No. 747,016. PATENTED DEC. 15, 1903.

A. SUNDH & D. L. LINDQUIST.

FRICTION GEAR.

APPLICATION FILED JULY 14, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.

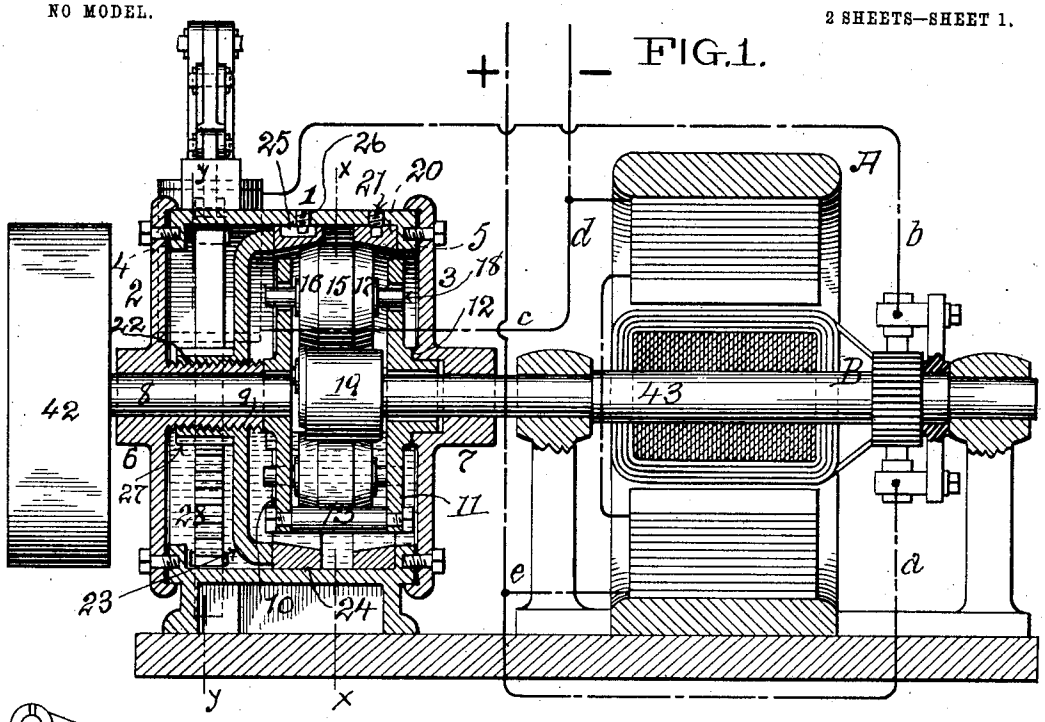


FIG. 2.

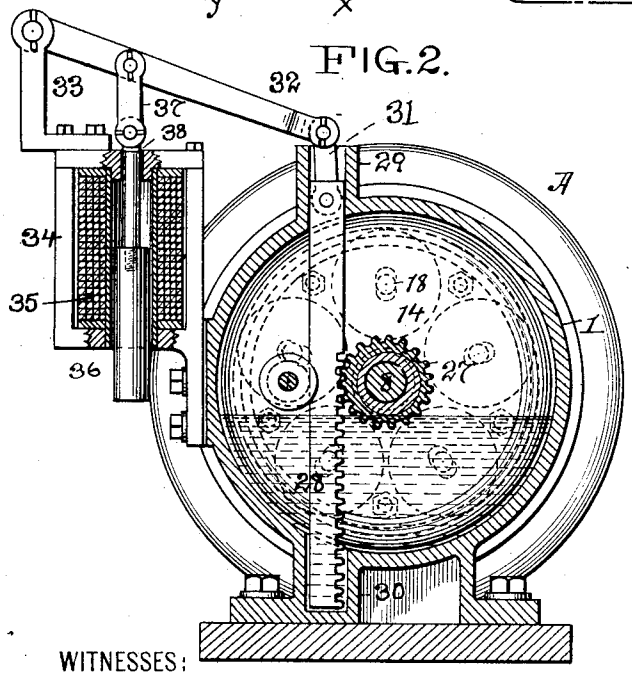
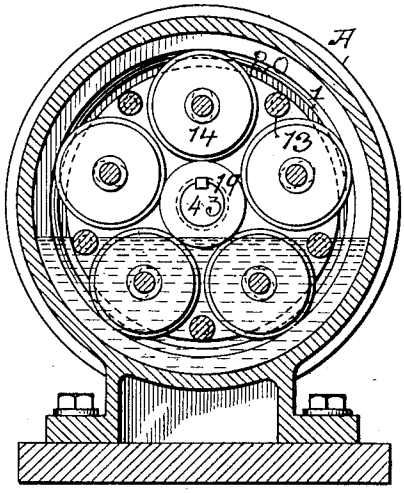


FIG. 3.



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NO MODEL. 2 SHEETS—SHEET 2.

FIG. 4.

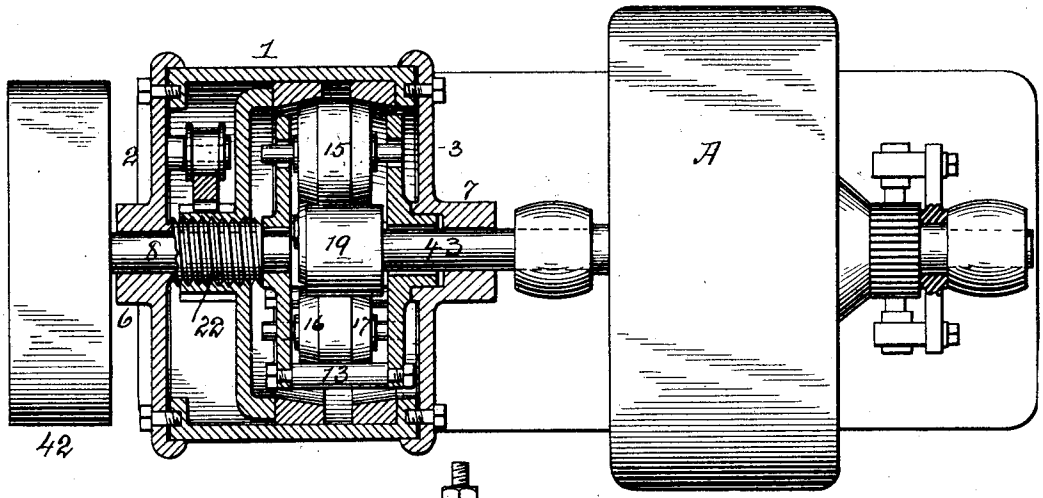
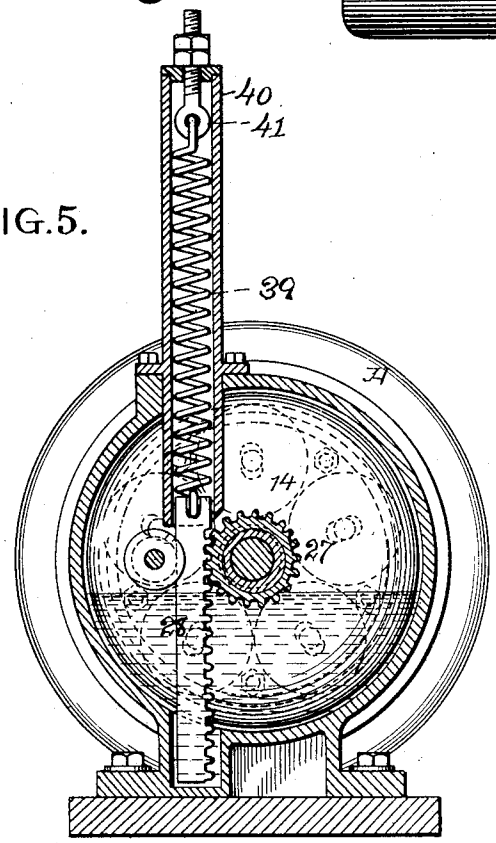


FIG. 5.



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No. 747,016. Patented December 15, 1903.

UNITED STATES PATENT OFFICE.

AUGUST SUNDH AND DAVID L. LINDQUIST, OF YONKERS, NEW YORK.

FRICTION-GEAR.

SPECIFICATION forming part of Letters Patent No. 747,016, dated December 15, 1903.

Application filed July 14, 1903. Serial No. 165,442. (No model.)

To all whom it may concern:

Be it known that we, AUGUST SUNDH and DAVID L. LINDQUIST, of Yonkers, Westchester county, New York, have invented a new and useful Improvement in Friction-Gear, of which the following is a specification.

The invention relates to a speed-reducing gear operating by frictional contact and causing said contact to be proportional to the load of the driving-motor. The central pulley is fast on the end of the driving-shaft. The planet-rollers are loosely journaled in a cylindrical cage wherein said central pulley rotates, which cage carries a short shaft in line with the driving-shaft. Means are provided for forcing friction-rings into more or less close frictional contact with planet-rollers, whereby the speed from said central pulley to the short shaft and belt-pulley thereon is regulated.

The invention consists, first, in the combination of an electric motor having a rotary shaft, a shaft disposed with its axis in prolongation of the axis of said motor-shaft, a friction-gear mechanism interposed between said shafts, and means external to the motor for regulating said friction-gear to become the more strongly engaged in proportion to the load on the driven shaft; second, in the construction of the friction-gear mechanism so that the friction is applied to a different part of the periphery of the planet-rollers from that which is in contact with the driving-pulley, and, third, in the construction whereby the friction-rings act toward the center of the planet-rollers, so as to give great friction between all of said rolls and the ring-surface against which they revolve.

In the accompanying drawings, Figure 1 is a vertical section of our improved friction-gear in connection with an electric motor. Fig. 2 is a transverse section on the line $x\ x$ of Fig. 1. Fig. 3 is a transverse section on the line $y\ y$ of Fig. 1. Fig. 4 is a top view of the motor and horizontal section of the gear, showing also a spring regulating device in lieu of the electrical controlling apparatus illustrated in Fig. 1. Fig. 5 is a view similar to Fig. 2, also embodying the spring regulator.

Similar characters of reference indicate like parts.

1 is the gear-casing, which is cylindrical in form and provided with detachable heads 2 3, secured to inwardly-turned flanges 4 5. The head 5 has a central projection 7, through which passes the shaft 43 of the armature B of the electric motor A. The head 6 has also a central external projection and a threaded internal projection 9, through which passes the short shaft 8, carrying the belt-pulley 42. The object of the friction-gear now to be described is to transmit motion from the motor A and shaft 43 to the short shaft 8 and belt-pulley 42.

Fast on the inner end of shaft 8 is a disk 10, to which is attached, by means of the rods 13, a second and similar disk 11. The disks 10 and 11 and rods 13 thus form a cage carried solely by shaft 8. The hub of disk 11 is prolonged to enter a recess in projection 7 and is shouldered, as shown at 12, to bear on said projection. Through said hub the shaft 43 passes with clearance, the said shaft having its supporting-bearing in the projection 7. In the disks 10 and 11 are openings to receive the shafts of the planetary rollers 14. Said shafts are loosely held in said openings, and said openings are elongated radially of the disks, so as to permit said rollers some play in said radial direction. Five rollers 14 are here shown disposed between the rods 13 and symmetrically around and in contact with a central pulley 19, which is within the cage and is fast on the end of shaft 43. The central pulley 19 is cylindrical. Each roller is cylindrical at its middle portion 15, which middle portion is in contact with pulley 19. On each side 16 17 of said middle portion said roller is frusto-conical in form.

Within the casing 1, bearing against the inwardly-turned flange 5 thereof, is a friction-ring 20, secured in place by set-screws 21. The inner periphery of this ring is inclined at the same angle as the frusto-conical portions 17 of the rollers 14, and said frusto-conical portions bear against said inner periphery. On the threaded sleeve 9 of head 6 is a nut 22, preferably formed integrally with a cup-shaped disk 23. The vertical face of the flanged edge of said disk bears against a loose brake-ring 24, the inner periphery of which is inclined at the same angle as the frusto-conical portions 16 of the rollers 14 and

surrounds said rollers. In the outer surface of the ring is formed a recess 25, in which enters a stop 26, which passes through the casing-wall.

Secured upon the nut 22 is a toothed pinion 27, which engages with the vertical rack-bar 28. Said rack-bar passes through a guide-tube 29 in the wall of casing 1 and at its lower portion enters a socket 30, formed in the bottom of said casing. At its upper end said rack is connected by a link 31 to one end of the pivoted lever 32. Said lever is pivoted at its other end to a fixed arm 33, supported on the shell 34 of a solenoid 35. Said shell is bolted to one side of the casing 1. The solenoid-core 36 passes through an opening in the bottom of the shell 34 and is connected to a rod 38, which extends upward through an opening in the top of said shell. The upper end of rod 38 is secured to lever 32 by a link 37.

In Fig. 1 we have shown our gear connected to an electric motor A of well-known construction and so arranged as to become engaged the more strongly in proportion to the load on said motor. The circuits are as follows: from the plus terminal by wire *a* to the motor-armature B, by wire *b* to the solenoid 35, and by wire *c* to negative terminal. The field is in shunt and connected to the armature-circuit at the points *d e*.

The operation of the device is as follows: The motor-shaft 43 being in rotation, the pulley 19 thereon by frictional contact with the rollers 14 rotates the cage containing said rollers, and hence the shaft 8, carrying the belt-pulley 42. In order to increase the frictional contact between the rollers 14 and pulley 19, the movable ring 23 is forced to the right of Fig. 1, thus carrying the inclined inner surface of said ring against the inclined parts 16 of each roller periphery and pushing said rollers themselves to the right, so that the inclined parts 17 become more or less jammed against the inclined inner surface of the fixed ring 20. In order to diminish frictional contact between the rollers 14 and the inclined inner surfaces of rings 24 and 20, the ring 24 is of course moved in the opposite direction.

Where the degree of frictional contact between rollers and rings is to be kept uniform, we prefer to connect the rack-bar 28 to a helical spring 39, received in a suitable cylinder 40, secured to the casing 1 and provided with an adjusting-screw and nut 41. By regulating the spring tension by means of nut 41 it will draw up the rack to any desired degree, thus rotating the pinion 27 and nut 22, and so moving the ring 24 to a corresponding extent and will hold said ring in adjusted position. Where, however, it is desired that the frictional contact between the rollers 14 and rings 24 and 20 shall vary proportionately to the load on belt-pulley 42, we prefer the arrangement represented in Figs. 1 and 2. The operation then is as follows: Upon an increase of current in the motor-armature circuit the solenoid 35 draws up its core 36 and so through lever 32 raises the rack-bar 28 to force ring 24 to the right, as already described. Upon a diminution of current the solenoid permits its core to descend, thus moving down lever 32 and lowering the rack-bar 28, which moves ring 24 in the reverse direction. Obviously the greater the load on the motor the more strongly the friction-gear will become engaged.

The construction of driving-pulley 19, rolls 14, and the friction-rings 20 and 24 is of special advantage for the following reasons: The contact-surfaces of pulley 19 and rolls 14 are not the surfaces which meet the friction-rings, so that frictional wear does not come on the driving and driven peripheries. Thus the pulley 19 is in contact with the cylindrical part 15 of the roller peripheries, while the friction-rings are in contact only with the inclined parts 16 17 of said peripheries. By reason of the inclination of the frictional surfaces all wear thereat is easily taken up. The two inwardly-tapered friction-rings practically exert their frictional stress toward the center, so that the friction occurs between their tapered inner surfaces and all the rollers 14.

We claim—

1. The combination of an electric motor having a rotary shaft, a shaft disposed with its axis in prolongation of the axis of said motor-shaft, a friction-gear mechanism interposed between said shafts, and means external to the motor for automatically regulating said friction-gear to become the more strongly engaged in proportion to the load on said driven shaft.

2. The combination of an electric motor, a shaft, a friction-gear mechanism interposed between said motor and said shaft, electromagnetic means in circuit with said motor for regulating said friction-gear to become the more strongly engaged in proportion to the load on said shaft.

3. The combination of an electric motor having a rotary shaft, a shaft disposed with its axis in prolongation of the axis of said motor-shaft, a friction-gear mechanism interposed between said shafts, and means external to the motor for automatically regulating said friction-gear to vary the strength of frictional engagement.

4. The combination of a rotary pulley, a separate shaft coaxial therewith, a planet-roller supported on said shaft and having a part of its circumferential periphery bearing on said pulley, and a friction member constructed and arranged to act on another part of said circumferential periphery of said roller.

5. The combination of a rotary pulley, a separate shaft coaxial therewith, a planet-roller supported on said shaft and having a part of its circumferential periphery cylindrical and another part of said periphery frusto-conical and a friction member con-

structed and arranged to act on said frusto-conical part.

6. The combination of a rotary pulley, a separate shaft coaxial therewith, a planet-roller supported on said shaft, a friction-ring concentric with said pulley and surrounding said roller, and means for moving said ring in the direction of its axis and into frictional contact with said roller periphery.

7. The combination of a rotary pulley, a separate shaft coaxial therewith, a plurality of planet-rollers symmetrically supported on and around said shaft and each bearing on said pulley, and a friction-ring movable in the direction of its axis and constructed and arranged to act simultaneously on said rollers.

8. The combination of a rotary pulley, a separate shaft coaxial therewith, a cage carried by said shaft, a plurality of planet-rollers loosely journaled in said cage and bearing on said pulley and a friction-ring adjustable in the direction of its axis and concentric with said shaft and constructed and arranged to act simultaneously on said rollers.

9. The combination of a rotary pulley, a separate shaft coaxial therewith, a planet-roller loosely supported on said shaft and having the middle portion of its circumferential periphery cylindrical and bearing on said pulley, and the outer portions frusto-concial, and two friction-rings concentric with said pulley and surrounding said roller; one of said rings being fixed and bearing on one of said frusto-conical portions of said roller periphery and the other being movable in the direction of its axis and bearing on the other of said frusto-conical portions.

10. The combination of a rotary pulley, a separate shaft coaxial therewith, a plurality of planet-rollers loosely supported on and around said shaft in contact with said pulley and having their circumferential peripheries outwardly tapered, two friction-rings surrounding said rollers having their inner surfaces corresponding to said tapered portions and means for varying the friction of said rings on said roller peripheries.

11. The combination of a rotary pulley, a separate shaft coaxial therewith, an externally-threaded bearing for said shaft, a nut on said bearing, a plurality of planet-rollers loosely supported on and around said shaft in contact with said pulley and having their circumferential peripheries outwardly tapered and two friction-rings surrounding said rollers and having their inner surfaces corresponding to said tapered portions; one of said rings being fixed and the other being carried by said nut.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

AUGUST SUNDH.
DAVID L. LINDQUIST.

Witnesses:
I. A. VAN WART,
J. LOESCH.