(No Model.)

W. C. PENNOCK.

VALVE MOTION.

No. 259,909. Patented June 20, 1882.

Fig. 1.

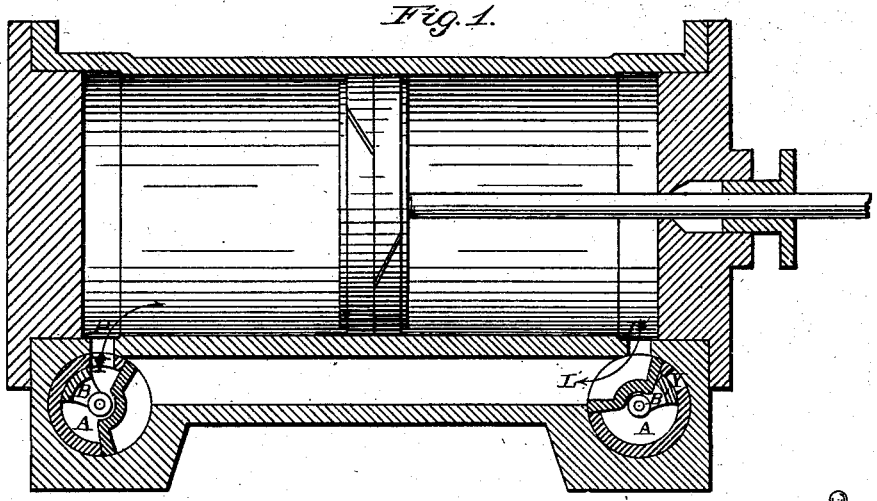


Fig. 5.

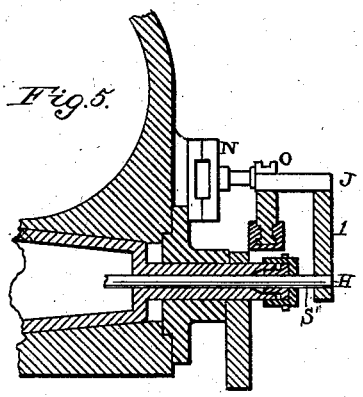
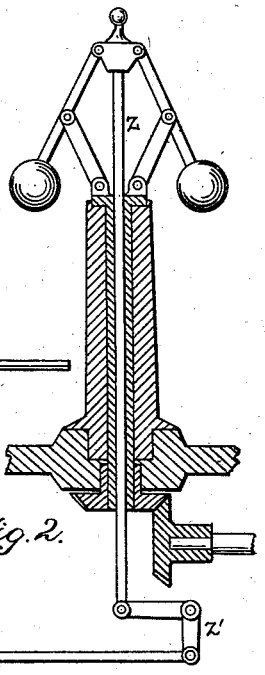
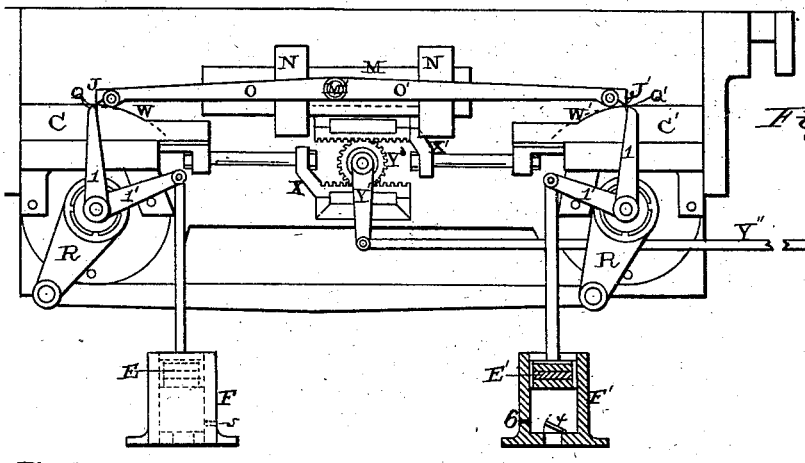


Fig. 4.

Fig. 2.



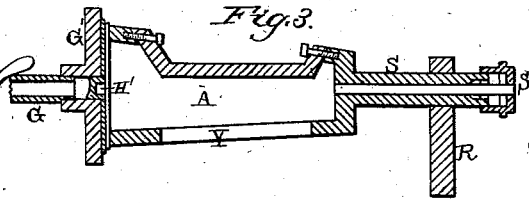


Witnesses:

J. W. Garner

W. S. O'Haines

Fig. 3.



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per

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UNITED STATES PATENT OFFICE.

WILLIAM C. PENNOCK, OF CARDINGTON, OHIO.

VALVE-MOTION.

SPECIFICATION forming part of Letters Patent No. 259,909, dated June 20, 1882.

Application filed March 29, 1882. (No model.)

To all whom it may concern:

Be it known that I, W. C. PENNOCK, of Cardington, in the county of Morrow and State of Ohio, have invented certain new and useful Improvements in Valve-Motions; 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improvement in valve-motion for steam-engines; and it consists, first, in the combination of the two valves and a mechanism for moving each one independently of the other, an arm connected to the valve-rod and having a weight which moves in a cylinder secured to its outer end, whereby the smaller valve is made to close when it is left free to move; second, in the combination of two slides which are connected together by suitable mechanism, so as to be drawn in or moved outward from each other, and which are operated by the governor so as to regulate the speed of the engine, all of which will be more fully described hereinafter.

The object of my invention is to regulate the speed of the engine by the valves and the parts connected with them, so that the engine is always under the most perfect automatic control and can be made to run at any desired rate of speed.

Figure 1 is a vertical longitudinal section of the cylinder, cutting the valves crosswise at their centers. Fig. 2 is a side elevation of my invention complete. Fig. 3 is a detached view of the valve. Fig. 4 is a detached view of the interior valve and the rod for operating it. Fig. 5 is a vertical cross-section of my invention.

The cylinder and piston used will be of the ordinary construction, and the steam-chest, which is placed under the cylinder, will be bored out at each end, so as to receive the hollow rotating or rocking valve A just opposite the ports P and P′ of the cylinder. The valves A are made hollow and conical, and are cut away upon one side, as shown in Fig. 1, so as to allow a free escape of steam from the cylinder. The outer and larger ends of the valves are left open so as to freely receive the steam, which is conducted through the pipe G from the boiler. Through one side of each of the valves is made a suitable port, Y, through which the steam escapes from the valve into the cylinder. The inner and smaller end of the valve is formed into a stem, S, which is made long enough to extend through the end of the steam-chest, and through this stem is made an opening, through which passes the rod H, which actuates the valve B, which is placed inside of the valve A, for the purpose of closing the ports Y. Upon the outer end of the stem will be made a suitable packing-box, S′, so as to prevent the escape of steam at this point. The opposite end of the rod H from the stem S has its bearing in the piece H′, which is inserted in the cap G′ of the steam-chest.

Secured to the two stems S are the two rocking levers R, which are connected together by a connecting-rod, and which, through connections with the eccentric on the engine-shaft, are caused to rock back and forth in their bearings.

To the outer ends of the two rods H are secured the two rockers, 1 1′, the rockers 1 having their outer ends to move through the arc of a circle indicated by the dotted lines W W′.

Secured to the side of the cylinder are the two guides N, through which move back and forth the slide M, which is moved by a second eccentric on the engine-shaft.

To the wrist-pin M′, to which is also attached the eccentric-rod of this second eccentric, are pivoted the two arms O O′, which have a sliding bearing on the two parts C C′, and for the purpose of causing these parts to move more easily the two ends J and J′ may be provided with friction-rollers, as shown. The two parts C C′, which are movable back and forth toward each other, have curved surfaces, as shown in Fig. 2, and these curved surfaces may be moved so as to be within the arcs W W′ or entirely outside of them, according to the speed at which it is desired to run the engine. The ends J J′ of the rods O O′ engage with the rockers 1 1′ of the valves B for the purpose of operating the valves when it is desired to open or close the ports Y in the valve A. When the end J comes in contact with the rocker 1 the motion of the end J which it gets from the second eccentric causes it to push the cut-off valve B from its position as covering

the port Y in the main valve A. The cut-off valve B always covers the port Y for the purpose of preventing the escape of steam from the main valve, except when its arm 1 is in contact with O at J and is being moved from its position by the motion imparted to it by O through its arm 1 and stem H. Now, the cut-off valve B moves in contact with the main valve except when its engagement by its arm 1 with J prevents it. By properly timing the second eccentric by which J is moved this engagement may be caused to take place at such time that the cut-off valve will be moved from off the port Y at the same time that the ports Y and P are being brought opposite each other; but the port Y will be opened twice as fast as P and Y are thus brought opposite to each other, because the motion of the cut-off valve B is the result of two motions in opposite directions, one being the motion of J toward the left and the other of the main valve toward the right; hence steam will have an uninterrupted passage from the main valve A through the ports Y and P. The steam will continue to flow through these ports into the cylinder until the cut-off valve is allowed to be closed by the disengagement of J and 1, or until the main valve cuts the steam off.

The two parts J and 1 are disengaged by the following arrangement, and the time of this arrangement relative to the speed of the engine is under the control of the governor. The points where the arcs W W′ of motion of the cut-off-valve arms intersect the boundary-line of C and C′ are the points Q Q′, when the disengagement of J and 1 or J′ and 1′ is effected. The two parts C and C′ get a motion toward or from each other from the governor through the two racks X X′, which mesh with the gear Y‴. (Shown in Fig. 2.) The gear Y‴ is moved by the rise or fall of the balls of the governor, as the governor is affected by the increase or decrease of the speed of the engine through the arm Y′, the connecting-rod Y″, the bell-crank Z′, and the governor-rod Z. When the engine is running at its usual speed these points Q Q′ are exactly opposite the centers of the ports P P′ and the engine is cutting off at one-half the stroke. Should any variation in the load cause the engine to run slower, the governor-balls fall and the arms Y′ receive a motion which causes the parts Z and Z′ to be thrown farther apart, and the points Q Q′ are moved respectively to the left and to the right of the centers of the ports P P′. The ends J J′ will therefore have to move a little farther before they reach Q Q′; hence a little more time will elapse before J and 1 are disengaged, and hence the point of cut-off will be delayed correspondingly. Steam will now continue to be cut off at this new point until some movement of the governor-balls changes the normal point of cut-off and establishes a new one. When the engine is first started and the governor-balls are in their lowest position the arcs W W′ fall wholly without C C′; hence just when the most power is required steam will be admitted to the cylinder for the longest time, because by the non-intersection of W W′ and C C′, J, 1, and J′ and 1 are not disengaged. This being the case, the cut-off valve will not be released to cut off the steam; but the cut-off will be effected by the main valve. The result of the increase of the speed of the engine would produce the opposite effect—that is, C C′, receiving a motion from the rising governor-balls, are moved respectively to the right and to the left, or toward each other; hence Q Q′ approach each other and J will not have to move so far before it reaches Q. The effect of this is that J and 1 are disengaged earlier relative to the stroke, and therefore the engine is cut off earlier and will continue to be cut off at this point until the governor is again influenced by an increase or decrease of speed. Should the governor-balls reach their highest position, the arcs W W′ will fall wholly within C C′; hence J 1 will not engage, the cut-off valve will not be moved from off the port Y, and steam will not therefore be admitted to the cylinder until the engine approaches more nearly its normal speed. The cut-off valves B and B′, after having been released from O and O′, are closed by the weights E and E′. These weights E E′ move loosely in the cylinders F F′, and the force of their fall is cushioned by the air which is compressed under them in the cylinders. In the bottoms of these cylinders are placed light hinged valves, which shut the openings made through the bottoms when the pistons E E′ are closed, but which rise and allow the air to follow the pistons when being raised upward. Near the bottoms of the cylinders are small holes 5 and 6, which allow the air to escape freely from before E and E′ when they fall, thus insuring a quick closing or quick throw of the cut-off valve. These holes 5 6 are not made through the cylinders at their bottoms, but are made such a distance above the bottoms that a certain quantity of air will always be held in the bottoms, so as to form a cushion to prevent such a movement as will cause the cut-off valve from striking against the valve-port of the motion-valve.

Having thus described my invention, I claim—

1. The combination of the two valves A B, the arms 1 1′, weight, and cylinder, the valve A being provided with the crank R, and the arm 1 being moved by the rod which is secured to the slide, substantially as shown.

2. The combination of the two rocking valves, each of which is provided with arms by means of which it may be moved, the slide M, carrying the two rods O O′, and the parts C C′, having curved surfaces and a suitable mechanism for moving them, substantially as specified.

3. The combination of the two parts C C′, connected together by the racks X X′, and pinion Y^3, with the slide M, rods O O′, the governor, and the two valves, the valves B B′ being provided with the arms 1 1′ and weights

to close them when left free to move, substantially as set forth.

4. The combination of the two parts C C′, connected together and operated by the governor, the valves, arms 1 1′, fastened to the valves B B′, the slide M, and arms or rods O O′, pivoted to the slide, the parts C C′ having curved surfaces, so that when the pressure of steam becomes too great the parts C C′ will be drawn together so as to prevent the rods O O′ from operating the valves B B′, substantially as specified.

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

WILLIAM CLARK PENNOCK.

Witnesses:

W. R. MEHAFFEY,

E. F. WILSON.