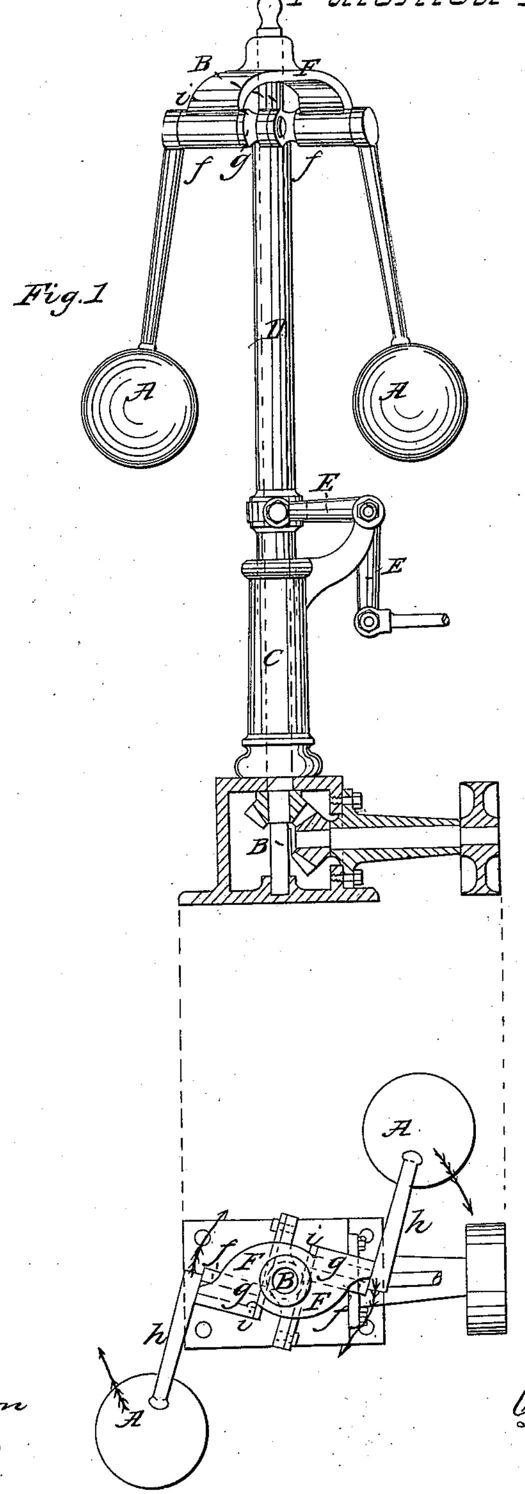
D. Shire,

Governor.

No. 54,423. Patented May 1, 1866.



Witnesses:

Benj Morison

R. F. Shattuck

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David Shire

UNITED STATES PATENT OFFICE.

DAVID SHIVE, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN STEAM-ENGINE GOVERNORS.

Specification forming part of Letters Patent No. **54,423**, dated May 1, 1866.

To all whom it may concern:

Be it known that I, DAVID SHIVE, of the city of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in Governors for Equalizing the Speed in Steam and other Engines; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 is a perspective view, and Fig. 2 a horizontal orthographic projection, of the said invention applied and in motion in the direction of the arrows in Fig. 2, like letters, when in both figures, indicating the same parts.

The object of my invention is the production of a governor depending upon inertia and momentum instead of centrifugal force and dead weight only for its principal acting forces, so constructed that the usual weight of the balls may be greatly reduced and the binding of the joints from which they are suspended entirely obviated during the motions of the governor, thus reducing the friction and rendering the governor more sensitive to the changes in the speed of the engine.

It consists, substantially as hereinafter described and set forth, in suspending the balls by their rigid arms from joints so constructed, arranged, and secured to the spindle that the said balls are left almost entirely free to rise and fall during the rotary motion of the governor in directions which may be considered the resultants of their gravitation and centrifugal forces.

In the drawings, A A are the balls; B, the rotatory spindle; C, the supporting-column; D, the sleeve, and E the lever whereby the sleeve is connected to the supply-valve. *h h* are the arms of the balls, and *f g f g* the joints of suspension.

Construction: On the upper end of the spindle B an arched piece, F, is fixed transversely, the lower ends of which being formed into bosses or cylinders *f f*, arranged horizontally, so as to be in planes parallel to each other, substantially as represented in the drawings. The cylinders *f f* are each bored longitudinally and fitted with a cylindrical mandrel, *g g*, which will be free to rotate therein. To the outer ends of these mandrels the rigid arms *h h* of the weight-balls A A are respectively fixed, while to the inner ends of the said mandrels short arms *i i* are respectively fixed, to project in opposite directions to each other and to connect by slotted joints or in any other suitable manner with the sleeve D, so that the rising and falling motions of the balls A A shall cause corresponding falling and rising motions, or vice versa, in the sleeve D, and consequently, through the lever E, operate the usual supply-valve of the engine.

Operation: When an engine fitted with this governor is started there will be communicated to the cylinders *f f* a tendency to run away from the balls A A by virtue of the inertia of the said balls, and consequently, aside from any centrifugal tendency imparted at the same time by the rotary motion of the spindle B, they will be caused to rise, and, the connections which unite them to the valve of the engine being adjusted to the required speed of the latter, whenever an excess of steam is admitted by the supply-valve, or the work to be performed by the engine diminished, the speed of the rotary motion of the spindle B will be accordingly increased; but the inertia of the balls A A not being instantly overcome thereby, they will rise from the operation of these causes, and thus instantly diminish the valve-opening and reduce the speed of the engine; and if there should occur even a slight reduction only in the required supply of steam through the valve, or an addition of work be put upon the engine, diminishing accordingly the rotary speed of the spindle B, the momentum of the balls A A, in connection with whatever diminution of their centrifugal force there may be, will cause them instantly to fall and so enlarge the opening in the valve and restore the regular speed of the engine. It will, therefore, be manifest that while the old ball-governor depends for its useful effect entirely upon the centrifugal motion and the gravitation of the balls, in this improvement the inertia and the momentum of the balls are thus made importantly effective for the purpose, and that consequently a more sensitive or quickly-acting equalizer of the speed of an engine is produced, and also that the weight required in the balls, and consequently the friction arising therefrom in the old governor, aside from the lateral strain produced in its

joints by changes in the rotary speed of its spindle, are in this improvement greatly reduced, thus rendering the apparatus more durable and lessening the consumption of the power of the engine to drive it.

The central longitudinal lines of the joints should, in order to allow the balls at all times to swing freely by their arms *h h*, be tangential to the spindle and at the distance of about the semi-diameter of either ball from the center of the shaft or spindle B, or substantially as represented in Fig. 2; and being thus applied to the spindle, it will be evident that the said suspension-joints will always remain free from any binding effect from the action of the balls, because the respective positions of the arms *h h* of the balls are always at right angles to the mandrels *g g* of their joints; and hence, also, all guides or other devices for keeping the arms and balls in proper positions are dispensed with. In action the balls are allowed to fall behind the spindle, or the spindle gaining on them and by first impulse correcting the valve, so as not to leave any perceptible change in the speed of the engine. If the speed of the engine relaxes the momentum of the balls gains on the speed of the spindle and thus instantly changes the valve.

Having thus fully described my improvement in governors and pointed out its utility, what I claim as new therein, of my invention, and desire to secure by Letters Patent, is—

Suspending the balls A A by rigid arms *h h*, connected to the spindle B by means of joints consisting of the cylinders *f f* and the mandrels *g g*, or their equivalents, arranged in relation to the said spindle, arms, and balls substantially as described and represented.

DAVID SHIVE.

Witnesses:

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