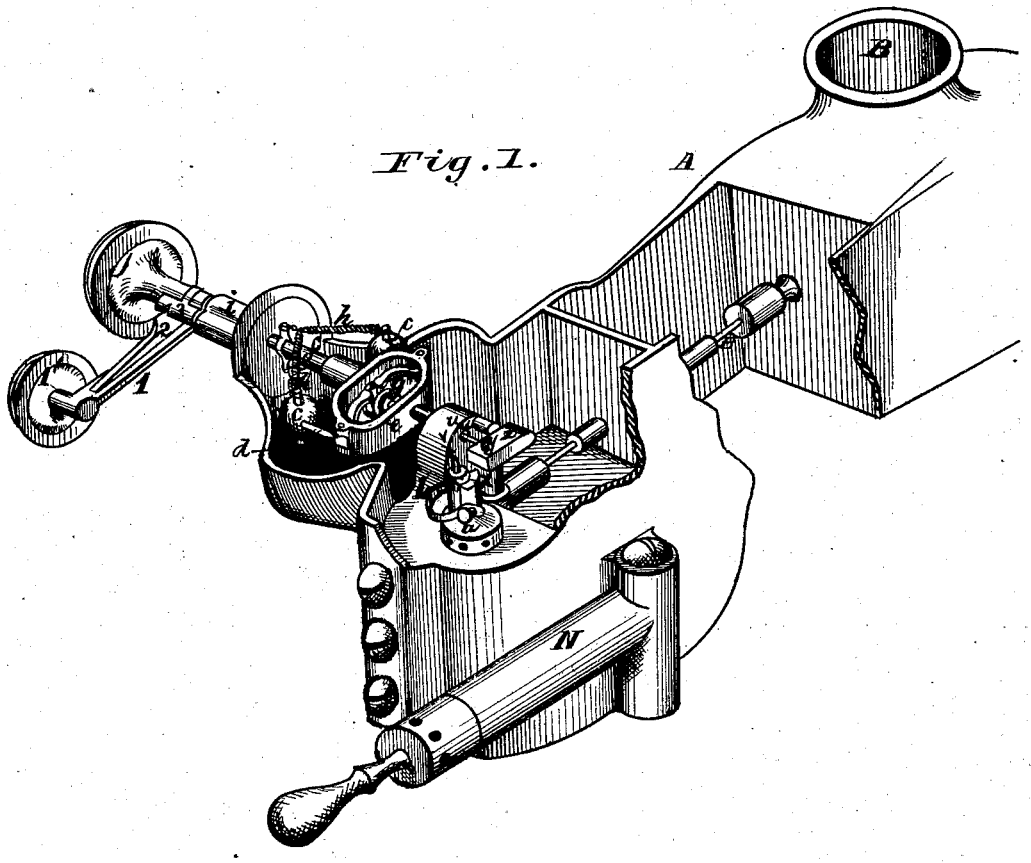
4 Sheets--Sheet 1.

F. M. MERRILL.

Governor for Steam-Engines.

No. 164,859. Patented June 22, 1875.

Fig. 1.



Witnesses

Jno. L. Boone

C. M. Richardson

Inventor

Frank M. Merrill

by Dewey & Co

Attys

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

4 Sheets--Sheet 2.

F. M. MERRILL.

Governor for Steam-Engines.

No. 164,859. Patented June 22, 1875.

Fig. 2.

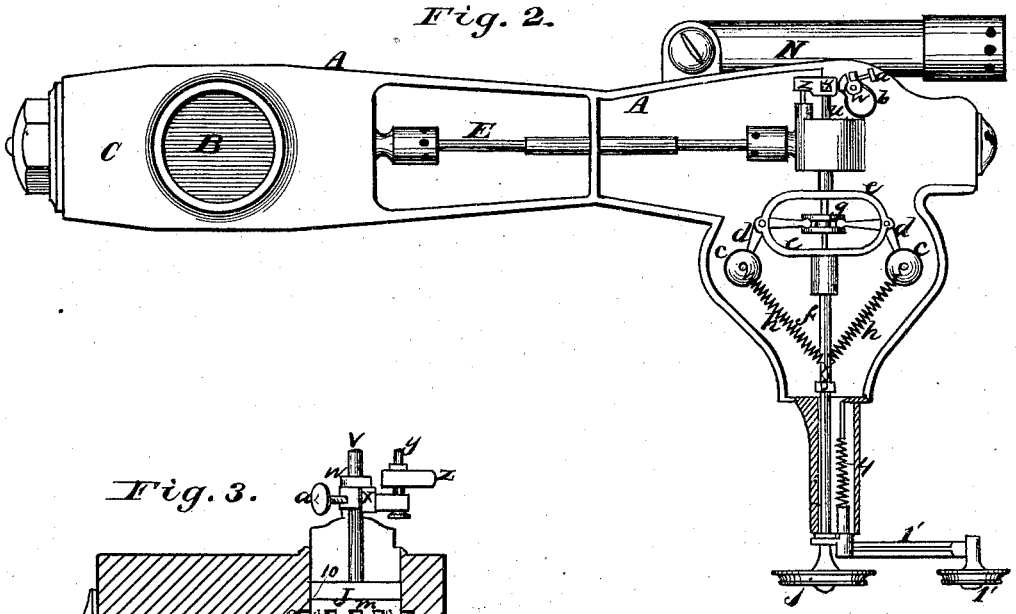


Fig. 3.

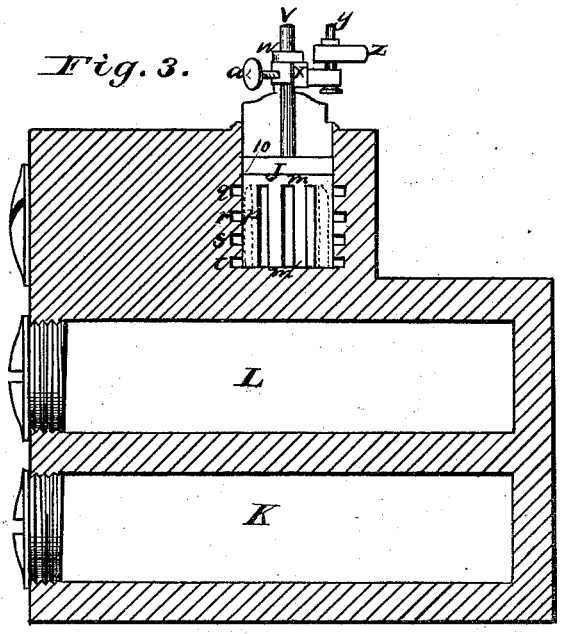


Fig. 4.

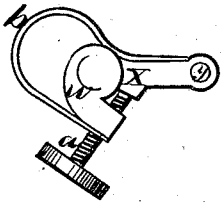
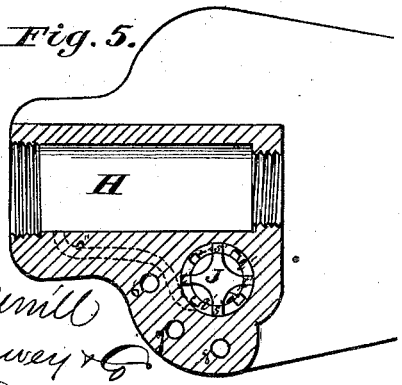


Fig. 5.



Witnesses

Jno. L. Boone

C. M. Richardson

Inventor

Frank M Merrill

by Dewey & Co

Attys

4 Sheets--Sheet 3.

F. M. MERRILL.

Governor for Steam-Engines.

No. 164,859. Patented June 22, 1875.

Fig. 6.

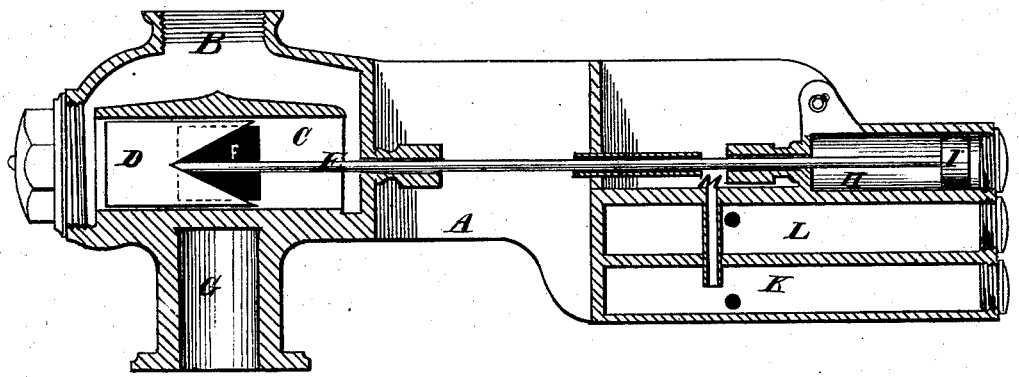


Fig. 7.

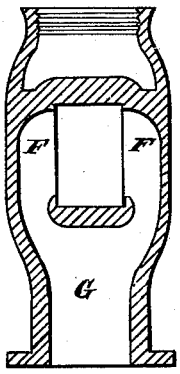


Fig. 8.

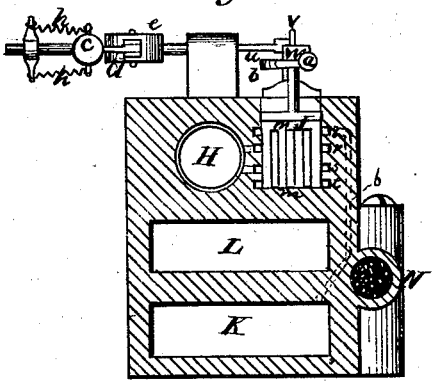
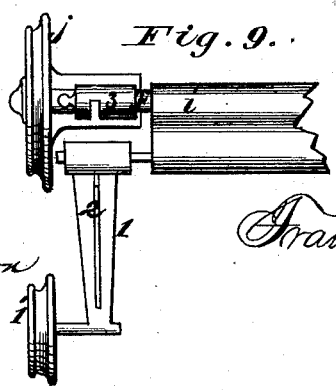


Fig. 9.



Witnesses
Jno. L. Boorge
C. M. Richardson

Inventor
Frank W. Merrill
by Dewey & Co
Attys

4 Sheets--Sheet 4.

F. M. MERRILL.

Governor for Steam-Engines.

No. 164,859. Patented June 22, 1875.

Fig: 10.

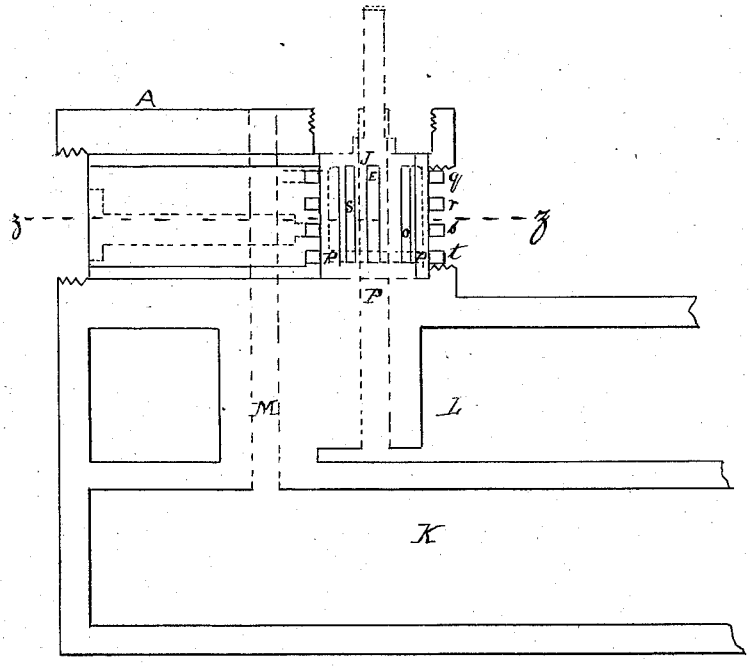
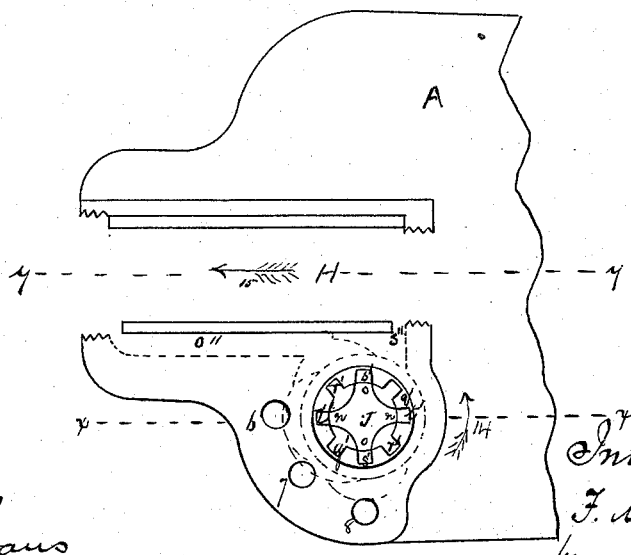


Fig: 11.



Witnesses
R. K. Evans
Will H. Moon

Inventor
F. M. Merrill
by A. H. Evans & Co
Attys

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE.

FRANK M. MERRILL, OF MARYSVILLE, CALIFORNIA.

IMPROVEMENT IN GOVERNORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **164,859**, dated June 22, 1875; application filed December 17, 1874.

To all whom it may concern:

Be it known that I, FRANK M. MERRILL, of Marysville, Yuba county, State of California, have invented a Governor; and I do hereby declare the following description and accompanying drawings are sufficient to enable any person skilled in the art or science to which it most nearly appertains to make and use my said invention without further invention or experiment.

My invention relates to a novel governor, which is to be employed for steam-engines, water-wheels, or any other machinery to which it may be necessary to impart a steady motion.

My invention consists in the employment of a pair of governor balls or weights, which are caused to act upon the stem of a valve admitting a liquid to one end or the other of a cylinder, within which moves a piston. The rod of this piston connects directly with the supply-valve or gate of the machine to be controlled, and thus opens or closes it, as may be necessary.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1, Sheet 1, is a perspective view of my governor. Fig. 2, Sheet 2, is a plan view. Figs. 3, 4, and 5 are enlarged sections of the valve and its adjusting apparatus and the hydrostatic cylinder. Fig. 6, Sheet 3, is a longitudinal section. Figs. 7, 8, and 9, Sheet 3, are enlarged detail views of part of the machine. Fig. 10 shows a section of the valve through the line *x x* and a portion of the cylinder through the line *y y*, of Fig. 11. Fig. 11 shows a section of the valve and cylinder through the line *z z* of Fig. 10, the arrow 15 showing the direction in which the piston moves to start the throttle, and the arrow 14 showing the direction of rotation of the hydraulic valve to shut the steam-valve.

A is a case, within which I have, in the present instance, shown my mechanism as contained. It is also illustrated as applied to a steam-engine, B being the inlet-pipe, which opens into the chamber C at each end, as shown. Within this chamber the valve D is fitted to move forward or back, actuated by means of the rod E, as will be more fully described hereafter.

The steam admitted to the rear of the valve is for the purpose of balancing it, while that from the front is allowed to pass to the engine, when the valve is open, by means of passages F upon each side of the chamber. These passages open into the pipe G below the chamber, and communicate with the steam-chest.

The valve D has its front end made V-shaped, so that it opens the square ports F gradually. The valve has its bearings upon the faces which cover the port F, and it is divided vertically, so that when it becomes loose a thin piece of paper can be introduced to this vertical space, and when the parts are again fastened together the additional thickness will again make a tight joint. The valve D is operated by the rod E, which extends through stuffing-boxes into a cylinder, H, and has a piston, I, secured to this end. This piston is moved back or forward by means of water, oil, alcohol, or other suitable liquid, which is supplied through a rotary valve, J, to one end or the other of the cylinder, as the change in speed may make it necessary. The liquid is contained in the lower of two compartments, K and L, which lie in the bottom of that part of the case A containing the cylinder H, and is supplied to this compartment K through a passage, M, which extends down to a point about halfway from the bottom. This is done for the purpose of gaging the amount of oil within the chamber, so that the pump can only force a certain amount into the pressure-chamber, after which it will only work air until a certain pressure is attained.

At one side of the chamber is placed the pump N, which is operated by means of an eccentric or other suitable connection from the engine-shaft; and by means of this pump the liquid is forced into the upper compartment L, which contains air, and this air is compressed by the entrance of the oil, so as to give an elastic pressure. A passage, 8, from this pressure-chamber allows the oil to pass to the valve J, which, when opened, admits it either to one end or the other of the cylinder H as the speed changes.

A suitable safety-valve may be connected,

so that the liquid cannot attain too great a pressure when the engine runs steadily and the valve J remains closed for a considerable time; but in practice this object is attained by leaving so much space between the piston and valves at the end of the stroke that one cylinder full of air will be alternately compressed and allowed to expand within the cylinder without ever becoming rare enough to open the ingress-valve, or dense enough to open the egress-valve. I make the space so large as to give a pressure of about eight atmospheres within the chamber L, and after this is reached the pump can force no more air in. Whenever oil enough has accumulated in the chamber K the pump will begin to draw it again. My present form of valve for admitting the liquid to the cylinder H, and discharging it again into the chamber K after its work is done, is rotary, although others might be substituted. It is made with each end *m* cylindrical, the central section being cut away on four sides, so as to leave the faces *n* and *o*. This valve fits into a case, 10, its ends making tight joints. Four annular grooves, *q*, *r*, *s*, and *t*, are cut in the metal surrounding the valve-case. Slots *q' r' s' t'* are cut in the casing, communicating, as shown in Fig. 10, at E S O P, with the respective grooves *q r s t*. There are eight slots to four grooves, each opposite slot communicating with the same groove, so that the pressure will enter and discharge on opposite sides of the valve, so as to balance perfectly. The groove *q* communicates with the passage E; the groove *r* with the port *s''*, opening to the "shut end" of the cylinder; the groove *s* with the port *o''*, going to the open end of the cylinder H; the groove *t* communicates with the port P. The port 7, Fig. 11, is merely a waste-passage, running down to the receiving-chamber K; it communicates with the hole in which the valve-casing is inserted, above and behind it, so as to take the leakage from it to the lower chamber. The communications between the governor, passage, and ports are made generally by a milling-tool, which is inserted in the groove, and then worked to one side until it cuts to the required passage or port. This is shown by the dotted arcs in Fig. 11, that are eccentric to the grooves.

It will be readily seen that when the valve is turned so that the opening *q'* from the pressure-chamber and *r'* to one end of the cylinder H are connected, the valve D will be forced open, thus admitting more steam to the engine; and when the opening *q'* connects with the openings *s'* from the opposite end of the cylinder, the piston will again close the valve D somewhat, thus reducing the supply of steam to the engine. These movements of the valve J will, in each case, open the discharge-port 7 from the back of the piston to the chamber K, into which the exhausted liquid flows, to be again pumped into the pressure-chamber when enough has accumulated.

In order to operate this valve its stem V is passed up through a cap at the top of the valve-chamber, and has the head W keyed to its upper end. To this head is hinged the part X, which has a post, *y*, passing up through the block Z, this block being secured to the end of the stem *u* of the governor. The reason for hinging the part X to the head W is to allow the valve to be adjusted, which is done by means of a screw, *a*, which passes through one side of the head W, and presses against the part X, so as to force the head W (and with it the valve-stem V) partly around. A spring, *b*, returns the head and stem whenever the screw is loosened. Any suitable form of governor-connection may be employed.

In the present case I have shown the stem *u* to be actuated by means of the centrifugally-acting balls *c c*, which are mounted upon the bell-crank arms or levers *d*, these levers having their fulcrum in the revolving frame *e*, which is secured to the driving-spindle *f*. The inner ends of the arms *d* operate to move the stem *u* through the grooved disk *g* when the balls *c* are separated by their centrifugal motion or drawn together by the centripetally-acting springs *h*.

The operation will be as follows: The pressure comes up the port S, and surrounds the valve-casing in the groove *t*, and enters the slots *t' t'*. The valve covers these slots when in its normal position; but if rotated in the direction of the arrow 14 it opens communication between the slots *t t* and slots *r' r'*, and as these slots communicate through the groove *r* with the port *s''*, the pressure is admitted to the shut end of the cylinder and closes the throttle. The liquid on the opposite side of the piston discharges through the port *o''*, and also a groove, *s*, and slot *s'*.

It will be seen that when the valve is situated so as to allow the slot *t' t'* and *r' r'* to communicate the slots *s' s'* and *q' q'* also communicate, allowing the liquid from the opening end of the cylinder to discharge through the slots *q' q'*, groove *q*, and passage 6 into the top of the receiving-chamber *k*. By moving the valve in the opposite direction, *t t'* and *s s'* are made to communicate, and *r r'* and *q q'* admit pressure to the open end, and opening the throttle.

In order to make my governor perfectly safe, and to automatically close the valve and stop the engine if the governor-belt should break, I pass the driving-spindle *f* through the sleeve or box *i*, giving it considerable end motion. The belt-pulley *j* is secured to the end of this spindle. An arm, 1, is pivoted just below this spindle, and carries at its outer end a pulley, 1', which rests upon the driving-belt when the latter is in place. A thin plate, 2, is formed upon the upper side of the arm 1, and this plate fits into a slot upon the collar 3, which surrounds the spindle *f*. This collar is so fitted that the spindle turns within it; but when the sleeve is released from

the plate 2 it can partake of the end motion of the spindle. This end motion is caused by a spring, 4, within the box or sleeve *i*, which acts upon the spindle *f* and tends to thrust it outward.

It will be manifest that as long as the belt remains in place it will support the pulley 1′ and hold the arm 1 in place, thus retaining the plate 2 within the slot in the sleeve 3, and preventing the spindle *f* from moving outward. In this position the valve J and the operation of the engine will be controlled by the varying motion of the balls *c c;* but if the belt should break or become displaced the arm 1 and pulley 1′ would fall by their own weight, thus releasing the plate 2 from the slot, and this would permit the spring 4 to act and force the spindle *f*, and with it the balls and stem *u*, back so far as to entirely close the valve J and stop the engine.

In my experiment I have obtained the best result by using a liquid to operate within the cylinder H; but it will be manifest that air, steam, or other elastic fluid could be substituted and the same effect produced.

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

1. The valve J, constructed as shown, in combination with its chamber *p*, said chamber having the annular passages *q r s t* and the ports *q′ r′ s′ t′*, for admitting and discharging the fluid to and from the cylinder H, substantially as herein described.

2. The adjusting device, consisting of the head W and the hinged portion X, with the screw *a* and returning-spring *b*, substantially as and for the purpose herein described.

3. The supply-chamber K and the pressure-chamber L, together with the pump N, valve J, and cylinder H, when combined to operate substantially as herein described.

4. The longitudinally-moving spindle *f* of the governor, in combination with the arm 1, holding-plate 2, and spring 4, arranged so as to close the valve and stop the engine by the displacement of the governor-belt, substantially as described.

In witness whereof I hereunto set my hand and seal.

FRANK M. MERRILL. [L. S.]

Witnesses:
JNO. L. BOONE,
C. M. RICHARDSON.