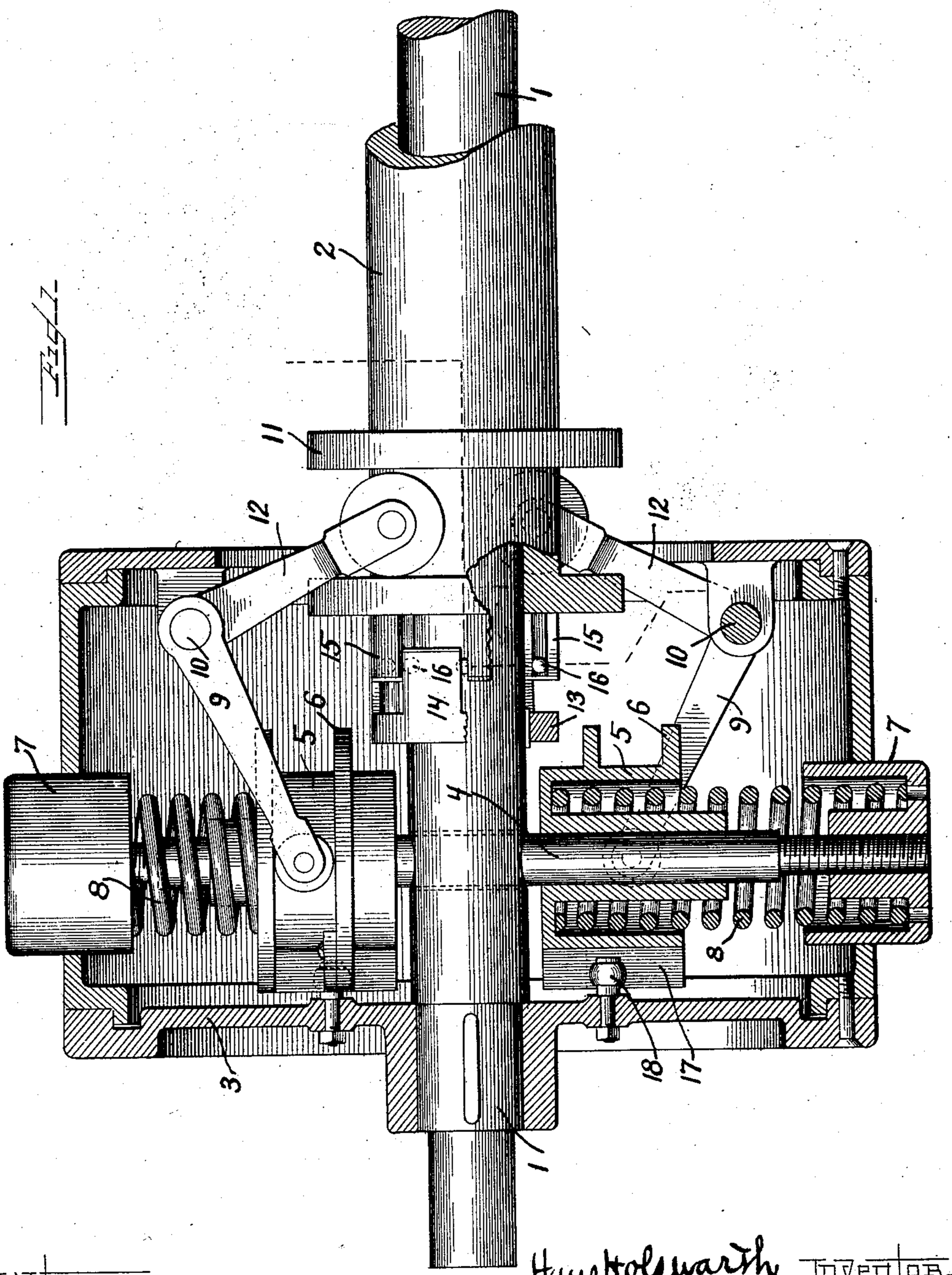
No. 754,563. PATENTED MAR. 15, 1904.

H. HOLZWARTH.

GOVERNOR FOR ENGINES.

APPLICATION FILED DEC. 10, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



Witnesses—
D. A. Rauberschmidt
M. S. Belden.

Hans Holzwarth Inventor—
by James W. See
Atty

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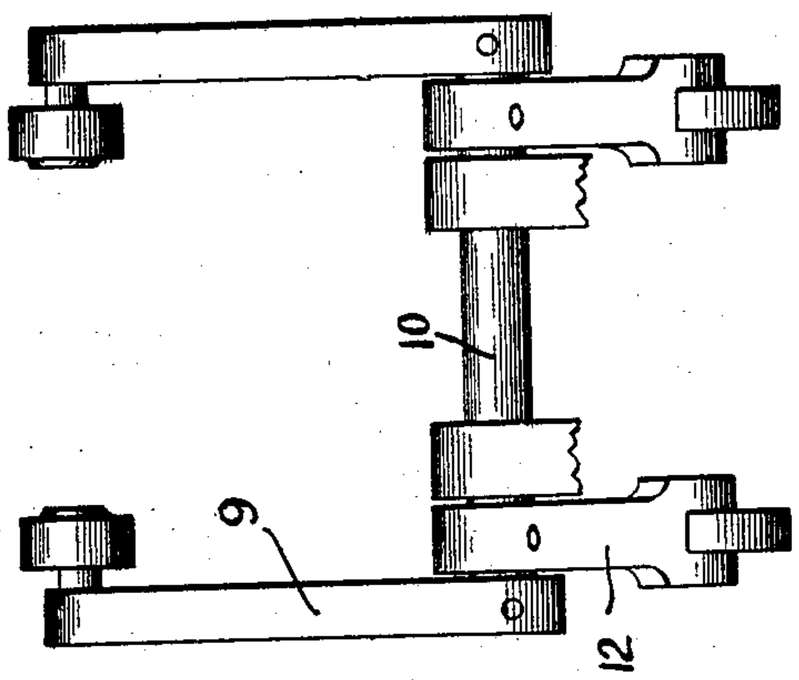

Fig. 3.

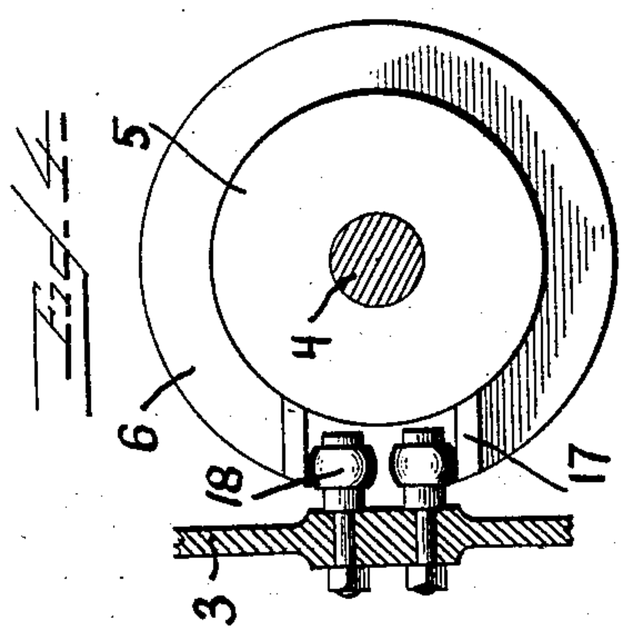

Fig. 4.

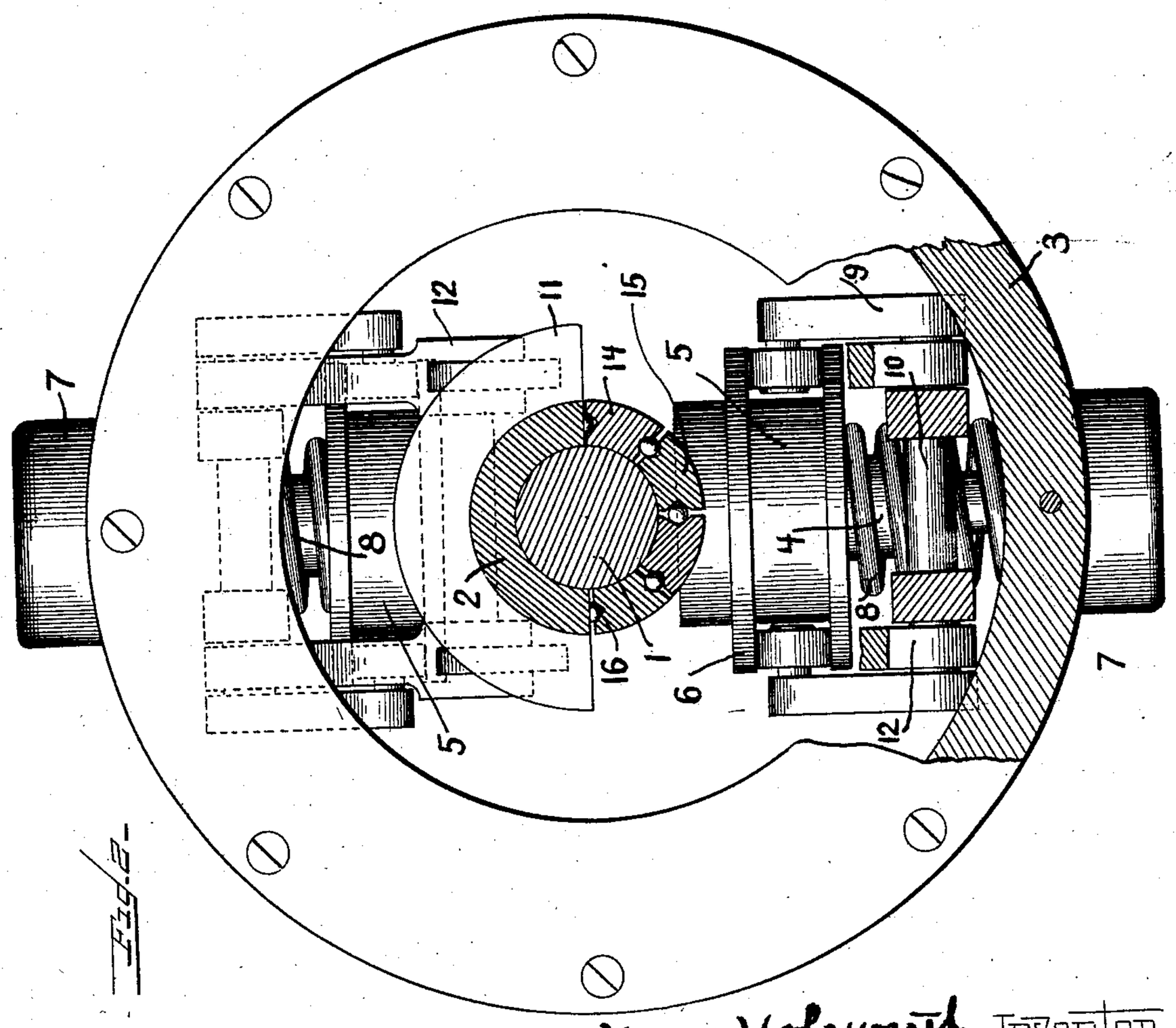

Fig. 2.

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No. 754,563. Patented March 15, 1904.

UNITED STATES PATENT OFFICE.

HANS HOLZWARTH, OF HAMILTON, OHIO, ASSIGNOR TO THE HOOVEN, OWENS, RENTSCHLER COMPANY, OF HAMILTON, OHIO.

GOVERNOR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 754,563, dated March 15, 1904.

Application filed December 10, 1903. Serial No. 184,635. (No model.)

To all whom it may concern:

Be it known that I, HANS HOLZWARTH, a citizen of Germany, residing in Hamilton, Butler county, Ohio, (post-office address, Hamilton, Ohio,) have invented certain new and useful Improvements in Governors for Engines, of which the following is a specification.

This invention, pertaining to improvements in governors for engines, while of general applicability has been contrived with special reference to the high-speed conditions found in connection with steam-turbines, conditions under which all governors of which I have practical knowledge have developed serious defects.

My improvements will be readily understood from the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a diametrical section of a governor embodying my improvements; Fig. 2, a face view of the same with parts broken away and parts appearing in section at right angles to the axis of the governor; Fig. 3, a plan of one pair of the transmitting-arms, and Fig. 4 a plan of one of the governor-weights.

In the drawings, 1 indicates the governor-spindle; 2, a sleeve reciprocating thereon under the influence of the governor and adapted to have connection with controlling-valve apparatus as usual; 3, a cylindrical casing fast upon the governor-spindle and containing the governor mechanism; 4, a cross-spindle intersecting the axis of the governor-spindle through which it passes preferably with considerable looseness, so as to be capable of endwise shifting; 5, the governor-weights sliding freely on the cross-spindle; 6, a pair of collars on each governor-weight; 7, caps screwing adjustably upon the outer ends of the cross-spindle and freely engaging apertures in the rim of the casing; 8, helical springs surrounding the cross-spindle and acting compressively between the governor-weights and the caps 7, these springs constituting the centripetal agents of the governor and opposing the centrifugal action of the weights; 9, a pair of arms pivoted to the casing and having their inner ends provided with rollers engaging the groove formed between the collars 6 of a governor-weight, there being a pair of these arms for each of the governor-weights; 10, the pivots of these arms, the same being mounted in lugs projecting inwardly from one end wall of the casing; 11, a pair of collars on sleeve 2; 12, a pair of arms for each pair of arms 9 and fast with them upon the pivots 10, the free ends of the arms 12 carrying rollers engaging the groove formed between the collars 11; 13, a collar fast on the governor-spindle between cross-spindle 4 and the inner end of sleeve 2; 14, prongs projecting outwardly from this collar along the governor-spindle toward the end of the sleeve, the side faces of these prongs being provided with grooves parallel with the governor-spindle; 15, similar prongs projecting inwardly from the inner end of sleeve 2 and lying between prongs 14; 16, balls disposed between the contiguous faces of alternating prongs 14 and 15 and lying in the grooves formed in the side faces of the prongs; 17, a guideway formed in each governor-weight parallel with the cross-spindle, and 18 rollers supported by an end wall of the casing and engaging these guide-grooves.

The general action of the governor is as usual, as will be obvious—that is to say, as the governor-weights move outwardly and inwardly the arms transmit adjusting motion endwise to sleeve 2, which motion is to be utilized in effecting the adjustment of valve apparatus.

A pair of arms 9, taken in conjunction with its fellow pair of arms 12, forms a skeleton bell-crank, one member of which straddles a governor weight, while the other member straddles the sleeve, the result being a symmetrical disposition of the mass in motion and a symmetrical transmission of the strains of adjustment. The tension of the springs may be adjusted by screwing the cap 7 inward or outward upon the cross-spindle. The balls between the prongs furnish a roller-bearing to meet the tangential thrusts involved in rotating the sleeve with the governor-spindle and permit the sleeve to move endwise in sensitive response to the influence of the governing forces. The grooves in the side faces of

the prongs stop short of the ends of the prongs to prevent the displacement of the balls, this stopping off of the grooves being preferably effected by thin end plates secured on the ends of the prongs.

The driving power for the governor parts is transmitted through the casing, one head of which is firmly keyed to the governor-spindle and both heads being firmly bolted and preferably doweled to the rim connecting the heads.

The cross-spindle 4 passes freely through the governor-spindle and preferably without any contact whatever with it, the cross-spindle and the parts carried by it being thus free to shift relative to the governor-spindle and adjust the center of gravity into coincidence with the geometrical center of the structure. The looseness of the cross-spindle where it passes through the governor-spindle need be only sufficient to insure against deleterious influence and to avoid the necessity for very accurate construction. In case this looseness is made excessive then the guiding arrangement formed by guides 17 and rolls 18 is to be recommended. Otherwise these guiding features may be omitted. In the construction illustrated each governor-weight is guided by a pair of rolls 18, each roll engaging a side wall of the guide-groove.

I claim as my invention—

1. In a governor, the combination, substantially as set forth, of a governor-spindle, a sleeve mounted to slide thereon, a casing fast on the governor-spindle and having apertures in its rim, a cross-spindle intersecting the governor-spindle, weights sliding on the cross-spindle, springs upon the cross-spindle for urging the weights inwardly, caps screwed upon the cross-spindle exterior to the springs and engaging the apertures in the rim of the casing, and lever connections between the weights and the sleeve.

2. In a governor, the combination, substantially as set forth, of a governor-spindle, a sleeve mounted to slide thereon, a casing fast on the governor-spindle, a cross-spindle intersecting and free for crosswise motion in the governor-spindle, weights sliding on the cross-spindle, springs urging the weights inwardly, caps screwed upon the cross-spindle exterior to the springs and engaging the rim of the casing, and lever connections between the weights and the sleeve.

3. In a governor, the combination, substantially as set forth, of a governor-spindle, a sleeve mounted to slide thereon, a casing fast on the governor-spindle, a cross-spindle intersecting and free for crosswise motion in the governor-spindle, weights sliding on the cross-spindle, springs urging the weights inwardly, caps screwed upon the cross-spindle exterior to the springs and engaging the rim of the casing, lever connections between the weights and the sleeve, and guide-rollers carried by the casing and coöperating with guideways on the weights.

4. In a governor, the combination, substantially as set forth, of a governer-spindle, a sleeve mounted to slide thereon, a casing fast on the governor-spindle, a cross-spindle intersecting the governor-spindle, weights sliding on the cross-spindle, springs urging the weights inwardly, caps screwed upon the cross-spindle exterior to the springs and engaging the rim of the casing, pivots carried by the casing at right angles to the axis of the governor-spindle, and bell-crank levers mounted on said pivots and straddling the weights and the sleeve and operatively engaging collars on the weights and sleeve.

5. In a governor, the combination, substantially as set forth, of a governor-spindle, a sleeve mounted to slide thereon, a casing fast on the governor-spindle, a cross-spindle intersecting the governor-spindle, weights sliding on the cross-spindle, springs urging the weights inwardly, caps screwed upon the cross-spindle exterior to the springs and engaging the rim of the casing, lever connections between the weights and the sleeve, cooperating prongs upon the sleeve and governor-spindle provided with grooves in their contiguous side faces, and balls disposed in said grooves.

6. In a governor, the combination, substantially as set forth, of a governor-spindle, a sleeve mounted to slide thereon, a casing-head fast on the governor-spindle, a rim secured to said head, an open head secured to the opposite face of said rim and free of the governor-spindle, a cross-spindle intersecting the governor-spindle, weights sliding on the cross-spindle, springs urging the weights inwardly, caps screwed upon the cross-spindle exterior to the springs and engaging the rim of the casing, and lever connections between the weights and the sleeve and working through the open head of the casing.

HANS HOLZWARTH.

Witnesses:
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