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W. MAIN.

POWER TRANSMITTING DEVICE.

No. 407,085. Patented July 16, 1889.

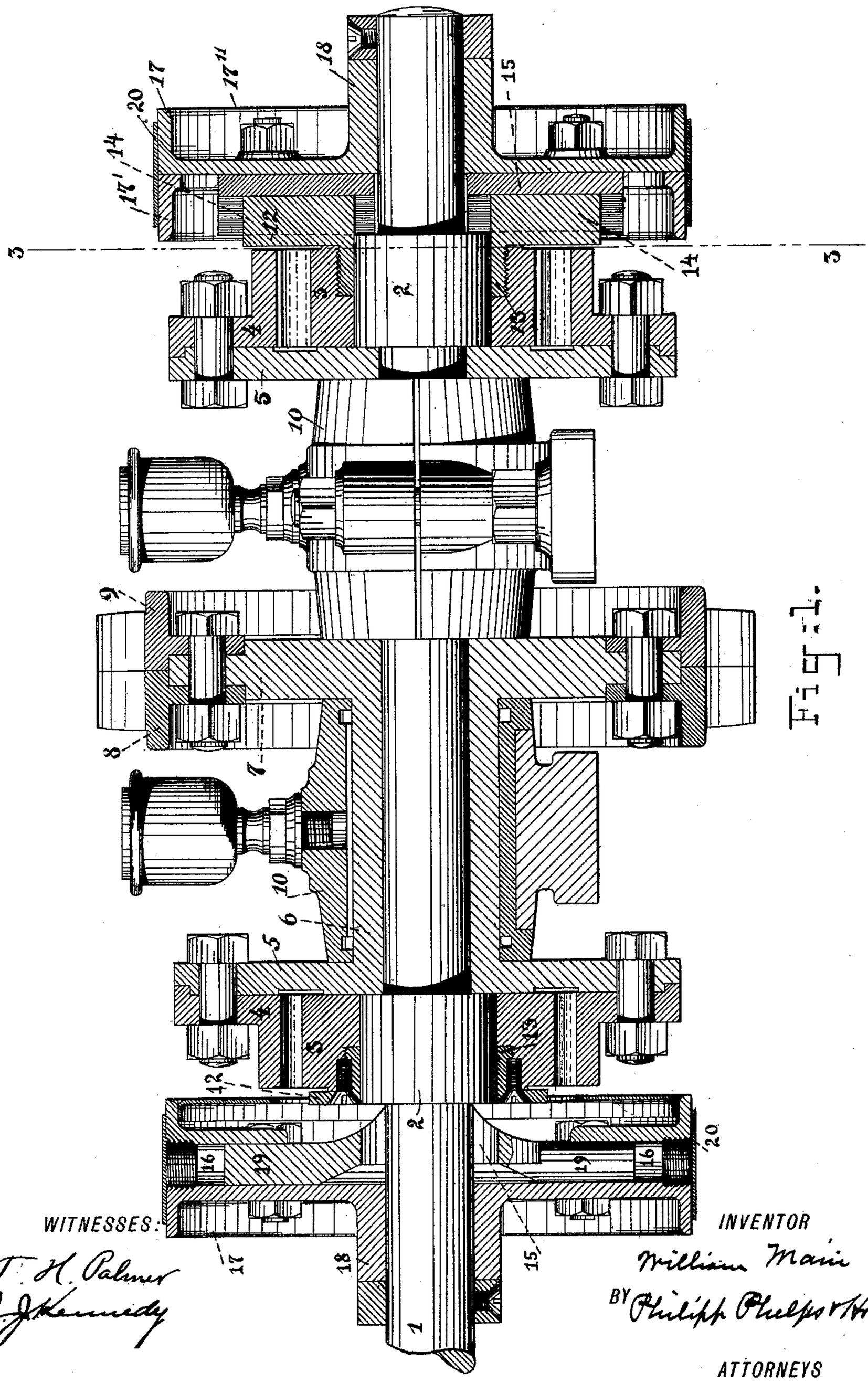

Fig. 1.

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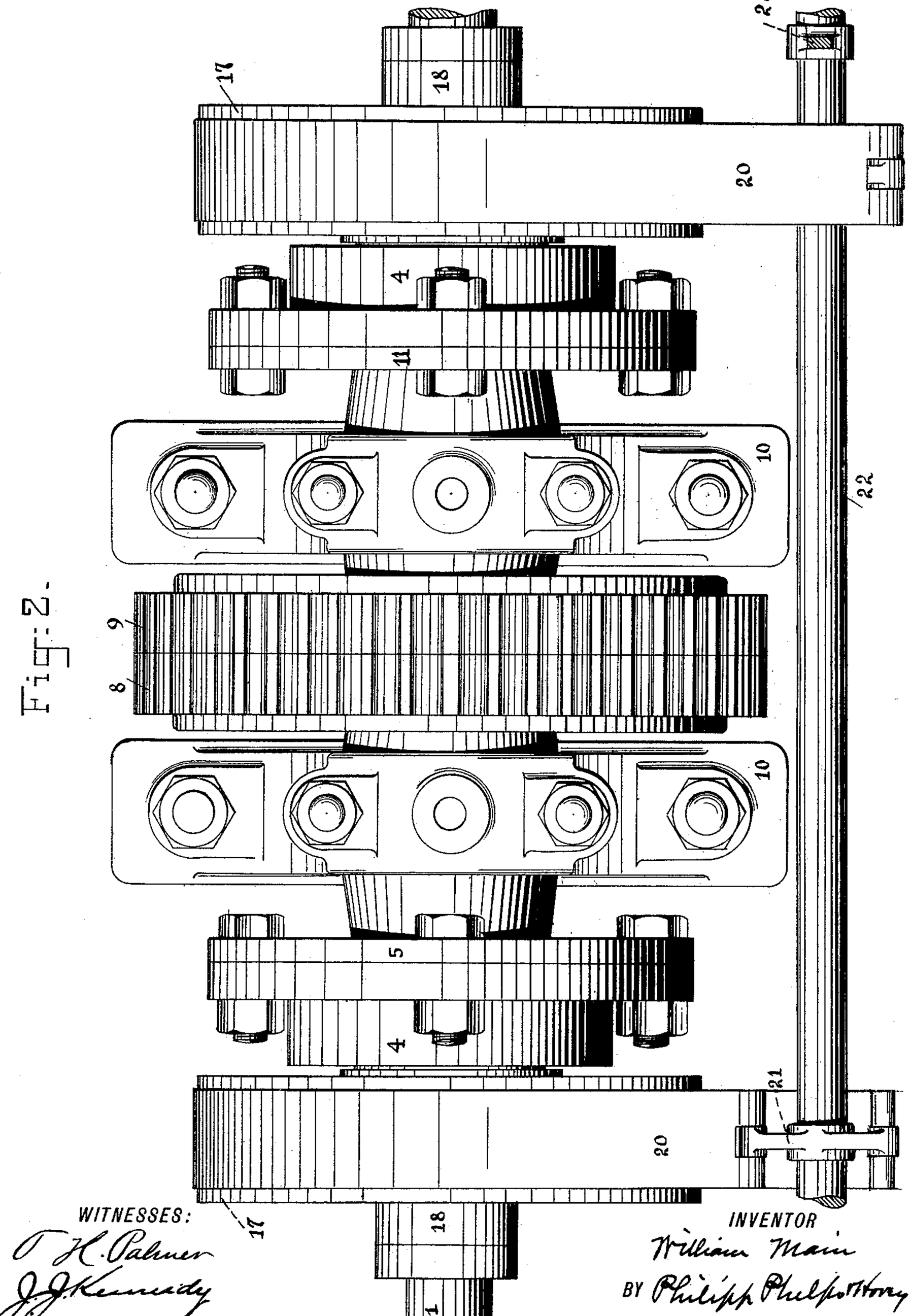

Fig. 2.

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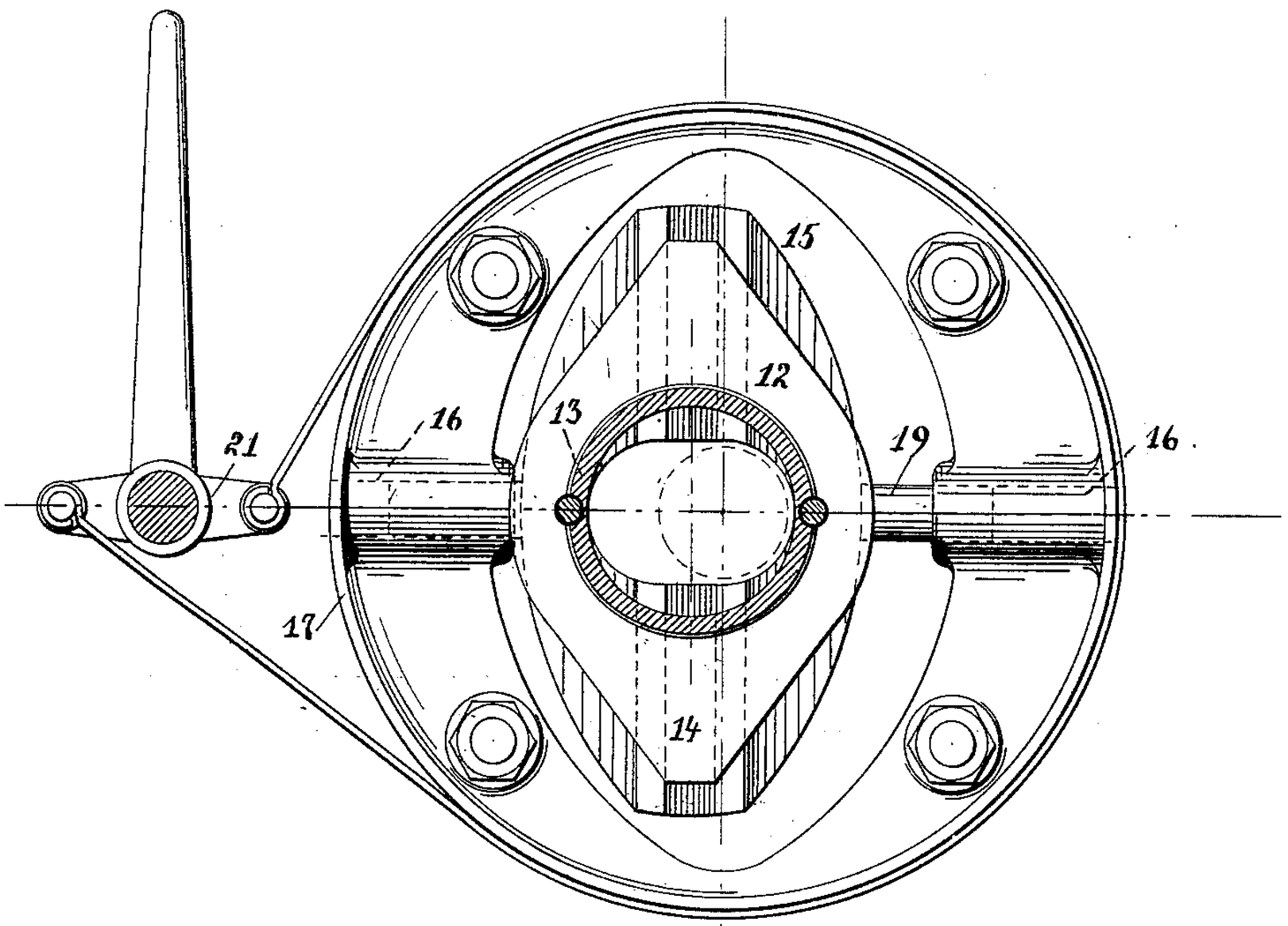

Fig: 3.

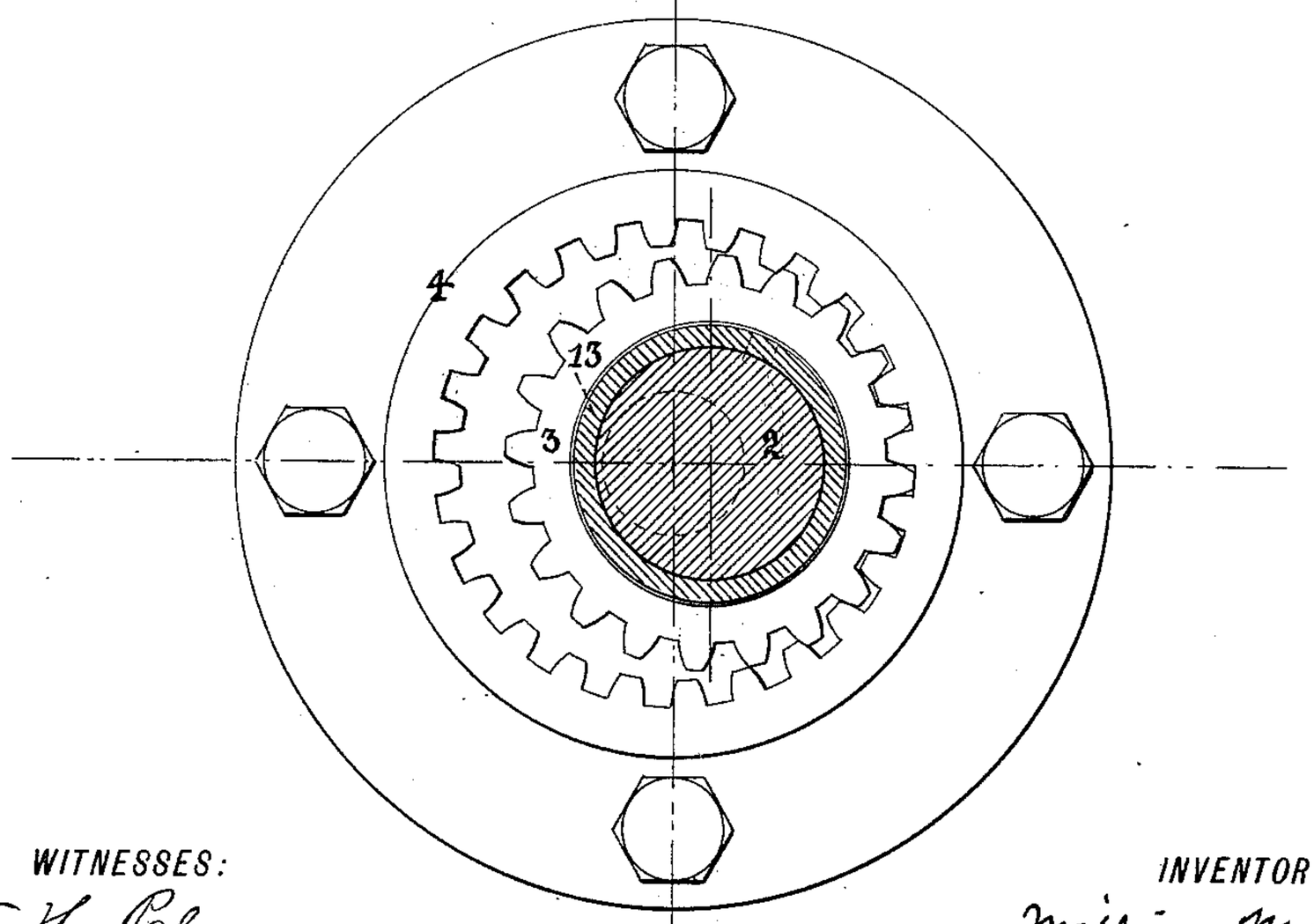

Fig: 4.

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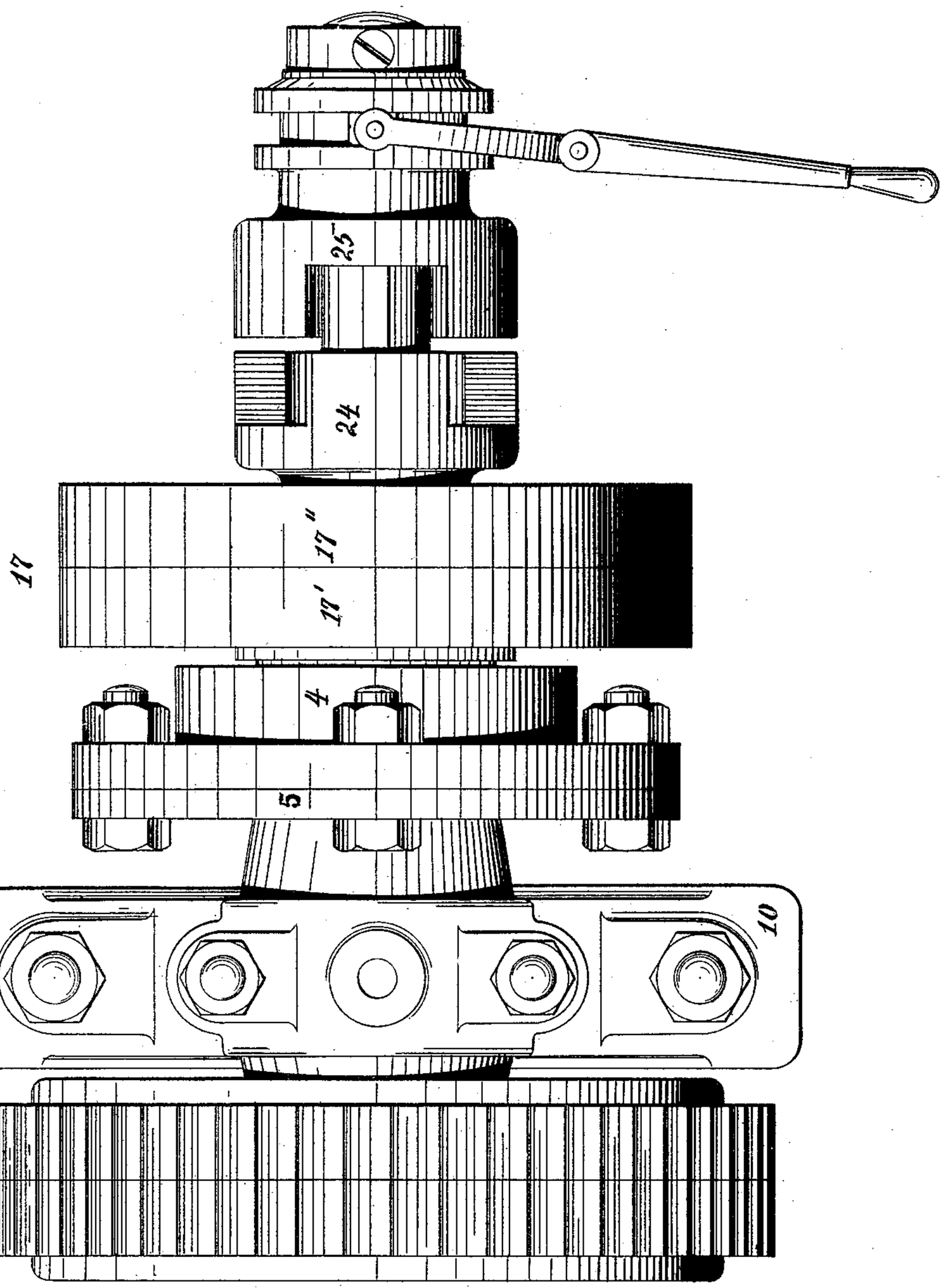

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UNITED STATES PATENT OFFICE.

WILLIAM MAIN, OF BROOKLYN, NEW YORK.

POWER-TRANSMITTING DEVICE.

SPECIFICATION forming part of Letters Patent No. 407,085, dated July 16, 1889.

Application filed August 27, 1887. Serial No. 248,011. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MAIN, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Power-Transmitting Devices, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of my invention is to provide a simple and compact device for reducing or increasing motion in transmitting power in a high ratio and for adapting that device so that it can be readily turned into and out of operation, and so that different speeds, by a combination of power-transmitting devices, may be given to the driven mechanism, as desired, these results to be accomplished with as little friction and loss of power as may be practicable.

My invention relates to the application for the transmission of power of what is known as the "Watt sun-and-planet gear," by means of mechanically practical mountings and connections in such manner as to impart motion to the driven mechanism only when the oscillating member of said gear is restrained to constant parallelism by means of a connection or guide extending from the oscillating gear to a guide-bearing, which guide-bearing moves with it when the power is not to be transmitted, but may be arrested or retarded, so as to throw the driving and driven mechanism into operative connection, and in such manner that uniformity of speed shall be imparted to the driven mechanism.

In another application filed June 13, 1888, Serial No. 276,982, I have shown and described a variety of mechanisms embodying my invention, and have explained at length the character of the said mechanism, generically considered.

My present application has for its object the protection by Letters Patent of my invention embodied in mechanism, wherein the connection or guide mechanism governing the action of the oscillating gear-wheel consists of double slides controlled by directing-surfaces. In the application above mentioned I have claimed in a power-transmitting device the subject-matter of my invention which is common to all of the several forms of mechanism described therein; and in another application filed June 12, 1888, Serial No. 276,984, I have claimed the method involved in my invention. I do not therefore claim, broadly, such subject-matter in the present application.

An important part of my invention, generically considered, and which I claim here, in combination with the particular form of guide mechanism herein shown and claimed, consists of a bearing for the guide mechanism which rotates in unison with the oscillating gear of the sun-and-planet series of gear-wheels, but which may be restrained or retarded, so as to throw the driving and driven mechanism into operative connection. The restraint or retardation of this bearing may be gradually accomplished, as by a spring-clutch, or preferably a friction-brake, and the power of the shaft and the momentum stored up in its rotating connections may thus be gradually and without shock or jar transferred to the driven mechanism. My invention thus possesses the advantages of frictional power-transmitting connections in starting the driven mechanism and of positive gear-connection after the transmission of power has been fully initiated, besides other advantages, which will be hereinafter more particularly pointed out.

In the drawings forming a part of this specification and illustrating this invention, Figure 1 is a side elevation, partly in section, of my improved apparatus. Fig. 2 is a plan view. Fig. 3 is a section on the line 3 3 of Fig. 1, the point of view being to the left of said figure; and Fig. 4 is a section taken on the same line, the point of view being to the right of said figure. Fig. 5 shows a clutch for effecting the direct connection of the shaft with the driven gear.

The driving-shaft 1 carries fast upon it an eccentric 2, which moves freely within a circular opening in a gear-wheel 3, which constitutes the fixed or initial member of the sun-and-planet series. Outside of and about this gear-wheel is an annular gear 4, concentric with the driving-shaft 1 and bolted to a flange 5 of a sleeve or hollow shaft 6, mounted upon the main shaft and carrying at its center a flange 7, to which are bolted the two halves 8 and 9 of a gear-wheel from which the power

is transmitted to the driven mechanism. The sleeve 6 rests in any suitable bearings, as 10. At the opposite end of the sleeve is a second flange 5, with which is connected a second set of devices identical with those above described, except that the ratio between the inner and outer gear-wheels is varied, this additional mechanism being provided in order that it may be possible to vary the speed of the driven mechanism. These two devices at the ends of the sleeve in Fig. 1 being identical in construction, with the exception, as stated, that the ratio between the gear-wheels varies, the same numbers of reference have been applied to the parts in each case, and the following description may be understood as applicable to both parts of the device.

To the inner gear-wheel 3 is rigidly fixed a slide 12, from the center of which projects an annular screw-threaded rim 13, which enters the interior of the gear and is locked therein, as shown in the left-hand part of Fig. 1. This slide is provided with lugs 14, which fit a recess in a cross-head 15, in turn provided with cylindrical lugs 19, fitting cylindrical sockets 16, formed in a pulley 17, mounted upon and rotating freely about the main shaft. This pulley 17 is made up of two castings 17′ and 17″, bolted together, as shown, one of the castings 17″ having a hub 18, which constitutes the bearing of the wheel. The cross-head 15 has an oblong central opening, which permits it to move in the direction of its lugs 19 over the main shaft 1.

It is obvious that the gear 3 and the pulley 17 will maintain fixed positions relative to each other as regards rotation, their absolute relative positions changing as the shaft 1 revolves to the extent of the sliding motion of the slide with reference to the gear and of the cross-head with reference to the pulley, caused by the eccentric position of the gear 3 with reference to the axis of the pulley 17, the slide 12 and cross-head 15 being double slides moving in right lines and uniting the gear and the pulley as regards circular motion. These slides together constitute a guide for the eccentrically-mounted gear 3, by which it is connected with the pulley 17, which pulley embodies in the mechanism herein described and claimed one form of the restrainable bearing for the guide. When the pulley 17 freely revolves about its axis, the gear 3 is also free, and will convey no power from the shaft to the outer gear 4. When, however, the pulley 17 is locked or held fast in one position, the gear 3 will be carried about by the eccentric in a position constantly parallel to itself, and will communicate to the outer gear 4 a rotating motion reduced to an extent dependent upon the ratio between the two gears. The amount of this reduction may be readily calculated according to well-known rules, which require no special explanation here. In other words, the line of the governing-points of the gear 3, which line we may conceive to be that joining the locking-screws between the wheel and the rim 13, Fig. 1, is constrained to always maintain, as the gear 3 oscillates, positions of parallelism with respect to a fixed line represented by the axial line of the lugs 19, the mechanism effecting the constraint being slide 12 and cross-head 15.

It is necessary to provide devices for the locking of the pulley 17 in order to effect the transmission of power through the gears; and for this purpose I prefer to use a friction-brake, (although any other form of suitable braking or arresting device may be employed.) As illustrated in Figs. 1 and 2, a strap 20 passes about the pulley 17, the ends of the strap being pivoted to a cross-piece 21, fastened upon a shaft 22, which shaft is revolved, as desired, by a handle 23, attached thereto, whereby the strap is tightened or loosened to arrest or release the pulley. In the mechanism shown two of these straps are used, one for each pulley, so connected with their arms 21 that in one position of the shaft 22 one of the said pulleys is arrested and the other released, and in the other position thereof the action of the straps upon the pulleys is reversed. By the use of this mechanism either one of the two sets of gears may be brought into operation, according to the speed desired to be given to the driven mechanism. If more than two speeds are desired for the driven mechanism, the number of sets of gears may be accordingly increased.

In order to give the hollow shaft the speed of the driving-shaft when required, I propose to lock the two rigidly together, and in Fig. 5 I have shown means for this purpose, which may, however, be effected by any sort of a clutch device between the two shafts. The means shown in Fig. 5 consists of a clutch, one part thereof 24 forming a part of the pulley 17, and the other part 25 splined upon the driving-shaft. By throwing this clutch the pulley may be locked to the shaft, the effect of which will be to cause the gear 3 to act as a crank and consequently gear 4 to revolve with the shaft. I thus obtain a third rate of speed for the driven mechanism.

My invention has the signal advantage over other sun-and-planet power-transmitting devices with which I am acquainted, in that it enables the power of the driving-shaft to be applied with the utmost advantage to the starting of the driven mechanism. At this moment great power, as well as the gradual application of that power, is required. My friction-brake controlling the operative engagement of the driven gear permits the entire force of the driving-shaft rotating at full speed to be applied with any desired leverage and with as gradual accession of speed as is advantageous. The control possessed over the whole mechanism is absolute, and its operation can be precisely directed. These advantages flow directly from the fact that the peculiar gear employed is out of operation when one of its members revolve freely, and that, consequently, it may be made op-

erative by the application of brakes to the revolving member, the mechanism to which the brakes are applied becoming, on their complete application to a fixed part of the framework of the machine, an abutment upon which the transmitting-gear rests while operative.

I do not limit myself to a construction in which the driving-gear is within the driven gear, as the relation of the parts may be reversed or a disk-gear may be substituted for the annular gear shown in this application, the two gears then being alike and having their cogs on their outer circumferences. The principle of operation would in this case be identical with that shown herein, though the details of the mechanism used and the results obtained in the transmission of power would be different. So, too, the power may be transmitted with an increase as well as a decrease of speed, and the oscillating gear may be the driven instead of the driving member.

It is evident that my invention may be employed generally wherever power is to be transmitted from one shaft to another. In the form shown, however, it is particularly designed for use in the propulsion of a car from an electric motor mounted thereon.

By the term "driven mechanism" in the claims I mean to indicate any mechanism to which the power transmitted through the gear-wheels may be applied, such mechanism being represented in the present device by the hollow shaft 6, the gear-wheels 8 and 9, and any power devices connected therewith.

Having thus described my invention, what I claim, and desire to protect by Letters Patent, is—

1. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a restrainable guide-bearing normally rotating with said oscillating wheel, and guide mechanism for restraining the motion of said oscillating wheel when the guide-bearing is restrained, said guide mechanism being made up of parts having a double sliding motion, substantially as described.

2. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, and a restrainable guide-bearing normally moving with said oscillating wheel and connected thereto by guide mechanism made up of a slide reciprocating in one direction along guiding-surfaces upon the guide-bearing and in a direction at right angles thereto along guiding-surfaces connected to said oscillating wheel, substantially as described.

3. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a restrainable guide-bearing connected with said oscillating wheel by guide mechanism made up of parts having a double sliding motion, and a brake for restraining or retarding the movement of the guide-bearing, substantially as described.

4. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a restrainable rotatory guide-bearing normally moving with said oscillating wheel, guide mechanism for restraining the motion of said oscillating wheel when the guide-bearing is restrained, said guide being made up of parts having a double sliding motion, and a brake for restraining the rotation of said bearing, substantially as described.

5. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a restrainable rotatory guide-bearing normally moving with said oscillating wheel, a brake for restraining the rotation of said bearing, and guide mechanism connecting said bearing with said oscillating wheel, said guide mechanism being made up of a sliding piece reciprocating with reference to the guide-bearing in one direction along guiding-surfaces and with reference to the oscillating wheel in a direction at right angles thereto along guiding-surfaces, substantially as described.

6. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a restrainable guide-bearing normally moving with said oscillating wheel, and guide mechanism for restraining the motion of said oscillating wheel when said guide-bearing is restrained, said guide mechanism including a sliding piece having a rectilinear reciprocation with respect to the oscillating wheel and a rectilinear reciprocation with respect to the guide-bearing, said reciprocations being at right angles to each other, substantially as described.

7. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a rotatory pulley mounted loosely upon the driving-shaft, a brake for restraining the rotation of the pulley, and guide mechanism connecting the pulley and the oscillating wheel for restraining the motion of the oscillating wheel, said guide mechanism consisting of a cross-head encircling the driving-shaft and connected, respectively, to the oscillating wheel and the pulley by the engagement of guiding-surfaces extending in directions at right angles to each other, substantially as described.

8. A power-transmitting device for connecting a driving-shaft with a driven mechanism,

consisting of a set of gear-wheels, one of said gear-wheels having a rotary and also an oscillating motion, a rotatory pulley, a cross-head encircling the driving-shaft and having guide-grooves for receiving lugs or projections mounted upon said oscillating wheel and adapted to slide in said guide-grooves, said cross-head also having at right angles to said guide-grooves lugs or projections adapted to slide in guide-grooves formed in the pulley, and a brake for restraining the rotation of said pulley, substantially as described.

9. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of separate sets of differently-proportioned gear-wheels, the members of each set being normally out of operative connection, and a brake for simultaneously throwing into operative connection the members of one set and throwing out of operative connection the members of the other set, whereby the motion due to either set of gears may, as desired, be imparted to the driven mechanism, substantially as described.

10. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of separate sets of differently-proportioned gear-wheels, one of the wheels of each set having an oscillating motion about a center, and each set having a restrainable guide-bearing normally moving with its oscillating wheel, guide mechanism for restraining the motion of said oscillating wheel when the guide-bearing is restrained, and a brake for simultaneously releasing both guide-bearings or arresting either one and releasing the other, substantially as described.

11. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a series of sun-and-planet gear-wheels, one member of which is in operative connection with the driving-shaft and the other with the driven mechanism, a restrainable guide-bearing normally moving with the oscillating member of said sun-and-planet gear, and a guide for restraining the motion of said oscillating gear when the guide-bearing is restrained, the parts of said guide having a double rectilinear motion, one motion with respect to the oscillating wheel and the other with respect to the guide-bearing, substantially as described.

12. A power-transmitting device for connecting a driving-shaft with a driven mechanism, consisting of a series of sun-and-planet gear-wheels, one member of which is in operative connection with the driving-shaft and the other with the driven mechanism, a rotatory pulley normally moving with the oscillating member of said sun-and-planet gear, a guide connecting the oscillating wheel with the pulley, said guide being made up of parts having a double rectilinear sliding motion, and a brake for arresting the rotation of said pulley for the purpose of restraining the motion of the oscillating wheel, substantially as described.

13. The combination of a driving-shaft, a driven mechanism, a set of sun-and-planet gear-wheels connecting said shaft and mechanism, guides connected to the oscillating member of the sun-and-planet gear, guide-bearings, and a clutch for locking the guide-bearings to said driving-shaft, substantially as described.

14. The combination of a driving-shaft, a driven mechanism, a set of sun-and-planet gear-wheels connecting said shaft and mechanism, the oscillating member of said gear-wheels being eccentrically mounted on said shaft, guides connected to the oscillating member of the sun-and-planet gear, guide-bearings, and a clutch for locking the guide-bearings to said driving-shaft, substantially as described.

15. The combination of two concentric shafts, sun-and-planet gear-wheels connecting the same, a rotatory pulley loosely mounted upon the inner shaft and connected to the oscillating member of said gear-wheels by guide mechanism, and a clutch for locking the rotatory pulley to the inner shaft, substantially as described.

16. The combination of a driving-shaft, a driven shaft concentric therewith, two sets of differently-proportioned sun-and-planet gears connecting said shafts, the oscillating members of each set being mounted upon the driving-shaft and the driven members being rigid with the driven shaft, and guide mechanism for throwing either of said sets of gears into operation, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM MAIN.

Witnesses:
J. J. KENNEDY,
G. M. BORST.