No. 771,150. PATENTED SEPT. 27, 1904.

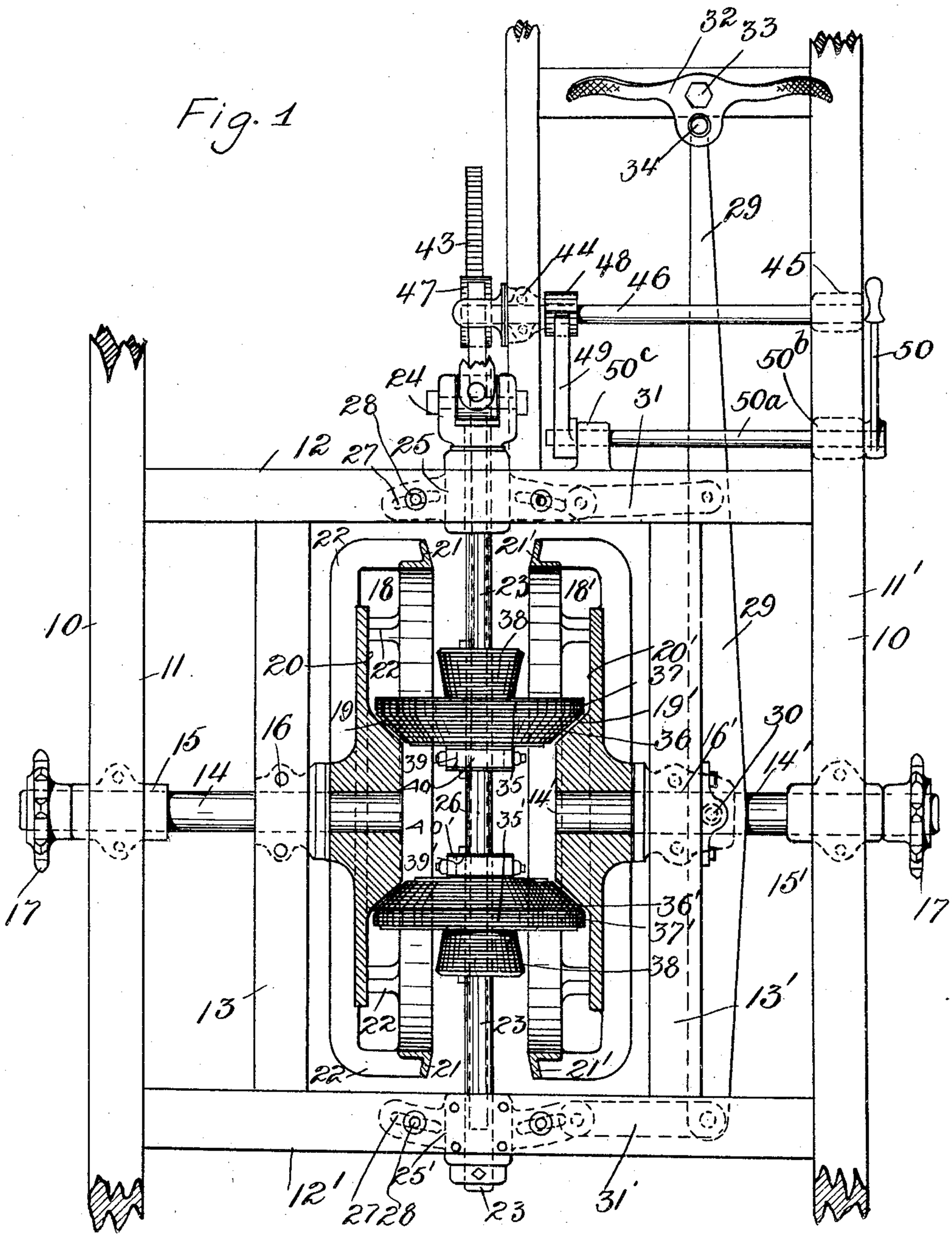
W. F. HOWE.

VARIABLE SPEED POWER TRANSMITTING DEVICE.

APPLICATION FILED DEC. 17, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1



WITNESSES:

George T. May Jr.

Carl L. Osgood

INVENTOR.

BY William F. Howe.

Foré & Bain ATTORNEY.

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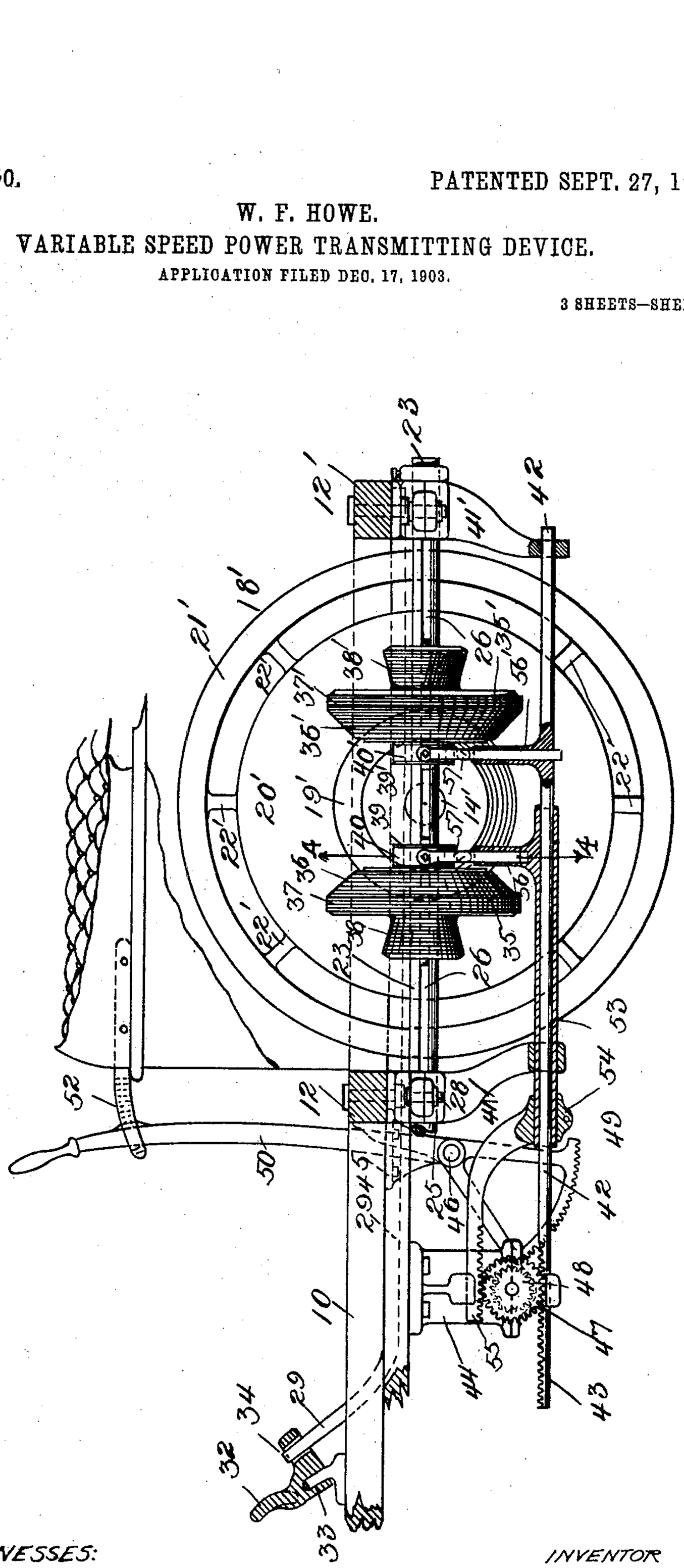
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2



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BY Fonté Bains

ATTORNEY

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3

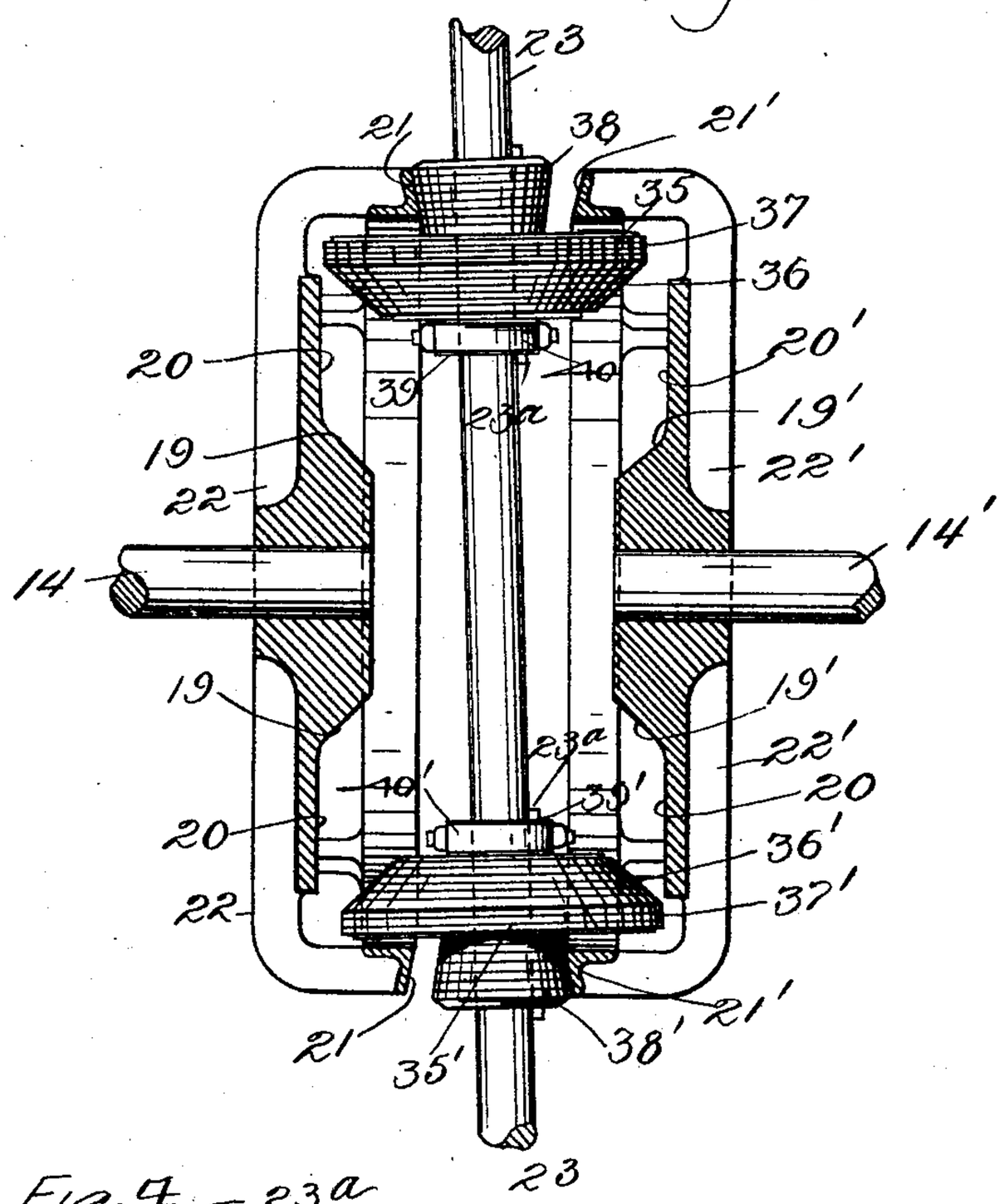
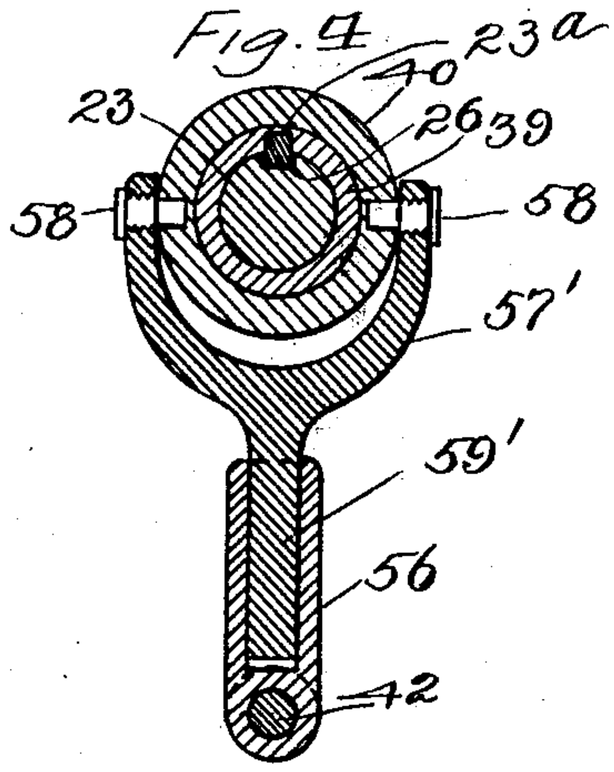


Fig. 4



Witnesses
Geo. J. May Jr.
Carl L Osgood

Inventor
William F. Howe.
By Foré Bain
Attorney

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UNITED STATES PATENT OFFICE.

WILLIAM F. HOWE, OF CHICAGO, ILLINOIS.

VARIABLE-SPEED POWER-TRANSMITTING DEVICE.

SPECIFICATION forming part of Letters Patent No. 771,150, dated September 27, 1904.

Application filed December 17, 1903. Serial No. 185,528. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. HOWE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Variable-Speed Power-Transmitting Devices; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to improvements in variable-speed power-transmitting devices.

It has especial reference to a power-transmitting device having one or more driving and driven members, one of the said members being provided with a plurality of variably-shaped working surfaces, the other coacting member having complementary working surfaces for engagement with the respective surfaces of the former, one of said members being adapted and arranged to be moved radially in either direction across the face of the other member for position of engagement and laterally for effecting said engagement.

The particular object of my present invention is to produce a device of the character described which is highly efficient when driven at the speeds near the limits of its capacity and by means of which an indefinite number of adjustments for varying the speed of the driven member thereof may be conveniently made when said device is operating at speeds intermediate of the highest and lowest velocity at which the driven member thereof may be rotated and to provide means by which the highest efficiency in the driving-contact relation of the two members is effected when the parts are in position to provide the highest and the lowest velocity of the driven member and to further provide a means in connection with the before-mentioned characteristics of the device whereby the driving and driven members may be conveniently brought into driving-contact relation.

A further object of my invention is to improve the general construction and arrangement of devices of the character described.

With a view to attaining these and other objects, which will be apparent to those skilled in the art from the following description, my invention consists in the features of construction and arrangement of parts hereinafter more fully described, and specifically pointed out in the claims.

In the drawings I have illustrated my invention as embodied in a device applicable to automobiles or other motor-vehicles, such as street-cars and the like, and I shall hereinafter describe the same with reference to such use, although I desire it to be understood that I do not limit myself to the use of my invention in such connection, as it is obviously susceptible of wide application.

In said drawings, Figure 1 is a broken-away top plan view of a power-transmitting device embodying my invention as adapted for automobile use. Fig. 2 is a longitudinal central section of the same. Fig. 3 is an enlarged broken-away section representing one operating position of the transmitting-gear. Fig. 4 represents an enlarged detail in cross-section taken through lines 4 4 of Fig. 2.

In all of the views the same reference-numerals indicate similar parts.

A rectangular supporting-frame 10 is shown in the drawings composed of the side pieces 11 11′, broken away, and the cross-pieces 12 12′. Intermediate side pieces 13 13′ are shown joining the cross-pieces 12 12′. The driven shafts 14 and 14′ are arranged coaxially in fixed bearings 15 15′ and 16 16′, respectively.

17 and 17′ are power-transmitting sprocket-wheels fixed upon the respective shafts 14 14′ for the purpose of transmitting the power therefrom to the traction-wheels of the vehicle, and 18 18′ are the driven members of the variable-speed transmitting device provided with a series of working contact-surfaces.

As several members of the device are duplicates in every part, I shall hereinafter indicate the various like parts by corresponding reference-numerals and differentiate the same by means of the exponent prime-mark (′).

The central portion of the driven disk or wheel 18 is provided with a coniform working surface 19, projecting laterally from the face of the said wheel. An extended annular working friction-surface 20 in a plane substantially at right angles to the axis of the shaft 14 is provided on the face of the wheel

18. An annular coniform overhanging working surface 21 forms a part of the driven member and is secured to the wheel or disk 20 by means of a series of ribs 22. The working coniform surfaces 19 and 21 are both in planes which substantially radiate from a point located centrally between the two driven members and the axis of the shafts 14 and 14′. The surfaces 19, 20, and 21 I shall hereinafter refer to as "face-working" surfaces of the driven members, although it is manifest that the surfaces 19 and 21 are somewhat oblique to the plane of the face of said members. It is also quite evident that the driven member 18 may be made the driving member instead of the driven member. I have used an arbitrary designation for the purpose of clearness.

A shaft 23 is arranged, preferably, in a central position longitudinally on the frame 10 and is located midway between the driven members 18 and 18′. It may be connected to a source of power, such as a gas-engine, (not shown,) adapted to be operated at a practically constant relative speed through a tumbling shaft or other flexible connection (shown broken off) to be connected thereto by means of the universal joint 24. The shaft 23 is mounted upon bearing-boxes 25 and 25′, which are supported upon the cross frame-pieces 12 12′, respectively. A spline 26 is made in and longitudinally of the shaft 23 and extends between bearing-supports of the said shaft. A feather 23^a rotatively secures the collars 40 and the elements 35 35′ to the shaft 23. The bearings 25 and 25′ are adapted to be slightly and laterally moved or oscillated in either direction from a central point taken through the axes of the shafts 14 and 14′ and midway intermediate of the driven elements 18 and 18′. The bearings 25 25′ are provided with laterally-extending flat segmentally-shaped projections on either side thereof, having similarly-shaped slots 27 for the reception of studs 28, which serve to guide the shaft 23 in the direction of its deflected bodily movement. A lever 29 is pivoted at the point 30 on the bearing 16′ and is loosely connected to the bearings 25 and 25′ by means of the links 31 and 31′, respectively. Two driving members 35 and 35′ are mounted on the shaft 23 and are rotatively fixed thereto by the feather 23^a, but are arranged for longitudinal slidable movement thereon. The working surfaces of the driving members are located on and somewhat near the periphery and slightly inclined therefrom at an angle more or less oblique. I shall hereinafter refer to these members as being adapted to make "peripheral" contact with the "face" of the driven members. The working surfaces 36 and 36′ are complementary surfaces for the surfaces 19 and 19′ of the driven members. The surfaces 37 and 37′ are complementary surfaces for the friction-surfaces 20 and 20′ of the driven members, and the surfaces 38 are complementary surfaces for the surfaces 21 and 21′ of the driven members. The driving members 35 35′ are each provided with an inwardly-projecting grooved collar extension (indicated by 39 39′) to receive loose rings 40 40′.

Supporting-brackets 41 and 41′ depend from the bearings 25 and 25′, respectively, and are adapted to support and afford bearing for the reciprocating rod 42. The forward end of the rod 42 is provided with teeth forming a rack 43. A bracket 44, in conjunction with a bearing 45, supports a shaft 46. The said shaft carries a pinion 47, fixed thereto, which engages the rack 43, and a pinion 48, which engages the segmental gear 49, the latter being an extension of the hand operating-lever 50, which is pivoted at the point 51 and which is guided and held in predetermined fixed positions by means of the guide 52, the notches therein being made to correspond with the various given positions of the driving members on the shaft 23 with reference to the driven members. The rod 42 is surrounded near its forward end by a tube 53, and the tube 53 and the rod 42 are adapted to be reciprocated laterally with reference to each other. An upwardly-curved rod 54 is fixed to the forward end of the tube 53 and is provided with a forwardly-extending rack 55, which meshes into the upper side of the geared pinion 47. Fixed to the rod 42 and to the tube 53 are upwardly-extending tubular pieces 56 and 56′ to receive the respective yokes 57 and 57′. These yokes are pivotally connected to the loose rings 40 and 40′ by means of screw-studs 58, which pass through the ends of the said yokes and take loosely into perforations made in the said loose rings. The lower ends of the yokes 57 and 57′ are made round in cross-section and are received by round tubes, the yokes being thereby made free to turn in the said tubes, so as to prevent binding when the driving members are shifted laterally in front of the face of the driven members.

The use and operation of my device are as follows: As shown in Fig. 1, the shaft 23, which carries the driving members 35 and 35′, occupies a normal position midway between the ends of the shafts 14 and 14′ and parallel to a plane at right angles to the axes of the said shafts, and in this position the shafts 14 and 14′ will not be rotated, as there is no driving contact or engagement made between the driving and driven members. In this position the foot-treadle 32 occupies a substantially horizontal position, and the lever 29 occupies a position substantially parallel with the shaft 23. Assuming now that the shaft 23 be rotated in a given direction at substantially a constant speed and that it is desired to rotate the shafts 14 and 14′ at a given speed, if the shafts 14 and 14′ are required to be rotated at the lowest possible speed consistent with a given speed at which the shaft 23 is being rotated it will be necessary to

shift the driving elements or disks 35 and 35′ outwardly and along the shaft 23 until they occupy the position shown in Fig. 3. The driving-disks may be shifted in the manner described by means of the lever 50. When the lever 50 is drawn or shifted in a direction toward the rear of the vehicle, as shown in Fig. 2, the rack extension 49 of the said lever will rotate the shaft 46 by virtue of its geared engagement with the geared pinion 48, by which means the pinion 47 is rotated. When the pinion 47 is rotated, (in the direction in which it will be rotated when the hand-lever 50 is moved toward the right or rear of the vehicle,) the rod 42, with the standard 56′, which carries the yoke 57′, will be moved outwardly toward the periphery of the driven element in a right-hand direction by the engagement of the geared pinion 56 with the rack 43. The tube 53 and the standard 56 will be coextensively and coincidentally moved in the opposite direction by the engagement of the rack 55 with the upper or top surface of the geared pinion 47. By the means just described the driving elements 35 and 35′ may be moved to any radial position within the limit of their excursion, which position may be predetermined and which may be ascertained by the location of the hand-lever 50 with reference to the support 52. After the driving elements have been moved to the desired position radially across the face of the driven elements by the means and in the manner described it then becomes necessary in order to establish driving engagement between the driving and the driven elements to laterally oscillate the shaft 23 by moving its opposite ends in opposite directions. This operation is effected by pressing on the treadle-lever 32, thereby applying pressure to either end of the said lever. When pressure is applied to the left-hand end of the tread-lever 32, the lever 29 is thereby deflected to the left, and the forward end of the shaft 23, together with the element 35, will be deflected in a like direction—that is to say, to the left—and the rearward end of the shaft 23 with the driving element 35′ will be deflected to the right. This operation will cause the surface 38 of the driving element 35 to make driving contact with the oblique or inclined surface 21 and the surface 38′ of the driving element 35′ with the surface 21′. As shown in Fig. 3, the surface of the smallest diameter of the driven members 35 and 35′ are now in driving-contact relation with the largest diameters of the driven members 18 18′. Now when the shaft 23 is driven or rotated at a practically-constant speed the shafts 14 and 14′ will be rotated at the lowest speed, but with the greatest turning effort or torque under the conditions described, and each of the shafts 14 and 14′ will be rotated in a given direction. If now the shaft 23 be deflected in the opposite direction by the means already described, whereby the coniform working surfaces 38 and 38′ of the respective driving elements are brought into driving engagement with the surfaces 21′ and 21, respectively, then the shafts 14 and 14′ will be driven at substantially the same speed as before, but in the opposite direction. If it is now desirable to increase the speed of the shafts 14 and 14′ without altering the speed of the shaft 23, the shaft 23 is once more brought into the central position shown in Fig. 1 by releasing pressure on the foot-treadle lever 32, and the driving elements 35 and 35′ are free to be coincidentally moved in a direction inwardly and radially toward the axis of the shafts 14 and 14′ until the surfaces 37 and 37′, respectively, are in positions to engage with the surfaces 20 and 20′, respectively, or vice versa. When the parts are in the last-described positions, the shaft 23 may be once more deflected by applying pressure on the foot-treadle 32 until the said surfaces are brought into respective driving relation. The speed of the shafts 14 and 14′ may be still further increased by the further movement of the driving elements 35 and 35′ in a direction toward the axes of said shafts 14 and 14′ to any intermediate points until they occupy the respective relations shown in Fig. 1 with reference to their positions on the shafts 23. When now the shaft 23 after the parts have been brought into such positions, the surfaces 36 and 36′ will be brought into driving relation with the surfaces 19 and 19′, respectively, or with the surfaces 19′ and 19, respectively, depending upon the direction in which the respective ends of the shaft 23 are deflected, as heretofore described, at which time the coniform surfaces of the driving elements will make driving engagement with similar coacting surfaces of the driven elements, and the latter will be driven at the highest speed and with the greatest mechanical efficiency as a result of the contact of the inclined surfaces of the transmission device.

It is manifest that instead of employing two shafts 14 and 14′ one shaft only may be employed, and the power from the shaft 23 may be transmitted to the particular shaft used without reference to the other. It is also apparent that if desired the shafts 14 and 14′, or either of them, may be used as the driver and the elements thereon as the driving elements, and the shaft 23 may be driven thereby through the driven element or elements carried thereby. I prefer the embodiment as exemplified in the drawings and the methods of their operation as the preferable form. It is also evident that other means than that shown in the drawings may be employed for the purpose of oscillating or deflecting the shaft 23, and that other means than that shown may be employed for shifting the driving elements 35 and 35′ without departing from the spirit of my invention. It is also evident that

the coniform working surfaces may be either friction or gear surfaces. The intermediate surface on the driven member and its coacting surface on the driving member, however, should be friction-surfaces.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a device of the character described, a driving-gear member having a plurality of working surfaces at various radial distances from and at different angles to its axis, and a working surface parallel with its axis, a driven-gear member having complementary working surfaces at various radial distances from its axis adapted to coact with the corresponding working surfaces of the driving-gear member, and means for moving the driving-gear member both radially and laterally relative to the driven member for effecting contact between the respective complementary couples of driving and driven surfaces.

2. In a device of the character described, a driving and a driven member, one of said members consisting of a wheel provided with a coniform working surface near its axis, a coniform working surface near its periphery, a working friction-surface in a plane at right angles to its axis and intermediate of the first and second named surfaces, the other one of said members consisting of a wheel provided with a plurality of working surfaces adapted to engage respectively the complementary surfaces of the first-described member, and a means for effecting engagement of the two members.

3. In a device of the character described, the combination of a driven wheel provided with a coniform friction-surface near its axis, a coniform friction-surface near its periphery, a flat annular friction-surface intermediate of the coniform surfaces and in a plane at right angles to the axis of the said wheel, a driving-wheel having complementary coacting friction-surfaces, adapted to engage the respective surfaces of the driven wheel, and a means for radially and laterally moving the driving-wheel into position and into contact with the driven wheel.

4. In a device of the character described, the combination of a driving and a driven member, one of the said members provided with a working surface near its axis and inclined with reference thereto, a working surface near its periphery inclined with reference to said axis, an intermediate friction-surface in a plane at substantially right angles thereto, the other member provided with complementary working surfaces, and a means for moving the driving member relative to the driven member for effecting driving engagement of the respective surfaces.

5. In a device of the character described, the combination of a driving and a driven member, one of said members provided with a working surface near its axis and inclined at an angle less than a right angle with reference thereto, a working surface extending outwardly and radially therefrom in a plane substantially at right angles to the axis of said member, and a working surface inclined at an angle less than a right angle from the axis of said member near the periphery thereof, and overhanging the before-mentioned surfaces, the other said member provided with complementary working surfaces, and a means for relatively moving said members for effecting driving engagement of the respective working surfaces.

6. In a device of the character described, the combination of a driving and a driven member, one of said members provided with a working surface near its axis and inclined at an angle less than a right angle with reference thereto, an annular working surface extending outwardly and radially therefrom in a plane substantially at right angles to the axis of said member, and a working surface inclined at an angle less than a right angle from the axis of said member near the periphery thereof, the other said member provided with complementary working surfaces, and a means for moving the latter member to predetermined positions for engagement of the respective working surfaces and laterally with reference to the former member, to effect said engagement.

7. In a device of the character described, the combination of a driving and a driven member, one of said members provided with a conically-inclined working surface near its axis, a radially-flat, annular friction-surface extending outwardly therefrom in a plane substantially at right angles to its axis, an annular conically-inclined working surface of larger diameter than the before-mentioned surfaces and overhanging the same, the other said member provided with a conically-inclined working surface adapted to engage the first-mentioned surface, a peripheral surface in a plane parallel with its axis, adapted to engage the second-mentioned surface and a smaller conically-inclined working surface adapted to engage the third-mentioned surface, and a means for relatively moving said members for effecting driving engagement of the respective working surfaces.

8. In a device of the character described, two confronting, coaxially-arranged, driven disks, on separate shafts, each disk provided with a plurality of working surfaces at various radial distances and at different angles from the axis thereof, two driving-disks, intermediate of the driven disks and adapted to be moved coextensively, coincidentally, laterally and radially relative to the driven disks, a plurality of coacting working surfaces on said driving-disks adapted to make driving contact with complementary surfaces on said driven disks, and means for coincidentally

moving said driving-disks into respective positions and into contact with said driven disks.

9. In a device of the character described, the combination of a driving and a driven gear member, one of said members being provided with a working surface substantially parallel to its axis and a working surface inclined relative to the said axis at a less radial distance therefrom than the parallel surface, the other of said members having a working surface at right angles to its axis, and an inclined working surface surrounding and overhanging the before-mentioned surface for coaction with the complementary inclined surface of the first-mentioned member, and means for varying the relative positions of the two members to effect driving engagement of selected complementary surfaces thereof.

10. In a device of the character described, a driving and a driven member, one of said members being provided with a working surface substantially parallel to its axis, and a working surface inclined relative to the said axis at a less radial distance therefrom than the parallel surface, the other of said members having a working surface at right angles to its axis and its inclined working surface exterior to and overhanging the beforementioned surface for coaction with the complementary inclined surface of the first-mentioned member, means for moving the driving-gear member both radially and laterally relative to the driven member for effecting contact between the complementary couples of driving and driven surfaces.

11. In a device of the character described, the combination of a driving-gear member and a driven-gear member, one of said members being provided with a working surface approximately parallel to its axis, and another working surface at a less radial distance from said axis than the first said surface, and the other of said members having a working surface approximately at right angles to its axis, and another working surface surrounding and overhanging the before-mentioned surface for coaction with the surface of the first-mentioned member at the least radial distance from its axis, and means for varying the relative positions of the two members to effect driving engagement of selected complementary surfaces thereof.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

WILLIAM F. HOWE.

In presence of—
FOREÉ BAIN,
MARY F. ALLEN.