C. Waters,

Governor.

No. 110,703. Patented Jan. 3. 1871.

Fig. 1

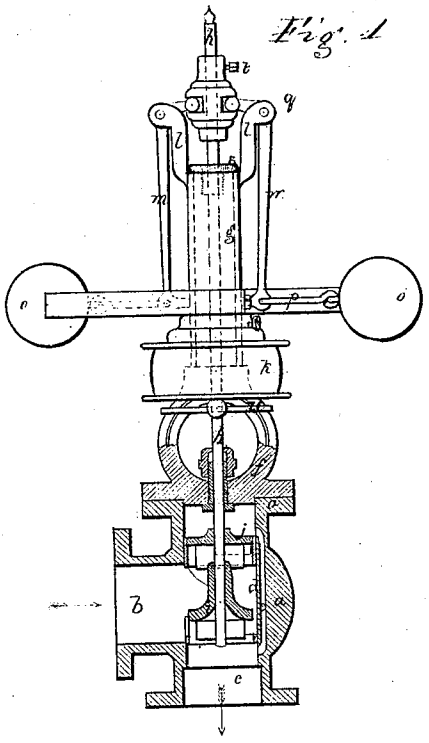


Fig. 2.

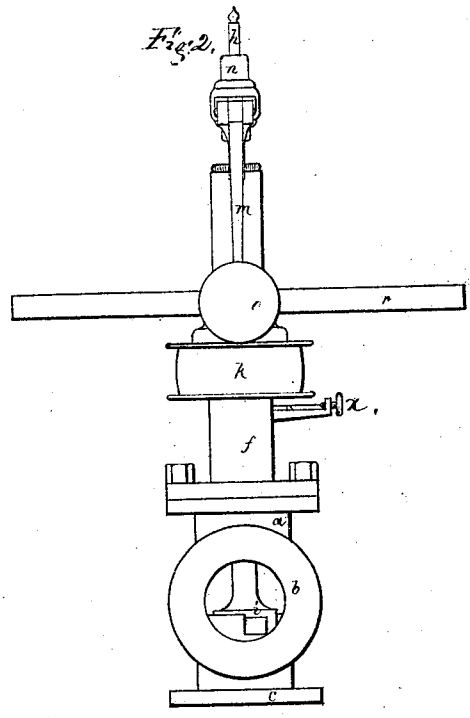


Fig. 3.

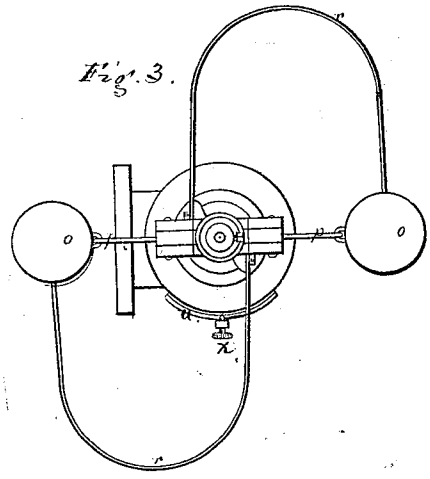
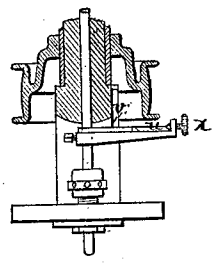


Fig. 4.



Witnesses { J. B. Crosby
C. Warren Brown.

Charles Waters

UNITED STATES PATENT OFFICE.

CHARLES WATERS, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN GOVERNORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **110,703**, dated January 3, 1871.

To all whom it may concern:

Be it known that I, CHARLES WATERS, of Boston, in the county of Suffolk and State of Massachusetts, have invented Improvements in Governing Mechanism for Steam-Engines; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

This invention has two parts—one relating to an improvement in the centrifugal regulator, and the other relating to improvements by which the valve worked by the regulator may be set or adjusted to conform to great changes in the amount of work to be done or in the pressure of the steam or other motive fluid.

In the ordinary pendulum-regulator two pivoted arms are commonly used, upon which are suspended weights in the form of balls, which cause considerable friction upon the pivots and joints of said arms, which friction renders the regulator less sensible to slight changes of speed of the engine than is desirable. In other words, it requires quite a perceptible change in the speed of the engine to overcome the friction on the pivots and joints of the weighted arms before the change in the centrifugal force of the weights causes them to change their position or plane of rotation; and one part of my invention consists in so connecting the weights to the arms that they are no longer supported by the pivots of the arms, but are sustained and rotated by other means, though connected with the pendulum-arms and moving them as the weights change their position.

Another part of my invention consists in provision for altering the relation of the governing-valve with reference to the steam passage or passages which it controls, so that the normal area of the steam-passage past the valve may be enlarged or diminished. For example, if the amount of work to be performed by the engine is very large, it is desirable to have the area of the steam-passage controlled by the valve larger than is required for a smaller amount of work, and it is desirable to change such area by mere adjustment instead of by actual change in the construction of the parts.

The drawings show, in Figure 1, a sectional elevation of my improved governing mechanism; Fig. 2, the same in elevation from a different point of view; Fig. 3, the same in plan, while Fig. 4 is a detail view of the parts by which a change can be effected of angular position of the valve with reference to the steam-passage which it controls.

a is the valve-case, having an entrance-nozzle, *b*, and an outlet-nozzle, *c*. The case contains a sleeve, *d*, in which the action of the regulator moves a valve vertically, there being between the sleeve and the case a passage, *e*, which admits steam above the valve, and thus prevents it from having an unbalanced condition. The top of the case *a* is closed by a casting, *f*, which serves to sustain the regulator, the upper part of said casting being made as a stud, on which the regulator-sleeve *g* fits and turns, said casting being centrally bored for the valve-stem *h*, which is packed where it passes to the case *a*. The valve shown is made in two parts, secured on stem *h*. The part *i* is that which operates to control the flow of steam from nozzle *b* to nozzle *c*, and is a hollow cylinder closed at its upper end and open at its lower end, and having opposite portions of its periphery removed to form ports through which the stem may pass. The other part, *j*, is similar to the part *i*, and both might be formed as one casting.

In the drawings the regulator is represented as at rest, and consequently the regulator-valve is wide open. The pulley *k*, which gives rotation to the regulator, is secured to the sleeve *g*, which carries at its upper end two brackets, *l*, to which are pivoted the arms *m*, which are bent levers, the short arms of which are connected through piece *n* to the valve-rod *h*, and the long arms to the weights or balls *o* by means of links *p*. The piece *n* is compound in its structure, the center part, with which the pendulum-arms *m* are geared, being loose and free to revolve about the other part, which is secured to the valve-stem by the set-screw *t*. The balls, instead of being hung upon arms *m*, as is usual, so as to bring their weight upon pivots *q*, are supported upon the free ends of springs *r*, the other ends of said springs being fixed to the rotating sleeve *g*. Though I prefer the springs for the purpose of supporting the balls, a system of jointed arms might be employed in place of the springs. The sleeve *g* is prevented from rising while left free to rotate by means of the screw *s*, so

that it will now be seen that if sleeve *g* is caused to rotate the balls will move outward, which, by the connections described, will lower the valve and will check the flow of steam, and also that, if the rotation of the balls slackens, they will move inward, which will open the valve more or less in proportion to such movements of the balls.

I provide either or both of two means for changing the area of the steam-passage past the valve. In the non-rotating part of piece *n*, I locate a set-screw, *t*, by means of which I can raise or lower the valve, and thus change the area of the passages through which the steam passes; but as it is desirable to be able to change said area with facility while the parts are in motion, I provide a means for changing the angular position of the valve, so as to vary the width of the steam-passages, which means are as follows:

A quadrant-piece, *u*, is centered upon the valve-stem *h*, and connected by a long pin, *v*, with the casting *f*, so that while the quadrant can rise and fall with the valve-stem it can have no angular motion.

On the valve-stem is fixed an arm, *w*, the outer end of which is provided with a clamping-screw, *x*, so that by said arm the valve can be turned more or less toward or away from projecting lips on the valve-casing, and thus the width of the steam-openings will be varied, and the valve can be set as to angular position by connecting the arm *w* to the quadrant *u* by means of the clamp-screw *x*.

While in the drawing the axis of rotation of the governing-weights is shown as vertical, it may be arranged horizontally, and if the weights are mounted on and are rotated by jointed arms taking the place of the spring *r*, then the preferable arrangement of the axis of rotation is horizontal.

With the jointed arms, which may be made to take the place of the springs *r*, there must be some arrangement of a spring or springs to act against centrifugal force to retract the weights toward the axis of rotation whenever the rotations of the governor lessen.

I claim—

1. A regulator or governor, substantially such as described, in which the weights or balls are supported independently of the pendulum-arms which operate the valve, when said balls are connected to said arms so as to control their position without loading the arms with the weight of the balls.

2. In combination with a regulator, a valve arranged to be adjusted in the direction of its axis of rotation, when arranged, also, so that it may be adjusted angularly upon or with reference to such axis.

CHARLES WATERS.

Witnesses:

J. B. CROSBY,

C. WARREN BROWN.