(No Model.) 2 Sheets—Sheet 1.

H. C. BEHR.

STEAM ENGINE VALVE GEARING.

No. 474,717. Patented May 10, 1892.

Fig. 2.

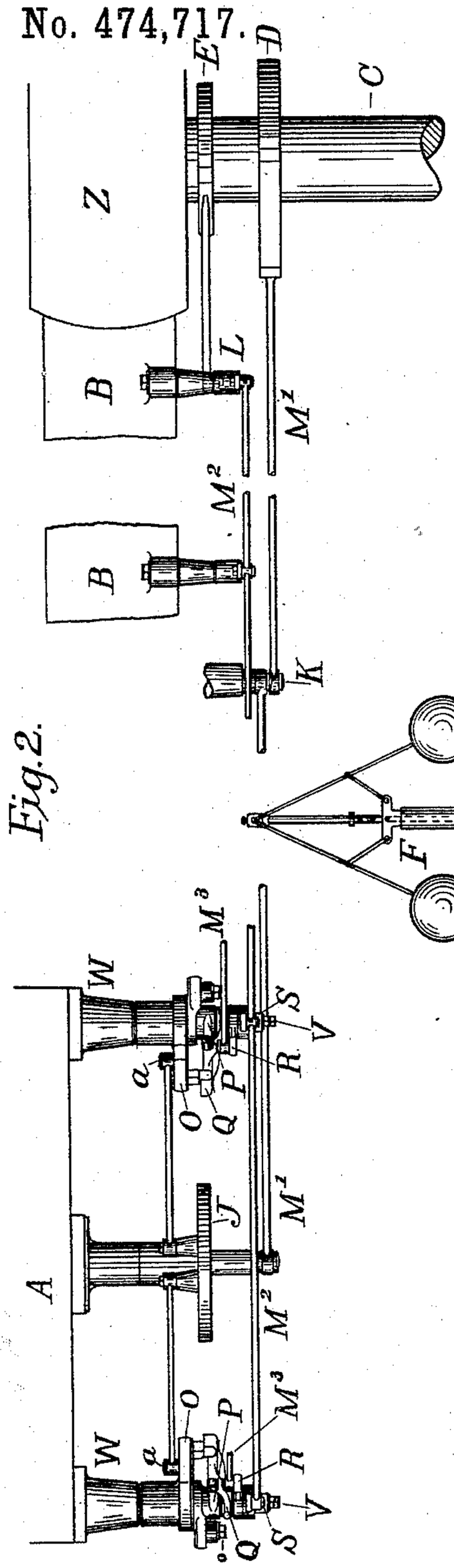
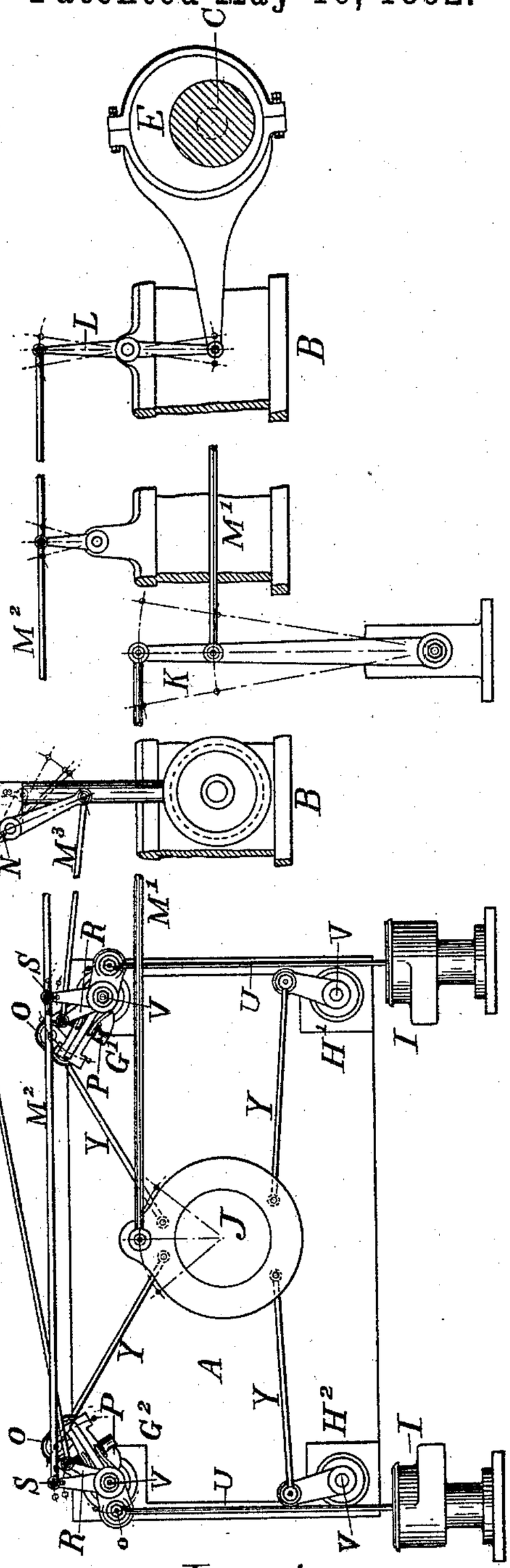


Fig. 1.



Witnesses.

S. Lucien Berry.

W. D. Bent Jr.

Inventor.

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By his Atty

John Richards

(No Model.) 2 Sheets—Sheet 2.

H. C. BEHR.

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Fig. 7.

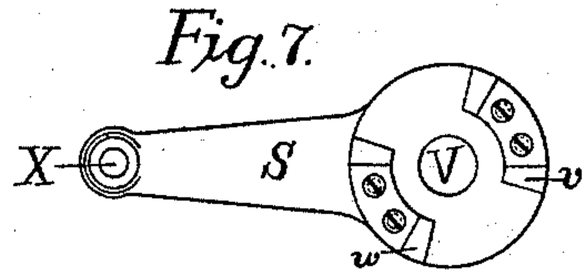


Fig. 6.

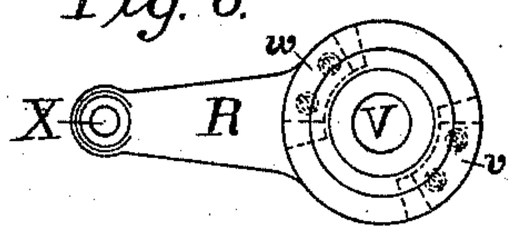


Fig. 4.

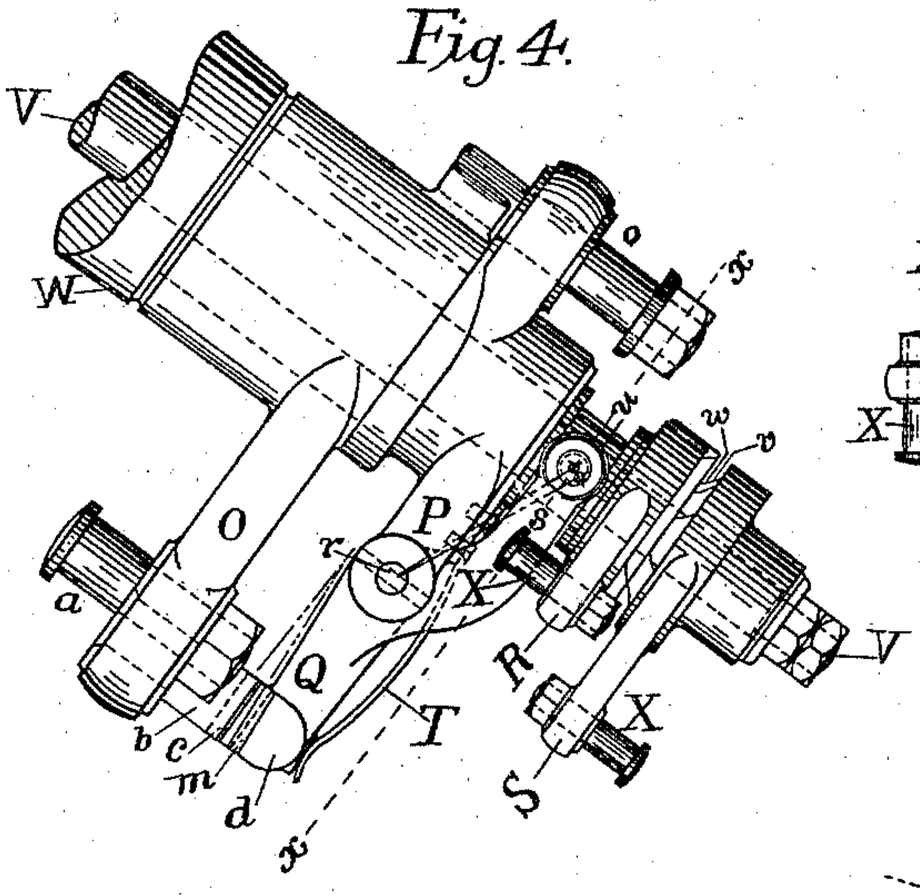


Fig. 5.

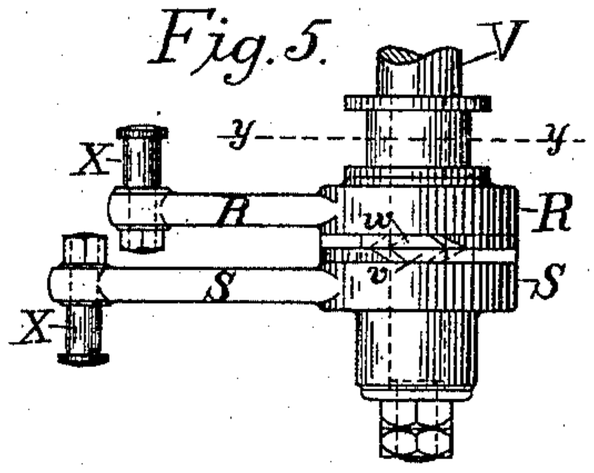


Fig. 3.

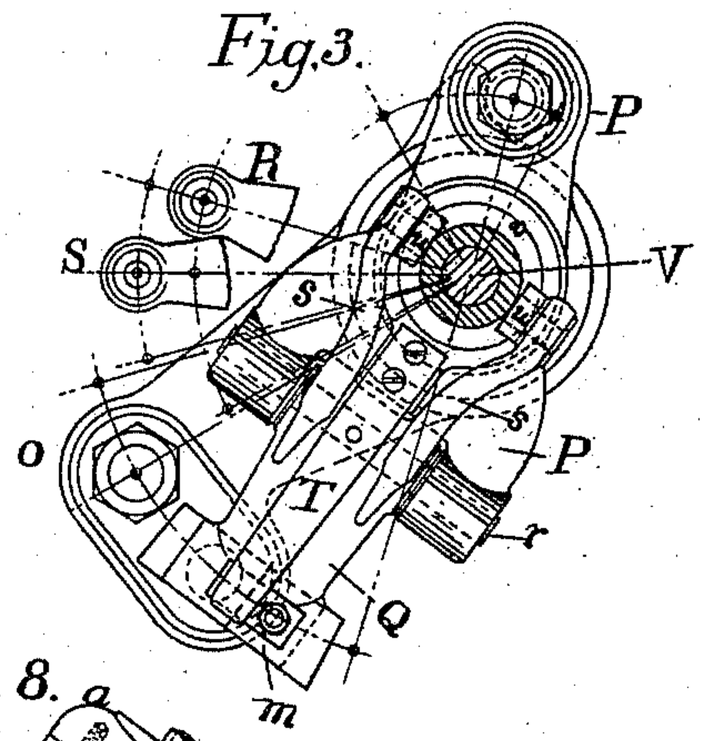
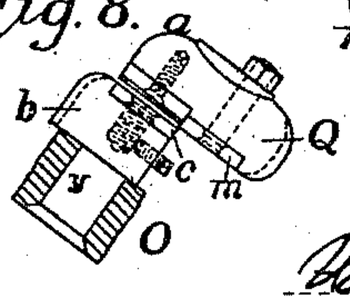


Fig. 8.



Witnesses.

S. Lucien Berry.

W. D. Bentley

Inventor.

Hans C. Behr

By his Atty

John Richards

UNITED STATES PATENT OFFICE.

HANS C. BEHR, OF SAN FRANCISCO, CALIFORNIA.

STEAM-ENGINE VALVE-GEARING.

SPECIFICATION forming part of Letters Patent No. 474,717, dated May 10, 1892.

Application filed October 27, 1891. Serial No. 409,982. (No model.)

To all whom it may concern:

Be it known that I, HANS C. BEHR, a citizen of the United States, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Steam-Engine Valve-Gearing; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to valve-releasing gearing to be applied to the admission-valves of steam-engines, particularly cylindrical valves having oscillating movement, and belongs to the type of valve-gears employing an independent eccentric, with the required connecting mechanism to disengage the admission-valves from the main eccentric, and by such disengagement or release of the admission-valves permit them to be closed at any point of the engine's stroke by means of weights, springs, or dash-pots, as in the case of what are called "Corliss" engines.

The object of my invention is to gain in valve-gears of the Corliss type a variation of cut-off between wider limits and permit the full-pressure steam to follow the piston for any part of the stroke up to nearly the end of the same, or in such degree as will meet the extreme requirements of practice.

My invention consists in the releasing mechanism to accomplish this purpose.

Referring to the accompanying drawings, Figure 1 is a partial side view of what is called a "Corliss" steam-engine with my improved releasing-gearing applied thereto. Fig. 2 is a partial plan view of Fig. 1, showing the arrangement of the parts in a horizontal plane. Fig. 3 is a partial end view of the valve-stem and its connected gearing when on the line *x x* of Fig. 4. Fig. 4 is a plan view of the releasing-gearing for one valve with the actuating links or motion-rods removed. Fig. 5 is a plan view of the trip-gearing on one of the admission-valve stems, taken outside the line *x x* of Fig. 4. Figs. 6 and 7 are side views of the tripping-cranks on the admission-valve stems. Fig. 8 is a detail of Fig. 3, showing the releasing-claws of the gearing.

Similar letters of reference are employed to designate similar parts on the different figures.

In notation the following letters are employed to designate the principal parts of the engine and of my improved valve-gearing:

A is an engine-cylinder; B, sections of the main frame; C, main shaft of the engine; D, main eccentric operating all valves of the engine; E, cut-off eccentric for releasing admission-valves; F, governor to determine time and position of release; G′ G^2, admission-valves of the engine; H′ H^2, exhaust-valves of the engine; I I, dash-pots to close the admission-valves; J, wrist-plate to which valve-motion rods are attached; K, vibrating lever or rock-shaft for main eccentric-rod; L, rock-shaft or lever for cut-off eccentric-rod; M′, rod from main eccentric; M^2, rod from cut-off eccentric; M^3, rods from the governor connected to trip-gearing on the valve-spindles; N, angle-lever to communicate the governor's movement to the trip-gearing; O, rocking or oscillating claw cranks or levers for admission-valves; P, crank or lever for operating the admission-valve stems; Q, hinged claw-lever operated upon by the regulating or cut-off gearing; R, trip-crank connected to the governor; S, trip-crank connected to cut-off eccentric; U, rods to dash-pots; V, valve-stems; W, main sleeves or brackets sustaining the valve-stems and their operating-gearing; X, crank-pins for cut-off-motion rods; Y Y, motion-rods to admission and release valves; Z, engine main bearing; *c* and *m*, hardened-steel claw-pieces for opening admission-valves.

The wrist-plate J has an oscillating motion imparted to it by the main eccentric D and rod M′. This oscillating motion of the plate J is communicated to the valves of the engine by the motion rods or links Y in such time and relation as permits the admission and release of steam up to nearly the full stroke of the engine. In order to secure variation of expansion of the steam and by the same means a regulation of the engine's power, the admission-valves G′ G^2 are released from their connection with the claw-lever O at various points of the stroke in the following manner: Referring to one admission-valve, the other admission-valve being in all respects the same, the lever or claw crank O is mounted loosely on an extension of the bracket W, as shown in dotted lines, Fig. 4, or may have its bearing on the valve-stem V. This lever or claw crank O has an oscillating or rocking move-

ment imparted to it by the links or rods Y and the wrist-plate J. At the outer end of this lever O and near the motion-rod pin *a* is a jaw *b*, with its shank *y* riveted in, as shown Fig. 8. This jaw *b* is faced with a hard-steel plate *c* to match a similar hard-steel plate *m* on the face of the hinged claw-lever Q, which is mounted on and moves with the lever or crank P. This crank P is keyed fast on the valve-stem V, and as the crank O moves forward the plates *m* and *c* of the levers O and Q engage and the crank P is moved coincidently with the one O, opening the valve to admit steam to that end of the cylinder A. The two cranks O and P thus move together, opening and holding open the admission-valve of the engine until the jaw-faces *m* and *c* are disengaged, as will be hereinafter explained, and when this takes place the crank P and claw-lever Q fly back to their original position by reason of the dash-pots I closing the admission-valve. This engagement and disengagement of the plates *m* and *c*, it will be observed, is transverse to the plane of their major movement—that is, parallel to the axis of valve-stem V—and not in the plane of movement of the cranks or arms O and P, as is common in such valve-gearing. This dash-pot I is connected by the rod *u* to wrist-pin *o* of the crank P, so as to secure abrupt closing movement. This dash-pot I is preferably a pneumatic cylinder, which by means of a partial vacuum beneath the piston therein acts as a spring, and then at the farther position of the stroke cushions the movement of the parts by means of air entrapped beneath the piston. These details for closing and cushioning the valve connections by means of a pneumatic cylinder, weight, or spring being familiar to common practice and not forming a part of my present invention, further description of them is not required here.

The period or range of movement imparted to the crank P and by it to the admission-valve is, as before explained, governed by the engagement and disengagement of the plates *m* and *c* and the jaws *b* and *d*, to which they are attached, and the control of this range by means of my improved gearing I will now proceed to described.

The claw-lever Q is pivoted on the crank P by means of the pin *r*, and has at its inner end a forked extension *s*, provided with two rollers *u u*, that fit into the groove *v*, formed on the hub or boss of the trip-crank R, so that any lateral or axial movement of this crank R on the stem V changes the position of the jaw *d* and the catch-plate *m* accordingly. This trip-crank R fits loosely on the stem V, and is adjusted in its angular positions by rod M^3, attached to the angle-lever N on the governor F, the range of movement being as indicated by the diagram in Fig. 3. The lateral or axial position and adjustment of this trip-crank R on the stem V, and consequent time or range of disengaging the jaws *b* and *d*, is governed by the relative radial position of the two cranks R and S in the following manner: On the inner or opposite faces of the two cranks R and S are attached beveled ledges *w* and *v*. (Shown in Figs. 5, 6 and 7.) When these ledges *w* and *v* are not opposite or are not overlapping each other, the crank R is pressed outward by the spring T close to the crank S, swinging the claw-lever on the pin *r* and causing the jaws *b* and *d* to engage. If these cranks R and S change relatively, so that the ledges *w* and *v* overlap and bear upon each other, then the crank R is pushed sidewise on the stem V, disengaging jaws *b* and *d* and the valve will close instantly by reason of the dash-pot I, as before described. In this manner the release of the crank P and closing of the admission-valve is dependent upon the relative angular positions of the two cranks R and S, and this relative position is dependent upon the action of the governor F, acting on the crank R by means of the lever N and rods M^3. The relative position of the crank S is governed by the eccentric E, lever L, and rod M^2, as shown in Figs. 1 and 2. The eccentric E is so adjusted that it imparts to the trip-cranks connected with it a movement coincident or nearly coincident with that of the piston. By this arrangement the release of the admission-valves may occur at any point during the stroke of piston. The rocking or oscillating motion of the crank S is constantly at a uniform range, so that the change in the relative positions of the two cranks R and S, and the consequent point of release or cut-off, is controlled by the governor F. If the crank R is advanced by the governor, then the beveled ledges *w* and *v* come sooner into contact, pushing the crank R sidewise axially on the stem V and releasing the jaws *m* and *c* at an earlier point of the engine's stroke. On the contrary, if the crank R is retarded the point of disengagement and cut-off is later, the initial steam following the engine-piston accordingly. The range and amount of lateral movement of the crank R is dependent on the thickness of the ledges *w* and *v*, and the suddenness of this movement is regulated by the inclination of the beveled ends of these ledges, as shown in Figs. 5, 6, and 7.

Having thus described the nature and objects of my invention and also the manner of constructing and applying the same, what I claim as new, and desire to secure by Letters Patent, is—

1. In a steam-engine valve-gearing as herein described, the arms or cranks R and S, mounted on the axis of the valve-stem V, one laterally movable thereon, and thereby acting upon the claw-lever Q, as their relative positions, controlled by the governor F and cut-off eccentric E, respectively, may determine, in the manner substantially as and for the purposes specified.

2. In a steam-engine valve-gearing as herein described, the arms R and S, having on their adjacent faces beveled ledges *w* and *v*, so arranged as to produce by their relative angu-

lar positions and movements a lateral or axial movement of the arm or crank R, and consequent action of the hinged claw-lever Q, substantially as herein described, and for the purposes specified.

3. In a steam-engine valve-gearing as herein described, the oscillating cranks O, P, R, and S, eccentric E, and governor F, combined and operating so as to close the admission-valves at any point of the stroke, substantially in the manner and for the purposes herein described and set forth.

4. In a steam-valve gearing, the combination of the arms or cranks R and S, the valve-stem V, on which they are mounted, one being laterally movable thereon, the claw-lever Q, which is acted upon by the said laterally-movable arm, the governor F, cut-off eccentric E, and the claw-pieces *m* and *c*, substantially as described.

5. In a steam-engine valve-gearing, the combination of the oscillating cranks O P R S, the eccentric E, governor F, wrist-plate J, and connecting-links, substantially as described.

6. In a steam-engine valve-gearing, the combination of the rocking arm or crank P, provided with the claw-lever Q, mounted thereon and capable of oscillating at a right angle to the movement thereof, a forked extension *s*, provided with rollers fitting into a groove formed on the hub of a trip-crank R, said crank R being fitted loosely on the valve-stem V, so that any lateral or axial movement of the crank on the stem will change the position of the jaw *d* and catch-plate *m*, substantially as described.

7. In a steam-engine valve-gearing, the combination of the arm or crank P, the valve-stem V, the arms or cranks R S, mounted thereon, one being laterally movable, the claw-lever Q, pivoted to the crank P and having at its inner end a forked extension provided with rollers *u u*, that fit into the grooves *v*, formed on the hub of the trip-crank R, the plates *m* and *c*, and the jaws *b* and *d* to which they are attached, substantially as described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

HANS C. BEHR.

Witnesses:
ALFRED A. ENQUIST,
WILSON D. BENT, Jr.