No. 786,413. PATENTED APR. 4, 1905.

H. H. CUTLER.

MAGNETIC CLUTCH.

APPLICATION FILED JULY 2, 1904.

2 SHEETS—SHEET 1.

Fig. 2.

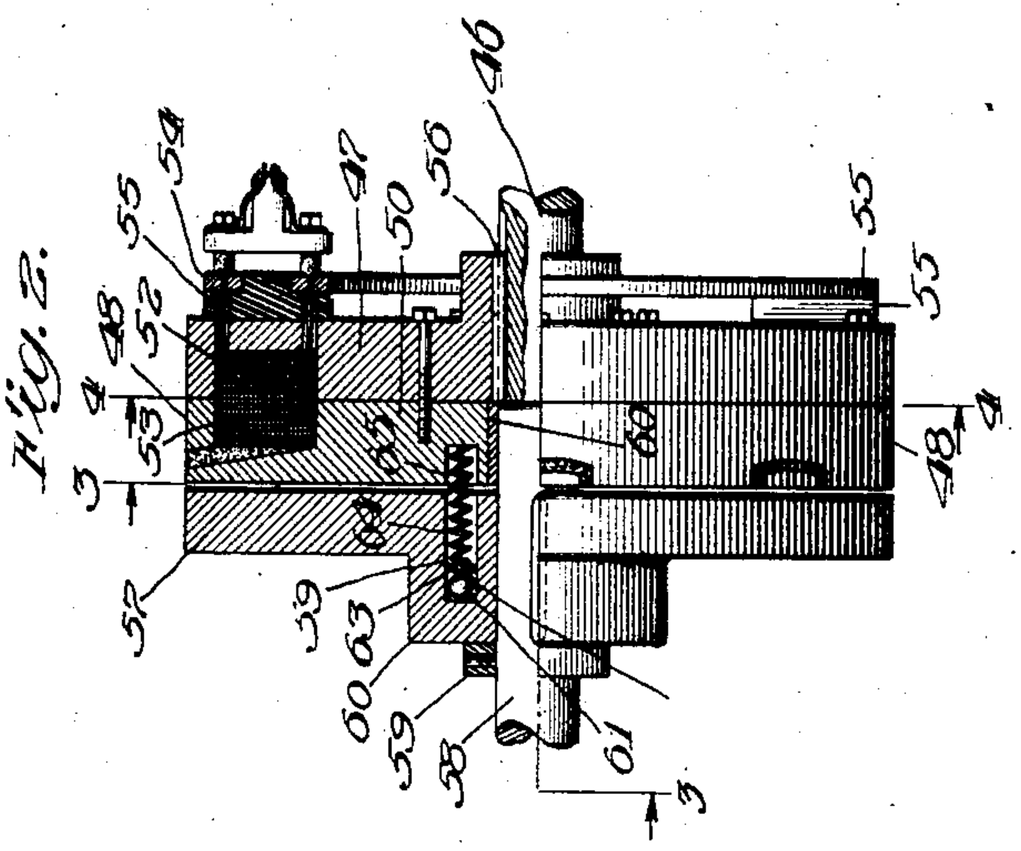
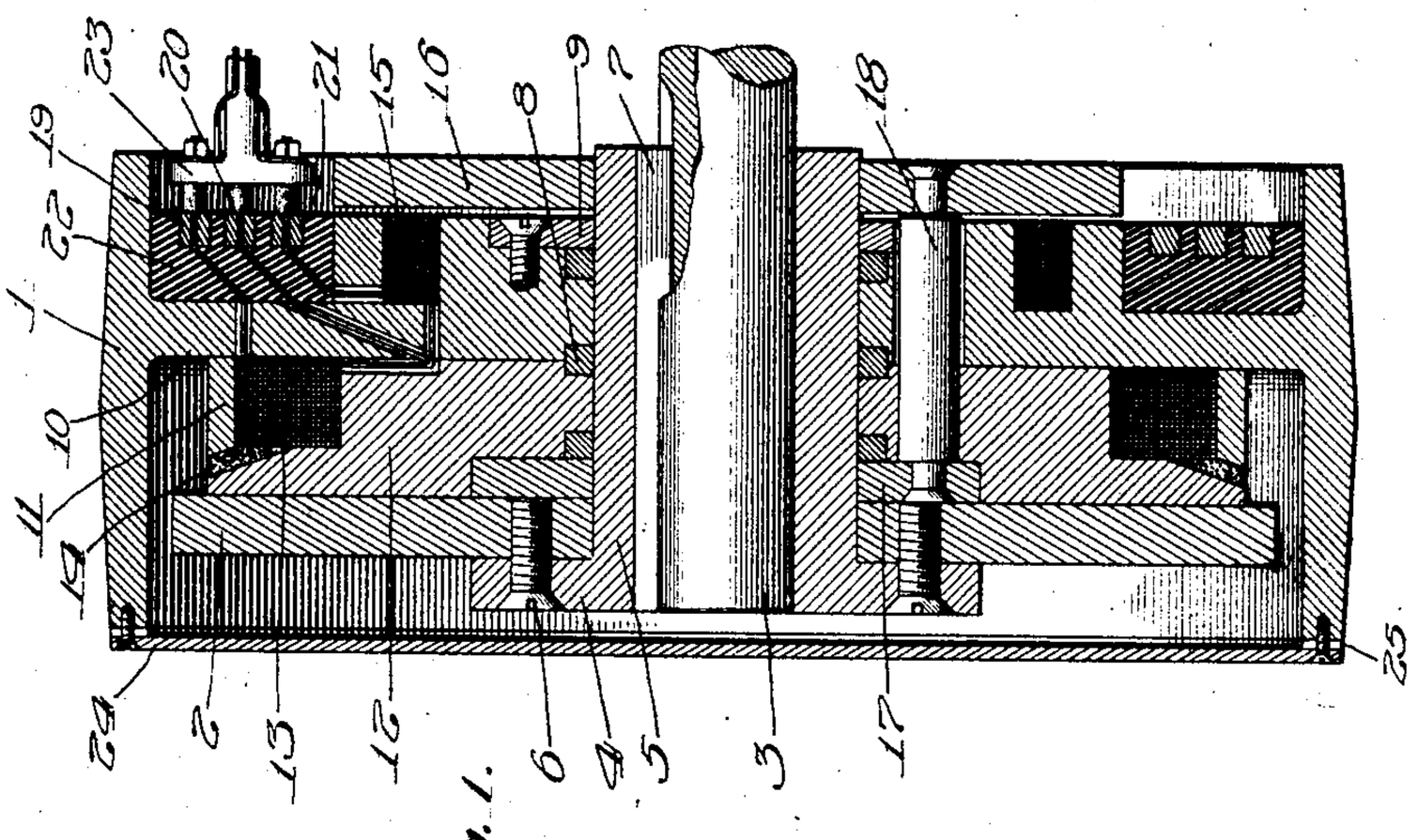


Fig. 1.



Witnesses:
Robert F. Allen
W. Perry Hahn

Inventor:
Henry H. Cutler
By: James Addington
Attorneys:

PHOTO-LITHOGRAPHED BY SACHETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 786,413. PATENTED APR. 4, 1905.

H. H. CUTLER.

MAGNETIC CLUTCH.

APPLICATION FILED JULY 2, 1904.

2 SHEETS—SHEET 2.

Fig. 3.

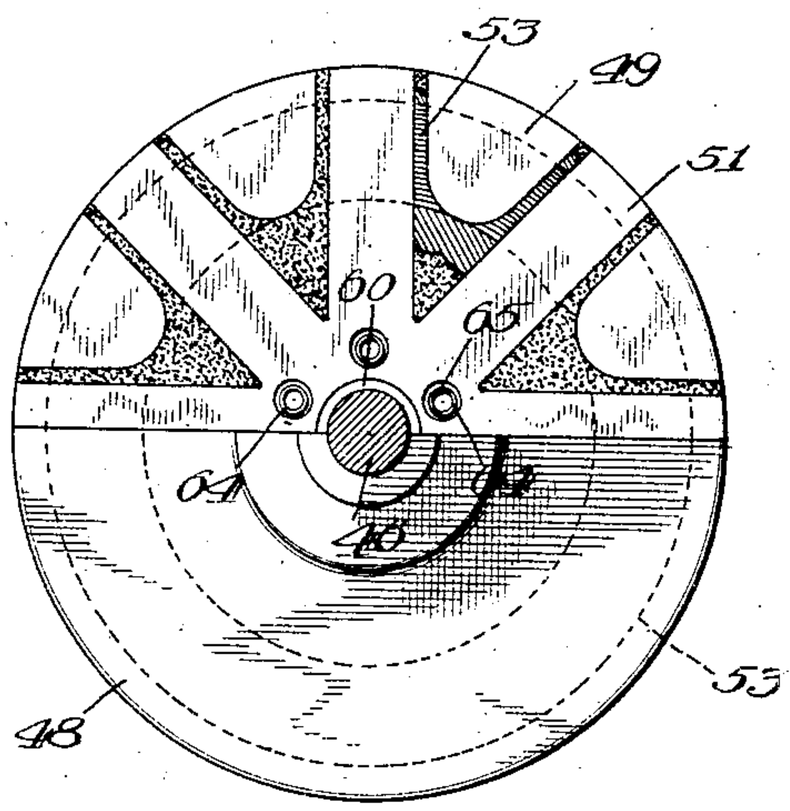


Fig. 4.

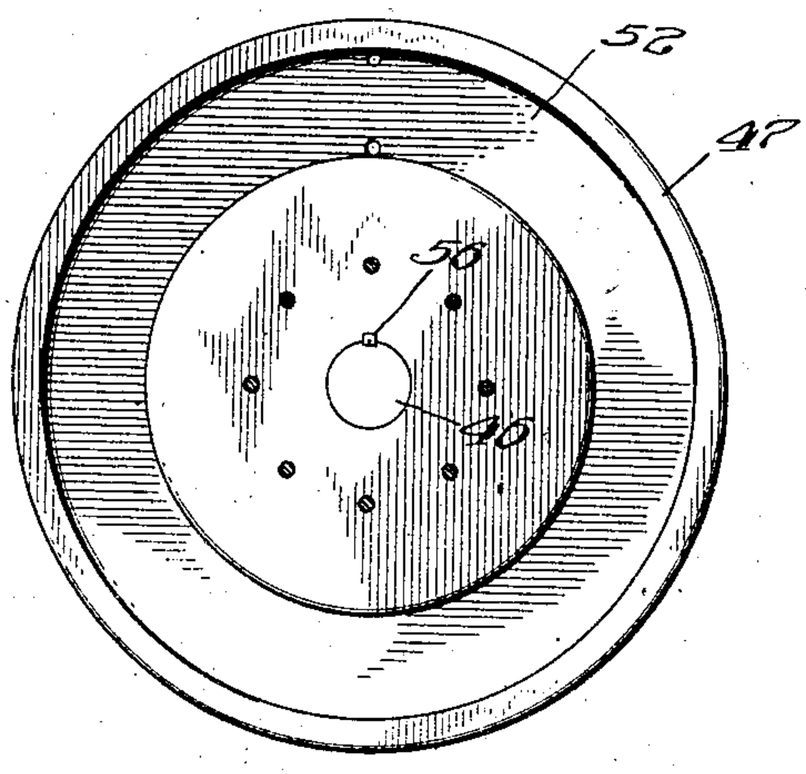
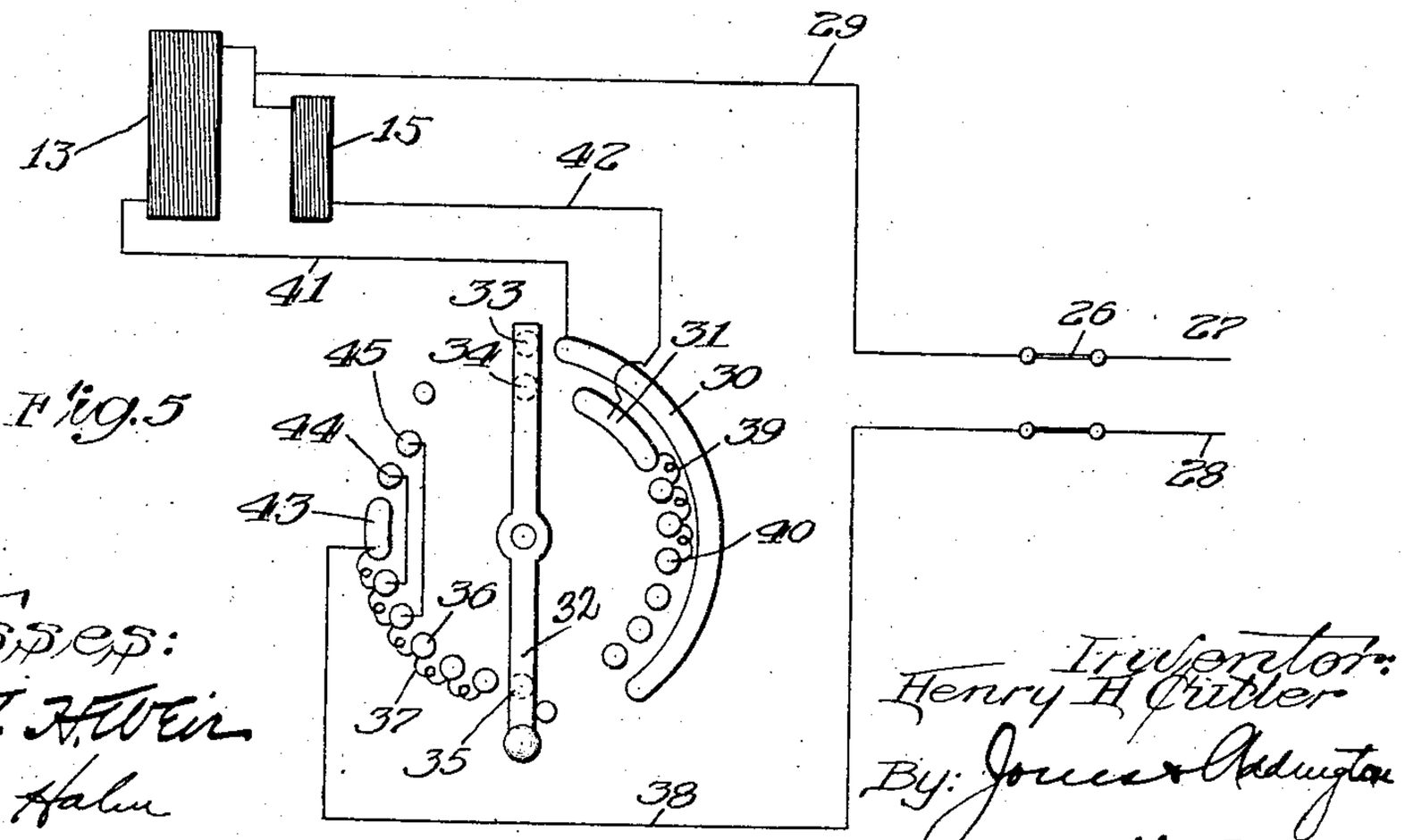


Fig. 5



Witnesses:
Robert A. Weir
W. Perry Halm

Inventor:
Henry H. Cutler
By: Jones & Addington
Attorney's

PHOTO-LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 786,413. Patented April 4, 1905.

UNITED STATES PATENT OFFICE.

HENRY H. CUTLER, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ARNOLD MAGNETIC CLUTCH COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

MAGNETIC CLUTCH.

SPECIFICATION forming part of Letters Patent No. 786,413, dated April 4, 1905.

Application filed July 2, 1904. Serial No. 215,082.

To all whom it may concern:

Be it known that I, HENRY H. CUTLER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Magnetic Clutches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to certain improvements in magnetic clutches or speed-accelerators, and has for its object to provide a clutch whereby a driven part may be rotated at a speed equal to or less than that of the driving part.

In an application filed by me on the 5th day of August, 1903, Serial No. 168,388, I have described and claimed an improved form of magnetic clutch or speed-accelerator; and the present invention relates to one of the several modifications or improvements of which the generic invention set forth in said application is susceptible. In said application I have illustrated a form of clutch or accelerator in which a winding is provided on a primary or inducing member adapted to inductively influence a suitable secondary or induced member, and in this form I have shown the induced or secondary member as being subjected continuously during the starting interval to the full frictional effect.

My present invention relates to a device embodying the general principles of the clutch above mentioned, in which, however, special means are provided for reducing the frictional effect of the driving member upon the driven member, as will hereinafter more fully appear.

In the drawings showing the preferred means for accomplishing the several objects in view, and in which like numerals refer to like parts throughout the several figures, Figure 1 is a sectional view of my improved clutch. Fig. 2 is a partial section of a modification thereof. Fig. 3 is a partial face view of the primary or inducing member. Fig. 4 is a section taken on the line 4 4 of Fig. 2, and Fig. 5 is a diagrammatic view of the circuit arrangement for the clutch shown in Fig. 1.

The clutch which I have worked out as the preferred form of my invention has a magnet member 1, which in the present instance has its periphery adapted for use as a pulley, and an armature member 2. The armature member is fixed upon the shaft 3, while the magnet member is free to rotate independently of said shaft and armature member. The armature member is fastened to a flange 4 upon the hub 5, which is of non-magnetic material, such as brass or other material, by screws 6, the hub being fixed to the shaft 3 by a key 7. The magnet member is rotatably mounted upon the hub 5 and has its walls, which bear upon said hub, preferably provided with annular channels in which are adapted to be placed lubricating or packing rings 8, the outer ring being held in place by a metallic ring 9, screwed to the magnet member.

To the face of the back plate 10 of the magnet member 1 rings are secured. One of these rings, 11, is provided with a plurality of inwardly-extending pole-pieces, these pole-pieces in the present instance being substantially triangular in shape. The other ring, 12, is provided with radially-extending pole-pieces, which are substantially rectilinear in shape and which when the rings are placed together are adapted to rest in the space between the triangular pole-pieces. When the rings 11 and 12 are placed together, they form an annular channel, in which the annular winding 13 of the clutch is adapted to rest. The spaces between the poles carried on the rings 11 and 12 are filled with Babbitt metal or other non-magnetic material 14. This material serves to entirely inclose the winding, and thus protect the same from injury and also from the oil employed for lubricating purposes. Moreover, the Babbitt metal affords, with the polar surfaces, a continuous frictional surface, against which the face of the armature is adapted to bear. As the rings 11 and 12 are constructed substantially the same as the rings 50 and 48, as shown in Fig. 3, I have not thought it necessary to further illustrate the same. By

this construction of the magnet member the inductive influence thereof upon the armature member 2 creates torque-producing currents in said armature member, whereby the same may be driven through the influence of induction alone or through the combined influence of induction and friction. In the opposite side of the plate 10 is formed an annular channel, in which is arranged the supplemental winding 15. An armature-plate 16 is situated adjacent to the side of the magnet member in which the supplemental winding is located, and when the supplemental winding is energized this armature member 16 is attracted to the magnet member for a purpose as will be hereinafter more fully explained. The armature-plate 16 is loosely mounted upon the hub 5, so that it may revolve with the magnet member independently of the armature member 2 of the clutch. The armature-plate 16 is connected with a ring 17 by one or more pins 18, which pass through suitable openings formed therefor in the magnet member, said ring 17 being preferably of brass or other suitable material and arranged in a depression in the face of the ring 12. The ring 17 when the supplemental winding 15 is energized is forced against the armature member 2 by the pins 18 and has the effect to move the armature member 2 out of frictional engagement with the primary member 1. The pins 18 hold the armature member 2 of the clutch and the armature-plate 16 at such a distance that when the magnet member is in contact with the armature member it is out of contact with the armature-plate 16. One terminal of the main winding is connected with a suitable ring 19, and the opposite terminal thereof is connected with a second collecting-ring 20, which ring is also connected with one terminal of the supplemental winding, the opposite terminal thereof being connected with a ring 21. The rings 19, 20, and 21 are suitably mounted upon an insulating-base 22, and brushes 23, connected with a suitable source of supply, serve to convey the current to the clutch-windings through the same.

To the sides of the magnet member forming the pulley portion is secured a plate 24, which serves the double purpose of excluding dust and dirt and retaining the lubricating-oil, a gasket 25 being interposed between the plate and the sides to make a tight joint therebetween. By the employment of this plate the clutch may be subjected to an oil-bath, and the oil placed in the shell formed by said plate will be carried to the frictional surfaces of the armature and magnet member.

By the above arrangement of the two windings in the primary member it will be noted that when the supplemental winding 15 is energized it will act as a balancing-coil and serve to counterbalance a portion or all of the frictional effect between the primary member and the armature member 2 when the winding 13 is energized, whereby the friction between said members is greatly reduced or may be entirely eliminated. It is especially advantageous in starting a light load to eliminate as much friction between the driving and driven members as possible to prevent the wearing of the two engaging faces; but with the friction eliminated the driven member can never attain full speed, and it is therefore desirable after the clutch has built up sufficient speed to cut out the balancing-coil and permit the clutch to run with full frictional effect. However, it has been found that by suddenly deënergizing the balancing-coil and permitting the full frictional effect to be brought into use there is a perceptible jerk from the speed at which the clutch is running to full speed, and to prevent this jerk I have provided means for gradually deënergizing the balancing-coil.

In Fig. 5 I have shown a diagrammatic view of one means for controlling my clutch. In said figure I have shown a switch 26 for controlling two sides 27 and 28 of a supply-circuit, one side of which is permanently connected by a conductor 29 with both the active coil 13 and the balancing-coil 15 of the clutch, the other two terminals of said coils being connected, respectively, with the segments 30 and 31 of a controlling-rheostat. A lever 32, carrying shoes 33, 34, and 35, which are electrically connected, is adapted to be moved to make contact with the segments 30 and 31 and with the contact-buttons 36 of the resistance 37, one end of which is connected by conductor 38 with the opposite supply-main 28. Connected with one end of the segment 31 is a resistance 39, which is subdivided into sections and connected with the contacts 40.

In operation the first movement of the lever 32 in a clockwise direction closes the circuit through the main winding 13 by the brush 33 making contact with the segment 30, and the circuit may be traced from the main 27 through the conductor 29, the winding 14, conductor 41, segment 30, lever 32, resistance 37, and by the conductor 38 to the opposite main 28. This will pull the armature-plate 2 against the primary member; but the resistance 37 will be ordinarily sufficient to prevent the load from being started. A further movement of the lever will then cause the brush 34 to make contact with the segment 31, thereby admitting current to the balancing-coil and relieving the pressure set up between the primary member and the armature 2. This circuit may be traced from the main 27 through conductor 29, the supplemental winding 15, conductor 42, the lever 32, through the resistance 37 and conductor 38 to the opposite main 28. Sufficient current is now admitted to the main winding 13 to start the clutch to operating. However, the same will be dependent for its operation upon the torque-producing currents

created in the armature member under the influence of the magnetism set up by the active coil, as the balancing-coil 16 will tend to prevent the frictional engagement between the primary member and its armature. The intensity of these torque-producing currents may be regulated a twill by the attendant by cutting in and out, as desired, portions of the resistance 37, so that the driven member may be operated at any speed. It is evident, however, that so long as the balancing-coil is in circuit the driven member can never attain the speed of the driving member. When it is desired to increase the speed of the driven member, the lever 32 is moved so as to make the contact-brush 34 move over the contacts 40, thereby gradually introducing the resistance 39 into the balancing-coil, and thus gradually increasing the pressure, and consequently the friction set up between the primary member and its armature. While the resistance 39 is being cut into the circuit of the balancing-coil 16 no change takes place in the resistance 36, the plate 43 being provided for carrying the contact-shoe 35. A still further movement of the lever 32 will finally move the contact-shoe 34 off the last of the contacts controlling the resistance 39, and consequently the circuit of the balancing-coil will be entirely opened. A still further movement of the lever 32 causes the contact-shoe 35 to move over the contact-buttons 44 and 45, which are connected with the resistance 37, and thereby introduce resistance into the active coil 13, since when the effect of the balancing-coil is removed sufficient pressure will be set up between the primary member and its armature to operate the driven member at full speed by friction alone without requiring as much current in the coil 13 as is necessary when this coil is used to cause torque-producing currents only in the armature-plate 2.

Another form of my invention is illustrated in Figs 2, 3, and 4, in which I have shown mechanical means for counterbalancing the effect in the magnet member, and thereby reducing the frictional effect of the same upon the armature member. In this construction I mount upon the shaft 46 a back plate or disk 47. To the face of this disk or back plate two rings are secured by bolts. One of these rings, 48, is provided with a plurality of inwardly-extending pole-pieces 49, these pole-pieces being in the present instance substantially triangular in shape. The other ring, 50, is provided with radially-extending pole-pieces 51, which, as shown, are substantially rectilinear in shape and which when the rings are placed together, as shown in Fig. 4, are adapted to rest in the spaces between the triangular pole-pieces, and the spaces between the same are filled with Babbitt metal or other non-magnetic material. An annular channel 52 is provided in the face of the back plate 47, and the rings 48 and 50 when placed together form an annular channel, which, with the channel 52, forms a chamber for the reception of the annular winding 53 of the clutch. The terminals of the winding or coil 53 extend through suitable openings in the back plate 47 to collecting-rings 54, mounted upon a suitable insulating-ring 55, secured to the back plate 47. Upon these rings 54 rest brushes, which are connected with any suitable source of supply for furnishing current to the clutch-windings. The magnet member thus formed is suitably secured to the shaft 46 by a key 56 and rotates with the shaft. The armature member 57 is keyed to the shaft 58 and is prevented from extreme lateral movement by a collar 59, secured upon said shaft. A cup 60 fits in a suitable opening in the magnet member, and the end of the shaft 58 is adapted to fit in this cup, whereby the shafts 46 and 58 are held in alinement. An annular recess 59 is formed in the hub 60 of the armature member, which recess extends more than half-way through said hub. At the inner end of said recess a bearing plate or ring 61 is placed, upon which are adapted to bear suitable balls 62. Over said balls to hold the same in place a second ring 63 is placed, and bearing against said ring are coil-springs 64, which at their opposite ends fit into suitable openings 65 in the magnet member. The ball-bearings thus formed permit the spring to revolve with the magnet member within the annular recess 59. By this arrangement the springs 64 counterbalance the magnetic attraction of the magnet member of the clutch upon the armature member thereof, and thereby reduce the frictional effect to the desired extent, thus preventing the members from becoming too closely engaged and enabling the device to be readily used as a controllable slip device. It is apparent that the frictional effect between the driving and the driven members may be reduced to any desired extent or may be eliminated entirely. If it be desired to bring the driven part to the full speed of the driving part, it will be necessary to utilize at least a part of the frictional effect.

It will be understood that I contemplate either reducing the frictional effect or directly eliminating the same, and the term "friction-eliminating" means as used in the claims is intended to include means for partially or entirely eliminating the frictional effect. Also where the expression "to counterbalance the frictional effect" is used I contemplate the counterbalancing of all or part only of the frictional effect.

While I have shown and described one means for accomplishing the various objects of my invention, it will be understood that I do not wish to limit myself to this particular construction, as there are numerous modifications which may be made without departing from the spirit of my invention.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a primary clutch member, of a secondary member adapted to rest in physical contact therewith, and means for eliminating the friction by producing repulsion between the members during the operation of the clutch.

2. The combination with a primary member, of a secondary member adapted to rest in physical contact therewith, and a coil or winding for eliminating the friction by causing a repulsion between the members during the operation of the clutch.

3. The combination with a primary clutch member, of a secondary member, and a coil or winding for eliminating friction by producing repulsion between the members during the operation of the clutch.

4. The combination with a primary member carrying an energizing-winding, of a secondary clutch member associated therewith, and means for eliminating friction by producing repulsion between the members during the operation of the clutch.

5. The combination with a primary clutch member carrying an energizing-winding, of a secondary clutch member associated therewith, and a friction-eliminating means comprising a counterbalancing-winding and an armature influenced thereby for producing repulsion between the members during the operation of the clutch.

6. The combination with a primary clutch member, of a secondary clutch member, a main winding for exerting a force to connect said primary and secondary members, a supplemental winding, and means operated by the force of said supplemental winding when it is energized to counterbalance the frictional effect between said primary and secondary members by producing repulsion between said members during the operation of the clutch.

7. The combination with a primary clutch member, of a secondary clutch member, a main winding for exerting a force to attract said secondary member to said primary member and frictional eliminating means, comprising a part arranged upon the opposite side of said primary member, means for holding said part out of contact with said primary member, when said secondary member is in contact with the same, and a supplemental winding for exerting force to attract said part to said primary member during the operation of the clutch.

8. The combination with a primary clutch member, of a secondary clutch member, an armature member arranged upon one side of said primary member, a main winding for exerting a force to connect said armature with said primary member, and a friction-eliminating means comprising a part arranged upon the opposite side of said primary member, one or more pins passing through said primary member and bearing against the armature member to hold said part out of contact with the magnet member when the latter is in engagement with the armature member, and a supplemental winding for exerting a force to attract said part to said primary member during the operation of the clutch.

9. The combination with a primary member, of a secondary member, a main winding for exerting a force to attract said secondary member to said primary member, and a friction-eliminating means comprising a part normally bearing against said secondary member, and a supplemental winding for exerting a force to operate said part to counterbalance the frictional effect between said primary and said secondary members during the operation of the clutch.

10. The combination with a primary member, of a secondary member moving relatively thereto, a main winding for exerting a force to connect said primary member with said secondary member, and a friction-eliminating means comprising a supplemental winding and a part operated by the force exerted by said supplemental winding to counterbalance the frictional effect between said primary and said secondary members during the operation of the clutch.

11. The combination with a primary member, of a secondary member, a main winding carried by said primary member for exerting a force to connect said secondary member therewith, and a friction-eliminating means comprising a supplemental winding also carried by said primary member and a part operated by the force exerted by said supplemental winding to counterbalance the frictional effect between said primary and said secondary members during the operation of the clutch.

12. The combination with a primary member, of a secondary member arranged upon one side thereof, a main winding for exerting a force to attract said primary member to said secondary member, and a friction-eliminating means comprising an armature arranged upon the opposite side of said primary member, one or more pins passing through said primary member and bearing against said secondary member to hold the armature out of contact with said primary member, and a supplemental winding for exerting a force to attract said armature to said primary member during the operation of the clutch.

13. The combination with a primary member, of a secondary member arranged upon one side thereof, a main winding carried by said primary member for exerting a force to connect said secondary member therewith, and a friction-eliminating means comprising an armature arranged upon the opposite side of said primary member, one or more pins passing through said primary member and

bearing against the secondary member to hold said armature out of contact with the primary member when the secondary member is in engagement therewith, and a supplemental winding also carried by said primary member for exerting a force to attract said armature to said primary member during the operation of the clutch.

14. The combination with a primary member, of a secondary member adapted to be inductively influenced thereby to create torque-producing currents in said secondary member, and friction-eliminating means.

15. The combination with a primary clutch member, of a secondary member adapted to rest in physical contact therewith and be inductively influenced thereby to create torque-producing currents in said secondary member, and friction-eliminating means.

16. The combination with a primary clutch member, of a secondary member adapted to rest in physical contact therewith and be inductively influenced thereby to create torque-producing currents in said secondary member, and a friction-eliminating coil or winding.

17. The combination with a primary clutch member, of a secondary clutch member adapted to be inductively influenced thereby to create torque-producing currents in said secondary member, and a friction-eliminating coil or winding.

18. The combination with a primary clutch member, of a secondary member adapted to be inductively influenced thereby to create torque-producing currents in said secondary member, and a friction-eliminating means comprising a counterbalancing-winding and an armature influenced thereby.

19. The combination with a primary clutch member, of a secondary member, and means for eliminating friction during the acceleration of the driven member.

20. The combination with a primary clutch member, of a secondary member adapted to rest in physical contact therewith, and means for eliminating the friction during the acceleration of the driven member.

21. The combination with a primary clutch member, of a secondary member and a coil or winding for eliminating friction during the acceleration of the driven member.

22. The combination with a primary clutch member, of a secondary clutch member in physical contact therewith, and a coil or winding for eliminating friction during the acceleration of the driven member.

23. The combination with a primary clutch member carrying an energizing-winding, of a secondary member associated therewith, and means for eliminating friction during the acceleration of the driven member.

24. The combination with a primary clutch member, carrying an energizing-winding, of a secondary member associated therewith, and means for eliminating friction during the acceleration of the driven member comprising a counterbalancing-winding, and an armature influenced thereby.

25. The combination with a primary clutch member, of a secondary clutch member, adapted to rest in physical contact therewith, friction-eliminating means, and means for gradually decreasing the strength of said friction-eliminating means.

26. The combination with a primary clutch member, of a secondary clutch member, a friction-eliminating coil or winding and means for gradually decreasing the strength of said coil or winding.

27. The combination with a primary clutch member carrying an energizing-winding, of a secondary clutch member associated therewith, a friction-eliminating means comprising a counterbalancing-winding and an armature influenced thereby, and means for gradually decreasing the strength of said counterbalancing-winding.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

HENRY H. CUTLER.

Witnesses:

FREDERIC S. WILHOIT,

NORMAN C. BASSETT.