(No Model.) 3 Sheets—Sheet 1.

J. KAISER.

GOVERNOR FOR STEAM ENGINES.

No. 333,130. Patented Dec. 29, 1885.

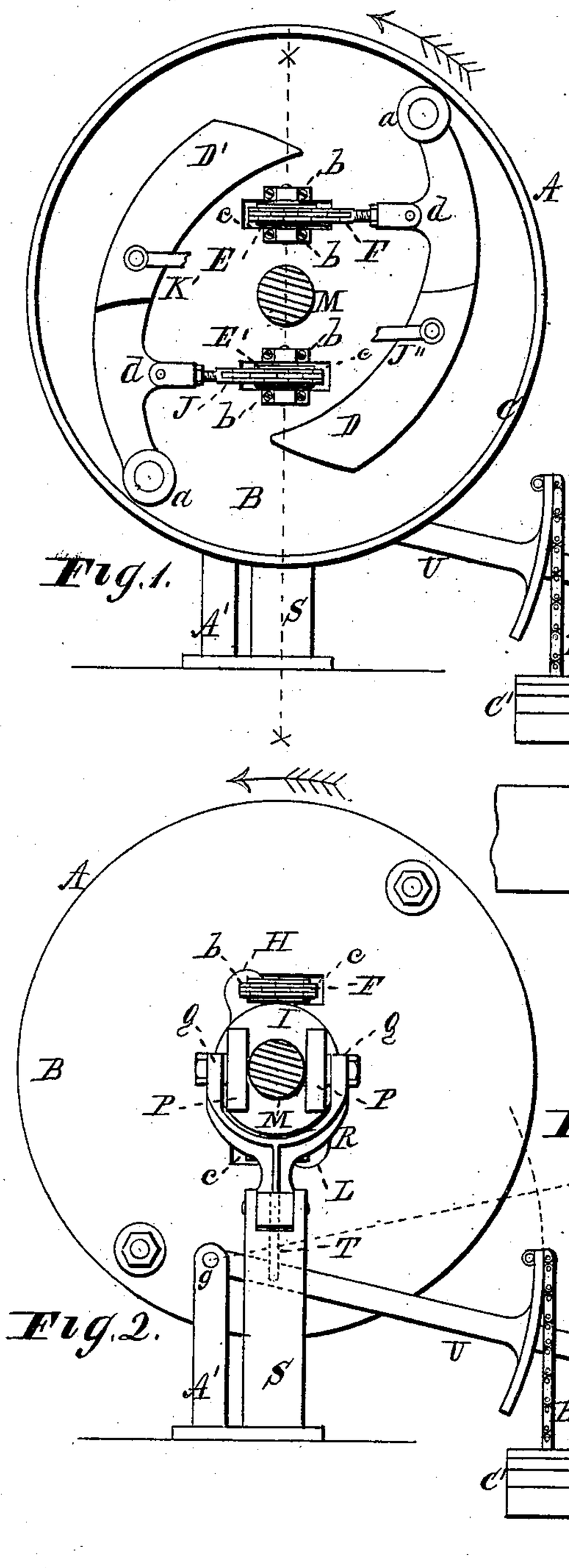

Fig. 1.

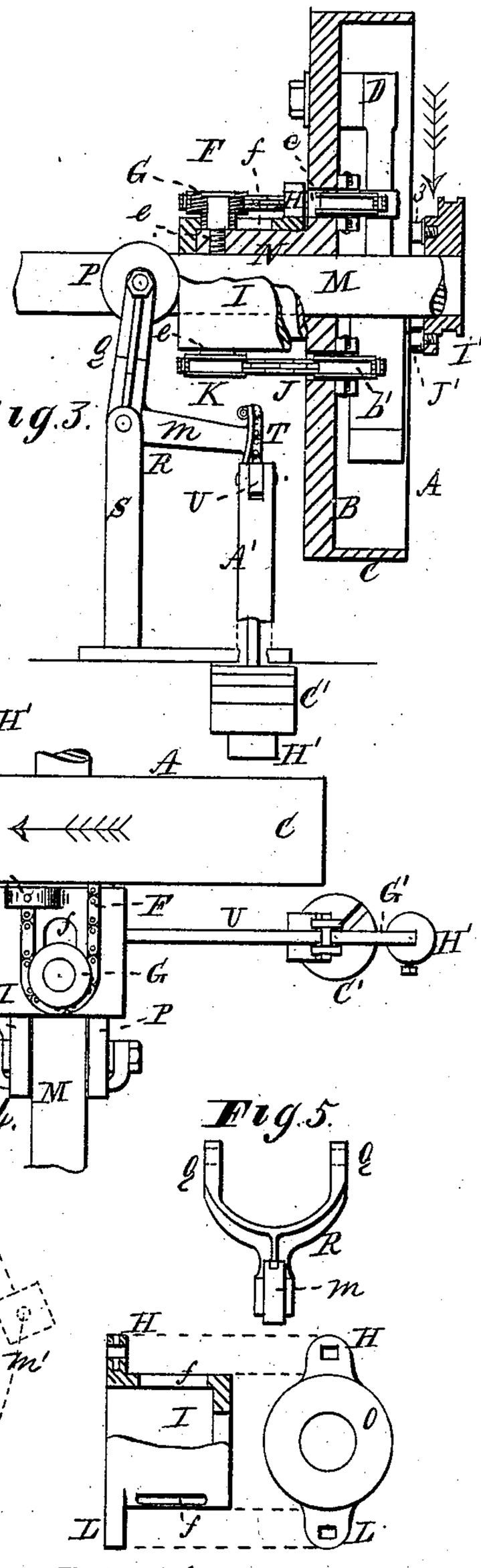

Fig. 3.

Fig. 2.

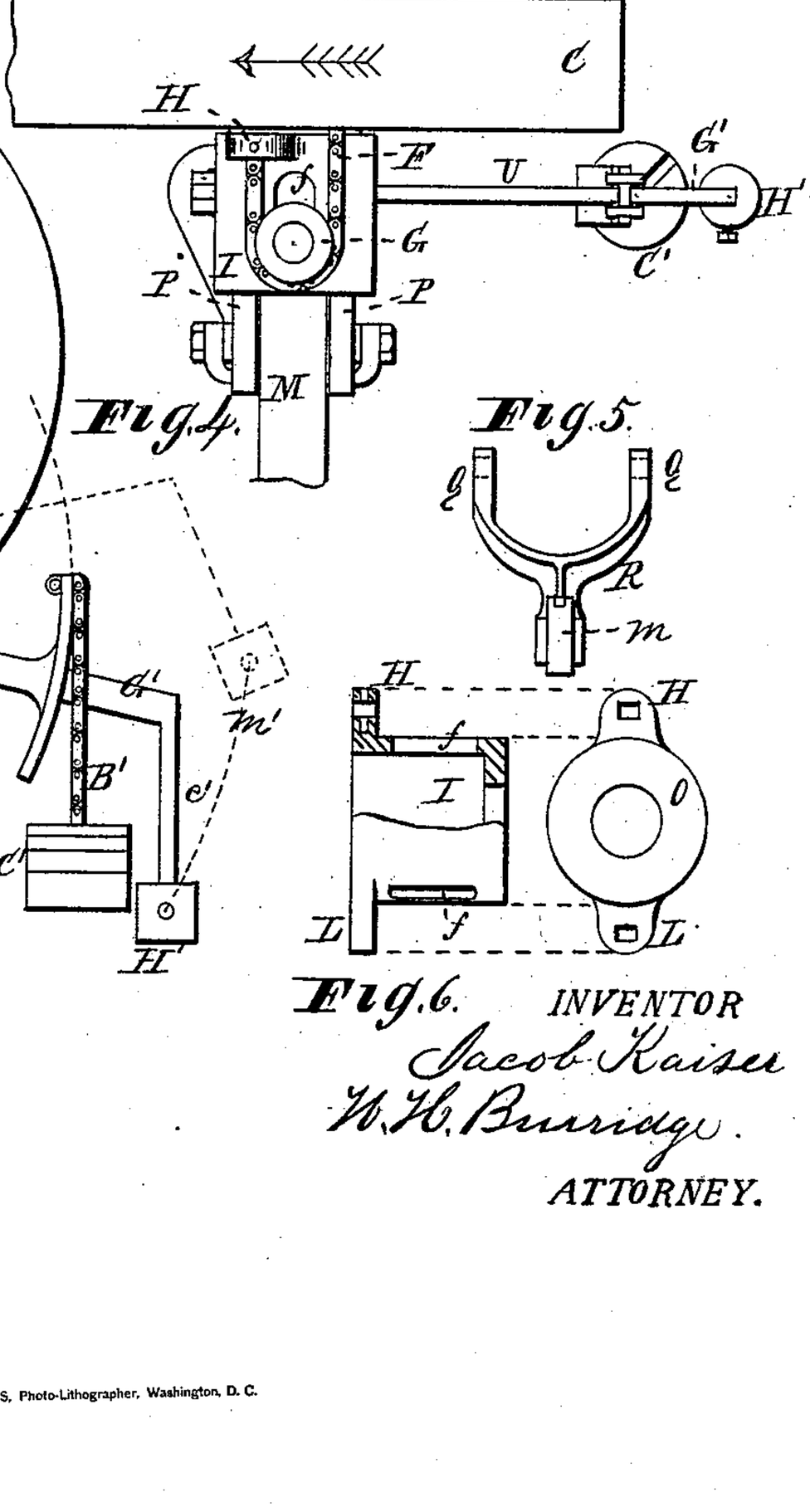

Fig. 4.

Fig. 5.

Fig. 6.

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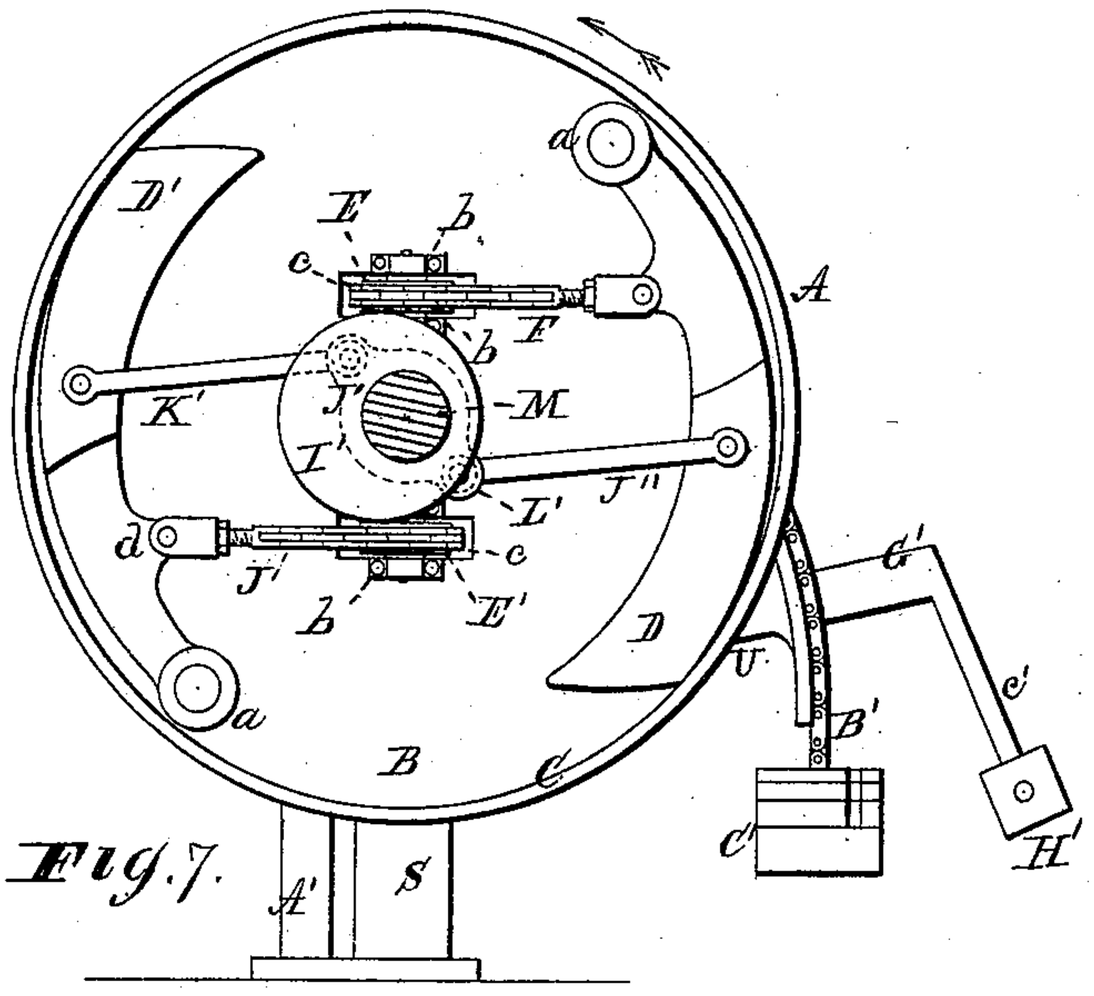

Fig. 7.

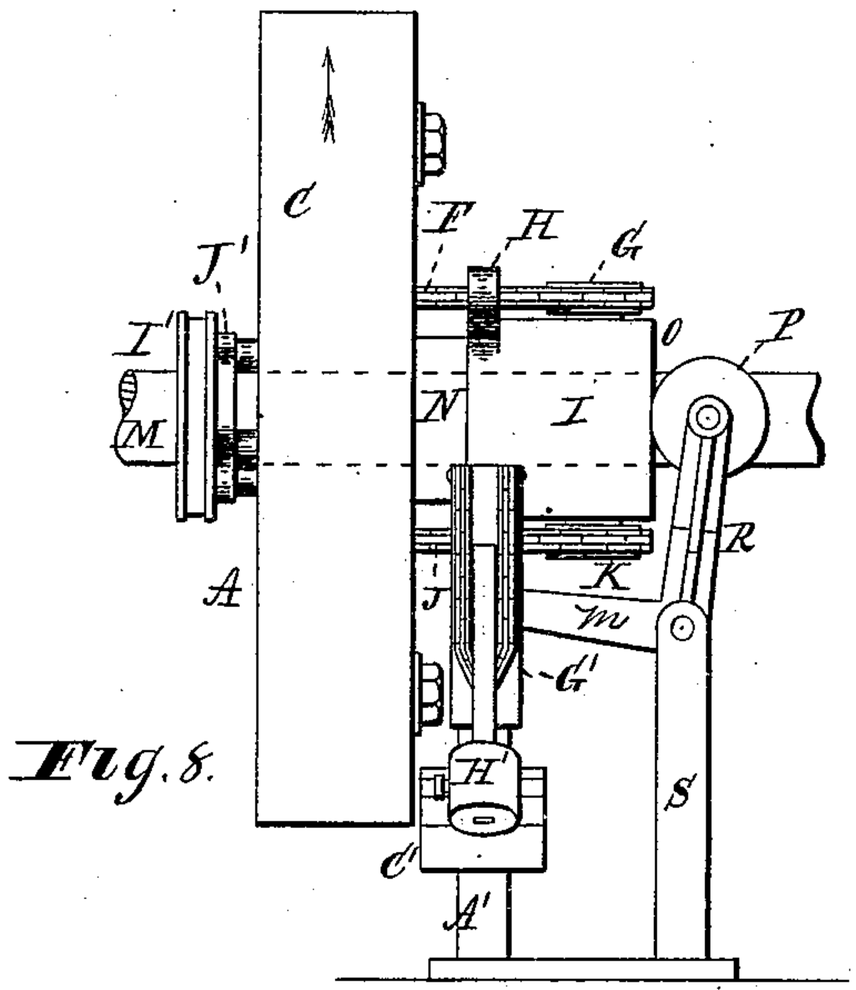

Fig. 8.

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 9.

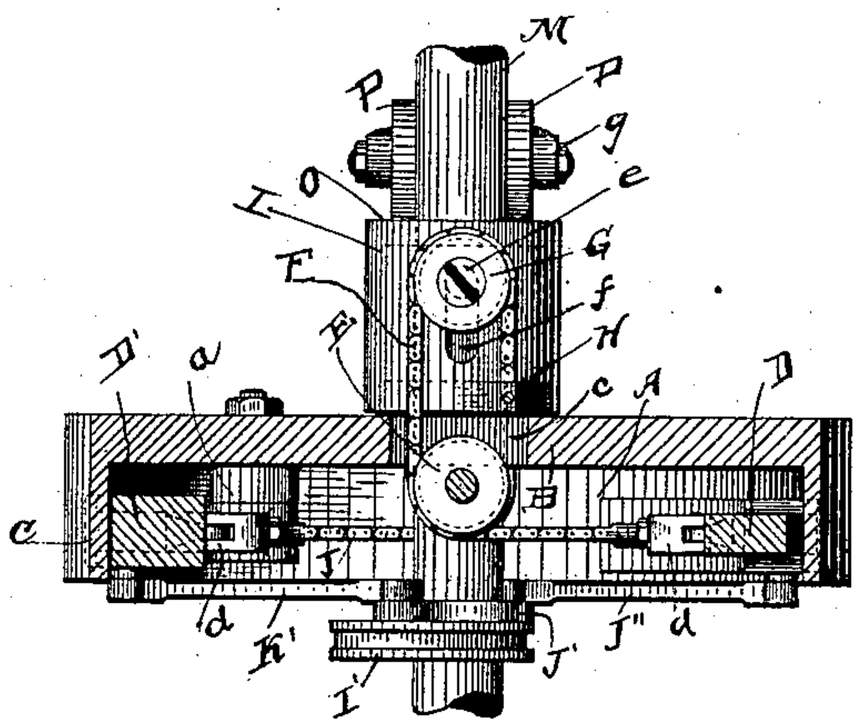
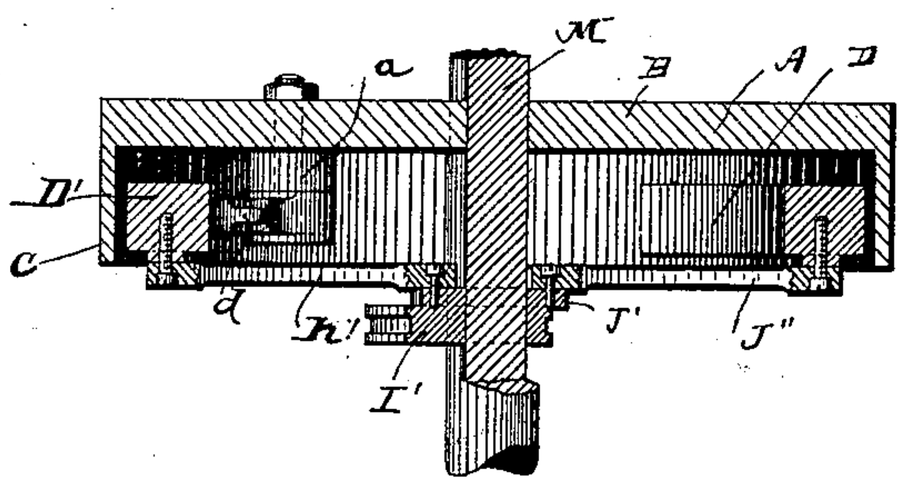


Fig. 10



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UNITED STATES PATENT OFFICE.

JACOB KAISER, OF CLEVELAND, OHIO.

GOVERNOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 333,130, dated December 29, 1885.

Application filed July 7, 1885. Serial No. 170,867. (No model.)

To all whom it may concern:

Be it known that I, JACOB KAISER, of Heidelberg, Germany, a subject of the Emperor of Germany, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and Improved Governor for Steam-Engines; and I do hereby declare the following to be a full and complete description of the same.

My invention relates to improvements in centrifugal governors of that class in which weights are employed instead of springs to regulate the movements of the parts and control the speed of the engine, the arrangement being such that weights may be added or removed while the governor and engine are in motion, to vary its effect upon the engine.

The object of my invention is to provide a governor that will always give a positive result, and has convenient means for adjusting or regulating its effect upon the engine.

With these objects in view my invention consists in certain features of construction and in combination of parts hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation showing the inside of the governor-case with the eccentric removed. Fig. 2 is a side elevation showing the opposite side of the case. Fig. 3 is an elevation in transverse section on the line *x x*, Fig. 1. Fig. 4 is a plan view. Fig. 5 is an end elevation of the forked bell-crank lever R. Fig. 6 is a side elevation, partly in section, and end view of the sleeve I. Fig. 7 is an end elevation, the same as shown in Fig. 1, but with the eccentric in position on the shaft, showing the position of parts with the flying weights distended. Fig. 8 is an elevation showing an edge view of the case, showing also the position of parts with the weights distended. Figs. 9 and 10 are plan views, partly in section, showing more especially the manner of connecting the eccentric with the flying weights.

A represents the casing of the governor, the same being cylindrical and mounted on and rigidly secured to the engine-shaft M, the casing consisting of the disk or head B and suitable hub, N, for embracing the shaft, and the overhanging rim C.

D and D′ are weighted arms, or so-called "flying weights," which are pivoted, respectively, at *a* to the disk B, said pivotal points being arranged on opposite sides of the engine-shaft.

I′ is an eccentric for operating the cut-off valves. (Not shown.) The eccentric is mounted loose on the engine-shaft, and has a yoke, J′, connected therewith. To the opposite ends of the said yoke are respectively pivoted the rods J″ and K′, that in turn are pivoted to the flying weights at or near the central portion of the latter. With this arrangement of parts, the rods J″ and K′ being connected, as aforesaid, with opposite sides of the eccentric, the latter, while the flying weights remain in the position shown in Fig. 1, is made to revolve with the shaft and casing; but when the weights are thrown outward, as shown in Fig. 7, the eccentric is advanced or turned forward on the shaft, which advancement of the eccentric causes the valve to cut off steam.

The mechanism for controlling the movement of the flying weights as against the centrifugal force is as follows: A sleeve, I, is mounted on the hub N of the casing. The sleeve overhangs the hub and extends to or near the shaft M, this end of the sleeve having a face, O. The sleeve has lugs H and L arranged on opposite sides thereof, and elongated openings *f*, also arranged in opposite sides of the sleeve. Through the openings *f* extend studs *e*, that screw into the hub N. On these studs are journaled, respectively, the wheels G and K. By means of the openings *f* and studs *e* the sleeve may slide endwise, but must turn with the hub N. Guide-wheels E and E′ have their trunnions journaled in boxes *b*, that are attached to the casing. These wheels are located opposite and partially in the openings *c* of the casing. Chains F and J are connected, respectively, with the flying weights, near the pivoted ends of the latter. These chains lead, respectively, around the wheels E and E′, and through openings *c* in the casing, and from thence around the wheels G and K and back to the lugs H and L, to which latter the chains are respectively attached. With this arrangement of parts it is evident that the outward movement of the flying weights will cause the sleeve I to move endwise in the direction away from the disk B.

To resist the end movement of the sleeve I,

and in so doing restrain the outward movement of the flying weights, I provide the following: Rollers P are journaled on studs connected, respectively, with the forked ends *g* of the lever R, in position for the periphery of the rollers to engage and roll on the outer end or face, O, of the sleeve I. The lever R is of the bell-crank variety, and is fulcrumed to the standard S. It is evident that weights attached at the end of the horizontal arm *m* of the lever would press the rollers P against the end of the sleeve I and resist the outward movement of the latter, caused, as aforesaid, by the outward movement of the flying weights.

As the lever R usually operates in a comparatively limited space between the engine-bed and fly-wheel, and where it is not convenient to attach weights thereto when the engine is in motion, I have devised the following: The horizontal arm *m* of the lever R terminates in a sector concentric with the fulcrum upon which said lever oscillates, to the upper end of which is attached a chain, T, which depends therefrom. By this arrangement the depending end of the chain is made to move in a strictly vertical plane. To the lower extremity of this chain is attached lever U, which is fulcrumed at *g* to a standard, A′. The lever U extends in a line at right angles to the line of the shaft M, and to where the free end of the lever is accessible. To this end of the lever U is rigidly secured a depending arm, *c*′, to which is permanently attached a weight, H′. The arrangement of parts is such that with the flying weights in the position shown in Fig. 1 the lever U is in the inclined position shown in full lines in Fig. 2. As the weights D D′ fly outward and cause the lever U to be elevated the weight H′ is thrown farther from the vertical line of the fulcrum, (see dotted lines, Fig. 2,) and is consequently more effective. This weight H′ would control the movement of the flying weights only with a very slow motion of the engine. To the lever U is also secured a sector which is concentric with the fulcrum upon which it oscillates, and in a manner similar to that above described a chain, B′, depends therefrom, which supports any necessary number of detachable weights C′, for the purpose hereinafter described.

During the normal running of the engine the weights D D′ and the lever U will be in the position shown in Fig. 1. As the speed of the engine increases and the gravity of the weights C′ is overcome by the centrifugal force of the weights D D′, the weight H′ in its ascent moves in the arc indicated by the dotted lines *m*′, Fig. 2. As the weights C′ move upward in a strictly vertical plane, (always the same distance from the fulcrum of the lever U,) they will of course produce no increment of power as the lever ascends, and upon them, therefore, devolves only the office of regulating the initial action of the governor, whereas the weight H′, as it rises simultaneously with the weights C′, has an increment or accession of power proportional to its increased distance from the vertical plane of the fulcrum of the lever U. Hence the higher the lever rises the greater the force exerted by the weight H′.

It will be observed that the governor is constructed without springs, the relaxation of which from use gradually changes the speed of the engine, while the weights that I employ always give a positive result, and with a given amount in pounds of these weights attached to the lever *v* a corresponding and uniform speed of the engine results with certainty.

If any of the connections between the flying weights and the lever *v* should break, no special damage would be done, as the flying weights would move outward to the limit of their throw and cut off the steam, so that the engine, if not stopped, would run very slow. The convenience with which the speed of the engine is regulated and the positive results attained render my improvements quite desirable.

The operation of the device is as follows: It is of course understood that at each revolution of the shaft M, which is driven either mediately or immediately by the piston of the engine, and always occupies the same position relatively thereto, the valve of the engine is moved to and fro by the eccentric *l* through the medium of suitable connection. (Not shown.) If the eccentric *l* were fixed to the shaft, so as to be incapable of rotation relatively thereto, the shaft, as before stated, having a fixed relation to the piston, there would thus be a fixed line of connection between the piston and the valve, so that the movements would be synchronous, the valves always opening and closing the ports of the cylinder when the pistons is in certain positions; but by making the eccentric movable relatively to the shaft M this synchronism of movement between the valve and piston is destroyed, and the time at which the valve commences or completes its movement is thereby made to depend upon the movement of the eccentric instead of the piston. By connecting the eccentric, in a manner substantially as described, with the weights D D′, it will be shifted or turned upon the shaft M as soon as the latter obtains such a speed that the centrifugal force of the weights D D′ is sufficient to overcome the weights suspended from the lever U. When the eccentric is thus shifted the valve cuts off the admission of steam to the cylinder at an earlier stage in the movement of the piston, thereby relying upon the expansion of the steam already admitted for completing the stroke. The engine is thus made to automatically govern its own speed.

What I claim is—

1. In a governor for steam-engines, the combination, with flying weights suitably connected with an eccentric, with the arrangement of parts substantially as indicated, whereby the eccentric is advanced with the outward movement of the flying weights, of a sliding sleeve, chains connecting the sleeve with the flying

weights, wheels, bell-crank lever, and weights for opposing the end movement of the sleeve and controlling the outward movement of the flying weights, the parts being arranged substantially as set forth.

2. In a governor, the combination, with flying weights operating substantially as described, of a sleeve mounted on the hub of the governor-casing and arranged to revolve with the hub and slide endwise thereon, chains connected with the sleeve and with the flying weights, said chains leading around suitable guiding-wheels, with the arrangement of parts, substantially as indicated, whereby the sleeve is moved endwise and from the eccentric by the outward movement of the flying weights.

3. In a governor, the combination, with flying weights connected by chains with a sliding sleeve, the parts being arranged substantially as indicated, of friction-wheels for engaging the end of the sleeve, said friction-wheels being mounted on a bell-crank lever, the latter being connected with a lever extending at right angles to the line of the engine-shaft, and suitable devices for attaching weights, the parts being arranged and operated substantially as set forth.

4. In a governor, the combination, with flying weights suitably connected with a sliding sleeve, friction-rollers mounted on a bifurcated bell-crank lever, said friction-wheels engaging the end of the sleeve for controlling the end movement of the latter and the outward movement of the flying weights, of a compound-lever attachment for operating the friction-wheels, the free end of said lever attachment having a depending arm, and weights permanently secured thereto, removable weights connected with said lever attachment, the parts being arranged and operated substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JACOB KAISER.

Witnesses:
J. H. BURRIDGE,
G. J. HARDWAY.