

No. 767,604.

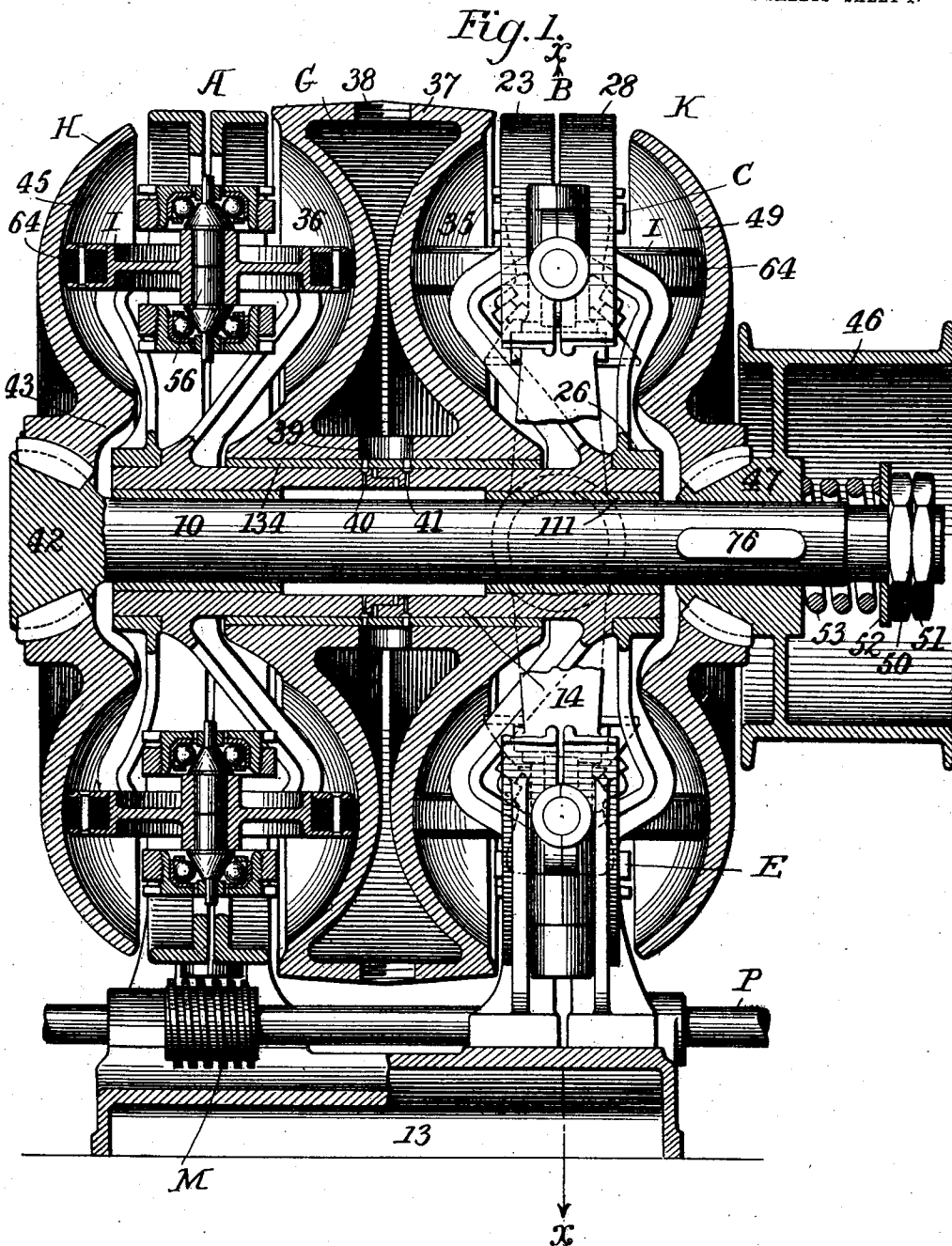
PATENTED AUG. 16, 1904.

E. A. SPERRY.
FRICTIONAL DRIVING MECHANISM.

APPLICATION FILED NOV. 24, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses

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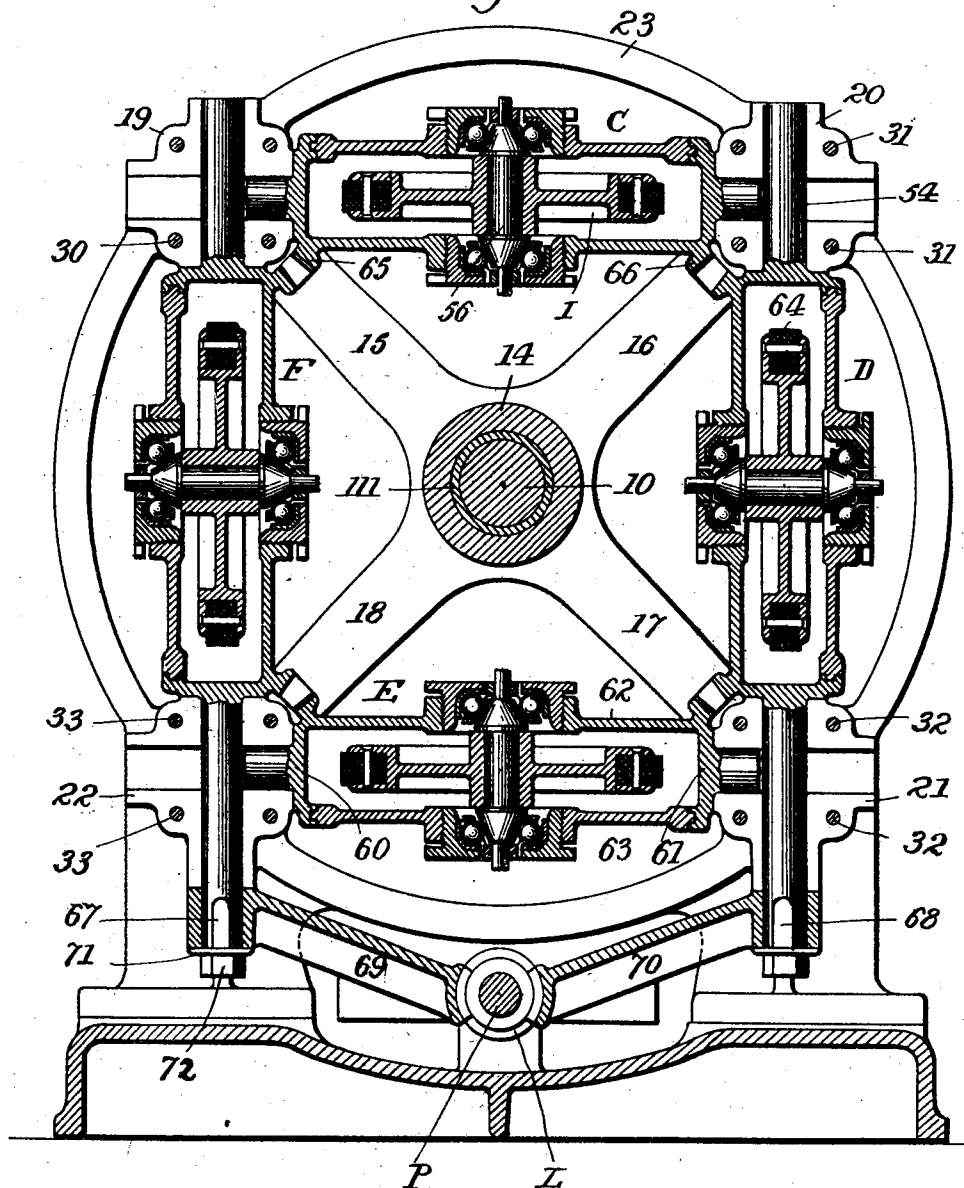
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN ELECTRIC AND CONTROLLER COMPANY, A CORPORATION OF DELAWARE.

FRICTIONAL DRIVING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 767,604, dated August 16, 1904.

Application filed November 24, 1903. Serial No. 182,498. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Cleveland, county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Frictional Driving Mechanism, of which the following is a specification.

This invention relates to frictional driving gear by which the ratio of the speed of the driving member to that of the driven member may be varied, and has for one object to secure the even distribution of strains, while also securing great variation of speed.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of my improved gearing, in which the friction-wheels and their supports on the right-hand side are shown in elevation. Fig. 2 is a vertical section on the line *x x* of Fig. 1 looking in the direction of the arrow.

There are two separated parallel frames A B erected upon a suitable base, and each has a central bearing for a rotating shaft 10 and carries four wheel-frames C D E F at right angles to each other, each of said frames having trunnions, so that it may swing about its longitudinal axis, and in each frame turns a friction-wheel I, the shaft or axis 56 of which is at right angles to that of the wheel-frame.

About the shaft 10 between the frames A B turns a rotatable member, as a pulley G, the opposite faces of which are curved to coincide with circles traversed by the peripheries of the wheels I as they are adjusted. Upon the shaft 10 are mounted friction members, as disks H K, each having a universal-jointed connection with the shaft, but rotating therewith, and each with an inner-curved face coinciding with the path traversed by the peripheries of the wheels I as they are adjusted.

The wheel-frames are operatively related to worms L M, secured to rotatable shaft P, so that all the wheel-frames may be turned about their longitudinal axes by rotating shaft P.

The above parts may be constructed in any suitable manner. I will now describe that shown.

The shaft 10 is supported in bearings in the

supporting-frames A and B, which rest upon the base 13. These frames are alike, and therefore a description of one is a description of each, and each comprises two sections, one of which rests upon the base 13 and comprises the hub 14, in which the shaft is journaled, a suitable bushing 111 being placed in said hub. Bent arms 15, 16, 17, and 18 radiate from the hub and carry at their outer ends the journal-box sections 19, 20, 21, and 22. Encircling the arms of the section and secured to their outer ends is the ring or band 23. The other section comprises a hub 26, adapted to sleeve upon hub 14, and from hub 26 extend four radial arms similar to those of the other section except that they are oppositely bent and upon their outer ends are supported the other section of the journal-boxes and an encircling band 28, similar to band 23. The sections are assembled to form a frame by sleeving the hub 26 upon the hub 14, and the arms on the two sections are brought opposite each other, when bolt-holes 30, 31, 32, and 33 of the journal-box sections will register, and they may then be bolted together. Journaled upon hubs 14 so as to rotate and have longitudinal movement thereon is a hollow pulley G, a suitable bushing 134 being interposed between the pulley and the hubs. The pulley G has concave side faces 35 and 36, which extend completely around the pulley and with which the friction-wheels engage. Inasmuch as the pulley G is longitudinally movable upon the hubs 14, it will readily adjust itself to any inequalities of the friction-wheels bearing upon its two faces. In the driving-face 37 of the pulley are oil-holes, as 38, through which oil may be introduced into the interior of the pulley, whence it finds its way through holes, as 39, to the pulley-bearings and thence through holes, as 40 and 41, to the bearings of the shaft 10. The holes 38 may be threaded, as shown, to receive threaded plugs whereby the holes may be closed and the entrance of dirt to the interior of the pulley prevented.

Secured to one end of the shaft 10 is the hemispherical piece 42, which is adapted to enter a hemispherical cavity in the hub 43 of

a disk H, and thereby form a sort of ball-and-socket joint. The disk is, however, keyed on the piece 42, so that it cannot rotate about the axis of shaft 10, but may change its angular relation thereto in a longitudinal direction. The disk H has a concave face 45 upon its inner side, which is similar to the face 36 on pulley G and is opposite thereto. Near the other end of the shaft 10 is mounted the pulley 46, which is chosen of a diameter with relation to pulley G such that certain relative peripheral speeds are obtained, as will be hereinafter described. Pulley 46 has the hub 47, which is secured against rotation upon the shaft 10 by a key 76; but it may have longitudinal movement and has a hemispherical portion on which is mounted a disk K. This disk is similar to the disk H and is mounted in the same manner, its concave face 49 being opposite to the similar face 35 of the pulley 34. The shaft 10 extends beyond the hub 47 and is threaded upon its end to receive the locking-nuts 50 and 51. A washer 52 is placed inside the nuts, and interposed between the washer and the hub 47 is a spring 53, which forces the disks H and K toward each other and against the friction-wheels, and since the disks H and K may have angular movement longitudinally of shaft 10 and are movable longitudinally they readily adjust themselves to inequalities in the friction-wheels.

Journalled in each of the boxes supported at the outer ends of the arms of each of the frames A and B are trunnions 54 and 55, which support frames C D E F for the friction-wheels I. In this case there are four of these wheel-frames and friction-wheels, Fig. 2, supported by frame A upon one side of the pulley G, and upon the other side of the pulley G similar friction-wheels and their supporting-frames are similarly supported by the frame B. The number of friction-wheels upon each side of the pulley should be at least three for proper operation where the friction-disks have universal-joint connections, as described, and these friction-wheels are preferably equidistantly spaced. The construction of each of the wheel-frames and friction-wheels is identical with the others except that certain of the trunnions 55 of the wheel-frames are shorter than others, 54, owing to the fact that their bearings cross each other, and therefore a description of one friction-wheel and its frame will be a description of each. Each wheel-frame comprises end pieces 60 and 61, secured to supporting-trunnions in any suitable manner, and to these end pieces are secured side bars 62 and 63, in which is journaled, preferably by means of ball-bearings, as shown, a friction-wheel I, having its axis passing through that of shaft 10. Secured in a peripheral groove of the friction-wheel is leather 64 or other suitable substance for insuring frictional engagement between the wheel and the surfaces with which it comes in contact. Upon

the inner sides and at the ends of each wheel-frame are the beveled gear-segments 65 and 66, which are adapted to engage with similar gears upon adjacent wheel-frames. Upon each side of pulley G two of the wheel-frame trunnions have extensions 67 and 68 projecting beyond their bearings. Upon these extensions are sleeved the hubs of arms 69 and 70, which are secured thereon by the washers 71 and screws 72, tapped into the ends of the extensions. The arms 69 and 70 are secured against rotation about extensions 67 and 68 by keys or other suitable means and at their outer ends are provided with worm-gears adapted to engage with a worm L or M, the arms upon one side of the pulley G engaging with one worm, while those on the other side of the pulley engage with the other worm. The worms L and M are rigidly secured to shaft P, which is rotatably mounted in the base 13 and extends longitudinally thereof.

Power may be applied to either of the pulleys G or 46 and taken from the other. Assuming that the power is applied to pulley G, the faces 35 and 36 will frictionally turn the friction-wheels I about their axes. These wheels in turn frictionally rotate the disks H and K by engagement with their faces 49 and 45, and shaft 10 and pulley 46 are carried with them. If power were applied to pulley 46, the power would be transmitted from the disks to the friction-wheels and thence to pulley G.

The ratio of the angular speeds of the driving and driven pulleys—that is, the ratio of their numbers of revolutions in a given time—depends upon the angular position of the friction-wheels with relation to the shaft 10, as will be well understood, and by turning the shaft P by any suitable means the worms L and M will operate through arms, as 69 and 70, to turn certain of the wheel-frame trunnions, as 54 and 55, by means of extensions, as 67 and 68, thereby changing the angular relation of the friction-wheels supported by those frames to the axis of shaft 10, and through the gears 65 and 66 the remaining wheel-frames will be similarly turned. It will thus be seen that by revolving shaft P all the friction-wheels upon both sides of pulley G are similarly and simultaneously adjusted to vary the ratio of the angular speeds of the driving and driven members. The ratio of the peripheral speeds of the pulleys, and therefore of the speeds of the belts upon them, is dependent upon their relative diameters as well as upon their angular speeds. A certain ratio of the peripheral speeds for a given adjustment of the friction-wheels may be obtained by choosing pulleys of proper diameters, and this ratio may be varied by adjusting the friction-wheels as described.

Without limiting myself to the precise construction and arrangement of parts shown and described, I claim—

1. In a frictional driving-gear, the combi-

nation of a rotatable member, friction-wheels engaging with opposite sides of said member, cooperating disks, a shaft therefor and a common support for said member and said shaft, substantially as described.

2. In a frictional driving-gear, the combination of a pulley, friction-wheels engaging with opposite sides of said pulley, cooperating disks, a shaft therefor and a common support for said pulley and said shaft, substantially as described.

3. In a frictional driving-gear, the combination of a rotatable member, friction-wheels engaging with one side of said member and a disk bearing upon said friction-wheels, said member and disk being longitudinally movable and the disk being angularly movable in respect to the shaft, substantially as described.

4. In a frictional driving-gear, the combination of a shaft, a disk thereon secured against motion of rotation with reference to said shaft but movable angularly with relation to the axis of said shaft and friction-wheels engaging with said disk, substantially as described.

5. In a frictional driving-gear, the combination of a shaft, a member longitudinally and rotatably movable, friction-wheels bearing against said member on opposite sides and disks secured against rotation with reference to said shaft and bearing against said wheels but angularly movable with relation to said shaft, substantially as described.

6. In a frictional driving-gear, the combination of a pulley having a curved face at each side, two sets of swinging friction-wheels bearing upon both faces of said pulley, each set having three or more wheels and disks having universal-joint connections and curved faces bearing upon said friction-wheels, substantially as described.

7. The combination in a frictional driving-gear, of three friction members, a set of friction-wheels between the central member and each outer member, each set comprising three or more wheels and the outer members having universal-joint connections, and means whereby the two outer members or the central member may be driven positively, substantially as described.

8. The combination in a frictional driving-gear, of three friction members having curved faces, a set of swinging friction-wheels between the central member and each outer member, each set comprising three or more wheels and the outer members having universal-joint connections, and means whereby the two outer members or the central member may be driven positively, substantially as described.

9. In a frictional driving-gear, the combination of a pulley, friction-wheels bearing upon both sides of said pulley and disks bearing upon said friction-wheels, said pulley and disks being longitudinally movable and the disks being angularly movable, substantially as described.

10. In a frictional driving-gear, the combination of a pulley, friction-wheels bearing upon both sides of said pulley and disks bearing upon said friction-wheels, said pulley and disks being longitudinally movable and the disks being angularly movable, and a shaft carrying the disks and about which the pulley rotates, substantially as described.

11. In a frictional driving-gear, the combination of two sets of friction-wheels, a stationary support for each set of wheels, a pulley mounted between said sets of friction-wheels so as to have movement of rotation, a shaft rotatably mounted in said supports, a disk secured upon said shaft in such manner as to have angular movement only with relation to said shaft and bearing upon one of said sets of friction-wheels and a second disk mounted upon said shaft and secured thereto in such manner as to prevent rotation but permit angular movement of said second disk with relation to said shaft, said second disk bearing upon the other of said sets of friction-wheels, substantially as described.

12. In a frictional driving-gear, the combination of two sets of friction-wheels, a stationary support for each set of wheels, a pulley mounted between said sets of friction-wheels so as to have longitudinal movement and also movement of rotation, a shaft rotatably mounted in said supports, a disk secured upon said shaft in such manner as to have angular movement only with relation to said shaft and bearing upon one of said sets of friction-wheels and a second disk mounted upon said shaft and secured thereto in such manner as to prevent rotation but permit longitudinal angular movement of said second disk with relation to said shaft, said second disk bearing upon the other of said sets of friction-wheels, substantially as described.

13. In a frictional driving-gear, the combination of two sets of friction-wheels, a stationary support for each of said sets of wheels, a shaft rotatably mounted in said supports, a pulley having concave sides, said pulley being mounted between said sets of friction-wheels, a disk having a concave face bearing against one of said sets of friction-wheels, said disk being mounted upon said shaft so as to have longitudinal and angular movement and a second disk having a concave face bearing against the other of said sets of friction-wheels, so as to balance the pressures upon the friction-wheels, substantially as described.

14. The combination with two oppositely-arranged frames of friction-wheels carried thereby, friction members engaging the wheels, and an intermediate pulley in contact with said wheels and journaled upon said frames, substantially as described.

15. The combination with two oppositely-arranged frames of swinging friction-wheels carried thereby, friction members engaging said wheels, an intermediate pulley in con-

tact with said wheels and journaled on said frames, and means for swinging the friction-wheels to different positions, substantially as described.

5 16. The combination with two oppositely-arranged frames of swinging friction-wheels carried thereby, friction members engaging said wheels each with a curved engaging face, and an intermediate pulley with a curved face
10 on each side and journaled on said frames, substantially as described.

17. The combination with the supporting-frame and its friction-wheels each mounted to rotate on its axis and swing about an axis
15 perpendicular thereto, of a shaft, and a member engaging the peripheries of said wheels and mounted on said shaft to rotate therewith while changing freely its angular position relative thereto, substantially as described.
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18. In a frictional driving-gear comprising friction-wheels and supporting-frames with trunnions, a frame in sections, and means for fastening said sections together, each section
25 comprising a hub, arms radiating from said hub and trunnion-box sections secured to said arms, substantially as described.

19. In a frictional driving-gear, the combination of a frame comprising sections with a
30 means for securing said sections together, each section comprising a hub, arms radiating therefrom, a band connecting the extremities of said arms and journal-box sections supported by the section, substantially as described.
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20. In a frictional driving-gear, the combination of a sectional frame and means for fastening the sections together, each section comprising a hub, bent arms radiating therefrom and box-sections secured to said arms,
40 friction-wheel frames journaled in the boxes said wheel-frames swinging in the openings formed by the bends in the arms, and friction-wheels mounted in said wheel-frames, substantially as described.
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21. In a frictional driving-gear, a frame, friction-wheel frames revolubly mounted thereon, friction-wheels mounted in said latter frames, gear-segments upon each wheel-
50 frame engaging with similar segments upon adjacent wheel-frames and means for swinging the friction-wheel frames, substantially as described.

22. In a frictional driving mechanism, the
55 combination of a support, a wheel-frame rocking thereon, a friction-wheel mounted in said frame, a friction member journaled on

said support and engaging with said friction-wheel, a gear on said frame, a worm engaging with said gear and means for turning said
60 worm, substantially as described.

23. In a frictional driving mechanism, the combination of a base, a plurality of supports mounted thereon, a set of revolubly-mounted wheel-frames carried by each support and
65 provided with worm-gears, friction-wheels mounted in said frames, a friction member journaled on said supports, a shaft and a worm on said shaft engaging with the worm-gears of each set, substantially as described.
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24. In a frictional driving-gear, the combination of a support, trunnion-boxes thereon, wheel-frames having trunnions supported in said boxes, one of said trunnions extending
75 beyond its box, an arm secured to said extended trunnion, said arm having a worm-gear at its extremity, a worm engaging with said worm-gear and a shaft carrying said worm, substantially as described.

25. In a frictional driving-gear, the combination of two friction members, one or more of which has a universal-joint connection, three or more friction-wheels between said
80 members and means for forcing said members against said wheels, substantially as described.
85

26. In a frictional driving-gear, the combination of two friction members, one or more of which has a universal-joint connection, three or more equidistantly-spaced friction-wheels between said members and means for
90 forcing said members against said wheels, substantially as described.

27. In a frictional driving-gear, the combination of two friction members, one or more of which has a universal-joint connection,
95 three or more friction-wheels between said members and resilient means for forcing said members against said wheels, substantially as described.

28. In a frictional driving-gear, the combination of two friction members, three or more friction-wheels between said members,
100 means for forcing said members against said wheels and a universal joint for one of said members mounted between said member and
105 said means, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ELMER A. SPERRY.

Witnesses:

F. L. FREEMAN,
THOS. HOWE.