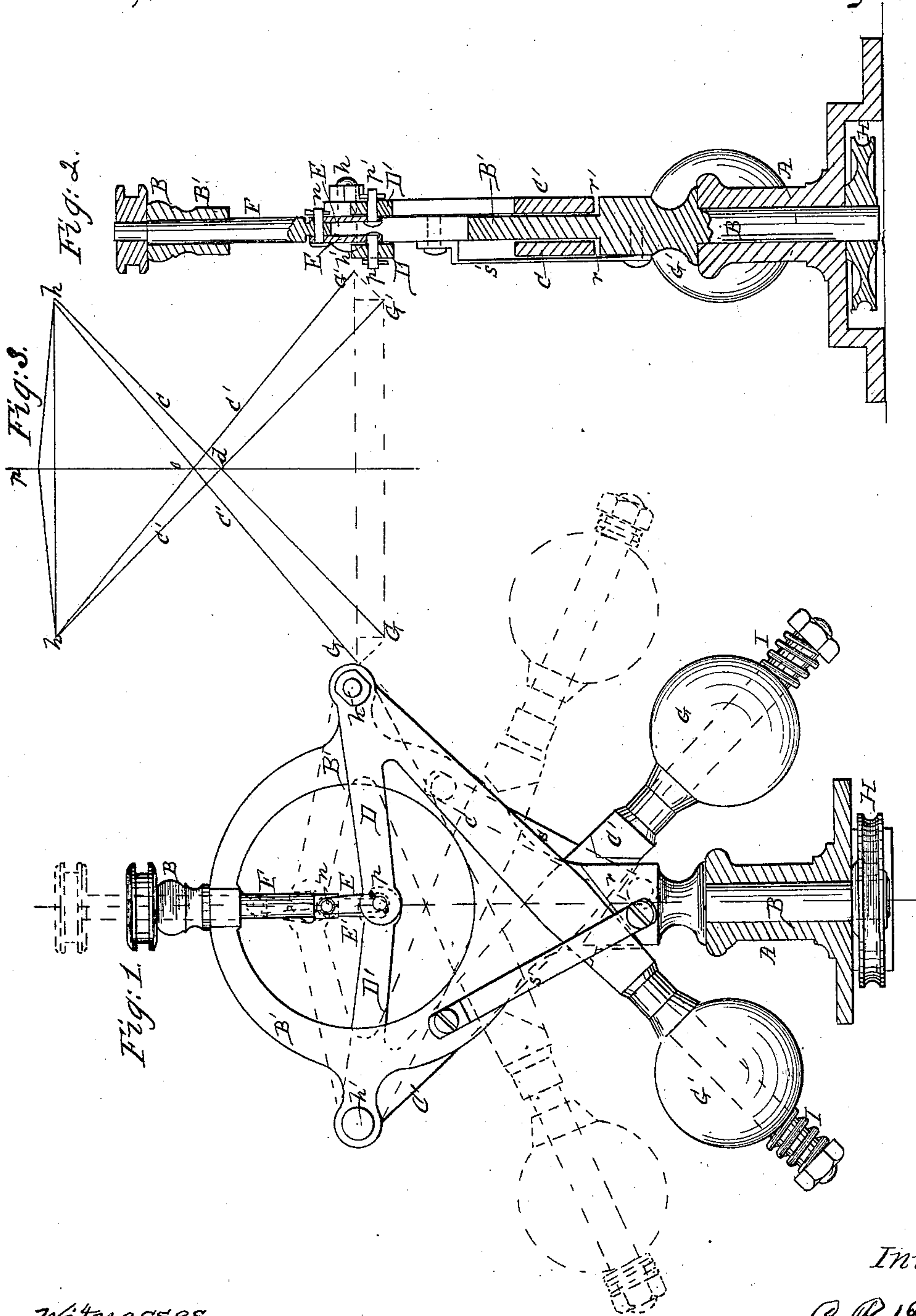


*C. P. Buckingham,*  
Governor.

*No 29,459.*

*Patented Aug. 7, 1880.*



*Witnesses.*

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# UNITED STATES PATENT OFFICE.

C. P. BUCKINGHAM, OF MOUNT VERNON, OHIO.

## GOVERNOR FOR STEAM-ENGINES.

Specification of Letters Patent No. 29,459, dated August 7, 1860.

*To all whom it may concern:*

Be it known that I, C. P. BUCKINGHAM, of Mount Vernon, in the county of Knox and State of Ohio, have invented a new and useful Improvement in Governors for Steam-Engines and other Motors; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side view of a governor constructed according to my invention. Fig. 2 is a central vertical section at right angles to Fig. 1. Fig. 3 is a diagram illustrative of the operation of my improvement.

Similar letters of reference indicate corresponding parts where they occur in the several figures.

It is well known that the time required for each revolution of the balls of the conical pendulum or centrifugal governor is equal to that required for two vibrations of an oscillating pendulum whose length is equal to the distance of the vertex of the cone described by the arms of the governor from the plane of the base whose circumference is described by the centers of gravity of the balls. Now in all those governors whose arms are suspended on a pivot whose axis passes through the axis of revolution, the vertex of the cone remains stationary and as the balls rise the axis of the cone becomes sensibly shorter by the rising of its base; and thus in order to raise the balls a given distance the time of revolution requires to be diminished and the velocity increased in the same ratio as the time of vibration of the proportionately shorter vibrating pendulum would be diminished, and in governors whose arms are suspended outside of the axis of revolution between the axis and the ball, the rising of the balls will shorten the axis of the cone still more, as not only does the base rise but the vertex descends and the change of velocity required to raise the balls and thereby close the valve becomes still greater than in the governors of the first mentioned construction. This requisite degree of change of speed, where the governor has considerable range of action (which in most cases is desirable) is the cause of much inconvenience where regularity of speed is desirable and the work irregular.

The object of my invention is to obviate the above-mentioned difficulty and secure a

good range for the governor with a slight change in its velocity; and to this end my invention consists principally in attaching the arms of the governor to the spindle or revolving frame at points beyond the axis of revolution with respect to the balls so that the arms cross each other between the balls and the points of suspension. By this arrangement, as the balls rise and carry up the base of the cone, the vertex (which is at the intersection of the arms) is caused to rise also and the axis of the cone diminishes in length very little.

To enable others skilled in the art to make and use my invention I will proceed to describe its construction and operation.

A, is the stationary standard in which the revolving main spindle B, B', of the governor is supported. This spindle has its upper part B', made in the form of a wide frame for the purpose of supporting at proper distances apart the two pivots  $h, h'$ , by which the ball arms C, C', are suspended, said arms constituting portions of elbow levers C D, C' D', the other arms of which are connected by two pivots  $p, p'$ , two links E, E', and a pivot  $n$ , with a rod F, which works through a guide in the part of the spindle above the frame like portion B', and which is connected with the valve in any suitable manner. G, G', are the balls. The levers C D, C' D', are arranged on opposite sides of the frame like portion of the spindle and their pivots  $h, h'$ , are shown in Fig. 1, to be arranged on opposite sides of the axis to their respective balls, so that the arms C, C', cross each other. On opposite sides of the frame like portion B', of the spindle are stops  $r, r'$ , for the arms C, C', to rest on when the balls are down, and above these stops there are attached to the spindle guard bars  $s, s'$ , to keep the said arms close against the frame like portion of the spindle and prevent them flying up to too high a position. The spindle B, is furnished with a pulley H, to receive a belt by which it is driven in the usual manner or it may be furnished with a spur wheel to be driven by gearing.

In the diagram Fig. 3, which represents only the centers and center lines of the working parts of the governor, the governor is shown in two positions viz the position shown in black being that which it occupies at the desired speed of the motor, and the



position shown in red being that which it occupies when the speed is increased. The point  $d$ , is the vertex of the cone in the lower position of the balls, and the point  $o$ , the vertex in their higher position of the balls, the vertex rising with the plane of revolution of the balls.

The best proportion for the parts of the governor is such that when the balls rotate at the desired speed the arms will cross each other at a right angle in points midway between the center of gravity of the balls and the centers of their respective pivots  $k, k$ , with which proportion diminution of the height of the axis and the consequent increase of speed required to produce it is at first scarcely perceptible through a considerable range of the connections  $p, p$ . In governors where extreme accuracy of operation is required the balls may be fitted to slide upon the arms under the control of spiral springs  $I, I$ , fitted to the arms beyond the balls in such a manner as to balance the centrifugal force of the balls to any required degree and so keep down the base of the

cone. This provision will not however in ordinary cases be needed.

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

1. The method of attaching the arms to the spindle of the governor, at points beyond the axis with respect to the balls; whereby the acting portions of the said arms lengthen, as the balls rise, carrying up the vertex of the cone described, at the same time with its base; and thus maintaining a nearly uniform length of axis, substantially as described.

2. The method of attaching the balls to the arms and sustaining them by springs, which can yield as may be necessary to the centrifugal force of the balls; whereby the arms of the governor lengthen at the lower end, and the rising of the base and shortening of the axis is diminished substantially as described.

C. P. BUCKINGHAM.

Witnesses:

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J. W. WHITE.