

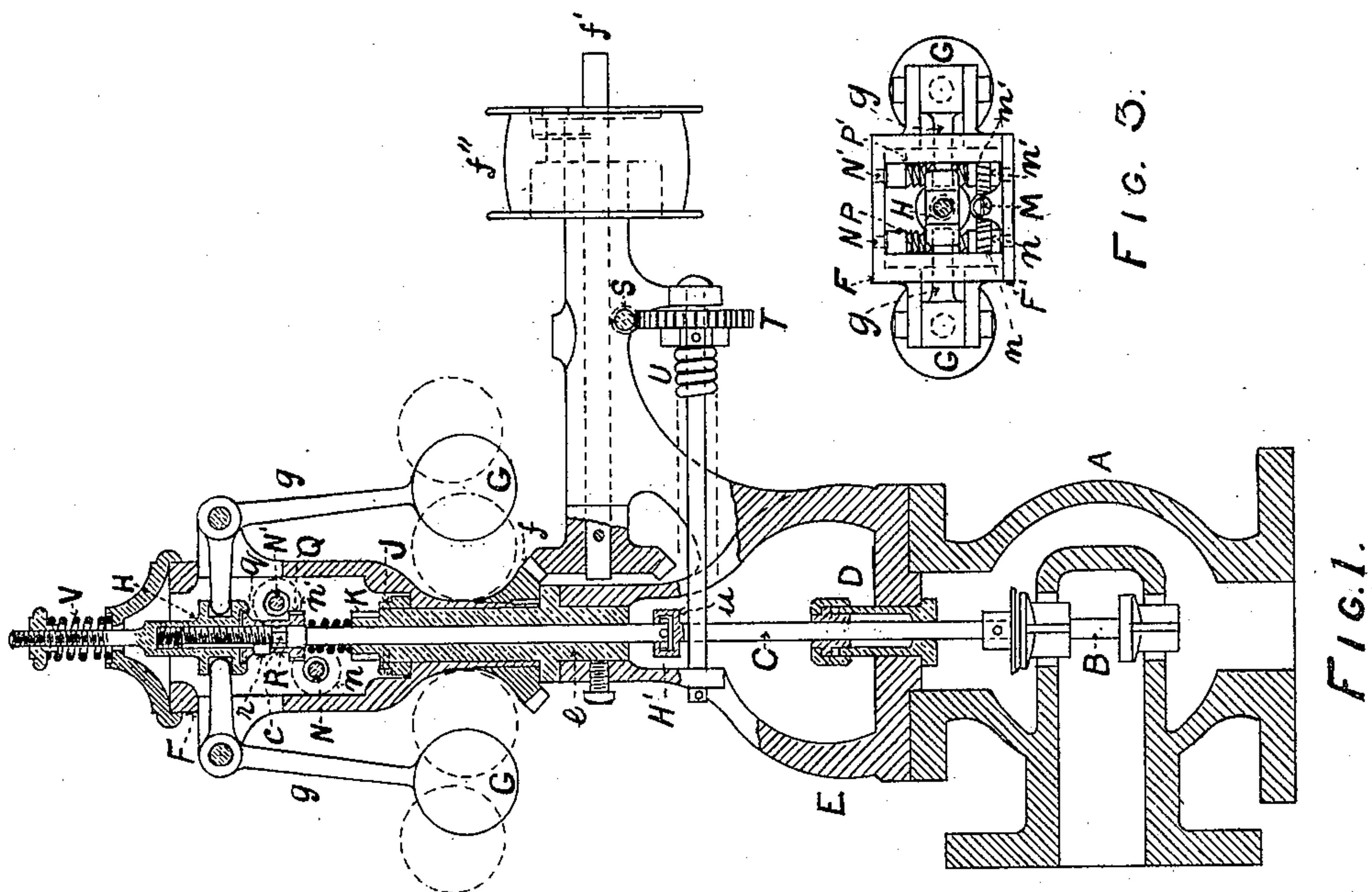
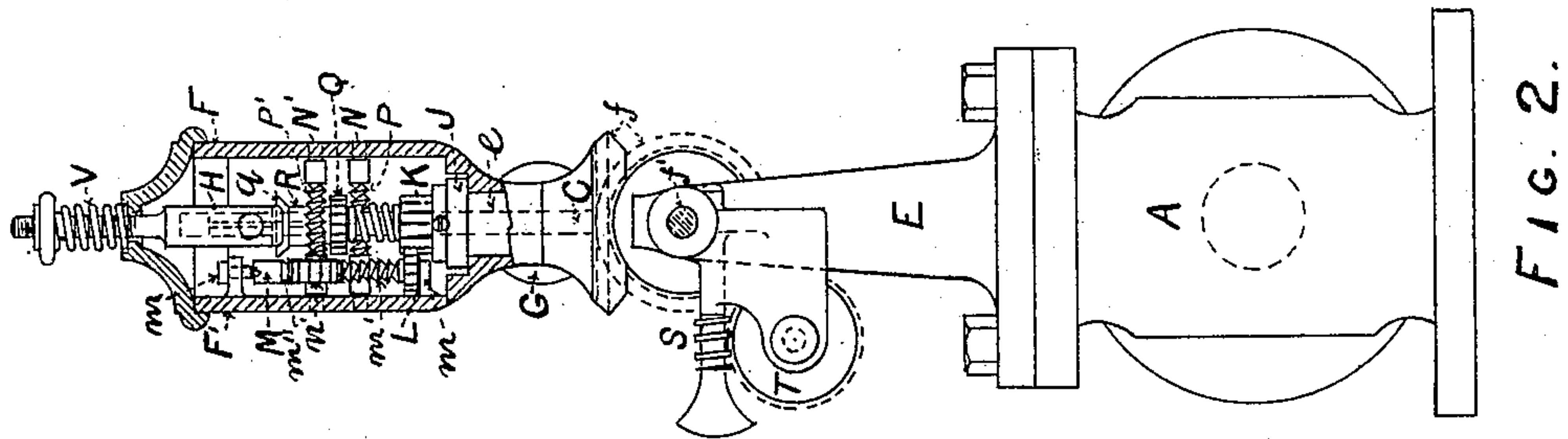
No. 611,729.

Patented Oct. 4, 1898.

G. H. FIRTH.  
GOVERNOR FOR STEAM ENGINES.

(Application filed Aug. 7, 1897.)

(No Model.)



WITNESSES

Emily Taylor  
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# UNITED STATES PATENT OFFICE.

GEORGE HENRY FIRTH, OF BRADFORD, ENGLAND.

## GOVERNOR FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 611,729, dated October 4, 1898.

Application filed August 7, 1897. Serial No. 647,485. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE HENRY FIRTH, a resident of 89 Richmond road, Bradford, in the county of York, England, have invented  
5 new and useful Improvements in Governors for Steam-Engines, of which the following is a specification.

This invention relates to improvements in steam-engine governors; and it consists in  
10 means for efficiently controlling the opening and closing of the steam-admission valve or valves so as to vary the admission of steam to the cylinder of the engine in accordance with the variation of load on the engine.

The invention will be fully described with  
15 reference to the accompanying drawings, in which—

Figure 1 is a sectional elevation of the improved governor complete; Fig. 2, an elevation partly in section, and Fig. 3 a plan of  
20 the top portion of the governor with the cover removed.

In carrying out my invention I employ a suitable casing A, in which is arranged any  
25 form of valve B commonly used in present forms of governors. The spindle C of this valve passes through a stuffing-box D in the usual way and thence through a bearing formed in a long bush, sleeve, or pillar *e*, secured in a suitable way to the bridge-bracket E. The bearing is sufficiently large to admit  
30 of the valve-spindle C moving easily in it when required. Surrounding the pillar *e* at its upper end is a casing F of a suitable design capable of being rotated round it by any ordinary means, such as a pair of bevel-wheels *f*, one of which is keyed or otherwise  
40 fixed to the casing F, while the other is fixed on one end of a short horizontal shaft *f'*, on the other end of which is fixed a pulley *f''*, through or by which motion is given to the governor in the ordinary way. Pivoted to the casing F by means of the bell-crank arms *g* are a pair of governor-balls G of a common  
45 type. The inner ends of the arms *g* engage with recesses provided for them in a boss or collar H, which is mounted on the valve-spindle C. The casing F is kept from rising vertically by a collar or nut J, secured to the  
50 pillar *e*. The parts so far described resemble an ordinary ball-governor and would act as such when in motion. Here, however, the resemblance ends. Instead of fixing the boss

or collar H firmly on the spindle C of the valve I provide it internally with a screw-  
55 thread and form a corresponding thread on the valve-spindle C, preferably near its top end. I also divide the spindle C midway, or thereabout, at H', so that the upper portion is at liberty to revolve in either direction  
60 without affecting the lower portion. The principal feature, however, of my invention consists in means for causing the valve-spindle C to be raised and lowered in addition to the ordinary raising and lowering action  
65 which takes place by the usual mechanism. For this purpose I form on or attach to the upper end of the pillar *e* a pinion K, into which gears a small wheel or pinion L, carried by a vertical shaft M, supported in bear-  
70 ings *m*, formed in the casing F, but preferably in its removable side F'. The shaft or spindle M has formed on it a left (*m'*) and right handed (*m''*) screw or worm, the former gearing with a worm-wheel *n* on a cross-shaft  
75 N and the latter with a similar worm-wheel *n'* on a second cross-shaft N'. Both shafts N N' are carried by the casing F in the manner shown and have each formed on them a right-handed screw or worm P P'. The rota-  
80 tion of the casing F causes the latter, through the mechanism referred to, to have given to them a rotary motion so long as the casing F revolves, and their disposition in the casing F is such that a worm-wheel Q is brought into  
85 engagement with worm P' when the valve-spindle C is raised and into engagement with P when it is depressed.

The worm-wheel Q is preferably formed at the lower end of a sleeve R, the upper end of  
90 which is formed with a conical or other suitably shaped flange *q*, supported by a similarly shaped recess formed in the lower end of the nut H. The sleeve R carries a feather *r*, that engages with a groove formed in the upper  
95 end of the valve-spindle C, while the latter is reduced in diameter at *c*, for the purpose hereinafter described. In order to prevent the valve-spindle C falling too suddenly under the influence of the balls G when the  
100 load on the engine is reduced, I use ordinary means whereby the resistance to fall may be regulated. These means consist of a worm S, gearing with a worm-wheel T, fixed on a shaft, round which is coiled a spring U, and  
105 on which is also fixed a lever for bearing



against the under side of the collar *u* on the upper end of the lower portion of valve-spindle C. In addition to or in place of this arrangement I may of course connect the two balls G by a spring, or, again, I sometimes continue the central portion of the nut H upward and fix to it a regulatable spring V, as shown.

The governor operates as follows: The casing F is rotated by means of the pulley *f''* and bevel-wheels *f*, and the balls G fly outward due to centrifugal action, and in accordance with the high or low speed of the casing F so is the longitudinal movement of the valve-spindle upward or downward. The tendency of the valve-spindle to fall is regulated by the mechanism hereinbefore referred to, so that during the normal working of the engine the worm-wheel Q is situated about midway between the two cross-shafts N and N' and is out of gear with the worms P and P' thereon. It will be observed that the casing F in its rotation carries round with it the spindle M, and so causes the latter to rotate by reason of the wheel L being in gear with pinion K on pillar *e*. This motion is transmitted by the worms or screws *m'* and *m''* and worm-wheels *n* and *n'* to the cross-shafts N and N', which are thus given a slow rotatory motion. It will now be understood that if the normal load on the engine were reduced there would be a tendency for the latter to increase in speed. Such increased speed would cause the balls G to fly farther outward from the normal position shown in full lines, and so tend through their arms *g* to depress the valve-spindle C and reduce the amount of steam passing through the valve B. The depression of the spindle would also cause the worm-wheel Q to come into contact with the worm P on cross-shaft N, and the worm being constantly rotating would cause the upper portion of the valve-spindle C to be rotated also through the agency of the feather *r* in sleeve R, engaging the groove in the spindle. The spindle being screwed at its upper end into the collar H is therefore caused to descend during the engagement of the worm and wheel, and this continues until the steam-pressure is normal or in accordance with the altered load on the engine and the latter is running at its usual speed. A similar action would take place if the load on the engine were increased so as to cause the balls G to go inward, only, of course, in this case the steam-valve B would be opened and the worm-wheel Q would be brought into contact with the worm P' on cross-shaft N', and so cause the valve-spindle to be moved upward. In both cases the worm-wheel Q is rotated by one or other of the worms P or P' until it is again clear of either of them by the balls G assuming their normal position. The slightest movement of the balls either inward or outward causes the engagement of the worm-wheel Q and worms P and P'.

The arrangement of the sleeve R and re-

ducing of the valve-spindle C at *c* is such that should the governor run under speed for any length of time the spindle would unwind itself until recess *c* came opposite feather *r*, when further motion would be stopped.

It will be quite understood that while I have described the new arrangements as applied to an ordinary governor they may also be combined with other forms of governor, throttle-valves, or Corliss valves, and other cut-off motions.

What I claim as my invention is—

1. A governor for steam-engines provided with means such as screwed nut or collar H worm-wheel Q cross-shafts N and N' worms P and P' worm-wheels *n* and *n'* shaft M and worms and wheels for driving shaft M valve-spindle C and governor-balls G substantially as and for the purposes described.

2. In a governor for steam-engines the combination with a rotatable casing F, of pillar *e* provided with wheel or pinion K, shaft M having formed thereon worms or screws *m m'* and pinion L, shafts N and N' with worms or screws *n* and *n'* formed thereon respectively, valve-spindle C, sleeve R with its wheel Q, feather *r* engaging with groove in spindle C and flange *q* engaging with nut H, nut H and balls G, the whole forming operative means for efficiently controlling the opening and closing of a steam-admission valve, or valves so as to control the admission of steam to the cylinder of a steam-engine in accordance with the variation of load on the engine.

3. In a governor for steam-engines the combination with a rotatable casing F, pillar *e* provided with wheel or pinion K, shaft M having formed thereon worms or screws *m m'* and pinion L, shafts N and N' with worms or screws *n* and *n'* formed thereon respectively, valve-spindle C, sleeve R with its wheel Q feather *r* engaging with groove in spindle C and flange *q* engaging with nut H, nut H, balls G and valve; of spindle C divided transversely as at H' substantially as described.

4. In a governor for steam-engines the combination with a rotatable casing F, pillar *e* provided with wheel or pinion K, shaft M having formed thereon worms or screws *m m'* and pinion L, shafts N and N' with worms or screws *n* and *n'* formed thereon respectively, valve-spindle C, sleeve R with its wheel Q, feather *r* engaging with groove in spindle C, and flange *q* engaging with nut H, nut H, balls G, valve-spindle C divided transversely as at H'; of bevel-wheels *f* shaft *f'* and pulley *f''* for driving or rotating casing F, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 20th day of July, 1897.

GEORGE HENRY FIRTH.

Witnesses:

FRED HAMMOND,  
H. R. HIRCOE.