No. 625,363. Patented May 23, 1899.

J. H. SMITH.

VALVE OPERATING MECHANISM.

(Application filed Feb. 21, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 4.

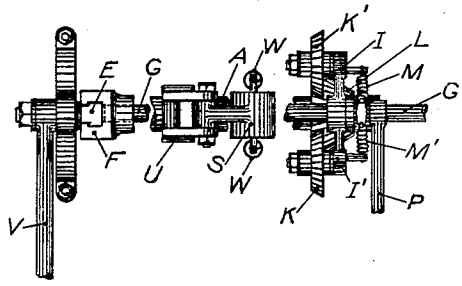


Fig. 2.

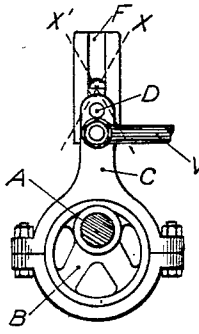


Fig. 1.

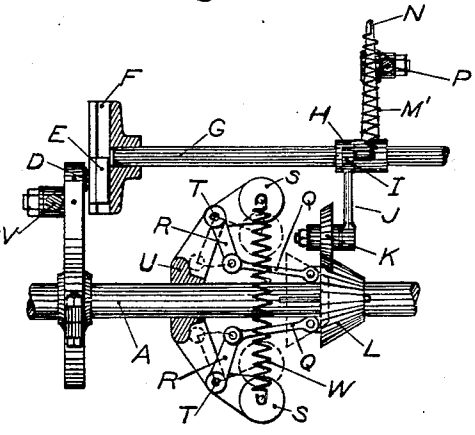
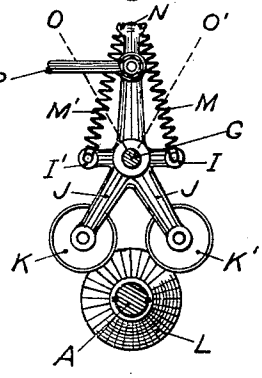


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 8.

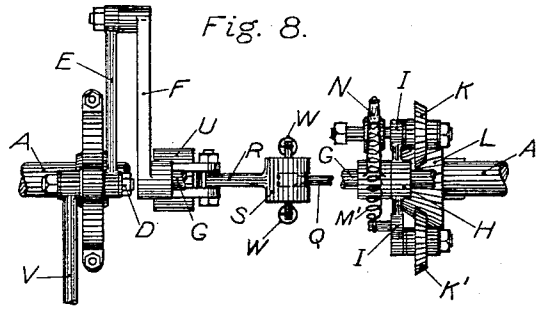


Fig. 6.

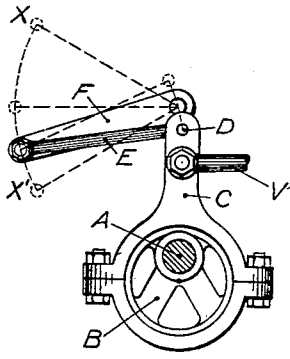


Fig. 5.

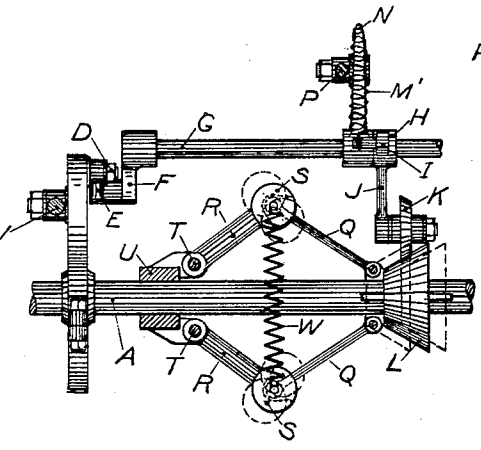
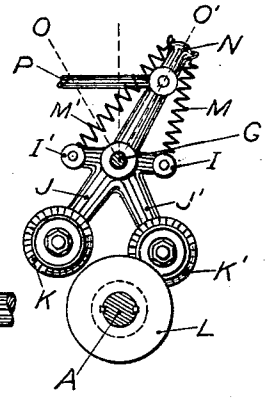


Fig. 7.



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VALVE-OPERATING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 625,363, dated May 23, 1899.

Application filed February 21, 1898. Serial No. 671,104. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. SMITH, a citizen of the United States, residing at Newark, in the county of Licking and State of Ohio, have invented certain new and useful Improvements in Valve-Operating Mechanisms, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to certain new and useful improvements in valve-operating mechanisms for steam or other engines; and its primary object is to enable the direction of motion of the engine to be reversed while the mechanism remains continuously under the control of a speed-regulating governor.

A further object of the invention is to provide means for automatically controlling the supply of steam to an engine, which means are in operative position at all times, whether the engine is moving forward or backward, and are under the direct influence of a speed-regulating governor.

The invention may be used in connection with any form of speed-regulating governor which is capable of moving the regulating-cone, forming part of the invention, in the proper manner. Furthermore, the invention is applicable to any form of valve-operating mechanism in which the motion of the valve is modified or reversed by moving one of the parts of the mechanism in either direction from a "neutral" position.

On Sheet 1 of the drawings I have shown my invention in connection with an old form of valve-operating mechanism known as the "Hackworth valve-gear" and with a common form of fly-ball governor.

On Sheet 2 of the drawings I have shown my invention in connection with a modification of the Hackworth gear, known as the "Marshall valve-gear," and with another common form of fly-ball governor.

Figure 1 is a side view, partly in section, containing my invention. Fig. 2 is an end view showing the Hackworth valve-gear. Fig. 3 is an end view of my invention. Fig. 4 is a top view with the shafts partly broken away. Figs. 5, 6, 7, and 8 are similar views with the Marshall valve-gear.

Referring to the drawings, in which like letters of reference denote corresponding parts in all the figures, A designates the main shaft, which is journaled in suitable bearings and upon which the eccentric B of the valve-gear is mounted. This shaft may also carry the speed-regulating governor; but it is obvious that the governor may be carried by another shaft connected with the shaft A in a suitable manner, if desired.

Referring particularly now to that application of my invention illustrated on Sheet 1, C is the eccentric-arm, whose upper end is pivoted at D to a block E, sliding in a straight grooved slide F. This slide is mounted on a shaft G, journaled in bearings which hold it in the proper relation to the shaft or shafts carrying the valve-gear and governor. I have shown the slide F on Sheet 1 in its neutral position—that is to say, in the position in which the valve connected to the stem V will not be opened to give motion to the engine in either direction. When the slide F is turned by its shaft G to the position indicated by the broken line X, the valve will have its greatest opening to give motion to the engine in one direction, and when the slide is turned to the position indicated by the line X′ the valve will have its greatest opening to give motion to the engine in the opposite direction. The positions of the slide F intermediate of the neutral and the two extreme positions (indicated by the lines X X′) correspond to smaller openings of the valve. The power and speed of the engine depend upon the degree of the valve opening and the time during which it is open, and these are controlled by operating the shaft G to turn the slide F forward and backward. My invention in this case is applied to turn the shaft G in either direction from the neutral position and permit the amount of the turning (and hence the speed of the engine) to be controlled by the governor. As thus applied my invention consists of a hub H, keyed on the valve-operating shaft G and having integral arms I I′ and J J′ thereon. A roller K is journaled on the arm J, and a corresponding roller K′ is journaled on the arm J′, one or the other of these rollers being maintained in engagement with a cone L on the governor-shaft. This cone is controlled and operated by the governor, being connected thereto in

the manner hereinafter described, and when the roller which is in contact with the cone travels on a smaller part of the cone said roller moves nearer to the axis of the cone and the shaft G is turned a corresponding amount to change the valve motion accordingly.

In Fig. 1 the cone L is in its extreme position to the right, and both rollers K K′ are in contact with the cone, and the valve-gear is held in its neutral position. The extreme position of the cone to the left is indicated by broken lines, and when the roller K is held in contact with the cone the slide F will take the position indicated by the line X, giving motion to the engine in one direction; but when the roller K′ is held in contact with the cone the slide will be in the position indicated by the line X′, giving motion to the engine in the opposite direction. Intermediate positions of the cone will give intermediate positions of the valve-gear between either extreme position and the neutral position. The roller K is held in contact with the cone by a spring M, which is connected at one end to the arm I and at its other end to the outer end of the arm N, which is loosely mounted on the valve-operating shaft G. A similar spring M′ is connected to the arm I′ and the arm N for the purpose of holding the roller K′ in contact with the cone. These two springs are adjusted so that their tendency will be to hold the rollers K K′ in a mid-position with reference to the arm N, as indicated in Fig. 3, and in this position the valve-gear will be held in its neutral position without regard to the cone. If the arm N be moved to the position indicated by line O by operating the reversing-rod P and locked in that position, the spring M will be expanded and the spring M′ contracted, thereby forcing the roller K against the cone L, and the engine will move in one direction. The speed and power will be controlled by the position of the cone, for it will be observed that when the roller K engages the smaller part of the cone the shaft G will be rocked to open the valve to its greatest extent to increase the speed of the engine, and, conversely, when the roller engages the larger part of the cone the shaft G will be rocked to open the valve only slightly, which will result in a diminution of the speed. If the arm N be moved to the opposite position, (indicated by the line O′,) the other roller K′ will be brought into contact with the cone and the engine will move in the opposite direction, the speed and power still being controlled by the position of the cone L. This operation of the reversing-handle to change the direction of movement of the engine may take place at any time and while the engine is working at a high rate of speed, and the parts of my invention are adapted and constructed and arranged with the purpose in view of facilitating the quick reversal of movement of the main shaft after the reversing-rod has been operated. Assuming that the engine is moving rapidly forward under the impulse of the steam acting on the piston and the arm N is operated to give a backward motion to the engine, the steam on the piston acts to retard the engine and bring it to rest and then starts it in the opposite direction. While the engine is still moving forward at considerable speed, the governor controlling the valve through the cone and rollers will only permit a small amount of steam to retard the engine; but as the speed decreases the cone moves axially and the valve is opened wider to permit a larger amount of steam to retard the piston, until the engine is finally stopped and the valve mechanism is in position to give the maximum of steam to the piston and cause the engine to move backward. As the backward movement increases in speed the cone moves axially on the shaft under the influence of the governor for the purpose of regulating the valve.

As shown in Fig. 1, the governor comprises a bracket U, which is keyed on the same shaft on which the cone L is mounted, and arms carrying balls S, pivoted at T to the bracket and balanced by the springs W, are connected with the cone by means of links Q and arms R. It will thus be seen that in whichever direction the engine moves it is always under control of the governor, and this control continues uninterruptedly at all times except at the instant when the reversing-lever is being thrown from its forward to its reversed position, and vice versa.

The valve-gear on Sheet 2 differs from that on Sheet 1 in having the pivot D at the outer end of the eccentric-arm guided on the arc of a circle by the radius-arm E, which is pivoted to the outer end of an arm F, keyed on the shaft G. The governor illustrated on Sheet 1 pushes the cone to the right as the speed increases, while the governor illustrated on Sheet 2 will pull the cone to the left. The reversing-arm N on Sheet 2 is shown in one of its extreme positions, (indicated on the line O′,) while the governor is shown in its mid-position, which gives the arm F an intermediate position between the neutral and the extreme position X′, which correspond to an intermediate power of the engine.

I have shown the contact between the arms J and J′ and the cone L made by means of rollers K and K′; but it is obvious that this contact may be direct or by means of shoes on the arms, which slide instead of roll on the cone, or in any other manner by which the desired movement of the parts can be secured.

The governor adjusts the cone to regulate the valve so as to control the speed of the engine; but the reversing-rod P is employed for controlling the direction of movement of the engine by bringing either the roller K or the roller K′ into contact with the cone, and whether one roller or the other is in contact with the cone the governor still controls the valve. It will thus be seen that by my in-

vention the governor not only controls the speed of the engine in whichever direction it may be running by controlling the quantity of steam let into the steam-chest, but the governor retains uninterrupted control of the steam-valve whether the engine is running in one direction or the other or being reversed, thereby obviating the necessity for shutting off steam from the cylinder by hand in the usual way in reversing the engine. In other words, the direction of the valve motion of the engine may be reversed while the engine continues to run, and without any other manipulation than that of shifting the reversing mechanism the engine will be automatically stopped, reversed, and started in the opposite direction, being all the time, while slowing up to stop and while starting up in the reversed direction toward full speed, under the control of the governor. In fact, by my invention the governor is enabled to so control the supply of steam to the steam-chest that during the interval of stopping, after the reversing mechanism has been changed, the supply of steam to the steam-chest is first utilized to assist in bringing the engine more quickly to a stop and then utilized to more quickly bring the speed of the engine in the opposite direction to the desired maximum. It will thus be seen that the steam-valve controlled by the governor is, more properly speaking, a reversing-valve, because by my invention the valve not only controls the quantity of steam admitted to the steam-chest regulated by the governor, but it also controls the direction in which the steam is taken into the steam-chest, and hence controls the direction in which the engine will run, this operation being brought about automatically after the reversing mechanism is set so as to determine the direction in which the engine is to run, it being understood that the reversing gear or mechanism may be set to reverse at any time regardless of the direction or speed at which the engine is running.

The distinguishing feature of my invention is a reversible valve motion always under control of the governor in whichever direction the engine may be moving, whereby the engine may be reversed while the steam or reversing valve remains uninterruptedly under the control of the governor, and any modification of the mechanism herein shown or described whereby this desirable result may be obtained is within the contemplation of my invention, it being manifest that many modifications and changes of such mechanism will readily suggest themselves to one skilled in the art to which my invention pertains.

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

1. The combination with a valve, of a speed-regulating governor, a cone connected with, and adapted to be operated by, said governor, reversing mechanism intermediate of said cone and the valve, enabling the governor to control the action of the valve, and means for reversing said mechanism, substantially as described.

2. The combination with a valve, of a speed-regulating governor, an axially-movable cone connected with said governor, reversing mechanism connected with the valve normally held in engagement with said cone, and means for reversing said mechanism, whereby the valve is controlled as the governor moves the cone axially, substantially as described.

3. The combination with a valve and a speed-regulating governor, of a valve-controlling mechanism comprising a cone connected with said governor, an arm carrying engaging devices, and means for holding either of said devices normally in contact with the cone, whereby the valve is automatically controlled by the governor, substantially as described.

4. The combination with a valve and a speed-regulating governor, of a valve-controlling mechanism comprising a cone connected with said governor, and adapted to be adjusted axially thereby, reversing mechanism intermediate of said valve and cone, and having engaging devices adapted to contact with said cone, and means for holding one of said engaging devices in contact with said cone, substantially as described.

5. The combination with a valve and a speed-regulating governor, a cone connected with, and operated by, said governor, and reversing devices intermediate of said cone and the valve, to adjust said valve by the movements of the cone so as to control the valve at all times during operation, substantially as described.

6. The combination with a valve, of a speed-regulating governor, a cone connected with said governor, and reversing devices normally held in engagement with said cone, whereby the valve is controlled as the governor moves the cone axially, substantially as described.

7. The combination with a valve, of a rock-shaft, a speed-regulating governor, a cone connected with said governor, an arm on said rock-shaft, and carrying engaging devices and means for holding said devices normally in contact with the cone, whereby the valve is automatically controlled by the governor, substantially as described.

8. The combination with a valve, of a rock-shaft, a speed-regulating governor, a cone connected with said governor and adapted to be adjusted axially thereby, arms on said rock-shaft and carrying engaging devices, and means for holding one of said devices in contact with the cone, substantially as and for the purpose described.

9. The combination with a valve, of a rock-shaft, a speed-regulating governor, a cone connected with said governor and adapted to be adjusted axially thereby, arms on the rock-shaft and carrying engaging devices, an arm loosely mounted on said rock-shaft, a reversing-rod connected to said arm, and springs

adapted to hold either one of the engaging devices in contact with the cone, substantially as and for the purpose described.

10. The combination with a valve, of a speed-regulating governor, a cone adapted to be adjusted axially by said governor and mechanism actuated by said cone for automatically regulating the operation of the valve, said mechanism comprising engaging devices either one of which may operate in contact with the cone and during any axial movement thereof, substantially as and for the purpose described.

JAMES H. SMITH.

Witnesses:
JESSE M. SMITH,
NELLIE MARTIN.