(Model.)

C. H. POWERS.

STEAM ENGINE GOVERNOR.

No. 248,881. Patented Nov. 1, 1881.

FIG. 1.

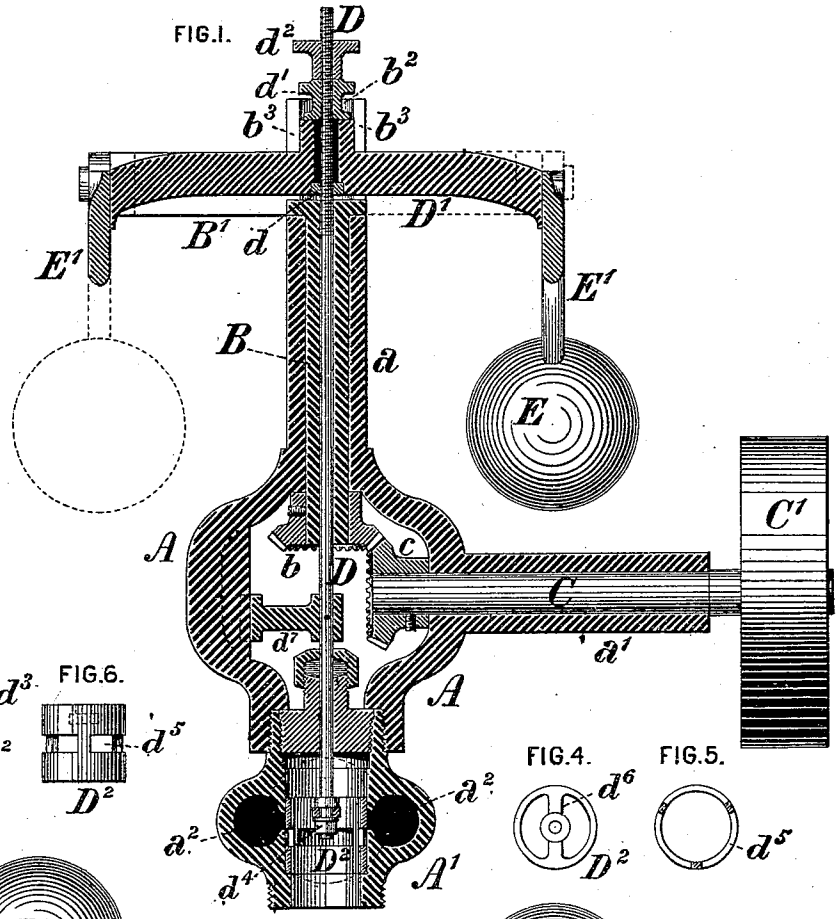


FIG. 3.

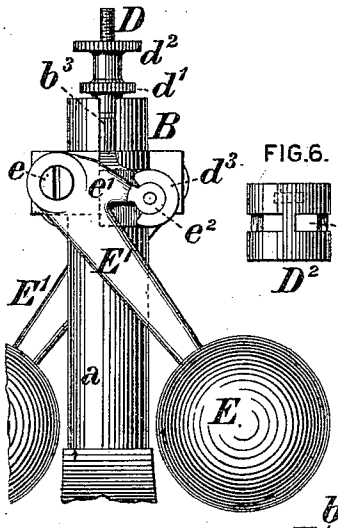
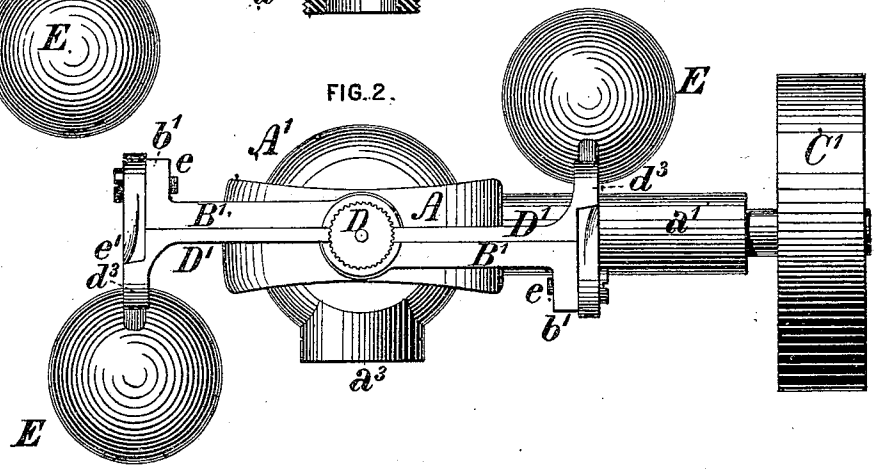


FIG. 6.

FIG. 4.

FIG. 5.

FIG. 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

CHARLES H. POWERS, OF PHILADELPHIA, PA., ASSIGNOR OF ONE-HALF TO EDWARD PINCUS AND EDWIN V. MACHETTE, BOTH OF SAME PLACE.

STEAM-ENGINE GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 248,881, dated November 1, 1881.

Application filed January 22, 1881. (Model.)

To all whom it may concern:

Be it known that I, CHARLES H. POWERS, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engine Governors, of which improvements the following is a specification.

My invention relates to governors of the class in which the supply of steam to the engine is regulated by movements of a valve effected by the oscillations of suspended weights or balls, due to centrifugal force; and its object is to provide a governor of such description which shall be simple and durable in construction, sensitive in operation, and exempt from liability to permit the "running away" of the engine in the event of the breaking of its driving-belt.

To this end my improvements consist in certain novel means for suspending the weights or balls, connecting the valve thereto and operating the same thereby, and effecting the graduated admission of steam to the engine, as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a vertical central section through a steam-engine governor embodying my improvements; Fig. 2, a plan or top view of the same; Fig. 3, a side view, in elevation, of the upper portion of the same; Fig. 4, a plan view of the valve; Fig. 5, a horizontal section through the same at its ports; and Fig. 6, a side view, in elevation, of the same.

To carry out my invention I provide a vertical standard, A, connected at its base to a valve chest or case, A′, and having vertical and horizontal bearings *a a′* projecting from the center of its top and from one of its sides, respectively, the axis of the vertical bearing *a* being in line with that of the valve-chest A′, and being at right angles to that of the horizontal bearing *a′*. A shaft, B, is fitted neatly within the bearing *a*, and is supported therein by a shoulder which is formed upon it adjacent to its upper end, and which bears on a seat on the top of the bearing. A miter-gear, *b*, secured upon the lower end of the shaft B, engages a corresponding gear, *c*, upon a shaft, C, fitted in the bearing *a′*, and carrying a driving-pulley, C′, by which rotation is imparted to the shafts by a belt from the main shaft of the engine. A cylindrical recess, b^2, having two longitudinal side slots, b^3, is formed in the shaft A above the bearing *a*, adjacent to which slots two horizontal arms, B′, project from the shaft in opposite directions from its axial line, and on opposite sides of the slots, respectively. A valve-stem, D, to the lower end of which the valve presently to be described is secured, passes centrally and freely through the shaft A, and a cross-head, D′, fitting, with the capacity of free vertical movement, within the recess and slots of the shaft A, is secured at its center to the valve-stem D by means of nuts *d d′* d^2, fitting a thread cut upon the valve-stem, the cross-head being clamped between the nuts *d* and *d′*, by the proper adjustment of which its position upon the valve-stem may be varied longitudinally, as required, for the purpose of setting the valve or compensating for wear, the cross-head being held firmly in its adjusted position by the jam-nut d^2. The cross-head is bored to a larger diameter than that of the valve-stem, to prevent cramping or lateral strain upon the latter, and the rotation of the valve-stem is prevented by an arm, d^7, secured upon it, the outer end of the arm having lips or flanges embracing a flat guide on the standard A.

The balls or pendulums E are secured upon arms E′, pivoted at their upper ends by studs *e* to bearings *b′* on the ends of the transverse arms B′ of the shaft A, so as to be vibratable about their centers of suspension in perpendicular planes at right angles to said arms—that is, in planes tangential to radii of a circle struck from a point in the axial line of the valve-stem. A short lever-arm, *e′*, projects from each of the ball-arms E′ adjacent to its center of suspension, said arms *e′* having rounded heads or pins e^2 upon their outer ends fitting easily within sockets d^3, formed upon the ends of the cross-head D′, parallel with the axes of the suspending-studs *e* of the ball-arms.

The effect of the above-described connection of the ball-arms and cross-head is to cause the cross-head, with the attached valve-stem and valve, to be moved vertically upward or downward coincidently with and proportionately to the upward or downward oscillations of the balls upon their supporting-studs, induced by increase and decrease, respectively, of the

speed of the crank-shaft of the engine. The suspension of the governor-balls with the capacity of vibration in planes which are tangential to the circle of rotation of their supports and the transmission of their movements by the devices described to the valve-stem and valve tend to increase the sensitiveness and freedom of action of the governor in reducing the friction opposing the free movement of the ball-arms, as well as the number of joints between the balls and the valve.

The governor-valve D^2 is a hollow metallic cylinder open at both ends, and turned truly on its periphery, so as to fit neatly within a corresponding central bore in the valve-chest A′, the lower face of the valve resting, when the balls are not in rotation, upon a shoulder or offset in said central bore, the diameter of which, below the offset, corresponds substantially with the inside diameter of the valve D^2. The supporting shoulder or offset is not, however, an essential, and may be dispensed with, if preferred. A bar, d^6, having a central eye for the reception of the valve-stem D, extends across the top of the valve, the valve-stem being secured thereto by means of a collar and lower nut, d^4, and a series of circumferential ports, d^5, is formed in the valve about midway of its length, said ports communicating, when the valve is raised, with an annular port extending around the central bore of the valve-chest and opening into an annular channelway, a^2, which communicates with a nozzle, a^3, on the side of the valve-chest, to which nozzle the steam-supply pipe is connected. By this construction I provide a valve which is, under all circumstances, perfectly balanced, thus correspondingly facilitating its operation by the governor-balls, and obviating the necessity of stop-motion gear, as the valve cuts off steam by the upper as well as the lower edges of its ports, and in the event of the breakage of the governor-belt will instantaneously shut off the supply of steam, instead of, as in the ordinary construction, permitting the engine to "run away" by the cessation of the rotation of the balls.

Referring to Fig. 1, it will be observed that the relation of the valve D^2 to the port of the chest and to its operating mechanism is such that when the engine is in a state of rest the port is only open for a sufficient distance to allow enough steam to pass to start the engine, the steam being cut off by the upper edge of the valve-port d^5. As the engine starts and gradually increases its speed the valve is elevated by the accompanying outward movement of the balls in their rotation until the port is fully open, and admits the quantity of steam required to operate the engine at its normal speed, upon an increase of which the valve continues to rise, and recloses the chest-port by cutting off at the lower edge of the valve-port. The valve is thus adapted to and performs a double action—that is to say, to properly regulate the supply of steam on its upward movement in the starting and during the operation of the engine and governor by an opening and a reclosing of the port, and likewise to instantaneously shut off the supply of steam by its downward movement, when the governor-balls cease to rotate, as in the case of the breaking of the belt. By such gradual admission of steam and regulation of supply by reclosure the liability to accident in starting the engine from the entrance of water to the cylinder is greatly reduced, and the cost of construction is diminished by the avoidance of the stop-motion mechanisms which are necessary as a safety-check in governors of the ordinary types.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, in a steam-engine governor, of a shaft rotatable in a vertical bearing, and having two transverse arms above said bearing, weights or balls pivoted to the ends of said arms, and moving in planes perpendicular to their center line, a cross-head connected to the governor-valve stem, said cross-head being fitted to rotate with and move longitudinally along said shaft, and lever-arms by which the cross-head is pivoted at its ends to the arms supporting the balls or weights, substantially as set forth.

2. The combination, in a steam-engine governor, of a shaft rotatable in a vertical bearing, and having a central recess and side slots above said bearing, a cross-head fitted to move vertically within said recess and slots, a valve-stem connected to said cross-head at its center, and transverse arms connected to the vertical shaft on opposite sides of its axis and of the cross-head, respectively, substantially as set forth.

3. The combination, in a steam-engine governor, of two weights or balls, suspending-arms by which said balls are pivoted to transverse arms on a vertical shaft, lever-arms connected to the ball-arms, and having rounded heads or pins on their ends, and a cross-head rotatable with the vertical shaft, and having sockets upon its ends fitting the heads of the lever-arms, substantially as set forth.

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