No. 754,804. PATENTED MAR. 15, 1904.

C. A. PRATT.

SPEED REGULATING MAGNETIC CLUTCH.

APPLICATION FILED DEC. 7, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

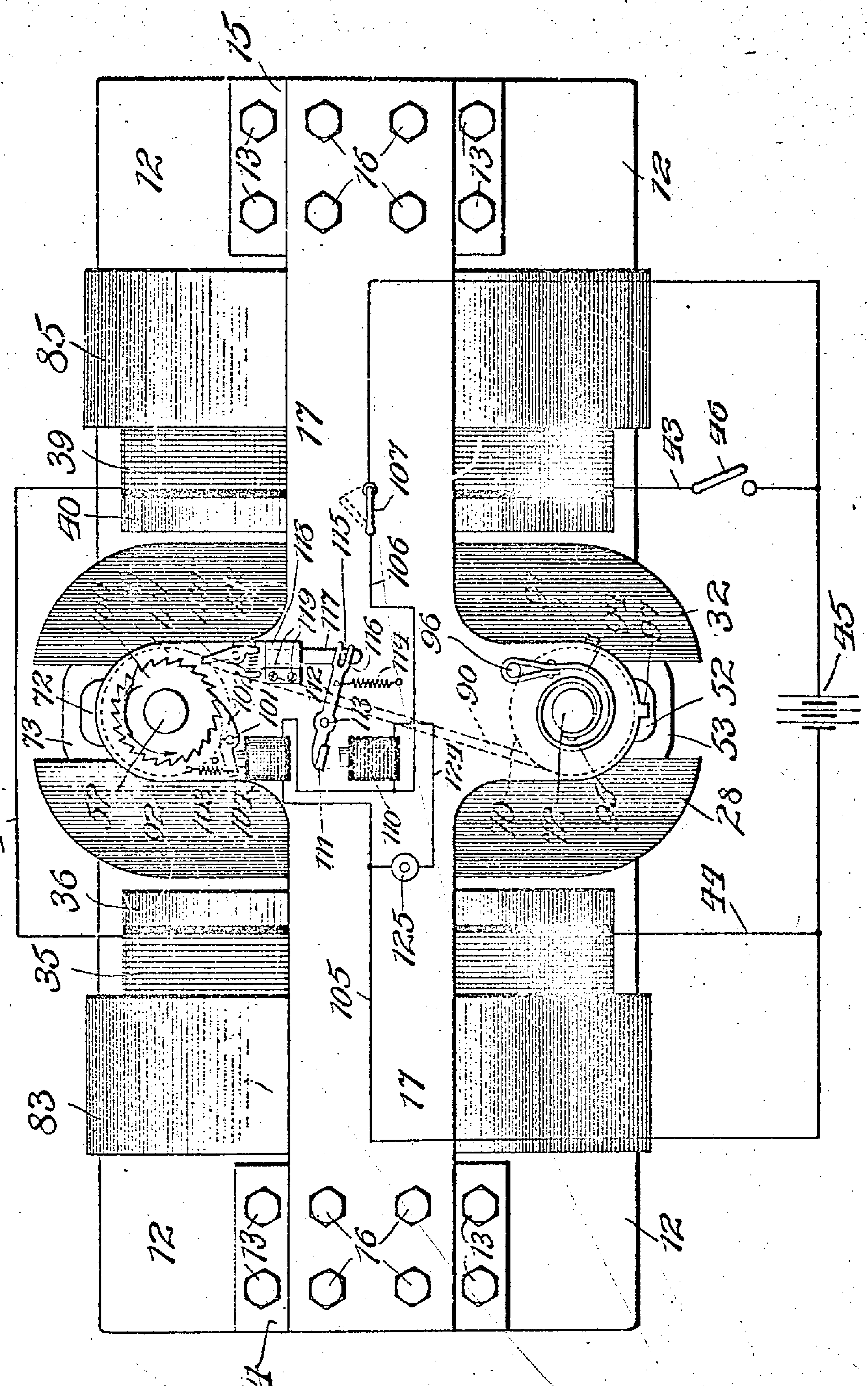

Fig. 1.

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NO MODEL. 3 SHEETS—SHEET 2.

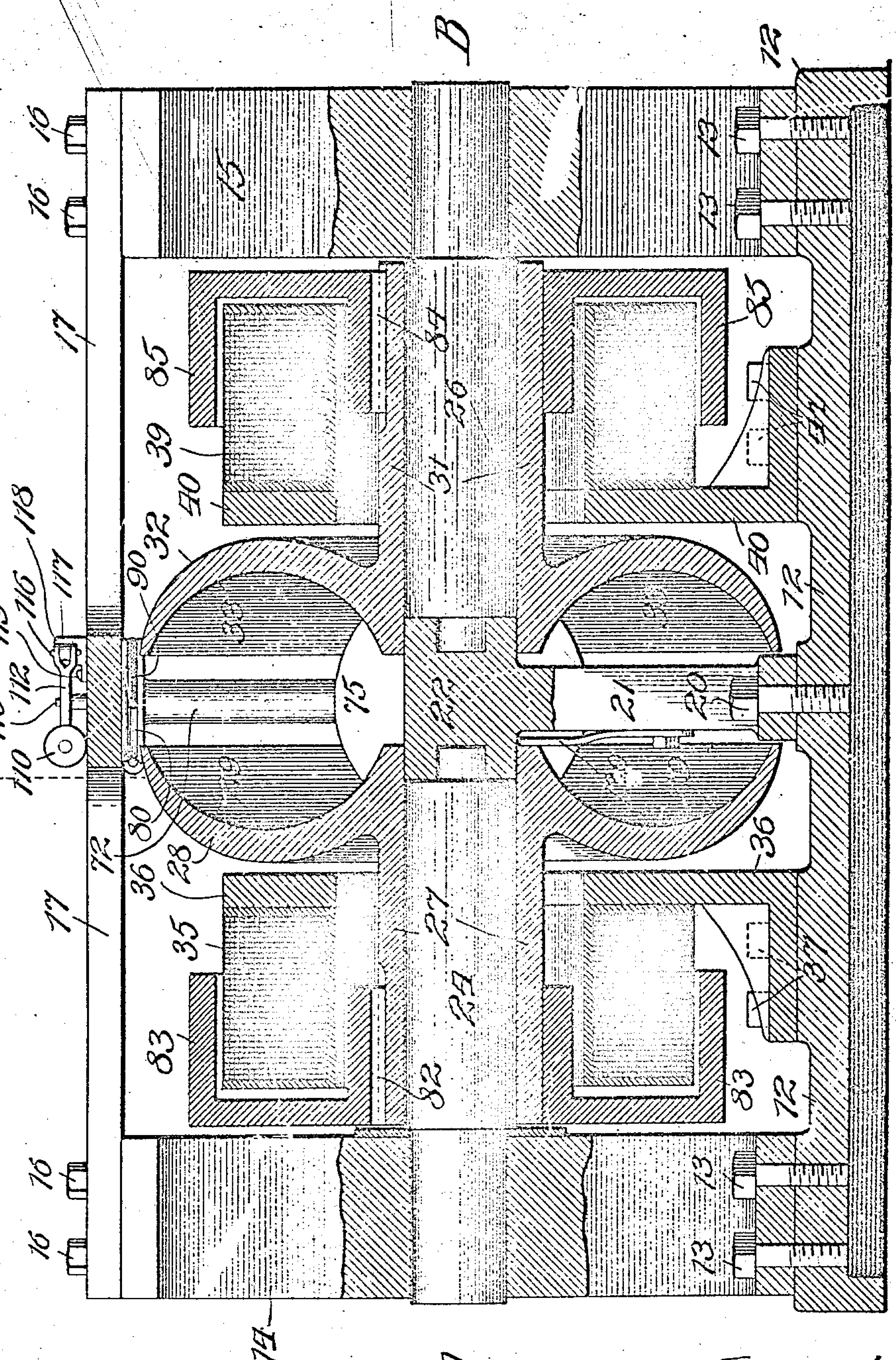

Fig. 2.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

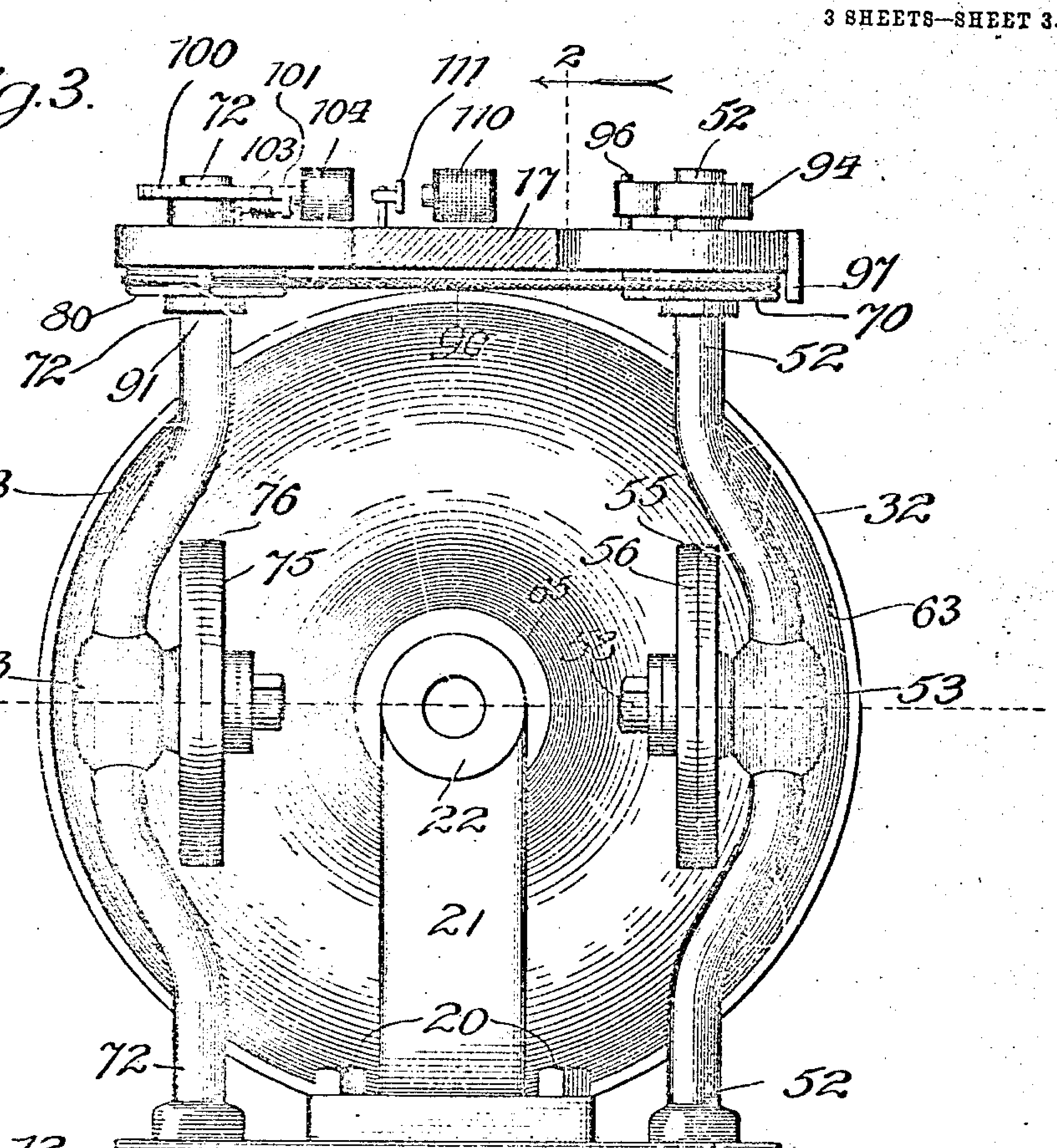
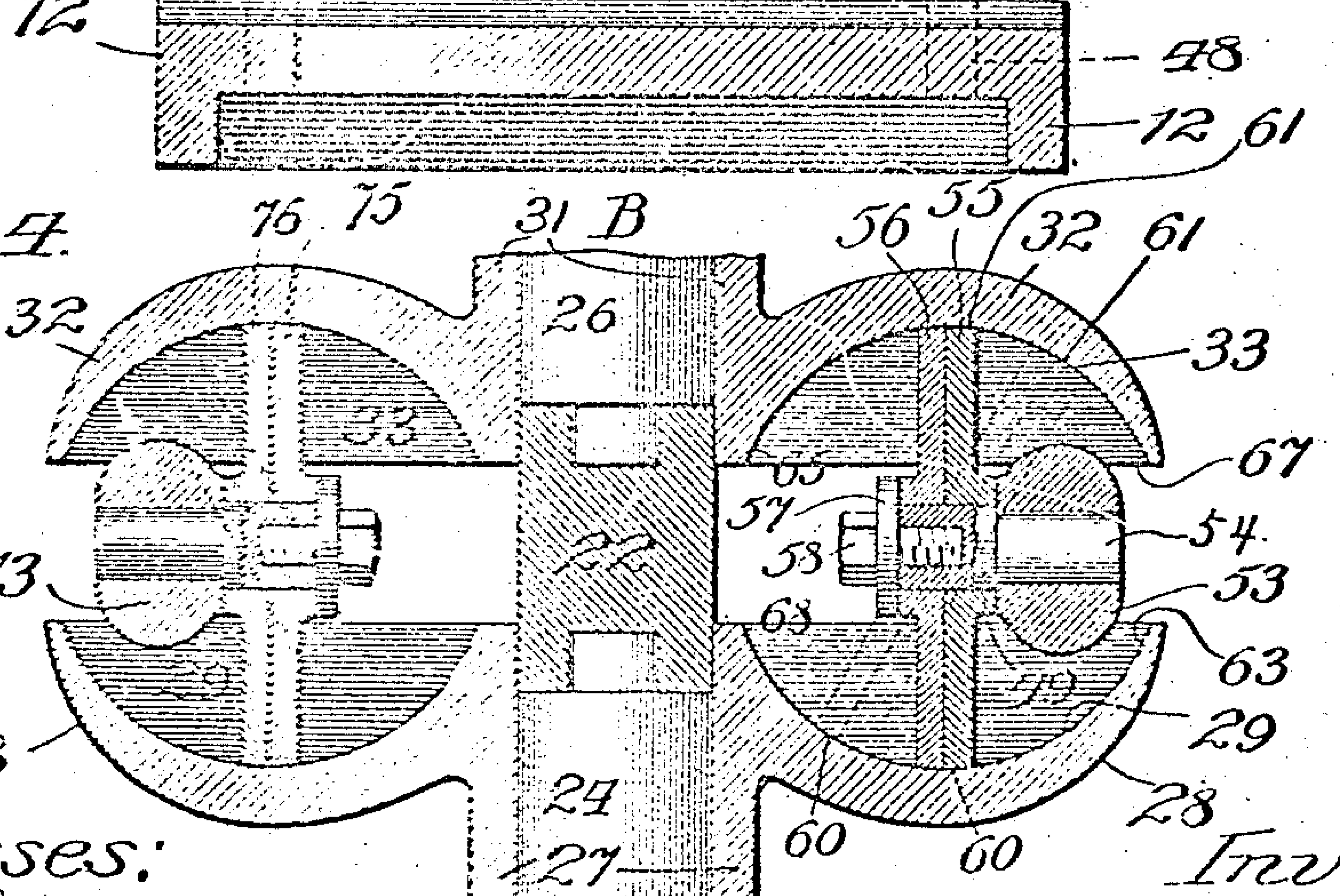


Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES A. PRATT, OF OAKPARK, ILLINOIS.

SPEED-REGULATING MAGNETIC CLUTCH.

SPECIFICATION forming part of Letters Patent No. 754,804, dated March 15, 1904.

Application filed December 7, 1903. Serial No. 184,188. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. PRATT, a citizen of the United States, residing at Oakpark, a suburb of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Speed-Regulating Magnetic Clutch, of which the following is a specification in its best form now known to me, reference being had to the accompanying drawings, in which similar characters indicate the same parts throughout the several views.

My invention relates to devices for regulating and varying the speed of rotation of a driven shaft with reference to another or driving shaft connected with a source of power.

The object of my invention is to provide mechanism for varying the speed of the driven shaft, said mechanism being one which gives a convenient and flexible means of varying the speed of said driven shaft, also being one which is neat and compact in form, efficient in operation, not liable to get out of order, and easily and cheaply constructed and installed.

My invention consists in two transmission-disks mounted so as to rotate independently, wheels or rollers being placed between the faces of the disks, the shape of the faces being such that by varying the position of the wheels or rollers the speed of the rotation of one disk with reference to the other disk may be varied. This in combination with magnetic means for holding the disks in contact with the intermediate wheels or rollers.

My invention also consists in a novel form of wheel or roller for use between the disks, whereby undue friction is avoided and the efficiency of the mechanism is increased.

It also consists in a novel form of mechanism for varying the position of the wheels or rollers with reference to the disks and in many details of construction which will be hereinafter more fully described and claimed.

Referring to the drawings, Figure 1 is a plan, Fig. 2 is an elevation view on line 2 of Fig. 3, and Fig. 3 is a sectional view on line 3 of Fig. 2, of the mechanism embodying my invention in its preferred form. Fig. 4 is a detail sectional view taken on line 4 of Fig. 3, showing the disks and the transmitting-wheels between them.

The entire mechanism is built upon a suitable base 12, usually a casting. Rigidly secured to this base by screws 13 or other suitable means are two upright end frames 14 and 15. Rigidly secured to the tops of these frames 14 and 15 by screws 16 or other suitable means is a top plate 17. To the base 12, between the end frames 14 and 15, I secure by screws 20 or other suitable means an upright support 21, terminating in a preferably enlarged head 22. This upright, or at least the head 22, is made of brass or other material through which the magnetic lines of a magnet do not readily pass. Rigidly mounted on one side of this brass head 22 of the upright 21 and in the upright 14 is a shaft 24, and similarly mounted in said brass head 22 and in the upright support 15 is another shaft 26, the two shafts being in line with each other, as shown, and except for the brass head 22 forming a continuous shaft. The center line of this shaft is distinguished by and will be referred to as A B. Rotatably mounted upon the shaft 24, heretofore described, is a hub 27, having either integral with or rigidly secured to it a transmission-disk 28, said disk having its transmission-face 29 cut away in the arc of a circle, this circular depression continuing annularly around the face of the disk, as shown. Geared to this hub 27 by a key 82 or other suitable method is a pulley or gear 83 or other transmission device. Similarly mounted on shaft 26 is a hub 31, bearing a transmission-disk 32, its transmission-face 23 being cut away in the arc of a circle. The radii of curvature of the transmission-faces 29 and 31 are the same for both disks. Similarly secured to hub 31 by a key 84 (or other suitable method) is a gear or pulley 85 or other suitable transmission device. The hub 27, heretofore described, is made of such a size and proportion that it serves as a core to a magnet-coil 35, which incloses it, as shown, the magnet-coil being mounted on a frame 36, rigidly secured to the base by screws 37 or other suitable means. Similarly, the hub 31 is adapted to act as a core in a magnet-coil 39, inclosing it, said magnet-coil being mounted in the frame 40, rigidly secured to the base 12 by screws 41 or other suitable means. These magnets are so wound and connected together by wires 42, 43, and 44 and to a source of electrical energy 45, as a dynamo or battery, through a switch 46 that by closing the switch 46 they operate to draw the two transmission-disks 28 and 32 toward each other and against the transmission mechanism, to be hereinafter described, placed between the transmission-faces 29 and 31 of said disks. Journaled in the top of frame 17 and in the base 12 in a vertical line through the center of curvature 49 of the transmission-faces 29 and 33 on one side of the center line A B of shaft 24 26 is a vertical shaft 52, having its middle portion offset to form a crank-arm 53. Extending from this crank-arm 53 is a stud 54, on which are journaled two or more transmission-wheels 55 and 56, the same being secured in position by the washer 57 and nut 58. These wheels 55 56 might be made in one piece; but it is a feature of my invention to make them in two or more pieces or laminæ, so that when the opposite sides of said wheels are, as will be hereinafter described, in contact with different radial portions of transmission-disks there will not be as much friction, due to the difference in the relative speed of rotation of the outer edges of wheels 55 and 56, as there is when a single wheel is used. In other words, these wheels rotate side by side at very slightly-different rates of speed, but so slightly different that no appreciable friction between the wheels themselves is apparent. These transmission-wheels 55 and 56 are of such a size and radius that, as shown in Fig. 4, they fit between the transmission-faces 29 and 33 of the disks 28 and 32. Their surfaces, which bear against the transmission-disks, are sections of a sphere whose radius is that of the transmision-faces of the disks, so that the wheels may be moved about between the transmission-faces 29 and 32, while always remaining in contact with them in all positions along the entire face of the wheel. The proportions of the crank-arm 53 and the stud are such that the center of said wheels 55 and 56 is always at the center of curvature 49 of the transmission-faces 29 and 33 of the disks and in line with the centers 47 and 48 of the shaft 52, from which it will be seen that by partially rotating the shaft 52 on its axis the transmission-wheels 55 56 may be rotated to the dotted-line position of Fig. 4, in which position the periphery portion 60 on one side of wheels 55 56 will be in contact with transmission-face 29 at a point nearer the center line A B of the shaft about which the transmission-disks are rotating than is the part of the periphery 61 of the wheels 55 56 in contact with the transmission-face 33. From this it will be seen that, assuming that the disk 32 is the driving-disk, the driven disk 28 will rotate very much faster when the parts are in the dotted-line position of Fig. 4. Continuing the rotation of the shaft 52 until the periphery portion 60 is at the inner end 68 of the face 29 of disk 28 and the periphery portion 61 is in contact with the outer edge 67 of the transmission-face 31 of disk 32 will further accentuate this difference in speed. It will also be seen that by rotating shaft 52 in the opposite direction until the periphery portion 61 is in contact with the inner end 65 of transmission-face 33 of disk 32 and the outer periphery portion 60 is in contact with the outer end 63 of transmission-face 29 of disk 28 will reverse the relation of these speeds, the driving-disk 32 rotating at one speed and the disk 28 rotating at a very much slower speed, the driven diameter 63 being greater than the driving diameter 65 taken about center A B. Mounted on shaft 52 near the upper frame 15 is a pulley 70. While theoretically only one set of wheels 55 and 56 is necessary between the transmission-disks 28 and 32, in order to balance the mechanical strains and increase the power which can be transmitted and make the machine symmetrical I mount upon the opposite side of the machine a similar shaft 72, having an offset forming a crank-arm 73, which crank-arm has journaled upon it other transmission-wheels 75 76, having identically the same relative position to the disks 28 and 32 as the wheel 55 56, heretofore described, except that these wheels are on the opposite sides of the machine and at the same distance from the center line A B. Mounted upon this shaft 72 is a pulley 80.

It will be seen that in order to have the machine operative the two transmission-wheels 55 56 and 75 76 must be moved in unison and to the same relative positions with reference to the transmission-surfaces of the disks 28 and 32. In order to accomplish this, I provide mechanism as follows: I connect the pulleys 70 and 80, heretofore described, with a practically non-elastic rope 90, the same crossing between the pulleys, as shown, and one end of the rope being rigidly secured to pulley 80 at 91 and the opposite end being secured to the pulley 70 at 92. On one shaft—as, for instance, shaft 72—I mount a coil-spring 94, having one end secured at 95 to this shaft 72, and the other end secured by a pin 96 or other suitable mechanism to the frame of the machine. This spring, when free to act, serves to hold the pulleys 70 and 80 and the rope 90 in the position shown in Fig. 1 against a stop 97. On the opposite shaft 52 I mount a ratchet-wheel 100. To the frame 15 I pivot at 101 a pawl 102, adapted to be held out of engagement with ratchet-wheel 100 by the spring 103. Adjacent to this pawl 102 I place a magnet 104, adapted when energized to draw pawl 102 toward it against the action of spring 103 and cause the pawl to engage with ratchet-wheel 100, as shown in Fig. 1. This magnet 104 is connected by wires 105 and 106 through switch 107 either to the source of electrical energy 45, heretofore referred to, or to an independent source, as desired. Closing this switch 107 energizes the magnet 104 and draws pawl 102 into contact with ratchet-wheel 100. Opening switch 107 releases this magnet's hold upon the pawl 102 and causes it to be withdrawn from ratchet-wheel 100 by spring 103, as heretofore described. Also adjacent to ratchet-wheel 100 I place another magnet 110, having its armature 111 on the end of a lever 112, pivoted at 113 and adapted to be normally held away from the magnet by the spring 114. The opposite end of the lever 112 has an elongated slot 115 cut in it, in which a pin 116 on vertical rod 117 is adapted to slide. This vertical rod 117 is slidably mounted in a guide 113, rigidly secured to the frame 15 by bolts or screws 119. Pivotally mounted at 120 upon the end of rod 117 is a pawl 121, adapted when the magnet is energized and the rod 117 is moved toward the ratchet-wheel to engage the teeth of the ratchet-wheel 100, said pawl being held in such contact by spring 122 and also adapted when rod 117 is in its normal position, as shown in Fig. 1, to entirely clear the teeth of the ratchet-wheel 100. The rod 117 is held in its normal position by spring 114. The magnet 110, above referred to, is connected by wires 124, through a push-button 125 through switch 107, with a source of electrical energy 45, heretofore referred to, or to some other source of electrical energy. (Not shown.) When the push-button 125 is closed, (the switch 107 having been previously closed,) the current of electricity is sent through magnet 110, which pulls down armature 111, and therefore moves rod 117, with pawl 121 upon it, into contact with ratchet-wheel 100, and as the motion is continued it rotates ratchet-wheel 100 against the tension of spring 94 in the direction shown by arrow in Fig. 1 at least the length of one tooth. The switch 107 having been previously closed, the pawl 102 clicks over one or more teeth of the ratchet-wheel 100 during this semirotation. The finger is now removed from the push-button 125, thereby deënergizing magnet 110 and allowing the pawl 121 to return to normal position, (shown in Fig. 1,) the wheel 100 being held stationary by pawl 102. The operator again presses push-button 125, which causes pawl 121 to move up and rotate ratchet-wheel 100 a distance of at least another tooth, and the pawl 102 again clicks over one or more teeth. The operator now releases the push-button 125, and the pawl 121 drops back, as heretofore described. Repeating this operation causes ratchet-wheel 100 to continue this step-by-step rotation in the direction of the arrow in Fig. 1 against spring 94, heretofore described. This step-by-step rotation of the ratchet-wheel 100, as will be seen from the description which has been given heretofore, has rotated shaft 72 with the parts attached to it, including the pulley 80, and this motion has been transmitted, through rope 90 and pulley 70 and shaft 52, to the parts attached to it, rotating them in the opposite direction against the action of spring 94, heretofore described. When now the operator wishes to have the parts move in the opposite direction and return to or toward the position shown in Fig. 1, he keeps his hand off from the push-button 125 and opens switch 107, thereby releasing pawl 102 from engagement with ratchet-wheel 100, in which position the parts are free to return to the normal position under the retractile action of spring 94. This spring 94 and the stop 97 should be so located that when both push-button 125 and the switch 107 are open the wheels 55 56 and 75 76 are returned to an extreme position—as, for instance, positions 67 and 68 or 63 and 65, heretofore described, Fig. 4.

In the general operation of my invention I provide mechanism of the general form here illustrated. I connect one gear or pulley, as 85, to a source of power, thereby making transmission-disk 32 a driving-disk. I also connect gear or pulley 83 with the machinery which is to be driven, thereby making transmission-disk 28 the driven disk. The transmission-wheels 55 56 and 75 76 are, as heretofore described, between transmission-disks 28 and 32 and are in an extreme position, as described in the last paragraph, so that when the machine is operated the driven disk 28 will, as heretofore described, rotate slower than the driving-disk 32. I now preferably start the source of power, thereby rotating gear or pulley 85 and driving-disk 32. I now close switch 46, thereby energizing magnets 35 and 39 and drawing transmission-disks 28 and 32 together upon transmitting-wheels 55 56 and 75 76. As soon as this operation is completed the motion of the transmission-disk 32 is communicated, through the transmitting-wheels, to transmission-disk 28. I now close the switch 107, thereby energizing magnet 104 and drawing pawl 102 into contact with ratchet-wheel 100, as heretofore described. I now repeatedly press the push-button 125, as heretofore described, thereby rotating ratchet-wheel 100, and therefore shafts 72 and 52. This rotation of the shafts 72 and 52 causes the transmission-wheels 55 56 and 75 76 to be moved step by step from an extreme position, heretofore described, past the dotted-line position of Fig. 4 to the full-line position of Fig. 4, at which time the disks 28 and 32 will rotate at the same speed. Continuing this step-by-step motion, they finally reach the extreme angular position opposite to that from which they started and to which the spring 94 would return were it free to act. After passing the full-line position of Fig. 4 the transmission-wheels 55 56 and 75 76 will cause the driven disk 28 to rotate faster than the driving-disk 32. When the desired speed for the driven machinery is reached, I permanently release the push-button 125, and thereby hold pawl 102 and the connected mechanism in a stationary position as long as it is desired to operate the driven machine at the same speed. If it is desired to slow down the driven machine speed, I open switch 107, thereby, as heretofore described, allowing spring 94 to return the parts to the starting position, above described. When it is desired to wholly stop the driven machine, I either open the switch 46 or shut off the source of power, or both, as desired.

If desired, a spring 130 may be inserted between the disks 28 and 32 to move them apart against any residual magnetism which may exist when switch 107 is opened, or this separating of disks 28 and 32 may be accomplished by reversing the current of one of the coils.

I do not wish to be understood as limiting myself to the exact details of construction, which can be varied within reasonable limits without departing from the principle of my invention.

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

1. In mechanism of the class described, the combination of two transmission-disks mounted in substantially parallel planes, transmitting mechanism adapted to communicate power from one of said disks to the other, magnetic mechanism adapted to move one of said disks toward the other and means adapted to vary the position of said transmitting mechanism with reference to the disks, whereby the speed of rotation of one of said disks with reference to the other is varied.

2. In mechanism of the class described, the combination of two transmission-disks mounted in substantially parallel planes, transmitting mechanism adapted to communicate power from one of said disks to the other, magnetic mechanism adapted to move one of said disks toward the other and means operated by electricity adapted to vary the position of said transmitting mechanism with reference to the disks, whereby the speed of rotation of one of said disks with reference to the other is varied.

3. In mechanism of the class described, the combination of two transmission-disks mounted face to face in line with each other, transmitting mechanism interposed between the faces of said disks adapted to communicate power from one of said disks to the other, magnetic means adapted to move one of said disks toward the other and mechanism adapted to vary the position of said transmitting mechanism with reference to the disks; whereby the speed of rotation of one of said disks with reference to the other is varied.

4. In mechanism of the class described, the combination of two transmission-disks mounted face to face in line with each other, transmitting mechanism interposed between the faces of said disks adapted to communicate power from one of said disks to the other, magnetic means adapted to move one of said disks toward the other, mechanism operated by electricity adapted to vary the position of said transmitting mechanism with reference to the disks, whereby the speed of rotation of one of said disks with reference to the other is varied.

5. In mechanism of the class described, the combination of a shaft, two transmission-disks mounted face to face upon said shaft, transmitting mechanism adapted to communicate power from one of said disks to the other, magnetic means adapted to move one of said disks toward the other and devices operated by electricity adapted to vary the position of said transmitting mechanism with reference to the disks whereby the speed of rotation of one of said disks with reference to the other disk is varied.

6. In mechanism of the class described, the combination of two transmission-disks mounted face to face, the adjacent faces of said disks being cut away in the arc of a circle, a transmitting-wheel, adapted to communicate power from one of said disks to the other, mounted in said curved surfaces between said disks and magnetic means adapted to move one of said disks toward the other of said disks upon said transmitting-wheel, mechanism operated by electricity adapted to vary the position of said transmitting-wheel upon the faces of said disks whereby the speed of one of said disks is varied with reference to the speed of the other disk.

7. In mechanism of the class described, the combination of a shaft, two transmission-disks mounted face to face thereon, the adjacent faces being cut away in the arc of a circle, transmitting mechanism adapted to communicate power from one of said disks to the other, the same being mounted in said curved surfaces between said disks and magnetic means adapted to move one of said disks toward the other of said disks upon said transmitting mechanism and mechanism operated by electricity adapted to vary the position of said disks whereby the speed of the rotation of one disk may be varied with reference to the speed of the other of said disks.

8. In mechanism of the class described, the combination of a shaft, two transmission-disks mounted thereon with their faces toward each other, transmitting mechanism adapted to communicate power from one of said disks to the other, interposed between said disks, a magnet inclosing the hub of one of said disks connecting through a switch to a source of electrical energy adapted, when the switch is closed, to move one of said disks toward the other disk upon the transmitting mechanism.

9. In mechanism of the class described, the combination of a shaft, two transmission-disks

mounted thereon with their faces toward each other, transmitting mechanism adapted to communicate power from one of said disks to the other, interposed between said disks, a magnet inclosing the hub of one of said disks connecting through a switch to a source of electrical energy adapted when the switch is closed to move one of said disks toward the other upon said transmitting mechanism and gears or pulleys upon the hubs of said disks adapted to deliver and receive power through said disks.

10. In mechanism of the class described, the combination of a shaft, transmission-disks mounted thereon, a transmitting-wheel interposed between and in engagement with said disks, said wheel being made up of two or more laminæ mounted side by side upon the same shaft said laminæ being capable of revolving independently each of the other.

11. As an article of manufacture for use in power-transmitting mechanism, where the speed of rotation of the power-wheel communicating with the wheel of this manufacture is different at different sides or edges of the transmission-wheel, a transmission-wheel composed of a set of two or more thin laminæ placed side by side and adapted to rotate at relatively different speeds while the entire combined wheel is rotated in the same direction for transmitting power.

12. In mechanism of the class described, the combination of a shaft having a section of its length made of non-magnetic material, transmission-disks independently mounted on said shaft on opposite sides of said non-magnetic portion of the shaft, transmission mechanism between the faces of said disks and magnetic means operating upon said disks adapted to move one disk toward the other upon said transmitting mechanism.

13. In mechanism of the class described, the combination of two transmission-disks, transmitting mechanism interposed between said disks, a shaft carrying said transmitting mechanism, a ratchet-wheel upon said shaft, a pawl adjacent to said ratchet-wheel normally held away from it, a magnet adapted when energized, to hold said pawl in contact with said ratchet-wheel, a second pawl mounted adjacent to said ratchet-wheel adapted to be moved toward and from said ratchet-wheel to communicate motion thereto, a second magnet adapted when energized, to move said second pawl into contact with said ratchet-wheel and means adapted to withdraw said second pawl from said ratchet-wheel when said second magnet is deënergized and means adapted, when both pawls are released from contact with said ratchet-wheel to move said ratchet-wheel and the shaft to which the wheel is attached, in the opposite direction.

14. In mechanism of the class described, the combination of two transmission-disks, transmitting mechanism interposed between said disks, a shaft carrying said transmitting mechanism, a ratchet-wheel upon said shaft, a pawl adjacent to said ratchet-wheel normally held away from it, a magnet adapted when energized, to hold said pawl in contact with said ratchet-wheel, a second pawl mounted adjacent to said ratchet-wheel adapted to be moved toward and from said ratchet-wheel to communicate motion thereto, a second magnet adapted when energized, to move said second pawl into contact with said ratchet-wheel, means adapted to withdraw said second pawl from said ratchet-wheel when said magnet is deënergized and a spring adapted, when both pawls are released from said ratchet-wheel, to move said ratchet-wheel and the shaft to which it is attached, in the opposite direction from the motion communicated by the moving pawl.

15. In mechanism of the class described, the combination of two transmission-disks mounted face to face, transmitting mechanism, interposed between said disks on opposite sides of the diameter, parallel shafts supporting said transmitting mechanism, a spring adapted to move one of said shafts in one direction, connecting mechanism so connecting said shafts that said spring is also adapted to simultaneously move the other shaft in the opposite direction, a ratchet-wheel mounted upon said second shaft and two electrically-operated pawls detachably engaging said ratchet-wheel, adapted when energized to move said shafts against the action of said spring.

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