the purpose set forth.

2. The combination with a cylinder, piston-valve and valve-rod, of a valve-shaft, a cam mounted on said shaft and provided with a curve of progressively-increasing radius a train of levers operated by said cam, a boss provided with tappets and carried by one of the levers of the train, a stop controlled by the regulator against which one of said tappets abuts during the period of inlet, means for controlling the piston-valve so that on release of the aforesaid boss by the regulator, the valve can only move into its middle position, and means for moving the valve to exhaust position substantially as described for the purpose set forth.

3. The combination with a cylinder, piston-valve and valve-rod, of a valve-shaft, a cam mounted on said valve-shaft, having two curves side by side, one of which is concentric with the valve-shaft and the other has a

progressively-increasing radius, a train of levers operated by said cam, a boss provided with tappets and carried by one of the levers of the train, a stop controlled by the regulator against which one of said tappets abuts during the period of inlet, means on the valve-rod adapted to control the piston-valve, so that on release of the aforesaid boss by the regulator the valve can only move into its middle position and means for moving the valve to exhaust position, substantially as described for the purpose set forth.

4. The combination with a cylinder, piston-valve and valve-rod, of a valve-shaft, a cam mounted on said valve-shaft, and having two curves side by side, one of which is concentric with the valve-shaft and the other has a progressively-increasing radius, a train of levers operated by said cam, a boss provided with tappets and carried by one of the levers of the train, a stop controlled by the regulator, against which one of said tappets abuts during the period of inlet, two oppositely-acting springs mounted on the valve-rod and adapted to control the piston-valve, so that on release of the aforesaid boss by the regulator the valve can only move into its middle position, and a projection on the valve-rod adapted to be engaged by another of the tap-

pets for moving the valve to exhaust position, substantially as described and for the purpose set forth.

5. The combination with a cylinder, piston-valve and valve-rod, of a valve-shaft, a cam mounted on said valve-shaft, and having two curves side by side, one of which is concentric with the valve-shaft and the other has a progressively-increasing radius, a train of levers operated by said cam, a boss provided with tappets and carried by one of the levers of the train, a stop controlled by the regulator, against which one of said tappets abuts during the period of inlet, two oppositely-acting springs mounted on the valve-rod and adapted to control the piston-valve, so that on release of the aforesaid boss by the regulator the valve can only move into its middle position, a projection on the valve-rod adapted to be engaged by another of the tappets for moving the valve to exhaust position, and means for preventing vibration of the valve, substantially as described.

In witness whereof I have signed this specification in the presence of two witnesses.

JOSEF VORRABER.

Witnesses:

WOLDEMAR HAUPT,
HENRY HASPER.