No. 889,769. PATENTED JUNE 2, 1908.

J. L. DIDIER.

CHANGE SPEED GEARING.

APPLICATION FILED JAN. 28, 1907.

3 SHEETS—SHEET 1.

Fig. 1ª.

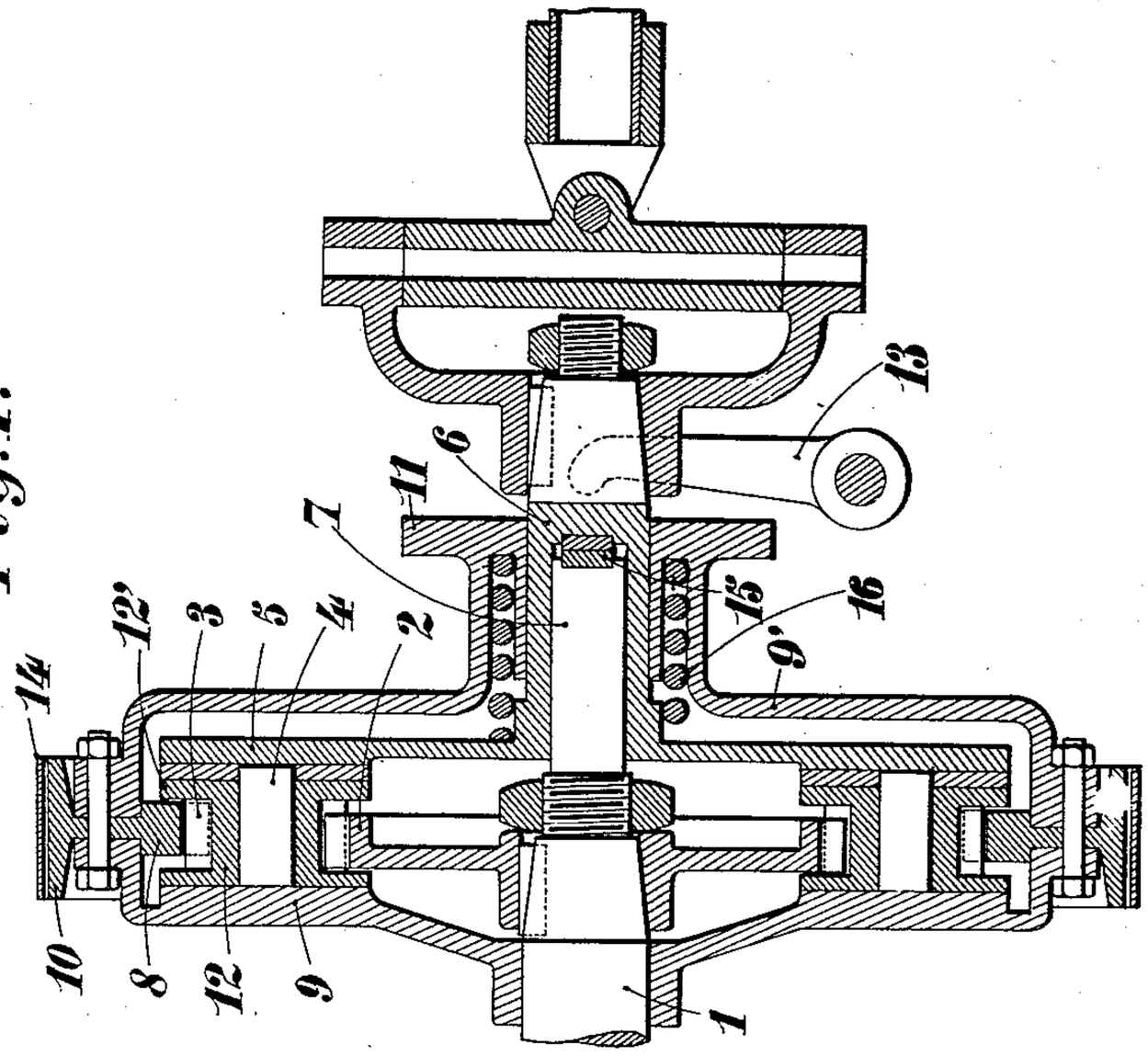
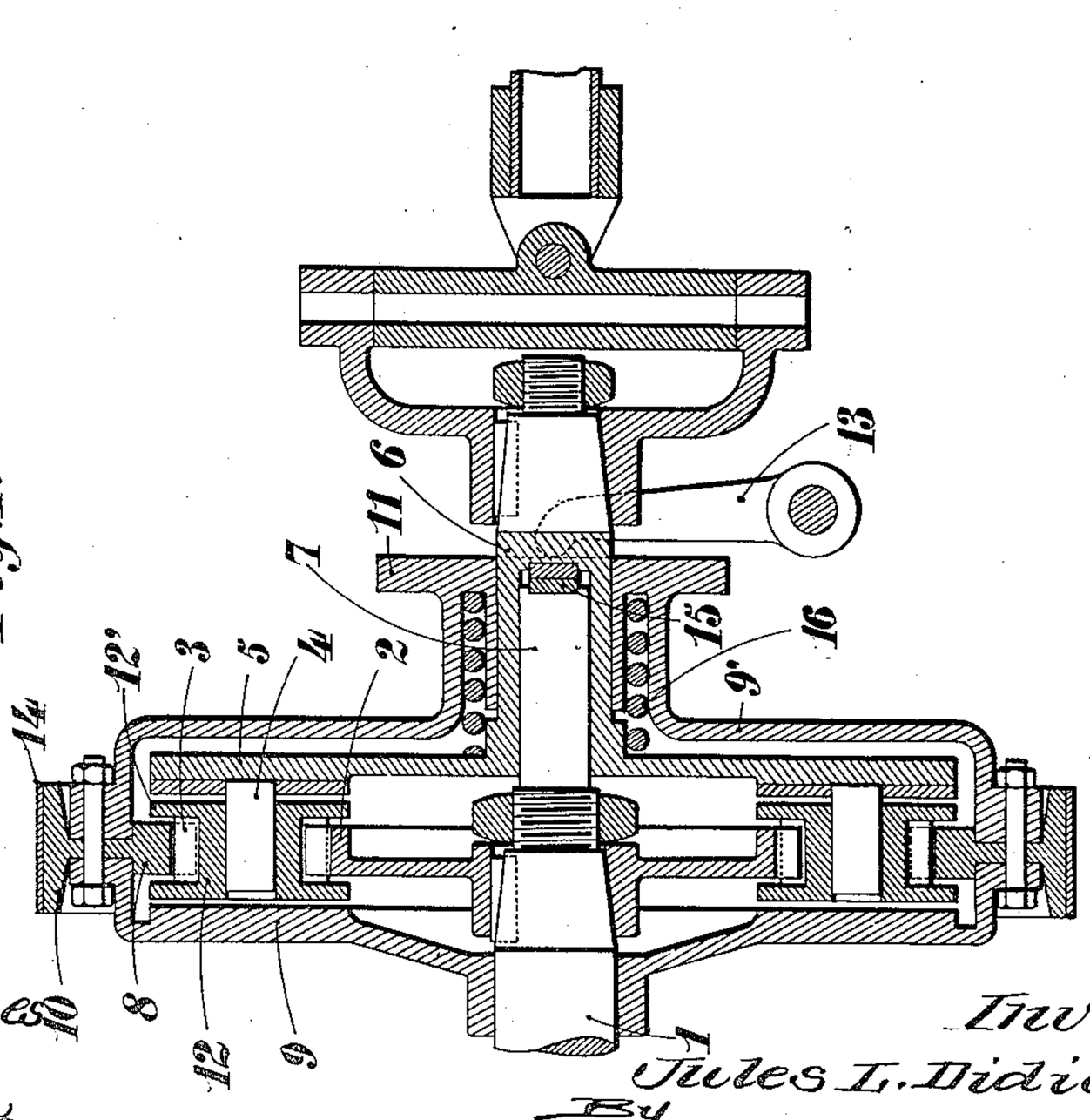


Fig. 1.



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3 SHEETS—SHEET 2.

Fig.3.

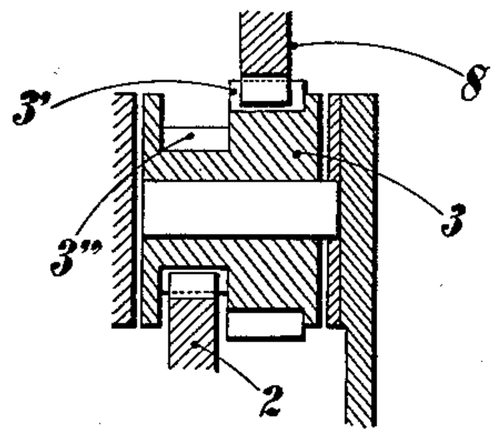
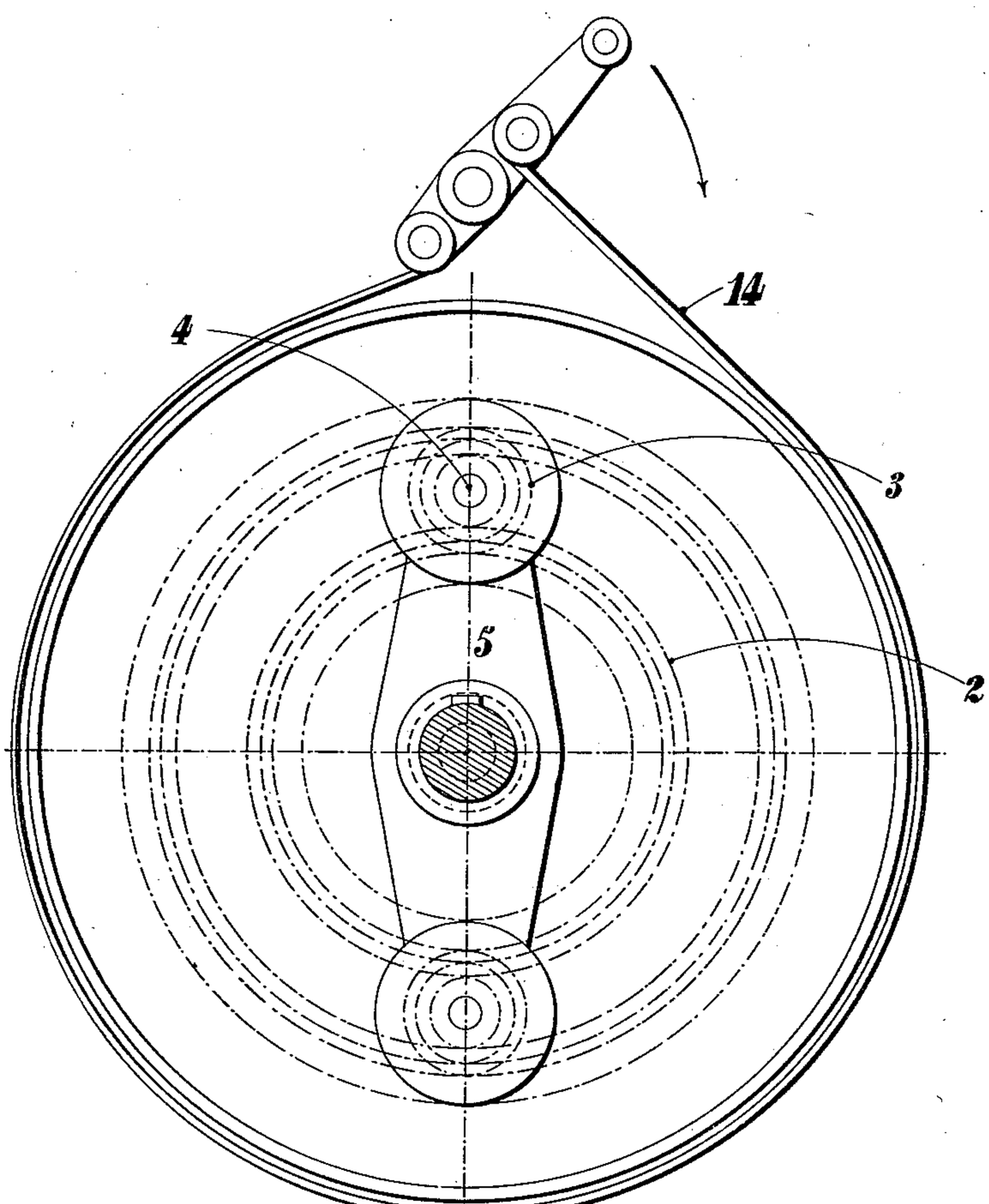


Fig.2.



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3 SHEETS—SHEET 3.

Fig. 6.

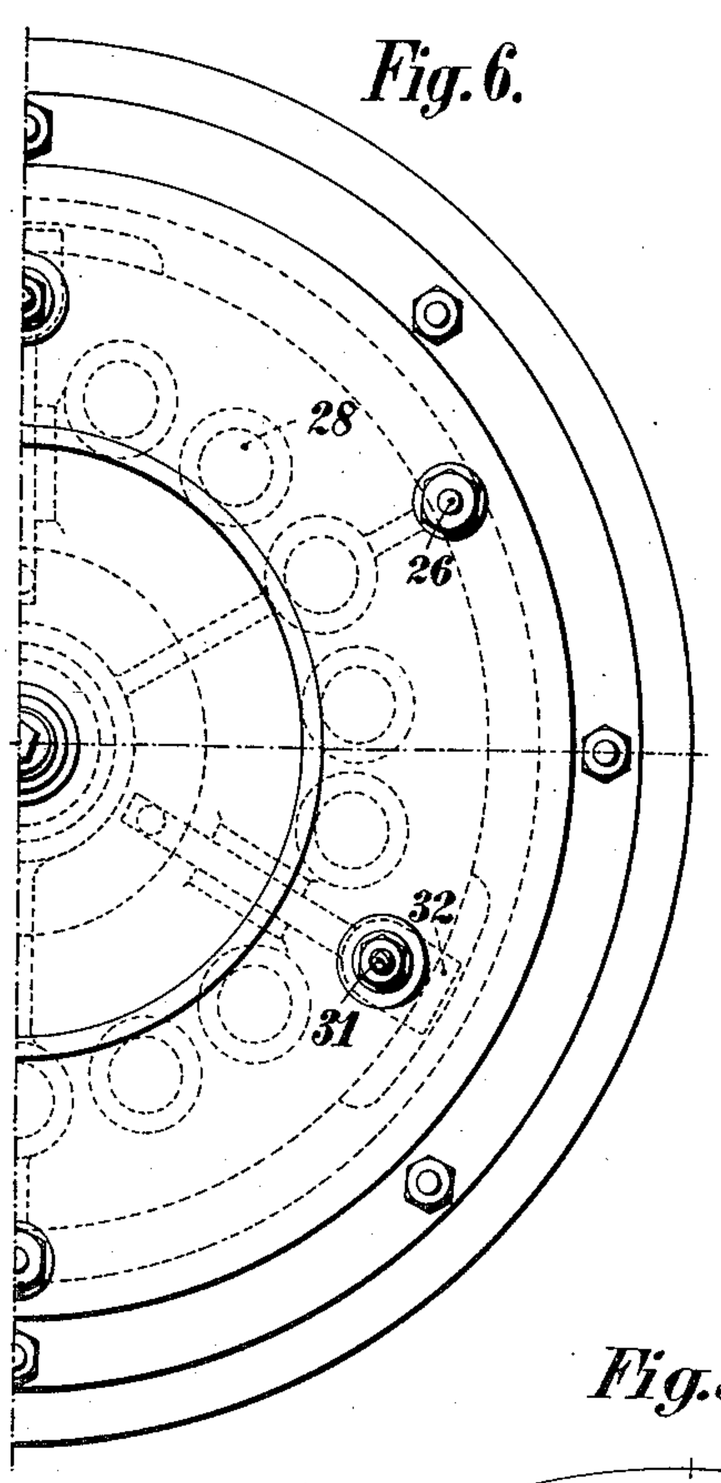


Fig. 4.

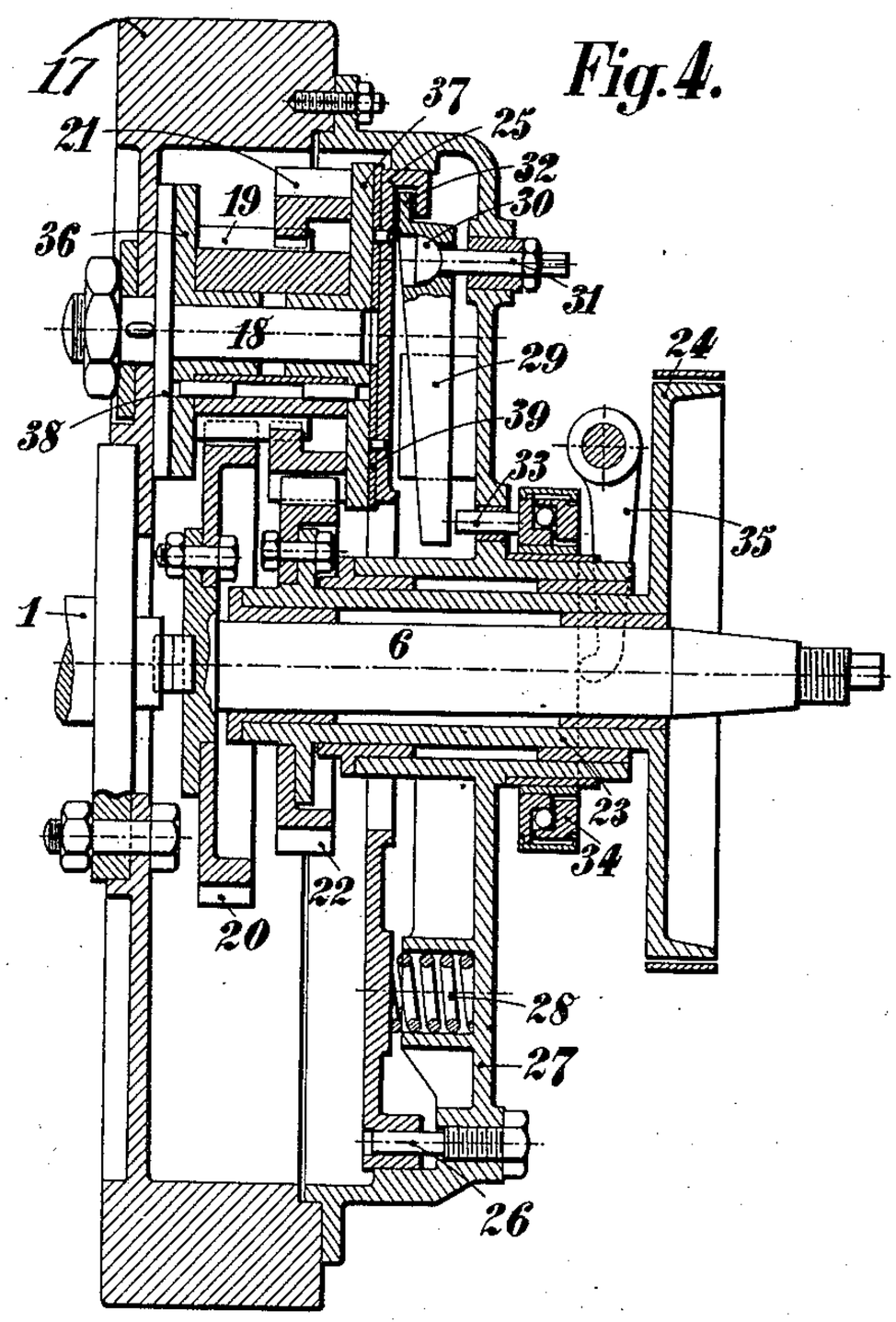
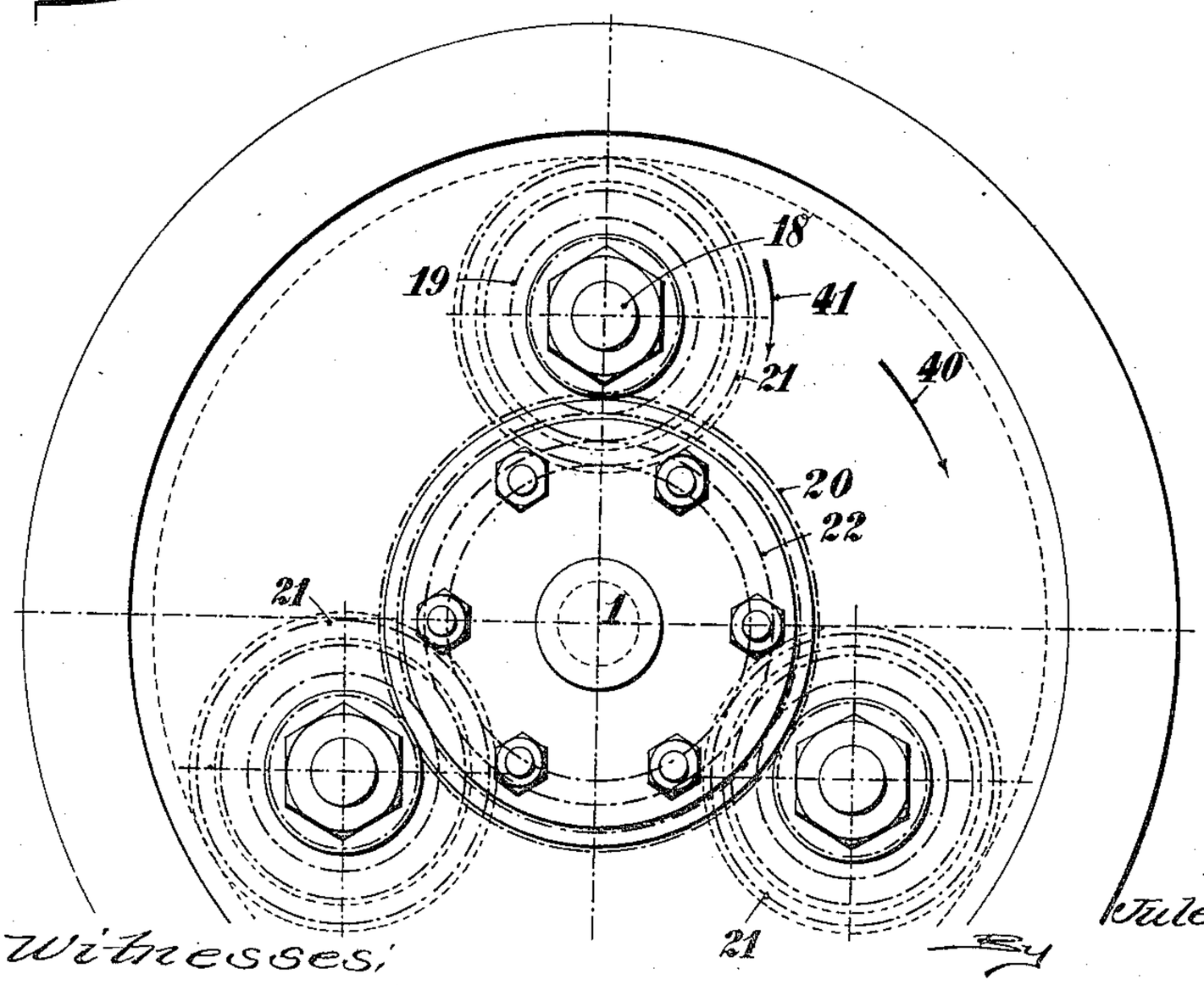


Fig. 5.



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UNITED STATES PATENT OFFICE.

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CHANGE-SPEED GEARING.

No. 889,769. Specification of Letters Patent. Patented June 2, 1908.

Application filed January 28, 1907. Serial No. 354,527.

To all whom it may concern:

Be it known that I, JULES LOUIS DIDIER, engineer, citizen of the French Republic, residing at St. Cloud, Department of Seine, Oise, France, having post-office address 26 Pare de Moutretout, in the said city, have invented certain new and useful Improvements in Epicyclic Change-Speed Gearings, of which the following is a specification.

This invention relates to improvements in epicyclic change speed gearing and has for its main object to provide means for locking the planet pinions when the mechanism is operated in order to obtain the high speed in direct mesh.

The accompanying drawings show, by way of example, change speed mechanisms, and for obtaining the high speed the planet pinions are locked by clasping between two parallel plates the said pinions, one of said plates carrying the axles of the said pinions.

In the drawings: Figure 1 is a longitudinal sectional view of the invention, the mechanism thereof being shown in low speed position. Fig. 1ª is a longitudinal sectional view showing the mechanism in high speed position. Fig. 2 is a front elevation of the invention. Fig. 3 is a fragmentary view in section of a modified form of the invention. Fig. 4 is a longitudinal section of another form of the invention, whereby different relative speeds of rotation of the two shafts in one direction is obtainable or relative forward and reverse motions of the two shafts may be obtained, according to the ratios of the gears. Fig. 5 is an end elevation thereof. Fig. 6 is a reverse end elevation of a part of the mechanism shown in Fig. 4.

In the mechanism shown Figs. 1 and 2, the motor shaft 1 carries at its extremity and keyed upon it a pinion 2 which meshes with a number of planet pinions 3. These planet pinions, the width of the teeth of which is slightly greater than that of the pinion 2, are mounted loosely upon shafts 4 fixed to a plate 5. This plate 5 is solid with the shaft 6 to be driven, and it is mounted loosely upon a prolongation 7 of the motor shaft 1. The planet pinions 3 are in mesh with an internally toothed crown 8 which is solid with a box 9 9′ capable of rotating idly upon the shaft 1 and the shaft 6. The box 9 9′ carries on its periphery a brake crown 10 and it is terminated by a plate 11 on the side opposite to the motor shaft. A spring 16 is mounted between the part 9′ and the plate 5 to normally draw the latter and plate 9 toward each other. Said plate 5 and part 9 have between them the planet pinions, which latter are provided with cheeks 12 and 12′ bearing respectively upon the cheek of the part 9 and the plate 5. In the box 9 9′ the bearing surface is constituted by a circular crown having its center upon the axis of the shaft 1. This crown is solid with the box; its mean radius is that of the circle passing through the centers of the planet pinions and its height is equal to the diameter of the cheeks 12. Upon the plate 5 there are as many circular bearing surfaces as there are planet pinions.

The shaft 6 is connected with the parts of the engine or of the motor vehicle that it is desired to rotate by means of any appropriate coupling, for example, a cardan coupling as in Figs. 1 and 1ª. Finally an operating fork 13 may bear upon the plate 11 and the brake band 14 may be applied upon the brake pulley 10.

The operation is as follows:—

1. Low speed: The spring 16 is compressed by means of the fork 13. The movement of the part 5 towards the left hand of the figure is prevented by the stop 15. The box 9 9′ moves towards the left hand and the planet pinions are released. At the same time the brake band 14 is tightened in such a manner as to lock the box 9 9′. In these conditions the shaft 1 in rotating causes the planet pinions to rotate, and they roll inside the crown 8; consequently the shaft 4 and the part 5, and therefore the shaft 6, are driven in the same direction as the shaft 1, but at a reduced speed which depends upon the relative diameters of the pinions.

2. High speed: The brake is released and the fork 13 is abandoned. Under the influence of the spring 16 the planet pinions are held between 5 and 9 and consequently can no longer rotate if the strength of the spring 16 is sufficient. The entire system then rotates in one piece and consequently the shaft 6 rotates at the same speed as the shaft 1. At the moment at which the plates hold the planet pinions, these latter are stopped by the friction resulting from their double movement of rotation round the shaft 4 and around the shaft 1. This contributes to producing a progressive engagement.

3. Disengagement: The fork 13 is acted upon in such a manner as to permit of the rotation of the planet pinions, and the brake

14 is released. The shaft 1 then produces the rotation of the planet pinions which themselves rotate the box 9 9′ loose upon the shaft 6.

Hitherto the planet pinions have been represented with a single set of teeth, but they may also be formed with two sets of teeth 3′ 3″, as shown in Fig. 3, one set being in mesh with the pinion 2 and the other with the crown 8.

In the mechanism represented in Figs. 4, 5, and 6, the motor shaft 1 carries at its extremity a fly-wheel 17, upon which there are fixed a certain number of shafts 18 (three in the example represented). Upon these shafts there rotate idly the pinions 19 meshing with a crown 20 solid with the shaft 6 to be driven, which is arranged in alinement with the motor shaft 1. Each pinion 19 is solid with pinion 21 meshing with a toothed crown 22 fixed upon a sleeve 23 capable of rotating freely on the shaft 6 to be driven and carrying a brake drum 24. A plate 25 is driven by the fly-wheel in its movement of rotation by means of bolts 26, which allow of this plate moving freely along the axis of the apparatus. These bolts 26 are carried by a part 27 bolted on to the fly-wheel 17. The fly-wheel constitutes a box and contains the various parts of the clutch and change speed mechanism, and the part 27 forms a cover serving as a dust excluder and permitting of filling the interior with oil for the lubrication of the mechanism. A number of springs 28 are interposed between the part 27 and the plate 25 constantly pressing this latter towards the left hand of Fig. 4. In order to bring the plate back towards the right hand, levers 29 mounted with a ball and socket joint at 30 around shafts 31 fixed to the part 27, engage with one of their extremities in a notch 32 in the plate 25, the other extremity bearing against a stop 33 carried by a ball bearing 34 capable of sliding parallelly with the axis of the apparatus under the influence of a fork 35.

The pinions 19 are provided with two cheeks 36 and 37 capable of coming into contact respectively with the circular bearing surfaces 38 solid with the flywheel and the bearing surfaces 39 solid with the plate. These bearing surfaces 38 and 39 are of the same diameter as the cheeks 36 and 37, and have likewise for centers the axes of the shafts 18.

The apparatus operates in the following manner: For the high speed, under the influence of the springs 28 the plate 25 is pressed towards the left hand of Fig. 4 and the assemblage of pinions 19 and 21 is powerfully held between the plate and the fly-wheel. In these conditions the pinions 19 and 21 are no longer able to rotate around their shafts 18 and act in the manner of a dog and drive the crowns 20 and 22. The driven shaft solid with the crown 20 then begins to rotate in the same direction and at the same speed as the driving shaft. When the high speed is thrown in, the pinions 19 and 21 are prevented from moving upon themselves by the friction of their cheeks upon the bearing surfaces 38 and 39; this contributes to produce a progressive engagement.

In order to effect disengagement, the fork 35 is acted upon in such a manner as to press back the ball bearing 34 towards the left hand of the figure. The levers 29 rock around their sockets 30 and the plate 25 is separated from the cheeks 37. At this moment the planet pinions 19 and 21 become free to rotate around the shafts 18. The crown 20, which is subjected to a resistant couple, tends to remain at rest, while nothing opposes the movements of the crown 22. The shafts of the planet pinions being driven by the rotation of the fly-wheel, the pinions 19 roll upon the crown 20 while rotating upon themselves and driving the pinions 21 which cause the rotation of the crown 22 solid with the brake drum. The driven shaft remains at rest.

For the low speed, the apparatus being in its released position, the brake arranged upon the drum 24 is applied. The crown 22 is locked and the fly-wheel being driven in the direction indicated by the arrow 40, the pinions 21 roll upon the crown 22 in turning upon themselves in the direction indicated by the arrow 41, driving the pinions 19. These pinions meshing with the crown 20 produce the rotation of this latter and consequently the rotation of the driven shaft. The pinions 19 then have a double movement of rotation; in the first place the movement around the axis of the apparatus, in the direction indicated by the arrow 40, tends to cause the crown 20 to rotate in the same direction and at the same speed as the driving shaft; secondly the movement around the shafts 18, in the direction indicated by the arrow 41, tends on the other hand to impart to the crown 20 a movement in the opposite direction to the foregoing. Owing to the rotation of the crown 20 resulting from the superposition of these two movements, it is obvious that this crown, and consequently the driven shaft, will be driven at a lower speed than that of the driving shaft, and this driving may be in the same direction or in the opposite direction according to the ratios of the gear wheels. The device is therefore capable of furnishing, according to the ratios of the gear wheels, either a clutch and reversing mechanism or a clutch and a change speed mechanism.

The principal advantages of the device are as follows: The pinions are always in mesh, the device occupies but little space and is of small weight, the lubrication of the mechanism is readily effected and the pinions may be caused to rotate in an oil bath.

Having thus described and ascertained the nature of my invention and in what manner the same may be performed, I declare that what I claim is:

1. A change speed gearing comprising driving and driven elements, motion transmitting devices operatively connected to the respective elements, and a pair of relatively movable plates arranged to frictionally engage the motion transmitting devices between them and form a direct driving connection between said elements.

2. A change speed gearing comprising driving and driven shafts, revoluble motion transmitting devices operatively connected to the respective shafts for effecting rotation of the latter at different relative speeds, and a pair of plates for non-rotatably holding said motion transmitting devices to form a direct driving connection between the shafts.

3. A change speed gearing comprising driving and driven shafts, a pair of plates arranged axially thereon, a set of planetary motion transmitting devices journaled on the axles carried by one of the plates and having an operative connection with the shafts, and means for proximating said plates to non-revolubly hold said motion transmitting devices between them and form a direct driving connection between the shafts.

4. A change speed gearing comprising driving and driven shafts, a pair of plates centered axially of the shafts, one of the plates having a set of axles thereon, pinions journaled on said axles and having an operative connection with said shafts, and means for proximating the plates to frictionally engage the pinions to prevent rotation thereof and form a direct driving connection between the shafts.

5. A change speed gearing comprising driving and driven shafts, a pair of plates mounted so as to permit relative axial movement, and a set of planetary pinions interposed between the plates and journaled on one of the latter, said pinions having an operative connection with said shafts for effecting rotation of the shafts at different relative speeds, and means for proximating the plates to non-rotatably hold the pinions and form a direct driving connection between the shafts.

6. A change speed gearing comprising driving and driven shafts, a pair of plates mounted so as to permit relative axial movement, a set of planetary pinions journaled on one of the plates and adapted to have a driving connection with the shafts, said pinions having friction cheeks on opposite ends, and means for proximating the plates to engage said cheeks to prevent rotation of the pinions and form a direct driving connection between the shafts.

7. A change speed gear comprising driving and driven shafts, a pair of plates mounted so as to permit relative axial movement, a set of planetary pinions journaled on one of the plates and adapted to be frictionally held between the latter, a pinion fixed to one of the shafts and coöperating with the planetary pinions, a gear element also coöperating with the planetary pinions, and a brake for preventing rotation of the said gear element when the planetary pinions are disengaged from said plates.

8. A change speed gearing comprising driving and driven shafts, a pair of plates mounted so as to permit relative axial movement thereon, one of said plates being fixed to one of the shafts, a pinion fixed to the other shaft, a set of planetary pinions journaled on the plate fixed to the shaft first mentioned and coöperating with said shaft pinion, a gear element coöperating with the planetary pinions, a brake for non-rotatably holding said gear element, and means for proximating said plates for non-rotatably holding the planetary pinions to form a direct driving connection between the shafts.

9. A change speed gearing comprising driving and driven shafts, a pair of friction plates centered axially thereof, a set of planetary pinions journaled to revolve between said plates and having an operative connection with both of the shafts for effecting a differential speed of rotation of the latter, a spring for proximating said plates to frictionally engage the ends of said pinions to form a direct driving connection between the shafts, and a device for separating said plates to release the pinions and permit rotation thereof.

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

JULES LOUIS DIDIER.

Witnesses:
EMILE KLOTZ,
MAA DE RIVAUD.