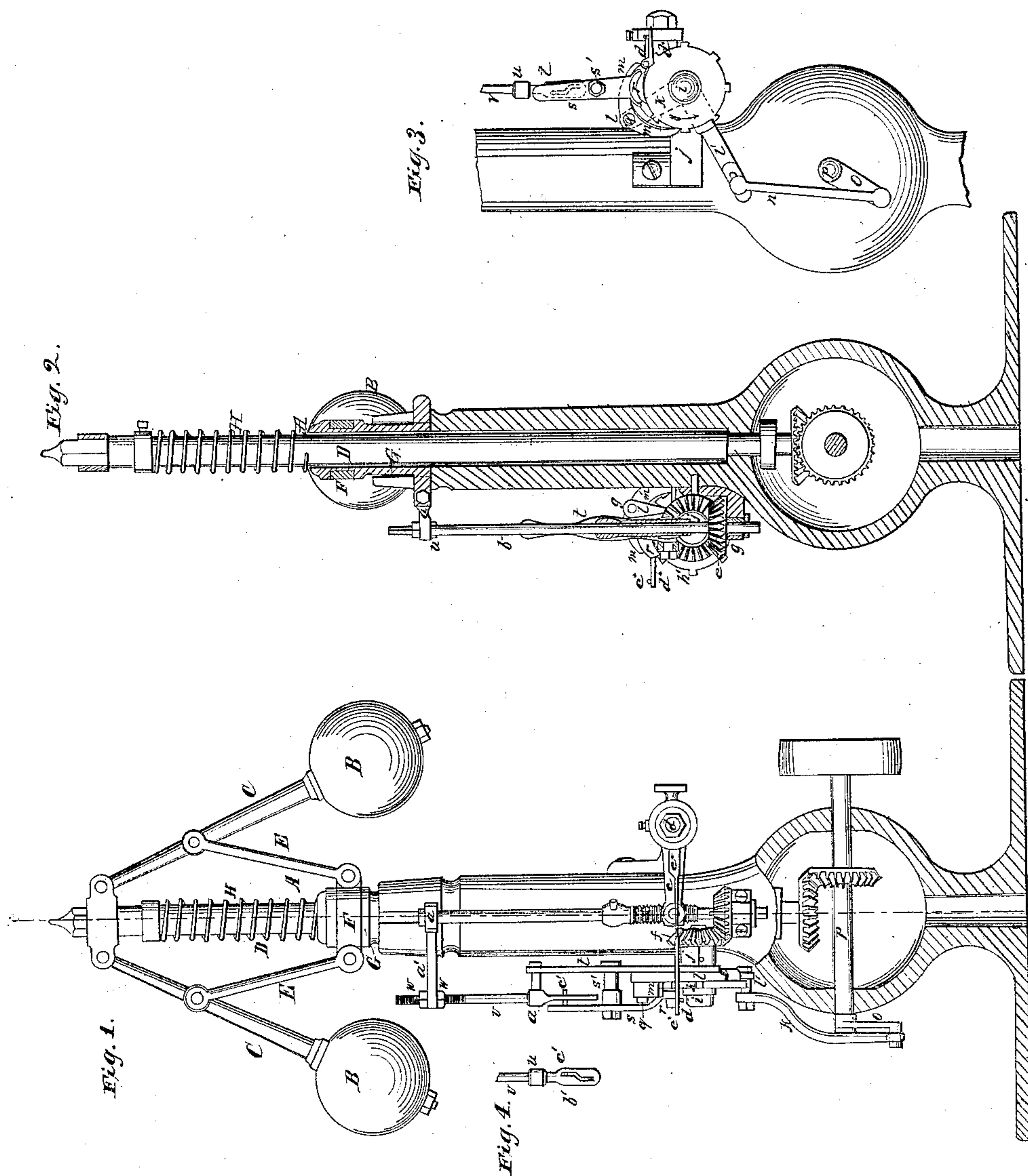


Kelly & Lamb,  
Governor.

N<sup>o</sup> 46,111.

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# UNITED STATES PATENT OFFICE.

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## IMPROVEMENT IN STEAM-ENGINE GOVERNORS.

Specification forming part of Letters Patent No. 46,111, dated January 31, 1865.

*To all whom it may concern:*

Be it known that we, OLIVER A. KELLY and ESTUS LAMB, of Slatersville, in the county of Providence and State of Rhode Island, have invented a new and Improved Governor; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional front elevation of this invention. Fig. 2 is a transverse vertical section of the same, taken in the plane indicated by the line *x x*, Fig. 1. Fig. 3 is a partial side elevation of the same. Fig. 4 is a detached front view of the rod and cam-slot regulating the position of the pawls.

Similar letters of reference indicate like parts.

This invention relates to an improvement in ball-governors, or in governors of any other construction based on the same or a similar principle to ball-governors; and its object is to obviate the violent fluctuations of the governors and consequent violent changes of the quantity of steam admitted to the cylinder, which are consequent upon a sudden increase or decrease of the resistance to or work of the engine; or to obviate the governor-balls assuming different positions corresponding with quantity of steam admitted in the cylinder by ordinary governors.

By this improvement in governors the requisite quantity of steam is admitted into the cylinder to cause the regulator-balls to assume and maintain a uniform position, corresponding with the speed of the engine, let the resistance, power, or labor of the engine be what it may. Consequently the governor has a more perfect action and the engine a more uniform and steady speed than from governors of the ordinary construction.

The invention consists in the employment or use of a revolving screw-rod to form the connection between the governor and the cut-off or throttle valve and applied in combination with an arm which extends from a rock-shaft connecting with said valve or from the valve-spindle, and the end of which is tapped to screw on said screw-rod in such a manner that by the revolving motion imparted to said screw-rod the valve is opened or closed independent

of or in opposition to the action of the governor—that is to say, the valve is partially closed, when, by some sudden increase of the resistance or work to be overcome by the engine, the balls sink down and the valve is partially opened, if by some decrease of the resistance or work the balls fly out and the supply of steam is equalized by means acting to some extent independent of the governor. The rotary motion of the screw-rod is governed by an escapement-wheel with two pawls, one of which causes said escapement wheel and screw-rod to turn in one and the other in the opposite direction.

An adjustable hinged shoe is applied to the escapement-wheel in such a manner that when the engine runs at its mean speed (or at the speed for which the governor is adjusted) the pawls are prevented from engaging with the escapement-wheel in either direction; but if the speed of the engine increases and the balls fly out, whereby the cut-off or throttle valve is partially closed, one of the pawls engages with the teeth of the escapement-wheel and turns the screw-rod, so that by its action the cut-off or throttle valve is brought in such a position that the speed of the engine falls off, the balls drop to their adjusted place, and the engine recovers its normal speed; but if the speed of the engine falls off and the balls drop down, whereby the cut-off or throttle valve is wider opened, the opposite pawl engages with the teeth of the escapement-wheel, and turns the screw-rod in the opposite direction until the balls again attain their adjusted place, and the engine recovers its normal speed. The position of the shoe is governed by a cam-slot in a rod which rises and falls with the governor-balls, and when the valve or cut-off motion is in a position to give the required speed to the engine the adjustable shoe is placed in such a position to the escapement-gear as to prevent the pawls from engaging in it in either direction. A spring-bar extending from the rock-shaft of the valve-gear or from the valve-spindle bears on the shank of the shoe and throws it in such a position that the pawls do not engage with the escapement-wheel in either direction, producing a stop motion to the escapement motion in case of deficiency of steam for the labor to be performed.

A represents a governor of the ordinary

construction. The balls *B* are suspended from pendulum-arms *C*, which are hinged to the upper end of the spindle *D*, and which connect by links *E* with a strap, *F*, fitted into a circular groove in the sleeve *G*, which rises and falls on the spindle *D* in the usual manner. To prevent a fluctuation of the balls by the momentum caused in the engine's crank passing the dead-centers, a spring, *H*, is applied to bear onto the sleeve *G*. This sleeve connects by an arm, *a*, and screw-rod *b* with an arm, *c*, which extends from the rock-shaft *d*, that carries the tappets acting on the valve-gear of a Corliss cut-off; or said arm may be connected directly to the spindle of an ordinary throttle-valve. The screw-rod *b* is connected to the arms *a* and *c*, so that when the speed of the engine increases and the balls fly out the rock-shaft or valve-spindle *d* will turn in the direction of the arrow marked on it in Fig. 1 of the drawings, and the valve closes. The screw-rod *b* turns freely in the arm *a*, and a rotary motion is imparted to it by a bevel-gear, *e f*. It extends through the wheel *e*, the hub of which is fitted into a box, *g*, so that said wheel can rotate freely, but is not allowed to move in any other way, and a key or feather secured in the bore of a wheel, and catching in a seat or groove in the screw-rod, compels the latter to rotate with the wheel, while it is allowed to rise and fall independent of the same.

A portion of the rod *b* is provided with a screw-thread; or, if desired, the screw-thread may be cut on a sleeve which is adjustable on the rod *b* by means of a set-screw, as clearly shown in the drawings, and this screw-thread is tapped into a swivel-nut secured to the end of the arm *c*.

The bevel-wheel *f* is mounted on the inner end of a shaft, *i*, which has its bearings in a bracket, *j*, secured to the column which forms the bearings for the governor-spindle, and the outer end of the shaft *i* bears the escapement-wheel *k*, and also a rocking elbow-lever, *l l'*, one arm of which carries the pawls *m m'*, whereas its other arm connects by a rod, *n*, with a crank, *o*, mounted on the end of the shaft *p*, which imparts motion to the spindle of the governor. The pawls *m m'* are connected to the arm *l* of the elbow-lever by a pivot, *q*, in such a position that they point in opposite directions, and both engage with the teeth of the escapement-wheel, and if a rocking motion is imparted to said elbow-lever one pawl turns the escapement-wheel in one and the other in the opposite direction.

In order to prevent the two pawls *m m'* from engaging with the teeth of the escapement-wheel during one and the same stroke of the elbow-lever *l l'*, a shoe, *r*, is applied under them in such a position that either one or both pawls are prevented from engaging with the escapement-wheel. The shoe is suspended from a lever, *s*, which oscillates on a stud, *s'*, secured in a standard, *t*, which is rigidly connected to the bracket *j*. The upper end

of this standard forms the bearing for an eyebolt, *u*, the eye of which forms the guide for a vertical rod *v*, which is adjustable by jam-nuts *w* in the end of a standard, *a'*, which extends from the arm *a* of the sleeve *G*, as clearly shown in Fig. 1. The lower end of the rod *v* is flattened out and provided with a cam-slot, *b'*, (see Fig. 4 of the drawings,) which catches over a pin, *c'*, projecting from the inner surface of the lever *s*. The rod *v* is so adjusted that when the balls are down the pin *c'* is in the upper part of the cam slot, and the lever *s*, with the shoe, is held in such a position that the pawl *m* is prevented from engaging with the teeth of the escapement-wheel. If an oscillating motion is imparted to the elbow-lever *l l'*, an intermittent rotary motion is imparted to the escapement-wheel in the direction of the arrow marked thereon in Fig. 3 of the drawings, and by this motion the screw-rod *b* is turned in such a direction that the swivel-nut on the end of the arm *c* is opened or the rock-shaft *d* turns in the direction opposite the arrow marked on it in Fig. 1 of the drawings.

If the balls fly out, the rod *v* rises with the sleeve *G*, and by the action of the cam-slot *b'* on the pin *c'* the lever *s* and shoe *r* are slightly turned, and said shoe assumes such a position that the pawl *m* engages with the teeth of the escapement-wheel, and the pawl *m'* passes over them without taking any effect. The escapement-wheel now turns in the direction opposite to the arrow marked thereon in Fig. 3 of the drawings, and the swivel-nut travels up on the screw-rod, and the rock-shaft or valve rod turns in the direction of the arrow marked on it in Fig. 1 of the drawings. The valve thereby closes, the balls drop down, and the speed of the engine slackens, until the balls arrive to their required position corresponding to the desired mean speed of the engine. When the governor has arrived in this position, the shoe *r* is brought on a parallel curve with the escapement-wheel, so that neither of the pawls engages with the teeth of said wheel. This object is effected automatically by constructing the shoe in two parts, one of which is rigidly connected to the lever *s*, while the second part is attached to the first by a hinge-joint and furnished with a tail, *d*, which projects beyond the circumference of the escapement-wheel, as shown in Figs. 2 and 3 of the drawings, while a spring-bar, *e'*, which is connected to the rock-shaft *d*, extends over the tail *d*, and as soon as said rock-shaft arrives in a position to stop cutting off, the spring-bar bears on the tail and raises the hinged part of the shoe and prevents the pawl *m'* from engaging with the teeth of the escapement-wheel. When the balls fly out sufficiently to raise the spring-bar off of the tail of the shoe, the pawl *m* engages with the escapement-wheel, turns it in a direction to open the valves, and the steam is let in sufficient to raise the balls to their required position. Both pawls are then detached from the

escapement-wheel by the adjustable shoe, and the engine assumes its normal speed.

By this arrangement we obtain a more perfect action of the governor and a more uniform and steady speed than is obtained by the ordinary ball or centrifugal governor or by a governor of any other construction.

We claim as new and desire to secure by Letters Patent—

1. The employment or use of a screw-rod, *b*, screwing in the end of an arm, *c*, which extends from the rock-shaft or valve-spindle *d*, and applied in combination with the governor and with suitable gear, substantially as and for the purpose set forth.

2. The escapement-wheel *k* and pawls *m m'*, applied in combination with suitable bevel-gear, *e f*, screw-rod *b*, and with the governor

and valve-gear, substantially as and for the purpose described.

3. The shoe *r* and cam-slot *b'*, arranged in combination with each other, and with the pawls *m m'*, escapement-wheel *k*, screw-rod *b*, and with the governor and valve-gear, substantially as and for the purpose specified.

4. Making the shoe *r* in two parts which are hinged together, substantially as and for the purpose set forth.

5. The tail *d\**, applied to the hinged shoe *r*, and operating in combination with the bar *e\** secured to the rock-shaft *d*, substantially as and for the purpose described.

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