No. 741,895. PATENTED OCT. 20, 1903.

C. I. EARLL.

MAGNETIC CLUTCH.

APPLICATION FILED APR. 17, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

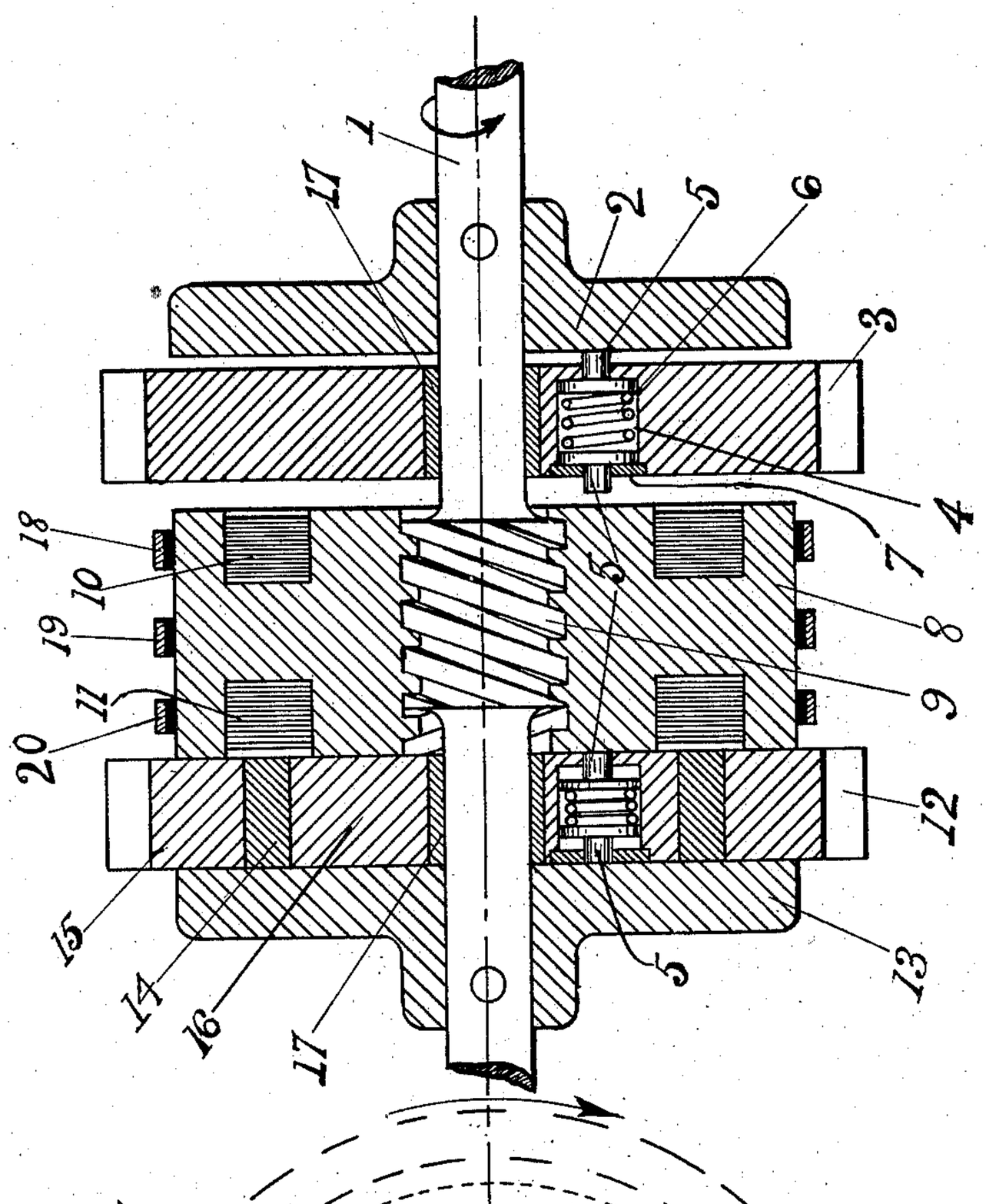
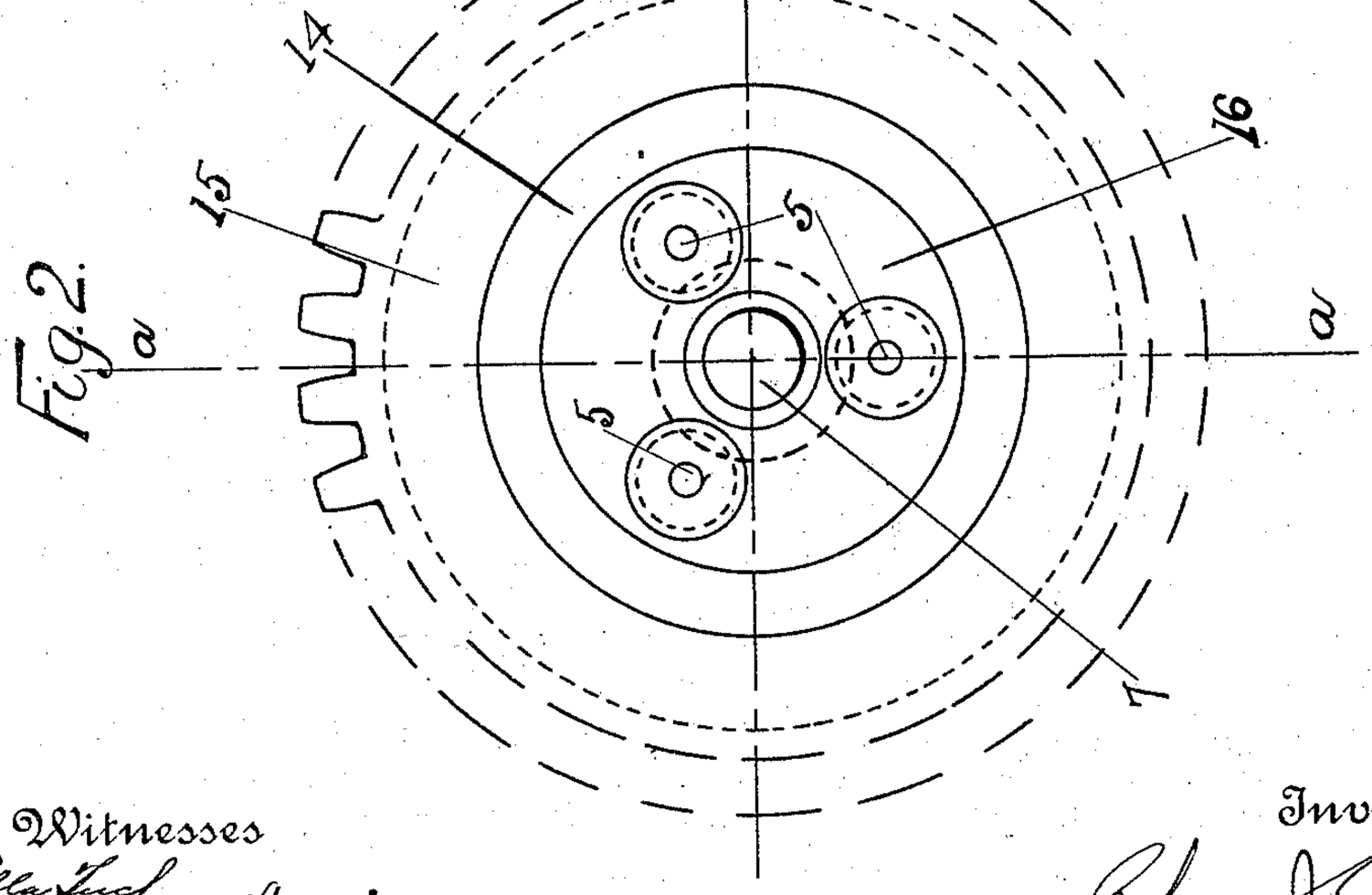


Fig. 2.



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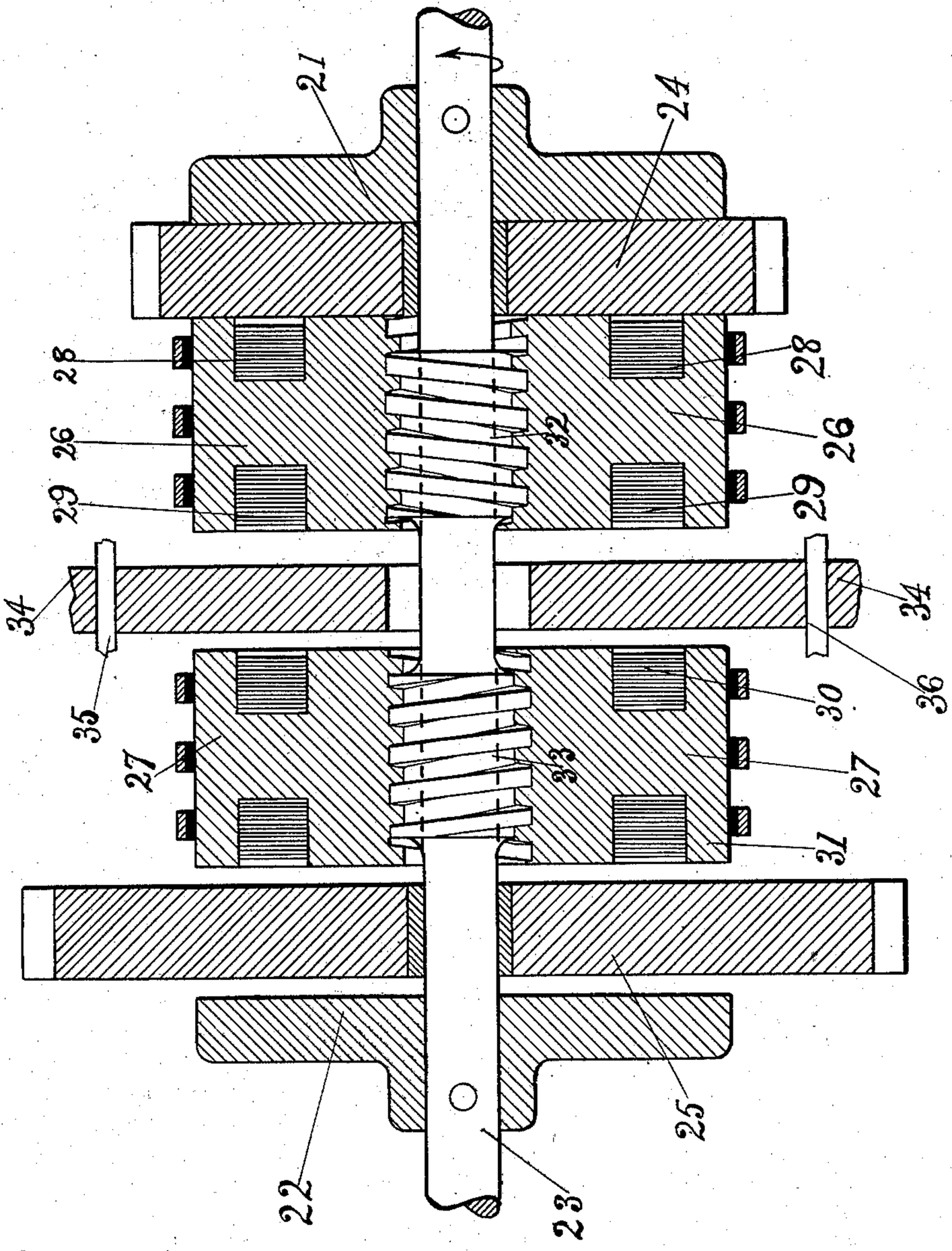
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.



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No. 741,895. Patented October 20, 1903.

UNITED STATES PATENT OFFICE.

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MAGNETIC CLUTCH.

SPECIFICATION forming part of Letters Patent No. 741,895, dated October 20, 1903.

Application filed April 17, 1903. Serial No. 153,011. (No model.)

To all whom it may concern:

Be it known that I, CHARLES I. EARLL, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Magnetic Clutches, of which the following is a specification.

My invention relates to electromagnetic clutches in which the engagement and disengagement of the members are controlled by the magnetic action induced by an electric current, and it is especially applicable to cases in which it may be desired to frequently reverse the direction of rotation of a driven shaft—that is, where a double clutch is adapted to engage at will one or the other of two revolving members driven in opposite directions. It is not, however, limited to such applications and may be used to advantage under many and various conditions.

The object of my invention is to produce a clutch of this class which shall be simple and effective in its construction and operation, one in which the power of the clutch is greatly augmented over that of the forms heretofore used, and in which the engagement and disengagement are conveniently and readily made.

My invention consists in providing a shaft having fixed thereon a threaded portion, in mounting upon said threaded portion a main clutch-body, so that as said main clutch-body is turned relatively to said shaft it is advanced along said shaft in one direction or the other, according to which direction it is turned, in mounting upon one or both sides of the clutch-body revoluble members or wheels adapted to slide to a limited extent longitudinally and to turn freely on said shaft, in fixing to said shaft friction-disks adjacent to said revoluble wheels or armatures, in providing elastic means for separating the clutch members when disengaged, in constructing the revoluble wheels which form the armatures for the main clutch-body so that they consist of two annular poles insulated magnetically from each other, whereby the magnetism is caused to penetrate more effectually through said armature to the disks fixed to said shaft, and in other novel features of construction to be hereinafter more fully pointed out and described.

In the drawings accompanying and forming part of this specification, Figure 1 is a central longitudinal section on line *a a* of Fig. 2, showing the preferred form of my invention adapted for a double or reversing clutch; and Fig. 2 is an end view of the same with one of the disks removed. Fig. 3 is a longitudinal section showing a clutch or a pair of clutches embodying my invention applied to a driven shaft where it is desired to drive the shaft at different speeds but in the same direction.

The reference characters are used in the same sense throughout the drawings and the specification.

Numeral 1 represents the shaft on which the various members of the clutch mechanism are mounted.

2 and 13 represent friction wheels or disks mounted on the shaft 1 and secured both against relative rotation and longitudinal movement.

3 represents a rotatable member mounted loosely on the shaft 1, free to turn thereon and to have a limited longitudinal movement. This member is here represented as a gear, and it is supposed to be driven from some outside source of power in a direction opposite to that indicated by the arrows in Figs. 1 and 2, and it forms an armature for the adjacent end of the main clutch-body 8.

4 is a recess formed in the armature 3 and is adapted to receive the plungers 5. The said plungers 5 have enlarged inner ends, which are engaged and forced outward by the spring 6.

7 represents a cap for securing the plunger 5 in position.

8 represents the main clutch-body, which is provided with an internal thread adapted to fit the threaded portion 9 of the shaft 1. This threaded portion 9 may be cut in an enlarged portion of the shaft, or it may be made of a separate sleeve secured to the shaft, in which case it is advantageous to make it of bronze or brass or some other non-magnetic material.

10 and 11 represent, respectively, two an-

nular coils of insulated wire received in suitable grooves cut in the faces of the main body 8 and connected in any convenient manner with a source of electrical energy, so that the current may be supplied to either coil at will to energize, respectively, one or the other side of the main body.

12 is a second armature revolubly mounted on the shaft 1 between the main body and the disk 13, the disk 13 being similar to the disk 2 and secured to the shaft in the same manner. The armature 12 is connected with some outside source of power, so as to be caused to revolve in the direction of the arrows. Thus the armatures 3 and 12 revolve in opposite directions, and the directions are such that as either armature engages the main clutch-body and causes it to turn upon the shaft it is advanced longitudinally of the shaft toward the armature which engages it. The armature 12 is constructed so as to have its two poles insulated magnetically from each other by means of the ring 14, which separates the outer pole 15 from the inner pole 16. Both armatures are preferably provided with sleeves 17, of non-magnetic and good bearing material. The purpose of separating the poles of the armature, as illustrated in armature 12, is to compel the lines of force or magnetic effect to penetrate through said poles to the disk 13. The means for controlling the currents in the energizing-coils may be of any approved form and are not herein shown, as they form no part of my present invention. I prefer, however, to use the means described in United States Patent No. 721,678 to Edwin Rust Douglas, and I have shown contact-rings 18, 19, and 20, adapted to be used with such means.

The operation of the mechanism is as follows: The armature-gear 12 is supposed to run continuously in the direction of the arrows and the armature 3 to run continuously in the opposite direction. When the current is turned on one of the energizing-coils—as, for instance, coil 11—the armature 12 being free to slide longitudinally on the shaft is caused to move up toward and engage the main body, and when such engagement is made the friction compels the main body to rotate with the armature and through the instrumentality of the thread 9 forces both the armature and main body to the left as seen in Fig. 1, bringing up against the fixed disk 13, thereby clamping the armature between said disk and the main body, the power of the clutch being determined by the pressure upon both surfaces of the armature produced by the action of the screw combined with that produced by the action of the magnetism. When it is desired to reverse the shaft, the current is turned off from the energizing-coil 11 and turned onto the energizing-coil 10, which demagnetizes that side of the main body in engagement with the armature 12 and magnetizes the other side, causing an engagement of the armature 3 with the main body, this engagement compelling the main body to turn in a direction opposite to that indicated by the arrows and through the instrumentality of the screw causing the main body to leave the armature 13 and advance with the armature 3 toward the friction-disk 2, thus clamping the armature 3 between the main body and this disk and causing the shaft to rotate with the armature 3. The purpose of the spring-pressed plungers 5 is to insure the separation of the armature from the main body on the one side and the disks on the other when the armatures are out of engagement.

The construction shown in Fig. 3 is designed to illustrate the application of my invention to a case where it is desired to cause the driven shaft to rotate in one direction only at one or more different speeds. 21 and 22 represent, respectively, two friction-disks fixed to the shaft 23. 24 and 25 represent two revoluble armatures located between and adjacent to, respectively, the disks 21 and 22. 26 and 27 represent two clutch-bodies provided with insulated coils 28, 29, 30, and 31, located between and adjacent to, respectively, the armatures 24 and 25 and having internal threads adapted to fit the threaded portions 32 and 33, respectively, on the shaft 23. 34 is a disk mounted between the bodies 26 and 27 and supported upon the pins 35 and 36 or in any other convenient manner, so that the disk is prevented from turning, but is free to move longitudinally. The operation of this construction is as follows: Let it be supposed that the armatures 24 and 25 revolve in the direction of the arrows at different speeds. When it is desired to cause the shaft to revolve with the armature 24, an energizing-current is sent through the coil 28, which engages the armature with the main body 26, causing the main body to revolve with the armature, and thus through the instrumentality of the screw 32 clamp the armature between the disk 21 and the main body. When it is desired to disengage the armature 24, the current is shut off from the coil 28 and turned onto the coil 29, causing the disk 34 to engage the main body and by means of the screw-thread to disengage the main body from the armature. The engagement and disengagement of the armature 25 are accomplished in a similar manner. By means of the rotative movement given by the clutch-body due to the magnetic action between the clutch-body and its armature I am enabled to apply to the screw as much power as is obtainable with the ordinary forms of magnetic clutches and to clamp the armature between the fixed disk and the clutch-body with great force. I thus obtain the advantage of a friction-clutch of great power combined with the ease of manipulation and simplicity of actuating mechanism obtainable only with a magnetic clutch. The pitch of the thread on which the main body is mounted may be varied to suit particular conditions. I prefer, however, to use

a pitch the angle of which shall be such that there shall be no tendency of the clutch to stick in disengaging.

It will be obvious that the energizing-coils may be located in the loosely-mounted members, which I have sometimes herein referred to as the "armatures," and thus make the internally-threaded clutch-bodies the armatures without altering the principle of operation or departing from the spirit of my invention.

Having thus described my invention, what I claim is—

1. In a magnetic clutch, the combination with a shaft, of a friction-disk fixed to said shaft, a clutch-body mounted on said shaft, means whereby a rotative movement of said clutch-body on said shaft causes said clutch-body to travel longitudinally of said shaft, a rotatable member loosely mounted upon said shaft between said clutch-body and said disk and an energizing-coil adapted to produce magnetic attraction between said clutch-body and said loosely-mounted rotatable member.

2. In a magnetic clutch, the combination with a shaft, of a screw-thread upon said shaft, a clutch-body mounted on said screw-thread, a disk fixed to said shaft, a wheel loosely mounted on said shaft between said clutch-body and said fixed disk and an energizing-coil adapted to produce magnetic attraction between said wheel and said clutch.

3. In a magnetic clutch, the combination with a shaft and screw-thread fixed to said shaft, of a clutch-body mounted on said screw-thread, a friction-disk fixed to said shaft, a wheel loosely mounted on said shaft between said friction-disk and said clutch-body and an energizing-coil in said clutch-body adapted to produce magnetic attraction between said clutch-body and said loosely-mounted wheel.

4. In a magnetic clutch, the combination with a shaft, of a disk fixed to said shaft, a loosely-mounted wheel on said shaft adjacent to said disk, a clutch-body mounted on said shaft adjacent to said loosely-mounted wheel, an insulated coil adapted to produce magnetic attraction between said clutch-body and said loosely-mounted coil, and means upon said shaft operated by the engagement of said clutch-body with said loosely-mounted wheel for causing a longitudinal movement of said clutch-body.

5. In a magnetic clutch, the combination with a shaft, of a pair of friction-disks fixed to said shaft, a screw-thread fixed to said shaft between said disks, a clutch-body mounted on said screw-thread, members loosely mounted on said shaft on either side of said clutch-body, energizing-coils in said clutch-body adapted to cause the engagement respectively of one or the other of said loosely-mounted members.

6. In a magnetic clutch, the combination with a shaft, of a screw-thread fixed to said shaft, a clutch-body mounted on said screw-thread, friction-disks fixed to said shaft on either side of said clutch-body at some distance therefrom, and loosely-mounted members between said friction-disks and said clutch-body.

7. In a magnetic clutch, the combination with a shaft and screw-thread fixed to said shaft, of a clutch-body mounted on said screw-thread, wheels loosely mounted on said shaft on either side of said clutch-body, friction-disks fixed to said shaft adapted to be engaged by said loosely-mounted wheels, energizing-coils in said clutch-body adapted to cause the engagement respectively of one or the other of said loosely-mounted wheels.

8. In a magnetic clutch, the combination with a shaft and a screw-thread fixed to said shaft, of a clutch-body mounted on said screw-thread, friction-disks fixed to said shaft on either side of said clutch-body, rotatable wheels loosely mounted on said shaft between said clutch-body and said friction-disks adapted to be driven in opposite directions, energizing-coils located respectively on the opposite faces of said clutch-body whereby when one of said coils is energized the loosely-mounted wheel opposite said coil is caused to engage said clutch-body and advance it in a direction along said shaft to clamp said loosely-mounted wheel between said clutch-body and one of said fixed disks.

9. In a magnetic clutch, the combination with a shaft, of a friction-disk fixed to said shaft, a clutch-body mounted on said shaft provided with an energizing-coil, a loosely-mounted rotatable member adapted to be clamped between said clutch-body and said disk when said coil is energized, and means for separating said rotatable member from said disk and said clutch-body when said clutch-body is demagnetized.

10. In a magnetic clutch, the combination with a shaft, a clutch-body and a friction-disk, of a wheel loosely mounted between said clutch-body and said disk, and spring-actuated means mounted in said loosely-mounted member adapted to cause the separation of said loosely-mounted wheel from said clutch-body and said disk.

11. In a magnetic clutch, the combination with a shaft and a clutch-body and friction-disk mounted thereon, of an armature mounted on said shaft between said clutch-body and said disk, plungers mounted in said armature projecting beyond the surfaces thereof and a spring between said plungers acting to force them apart.

12. In a magnetic clutch, the combination with a shaft and a main body mounted thereon, of a friction-disk mounted on said shaft, a revoluble armature mounted on said shaft between said disk and said main body said armature consisting of annular poles of magnetic material separated from each other by non-magnetic material.

13. In a magnetic clutch, the combination with a shaft having a screw-thread fixed thereto, of a main body mounted on said

screw-thread provided with an energizing-coil, a revoluble armature loosely mounted on said shaft adjacent to said main body and adapted to be drawn up to said main body when the latter is magnetically energized and a disk fixed to said shaft between which and said main body said armature is frictionally engaged when said main body is engaged.

14. In a magnetic clutch, the combination with a shaft and a member loosely mounted on said shaft, of a friction-disk fixed to said shaft on one side of said loosely-mounted member, an internally-threaded clutch-body mounted upon a thread fixed to said shaft on the other side of said loosely-mounted member, an energizing-coil in said clutch-body or said loosely-mounted member adapted when energized to cause frictional engagement between said clutch-body and said loosely-mounted member, whereby said clutch-body is caused to traverse along said thread toward said fixed disk and clamp said loosely-mounted member between said disk and said clutch-body.

15. In a magnetic clutch, the combination with a shaft and screw-thread fixed thereto, of an internally-threaded clutch-body mounted on said screw-thread and provided with an energizing-coil, an armature free to turn and slide on said shaft adjacent to said clutch-body and adapted to frictionally engage and turn said clutch-body when said energizing-coil is energized and means fixed to said shaft adapted to be engaged by said armature as a result of the engagement of said armature with said clutch-body.

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

CHARLES I. EARLL.

Witnesses:
HARRY S. BANDLER,
ELLA TUCH.