

No. 731,470.

PATENTED JUNE 23, 1903.

L. J. LE PONTOIS.
ELECTRICALLY CONTROLLED SPEED CHANGING APPARATUS.

APPLICATION FILED JULY 25, 1902.

NO MODEL.

3 SHEETS—SHEET 1.

Fig 4

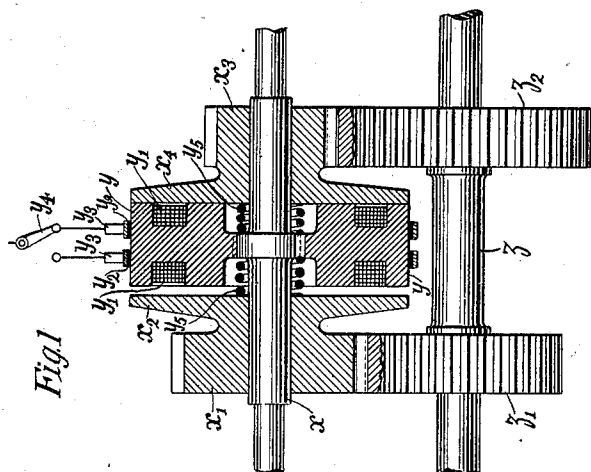
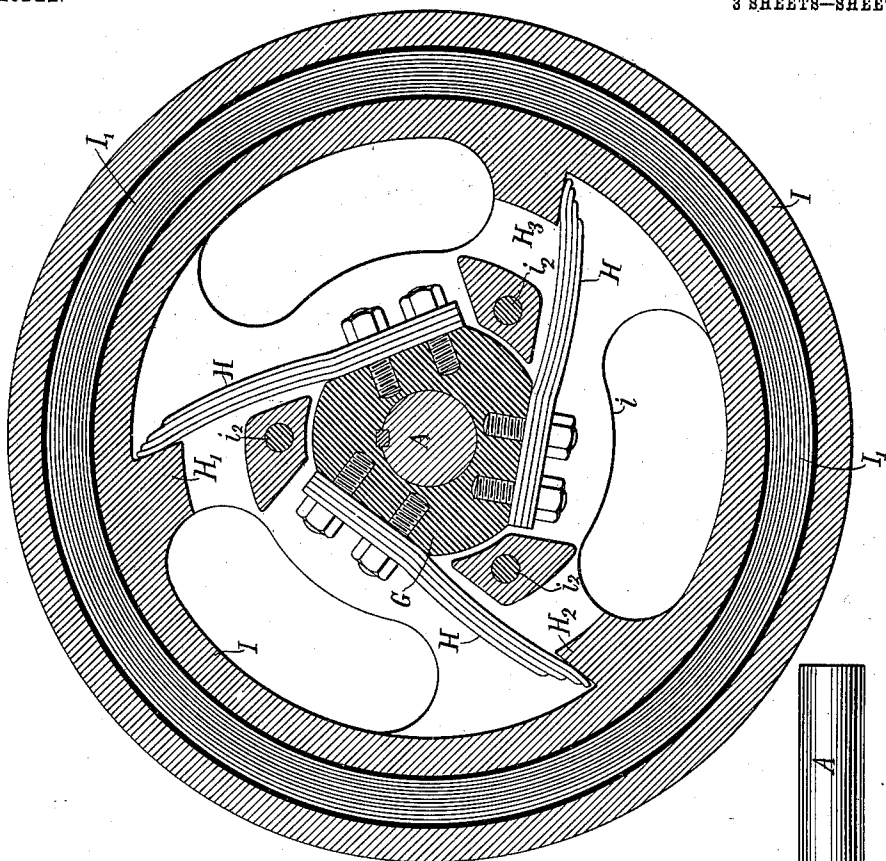
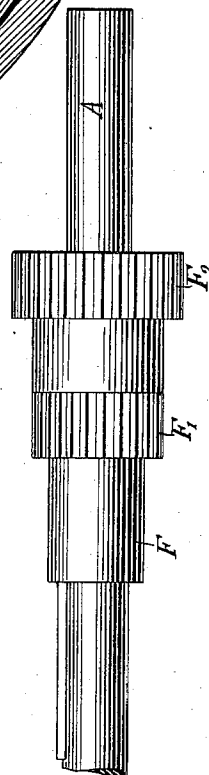


Fig 1

Fig 3



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3 SHEETS—SHEET 2.

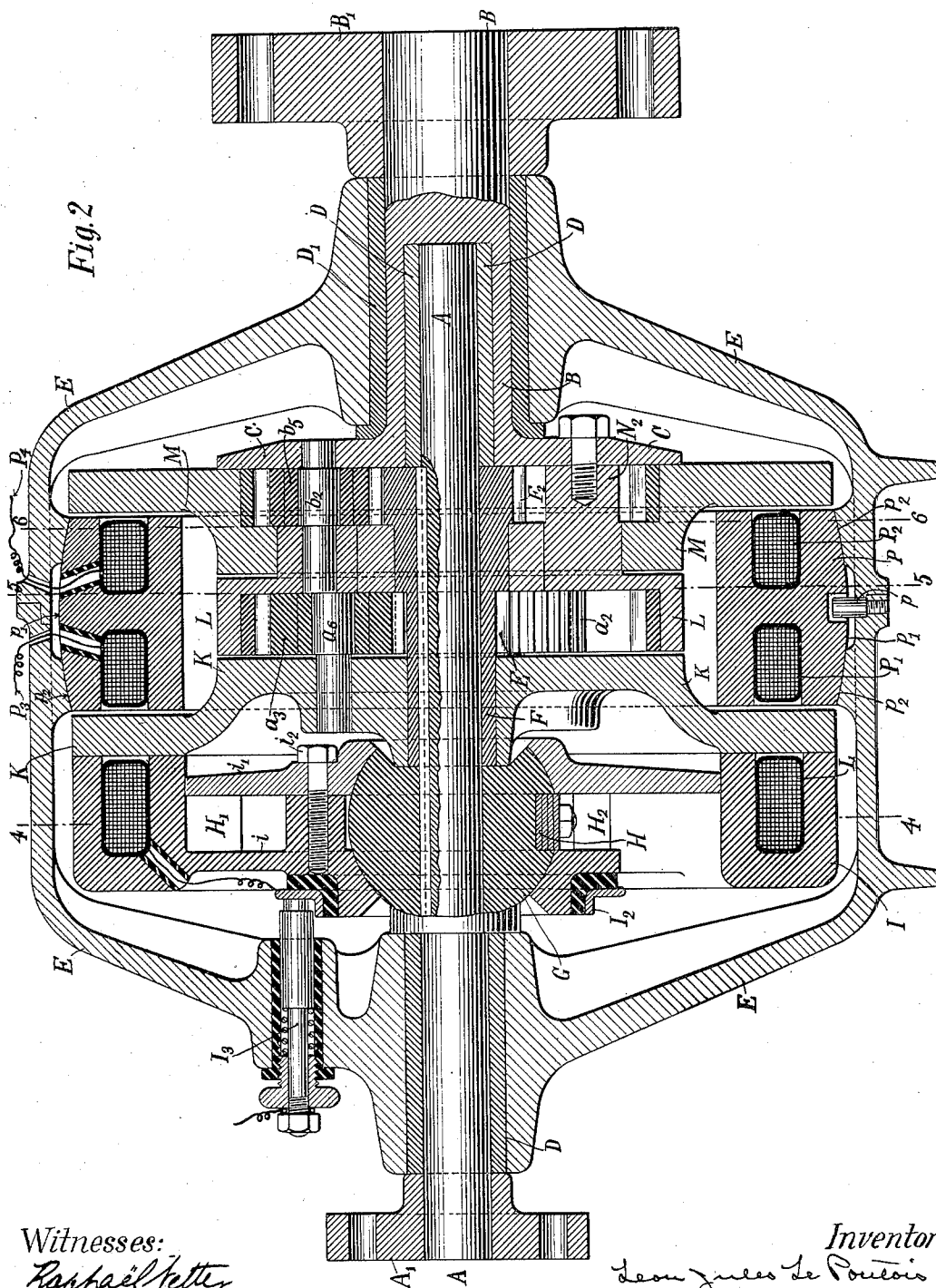


Fig. 2

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3 SHEETS—SHEET 3.

Fig. 6

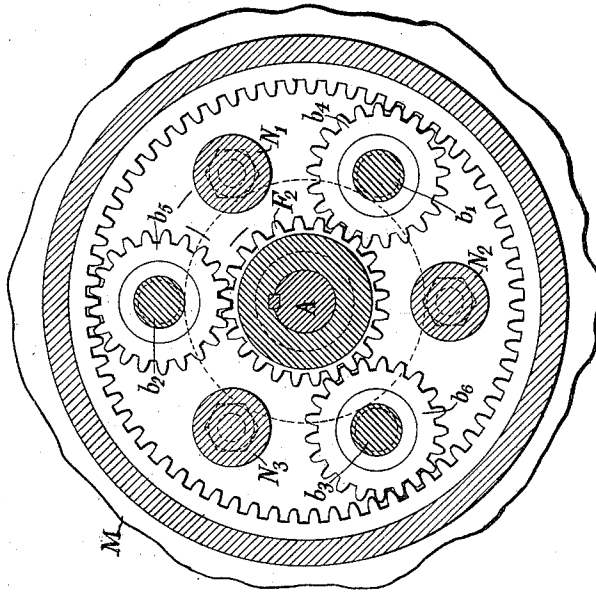
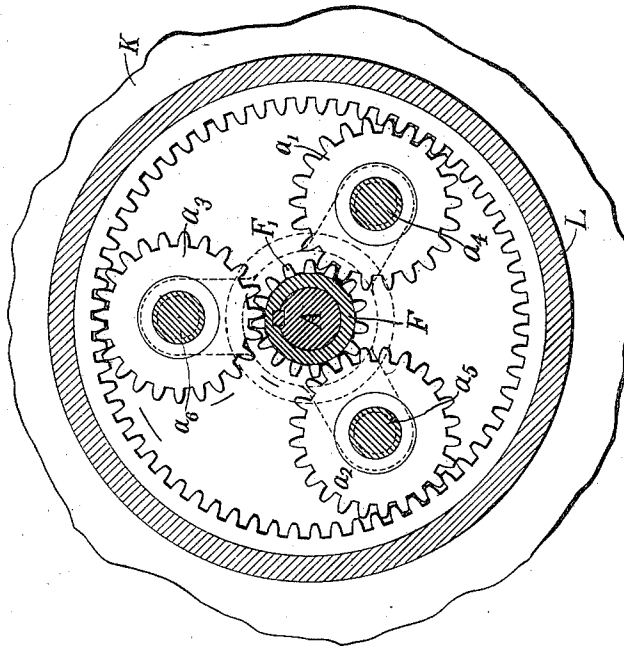


Fig. 5



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UNITED STATES PATENT OFFICE.

LEON JULES LE PONTOIS, OF NEW YORK, N. Y.

ELECTRICALLY-CONTROLLED SPEED-CHANGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 731,470, dated June 23, 1903.

Application filed July 25, 1902. Serial No. 117,041. (No model.)

To all whom it may concern:

Be it known that I, LEON JULES LE PONTOIS, a citizen of the Republic of France, and a resident of New York city, State of New York, have invented an Electrically - Controlled Speed-Changing Apparatus, of which the following is a specification.

My invention relates to a new electrically-controlled speed-changing apparatus whereby the speed of the driven shaft may be varied or its direction of rotation may be reversed and the driven shaft may be connected with or disconnected from the driving-shaft.

The object of the invention is accomplished by combining electromagnetic friction-clutches with suitable gears arranged as hereinafter described, thus dispensing with those means at present in use which require complicated mechanical devices as well as delicate adjustment for the suitable intermeshing or interlocking of the gears.

In the following I have described, with reference to the accompanying drawings, a construction embodying my invention, the features thereof being more fully pointed out hereinafter in the claims.

In the drawings, Figure 1 is a simple diagrammatic representation illustrating the principle of operation. Fig. 2 is a central lengthwise vertical sectional view of one form of apparatus embodying my invention. Fig. 3 is a side elevation of the driving-shaft, parts being broken away, showing the arrangement of driving-pinions. Figs. 4, 5, and 6 are cross-sectional views, parts being broken away, of the parts shown in Fig. 2 along the plane of lines 4 4, 5 5, and 6 6, respectively.

In the several views similar letters of reference indicate similar parts.

I shall first describe my invention with reference to Fig. 1. In said figure, x represents the driving-shaft, and y a disk keyed thereon. On one side of disk y is a pinion x' , loosely mounted on shaft x and carrying a disk x^2 , corresponding in diameter to disk y . On the other side of disk y , also loosely mounted on shaft x , is a pinion x^3 , of less diameter than pinion x' , carrying a disk x^4 , corresponding in diameter with disk y . The disk y is provided on each side with a coil y' , which is electrically connected with a corresponding insulated contact-ring y^2 on the periphery of

disk y , adapted to receive current through stationary brushes $y^3 y^3$ from a suitable source of electricity governed by switch y^4 . Springs $y^5 y^5$ hold the disks x^2 and x^4 normally out of contact with the disk y . z represents the driven shaft, having keyed thereon spur-wheels z' z^2 , adapted to mesh with pinions x' and x^3 , respectively. If current is permitted to flow through coil y' on the side toward disk x^2 , a magnetic field is established which attracts disk x^2 against the force of spring y^5 , causing disk x^2 to firmly adhere to disk y and move therewith, consequently transmitting the motion of shaft x to pinion x' and spur-wheel z' on the driven shaft z . Should the current flow through the other coil y' of disk y , a similar action will take place on that side, the motion of the driving-shaft being transmitted to spur-wheel z^2 , the disk x^2 being thrown out of contact with the face of disk y by spring y^5 . It is obvious that the speed of rotation of the driven shaft depends on the relationship of the respective gears described.

I shall now describe a preferred form of apparatus embodying my invention.

A represents the driving-shaft, receiving motion from any convenient source through driving-wheel A'.

B represents the driven shaft, transmitting motion through wheel B'. The shaft A rotates in bearings D D, the former being in the casing E, designed to inclose the operating parts, and the latter in the end of driven shaft B, thus insuring perfect alinement. Shaft B rotates in bearing D' in the casing E. The inner end of the shaft B terminates in or has firmly fixed thereto a disk C, the purpose of which will be hereinafter set forth. On shaft A is keyed a sleeve F, having pinions F' and F² keyed thereon. On shaft A, between sleeve F and bearing D, is keyed the ball G. On the periphery of ball G are mounted leaf-springs H H H, adapted to rest on lugs H' H² H³ on the inside of a wheel I, loosely mounted on the ball G, so as to form a knuckle or ball socket joint. The springs H H H by the arrangement described form a yielding connection between the driving and the driven shafts, as hereinafter set forth. The wheel I is made in two parts i and i' , as shown, held together by bolts $i^2 i^2 i^2$. Within

the rim of the wheel I is placed a copper coil I', electrically connected with a contact-ring I² on wheel I and suitably insulated therefrom, as shown. Contact-ring I² receives
 5 current through spring-controlled brush I³ from any convenient source of electricity.

A disk K, preferably of cast-iron, loosely mounted on sleeve F, carries on its inner face idlers a', a², and a³, rotating freely on their
 10 respective axles a⁴, a⁵, and a⁶ and intermeshing with pinion F'. On sleeve F, between pinions F' and F², is a disk L, rotating freely on the sleeve F and carrying idlers b⁴, b⁵, and b⁶, rotating freely on their respective axles b',
 15 b², and b³. Idlers b⁴, b⁵, and b⁶ intermesh with pinions F² on sleeve F. On the inner surface of the crown of disk L is an internal gear meshing with idlers a', a², and a³ on disk K.

Loosely mounted on a projecting annular shoulder of disk L is a disk M, having an internal gear meshing with idlers b⁴ b⁵ b⁶. Integral with disk L are cast lugs N', N², and N³, bolted to disk C on driven shaft B, as
 25 shown.

Between disks K and M and supported by the casing E is mounted an annular magnetic field P, held against rotation by a lug p. Within the rim of field P are placed copper
 30 coils P' and P², electrically connected by wires P³ and P¹ with any suitable source of electricity.

The field P has a convexly-curved crown p', which rests on correspondingly concave surfaces or supports p² p² on the casing. The field P is held loosely by lug p, so that the field may oscillate slightly on the concave surfaces p² p² of the casing, thus being adapted to set itself into close contact with disks
 40 K and M in spite of any slight irregularities of their surfaces, thus forming practically a ball-and-socket joint. The wheel I being also loosely mounted on ball G, as hereinbefore described, is permitted to oscillate slightly
 45 for the purpose of a similar self-adjustment.

I shall now describe the mode of operation of the apparatus as set forth and illustrated. Shaft A is caused to turn by any suitable means through driving-wheel A', carrying
 50 ball G and pinions F' and F² with it in its rotation. Disks K and M being normally free to rotate on sleeve F, pinions F' and F² drive them around without turning shaft B. If current is now sent through brush I³ to coil I', wheel I is magnetized and clutches disk K,
 55 so that wheel I and disk K rotate as one with the driving-shaft, the wheel I being forced around by the springs H H H, which by their resiliency form a yielding connection between the ball G and the wheel I and consequently
 60 between the driving-shaft A and the driven shaft B through the wheel I and the connecting parts. Disk K rotating with wheel I and carrying idlers a', a², and a³, which latter are now stationary and intermeshed with the internal gear of disk L, carries disk L with it in its rotation, thus through lugs N', N², and

N³ driving shaft B in the direction of rotation of the driving-shaft A, this arrangement of parts driving the driven shaft at the speed
 70 of the driving-shaft, thus constituting the high-speed gear. If current is turned off at brush I³ and on at P³, field P is magnetized and clutches disk K³, holding it stationary. Pinion F then drives idlers a', a², and a³, which,
 75 intermeshing with internal gear of disk L, drive it in a direction opposite to the rotation of driving-shaft A, thus through lugs N', N², and N³ causing driven shaft B to turn in a direction opposite to the rotation of driv-
 80 ing-shaft A, the speed depending on the ratio between pinion F and the internal gear of disk L. This arrangement of mechanism constitutes the reverse-speed gear. If current is turned off at both I³ and P³ and on at P⁴,
 85 the other face of field P is magnetized and clutches disk M, holding it stationary. Idlers b⁴, b⁵, and b⁶, driven by pinion F², will roll on the internal gear of disk M, acting as a stationary rack, thus driving disk L, bearing
 90 lugs N', N², and N³, and consequently the driven shaft B in the direction of rotation of the driving-shaft A, the speed depending on the ratio of pinion F to the internal gear of disk M. This arrangement of mechanism
 95 constitutes the low-speed gear.

It will be obvious that the details of the apparatus as shown in the drawings and hereinbefore described may be varied to a great extent while securing the different operations
 100 before described and without departing from the spirit of my invention.

Without limiting myself to the precise construction and operation of parts shown and described, I claim as my invention—

1. In a speed-changing apparatus, a shaft, driving-pinions and a wheel adapted to be magnetized, disks adapted to be laterally shifted riding loosely on said shaft, a magnetic field between said disks, a driven shaft
 110 and means controlled by said wheel and said field for transmitting motion from said wheel and said pinions to the driven shaft.

2. In a speed-changing apparatus, the combination of a driving-shaft, disks loosely
 115 mounted thereon, means actuated by the driving-shaft to turn said disks, an electromagnetic clutch yieldingly connected and moving with the driving-shaft, a driven shaft, a fixed electromagnetic clutch and means actuated by said disks and controlled by said clutches for varying the speed of the driven shaft.

3. In a speed-changing apparatus the combination of a driving-shaft, a driven shaft, electromagnetic friction-clutches and gear-wheels so arranged that the said gears can be made to move with the driving or the driven shaft or to turn loosely upon either of them.

4. In a speed-changing apparatus the combination of a driving-shaft, a driven shaft, trains of gear-wheels adapted to transmit power from one shaft to the other shaft and

electromagnetic friction-clutches capable of immobilizing some of the gear-wheels or all of them, on either the driving-shaft or the driven shaft, so as to vary the speed of rotation of the driven shaft or to change the direction of rotation of the driven shaft.

5 5. In a speed-changing apparatus the combination of a stationary magnetic clutch, a driving-shaft having a bearing in said clutch, 10 a pinion mounted on the driving-shaft, a sliding friction-disk adjacent to said clutch, a driven shaft, an internal gear mounted on the driven shaft and idler-gears supported by the friction-disk and meshing with the internal gear mounted on the driven shaft and 15 the pinion, said clutch being adapted to immobilize the friction-disk so that the driven shaft rotates in an opposite direction to the driving-shaft.

20 6. In a speed-changing apparatus a driving-shaft, a driven shaft, an electromagnetic clutch mounted on and rotated by the driving-shaft, a friction-disk mounted on said shaft and adapted to slide thereon and to be 25 attracted against the face of the clutch, idlers mounted on said disk and an internal gear mounted on the driven shaft in mesh with said idlers, so that the engagement of the clutch and friction-disk results in the direct 30 driving of the driven shaft by the driving-shaft.

7. In a speed-changing apparatus, the combination of a stationary magnetic clutch, a driving-shaft having a bearing in said clutch, 35 a pinion mounted on the driving-shaft, a sliding friction-disk adapted to be attracted against the face of the clutch, an internal gear on said disk, a disk mounted on the driven shaft, idlers on said last-mentioned 40 disk in mesh with the pinion and the internal gear of the friction-disk, said clutch being

adapted to immobilize the friction-disk so that the driven shaft rotates in the same direction as the driving-shaft.

8. In a speed-changing apparatus the combination of a stationary magnetic clutch, a driving-shaft having a bearing in said clutch, a rotating electromagnetic clutch mounted on the driving-shaft, a friction-disk supported by said shaft between said clutches and 50 adapted to be attracted from one to the other, a second friction-disk supported by the driving-shaft at the other side of the stationary clutch, a driven shaft, a disk mounted on and turning with the driven shaft between said 55 friction-disks, pinions on the driving-shaft and gears supported by the friction-disks and the disk between the same, the relation of the parts being such that the motion of the driving-shaft may be transmitted to the 60 driven shaft and either varied or reversed.

9. In a speed-changing apparatus, a driving-shaft, an electromagnetic clutch mounted on and rotated by the driving-shaft, a stationary double electromagnetic clutch, a friction-disk 65 mounted on the driving-shaft between said clutches and adapted to be attracted from one to the other, a friction-disk adapted to be attracted against the other face of the stationary electromagnetic clutch, a driven 70 shaft and means actuated by the driving-shaft for communicating motion to the driven shaft through said disks, substantially as described.

In testimony whereof I have signed my 75 name to this specification in the presence of two subscribing witnesses.

LEON JULES LE PONTOIS.

Witnesses:

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CHARLES S. JONES.