(No Model.)

W. KNOWLES.

GOVERNOR FOR STEAM ENGINES.

No. 282,908. Patented Aug. 7, 1883.

Fig. 1.

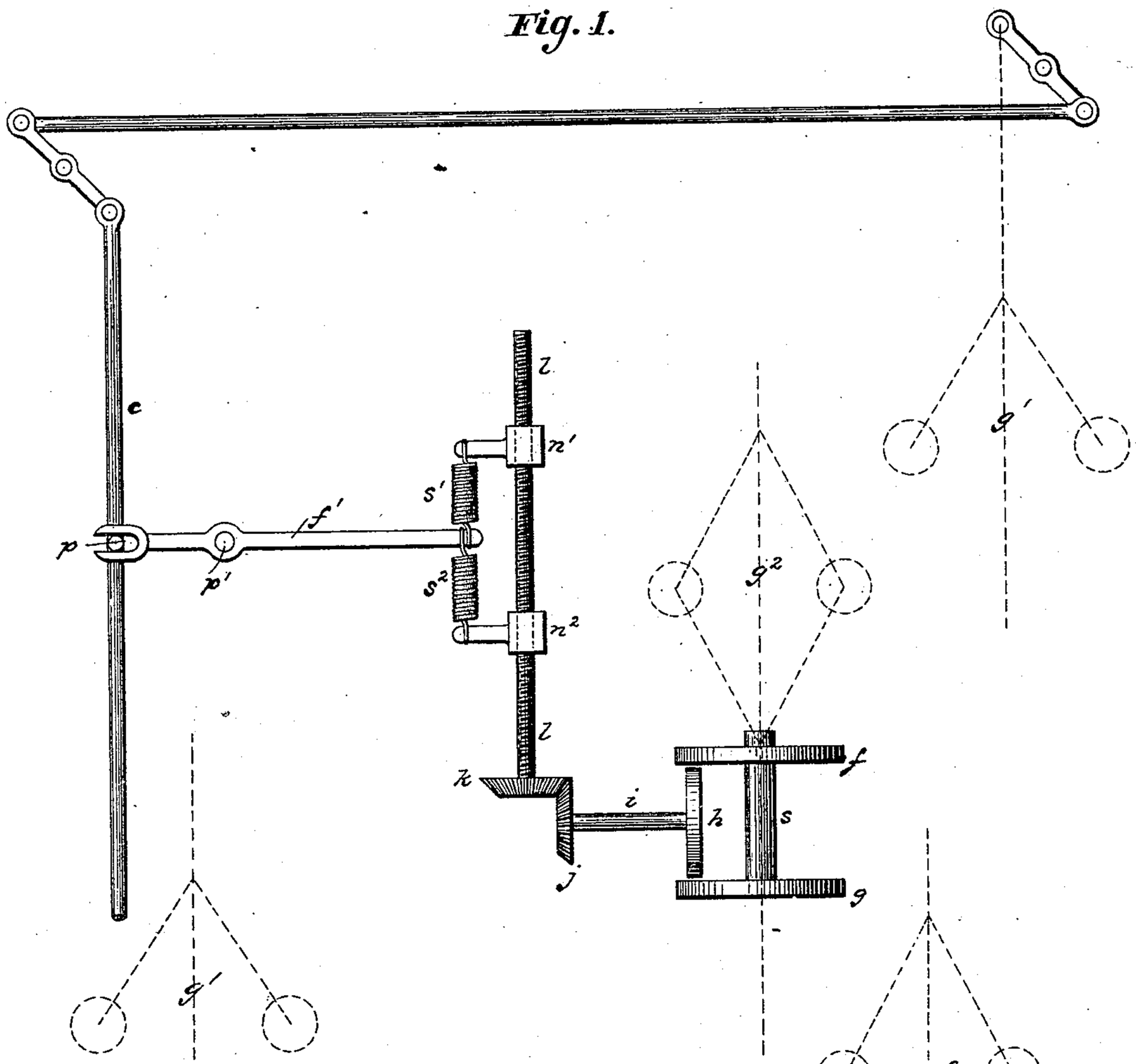
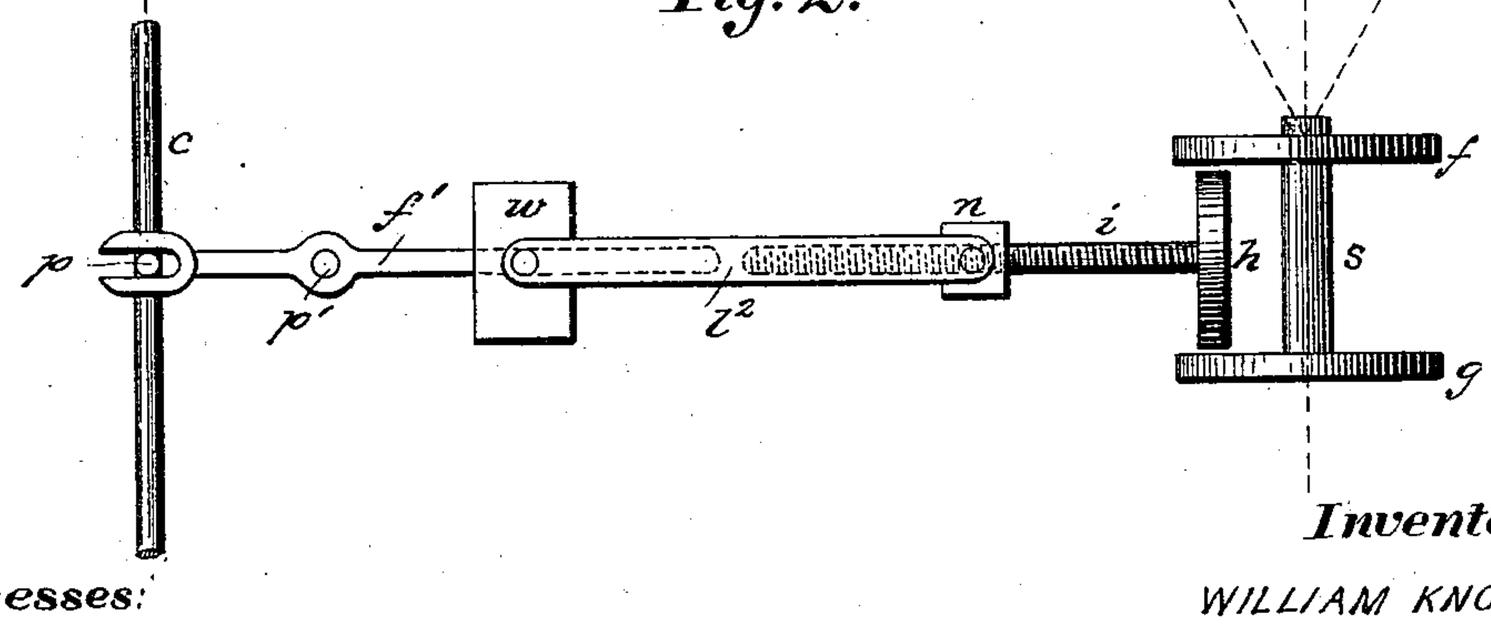


Fig. 2.



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GOVERNOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 282,908, dated August 7, 1883.

Application filed July 10, 1883. (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 Queen of Great Britain and Ireland, residing at Bolton, in the county of Lancaster, England, have invented a new and useful Improvement in Governors for Steam-Engines, (for which I have obtained Letters Patent in England, No. 310, bearing date January 21, 1882,) of which the following is a specification.

In my specification forming part of Letters Patent of the United States No. 279,097, dated June 5, 1883, I set forth one genus of devices described and claimed in my said English patent as means for the accomplishment of a certain general object or result in the operation of governors for steam-engines—or, in other words, the control of steam-engine valves and cut-offs. My present invention consists in another genus of devices and a preferred species thereof, described and claimed in said English patent, for accomplishing the same general result or object in a somewhat different way. The object common to both of these inventions, or both parts of my general invention, is to reduce to a minimum variations of speed in steam-engines, due to increases or decreases of pressure or load.

The basis of the invention described and claimed in my previous specification aforesaid is "extensible and contractible connections" communicating between the ordinary or main governor and the throttle-valve or cut-off, with "means for automatically extending and contracting said connections" as the speed of the engine varies, with or without the aid of a "supplementary governor." In some instances it may be impossible or difficult, or undesirable, to use at all or to so operate an extensible and contractible joint in the engine-connections. My present invention therefore provides for automatically accomplishing the same general result instead, with a supplementary governor as its basis, by causing an aiding or expediting device to act upon the connections between the main governor and the valve or cut-off, at any convenient point or points, through the medium of a forked lever or its equivalent and suitable connections, by means of the supplementary governor, which thus anticipates and facilitates the work of the main governor, or assists the main governor and quickens its action on the valve or cut-off, as the case may be, so as to reduce the extent of variations in the speed of the engine. An engine may be thus kept almost exactly at its normal speed.

A sheet of drawings accompanies this specification as part thereof. Figures 1 and 2 of these drawings are diagram elevations of two forms of governor mechanism, illustrating, respectively, the use of aiding or expediting springs and weights according to this invention.

Like letters of reference indicate corresponding parts in both figures.

g in each figure represents an ordinary ball-governor; and *c*, a connecting rod or stem operated more or less directly by said governor, and serving to transmit motion therefrom to the throttle-valve or cut-off of a steam-engine; and g^2 represents a supplementary governor connected with the same rod or stem, and driven, as is said main governor *g'*, from some convenient rotary part of the engine. The balls of said supplementary governor g^2 are in each case connected to a sleeve, *s*, adapted to slide upon its spindle and to rotate therewith, carrying friction-disks *f g* at its respective ends; and a friction-pulley, *h*, on a shaft, *i*, perpendicular to said spindle of the supplementary governor, is so supported between said disks *f g* that at the normal speed of the engine it is out of contact with both of said disks, and said shaft *i* remains stationary; but when the speed of the engine rises or falls above or below a given close limit said disks *f g* respectively come in contact with the periphery of said pulley *h* and turn said shaft *i* in one direction or the other, as set forth in said Patent No. 279,097. This transmitting mechanism is preferred for general use, owing to its simplicity and sensitiveness; but other known devices may be substituted therefor to produce the same result without departing from my invention. Likewise, in each figure *f'* represents a forked lever having a central pivot, *p'*, and a forked extremity, which embraces a stud-pin or pair of stud-pins, *p*, on said rod or stem *c*, as illustrative means for connecting an aiding or expediting device to said rod or stem without cutting or dividing the latter. In the mechanism represented by Fig. 1 said shaft *i* carries, at its extremity opposite to that upon which said friction-pulley *h* is fast, a miter-

wheel, *j*, meshing with a similar wheel, *k*, preferably of the same or a smaller diameter, the latter fast upon one end of a screw-shaft, *l*, provided with a continuous screw-thread which carries a pair of non-rotary traveling nuts, n' n^2, having arms or projections from which a pair of spiral springs, s' s^2, extend to the extremity of said lever f', opposite to its said forked extremity. As said nuts travel in either direction it will be seen that the springs s' s^2 are respectively put in tension and compressed, more or less, so that one of them tends to push and the other to pull said extremity of said lever f', and therethrough to move said connection *c* in one and the same direction. The parts are so constructed and arranged that when said friction-disk *f*, Fig. 1, is brought into contact with the periphery of said friction-pulley *h*, by a decrease in the speed of the engine motion is so transmitted through said shaft *i*, miter-wheels *j k*, screw-shaft *l*, nuts n' n^2, springs s' s^2, and lever f' to said connection *c* as to tend to open the throttle-valve wider, or so shift the cut-off as to increase the speed of the engine; and, correspondingly, when through increasing speed of the engine said friction-disk *g* is brought into contact with said friction-pulley *h* motion is so transmitted to said nuts n' n^2 that said springs s' s^2 will be made to tend to so move said lever f', and therethrough said connection *c*, as to close the throttle-valve more or less, or so act on the cut-off as to reduce the speed of the engine. In the mechanism represented by Fig. 2 said shaft *i*, which receives motion in one direction or the other from the supplementary governor g^2, according to whether the speed of the engine is increasing or decreasing, is itself a screw-shaft having a continuous thread, to which a traveling nut, *n*, is fitted. This traveling nut is connected by a link or links, l^2, preferably a pair of links, to a weight, *w*, fitted to said extremity of said lever f', opposite to its forked extremity, so as to slide thereon, and, by its proximity to or distance from the fulcrum of said lever f', to act through said lever upon said connection *c* with less or greater tendency to overcome the inertia of the main governor g', and thus facilitate or quicken its action in opening the valve wider, or so acting upon the cut-off as to increase the speed of the engine.

By using a pair of weights on the respective ends of the lever f', or so locating said weight *w* that when the engine is running at normal speed it is balanced upon the fulcrum of said lever and projects equally on the respective sides thereof, the mechanism shown in Fig. 2 may be rendered double acting, like that shown in Fig. 1, and by omitting one of the springs s' s^2 this may be rendered single acting. The supplementary governor g^2 is in either case preferably constructed of a smaller size or driven at a higher rate of speed as compared with the main governor, so as to be more sensitive to change in speed; but this is not considered essential, as a second governor of one and the same size or speed connected with the rod or stem *c*, or an equivalent part of the connections between an ordinary or main governor and the valve or cut-off in either of the ways above set forth, or in any equivalent way, would greatly facilitate and quicken the operation of said ordinary or main governor, and thus aid in keeping the speed of the engine uniform or regular.

The respective governors may be of any approved pattern or make, and various other forms of aiding or expediting devices may be combined therewith without materially changing the result and mode of operation above set forth.

Having thus described my present improvement in governors for steam-engines, I claim as my invention, and desire to patent under this specification—

1. In combination with an ordinary or main governor and connections transmitting motion therefrom to a throttle-valve or cut-off, a supplementary governor, aiding or expediting devices controlled thereby, and means for transmitting motion from said devices to said connections, substantially as herein described, for automatically assisting said ordinary or main governor by force applied in the proper direction to equalize the speed of the engine, in the manner set forth.

2. The combination, substantially as herein specified, of an ordinary or main governor, a rod or stem transmitting motion from said governor to a throttle-valve or cut-off, springs or weights connected with said rod or stem and adapted to aid in moving the same, and means connected with said springs or weights for shifting the latter, comprising a supplementary governor to automatically control or vary their action, in the manner set forth, for equalizing the speed of the engine.

3. The combination of the supplementary governor g^2, rotary sleeve *s*, friction-disks *f g*, friction-pulley *h*, shaft *i*, miter-wheels *j k*, screw-shaft *l*, and a traveling nut or nuts upon said screw-shaft, with a spring or springs stretched from projections on said nuts to a transmitting-lever, f', substantially as shown and described, for the purpose set forth.

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Witnesses:

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WM. HULNEY,
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