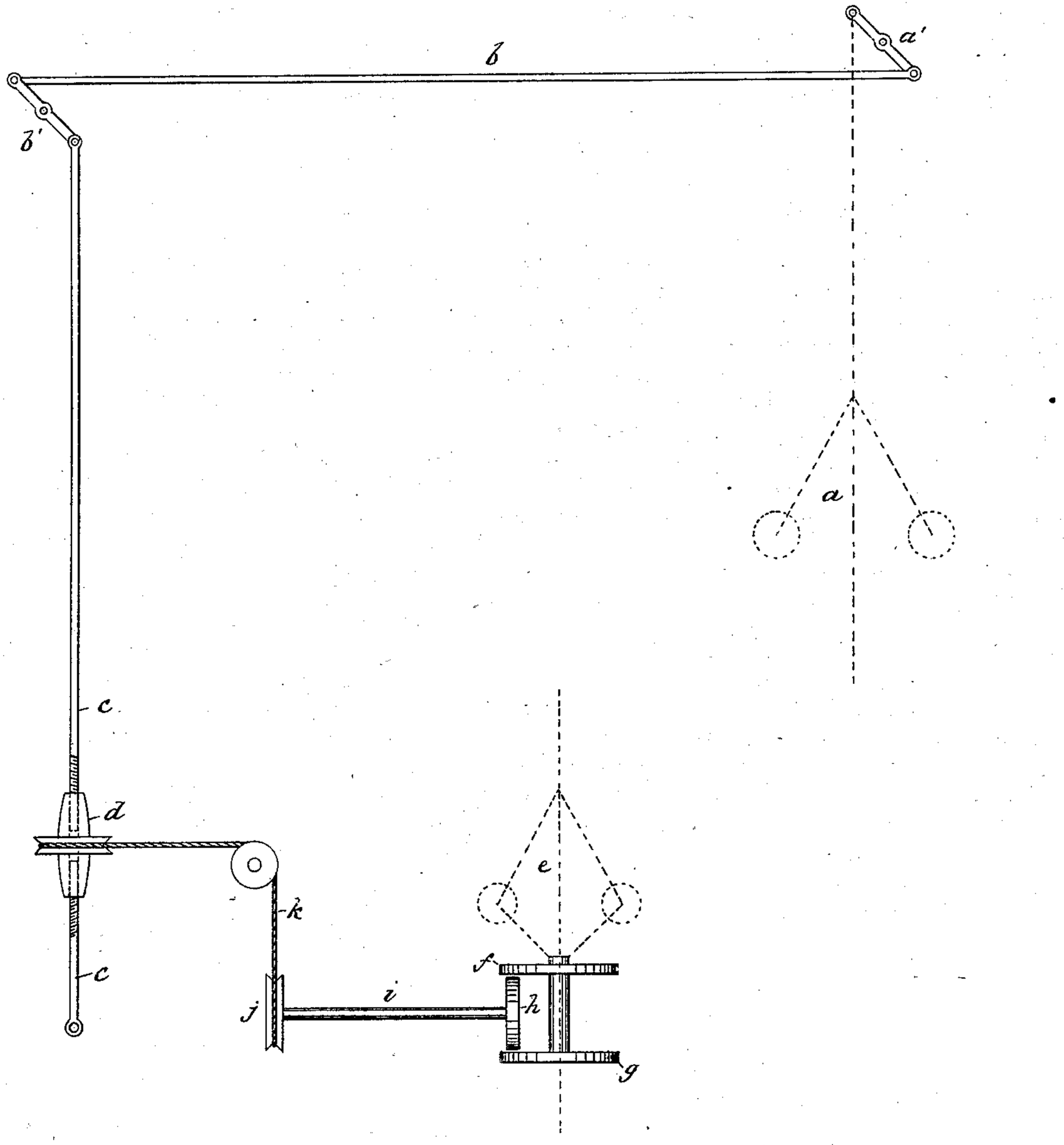
(No Model.)

W. KNOWLES.

GOVERNOR FOR STEAM ENGINES.

No. 279,097. Patented June 5, 1883.



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WILLIAM KNOWLES, OF BOLTON, COUNTY OF LANCASTER, ENGLAND.

GOVERNOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No 279,097, dated June 5, 1883.

Application filed December 19, 1882. (No model.) Patented in England January 21, 1882. No. 310.

To all whom it may concern:

Be it known that I, WILLIAM KNOWLES, a subject of the Crown of Great Britain, residing at Bolton, in the county of Lancaster, England, have invented a new and useful Improvement in Governors for Steam-Engines, (for which I obtained Letters Patent in Great Britain, No. 310, bearing date January 21, 1882,) of which the following is a specification.

Heretofore it has been common to control the action of engine throttle-valves and cut-offs by a single agency or means acting upon the same—such, for instance, as a ball-governor, which closes the throttle-valve more or less when too great a velocity of the engine raises the balls, and by the reverse action gradually opens the valve to the required extent to cause the engine to regain normal speed. A certain amount of force is required to operate the valve. To furnish this force the weight of the balls and the length of their arms have to be proportioned to the power and speed of the engine and the force required. As a general rule the larger the engine the heavier the governor-balls must be, and as a natural consequence the more slowly their inertia will be overcome, so the less quickly will they act on the valve.

The object of my invention is to accelerate the action of the governor on the throttle-valve or the cut-off, as the case may be, in order that the variation of speed of the engine consequent to varying pressure of steam and varying amount of load may be reduced to a minimum.

To this end my invention consists in a regulating device interposed between the main or usual governor and the valve on which it acts, and operated automatically, as hereinafter described and claimed, reference being had to the accompanying drawing, which is an elevation of one form of my invention, showing also its relation to a common ball-governor.

a represents a common ball-governor operating a valve-rod or cut-off rod, *c*, by means of a lever, *a'*, connecting-rod *b*, and lever *b'*, or by any other usual means.

e represents an auxiliary governor driven from any convenient shaft which receives motion from the same engine.

I make the rod *c* in two parts, and provide their adjacent ends, respectively, with right and left screw threads, and I join them by means of a right-and-left-screw-threaded nut, *d*. I provide this nut *d* with a grooved pulley to be run by a driving-band, *k*, from another pulley, *j*, the latter fixed upon a shaft, *i*, which is provided with a disk, *h*. This disk *h* is caused to rotate by frictional contact with either one of two other disks, *f* and *g*, and the latter rotate together in one direction with the spindle of the auxiliary governor *e*.

The two disks *f* and *g* are fixed upon a sleeve which is caused to reciprocate vertically upon the governor-spindle by the usual action of the governor-balls as their speed varies. These disks *f* and *g* may be arranged to be adjusted vertically upon their sleeve to allow much or little vertical play before coming in contact with disk *h*.

It has been found in practice that the best results are produced when the two disks *f* and *g* are placed very close to the edge of disk *h*—say one-sixteenth of an inch, or even less, therefrom—and said disks are controlled by a separate and independent governor, *e*, driven from some shaft of the same engine.

The action is as follows: Supposing the speed of the engine to be increasing, the balls of the governor *a* are gradually rising, causing the valve or valves operated thereby to be acted on through the valve-rod *c*, so as to gradually reduce the speed. The balls of the auxiliary governor *e* will also rise, bringing disk *g* in contact with disk *h*, which causes the nut *d* to rapidly unscrew, thus extending rod *c* and accelerating the reduction of speed. When the speed falls below the standard, disk *g* will be disengaged from disk *h*, and disk *f* engaged therewith, causing nut *d* to rotate the other way, drawing in the ends of rod *c* and shortening it, thus in a similar manner accelerating the process of increasing speed.

I have thought of so many modes of automatically operating a regulating device interposed between the main governor and its valve, to insure and accelerate the regulation of the speed of a steam-engine, that I do not deem it necessary to illustrate my invention by more than the one device shown.

The auxiliary governor *e* may be dispensed with, and its duty in operating said regulat-

ing device be performed by the main governor *a*; but I prefer the use of an independent governor substantially as shown.

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

1. The combination, with an engine-governor and the valve operated thereby, of extensible and contractible connections communicating between said governor and valves, and means, substantially as described, for automatically extending and contracting said connections, as and for the purpose specified.

2. The combination, with an engine-governor, the valve operated thereby, a parted rod having right and left screw-threads, respectively, on its adjacent ends, and means for connecting said rod with the valve and with the governor, of a right-and-left-threaded screw-nut adapted to receive said screw-threaded rod ends, and means, substantially as described, for revolving said screw-nut to and fro, as and for the purpose specified.

3. The combination, with the parted right-and-left-screw-threaded rod *c*, and means for connecting the same at one end with an engine-valve and at the other end with an engine-governor, of the right and left threaded nut *d*, engaging the threads of the adjacent ends of rod *c*, the governor *e*, the disks *f* and *g*, operated thereby, the disk *h*, between said disks *f* and *g*, the shaft *i*, supporting and revolved by disk *h*, the grooved pulley *j* on shaft *i*, the grooved pulley on nut *d*, and the band *k*, communicating rotary motion from pulley *j* to nut *d*, as and for the purpose specified.

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