

(No Model.)

2 Sheets—Sheet 1.

W. DENNIS.
ENGINE GOVERNOR.

No. 435,923.

Patented Sept. 9, 1890.

Fig. 1.

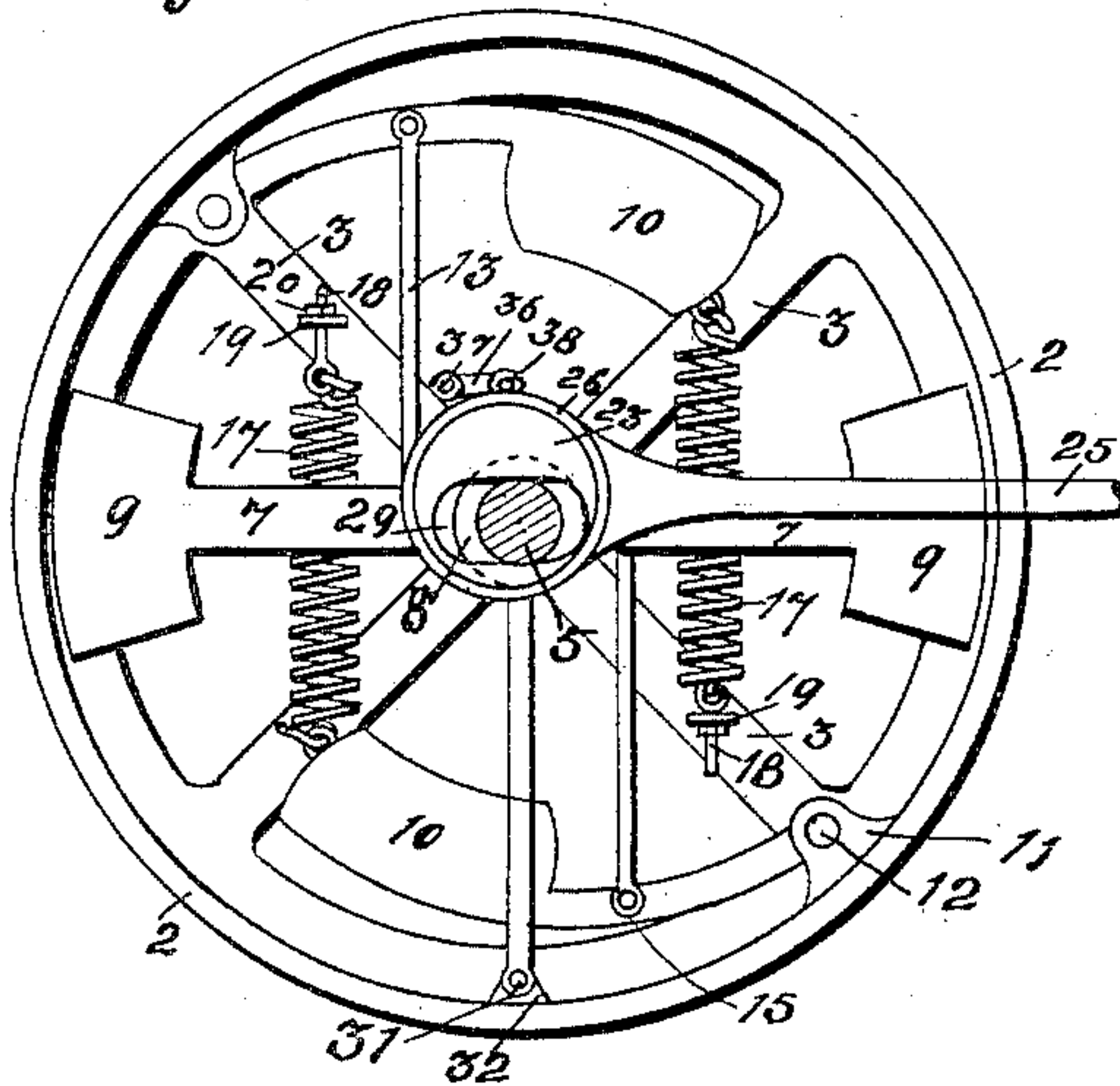


Fig. 2.

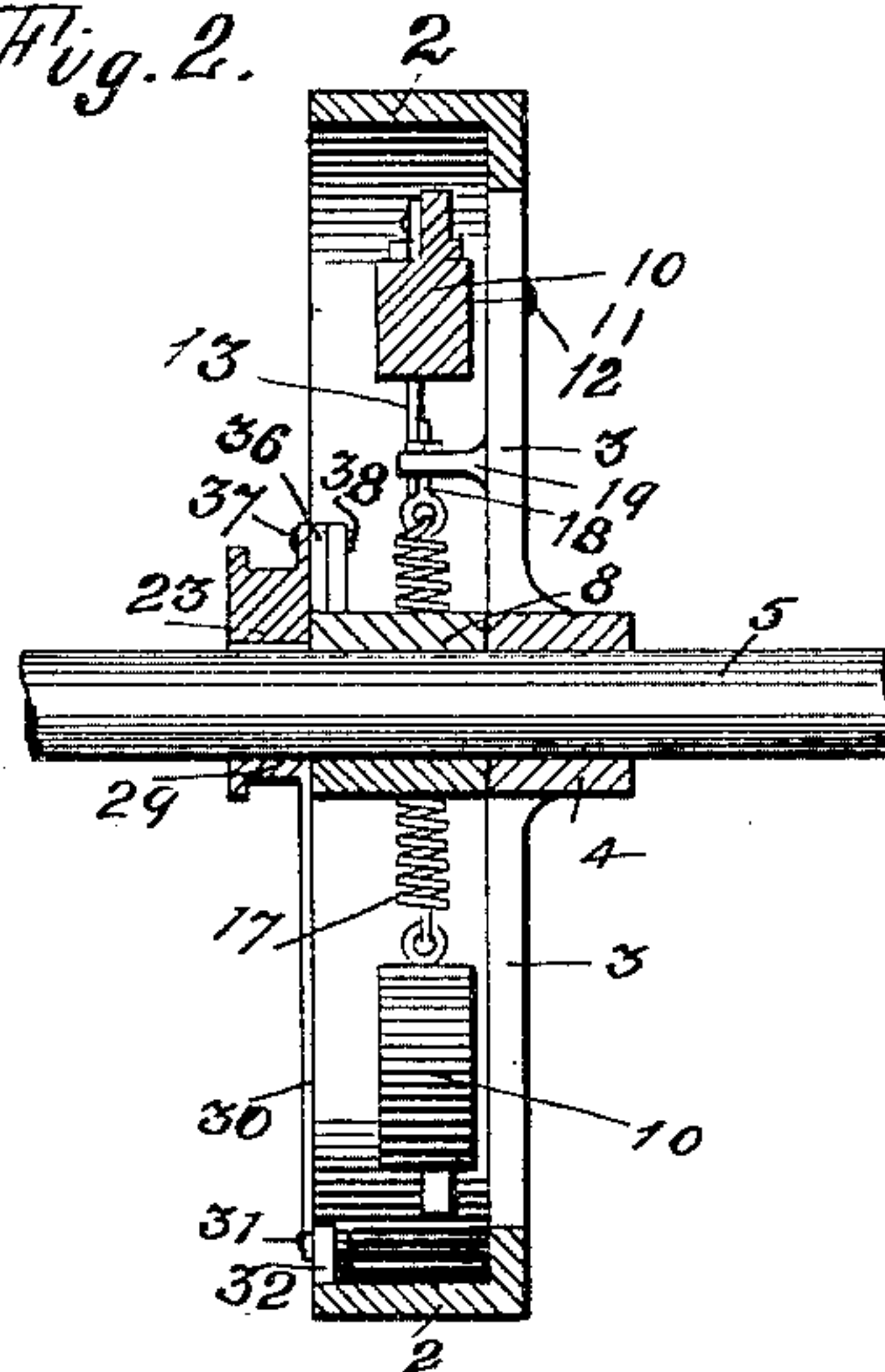


Fig. 3.

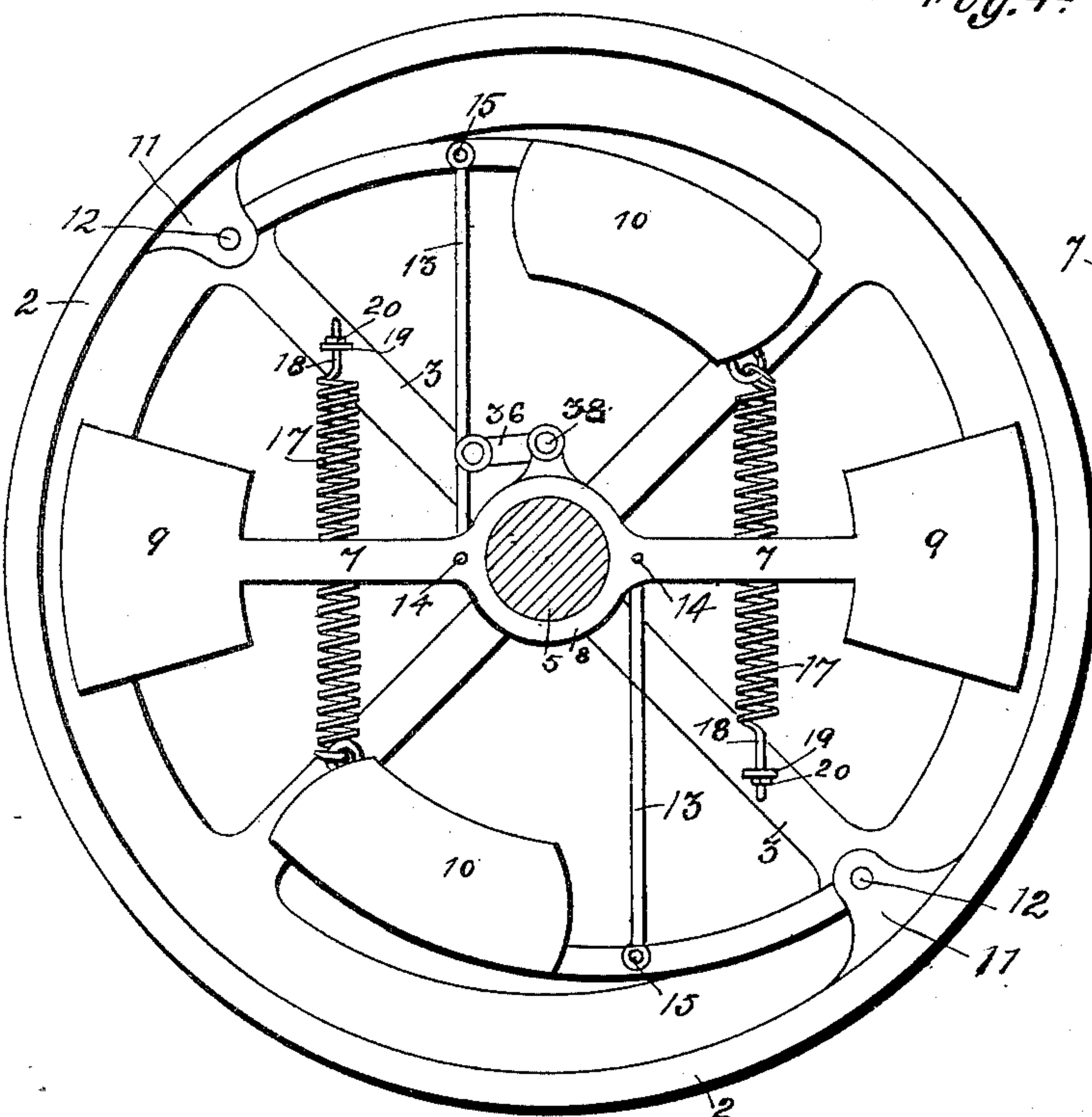
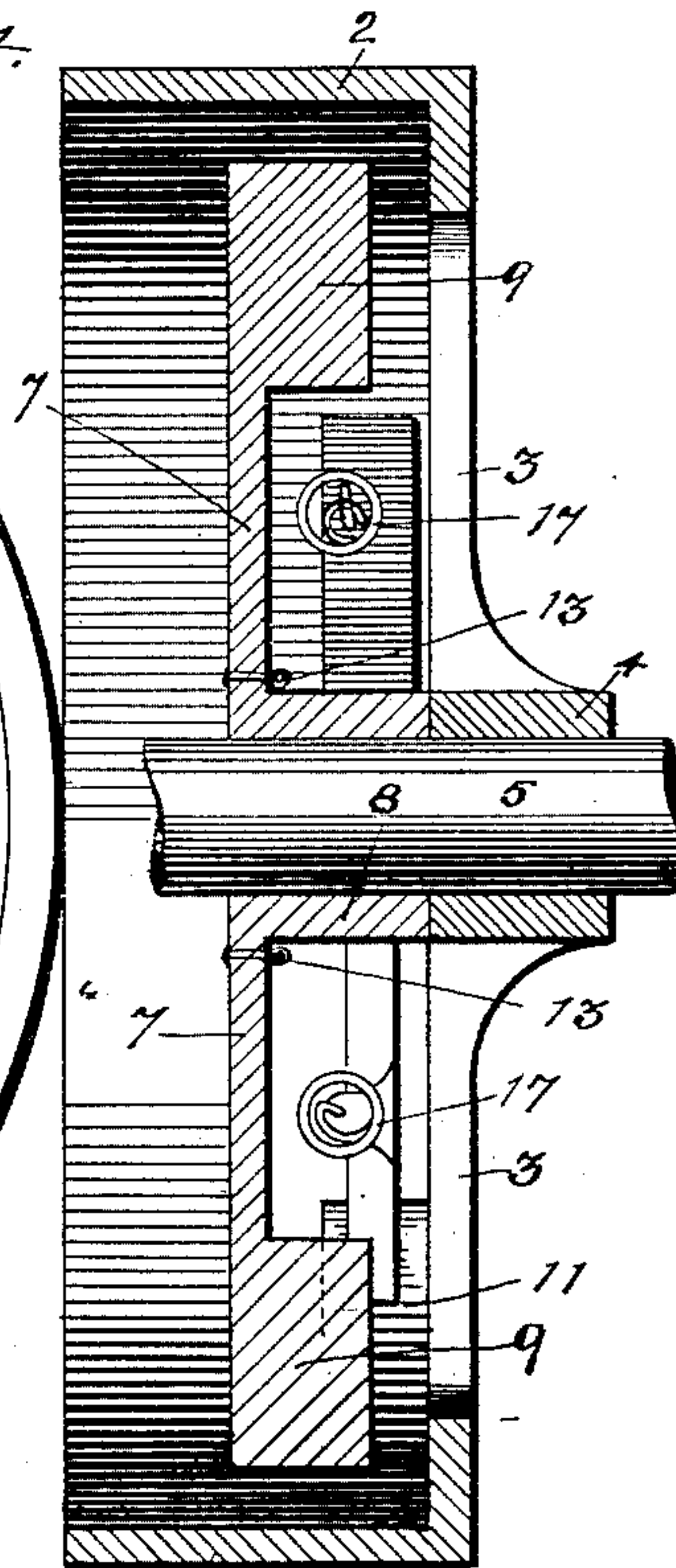


Fig. 4.



Witnesses.

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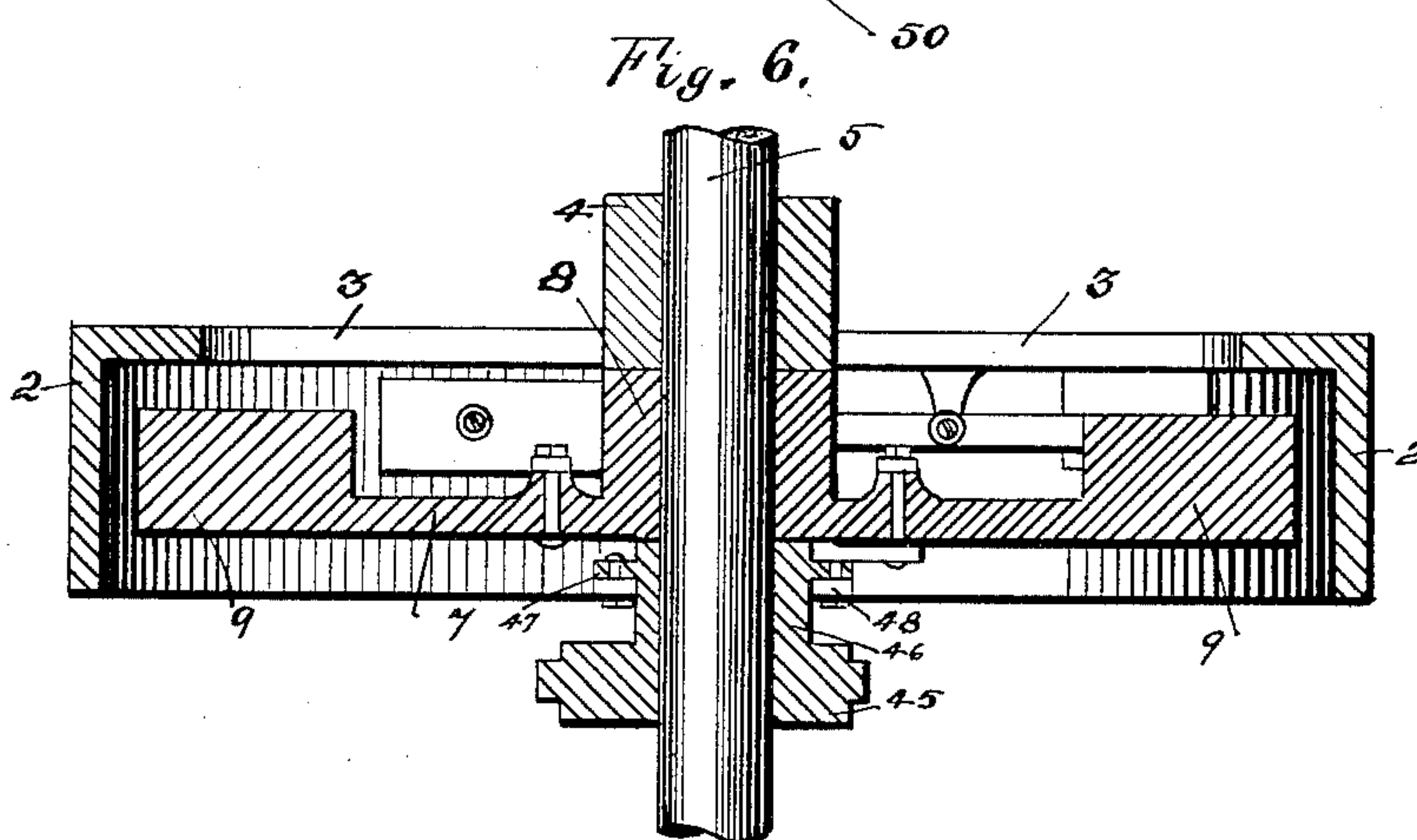
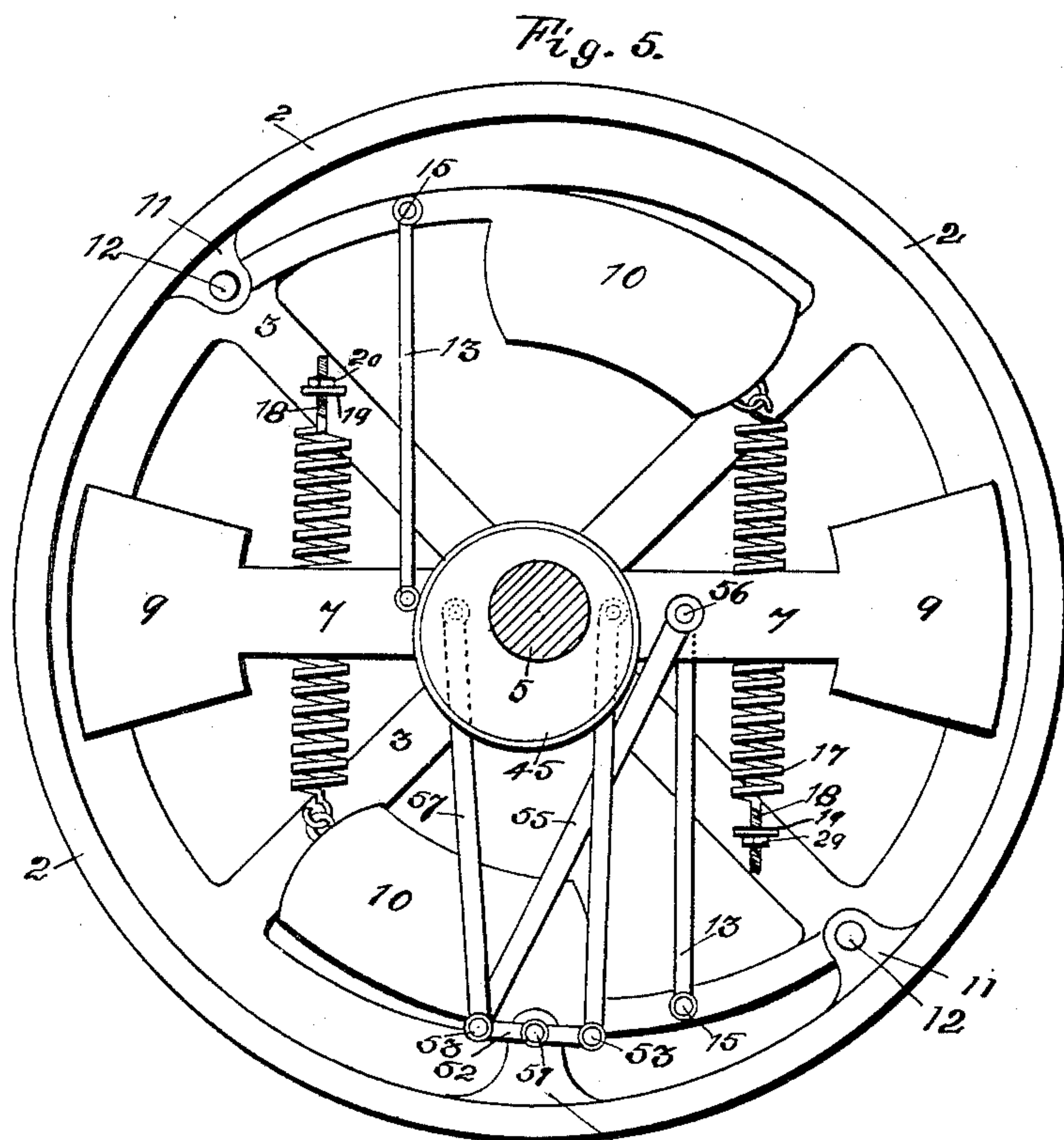
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2 Sheets—Sheet 2.

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UNITED STATES PATENT OFFICE.

WILBER DENNIS, OF MINNEAPOLIS, MINNESOTA.

ENGINE-GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 435,923, dated September 9, 1890.

Application filed February 14, 1890. Serial No. 340,499. (No model.)

To all whom it may concern:

Be it known that I, WILBER DENNIS, of Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain
5 new and useful Improvements in Engine-Governors, of which the following is a specification.

My invention relates to improvements in automatic governors for steam-engines, and
10 to that class of governors which by changing the position of the eccentric from which the motion of the valve or valves is derived cause the admission of steam to the cylinder of the engine to be cut off at different points in the
15 stroke. Governors of this general class have long been known. In one form of such governor the centrifugal force of weights revolving with the shaft is resisted by the extension of springs, which tend to pull the weights
20 inward. Said weights being pivoted at or near one end, can be moved radially on their pivotal points to and from the shaft. The centrifugal force of the weights being opposed to the force of the springs, and being depend-
25 ent upon the speed of the engine-shaft, there is a certain speed at which the two opposing forces are in equilibrium, any increase in speed causing an increase of centrifugal force and a corresponding outward movement
30 of the weights, while a decrease of speed causes a loss of centrifugal force when the springs pull the weights inward. By means of suitable connecting devices between the weights and eccentric the eccentric is moved
35 into a proper position to cut off the admission of steam at an earlier or later point in the stroke corresponding with the inward or outward movement of the weights as the speed is changed.

40 I use the same general arrangement in my invention, wherein the motion of the weights during the establishment of an equilibrium between the two opposing forces described is the ultimate means by which the eccentric
45 is adjusted and the speed of the engine controlled. A difficulty has been found in making such governors sufficiently quick in action without producing an overaction, whereby too great change in the adjustment of the
50 cut-off mechanism is produced. Owing to friction and inertia of the moving parts the

weights stay at an inward position until the speed is too fast, then move outward too far, owing to their momentum and increased centrifugal force due to increase of speed. This
55 movement causes the eccentric to assume a position whereby too early a cut-off is given, thus reducing the speed of the engine below the proper speed. Then the weights are forced inward too far. This causes too
60 late cut-off and the speed is increased again. These vibrations of speed continue and are greatly detrimental to the satisfactory workings of the engine and machinery which may be driven by it. Many different devices have
65 been tried to obviate this irregularity. My invention provides means for preventing these vibrations, and at the same time renders the governor much quicker in the adjustment of its parts to meet the sudden
70 changes in speed under sudden variations of load or steam-pressure, all of which is hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, forming a
75 part of this specification, Figure 1 is an elevation of the governing mechanism as applied to an eccentric to vary the amount of its eccentricity with eccentric and rod. Fig. 2 is a sectional view of Fig. 1 on line *x x* of Fig. 1. 80
Fig. 3 is an elevation showing the eccentric removed. Fig. 4 is a sectional view of Fig. 3 on line *y y*. Fig. 5 is an elevation showing the governor applied to an eccentric to vary the angular advance of the same. Fig. 6 is a
85 sectional view of Fig. 5 on line *z z*.

It should be understood that there is a crank, piston, cylinder, and the other essential parts of a steam-engine, and that the valves and other parts are so arranged and proportioned
90 that the point in each stroke of the piston at which admission of steam to the cylinder is stopped or cut off may be varied within wide limits by varying the amount of eccentricity of the eccentric, as shown in Figs. 1 and
95 2, or by a partial rotation of the eccentric on the shaft, thereby changing its angular advance, as shown in Figs. 5 and 6.

In the drawings, 2 represents a case or rim having the arms 3 and the hub 4 rigidly se-
100 cured to the shaft 5 in any suitable manner. The hub 4 is preferably set off, as shown, to

allow room for the proper reception of certain parts of the governor within the rim 2. 5 represents the shaft of the engine whose speed it is desired to regulate by this governor.

5 7 is an arm, preferably formed with a hub 8 in its center, and with its ends 9 enlarged, so as to possess considerable weight. The hub 8 is adapted to rotate upon the shaft 5, so as to allow free movement of the arm 7 upon
10 said shaft.

10 represents suitable weights pivoted within the rim 2 to lugs 11 by means of the pins 12. These pins passing through one end of each weight allow of the movement of the
15 loose end of each toward or away from the shaft 5.

Connecting the weights 10 with the arm 7 are the connecting-rods 13, one end of each secured to the arm 7 by means of the pin 14, 20 their opposite ends being pivotally connected to the weights 10 by means of the pins 15; also secured to the weights 10 are the springs 17, adjustably secured at their opposite ends by tension-bolts 18, projecting through lugs
25 19, formed upon arms of the wheel 2 and held in place by means of nuts 20. The tension of the springs may thereby be increased or diminished, requiring a greater or less force to throw the weights 10 outward.

30 In Figs. 1 and 2, 23 represents a shifting-eccentric carrying the eccentric valve-rod 25 by means of the strap or ring 26, which as the eccentric revolves operates the valve by means of the eccentric-rod. The eccentric 23
35 is provided with the slotted opening 29, permitting it to be shifted across the shaft 5 upon the arm 30, pivotally secured to the rim 2 by means of the bolt 31 passing through said arm and the lug 32 of the rim 2. The shifting of the eccentric, throwing its center farther from or nearer to the center of the shaft
40 5, increases or diminishes its eccentricity. When the eccentric is so situated on the shaft 5 as to be near one end of the slot 29, the rotation of the shaft does not move the valve far enough to admit steam to the cylinder; but when shifted so that the shaft 5 is near the other end of the curved slot 23 full steam is admitted by the valve. When the eccentric
45 is in an intermediate position, it will move the valve properly to cut off the admission of steam to the cylinder at an earlier point in the stroke. A lug 35 formed upon the eccentric is connected with the arm 7 by means of
50 link 36 and pins 37 and 38. A partial rotation of the arm 7 around the shaft 5 will cause the eccentric 23 to be moved across the shaft by means of the link 36 and its connections, as described. Each position of the arm 7 coincides with a certain position of the eccentric 23. In practical operation the connection between the arm 7 and eccentric 23 is
55 so made that the partial rotation of the arm 7 around the shaft 5 in the same direction in which the shaft revolves will move the eccentric 23 so that it will have a greater throw or amount of eccentricity, thereby operating the

valve so as to cause a later point of cut-off and a greater amount of steam to enter the cylinder during each stroke. An opposite
70 movement of the arm 7 moves the eccentric so as to cause the valve to cut off steam from the cylinder at a point earlier in the stroke, causing a less amount of steam to enter the cylinder during each stroke. 75

The operation of this governor is as follows: Steam being admitted to the cylinder the engine starts, and as its speed increases the centrifugal force of the weights 10 causes them to move out, drawing arm 7 around the
80 shaft, causing the valve to cut off shorter by means of the connecting devices previously described. When the speed has increased to that point where the centripetal force furnished by the tension of the springs 17 equals
85 the centrifugal force of the weights 10, the increase of speed of the engine will cease and the speed of the engine remain constant until a change of load or steam-pressure occurs. Underslight variations, either of load or steam-
90 pressure, the action of the weights 10 and spring 17 is sufficient to govern the engine, the inertia of arm 7 providing means to prevent any vibrations which might otherwise ensue from excessive valve-friction or other
95 disturbing causes. When a heavy load is suddenly put upon the engine, the speed is lessened until the governor shall have adjusted the position of the eccentric to admit the proper amount of steam to carry the increased
100 load at the requisite speed. Ordinary governors of this class delay action until the centrifugal weights lose part of their force sufficient for force of the springs to overcome the inertia of the weights, and also the frictional
105 resistance of the governor before they can adjust themselves. This often requires sufficient time to allow of great variation of speed. With my governor any sudden decrease of speed is met by the action of the arm 7, which
110 will by its momentum continue to revolve without a decrease of speed for a short space of time, and during this time will have moved so that its position with relation to the remainder of the governor is ahead of that
115 which it occupied when the speed was decreased. This movement of the arm 7, in combination with the action of the springs 17 on the weights 10, results in such a quick adjustment of the supply of steam to the engine-
120 cylinder that little or practically no decrease of speed occurs. The same quickness of adjustment occurs when the opposite conditions are presented. The whole or greater part of the load being instantly taken off the
125 engine its speed will be immediately accelerated. The arm 7 not partaking of this immediate acceleration because of its inertia, drags behind the rest of the governor and shaft, and through its connections acts with the in-
130 creased centrifugal force of the weights 10 to adjust the eccentric so that a less amount of steam may enter the cylinder corresponding to the decrease of load on the engine.

Figs. 5 and 6 show the arrangement of this governor as applicable to an eccentric for varying its angular advance by partially rotating it around the shaft, whereby the position of the cut-off valve or valves operated by the eccentric is so changed with reference to the position of other valve or valves as to cause the admission of steam to the cylinder of the engine to be cut off at different points in the stroke, such point of cut-off being dependent upon the angular advance of the eccentric which is controlled by the governor. This application of the governor requires but small changes from the form in which it has been previously, as described in the specification.

The case 2, arm 7, weights 10, springs 17, and their connections, forming the governing mechanism, are identical with those hereinbefore described, with a cut-off eccentric having a variable amount of eccentricity.

In Figs. 5 and 6, 45 is the eccentric, formed upon a sleeve or collar 46, bored to fit the shaft 5, so as to allow of free motion thereon. Sleeve 46 has upon it projecting lugs 47 and 48, each with a pin 49 projecting therefrom. Upon the inner circumference of the rim of the governor case or rim 2 is a projecting lug 50, upon which is pivoted, by means of the pivot 51, a rocker-arm or lever 52. This lever is provided with two pivot-bolts 53, one near each end and equally distant from the central pivot 51. The rod 55 connects the rocker-arm 52 with the arm 7 by means of the bolt 53 in the rocker-arm 52 and 56 in arm 7, thereby communicating any movement of arm 7 to rocker-arm 52, from which rods 57, connected with the pins 53 on the arm 52 at one end, and with pins 49 upon the sleeve 46 at their other ends, transform any vibratory motion of the rocker-arm into a partial rotation of the sleeve 46 and eccentric 45, so that the action of the governor varies the angular advance of the eccentric, thereby varying the point of cut-off, as previously described, centripetal force, inertia, momentum, and centrifugal force acting together to produce the adjustments in the same manner as in the former construction.

I claim as my invention—

1. In an engine-governor, the combination,

with a wheel adapted to carry a part of the governing mechanism and rigidly secured to the shaft whose speed is to be governed, centrifugal weights pivotally secured to said wheel, and tension-springs adjustably secured to said weights and to said wheel, of a weighted arm loosely journaled upon the same shaft and pivotally connected to said centrifugal weights by inelastic connections, and suitable connections from said weighted arm, whereby an eccentric may be shifted across or partially rotated around said shaft, for the purposes specified.

2. In an engine-governor, the combination, with a wheel adapted to carry a part of the governing mechanism and rigidly secured to the shaft whose speed is to be governed, centrifugal weights pivotally secured to said wheel, tension-springs adjustably secured to said weights and to said wheel, and an eccentric adapted to be rotated about said shaft, of a weighted arm loosely journaled upon said shaft and pivotally connected to said centrifugal weights, a rocker-arm pivotally secured at its center to said wheel, a connecting-rod pivotally connecting said weighted arm with one end of said rocker-arm, and connecting-rods pivotally connecting said rocker-arm with said eccentric, substantially as described, and for the purpose specified.

3. The combination, with a wheel adapted to carry a part of the governing mechanism and rigidly secured to the shaft whose speed is to be governed, centrifugal weights pivotally secured to said wheel, and tension-springs adjustably secured to said weights and to said wheel, of a weighted arm loosely journaled upon said shaft and pivotally connected to said weights, and a slotted eccentric pivotally connected to the rim of said wheel and to said weighted arm and adapted to be shifted across or partially rotated around said shaft, for the purpose specified.

In testimony whereof I have hereunto set my hand this 8th day of February, 1890.

WILBER DENNIS.

In presence of:

A. C. PAUL,

A. M. GASKILL.