(No Model.)

2 Sheets—Sheet 1.

H. A. BALLARD.

SPEED CONTROLLING DEVICE.

No. 462,028. Patented Oct. 27, 1891.

FIG. 1

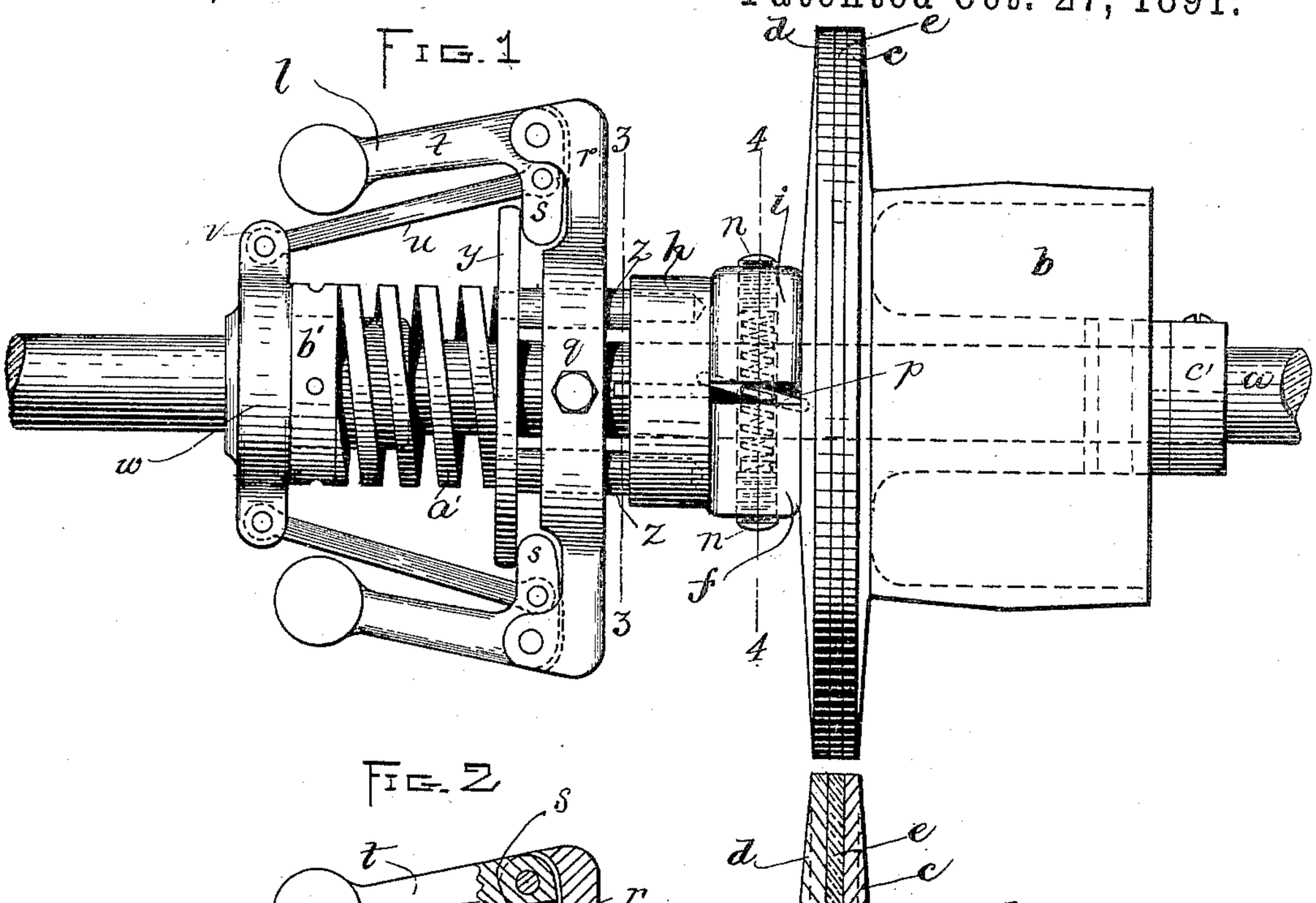


FIG. 2

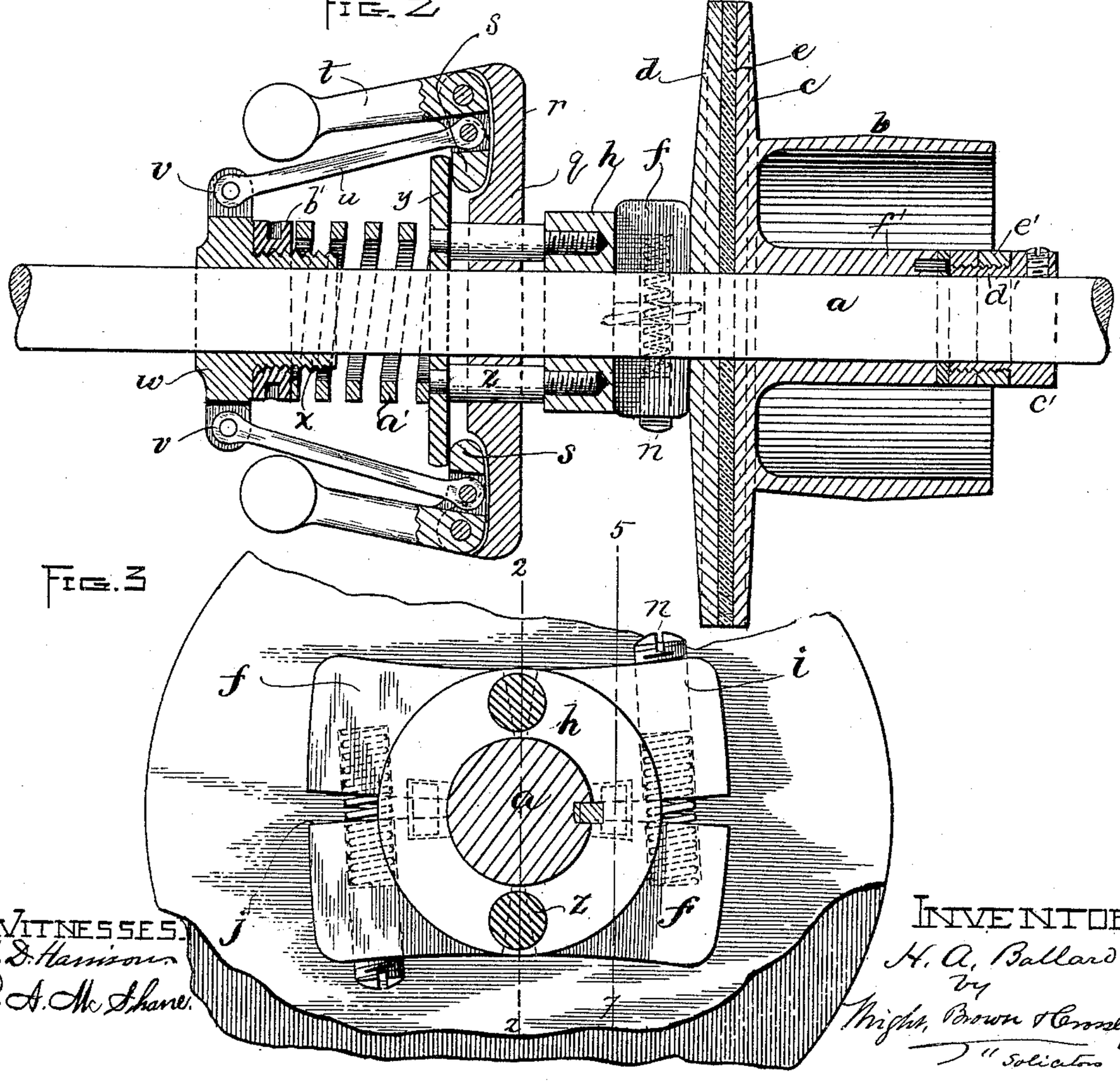


FIG. 3

WITNESSES:
A. D. Harrison.
B. A. McShane.

INVENTOR
H. A. Ballard
by
Wright, Brown & Crosby
his Solicitors

(No Model.) 2 Sheets—Sheet 2.

H. A. BALLARD.

SPEED CONTROLLING DEVICE.

No. 462,028. Patented Oct. 27, 1891.

FIG. 4

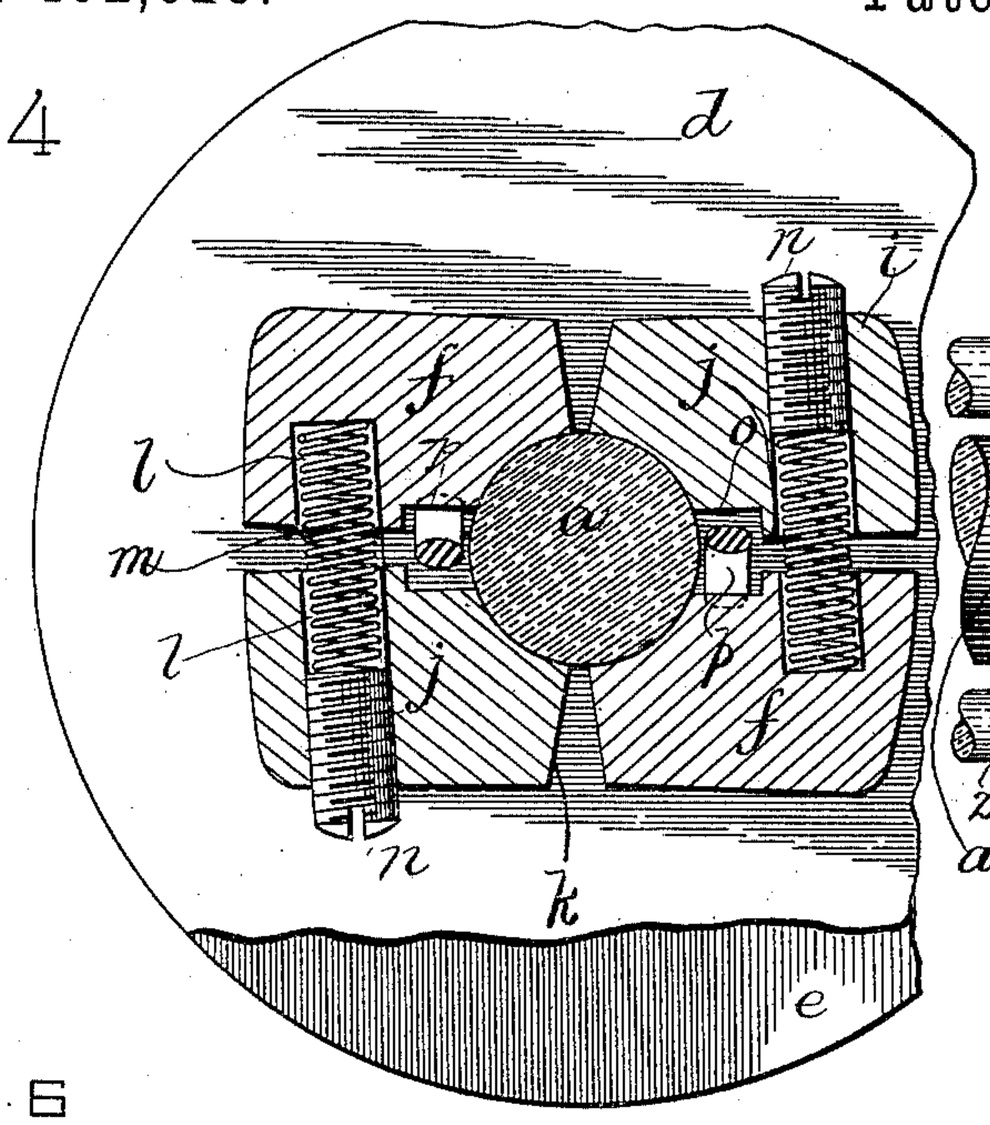


FIG. 5

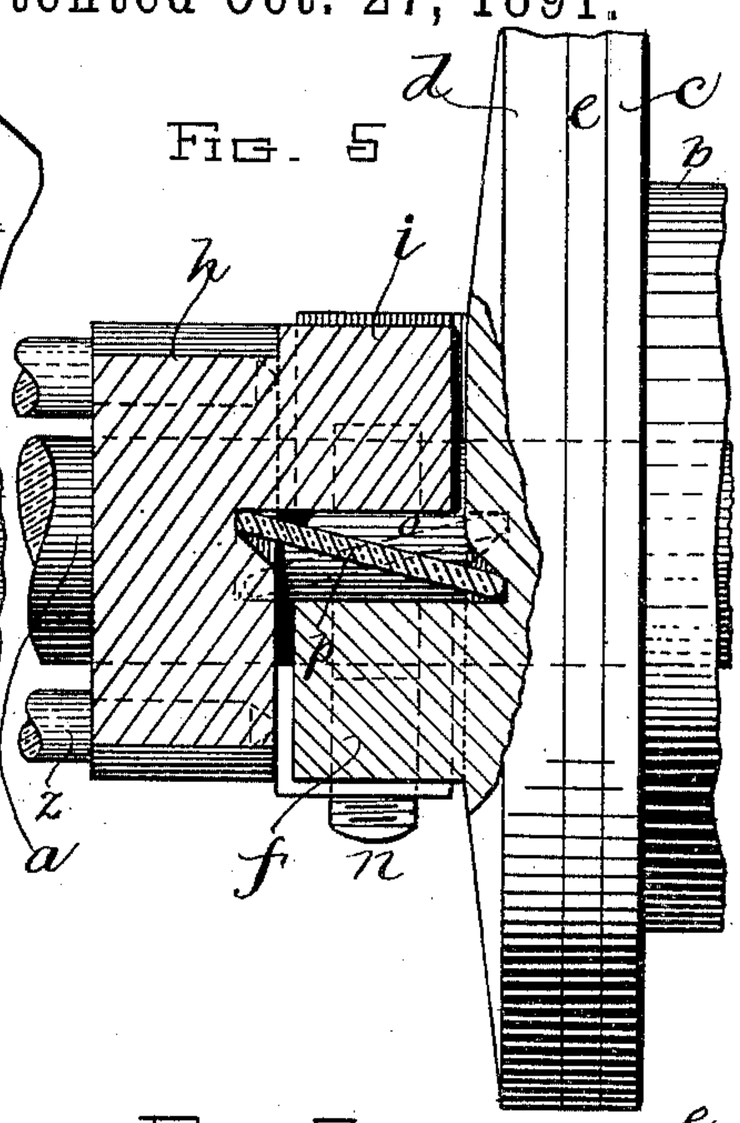


FIG. 6

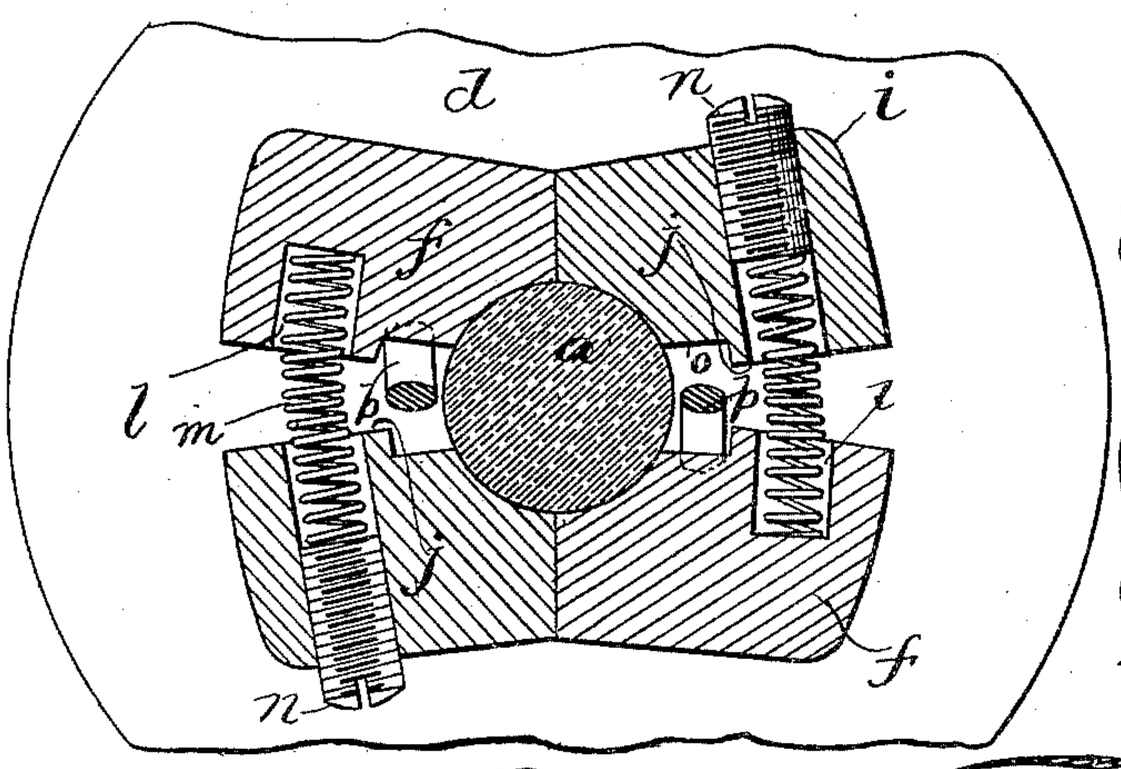


FIG. 7

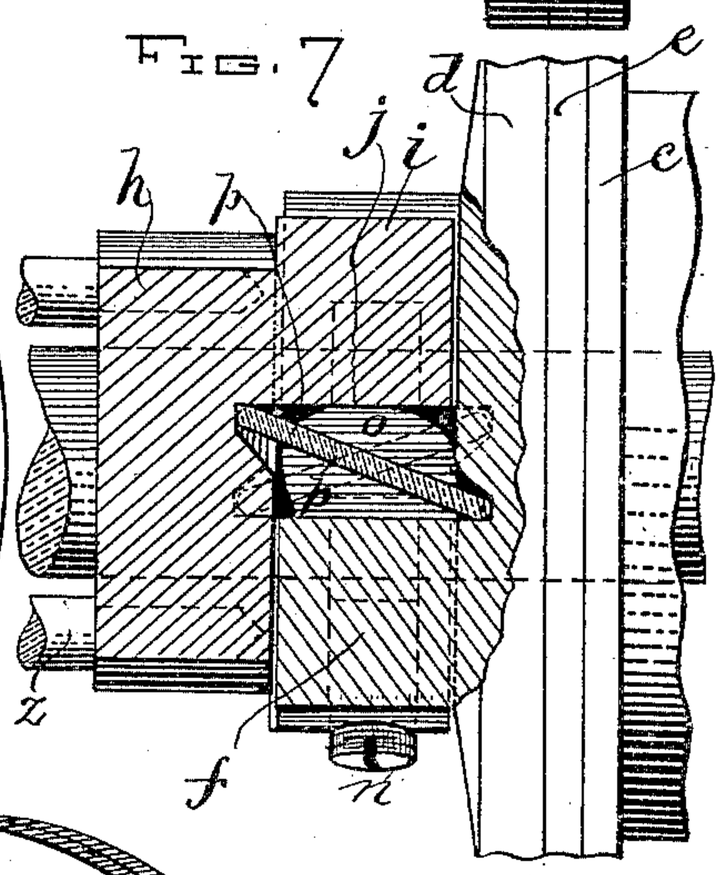


FIG. 8

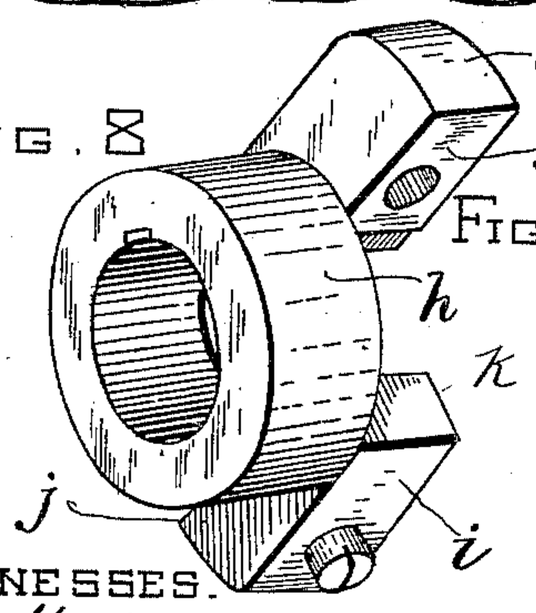
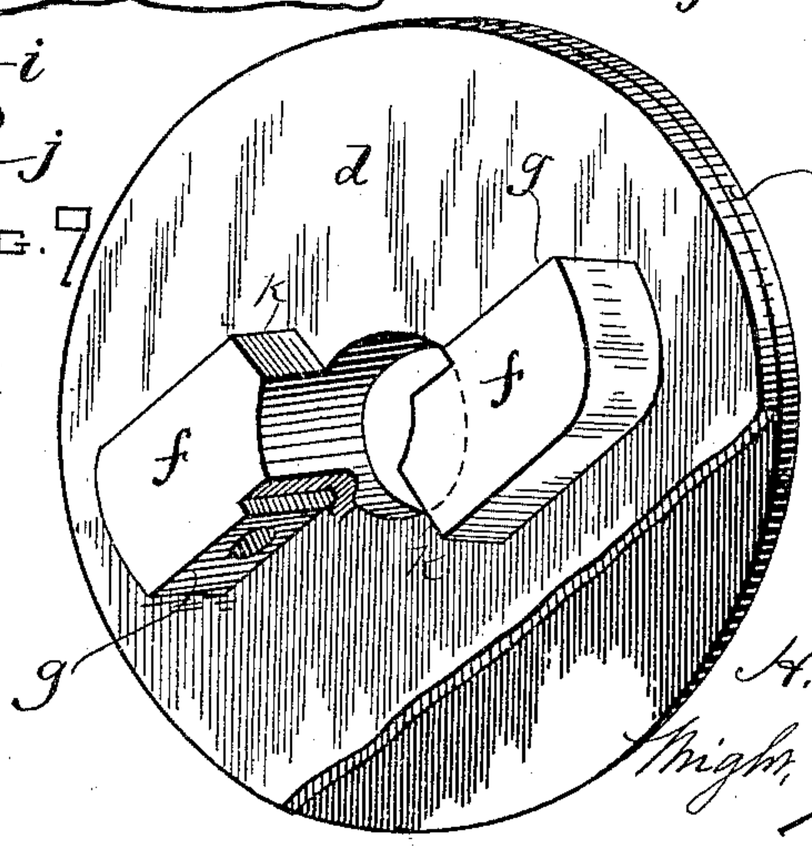


FIG. 9



WITNESSES.
A. D. Harrison
B. A. McShane.

INVENTOR.
H. A. Ballard
by Wright, Brown & Crosby
Solicitors.

UNITED STATES PATENT OFFICE.

HARRIE A. BALLARD, OF ASHLAND, ASSIGNOR OF ONE-HALF TO CHARLES J. PILLSBURY, OF BOSTON, MASSACHUSETTS.

SPEED-CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 462,028, dated October 27, 1891.

Application filed June 12, 1891. Serial No. 395,976. (No model.)

To all whom it may concern:

Be it known that I, HARRIE A. BALLARD, of Ashland, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Speed-Controlling Devices, of which the following is a specification.

The invention has relation to that class or kind of devices which are contrived to regulate or control the speed at which machines may be operated; and it has for its object the provision of such improvements as will cause the governor or regulator to make instant response to any change in or variation of the load carried by the machine.

Heretofore in devices of the kind to which this invention has reference a considerable period of time elapsed between the moment of varying the load upon the machine and the time when the weighted levers of the centrifugal device are able to assume proper position to secure an operation of the machine at the same speed at which it was run before the load there was changed. For example, if the machine should be carrying a heavy load and a portion thereof should be taken off, the machine would immediately start up at an unduly high rate of speed until the centrifugal tendency imparted to the weighted arms threw them out far enough from the axis of the shaft to release to a proper degree the frictional connection between the driver and friction-disk; and, *per contra*, should the machine be carrying a comparatively light load and more should be added, an appreciable period of time would elapse between the time of such addition to the load and the time when the momentum of the weighted arms would be overcome, within which time the machine would be run at an unduly slow rate of speed.

The invention herein shown and described overcomes the objections and difficulties mentioned and secures the purposes of the improvements, as hereinbefore recited, said invention consisting in securing the clutch-disk or part with which the driver co-operates so that it may be moved axially as well as longitudinally on the shaft, to a limited extent, and combining with the said disk or clutch part and the movable collar adjacent thereto and intermediate of the same a clamping device constructed and arranged to be actuated by the increased resistance to the rotation of the shaft to bear with increased force against the friction-disk or clutch part co-operating with the driver, and cause said clutch part to hug the driver to a greater degree, and to an extent corresponding to the increased resistance to the rotation of the shaft, and, when the load upon the machine is lightened, and the speed of the shaft is accelerated, to cause said clamping means to bear with less force against the said clutch part, the clamping means responding instantly to increase and decrease of load upon the machine.

The invention also consists of improved combination of other parts in a speed-controller, and the combination of such other parts with the groups or combination of parts hereinbefore described.

Reference is to be had to the annexed drawings and to the letters marked thereon, forming a part of this specification, the same letters designating the same parts or features, as the case may be, wherever they occur.

Of the said drawings, Figure 1 is a side view of the invention applied to a shaft. Fig. 2 is a longitudinal central sectional view on the line 2 2 of Fig. 3. Fig. 3 is a cross-section taken on the line 4 4 of Fig. 1, and showing the position of the means for controlling the speed of the machine with reference to the load when a heavy load is being carried. Fig. 5 is a side view, partially in section, on the line 5 7, Fig. 3, showing a position or relationship of parts represented in Fig. 4. Fig. 6 is a cross-section similar to Fig. 4, showing the position of the parts when the machine is running with a light load or with substantially no load whatsoever. Fig. 7 is a side view, partially in section on the line 5 7, Fig. 3, representing the devices as shown in Fig. 6. Fig. 8 is a perspective view of the movable collar and its equipments, which co-operates with the clutch part and its equipments to control the speed of the machine with reference to its load. Fig. 9 is a perspective view of the clutch part and its equipment mentioned in the description of Fig. 8, showing also the

friction-disk or washer interposed between the two clutch parts, a portion of the clutch part shown.

In the drawings, *a* designates the shaft to be driven.

b is the driver, which may be a gear or other equivalent device, it being here shown as consisting of a pulley provided at one end with a disk *c*.

d is a disk similar to disk *c*, connected with the driver *b*. Intermediate of the two disks *c* and *d* is a disk *e* of leather, leatheroid, or other suitable frictional material. Connected with the side of disk *d*, facing away from the intermediate disk *e*, are blocks *f f*, the faces *g g* of which extend in plane radial to the axis of the said disk.

h is a collar splined upon the shaft, so as that it may be moved longitudinally of the latter. The said collar is provided upon its side or face adjacent to the disk *d* with blocks *i i*, the faces *j j* of which extend in a plane radial to the axis of the collar *h*. The blocks *f* and *i* are so arranged on their respective supports that the adjacent sides of the collar and disk *d* may be brought into contact one with the other, and the faces *g j* of the blocks *f i* brought into the same relationship.

Both the driver *b* and the disk *d* are loosely arranged on shaft *a;* but by reason of the contact of the blocks *i* of the collar *h* with the blocks *f* of the disk *d* the latter will be driven when the shaft *a* is rotated. The bases or inner ends of the said blocks are slightly inclined or beveled, as is best indicated at *k* in Figs. 4 and 6, so as to render the disk *d* revolubly movable on the shaft *a* to a slight extent. Sockets *l* are formed in the opposing sides of the blocks, and helical springs *m* seated at their ends in the said sockets serve to hold the blocks normally apart to the degree permitted by their inclined ends *k*. Screws *n* tapped into the blocks and bearing at their inner ends upon the springs serve as a means for adjusting the stress exerted by the said springs upon the blocks. Any other form and arrangement of springs and adjusting means may, however, be used for the purpose mentioned. Chambers *o* are formed in the opposing sides of the blocks at their bases, and levers *p*, seated at one end in the collar and at the opposite end in the hub of the disk *d* and extending in an inclined direction with respect to the shaft *a*, are arranged to operate in the said chambers.

q is a collar or disk rigidly secured to the shaft *a*, upon projections *r* of which are fulcrumed angle or bell-crank levers, the longer outer arms *t* of which are weighted. Link-rods *u* are pivoted at one end to the inner shorter arms *s* of the angle-levers, and are connected in like manner with lugs *v* of a collar *w*, provided with a screw-threaded hub *x* loose on the shaft *a*.

y designates a washer surrounding the shaft *a* and bearing near its periphery upon the inner ends of the arms *s* of the angle-levers. The said washer also rests upon (or it may be connected with) the ends of pins *z*, which extend through holes formed in the collar or disk *q*, and are tapped at their inner ends in the collar *h*.

a' designates a helical spring surrounding the shaft *a* and bearing at one end upon the washer *y* and at the other upon the screw-threaded collar *b'*, turned upon the hub *x*.

c' designates a collar provided with a screw-threaded hub *d'*, arranged to be secured by a set-screw or other suitable means upon the shaft *a*. A collar or collars *e'* are threaded upon the hub *d'* and are adapted to be adjusted nearer to or farther from the hub *f'* of driver *b*, so as to hold the driver in place on the shaft and adjust it with reference to the position of friction-disk *d*.

In the use of my invention with the weighted arms *t* in their normal position, the collars *b'* and *e'* will be adjusted so as to cause the spring *a'* to frictionally clutch or connect the disks *c* and *d* through the medium of the disk *e* to the desired degree. In operating the machine, should there be a tendency to drive the shaft *a* at too great a speed, the centrifugal tendency imparted to the weighted arms *t* will throw the free ends thereof outward, causing the ends of the arms *s* to bear upon the washer *y* and move it in a direction away from the collar *q*, the link-rods *u* acting to move the collar *w* in the same direction and consequently relieving the stress with which the spring *a'* (through the medium of the washer *y*) exerts upon the pins *z*, connected with the collar *h*. As a result of this operation the frictional connection of the disks *c* and *d* will be lessened in force, and the former will slip upon the latter to the extent of the unduly rapid movement of the driver. Should now additional load be added to the machine connected with the shaft *a*, the increased resistance to the rotation of the latter by the driver will cause the blocks *f*, connected with the disk *d*, to overcome to a greater or less extent the stress of the springs *m*, and, as it were, catch up with the blocks *i*, actuating the levers *p*, (see Fig. 5,) so as to cause the disks *c d* to hug each other with greater force, and with a force corresponding to the increase of load upon the machine.

The instant the load upon the machine is lightened and the resistance to the rotation of the shaft *a* is lessened the springs *m* will operate to separate the blocks *i f*, moving the levers *p* to a position indicated in Fig. 7, and so lessening the degree of frictional connection between the disks *c d*.

In the way described I am enabled to provide means for controlling the speed of the shaft *a* with reference to the load upon the machine and an unvarying speed of the driver and separate means for controlling the operation of the said shaft with reference to variations in the speed of the driver and an unvarying load.

If desired, the outer free ends of the arms *t* may be made hollow with closable apertures, so as that the weight thereof may be adjusted by means of shot or the like to suit circumstances, as shown, described, and claimed in a patent granted to me June 1, 1891, No. 456,392.

It is to be observed that when the weighted arms *t* are thrown outward by centrifugal tendency the spring *a'* is moved bodily away from exerting pressure upon the disk *d*, so that no force exercised by the levers *t* is lost in compressing the said spring; but all of the said force or power is employed in relieving the frictional connection between the driver and the disk *d*. This is an important feature of the invention.

Having thus explained the nature of my invention and described a way of constructing and using the same, I declare that what I claim is—

1. A speed-controller comprising in its construction a driver provided with a friction-disk loose on the shaft to be driven, a co-operating friction-disk adapted to have a limited movement both longitudinally and revolubly on the shaft and provided with a clutching part, a collar on the shaft provided with a clutch part to co-operate with the first-mentioned clutch part, a spring for holding the said clutch parts normally separated, and a clamping or pressing device intermediate the collar and last-mentioned friction-disk to press upon the latter and cause the friction-disks to hug the more closely as load is added to the machine driven by the shaft, as set forth.

2. A speed-controller comprising in its construction a driver provided with a friction-disk loose upon the shaft to be driven, a co-operating friction-disk adapted to turn with the shaft, but movable longitudinally thereon, a collar secured to the shaft, weighted angle-levers pivoted upon said collar, a washer surrounding the shaft, a second collar loose upon the shaft, a spring interposed between the washer and second collar, link-rods connecting one of the arms of each of the said weighted levers with the second collar, the ends of the said arms extending under the said washer, and devices consisting of levers intermediate the washer and second-mentioned friction-disk, as set forth.

3. A speed-controller comprising in its construction a driver provided with a friction-disk loose upon the shaft to be driven, a co-operating friction-disk adapted to turn with the shaft, a collar, a clamping device intermediate the last-mentioned friction-disk and the said collar for causing the two disks to hug the more closely as load is added to the machine driven by the shaft, a spring surrounding the shaft, devices consisting of levers intermediate of the said spring and collar, and a centrifugally-operated device for overcoming the stress with which the said spring acts upon the friction-disks, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses, this 3d day of June, A. D. 1891.

HARRIE A. BALLARD.

Witnesses:

ARTHUR W. CROSSLEY,

A. D. HARRISON.