# J. D. WILLOUGHBY.

## GOVERNORS FOR STEAM ENGINES.

No. 181,509. Patented Aug. 22, 1876.

Fig. 1.

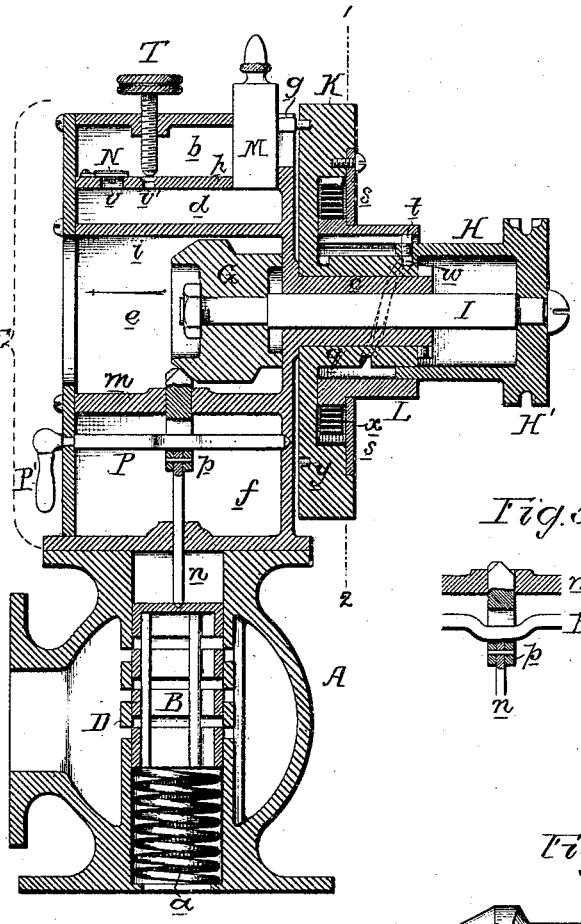



Fig. 5.




Fig. 2.

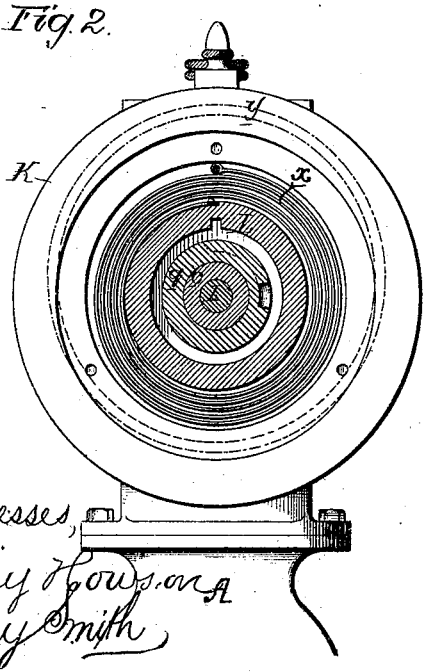



Fig. 4.

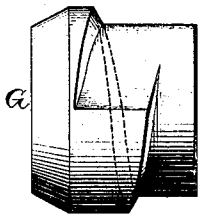
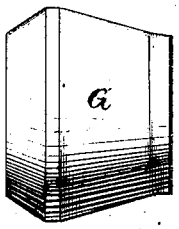



Fig. 3.




Witnesses,
Harry Howson
Harry Smith

James D. Willoughby
by his Attorneys,
Howson and Son

# UNITED STATES PATENT OFFICE.

JAMES D. WILLOUGHBY, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN GOVERNORS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. **181,509**, dated August 22, 1876; application filed January 12, 1876.

*To all whom it may concern:*

Be it known that I, JAMES D. WILLOUGHBY, of Philadelphia, Pennsylvania, have invented an Improved Governor for Engines, of which the following is a specification:

My invention consists of a device, fully described hereafter, for regulating or cutting off the supply of steam in steam-engines, in accordance with the demands of the same.

In the accompanying drawing, Figure 1 is a vertical section of my improved governor or cut-off; Fig. 2, a transverse section on the line 1 2; Fig. 3, a detached view of a device to be used when my invention is employed solely as a governor; and Fig. 4, a device to be applied when the invention is to be used as a cut-off.

A is the chest of the governor or cut-off valve, the valve itself consisting, in the present instance, of a transversely-slotted cylinder, B, arranged to slide in a cylindrical slotted chamber, D, in the chest A, a spring, *a*, contained within the said chamber, tending to elevate and close the valve.

It may here be remarked that different kinds of valves may be used without departing from the main features of my invention.

To the valve-chest A is secured a frame or stand, E, which is, in the present instance, of a box-like form, and is separated into the four compartments, *b*, *d*, *e*, and *f*, by partitions *h*, *i*, and *m*. The valve-spindle passes through the base of the stand E, and is secured to a slide, *p*, which passes through, and is guided by, the the partition *m*, the upper end of the slide being adapted to the hub G, which, as shown in Fig. 4, is constructed to form a cut-off cam, having a spiral shoulder—such as heretofore used when a variable cut-off is required. This hub or cut-off cam G is connected to a sleeve, H, by a spindle, I, which turns in a projection, *c*, at the rear of the stand E, the sleeve being driven, in the present instance, through the medium of an endless chain, adapted to a chain-pulley, H′, secured to, or forming a part of, the said sleeve, which can slide between the hub *q* of the wheel K and a ring, L, which is confined to the wheel by a plate, *s*. A pin, *t*, on the sleeve H is so adapted to a straight groove in the ring L that both must turn together, and an internal pin, *w*, on the sleeve is adapted to a spiral groove in the hub *q* of the wheel K. A coiled spring, *x*, is contained within a recess in the wheel K, one end of the spring being connected to the wheel and the other end to the ring L, as shown in Fig. 2. In the face of the wheel K is an eccentric groove, *y*, (shown by dotted lines in Fig. 2,) and into this groove projects the end of a pin, *g*, on the plunger M, the latter passing through, and being guided by, the top of the stand E and the partition *h*, which has two openings, *v* and *v′*, above the former of which is a valve, N, opening upward, and above the latter a set-screw, T, which can be so adjusted as to enlarge or contract the communication through the opening *v′* between the compartments *b* and *d*. As the wheel revolves, the reciprocating plunger M, during its downward movement, forces a suitable fluid from the chamber *d* through the valved opening *v*, as well as through the opening *v′*, into the chamber *b*, the fluid, during the upward movement of the plunger, returning to the lower compartment through the said opening *v′*. The resistance with which the plunger meets on its ascent will depend upon the area of the opening *v′*, and this can be readily determined by the adjustment of the screw T. The set-screw T must, in the first instance, be so adjusted as to permit the fluid to pass to and fro freely, and the wheel K to revolve at a given number of revolutions per minute, indicative of the number of revolutions per minute at which the engine must revolve without the spring *x* yielding to any great extent.

Should the engine commence to run at too great a speed, the wheel K being restricted to its uniform speed by the flow of fluid, the sleeve H will commence to turn faster than the wheel K, and this must result in the yielding of the spring and in the inward movement of the sleeve, owing to the spiral groove in the hub *q* of the wheel, and to the pin *w*, which projects into the groove. On the sleeve moving inward, it will be followed by a corresponding movement of the cam G, and by such a movement of the valve as will diminish the supply of steam to a degree which the excessive speed of the engine demands.

It will be readily understood that when the engine commences to run at less than its proper speed, the sleeve H will move outward, and

s will be followed by such a movement of cam G and the valve that the latter will nit to the engine a supply of steam necessy for causing it to run at its proper speed. n the event of the breaking of the chain or t which drives the sleeve H, so that a sudn stoppage of the rotation of the latter rets, the continued movement of the wheel K l force the pin *w* of the sleeve to the exme outer end of the slot in the hub *q*, thus ısing such a movement of the hub G that conical end will permit the elevation of the per end of the slide *p* to its highest point, d the consequent complete closing of the lve.

The restriction of the wheel K to a given eed may be accomplished by friction, any itable frictional device capable of nice adstment being applied to the wheel.

Instead of imparting motion to the wheel K m the sleeve H through the medium of a ring, as described, said wheel K may be iven by a power independent of the engine, be governed by clock-work, for instance, or any motive power which will insure a derminate speed of the said wheel K. In this se the spring would be dispensed with, the fferences in speed between the hub of the ieel K and the sleeve H causing the lateral ovement of the latter in the same manner as the former case.

When my invention has to be used solely as governor, the cut-off cam G must be removed, id the plain tapering hub illustrated in Fig. secured to the spindle I, with a result similar that obtained from any ordinary governor, will be readily understood by engineers without further explanation.

A transverse spindle, P, having its bearings the stand A, passes through a slot in the ide *p*, and is so cranked (see Fig. 5) that on eing turned by a suitable handle, P′, it will epress the slide, its spindle, and valve B, and pen the latter when steam has to be admitted the engine in the first instance. After the steam has been thus admitted, the sleeve will commence to move inward, and the cam G to depress the slide *p*, and the cranked portion of the spindle P, being relieved from the pressure of the spring *a*, will, owing to the weight of the handle P′, be so turned as to present no obstacle to the automatic movement of the slide and valve.

I claim as my invention—

1. The combination of a hub or cam, G, driven by the engine, and controlling the spring-valve B, with a wheel, K, revolving at a determinate speed, and with mechanism, substantially as described, by which the said wheel governs the longitudinal position of said hub, as set forth.

2. The combination of a spring steam-valve and its guided spindle with the rotating hub G, the sleeve H, driven by the engine attached to the said hub, the ring L, the spring-wheel K, its hub having a spiral groove adapted to the said sleeve H, and a device for retarding the wheel, as specified.

3. The combination of the said spring-wheel K and the plunger M, operated by the same, with the compartments *b* and *d*, and communications between the compartments.

4. The combination of the spring valve-stem *n* or its slide *p* with the hub G, controlled in its lateral movement by the variations in the speed of the engine, and having a tapered or grooved end, which will permit the complete closing of the valve, as set forth.

5. The combination of the hub G and spring-valve B with the intermediate sliding valve-stem *p* and cranked spindle P, with its handle P′, all as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES D. WILLOUGHBY.

Witnesses:
HARRY HOWSON, Jr.,
HARRY SMITH.