No. 785,126. PATENTED MAR. 21, 1905.

W. N. SPRINGER.

VARIABLE SPEED GOVERNOR.

APPLICATION FILED FEB. 27, 1902.

2 SHEETS—SHEET 1.

Fig. 1.
on line 1-1

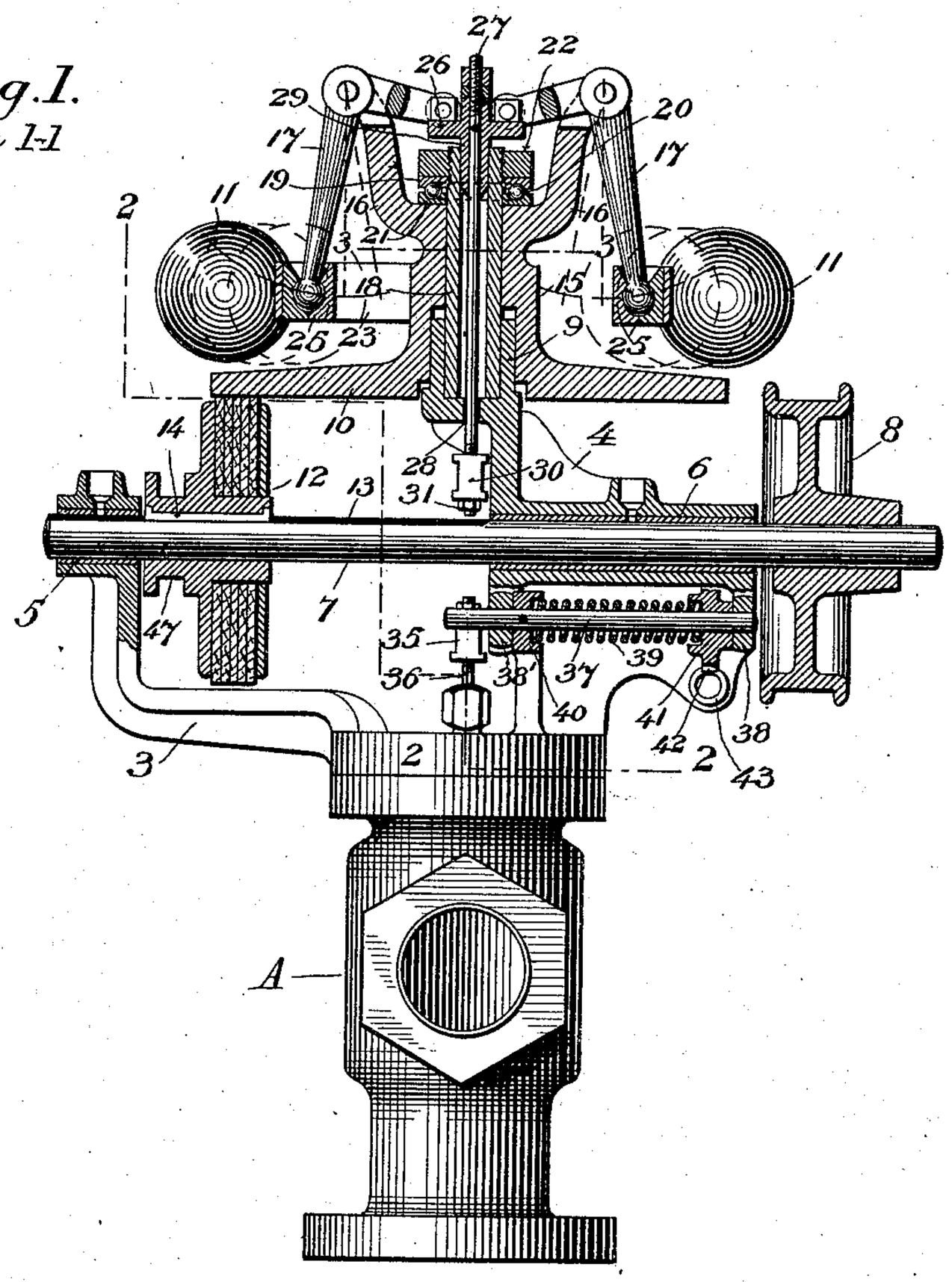
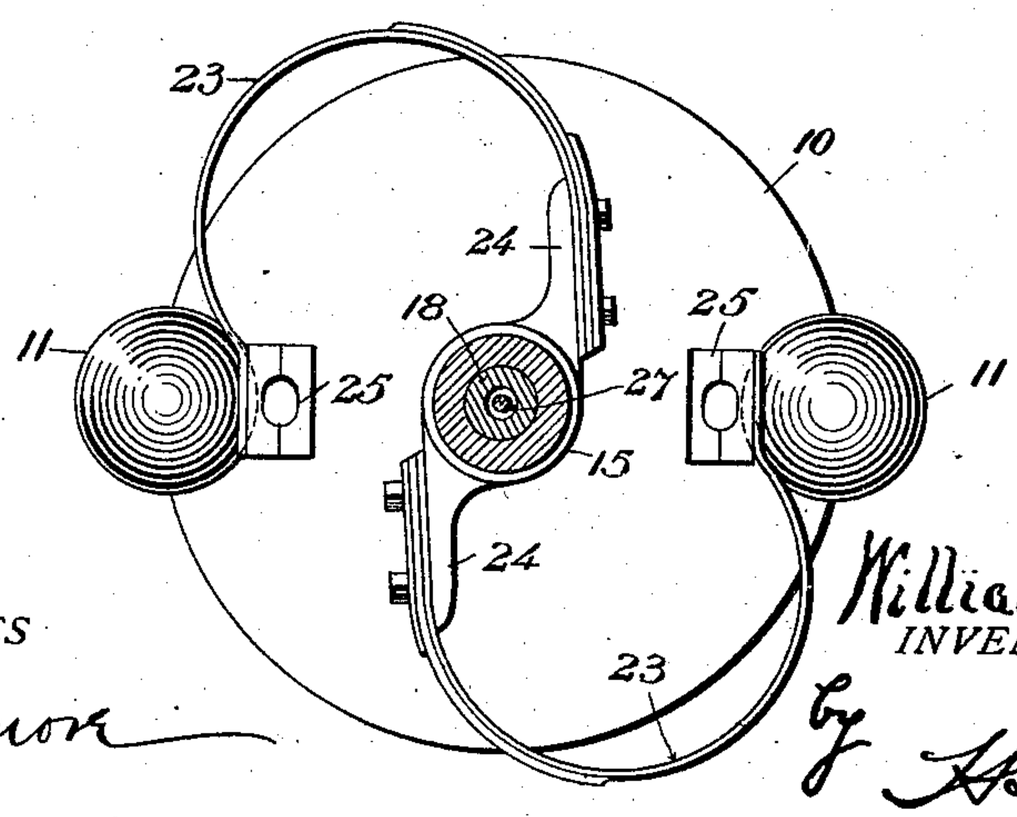


Fig. 3.
on line 3-3.



WITNESSES

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2 SHEETS—SHEET 2.

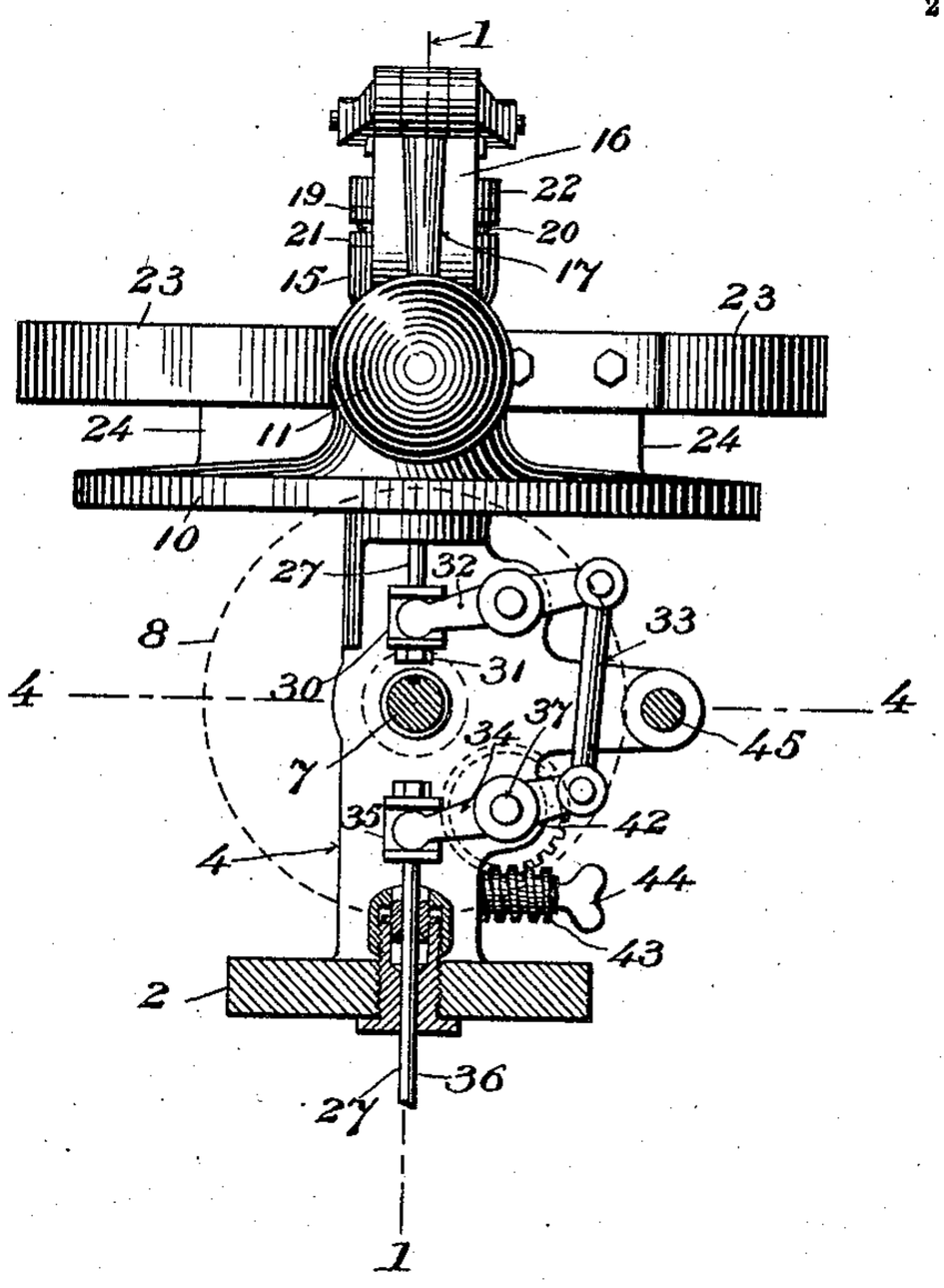

Fig. 2.
on line 2-2.

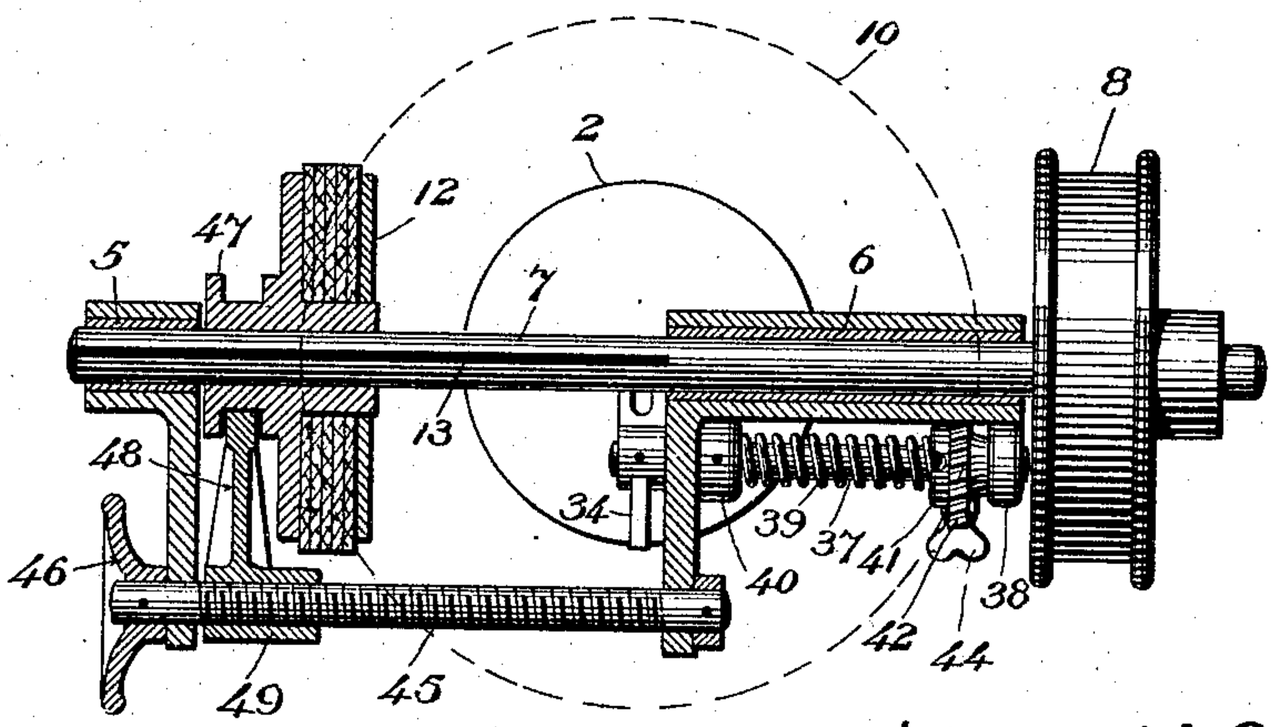

Fig. 4.
on line 4-4.

WITNESSES

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No. 785,126. Patented March 21, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM N. SPRINGER, OF PEORIA, ILLINOIS, ASSIGNOR TO AVERY MANUFACTURING COMPANY, OF PEORIA, ILLINOIS.

VARIABLE-SPEED GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 785,126, dated March 21, 1905.

Application filed February 27, 1902. Serial No. 95,982.

To all whom it may concern:

Be it known that I, WILLIAM N. SPRINGER, a citizen of the United States, residing at Peoria, in the county of Peoria and State of Illinois, have invented certain new and useful Improvements in Variable-Speed Governors, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to speed-governing devices for steam-engines.

With certain types of engines—for instance, those used in connection with road or traction locomotives—it is desirable to run the engine at very different speeds, sometimes fast and sometimes slowly.

My invention has for its object to produce a governor which may be readily and accurately adjusted to so control the steam as to allow the engine to run at different speeds, accordingly as the governor may be set.

In the accompanying drawings I have shown the preferred embodiment of my invention, it being applied to a centrifugal governor which is well adapted for use in connection with a traction-engine.

Figure 1 is a central sectional view of a governor device embodying my invention, the section being taken on the line 1 1 of Fig. 2. Fig. 2 is an end elevation of the governor device, parts being indicated in section, taken on the line 2 2. Fig. 3 is a horizontal section taken on the line 3 3 of Fig. 1. Fig. 4 is a horizontal sectional view taken on the line 4 4 of Fig 2.

In the drawings, A represents the valve-casing upon which is mounted the supporting stand or framework for the governor device. This stand comprises the base-plate 2 and the brackets 3 and 4. In these brackets are arranged the bearings 5 and 6 for the main driving-shaft 7 of the governor. This shaft is belted to a suitable shaft of the engine, being provided at one end with a belt-pulley 8.

The bracket 4 is provided with a vertically-disposed bearing 9, which is preferably arranged directly above the valve-seat in the casing A. Upon this bearing there is mounted a disk 10, which is free to turn thereon and which is connected with the governor-balls 11 in a manner which will presently be described. The disk 10 is driven from the shaft 7 by a friction wheel or pulley 12, which is held in frictional engagement with the face of the disk. The shaft 7 is longitudinally grooved, as indicated at 13, and the friction-wheel 12 is connected with the shaft by a spline 14, seated in the groove 13. The friction-disk is provided with a hub 15, from the upper portion of which extend the bracket-arms 16, in the upper ends of which are mounted the bell-crank levers 17. The hub of the friction-wheel is hollow, its lower portion being chambered to fit the bearing 9. The upper portion of the hub is fitted to a sleeve or tube 18, seated at its lower end in a recess formed in the bearing 9 and extending thence upward through the hub and beyond the upper end thereof. The upper end of the sleeve is exteriorly screw-threaded to receive the nut 19, which is provided on its end face with a race or groove to receive the anti-friction bearing-balls 20. The balls 20 run in a grooved bearing-plate 21, which is secured to the upper face of the hub 15 of the friction-disk.

22 represents a set-nut engaging with the screw-threaded end of the sleeve 18 and arranged to bear against the nut 19.

It will be seen that the arrangement described provides a vertical bearing of considerable length for the friction-disk 10 and that the parts of the bearing are so constructed that the disk, and with it the sleeve 18, may be easily removed without changing the adjustment of the horizontal bearing 19, 20, and 21. These adjustable parts bearing downward upon the hub or sleeve 15 of the upper friction-wheel are utilized as one of the agencies for normally maintaining contact between the gearing.

The balls 11 of the governor are supported at the outer free ends of the springs 23. These springs are horizontally-disposed leaf or plate springs of semicircular form, being connected at their outer ends to the balls and at their inner ends to the arms or brackets 24, extending outward from the hub 15 of the friction-

disk. My invention is not limited to this particular form of governor-spring, and any other suitable spring may be employed in lieu of that shown. The outer ends of the bell-crank levers 17 are connected with the governor-balls by ball-and-socket joints 25, while the inner ends of the levers are pivotally connected with a collar 26, screwed to the upper end of the part 27 of the valve-stem. This valve-stem extends downward through the tube or sleeve 18, being guided in its movements by the bearing 28 therefor in the bracket 4 and at its upper end by a bearing-sleeve 29, which is preferably connected with the collar 26 and extends sufficiently far into the central opening of the sleeve 18 to maintain permanent bearing, notwithstanding the movements which may be imparted to the valve-rod or stem.

In order to have the elements of the frictional gearing, the wheels 10 and 12, normally maintained in contact, I so construct the parts which support the wheel 10 that it shall normally have a tendency to move downward, the journal and the bearing parts which support it having clearance for this purpose, as will be seen, and then I add to and support upon the wheel 10 parts which by their gravity tend to press it downward, and thus normally maintain the frictional contact of the driving-gear.

It is very desirable that the shaft 7 should extend across the face of the disk 10 in order that its bearings 5 and 6 may be widely separated and upon either side of the friction-wheel 12, which is mounted thereon. When the shaft 7 is thus mounted, it is necessary that it be carried across the face of the disk diametrically. It is also very desirable that the valve-stem should be arranged so as to be directly in line with the movements of the valve and that the governor should be placed directly over and as close as possible to the valve-chamber A. It follows that when the parts are thus arranged—that is, with the driving-shaft extending diametrically across the face of the disk 10—the axes of these two parts—the driving-shaft and the valve-stem—intersect, and provision must therefore be made for carrying the valve-stem past the shaft in such manner that each of these parts shall be free to operate without interfering with the other. I make provision for thus carrying the valve-stem past the driving-shaft by forming the valve-stem in two parts, which are united by a train of connecting mechanism extending past the driving-shaft on one side and which mechanism I will now describe.

30 indicates a connecting-block secured to the lower end of the upper section of the valve-stem. It is preferably secured to the valve-stem by a nut 31 in order that it may be easily disconnected.

32 is a lever pivoted to the bracket 4 and engaging with the connecting-piece 30. This lever is connected by a link 33 with a similar lever 34, also mounted in the bracket 4 and which in turn engages with a connecting-block 35, secured to the upper end of the lower section 36 of the valve-stem. I prefer that the levers 32 and 34 should be of the first order and that the opposite arms of each lever should be of equal length, so that the movements imparted to the two portions 27 and 36 of the valve-stem should be the same in extent and direction. I connect with the valve-stem a spring and combine with such spring suitable adjusting devices, whereby its tension may be regulated.

37 indicates a rod mounted in bearings 38 38′ in the bracket 4. The lever 34 is fastened to this rod by a pin or otherwise, so that the rod partakes of the rocking movements of the lever. Surrounding the rod is a torsion coiled spring 39, one end of which is secured to the rod by the collar 40, while its other end is connected with a collar 41, loosely mounted upon the shaft and preferably resting against the inner face of the bearing 38. The loose collar 41 is provided with a worm-wheel 42, with which engages a worm 43, suitably supported in the bracket 4. The worm is formed with a finger-piece 44 or with other means by which it may be manipulated in order to rotate the loose collar 41. The worm 43 serves both to hold the loose collar against free rotation upon the shaft 37 and as part of the adjusting means for varying the tension of the spring 39. This spring and the means for varing its tension, it will be seen, have peculiar relation with the friction-gearing. The energy of the spring is so exerted as to draw downward on the valve-rod 28 and through that and the parts connected thereto to draw downward upon the frictional gear-wheel 10. The spring and its connecting devices thus constitute a means which act normally to maintain contact between the elements of the friction-gear.

I am aware of the fact that springs have been heretofore used in governors employing bevel positive-toothed gears; but in such cases the two elements of the toothed gearing are always fixed in position in relation to each other and necessarily must be fixed, as is well known, with respect to such gearing in order to maintain the proper positions of their working pitch-lines. I believe myself to be the first to employ in a steam-governor a frictional gearing having a relatively large horizontal driven disk or wheel free to move vertically and a relatively small horizontally-adjustable driving friction-pinion with the valve-rod passing vertically through the horizontal disk, in combination with means, such as a spring or the like, having a normal tendency to hold or assist in holding the horizontal disk down upon the adjustable driving-pinion.

As has been intimated, it is often of advantage to be able to suddenly very much reduce

the speed of the engine or to greatly increase its speed, according as the work to be done by the engine may demand, and I effect this change by directly controlling the speed of the governor, and this I do by adjusting the friction-wheel 12 toward or from the axis of rotation of the friction-disk 10. It will be understood that when the friction-wheel 12 is moved toward the center of the disk 10 the governor will begin to cut off steam when the engine is running at a lower rate of speed than when the parts are in the position indicated in Fig. 1 of the drawings, where the engagement of the wheel is with the outer portion of the disk.

The friction-wheel 12 is provided with a hub 47, with which engages a shifting arm 48. This arm is provided with a nut 49, which is mounted upon and engages with a screw-threaded shaft 45, mounted in suitable bearings in the governor frame or stand. The screw-shaft is provided with means whereby it may be rotated, such as the hand-wheel 46.

Among the advantages incident to a governor of a construction which I have described the following may be noted. The arrangement of the parts is exceedingly compact, and the various shafts and moving parts are provided with widely-separating bearings, thus giving rigidity to the construction as a whole and to the several moving parts thereof. By mounting the friction-disk as described I am enabled to remove it and the governor-balls easily and without disturbing any of the adjustments of the parts, it being only necessary to disconnect the valve-stem by removing the nut 31 and the block 30, after which the disk 10 and associated parts may be entirely removed. It will be observed that the bearing, which is composed of the parts 19, 20, and 21, is horizontally disposed and is parallel with the friction-face of the disk 10. It thus operates to cause the disk to run in a true plane and very materially lessens the wear upon the vertical bearing of the disk and of the centrifugally-operated weights and the other parts which are associated therewith.

Other advantages incident to my invention have been pointed out in connection with the description of the parts.

What I claim is—

1. In a governor, the combination of the stationary supporting-frame, the centrifugally-operated weights, the rotating support for such weights, a bearing in the frame upon which the support is loosely and removably mounted, and connections between the weights and the valve comprising a detachable coupling arranged to permit the said connection to be severed and leave the support free to be removed from its bearing in the frame, substantially as set forth.

2. In a governor, the combination of the stationary supporting-frame, the governor-weights, the support for the weights, a bearing in the frame for such support concentric with the axis of rotation of the weights, and another bearing for the support arranged in a plane at right angles to the first-mentioned bearing, comprising two members one carried by the support for the weights and the other by the supporting-frame, one of such members being adjustable relative to the other, substantially as set forth.

3. In a governor, the combination of a stationary supporting-frame, the governor-weights, a support for the weights, a vertical bearing in the frame for such support concentric with the axis of rotation thereof, and a horizontal bearing for the support arranged above the same, whereby the said horizontal bearing serves to cause the support for the weights to run in a true plane, but does not operate to sustain the support, substantially as set forth.

4. In a governor, the combination of the stationary supporting-frame having a vertically-disposed bearing, the governor-weights, the support for the weights surrounding the said bearing and arranged to rotate about the same, and a horizontally-disposed bearing for the support having one member carried by the hub of the support for the weights, and the other member carried by the vertical bearing of the stationary frame, substantially as set forth.

5. In a governor, the combination with a stationary supporting-frame, a rotary friction-disk, the governor-weights connected with the disk, a bearing for the disk concentric with its axis of rotation, another bearing for the disk parallel with its friction-face, and means for driving the friction-disk, substantially as set forth.

6. In a governor, the combination of a stationary frame, the governor-weights, a rotary carrier for the weights, a bearing for the said carrier concentric with its axis of rotation, from which bearing the carrier is freely removable, another bearing for the carrier disposed in a plane at right angles to its axis of rotation, the last said bearing being removable with the carrier, and means for rotating the carrier, substantially as set forth.

7. In a governor, the combination of a supporting-frame, the governor-weights, a carrier for the weights mounted in vertically-disposed bearings in the frame, a horizontally-disposed vertically-adjustable bearing for the carrier, and means for driving the carrier, substantially as set forth.

8. In a governor, the combination with a supporting-frame, of a friction-disk having a horizontal bearing-face, and mounted in vertically-disposed bearings in the frame, the centrifugally-operated weights connected with the said disk, a horizontally-disposed bearing for the disk, it being removable from the frame

along with the disk, and a friction driving-wheel for rotating the disk, substantially as set forth.

9. In a governor, the combination of a supporting-frame having a bearing 9, the governor-weights, a rotary carrier for the weights mounted on the said bearing, another bearing for the carrier arranged in a plane at right angles to the axis of rotation of the carrier, and a support for the last-named bearing loosely supported in the frame, substantially as set forth.

10. In a governor, the combination of the governor-weights, a rotary carrier therefor having a hub, a stationary bearing for the carrier extending through the hub, and a second bearing arranged in a plane at right angles to the axis of rotation of the carrier, substantially as set forth.

11. The combination of a supporting-frame provided with a vertically-disposed chambered bearing 9, a friction-disk mounted upon the bearing and provided with a hub 15, the weights connected with the hub of the friction-disk, a tube or sleeve 18 mounted in the chambered portion of the bearing 9 and extending through the hub of the disk, a horizontally-disposed bearing for the disk arranged at the upper end of the tube or sleeve 18, and the friction-wheel for driving the disk, substantially as set forth.

12. In a governor, the combination of the weights, a rotary carrier therefor, a driving-shaft extending diametrically across the face of the carrier, gearing between the driving-shaft and the carrier, and valve connections operated by the weights and offset about the shaft and extending in line with the axis of rotation of the carrier on either side of the driving-shaft, substantially as set forth.

13. In a governor, the combination of the weights, a rotary carrier therefor, a driving-shaft extending diametrically across the face of the carrier, gearing between the driving-shaft and the carrier, a valve stem or rod operated by the governor-weights, made in two parts which are arranged on opposite sides of the driving-shaft, and connections between the two parts of the valve stem or rod extending past the driving-shaft, substantially as set forth.

14. In a governor, the combination of the weights, a carrier therefor, a driving-shaft extending across the face of the carrier, gearing between the driving-shaft and the carrier, a valve-rod operated by the governor-weights and made in two parts situated upon opposite sides of the driving-shaft, and the connecting-levers 32 and 34, and the link 33 between the levers uniting the two parts of the valve-rod, substantially as set forth.

15. In a governor, the combination of the weights, a carrier therefor, a valve-stem passing through the carrier and connected to the weights, a driving-shaft extending across the face of the carrier, bearings for the driving-shaft arranged upon opposite sides of the axis of rotation of the carrier, a driving-wheel for rotating the carrier mounted upon the shaft between the said bearings and free to move longitudinally upon the shaft, and means for shifting the driving-wheel upon its shaft, substantially as set forth.

16. In a governor, the combination of the weights, a rotary carrier for the weights having a friction-face, a driving-shaft, a friction-wheel mounted on the said shaft arranged to engage with the friction-face of the carrier, such wheel being free to move longitudinally along its shaft, a shifting-arm engaging with the said wheel and adapted to move it longitudinally of its shaft, and a screw-threaded shaft arranged to move the shifting-arm, substantially as set forth.

17. In a governor of the class described, the combination of the weights, a rotary carrier for the weights having a friction-face, a valve-stem passing through the carrier and adapted to be operated by the weights, a driving-shaft, a friction-wheel carried by the said shaft, and arranged to engage the friction-face of the carrier, and means for shifting the said wheel across the face of the carrier, substantially as set forth.

18. In a governor of the class described, the combination of the friction-disk, the weights connected with the said disk, the valve-stem passing through the disk and adapted to be operated by the said weights, the driving-shaft, the friction-wheel carried by the said shaft and arranged to engage with the said friction-disk, and means for moving said wheel across the face of the disk, substantially as set forth.

19. In a governor of the class described, the combination of the weights, the valve-stem operatively connected with the weights, the friction-disk adapted to rotate about the axis of the said stem and to support the said weights, a driving-shaft, a friction-wheel carried by the said shaft and adapted to engage with the friction-face of the said disk, and means for shifting the said wheel across the face of the disk, substantially as set forth.

20. In a governor of the class described, the combination of the weights, a rotary carrier therefor having a friction-face, a valve-stem passing through the carrier and operatively connected with the said weights at points above the said friction-face, a driving-shaft, a friction-wheel carried by the said shaft and arranged to engage with the friction-face of the carrier, and means for shifting the friction-wheel across the face of the carrier, substantially as set forth.

21. In a governor of the class described, the combination of the weights, a rotary carrier for the weights having a friction-face, a vertically-arranged valve-stem passing up through the carrier and operatively connected with the weights at points above said friction-face, a

driving-shaft, a friction-wheel carried by the said shaft and arranged to engage with the friction-face of the carrier, and means for shifting said friction-wheel across the face of the carrier, substantially as set forth.

22. In a governor of the class described, the combination of the weights, a rotary carrier therefor having a friction-face, a driving-shaft extending diametrically across said face, a friction-wheel carried by the shaft and arranged to engage with the friction-face of the carrier, means for shifting the friction-wheel across the face of the carrier, a valve-rod operated by the governor-weights, a spring connected with the rod adapted to oppose the action of the weights on the rod, and means for varying the tension of the spring, substantially as set forth.

23. In a governor of the class described, the combination of the weights, the driven friction-disk supporting the weights, a valve-rod passing through said disk and operated by the weights, the friction driving-disk arranged to engage with the friction-face of the driven disk, means for shifting the driving-disk across the face of the driven disk, and means for normally maintaining the contact between the disks, substantially as set forth.

24. In a governor of the character described, the combination of the horizontal driving-shaft, the vertical tubular shaft, the steam-controlling valve directly below said shafts, the speed-changing frictional wheels respectively mounted on the axes of said shafts, and each adapted to be moved longitudinally of its shaft, and a vertically-adjustable valve-rod loosely connected to one of said frictional wheels, substantially as set forth.

25. A governor of the character described provided with speed-changing gearing, means for normally maintaining contact between the gearing, and means for shifting one of the gears across the face of its opposing gear, substantially as described.

26. In a governor of the character described, speed-changing gearing comprising friction-disks, means for shifting one of said disks across the face of its opposing gear to change the point of contact, and means for normally maintaining the disks in contact, said last-mentioned means being independent of the adjusting means for the movable disk, substantially as described.

27. In a governor of the character described, friction-gearing, and means for normally maintaining a forced contact between the friction-gearing comprising adjustable mechanism associated with the governor-rod, substantially as described.

28. In a governor of the character described, friction-gearing, and means for normally maintaining a forced contact between the gearing comprising yieldable adjusting mechanism associated with the governor-rod, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM N. SPRINGER.

Witnesses:
ROY KENNEDY,
LEE W. HAZARD.