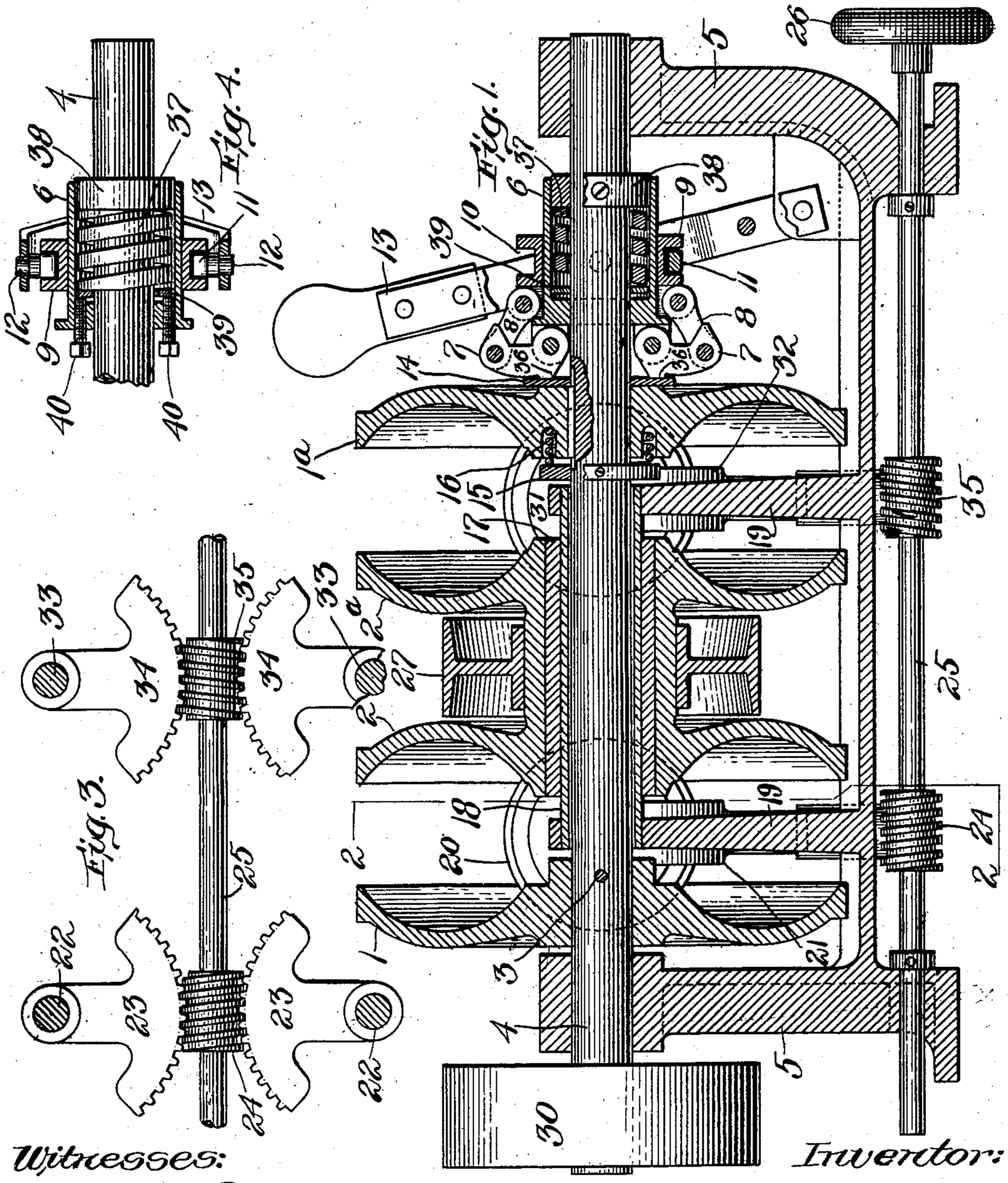
No. 744,550. PATENTED NOV. 17, 1903.

W. D. HOFFMAN.

SPEED VARYING MECHANISM.

APPLICATION FILED JAN. 2, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



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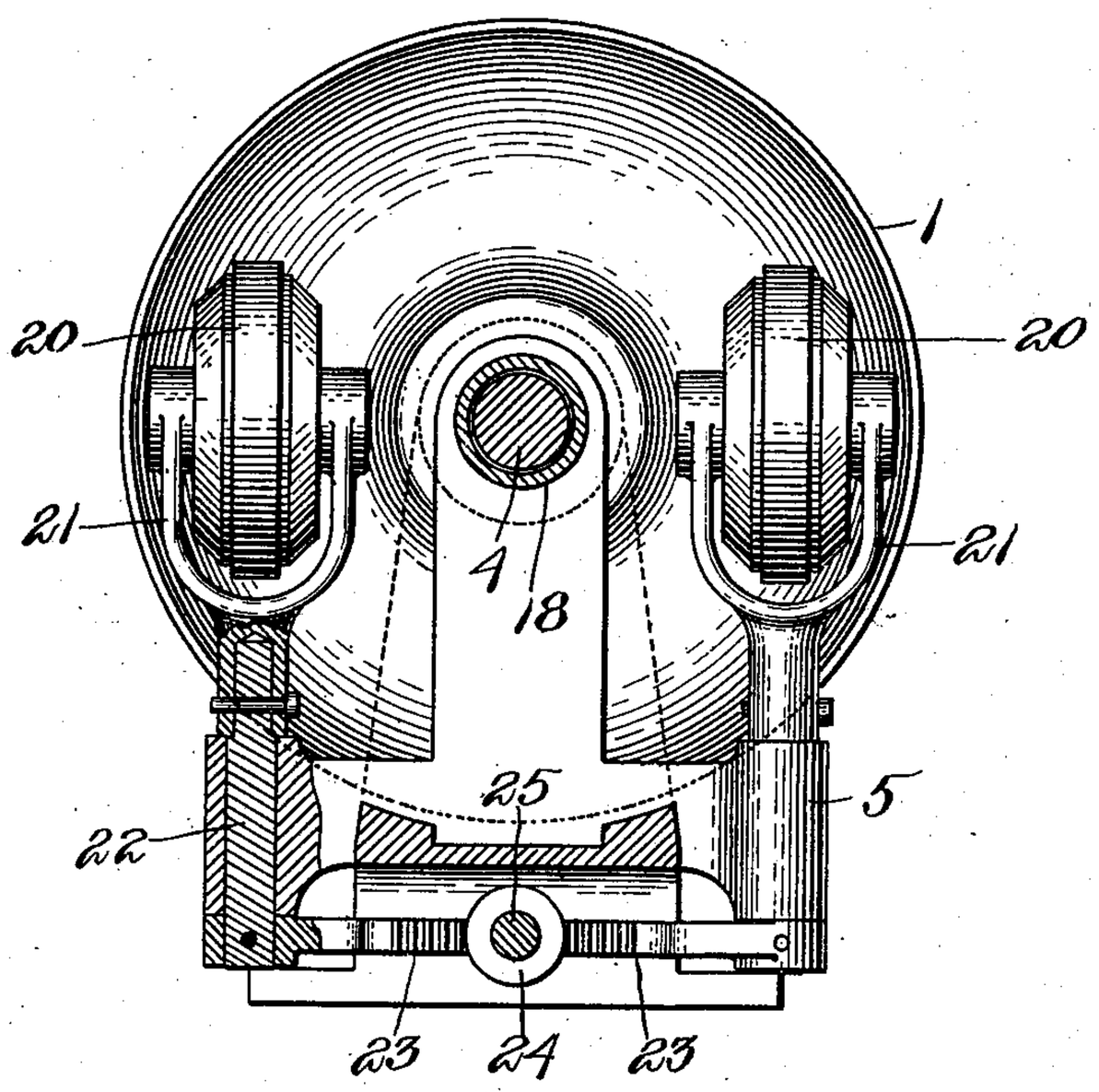

Fig. 2.

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No. 744,550. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM D. HOFFMAN, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO THE POWER AND SPEED CONTROLLER COMPANY, A CORPORATION OF NEW JERSEY.

SPEED-VARYING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 744,550, dated November 17, 1903.

Application filed January 2, 1903. Serial No. 137,381. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. HOFFMAN, a citizen of the United States, and a resident of Newton, in the county of Norfolk and State of Massachusetts, have invented new and useful Improvements in Power-Transmitting Mechanism, of which the following is a specification.

My invention relates to variable-speed power-transmitting mechanism of the same class as the mechanism shown and described in Patent No. 638,965 granted in my name December 12, 1899, and my present invention is an improvement on the mechanism therein shown and described.

In all variable-speed power-transmitting mechanism of this class comprising opposed disks clamped onto intermediate friction-rolls the clamping means always acts in opposite directions on the disks through two abutments, and prior to the invention of the mechanism of the patent above noted both of these two abutments turned with the disks and relatively to the clamping means, which was stationarily supported. Consequently a great amount of friction and wear existed between the bearing-surfaces of the abutments and the clamping means, constituting, in effect, two friction-brakes, one acting to oppose the rotation of one disk and the other acting to oppose the rotation of the other disk. The frictional resistance at these two bearings was of course in proportion to the pressure exerted by the clamping means and varied directly as said pressure varied. This resulted not only in the rapid wearing away of the bearing-surfaces between the clamping means and the abutment, but also in the expenditure of so much power to overcome the great amount of resistance offered by these bearing surfaces as to make the mechanism unduly extravagant and wasteful as a power-transmitter and with respect to its use of power, and this fact considerably restricted its field of utility, for the practical range of utility of mechanisms of this type depends in large part upon their economical transmission of power. The operation of mechanisms of this class depends almost solely upon the frictional adhesion between the disks and the intermediate friction-rolls, which adhesion is obtained by the clamping means, and the principal problem is to secure this adhesion with the loss of as little power as possible. Owing to the "braking" action of the bearing-surfaces between the abutments and the clamping means, it has heretofore been impossible to secure this frictional adhesion without the loss of a great amount of power or without the use of comparatively wide-faced intermediate friction-rolls. The inner side of each roll is nearer the axes of the disks than the outer side and obviously has less distance to travel to circumscribe the disks than the outer side. Therefore either one side or the other of the roll or both sides must slip relatively to the disks, thus causing great wear on the rolls and disks. Of course this characteristic action is present with all widths of rolls to a greater or less extent; but the narrower the face of the roll the less marked is it, and obviously, therefore, it is highly desirable that the rolls be as narrow-faced as possible. If, however, the face of each roll be narrowed, then in order to maintain the economical power-transmitting capacity of the mechanism it becomes necessary to increase the clamping pressure in order to compensate by increased pressure for the reduction in contacting surfaces between the rolls and disks and, as explained above, in the power-transmitting devices of this class employed prior to my invention presently to be described the braking action of the bearing-surfaces between the clamping means and the abutments will be increased proportionately, thus wastefully absorbing more of the prime motive power to overcome the increased friction at the abutments.

In the mechanism of the patent above noted the same objectionable features exist, although in a slightly-modified degree. In this patent one of the disks is shown as fixed to one end of a shaft extending loosely through the other disk and carrying at its other end one of the abutments and also the clamping means, which turns with the shaft. The other abutment is, in effect, the end of the hub of the other loose disk, between which and the clamping means a single roller-bearing is interposed which serves as a substitute for the two bearings above described as char-

acteristic of the older mechanisms; but this change, while modifying somewhat the objectionable characteristics above pointed out, did not entirely eliminate them, and the wasteful but necessary absorption of power to overcome the braking action of the single bearing still remained.

The main object of my invention is to provide a variable-speed power-transmitting mechanism of the above-described class in which the defects noted above regarding friction are eliminated; but my invention also has for its object to improve otherwise the construction of such mechanisms.

My improved mechanism, as herein shown, comprises a shaft and two pairs of disks, one pair mounted on the shaft and the other pair arranged between the disks of the first pair. Between the adjacent disks of the two pairs are provided friction-rolls, onto which the disks are clamped by means which acts in opposed directions on the two disks of one pair to force them toward the disks of the other pair, and thus clamp all of the disks onto the friction-rolls. Thus the disks of one pair will be caused to turn in one direction and the disks of the other pair to turn in the opposite direction, and the clamping means is made to turn with the two disks of the pair upon which it acts, whereby all relative movement between the clamping means and said pair of disks is prevented, and therefore all friction heretofore due to the pressure of the clamping means on its two abutments is eliminated.

Other features of my invention appear hereinafter.

In the accompanying drawings, which illustrate the preferred embodiment of my invention, Figure 1 is a central longitudinal section of a variable-speed power-transmitting mechanism embodying one form of my invention. Fig. 2 is a section on line 2 2 of Fig. 1. Figs. 3 and 4 are details described below.

Having reference to the drawings, 1 represents one of the disks of a pair, and 1^a represents the other disk of that pair. The disk 1 is fixed by a pin 3 to a shaft 4, journaled in bearings on a frame 5. The shaft 4 extends loosely through a pair of disks 2 and 2^a and near its opposite end carries a sleeve 6, to which is pivoted a pair of cam-levers 7, connected by links 8 with a ring 9, loosely mounted on the sleeve 6. The ring 9 is made with an annular groove 10, which engages a yoke 11, provided with trunnions 12. The trunnions 12 are mounted in a shipper-lever 13, pivoted to the frame 5, and by means of this lever the ring 9 may be slid on the sleeve 6 to operate the cam-levers 7.

The cam-levers 7 engage a washer 14, which rests against the hub of the disk 1^a, which is splined on the shaft 4 with provision for sliding movement longitudinally thereof. Between the disk 1^a and a collar 15, fast on the shaft 4, is a spring 16, whose function will appear later.

The hub of the pair of disks 2 2^a is bushed, as at 17, and journaled on a hollow sleeve 18, surrounding but out of contact with the shaft 4, and said sleeve is fixed at its ends in uprights 19, which are part of the frame 5.

Between the disk 1 and the disk 2 is a pair of friction-rolls 20, carried by yokes 21, (see Fig. 2,) which are fixed to pins 22, journaled in bearings on frame 5. On the lower end of each pin 22 is fastened a toothed segment 23, and the two segments mesh with a worm 24, fast on the shaft 25. The shaft 25 is journaled in bearings on the frame 5 and carries at one end a hand-wheel 26, by means of which said shaft may be rotated to swing the segments and rolls 20 on the axes of the pins 22. By this means the points of contact of each roll 20 with disks 1 and 2 may be changed relatively to the axis of the shaft 4, so as to change the relative speeds of disks 1 and 2. Between the disks 1^a and 2^a is a second pair of friction-rolls 31, each roll 31 being carried by a yoke 32, fast on a pin 33, journaled in bearings on the frame 5. These two pins 33 each carry at their lower ends a toothed segment 24, engaged by a worm 35, fast on shaft 25. The worm 35 is of opposite pitch to the worm 24, so that when shaft 25 is rotated and the rolls are swung on the axes of pins 22 and 33 the points of contact of the rolls 20 and 21 with the pair of disks 2 2^a will be moved relatively to the axes of shaft 4 correspondingly in the same direction.

I have herein shown the pair of disks 2 2^a as provided with a pulley 27, to which power is applied through a belt, (not shown,) and have shown a pulley 30, fast on the shaft 4, from which power may be transmitted through a belt (not shown) to any desired point.

The sleeve 6 is made hollow to inclose a spring 37, which rests at one end against an abutment 38, fast on the shaft 4, and at its other end against a washer 39, adjustably supported within the sleeve 6 by a pair of screws 40, mounted in the sleeve 6, as shown in Fig. 4.

When the shipper-lever is swung into the position shown in Fig. 1, the ring 9 is slid on the sleeve 6, and this relative movement of said ring and sleeve swings the cam-levers 7 on their pivots into the position shown in Fig. 1, and the engagement of cams 36 with the washer 14 tends to slide said washer and also disk 1^a on shaft 4 against the pressure of the spring 16, and also, acting through spring 37 on the abutment 8, tends to shift the shaft 4 and the disk 1 in the opposite direction. This clamps disks 1 and 2 onto the rolls 20, and also clamps the rolls 31 between the disks 1^a and 2^a. Inasmuch as disks 2 2^a are free to shift longitudinally on the sleeve 18 to a limited extent, the pressure on one disk thereof will be opposed and counterbalanced by the pressure on the other disk thereof, as will be clear.

When the shipper-lever 13 is swung to the

right out of the position shown in Fig. 1, the ring 9 is slid on sleeve 6, so as to swing the cam-levers 7 each in a direction to carry its cam 36 out from between the washer 14 and the sleeve 6. This relieves the shaft 4 and disk 1^a of pressure from the spring 37 and allows the spring 16 to shift the disk 1^a away from the disk 2^a, and thus relieve the rolls 20 of pressure from the disks 1 and 2 and the rolls 31 of pressure from the disks 1^a and 2^a. Thus it will be obvious that cams 36 control the action of spring 37 and that movement of ring 9 in one direction causes spring 37 to clamp the disks onto the interposed friction-rolls and that movement of ring 9 in the opposite direction unclamps the disks.

It will now be observed that the means employed for clamping the disks onto the rolls 20 and 31 is mounted upon shaft 4 between the abutment 38, fastened to said shaft, and the hub of disk 1^a, which is splined to said shaft, so that the abutment 38, the clamping means, and disk 1^a turn in unison, and all relative rotary movement and resulting friction heretofore existing between the clamping means and the two abutments upon which it acts, herein constituted by the hub of disk 1^a and abutment 38, is eliminated from the mechanism.

Although the disk 1^a is herein shown as splined to the shaft 4, it is obvious that this is not essential and that, if desired, the spline may be omitted, so as to leave the disk 1^a entirely loose on the shaft 4; but I prefer the construction shown and described because then the disk through its connection with the shaft serves as a positive transmitter of power to or from the shaft as well as an abutment for the clamping means, which turns in unison with the latter, whereas if the disk 1^a be not splined to its shaft then it will not serve as a positive power-transmitter, but merely as a rotating abutment for the clamping means, its rotation in unison with the latter being effected by the friction-rolls 31, as will be clear without further description.

What I claim is—

1. In a power-transmitting mechanism, a shaft, a pair of disks on the shaft, an intermediate pair of disks in opposition to the first pair, friction-rolls between the opposed disks, and a clamp, mounted to rotate as one with one of the said pairs of disks and arranged to exert its effort reactively upon the disks of the pair with which it rotates to clamp them against the friction-rolls.

2. In a speed-varying mechanism, in combination with a shaft; a pair of disks on said shaft one of which is fixed to the shaft and the other movable longitudinally thereon; an intermediate pair of disks between and opposed to the disks of the first pair; friction-rolls between the opposed disks of the two pairs; and means for thrusting the movable disk of the first pair in one direction and the shaft in the opposite direction, said means being mounted on said shaft and arranged to turn therewith.

3. In a speed-varying mechanism, in combination with a shaft; a pair of disks on said shaft; one of which is fixed to the shaft and the other movable longitudinally thereon; an intermediate pair of disks between and opposed to the disks of the first pair; friction-rolls between the disks of the two pairs; means to adjust the friction-rolls to vary the relative speeds of the two pairs; and a clamp to thrust the movable disk of the first pair in one direction and the shaft in the opposite direction, said clamp being mounted on said shaft and arranged to turn therewith.

4. In a speed-varying mechanism in combination; a shaft; a pair of disks on said shaft one of which is fixed to the shaft and the other movable longitudinally thereon; an intermediate pair of disks between and opposed to the disks of the first pair; friction-rolls between the disks of the two pairs; means to adjust the friction-rolls to vary the relative speeds of the two pairs of disks; a clamp to thrust the movable disk of the first pair in one direction and the shaft in the opposite direction, said clamp being mounted on said shaft and arranged to turn therewith; a power-transmitting wheel on the shaft, and a power-transmitting wheel connected with the intermediate pair of disks.

5. In a speed-varying mechanism, in combination, a shaft; a pair of disks on said shaft one of which is fixed to the shaft and the other movable longitudinally thereon; an intermediate pair of disks between and opposed to the disks of the first pair, friction-rolls between the disks of the two pairs; a spring to thrust the movable disk of the first pair in one direction and the shaft in the opposite direction, said spring mounted on said shaft and arranged to turn therewith; and means by which to control the tension of said spring.

6. In a speed-varying mechanism, in combination, a shaft; a pair of disks on said shaft one of which is fixed to the shaft and the other movable longitudinally thereon; an intermediate pair of disks between and opposed to the disks of the first pair; friction-rolls between the disks of the two pairs; a spring to thrust the movable disk of the first pair in one direction and the shaft in the opposite direction said spring being mounted on said shaft and arranged to turn therewith, and means for controlling said spring comprising one or more cams carried by said shaft.

7. In a speed-varying mechanism, in combination, a frame; a shaft journaled in bearings thereon; a pair of disks on said shaft one of which is fixed to the shaft and the other longitudinally movable thereon; an intermediate pair of disks between and opposed to the disks of the first pair; a power-transmitting wheel on said shaft; a power-transmitting wheel connected with the intermediate pair of disks; friction-rolls between the disks

of the two pairs; means on said frame for adjusting the friction-rolls to vary the relative speeds of the two pairs of disks; a spring to thrust the movable disk of the first pair in one direction and the shaft in the opposite direction, said spring being mounted on said shaft and arranged to turn therewith, a pair of cams carried by the shaft to control said spring; and a lever on the frame for operating said cams.

8. In a speed-varying mechanism in combination; a shaft; a pair of disks on said shaft one of which is fixed rigidly to the shaft and the other splined so as to move longitudinally thereon; an intermediate pair of disks between and opposed to the disks of the first pair; friction-rolls between the disks of the two pairs; and means for thrusting the movable disk of the first pair in one direction and the shaft in the opposite direction said means being mounted on said shaft and arranged to turn with said shaft and movable disk.

Signed by me at Boston, Massachusetts, this 29th day of December, 1902.

WILLIAM D. HOFFMAN.

Witnesses:

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