No. 780,486. PATENTED JAN. 17, 1905.

R. M. PHILLIPS.

FRICTION CLUTCH.

APPLICATION FILED AUG. 24, 1903. RENEWED NOV. 28, 1904.

4 SHEETS—SHEET 1.

Fig. 1.

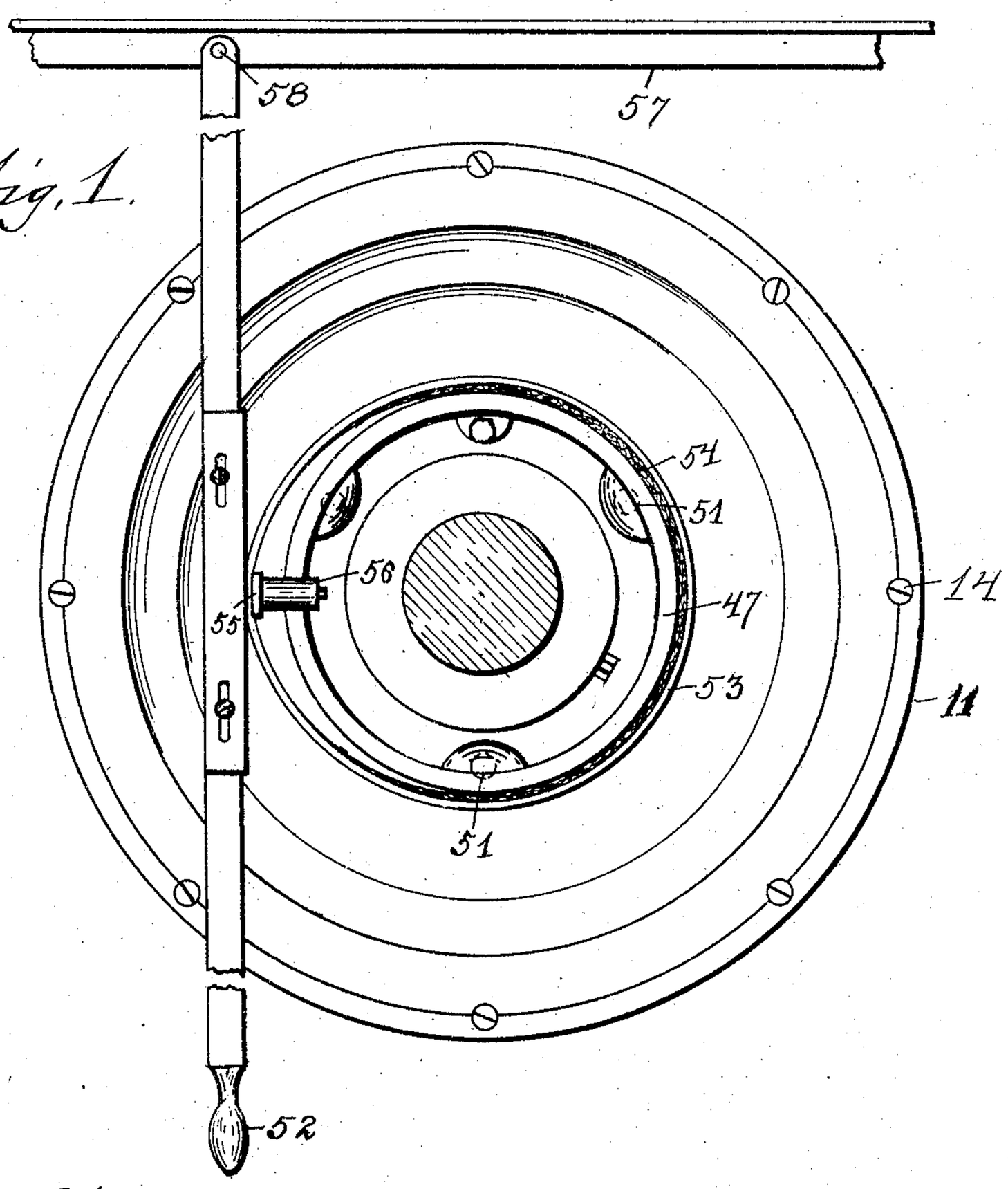
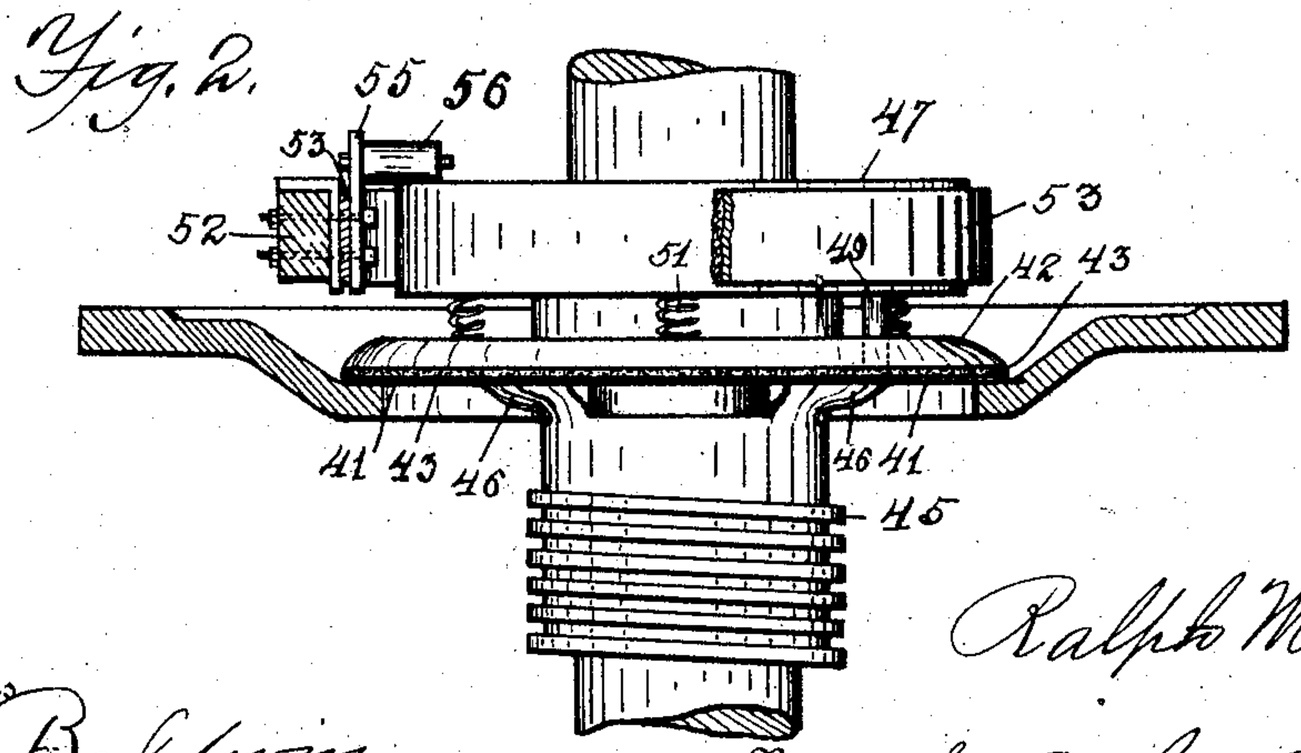


Fig. 2.



Witnesses
F. E. Baldwin.
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4 SHEETS—SHEET 2.

Fig. 3.

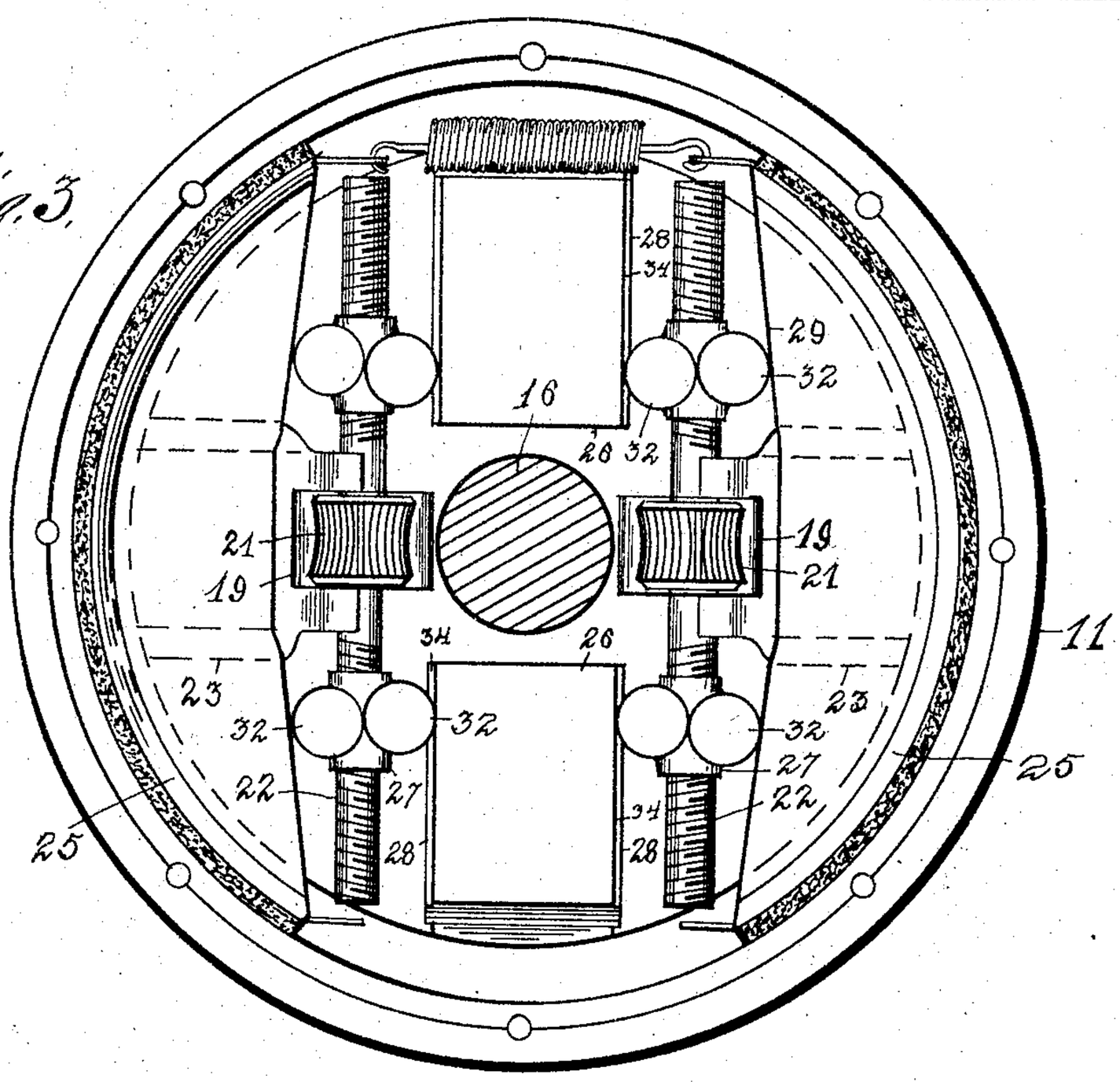


Fig. 4.

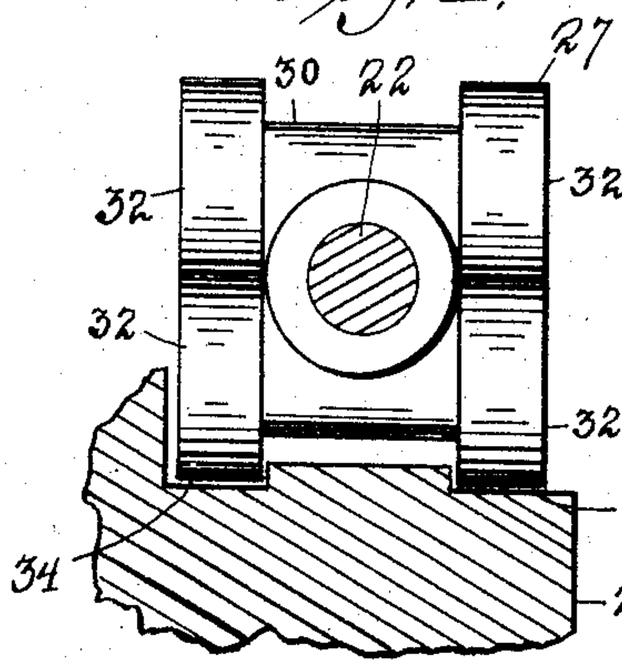


Fig. 5.

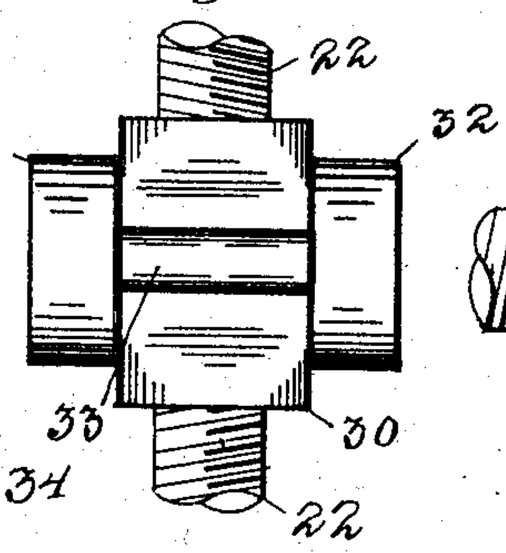
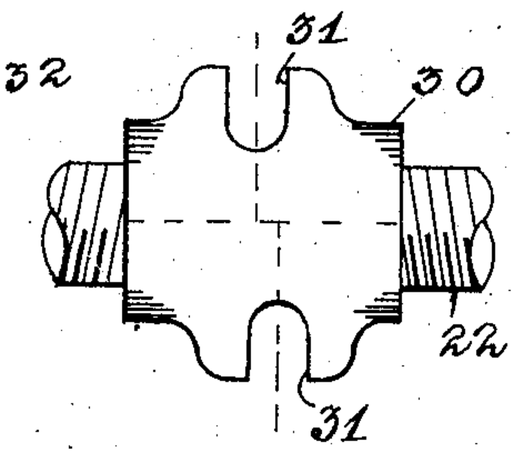


Fig. 6.



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4 SHEETS—SHEET 3.

Fig. 7.

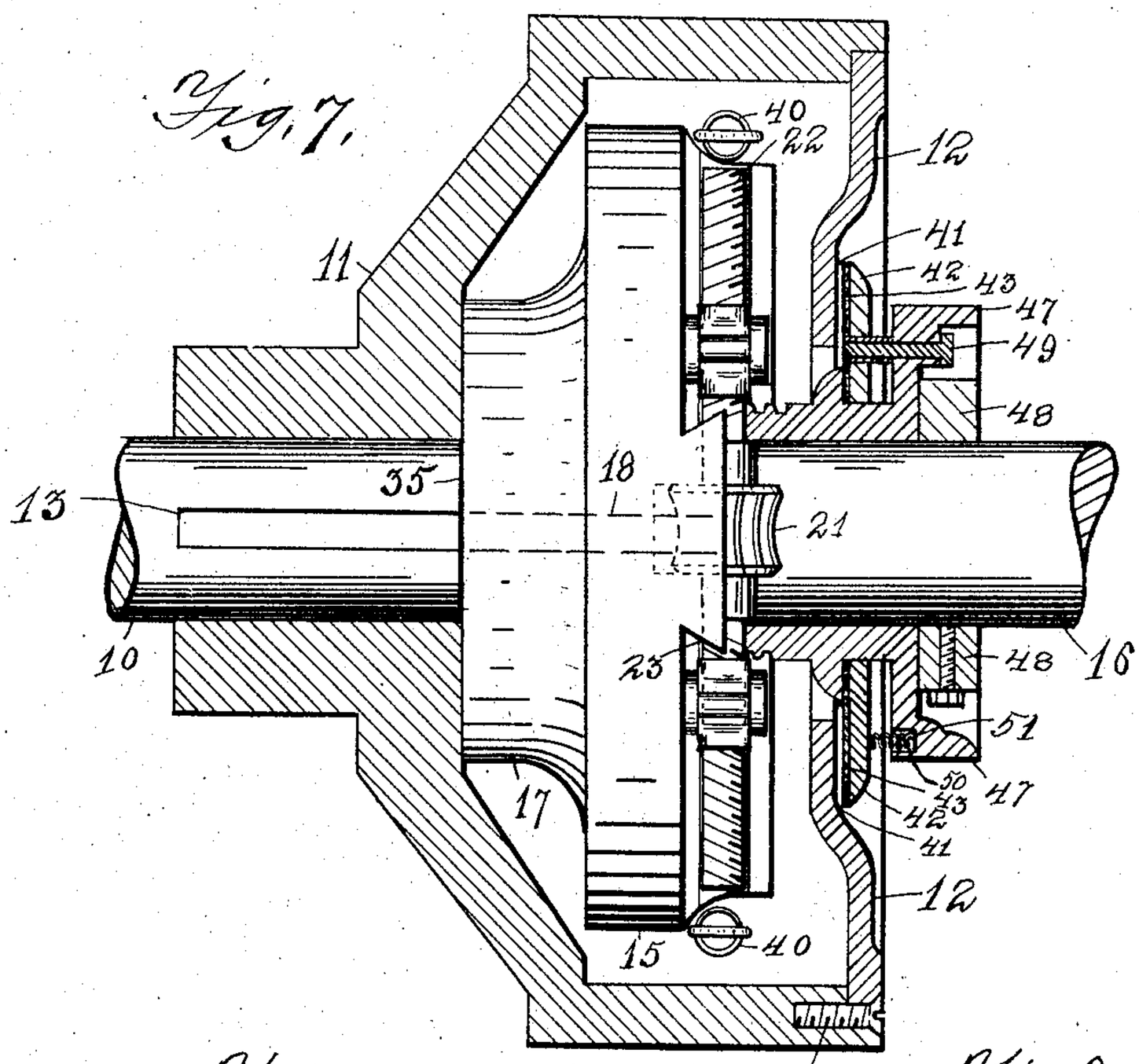


Fig. 8.

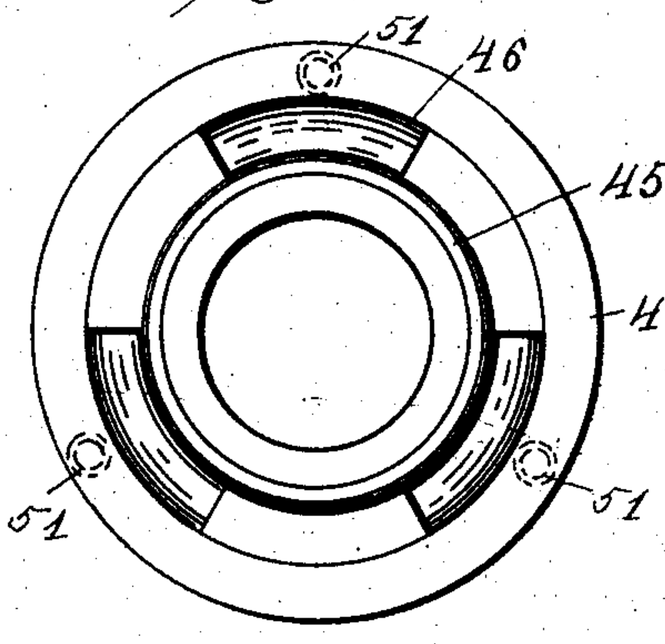
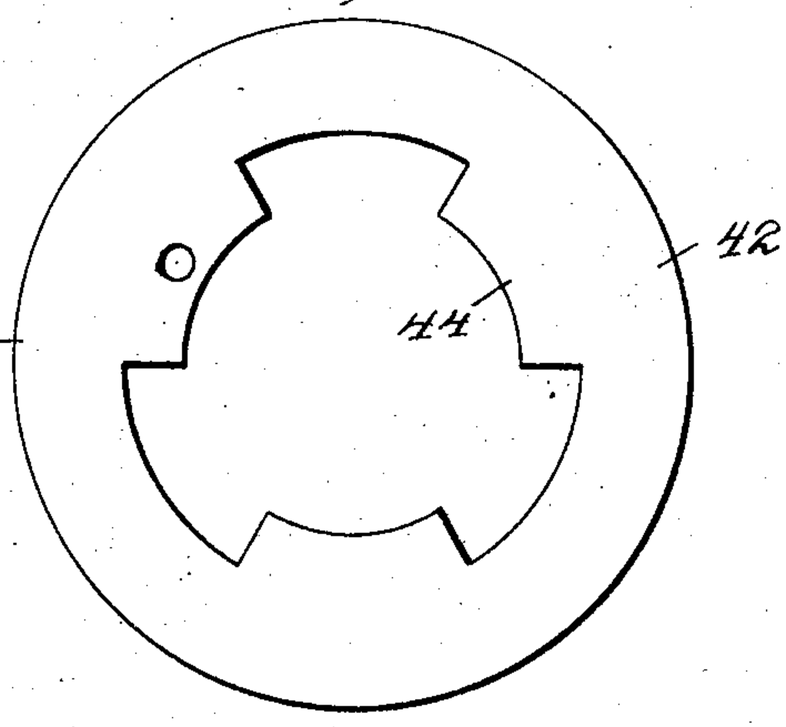


Fig. 9.



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4 SHEETS—SHEET 4.

Fig. 10.

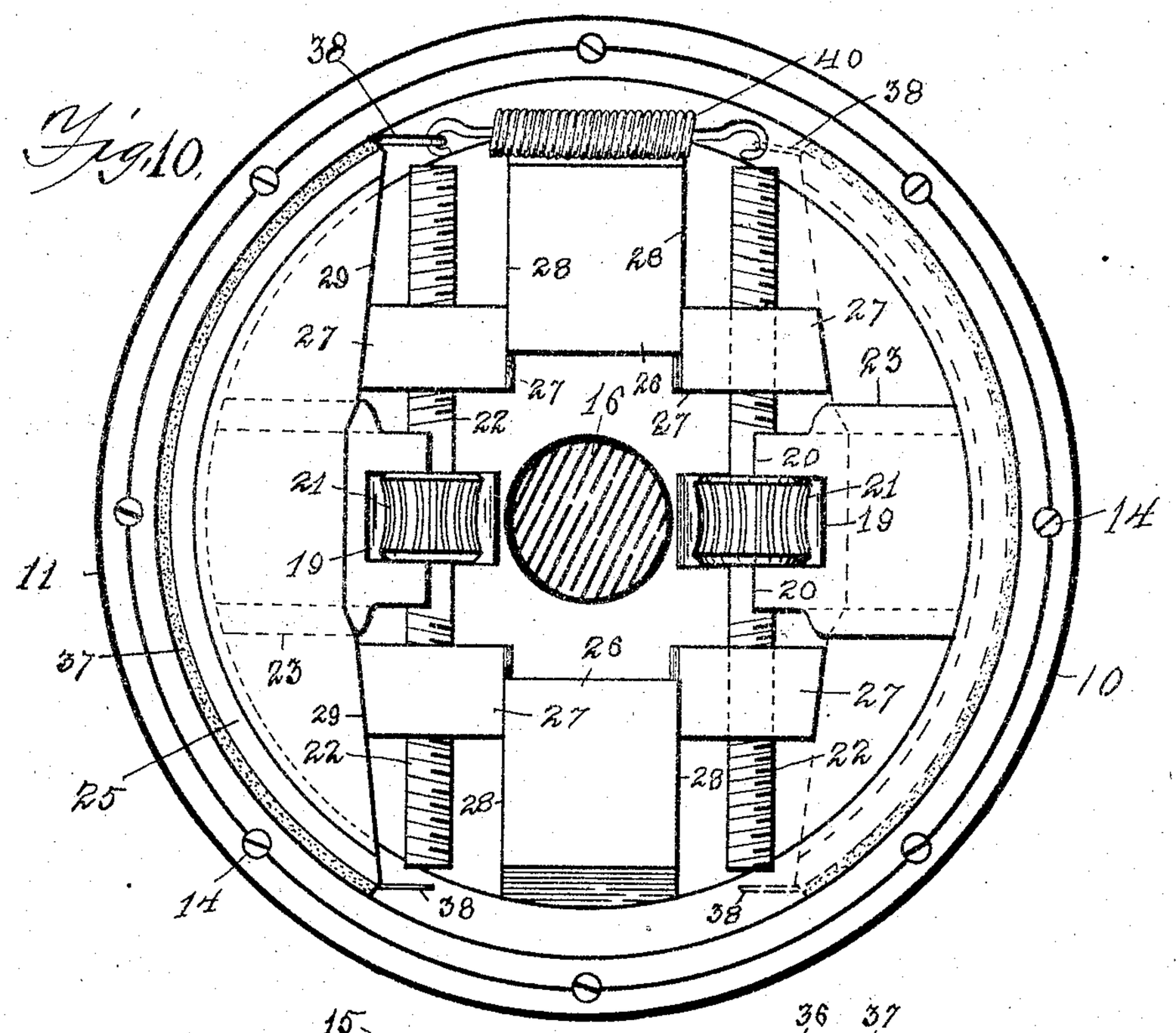


Fig. 11.

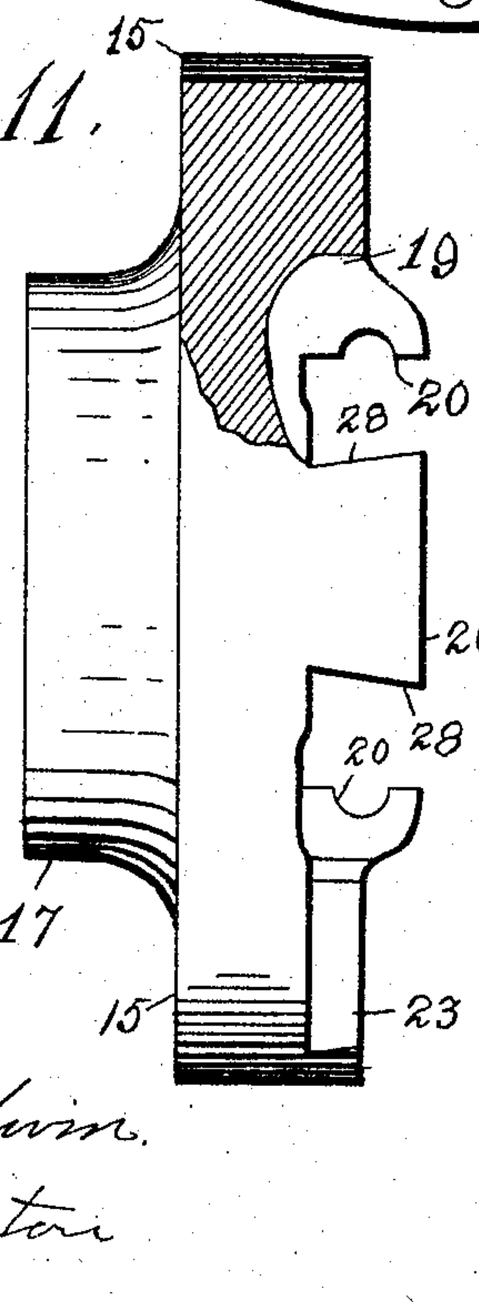
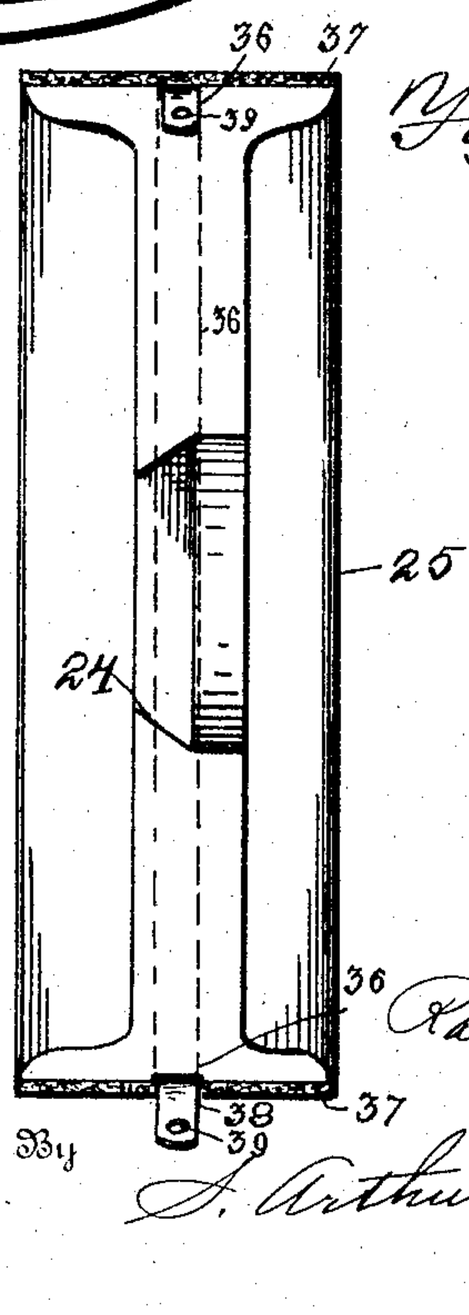


Fig. 12.



Witnesses
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No. 780,486. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

RALPH M. PHILLIPS, OF JAMESTOWN, NEW YORK, ASSIGNOR TO THOMAS HENRY SMITH, OF JAMESTOWN, NEW YORK.

FRICTION-CLUTCH.

SPECIFICATION forming part of Letters Patent No. 780,486, dated January 17, 1905.

Application filed August 24, 1903. Renewed November 28, 1904. Serial No. 234,544.

To all whom it may concern:

Be it known that I, RALPH M. PHILLIPS, a citizen of the United States, residing at Jamestown, in the county of Chautauqua and State of New York, have invented new and useful Improvements in Friction-Clutches, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

The clutch mechanism herein shown and described is an improvement on the mechanism shown in my United States Patents Nos. 673,888 and 673,924, of May 24, 1901, and No. 735,811, of August 11, 1903.

The objects of my improvement are, first, the provision of roller-wedges adapted to my construction which overcome the friction of the wedges and ways; second, to provide ways for the wedges on the central plate whereby all tendency to sidewise movement is taken from the screws; third, to provide a simple and effective starting device for the worm which will not be inoperative when the parts are out of line, and to otherwise simplify and perfect the general construction of the clutch.

In the drawings, Figure 1 is a side elevation showing the front of my improved clutch with starting-lever and brake. Fig. 2 is an elevation from the upper side of the worm, face-plate, and starting and stopping mechanism, the face-plate and lever being in section and the brake-band broken away. Fig. 3 is a plan view of the expanding mechanism of the clutch with the face-plate, worm, and one of the withdrawing-springs removed. Fig. 4 is a detail view of my roller-wedge endwise of the screw with the screw and a portion of the track in section. Fig. 5 is a side elevation of my roller-wedge with screws broken away. Fig. 6 is a side elevation of the block for holding the rollers of the wedge with the screw broken away. Fig. 7 is a sectional view of the shell, worm, and starting mechanism and an elevation of the remaining inner parts of the clutch with the friction-block removed. Fig. 8 is an elevation of the inner side of the starting clamping-ring and the inner end of worm, showing the method of attaching the ring to the worm. Fig. 9 is a detail pattern of clamping-ring. Fig. 10 is a plan view of the expanding mechanism, showing a modification adapting my former solid wedges to my present construction. Fig. 11 is a side elevation of the disk-shaped central plate, part of the plate being broken away to show the bearing for the screw and worm-gear. Fig. 12 is a plan view of the inner edge of one of the segmental friction-blocks.

Similar numerals refer to corresponding parts in the several views.

The driving-train of my clutch is composed of the power or driving shaft 10 and the shell 11, with its face-plate 12. The hub of the shell 11 is secured on the end of the driving-shaft 10 by a suitable key in key-seat 13, and shell 11 always revolves with shaft 10. Face-plate 12 is secured to the rim of shell 11 by suitable screw-bolts 14 in the joint between the plate and the rim, thus locking the face-plate from turning and securing it at the same time.

The driven train of the clutch is composed of a disk-shaped central plate 15, the driven shaft 16, and the expanding mechanism. The central plate 15 is a heavy disk supported upon the end of the driven shaft 16 by a suitable hub 17 on one side of the plate, the hub being fastened to the shaft by a key in key-seat 18 in order that plate 15 may turn the shaft. The adjacent ends of the driving and driven shafts usually abut upon the line 35 of the inner end of the hub of shell 11 and the end of hub 17. The front side of central plate 15 is formed with openings 19 and bearing 20 for worm-gears 21 and right-and-left screws 22. Plate 15 also has broad dovetail-shaped projections 23 for interlocking with like-shaped openings 24 in segmental friction-blocks 25, thus simultaneously guiding and holding the blocks in position as they are moved out and in radially by the expanding mechanism. Plate 15 has also the projections 26 between the screws 22 for supporting the screws 22 and wedges 27. The edges 28 of projections 26 adjacent to the wedges 27 are made straight lengthwise. The edges 29 of the friction-

blocks are given angles of incline which converge toward their outer ends, as in my former construction.

My roller-wedges are formed to overcome the friction from the sliding contact of the parts and are made with a central block 30, which has a threaded opening therein for the screw 22. On opposite sides of the block are the U-shaped crosswise grooves 31, which are deeper than the shaft usually works and serve as a guide for the connecting-shafts of rollers 32. The rollers 32 and connecting-shaft 33 are usually made of one piece, with a roller at each end connected by shaft 33, which shaft works in opening 31. The rollers 32 are placed in crosswise grooves 31 on opposite sides of block 30 and are of such a size as to bear on each other, as shown in Fig. 4, and also on incline 29 and straight way 28 on either side, the block 30 being loose, or so that it can be moved back and forth, on account of the deep grooves 31 while the rollers 32 are bearing the load. This arrangement prevents all sidewise binding of the block. It is apparent, however, that rollers 32 would bind on the block while being pressed out between a straight and an inclined way if the rollers were directly opposite one another. Accordingly the rollers are placed at a compensating angle by making grooves 31 slightly out of line, as shown in Fig. 6. This compensating angle is attained by placing the rollers so that a diametral line drawn through the rollers will cut a line at right angles which is drawn at one-half the angle of inclines 29. For example, if the angle of incline 29 were seven degrees the angle of the line drawn through the rollers would be three and one-half degrees. This arrangement of the rollers on block 30 compensates for the difference between the straight and inclined ways between which the rollers are forced out. Grooves 34 are cut lengthwise of the edges 28 of projections 26 for the rollers 32 to work in, and thereby hold the wedges 27 in line as they work back and forth in expanding the clutch. My roller-wedges not only do away with the frictional contact of the parts in making the expansion, but also make it unnecessary to provide wedges of different angles corresponding to the different angles of incline 29 to expedite or retard the speed of contact in different clutches, for it is apparent that by altering the angle of incline of the inner edges 29 of the friction-blocks I can change the speed with which my clutch can be thrown in and out of contact and one size of my improved roller-wedges will act upon any angle of incline.

Friction-blocks 25 have a groove 36 cut on their outer surface, which forms a slot when the frictional material 37 is attached to the outer side of block 25. A strip 38 of band-steel is inserted through slot 36, which strip has holes 39 in each end to receive returning-spring 40, as shown in Figs. 3 and 10. The withdrawing-springs 40 being placed at each end of the friction-blocks and by means of the bands 36, they form an independent withdrawing means for holding the blocks 25 out of contact with the revolving shell 11 when the clutch is out of action. This method of attaching the returning-springs is much easier and simpler than my former method and works with absolute surety. The straps 38 are not readily broken, and they adjust themselves to the expansion of the clutch mechanism with perfect uniformity. The grooves 36 are easily cut on the blocks, and I thus have a much simpler, cheaper, and better means of withdrawing friction-blocks 25.

As in my former construction, I make use of a worm 45 for operating the expanding mechanism through worm-gears 21 and right-and-left screws 22 operating wedges 27 against friction-blocks 25. Worm 45 has the sectional flanges or wings 46 and the flanged rim 47 on its outer end. Worm 45 is mounted directly upon the driven shaft 16 and is held in place at its outer end by means of a set-collar 48 on shaft 16.

Face 41 of face-plate 12 is made flat to receive the clamping ring or plate 42, the adjacent side of which ring is made correspondingly flat and has frictional material 43 attached thereto in order that frictional contact may be easily made between the two faces when they are pressed together by the draw of the worm. This frictional covering may be of leather, wood fiber, or any suitable material. The flat clamping-plate 42 has wings 44, as shown in Fig. 9, which project inwardly, and the worm 45 has the sectional flange projection or wings 46, as shown in Fig. 8, which fit the openings between wings 44 on clamping-ring 42. Accordingly ring 42 can be entered to its normal position between flanges 46 and flange-rim 47 on worm 45 by inserting the inner end of the worm through ring 42 until wings 44 pass through the openings between flanges 46, after which ring 42 may be turned until the wings 44 and sectional flanges 46 intersect. A fixed pin 49 is then inserted in flange 47, which projects loosely in a hole in one of the wings 44 of ring 42. This looseness of pin 49 in ring 42 allows the ring a certain amount of play in order to accommodate the movement of the parts when they get out of line. Flange-rim 47 has small circular openings 50 therein to receive coil-springs 51, which bear against plate 42 and press plate 42 against the face-plate, thus causing it to always hug the face 41 of the revolving shell when in action even when the parts are out of line. The grip of the clutch is thus always preserved, which will be recognized as an essential feature of a clutch. This loose mounting of ring 42 on worm 45 has caused it to sometimes be called a "wabble-plate."

To start and stop my clutch, I employ a

starting-lever 52, which has attached thereto a brake-band 53, which encircles flange 47 of worm 45, and has suitable frictional material 54 on the inside of brake-band 53. At the same point where band 53 is attached to the lever 52 I attach a short bar 55, and to the outer end of this a roller 56 is mounted at right angles to the bar 55, so as to project over the outer edge of flange 47. Lever 52 is pivotally hung from an angle-piece 57 at 58, as shown in Fig. 1.

In Figs. 10 and 11 I have shown a modification of this construction adapting the solid wedges of my former construction to my present arrangement with projections 26. It is apparent that my former solid wedges are easily adapted to this construction. I give the edges 28 of projections 26 adjacent to the wedges 27 an undercut, as shown in Fig. 11, so that the wedges are held in line as they work back and forth in operating the clutch. The solid projections 26 on central plate 15 present a broad flat surface, upon which the load is carried, obviating all wear, binding, or breakage of the parts.

I have constructed my present arrangement of the parts with the aim of doing away with all bolts and also to simplify the parts as much as possible. The bearings 20 for screws 22 are placed at just the correct distance from the shaft, so that in assembling the clutch the worm-gears are placed close to the shaft and after being raised into the bearings 20 are turned, drawing the wedges in until they are exactly the same distance apart and also the same distance from the ends of the gears, which places them in true working position.

I will now describe the operation of my clutch. When the operator wishes to start the clutch, he pushes the lever 52 in toward the face of the clutch, causing roller 56 to have contact with the outer edge of flange-rim 47, and thus push the worm inward, thereby causing wabble plate 42 to touch face 41 of the revolving shell. This touching of plate 42 and the revolving shell causes plate 42 and the attached worm 45 to turn, thereby turning the worm into the resisting-gears 21 and turning the right-and-left screws 22, pushing out the wedges 27. As soon as the worm starts and begins to turn the gears an interdraw is established between gears 21 on the worm and plate 42 on the revolving shell, caused by the worm turning into the gears. Accordingly the turning of the worm in the resisting-gears by its draw forces the plate 42 into sufficiently strong contact with face 41 of the shell to operate the other parts, and thereby carry the load. This on account of the swiftly-revolving shell takes but a moment. The worm 45 turns the worm-gears 21 and right-and-left screws 22, pushing out wedges 27 between ways 28 on the central plate and inclines 29 on the friction segments or blocks 25 until a complete frictional contact is made between segments 25 and revolving shell 11. This frictional grip of segments 25 on shell 11 is that which really carries the load, the draw of the wabble-plate on the shell by the worm and gears automatically operating the screws and wedges and forcing out the segments. On the other hand, it is the resistance of the load on the segments which is communicated through the wedges and screws to the gears, and thereby increases the contact or grip of the plate 42 on the shell by increasing the draw of the worm on the gears. It is apparent that ring-plate 42 is drawn into complete frictional contact or grip by the worm after it is put in touch by the lever. It is an impossibility to attain the said complete frictional contact by pressure on the lever 52 without the draw of the worm. I therefore mean two quite different operations when I speak of putting plate 42 in touch with the shell and when I speak of its being drawn into complete frictional contact by the worm. It is obvious, therefore, that the action of the clutch becomes entirely automatic when the wabble-plate is put into touch with shell 11. Thus when carrying a load and additions are made to the load, whereby it would naturally slip, the interaction of the parts causes the clutch to wind up automatically and carry the increased load, the strength of the contact of the plate increasing with the load. If it is desired to have the clutch slip at a given point in its carrying power, plate 42 is put in touch with the shell, and the clutch winds up to the desired point. Plate 42 is then put out of touch with the shell, and the clutch will then stand at that point in its carrying power and will slip under added strain. This interdraw of the worm and worm-gears on the wabble-plate and shell normally keeps them in contact. The springs 50 are only to cause ring 42 to hug face 41 when the shafts are out of line, and thus always preserve the grip of the clutch. In order to release the clutch, lever 52 is pushed to the left, as shown in Fig. 1, so that band 53 clamps flange 47 of the worm and holds the worm stationary, instantly breaking the contact between plate 42 and face 41. The stationary worm is pushed back by the unwinding of the other parts until stopped by set-collar 48, which set-collar is placed far enough from face-plate 12 to allow plate 42 to break contact with face 41 of the revolving shell, and when once the contact is broken the ring is held away from face 41 by flanges 46 on the worm. The momentum of the other parts of the expanding mechanism revolving around the stationary worm will quickly unwind the gears and screws running in the wedges, and the withdrawing-springs 40 will draw in the friction-blocks and break the contact with the revolving rim. This entirely separates the driving and driven trains and stops the clutch.

It is apparent that my roller-wedges can be

used on the clutch construction shown in my former patents or in any place where wedge expansion is needed.

I claim as new—

1. In a friction-clutch having a revoluble driving member, a driven member having means for gripping said driving member, connecting and disconnecting means for said members consisting of a "wabble-plate" mounted on the driven member to be drawn into frictional contact with said driving member, and means for putting said plate in and out of touch with said driving member.

2. In a friction-clutch having a revoluble driving member, a driven member having means for gripping said driving member, connecting and disconnecting means for said members consisting of a "wabble-plate" mounted on the driven member to be drawn into frictional contact with said driving member, spring-pressure on said "wabble-plate" to insure said contact, and means for putting said plate in and out of touch with said driving member.

3. In a friction-clutch, a driving member consisting of a revoluble shell, a driven member composed of a worm, and mechanism expanded by said worm to grip said shell, connecting and disconnecting means for said worm and shell consisting of a plate loosely mounted on said worm to be drawn thereby into complete frictional contact with said shell, putting said plate in and out of touch with said shell.

4. In a friction-clutch, a driving member consisting of a revoluble shell, a driven member composed of a worm, and mechanism expanded by said worm to grip said shell, connecting means for said worm and shell consisting of a plate loosely mounted on said worm, connection for said plate with said worm whereby said shell and plate are caused to make and break contact by the movement of said worm, and means for moving said worm.

5. In a friction-clutch a driving member consisting of a revoluble shell, a driven member composed of a worm and mechanism expanded by said worm to grip said shell, connecting and disconnecting means for said worm and shell consisting of a flat ring mounted on said worm to turn therewith and be drawn into frictional contact with said shell, spring-pressure on said ring to insure said contact, and projections on said worm to break said contact of said flat ring and hold it out of touch with said shell when the worm is pushed outward.

6. In a friction-clutch, a driving-train consisting of a revoluble shell, a driven train composed of a worm, worm-gears, screws, wedges, segmental friction-blocks and with drawing-springs arranged to be expanded by said worm and engage said shell, a spring "wabble-plate" mounted on said worm to thereby be drawn into and pushed out of frictional contact with said shell and a starting and stopping lever having a brake-band and a starting-roller to throw said worm into and out of action.

7. In a friction-clutch having members to be expanded, wedges for said expansion composed of, a central block with cross-grooves therein on opposite sides, rollers mounted in said grooves having a bearing on one another, and means for actuating said wedges.

8. In a friction-clutch having members with inclined and straight ways thereon, wedges working on said ways composed of, a central block with cross-grooves therein, reciprocally-bearing rollers mounted in said blocks between said ways at a compensating angle, and means for actuating said wedges.

9. In a friction-clutch having members to be expanded, wedges composed of a central guide-block with cross-grooves therein, shafts with a roller at each end having reciprocal bearing on each side of said central block and mounted in said cross-grooves, and means for actuating said wedges between said members.

10. In a friction-clutch having driving and driven members, the driven member having inclined ways, and wedges working on said ways, said wedges composed of a block and rolls on said block, screws working in said blocks, worm-gears on said screws, a worm, and means for turning said worm.

11. In a friction-clutch having driving and driven members, the driven member having segmental friction-blocks with inclined ways thereon, a central plate having ways thereon opposite to said inclines, wedges working between said ways and inclines, and means for moving said wedges.

12. In a friction-clutch having driving and driven members, the driven member having segmental friction-blocks with inclined ways thereon, a central plate having ways thereon opposite to the said inclines, wedges working between said ways and inclines, said wedges composed of a central block, reciprocally-bearing rollers revolubly mounted on opposite sides of said block, grooves on said ways to keep said rollers in line, and means for actuating said wedges.

In testimony whereof I affix my signature in the presence of two witnesses.

RALPH M. PHILLIPS.

In presence of—
S. A. BALDWIN,
A. L. FURLOW.