

(No Model.)

M. WATERS.  
STEAM ENGINE GOVERNOR.

No. 246,578.

Patented Aug. 30, 1881.

Fig: 1.

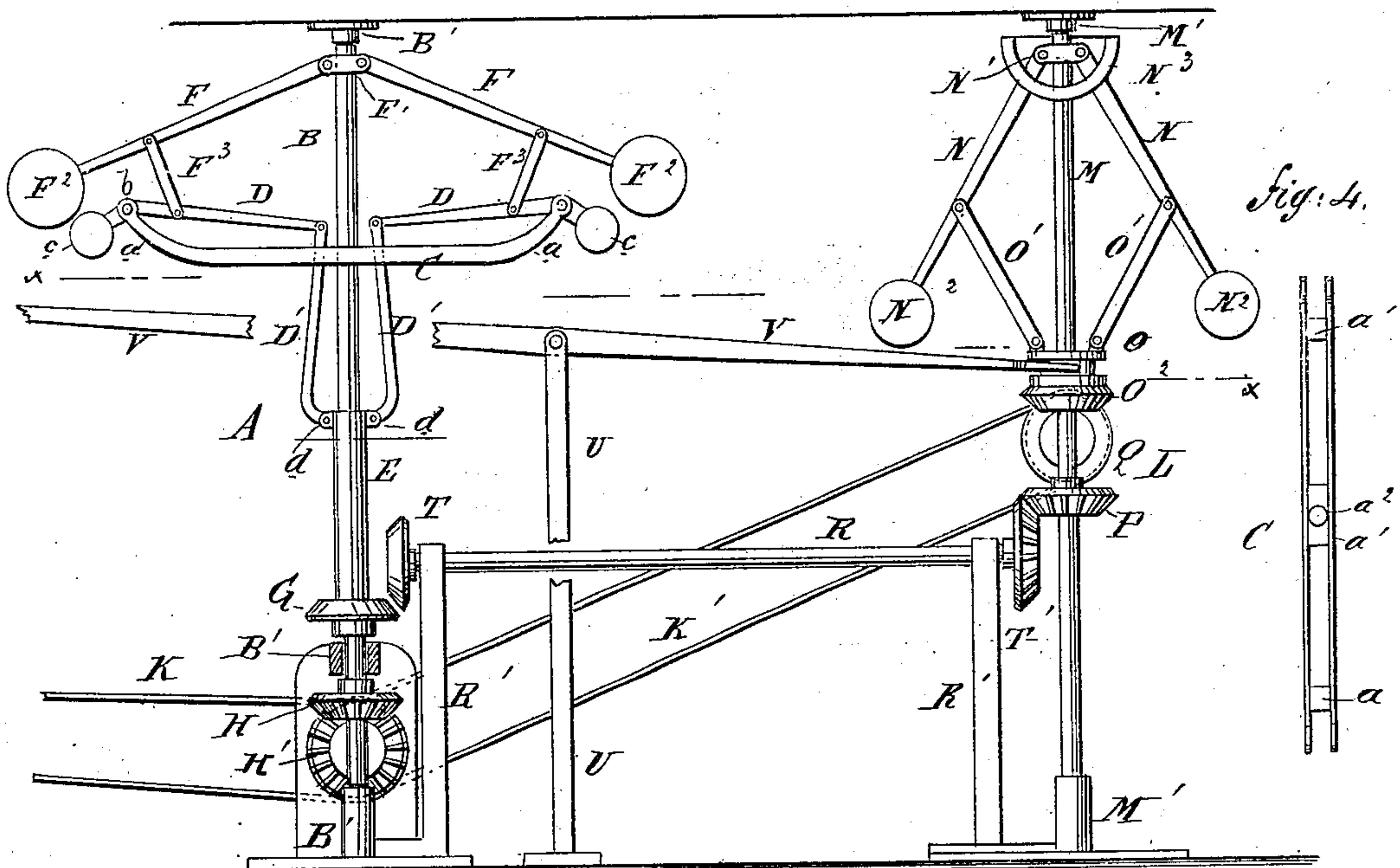


Fig: 4.

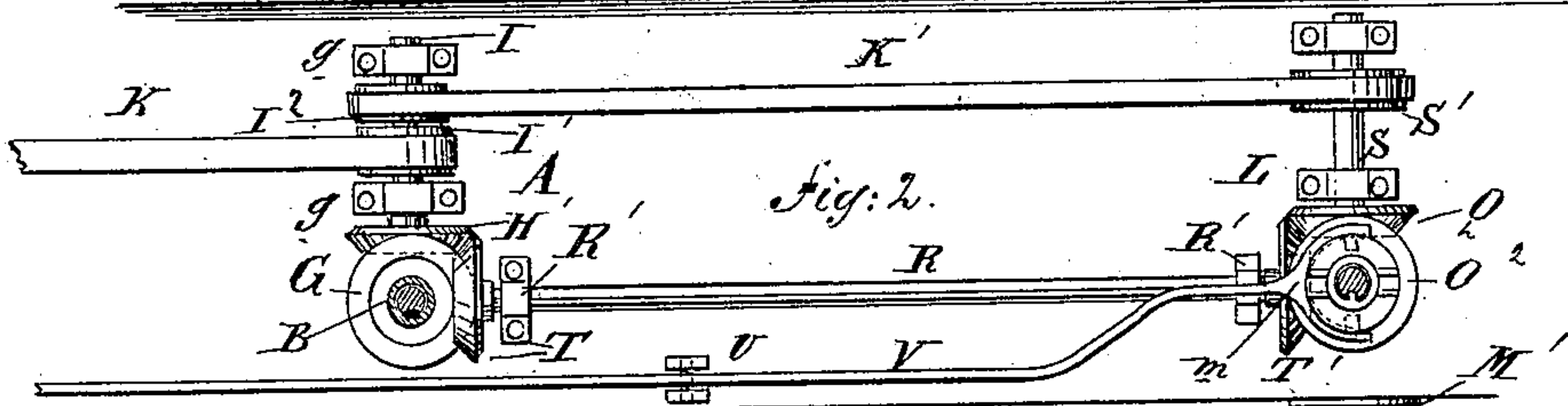


Fig: 2.

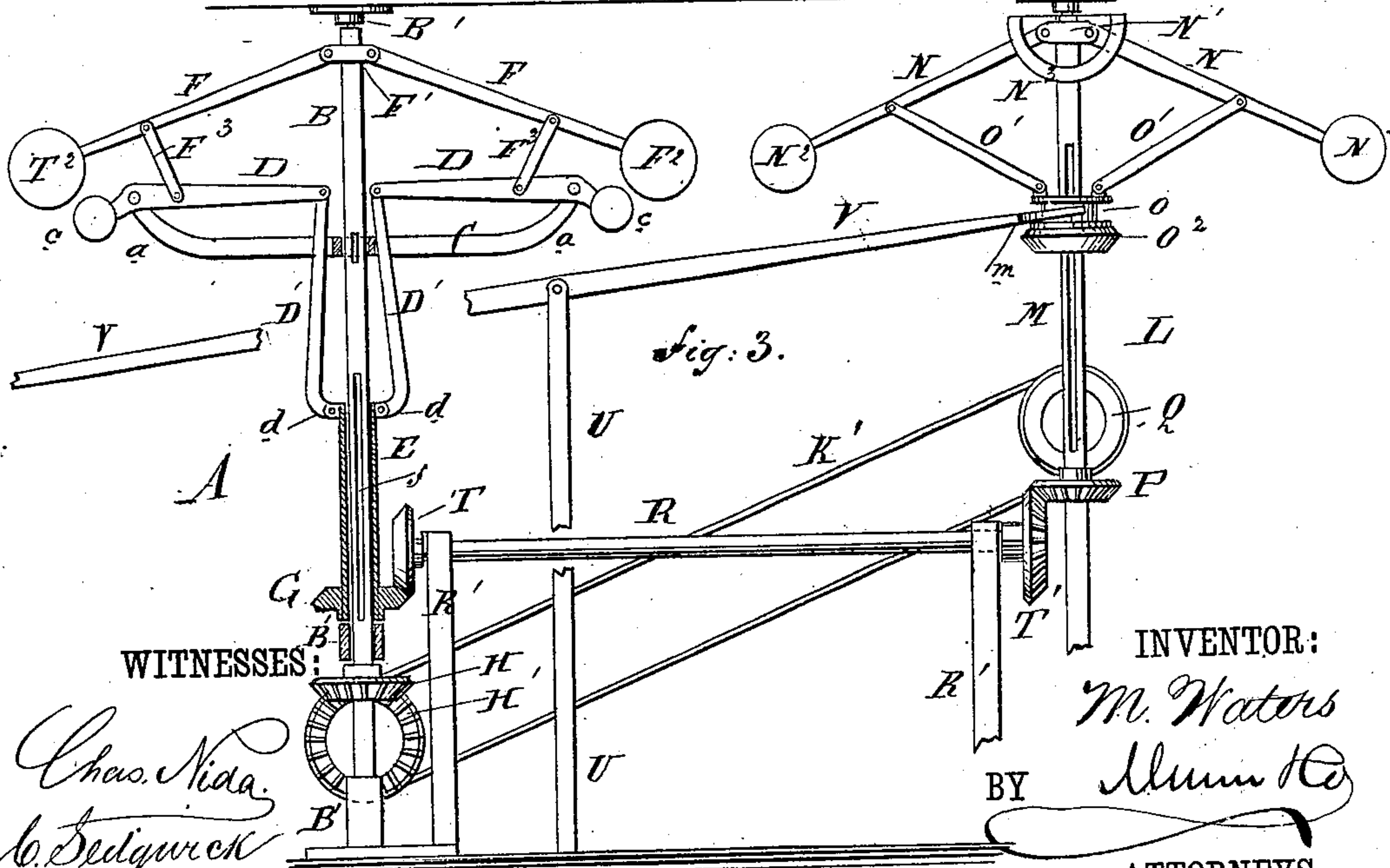


Fig: 3.

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# UNITED STATES PATENT OFFICE.

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## STEAM-ENGINE GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 246,578, dated August 30, 1881.

Application filed June 28, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, MICHAEL WATERS, of the city, county, and State of New York, have invented certain useful Improvements in Steam-Engine Governors, of which the following is a specification.

The object of this invention is to provide a more sensitive steam-engine governor, and one that will operate, when additional work is thrown on the engine, to instantly open the valves for the admission of a corresponding head of steam into the steam-cylinder, so that the usual "slacking down" of the engine on such occasions shall be avoided, and economies in power or fuel and in time be thereby obtained.

The invention consists of two ball-governors, one of which is driven by a belt from the engine-shaft, while the other is directly connected with the valve lever or rod connected with each other by gear-wheels and belts that operate to magnify in one governor the motion of the other, so that the device shall instantly respond to the slightest requirement for more or less steam in the cylinder, all of which will be hereinafter set forth.

Figure 1 is a front elevation of the device, with parts in position for opening steam-cylinder valve. Fig. 2 is a sectional plan of the same on line  $x x$ , Fig. 1. Fig. 3 is a partly-sectional front elevation of the same, with parts in position for closing steam-cylinder valve. Fig. 4 is a plan of the arms on a portion of the device.

Similar letters of reference indicate corresponding parts.

In the drawings, A represents that section or element of the governor which is designed to be located nearest to the crank-shaft of the engine, and which is driven by a belt directly from said shaft. This element consists of an upright shaft, B, supported and moving in suitable bearings and standard B', and having fixed upon it, near its top and at right angles thereto, a pair of parallel arms, C, whose ends are bent upward, as shown at  $a$ , to afford support for the levers D, that are pivoted therein, as shown at  $b$ . The arms C are held together by short braces  $a' a'$ , the central one of which is perforated, as shown at  $a^2$ , Fig. 4, to fit over the shaft B, and said arms C are secured on

said shaft B by keys or in any other convenient manner. The outer ends of the levers D are weighted, as shown at  $c$ , to counterbalance the sleeve E, that encircles and slides upon the shaft B, about the middle portion thereof; and said levers D have their inward-projecting ends pivoted to vertical connecting-rods D', that extend down on opposite sides of the shaft B, and have their lower ends hinged, as shown at  $d$ , to said sleeve E. By passing down between the arms C the rods D' are restrained from torsional or lateral motion, and the said sleeve E is designed to have a longitudinal keyway formed in it to receive the spline  $f$  of the shaft B, so that said sleeve E will not turn independently of shaft B.

Encircling the top of the shaft B, near its top bearing, B', is a fixed collar, F', in the opposite lugs of which are pivoted the arms F, carrying on their outer ends the balls F<sup>2</sup>. Said arms F are connected with the levers D by connecting-links F<sup>3</sup>, whereby the rising and falling motion of the balls F<sup>2</sup> is communicated through said levers D and connecting-rods D' to the sleeve E.

On the sleeve E, about its lower end, is firmly secured a friction bevel-wheel, G, whose function will be hereinafter set forth, and below the sleeve E a bevel cog-wheel, H, is firmly secured on the shaft B, which cog-wheel H gears with a corresponding cog-wheel, H', which is fixed on the end of a horizontal shaft, I, that is journaled in suitable boxes,  $g$ , and has keyed on it two pulleys, I<sup>1</sup> I<sup>2</sup>, over the former of which runs the crank-shaft belt K, that operates the device, while from the pulley I<sup>2</sup> a belt, K', extends over the pulley S' on the horizontal shaft S, that forms part of the governor section or element L, which is designed to be located nearest the engine-cylinder. This governor section or element L consists of an upright shaft, M, supported and revolving in suitable bearings and standard, M'. Encircling the top of this shaft M is a fixed collar, N', in the opposite lugs of which are pivoted the arms N, carrying on their outer ends balls N<sup>2</sup>, and to stiffen said arms N, to prevent their torsion and to limit their upward movement, a laterally-slotted segment, N<sup>3</sup>, is secured to the collar N'.

Pivoted to the arms N are the connecting-



links O', whose lower ends are hinged to the sliding sleeve O, on which is fixed the friction bevel-wheel O<sup>2</sup>, that gears with the bevel friction-wheel Q on the shaft S, and below the sleeve and wheel O O<sup>2</sup> a bevel cog-wheel, P, is firmly secured on the shaft M, the function of which cog-wheel P will be hereinafter set forth.

Supported in standards R' is the horizontal shaft R, by which the two governor sections or elements are connected, and on one end of this shaft R is keyed a bevel friction-wheel, T, with which at certain times, as hereinafter set forth, the bevel friction-wheel G engages to revolve said shaft R, while on the opposite end of this shaft R is secured a bevel cog-wheel, T', that is designed to engage at certain times with the bevel cog-wheel P.

Pivoted on a suitable standard, U, is the valve lever or rod V, whose forked end embraces the sliding sleeve O, as shown at m, while its opposite end is designed to be connected with the engine-valve. (Not shown.)

When the engine begins to run the balls F<sup>2</sup> N<sup>2</sup> are down, as shown in Fig. 1. Both elements then instantly start in motion, the belt K revolving the shaft I, which in turn gives motion to the section A through the cog-wheels H' H, and the belt K' giving motion to the shaft S, which in turn imparts motion to the section L through the friction bevel-wheels Q O<sup>2</sup>. In consequence of this motion the balls F<sup>2</sup> rise first and give increased motion to the section L through the medium of the shaft R, the elevation of the balls F<sup>2</sup> pulling up the sleeve E and its attached bevel friction-wheel G until the latter is in gear with the corresponding bevel friction-wheel T on the end of the said shaft R, and the cog-wheel T' on the opposite end of the shaft R (which wheel T is designed to contain a few more teeth than the corresponding cog-wheel, P) being thereby made to revolve in gear with said cog-wheel P. This increased speed of the section L causes the balls N<sup>2</sup> instantly to rise somewhat and measurably to lift the sleeve and wheel O O<sup>2</sup>, and thereby the yoked end of the valve lever or rod V, whereby the opposite end of said lever or rod V is depressed thereby, in like degree closing the valve (not shown) and cutting off in equal measure the admission of steam into the engine-cylinder. (Not shown.) When the engine is running without laboring the sleeves on both parts of the governor always rise and fall a little and very quickly, thus letting but little steam into the cylinder. When the engine begins to labor a little the sleeve E drops first, throwing the friction-wheels G T out of engagement, which causes the sleeve on part L to drop quickly, thus letting on steam until it increases the motion of the engine and raises the sleeve E, which carries the friction-wheel G upward to engage the friction-wheel T, thereby giving increased motion and raising the sleeve on part L, so that steam is shut off and let on quickly. When the engine begins to labor

heavily the sleeve E drops, thus causing the sleeve on part L to drop down quickly, fully opening the valve and letting a full head of steam into the cylinder, and continuing to do so until the engine ceases laboring heavily. The sleeve on part L never stops fully up nor half-way down, but rises and falls quickly, except when the engine is laboring heavily, when it stays fully down until the engine stops laboring heavily. Both parts of the governor are always in motion when running at a high rate of speed.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. An improved steam-engine governor, constructed substantially as herein shown and described, consisting of two ball-governor sections connected with each other by means of belt, sliding and fixed friction-wheels, shafts, and gear-wheels, arranged and operating to transmit the motion of one section to the other, as set forth.

2. In a steam-engine governor, the combination, with the section or element A, consisting of upright shaft B, supporting-arms C, weighted levers D, sleeve E, carrying friction-wheel G, connecting-rods D', collar, arms, and balls F' F F<sup>2</sup>, links F<sup>3</sup>, and cog-wheel H, and horizontal shaft I, carrying cog-wheel H' and pulleys I' I<sup>2</sup>, and with the element or section L, consisting of upright shaft M, supporting collar, arms, and balls N' N N<sup>2</sup>, links O', sliding sleeve and bevel-wheel O O<sup>2</sup>, and cog-wheel P, and of horizontal shaft S, carrying pulley S' and friction-wheel Q, of the belt K' and horizontal shaft R, carrying friction-wheel T and cog-wheel T', and of valve-rod V, substantially as herein shown and described.

3. In a steam-engine governor consisting, chiefly, of two connected ball-governor sections, the combination, with a sliding sleeve and friction-wheel on the upright shaft of one section and a fixed cog-wheel on the upright shaft of the other section, of a horizontal shaft carrying at one end a friction-wheel and on the other a cog-wheel, substantially as herein shown and described, whereby the motion of the one section is transmitted to the other or interrupted, as set forth.

4. In a steam-engine governor consisting, chiefly, of two connected ball-governor sections, A L, the combination, with the cog-wheel H, shaft I, carrying cog-wheel H' and pulley I<sup>2</sup>, belt K', and shaft S, carrying pulley S' and bevel friction-wheel Q, of the sliding sleeve and bevel friction-wheel O O<sup>2</sup>, substantially as herein shown and described, whereby the motion of one section is transmitted to the other or interrupted, as set forth.

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Witnesses:

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