J. D. WILLOUGHBY.

Governor for Steam-Engine.

No. 162,446.

Patented April 20, 1875.

Fig. 1.

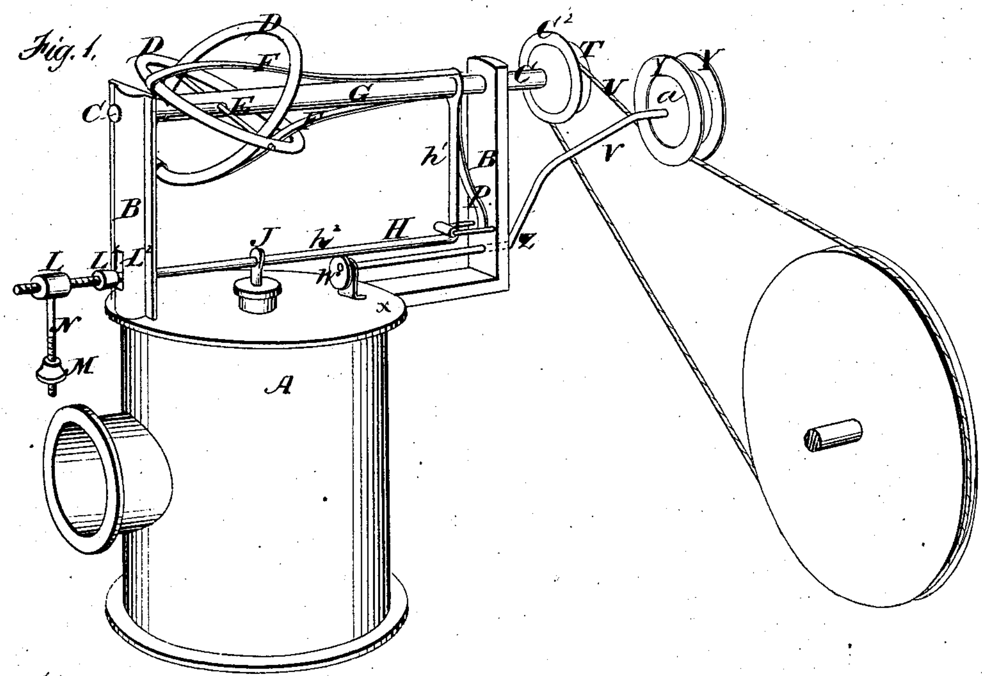


Fig. 2.

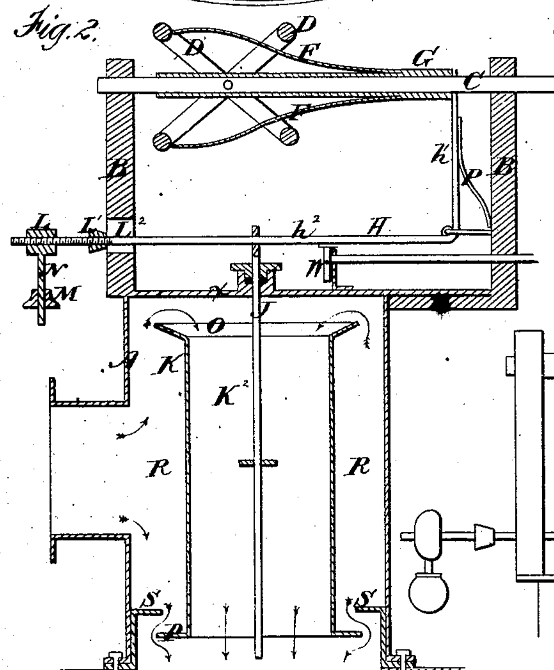
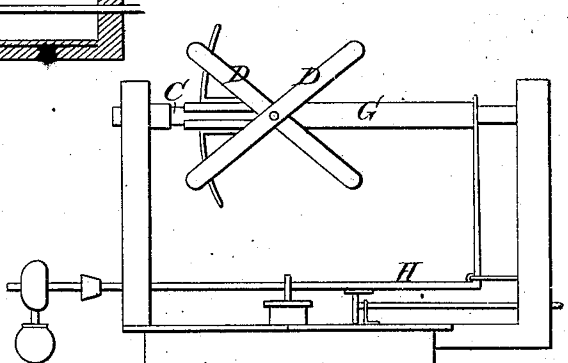


Fig. 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

JAMES D. WILLOUGHBY, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN GOVERNORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **162,446**, dated April 20, 1875; application filed March 27, 1874.

To all whom it may concern:

Be it known that I, JAMES D. WILLOUGHBY, of the city and county of Washington, in the District of Columbia, have invented a new and Improved Governor for Steam-Engines; and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of my invention. Fig. 2 is a vertical section. Fig. 3 is a similar section, showing a modification.

My invention has for its object, first, to provide a centrifugal governor for steam-engines, which shall possess such a degree of sensitiveness as to respond immediately to every change in the speed of the engine, and which shall be susceptible of such minute regulation and adjustment as to correspond with the various circumstances under which it may be placed. It also has for its object to provide in connection with the sensitive governor a steam-valve, operated thereby, of such construction as to be perfectly balanced by the steam-pressure at all times, and thus offer little or no impediment to the action of the governor.

To these ends my invention consists, primarily, in the employment of two rings, pivoted to a common axis passing through a horizontal driving-shaft, the rings being connected by two springing arms, connecting each of them with a sleeve sliding on the horizontal shaft, the outward motion of the rings being resisted to a slight degree by the spring of the arms, until the force reaches a certain degree, when the force of the rings overcome the springs and force the arms and sleeve along the shaft horizontally.

My invention further consists in an elbow-lever having a horizontal long arm, and a vertical short arm, the latter being connected to the horizontal shaft of the governor at its upper end, in such a manner as to bear against the sliding collar or sleeve thereon, while the former is attached about midway of its length to a vertical rod of the steam-valve. The lever is pivoted at its elbow, and is operated by the pressure of the sliding sleeve on the governor-shaft against its upper end.

My invention also consists in an adjustable weight, arranged on the free end of the long arm of the elbow-lever below the same, said weight being adjustable vertically and longitudinally, so as to regulate the degree of force required to close the valve.

My invention further consists in certain details of construction hereinafter more fully set forth.

In the drawings, A represents the steam-chest having vertical standards B B′ projecting from its upper end, in which are the bearings of a horizontal shaft, C. D D are metallic rings, pivoted one within the other upon a transverse axis, E, extending through the shaft C. The rings D, when at rest, are at opposite angles with the shaft C, and each is connected by a spring-arm, F, with a sliding collar or sleeve, G, on the shaft C. H is an elbow-lever, having a vertical arm, h^1, and a horizontal arm, h^2. Said lever is pivoted at its elbow to a bracket on one of the standards B, and its upper end is provided with an orifice, which incloses the shaft C, and bears against the end of the collar G. The horizontal arm h^2 of the lever H passes through the upper end of a vertical rod, J, which is attached to the valve K within the steam-chest A. L represents a weight or collar, screwed on the end of the arm h^2, so as to be adjustable horizontally on the latter. M is a pendent weight located on a vertical screw-stem, N, depending from the collar L, and therefore adjustable horizontally and vertically. L^1 is a conical nut or collar arranged on the arm h^2, so as to be screwed into or out of a vertical slot, L^3, in one of the standards B. The valve K is a hollow cylinder open at both ends, and provided with external flanges O P at its upper and lower ends, said flanges extending little more than half-way across the annular space R between the valve and steam-chest. S is an internal flange projecting from the steam-chest near its lower end. The flange S is of the same width as the flanges O P, and is located at the same distance above the lower flange P of the valve that the upper flange O of the latter is below the top of the steam-chest, so that when the valve is raised its flanges come in contact with the flange S and top of the chest simultane-

ously. T represents a pulley located on the end of the shaft C, and connected by a belt, U, with the driving-wheel of the engine. V is a shaft located in suitable bearings on the steam-chest under the horizontal arm h^2 of the lever H, and having a cam, W, on its inner end, which bears against the arm h^2. The shaft V is bent at right angles at its outer end, a crank or elbow, Z, being thus formed, in the outer end of which is journaled a pulley, *a*, bearing on the belt U, as shown in Fig. 1.

In the operation of the parts described the shaft C is rotated by power from the driving-wheel of the engine. The rings D being independent of each other and pivoted to a transverse axis, it will be seen that their tendency is to assume a vertical position by centrifugal force, when the shaft is rotated with sufficient rapidity. This movement results in sliding the collar G along the shaft C, by means of the arms F, raising the horizontal arm h^2 of the elbow H by the pressure of the collar against its vertical arm h^1, thereby raising and closing the valve to a degree corresponding to the angle of the rings D, the valve being entirely shut off when the rings reach their highest or most nearly vertical position, as will be readily understood; hence the higher the speed of the engine the more nearly the valve is closed.

The construction and arrangement of the rings D make them extremely sensitive to centrifugal force, and as the valve K is of such construction as to be perfectly balanced, it follows that the valve is liable to be closed by a low degree of speed in the engine; hence it is necessary to provide means for counteracting this over-sensitiveness, and for preventing the valve from rising until a certain definite rate of speed is attained. These ends are accomplished, first, by the spring-arms F, which have a tendency to prevent the rings from approaching a vertical position, and this tendency having to be overcome by the rings before they can rise; secondly, by the auxiliary spring P, which presses against the vertical arm h^1 of the elbow-lever A; and, thirdly, by the adjustable weights L M, the object of the former being more particularly to load down the valve, so that it will not rise until the desired speed of the engine has been reached, while the latter, M, being below the horizontal line of the arm h^2, acts as an auxiliary to the springs F P in overcoming the sensitiveness of the governor, its leverage on the horizontal arm h^2 increasing as the latter swings upward on its pivot. The governor and valve, thus balanced and regulated, may be compared in their operation to grocers' scales, which do not move until the desired weight is upon them, when a few grains in addition will carry the whole. So, in my device no effect is produced on the valve until the desired rate of speed is attained, when a slight increase will operate the valve, this degree of speed being adjustable by moving the weights along the arm h^2. The pulley *a* and crank-shaft Z constitute an automatic device for closing the valve in case of the breakage of the belt U and the consequent stoppage of the governor. The pulley Y resting on the belt naturally drops when the belt breaks, and, turning the arm Z and its horizontal part, causes its cam W to bear on the horizontal arm h^2, raising the same and closing the valve, thereby guarding against the engine running without means of control. The pulley T has a wide flange, C^2, on its inner side, which prevents the belt from falling where it will obstruct the descent of the pulley. When it is not desirable to entirely stop the engine, in consequence of the stoppage of the governor, but to partially close the valve, the conical collar L^1 is screwed along the arm until its smaller end enters the slot L^2 of the standard B. The vertical movement of the arm h^2 is thus restricted in proportion to the extent that the collar enters the slot. This device is designed particularly for use in connection with rolling-mills, where the entire stoppage of the engine would involve the chilling of the iron in the rolls.

By my construction of centrifugal device, herein described, the weight of the rings is uniformly distributed, and I am enabled to throw the same amount of weight on each side of the common diameter of the rings, and on each side of the governor-shaft, and thereby lessen the friction of the parts, while I entirely obviate pinching. It will also be seen that, by the employment of the pendent and adjustable weight M, as the horizontal arm h^2 is raised, the distance of the pendent weight M from its fulcrum is increased, thus rendering the weight one of varying resistance, the spring P also co-acting and its tension increasing as the arm h^2 of the elbow-lever H is raised.

I claim as new and my invention—

1. The rings D D, in combination with the spring-arms F F and sleeve G, substantially as and for the purpose set forth.

2. The pivoted elbow-lever H, consisting of the arms h^1 h^2, in combination with the valve K and sleeve G, whereby a horizontal motion, given by the centrifugal device to the arm h^1 produces a vertical motion in the arm h^2 and valve K, substantially as and for the purposes set forth.

3. The pendent weight M, of varying resistance or force, in combination with the arm h^2 of the elbow-lever H, and spring P, substantially as described, and for the purposes set forth.

4. The adjustable-nut or sleeve L^1, in combination with the arm h^2 and slot L^2, substantially as and for the purpose set forth.

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Witnesses:

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