(No Model.)

E. CONRADY.

STEAM ENGINE GOVERNOR.

No. 503,785. Patented Aug. 22, 1893.

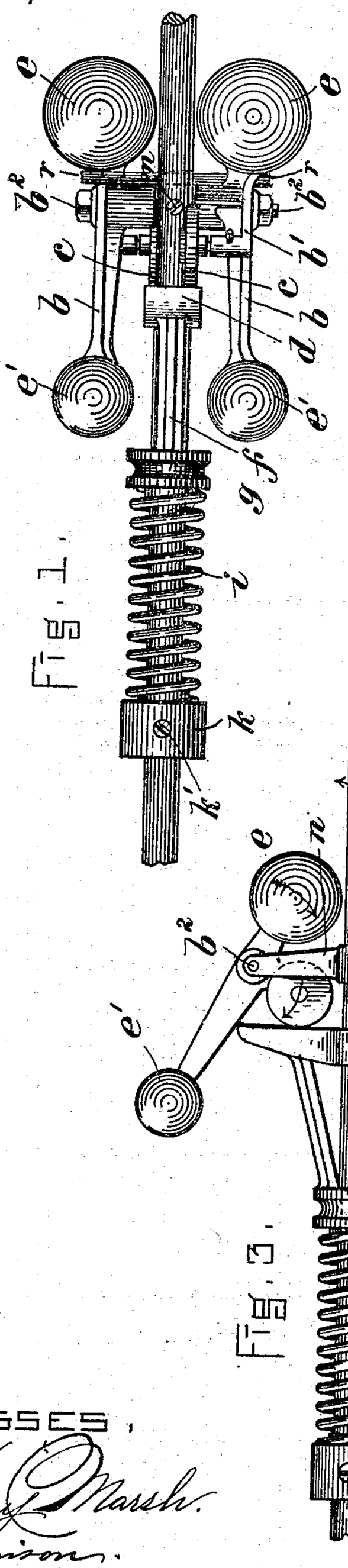

FIG. 1.

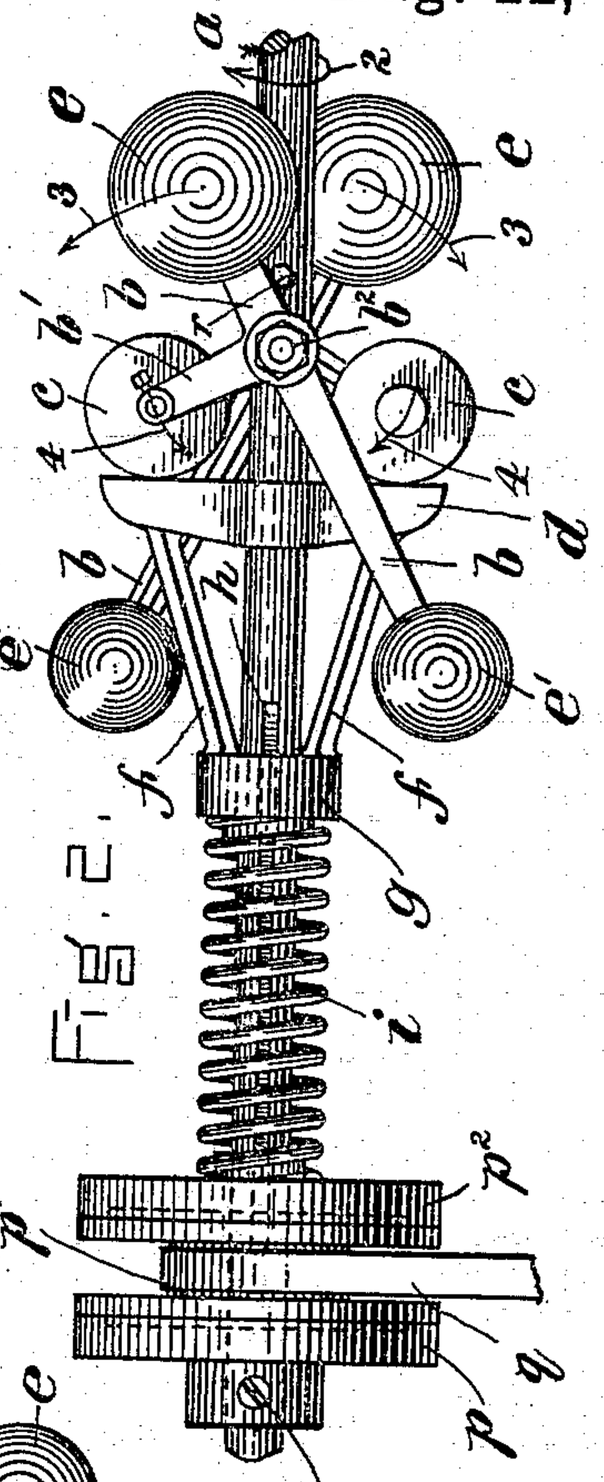

FIG. 2.

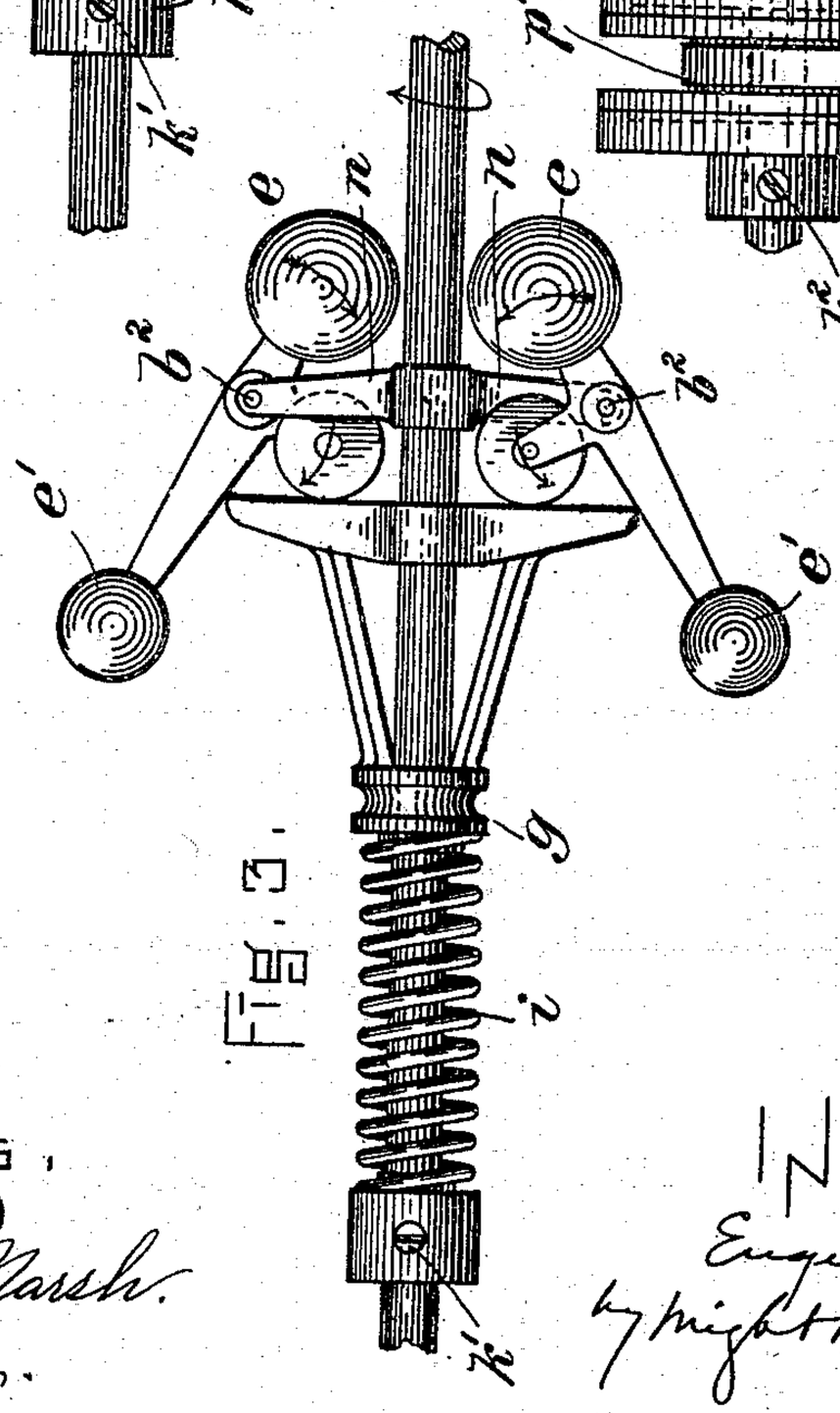

FIG. 3.

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UNITED STATES PATENT OFFICE.

EUGEN CONRADY, OF MORGANTON, NORTH CAROLINA.

STEAM-ENGINE GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 503,785, dated August 22, 1893.

Application filed November 7, 1890. Serial No. 370,618. (No model.)

To all whom it may concern:

Be it known that I, EUGEN CONRADY, of Morganton, North Carolina, have invented certain new and useful Improvements in Steam-Engine Governors, of which the following is a specification.

This invention has for its object to provide a centrifugal governor for steam engines, adapted, first, to operate equally well in any position; secondly, to be adjusted as to its sensitiveness to variations of speed, so that it may be made to operate the throttle valve when the speed of its revolution reaches any predetermined rate; and thirdly, to overcome the resistance in the mechanism which communicates motion to the throttle valve from the governor, without obstruction to the free motion of the governor arms.

To these ends my invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings forming a part of this specification, Figure 1 represents a side view of a governor embodying my invention. Fig. 2 represents a side view from a different point and showing the preferred means for indirectly connecting the governor with the throttle operating mechanism. Fig. 3 represents a side view of a modification.

The same letters of reference indicate the same parts in all of the figures.

In the drawings *a* represents the governor shaft which may be adapted, in any suitable way, to be rotated by the engine controlled or governed by the governor.

The essential features of my improved governor are, first, two weighted levers *b b* mounted to oscillate freely on pivots or bearings b^2 connected with the shaft *a*, each lever having an arm *b'* extending at right angles to the direction of the length of the lever from the center on which the lever oscillates and an antifriction roll *c* on said arm, and secondly, a cross head *d* extending across the shaft at right angles thereto and fitted to slide in the direction of the length of the shaft, said cross head having a flat face on which the rolls *c c* bear. The cross head *d* is connected by arms *f f* with a collar *g*, which is fitted to slide on the shaft *a* and is caused to rotate with said shaft by a key *h* on the shaft engaged with a groove in the collar *g*. Hence the collar and cross head rotate with the shaft, although they are free to move in the direction of the length thereof. The collar *g* is yieldingly supported by a spiral spring *i*, one end of which bears on the collar, while the other end is supported by a shoulder or bearing on the shaft, as hereinafter described. The levers *b b* are provided at their ends with weights *e e'*, said weights being so proportioned to the length of the arms of the levers that each lever is perfectly balanced in any position it may assume. When the shaft *a* is rotated in the direction indicated by the arrow 2, Fig. 2, the levers are revolved about the axis of rotation of the shaft. The cross head is normally held by its supporting spring *i* so that it holds the levers *b b* about parallel with the shaft *a* when the shaft is at rest or moving slowly, the spring pressing the cross head against the rolls *c c* and acting through said rolls and through the arms *b'* to hold the levers in said position. The rotation of the shaft tends to throw the weighted ends of the levers *b b* outwardly from the shaft in the direction indicated by the arrows 3, 3, Fig. 2. When the rotation of the shaft reaches the degree of rapidity which makes it desirable to operate the throttle and check the speed of the engine, the rolls *c c*, which are moved in the direction indicated by the arrows 4, 4 by the described movement of the levers *b b*, are caused to move the cross head *d* against the pressure of the spring *i* sufficiently to operate the throttle through suitable intermediate devices, such as are hereinafter described.

The means for connecting the cross head *d* with the throttle may be variously modified.

In Fig. 1 the collar *g* has a peripheral groove i^2 which may be engaged with throttle operating devices such as are used in connection with the grooved collar of an ordinary ball governor, the spring *i* in this case being supported by a collar *k* rigidly attached to the shaft.

In Fig. 2 I show the shaft *a* provided with three pulleys *p p' p²*. The pulley *p* is rigidly attached to the shaft, the pulley *p'* is loose thereon, and the pulley p^2 is adapted to slide on the shaft toward and from the pulley *p* and is engaged with the key *h* so that it rotates with the shaft. The said pulleys constitute a friction clutch which is made operative

to engage the loose pulley p' with the pulleys p p^2 and cause it to rotate with the shaft a by a movement of the pulley p^2 toward the pulleys p' and p. The spring i bears against the sliding pulley p^2 and when the head d is moved by the described centrifugal action of the weighted arms the spring presses the pulley p^2 against the pulley p' and the latter against the pulley p, thus causing the rotation of pulley p' with the shaft a. A strip q of any suitable material attached at one end to the pulley p' communicates motion from the latter to any suitable regulating mechanism adapted to actuate the throttle valve. Said regulating mechanism should have a spring to retract it and open the throttle valve when in consequence of a reduction of speed the governor arms fall back and the pressure of the spring on the pulleys is reduced so that the pulley p' is again loose.

An important advantage resulting from the employment of the last described means for communicating motion from the cross head is that there is no interference with the free movement of the governor arms or levers and cross head by friction resulting from direct contact of the regulating mechanism with the collar g, there being no contact between said mechanism and collar. When the collar g is directly connected with the regulating mechanism as described in connection with Fig. 1, the governor arms have to overcome the frictional and other resistance of the regulating mechanism, resulting from the contact thereof with the collar g, before they can change their position and thus influence the speed of the engine or motor. Hence, as in all other governors heretofore known, the weights have to be made of considerable size and the shaft run at a high speed to overcome the disturbing influence of said resistance. It will be seen, however, that the pressure imparted by the spring to the friction pulleys does not involve frictional or other resistance to the movements of the governor. Hence the weights can be much smaller than they could otherwise be, and the governor can be made to operate when the shaft a is running less rapidly than is necessary when the ordinary direct connection of the regulating mechanism with the governor is employed. In each or the examples shown the force of the spring can be adjusted to vary the sensitiveness of the governor. In the construction shown in Figs. 1 and 3 this result may be accomplished by adjusting the collar k upon the shaft, said collar being detachably secured by a set screw k'. In the construction shown in Fig. 2, the same result may be accomplished by adjusting the series of friction pulleys, the pulley p being detachably secured by a set screw k^2 while the pulleys p' p^2 are free to move to a limited extent in the direction of the length of the shaft. In this way the governor can be made so sensitive that the least increase of sepeed over a predetermined rate will cause the governor arms to open at once to their fullest extent and close as quickly upon a reduction of the speed.

The arms or levers b b are shown in Figs. 1 and 2 as mounted on pivots or bearing which are parts of a stud or pin passed through a hole in the shaft a and secured by a set screw m. In Fig. 3 said levers are connected by separate pivots to arms n n attached to the shaft a and projecting in opposite directions therefrom.

It will be seen that the weighted levers b b and the arms b' extending at right angles with said levers from their pivots and bearing on the cross head d, enable the governor to operate equally well in any position, or, in other words, when the shaft is either horizontal, vertical or inclined.

In the construction shown in Fig. 3, the operation of the governor is due to the fact that one arm of each lever b is normally farther from the center of rotation than the other arm, the levers occupying inclined positions as shown. The weight of each lever that is farthest from the center is therefore enabled to overpower or control the other so that when the levers are revolved the tendency of the outer arm is to move still farther outward. For this reason it is desirable to provide some means for preventing the arms b b from assuming positions parallel with the shaft, and this may be accomplished by arranging any suitable stop devices to prevent the longer arms from swinging inwardly beyond a predetermined point. The weighted levers b may be prevented from swinging past their required position of rest when forced thereto by the spring i by means of any suitable stop. In the form of the governor shown in Figs. 1 and 2 this stop may be a pin r passing through the shaft, as shown, against which the upper sides of the upper portions or arms of the lever b will rest when the said arms are in their normal position, while in the form shown in Fig. 3 the said stop may be the edges of the crosshead d which may be extended to such an extent that its sides will bear against the inner sides of the lower portion or arms of the levers b when the device is at rest in its normal position. I do not limit myself to these forms of stops; however, but may vary the same without departing from the spirit of my invention.

I claim—

1. In a governor, the combination of the shaft, the yieldingly supported crosshead thereon, and the levers mounted intermediate of their ends to oscillate on pivots or bearings attached to the shaft and located at opposite sides thereof, and having weights at both ends, the said levers having arms extending from their pivots at right angles to the direction of the length of the levers and bearing on the top surface of the crosshead, as set forth.

2. The combination of the shaft or spindle, the crosshead fitted to slide thereon and rotatively engaged therewith, a spring yieldingly supporting said crosshead and support-

ed by a fixture on the shaft, and the levers mounted intermediate of their ends to oscillate on pivots at opposite sides of the shaft, each lever being provided at both ends with weights, said levers being also provided at intermediate points with arms having anti-friction rollers bearing on the top surface of the crosshead, as set forth.

3. The combination of the shaft, the cross head rotatively engaged with the shaft and adapted to slide thereon, the weighted levers mounted to oscillate on pivots at opposite sides of the shaft, a series of friction pulleys on said shaft, one being affixed to the shaft, another loose thereon, and the third adapted to rotate with and slide upon the shaft, said loose pulley being connected with a device for transmitting motion, and a spring interposed between the cross head and the sliding pulley whereby the motion of the cross head is caused to impart pressure to the sliding pulley, and the latter is caused to co-operate with the fixed pulley in rotating the loose pulley by friction, as set forth.

4. The combination of the shaft, the cross-head rotatively engaged therewith, and adapted to slide thereon, the levers mounted intermediate of their ends on pivots at opposite sides of the shaft, provided with weights at both ends, and having projections which bear on the top surface of the cross-head the said weights being so adjusted that the levers are not actuated by gravitation, a spring on said shaft yieldingly supporting the crosshead, and means for adjusting said spring to vary the sensitiveness of the governor, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 31st day of October, A. D. 1890.

EUGEN CONRADY.

Witnesses:
S. T. PEARSON,
GEO. T. ERWIN.