L. M. DIETERICH.

POWER TRANSMISSION APPARATUS.

APPLICATION FILED MAY 6, 1911.

1,093,922.

Patented Apr. 21, 1914.

3 SHEETS—SHEET 1.

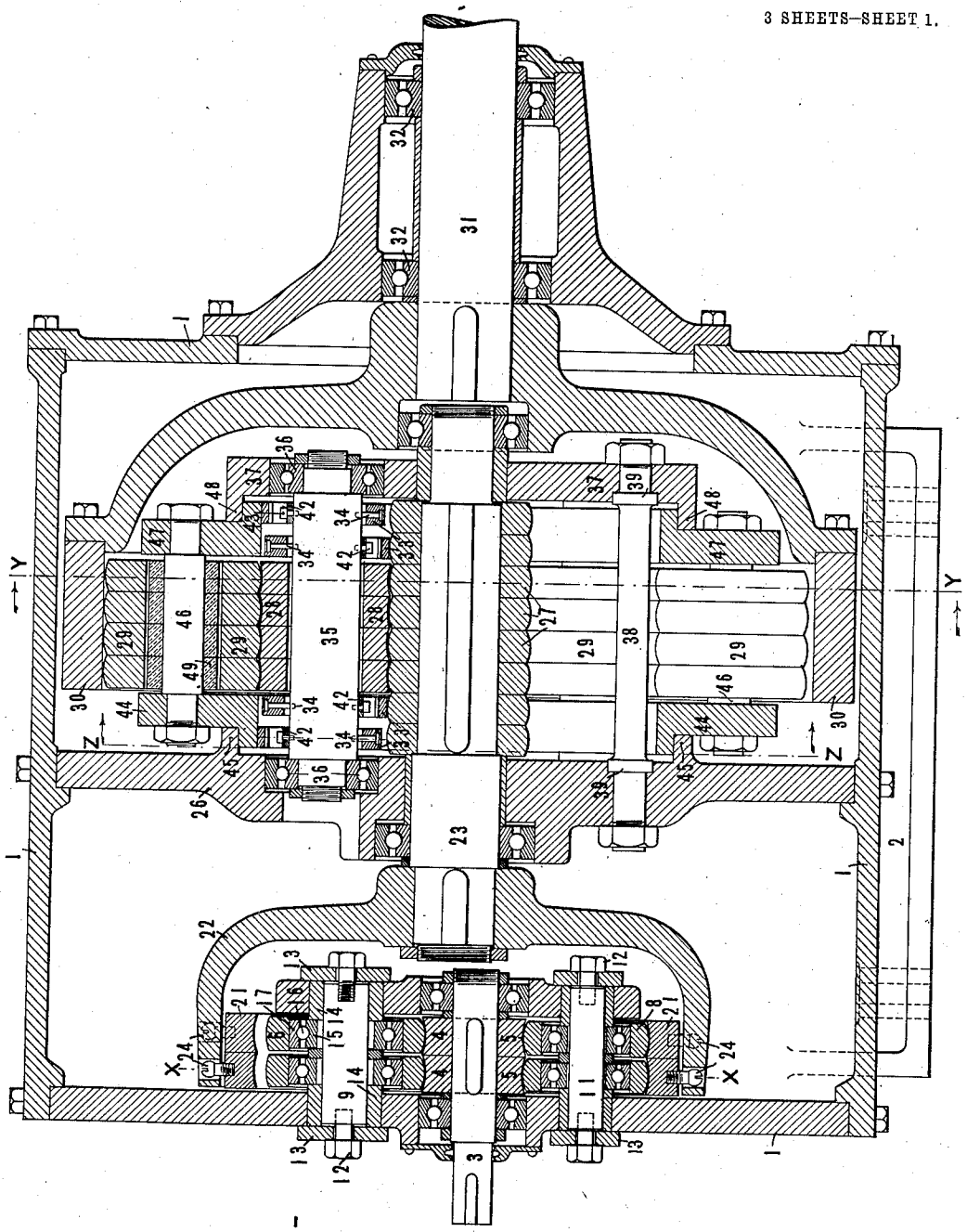


Fig. 1.

WITNESSES

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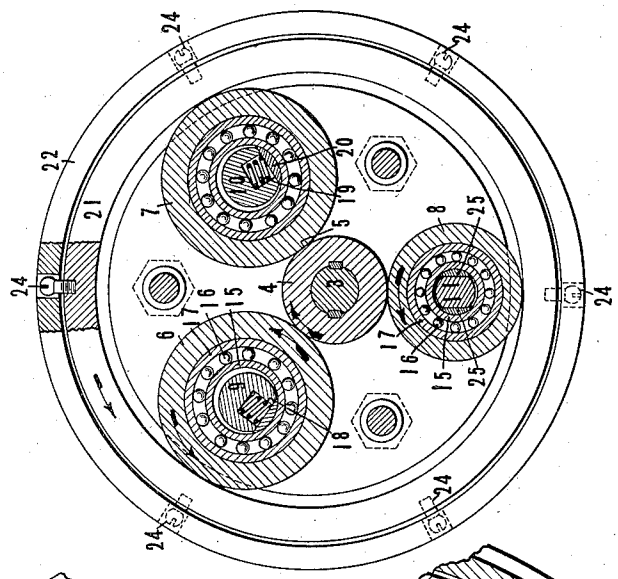


Fig. 2.

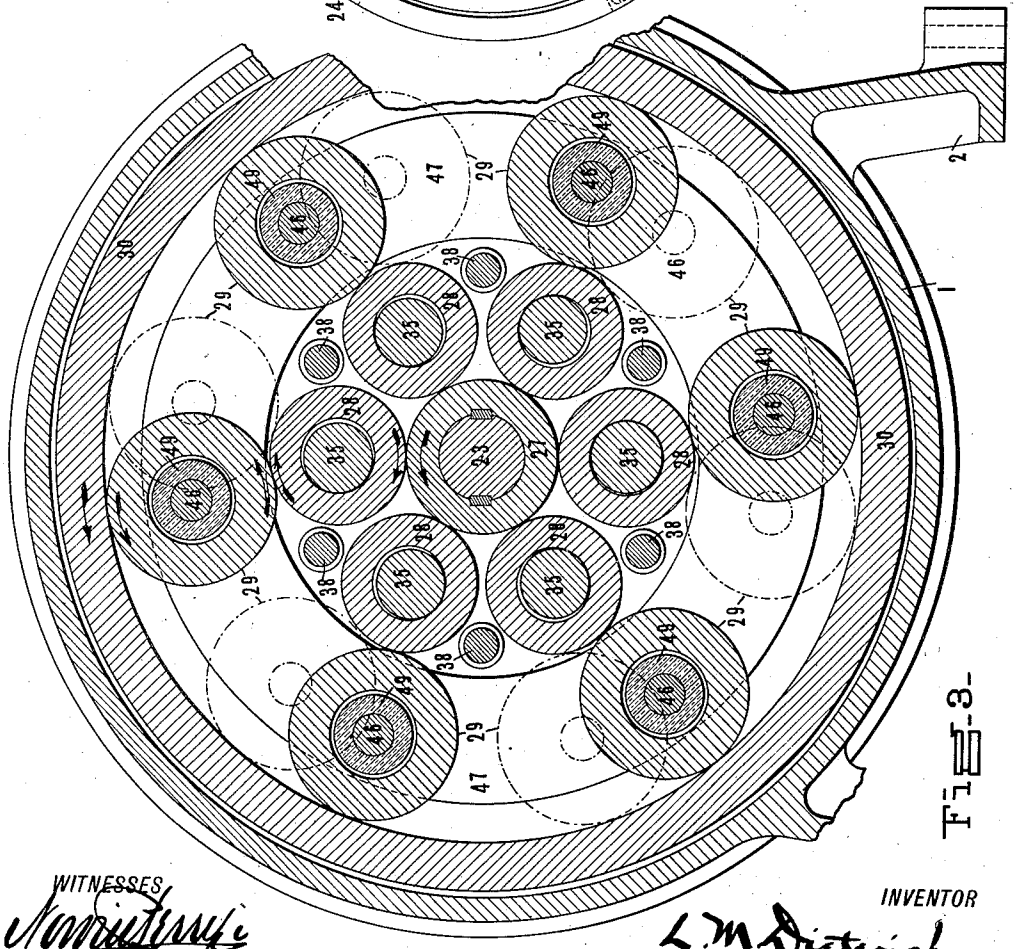


Fig. 3.

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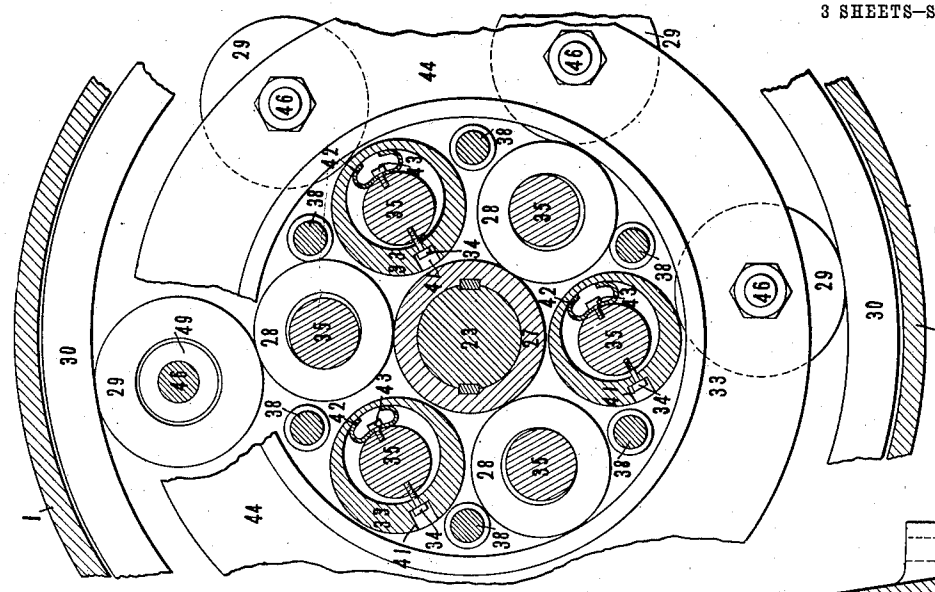


FIG. 5.

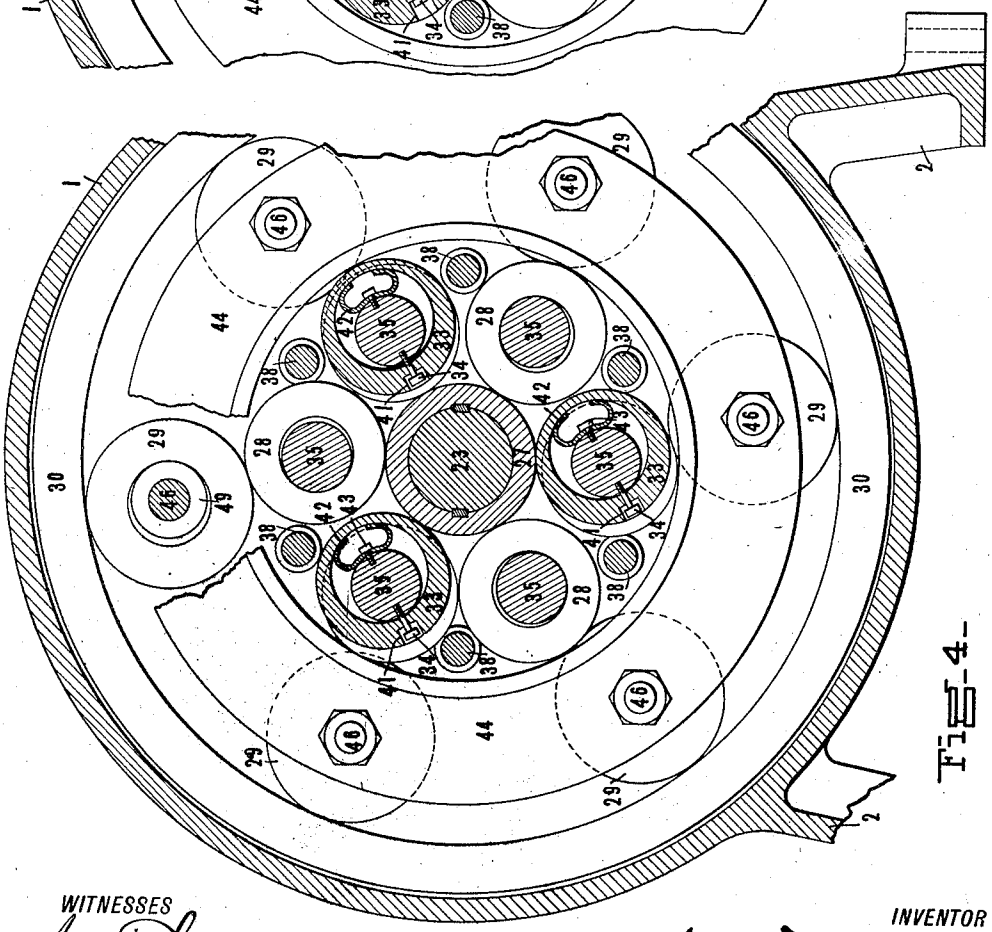


FIG. 4.

WITNESSES

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UNITED STATES PATENT OFFICE.

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POWER-TRANSMISSION APPARATUS

1,093,922. Specification of Letters Patent. Patented Apr. 21, 1914.

Application filed May 6, 1911. Serial No. 625,626.

To all whom it may concern:

Be it known that I, LUDWIG M. DIETERICH, a citizen of the United States, residing at Mount Vernon, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Power-Transmission Apparatus, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to power transmission, and with respect to the more specific features thereof, to power transmission mechanism for converting high speed power to low speed or vice versa.

One of the objects of the present invention is to provide an efficient and practical power transmitting mechanism which will be simple to construct and cheap to manufacture.

Another object is to provide mechanism of the above character in which the wear of the parts will be reduced to a minimum and the tendency to slip entirely eliminated.

Another object is to provide a mechanism of the above character which will operate efficiently in either direction, or in transforming high speed to low or low speed to high.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts which will be exemplified in the construction hereinafter set forth, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, wherein is shown one of various possible embodiments of this invention, Figure 1 is a longitudinal sectional view taken at an angle of substantially 120° along the axis of the machine. Fig. 2 is a sectional view taken on the line x—x, Fig. 1. Fig. 3 is a sectional view taken on the line y—y, Fig. 1. Fig. 4 is a sectional view taken on the line z—z, Fig. 1, certain parts being broken away or removed for the sake of clearness. Fig. 5 is a view similar to Fig. 4 with the parts in a slightly different position as will be more fully hereinafter explained.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring to the drawings more in detail and particularly to Fig. 1, 1 denotes a cylindrical casing inclosing the apparatus supported by suitable legs or pedestals 2. A driving shaft 3 having roller bearings is adapted to be directly connected to a source of power as an electric motor and passes through one end wall of the casing 1. A set of rollers 4, in the present case, two in number, are keyed thereon, and have slightly concave peripheries 5 coacting with three sets of rollers 6, 7 and 8, see Fig. 2, positioned substantially 120° apart. These last mentioned rollers have convex peripheries each contacting with concave peripheries of the rollers 4 at substantially one point, thereby greatly increasing the efficiency as the parts are driven and tending to hold them in alinement. The sets of rollers 6, 7 and 8 are mounted upon studs 9, 10 and 11, respectively, rigidly secured to the end wall of the casing 1. These studs comprise a central cylindrical member tapped out at each end and engaged by bolts 12 passing through washers 13. Intermediate the washers 13 are two spacing sleeves 14 holding in place loosely mounted collars 15. The collars 15 are provided with raceways for bearing balls 16 which coact with the annular linings 17 of the rollers 6, 7 and 8. Each of the members 9 and 10 is provided with a longitudinal recess 18, Fig. 2, in which is placed one or more compression springs 19 reacting against a segment 20. As the studs 9 and 10 are rigid with respect to the end wall of the casing, these segments will always be urged in the same relative direction for the purpose of forcing the rollers 6 and 7 into frictional engagement with the driving rollers 4, as well as a floating ring 21, surrounding the same. This ring 21 is loosely mounted within a driven member 22 keyed to an intermediate driven shaft 23. From Fig. 2 it will be seen that this ring 21 is held in place by small pins 24 which permit a slight movement in any direction with respect to the member 22, as well as a slight angle of rotation with respect to the driving and driven members. The lower roller 8 differs slightly in its mounting from the rollers 6 and 7, in that it is limited to movement in a radial direction, that is, instead of having a recess 18 containing the spring 19, the sides of the stud are flattened and separate

slightly enlarged segments 25 are positioned intermediate the ring 15 and the sides of the stud 11. In this manner the rollers 8 can move only up and down to conform to the movement of the floating ring 21. Before considering the remaining part of the apparatus, the operation of this part of the mechanism will be described in brief. Assuming the shaft 3 to be driven in the direction of the arrow, Fig. 2, the rollers 4 contacting with the rollers 6, 7 and 8 cause them to rotate in the direction of the arrows as shown. The spring 19, within the stud 9, normally forces the roller into engagement with the driven rollers 4 and the floating ring 21, causing the same to move in the direction indicated, and as it is mounted within the driven member 22, the shaft 23 will thus be driven in a similar direction. However, as the ring 21 tends to rotate in an anti-clockwise direction, it will tend to force the roller 7 into wedging engagement with the ring 21 and the roller 4, thus increasing the pressure between the roller 4 and the roller 6. This reacts by an upward movement of the ring 21 to increase the pressure of contact between the roller 8 and the roller 4. As, of course, the force exerted in one direction cannot exceed its reactive force, the several forces will immediately balance one another, whereby the friction on the several rollers and the ring 21 is equalized and the driven member 22 is driven smoothly and rapidly without binding the parts or causing unnecessary friction in the bearings. If desired, the direction of rotation of the driven shaft may be reversed when the spring 19 within the stud 9 forces the roller 6 into wedging contact with the roller 4 and the ring 21, whereby the moment the machine is started the rollers 4 will immediately convey motion to the ring 21. The same automatic adjustment of forces exerted by the different rollers will immediately take place and the member 22 will be driven in the opposite direction.

Taking up the second part of the apparatus, the driven shaft 23 now becomes the driving shaft, and, like the shaft 3, is suitably mounted in ball-bearings in a central partition 26. Keyed to the shaft are a plurality of rollers 27 which engage a plurality of sets of rollers 28 arranged thereabout, in the present case, six sets, each roller having a slightly concave bearing surface coacting with the convex bearing surface of the rollers 27, as well as outside rollers 29. The rollers 29 coact with a driven member 30 keyed to a driven shaft 31 mounted in suitable ball-bearings 32 in the opposite end plate of the casing 1. The rollers 27 are greater in number than those of any one set or rollers 28 or 29. As herein shown, they are twice the number, that is, the four central rollers coact with the rollers 28, while the outer rollers coact with eccentric rollers 33 rigidly secured by means of bolts 34 to shafts 35 rotatably mounted in antifriction bearings 36 in the partition 26 and a plate 37 secured thereto by means of a plurality of transverse bolts 38. These bolts are provided with suitable collars 39 for properly spacing the parts as shown in Fig. 1. Each one of the rollers 33 is secured to the shaft 35 upon which it is mounted by a threaded bolt 34 having its head positioned within a recess 41 in the surface of the roller so that it is free to move radially relatively to the surface of the shaft for reasons which will be hereinafter explained. Diametrically opposite the bolt 34 is a curved spring 42 which is rigidly secured by means of a bolt 43 to the shaft 35. This spring normally holds the opposite side of the roller 33 in engagement with the shaft 35, as shown clearly in Fig. 4, and is of such strength as to be compressed when the roller 33 is rotated at a high rate of speed and the side thereof opposite the spring, which is of greater weight, moves outwardly under centrifugal force to the position shown in Fig. 5. There are three double sets of these friction rollers or reversing rollers at each end of the shafts, as shown in Figs. 4 and 5. The reverse rollers of each pair act in opposite directions, as shown in Fig. 1, that is, one of the rollers 33 is in engagement with one of the rollers 27, while the adjacent roller is out of engagement with the roller 27 and in engagement with a ring 44 surrounding the same. Consequently, as the rollers 27 start to rotate, the shaft 35 will also be rotated, causing the ring 44 to rotate within an annular flange 45 on the partition 26. Bolted to this ring, by means of bolts 46 carrying rollers 29, is a similarly shaped ring 47, between which these rollers are positioned. The ring 47 rotates within an annular flange 48 on the plate 37. Interposed between each bolt 46 and the rollers 29 are rubber rolls or bearings 49 for producing a cushioning effect as the rollers wedge between the driving rollers 28 and the driven member 30. The operation of this last-described part is substantially as follows: The shaft 23 is driven at a reduced rate of speed by the mechanism heretofore described, which rotates the rollers 27. Motion is transmitted from these rollers through the rollers 28 to the rollers 29 carried by the frame constituted by the rings 44 and 47 connected by the bolts 46, thence to the driven member 30 in substantially the manner heretofore described. When it is desired to reverse the direction of rotation, the shaft 23 is reversed in the manner heretofore described which causes the rollers 27 to turn in the opposite direction. The rollers 28 and 29 will immediately cease to have their wedging connection to turn the mem-

ber 30, and they will consequently roll out of engagement with each other and the machine slow down until the friction rings 33 are permitted to act. The time required for this reversing, however, is so slight that the change in drive is almost immediate. As soon as the rollers 27 turn in the opposite direction they will engage the sets of rollers 33 which will cause the rings 44 and 47 to rotate within the flanges 45 and 48 until the rollers 29 are forced into wedging engagement with the next adjacent rollers 28, and the member 30 as shown in Fig. 3. The dotted position of the rollers 29 to the left of the top roller in this figure is the position of that roller when the machine is reversed. It is to be noted that all of the rollers are loosely mounted upon the parts supporting the same whereby they are free to turn and equalize the pressure exerted thereon by their slight movement. The angle into which these several parts are wedged in contact depends upon the co-efficient of friction of the material of the bearing surfaces and varies inversely with this factor.

It is thus seen that this invention provides for a simple and practical power transmission mechanism adapted to transmit power obtained from a motor revolving at a high rate of speed, for example, and deliver substantially the same horsepower at a speed greatly reduced. The mechanism as herein shown is adapted to receive power as high as 20,000 revolutions per minute and reduce the same to substantially a thousand revolutions per minute, the intermediate shaft 23 being driven at substantially 4,000 revolutions per minute. It is, of course, to be understood that by slightly varying the proportions of the rollers from those herein shown greater or less speed at the driving end may be obtained. It is also to be understood that not only can the apparatus be reversed in its direction of rotation, but also be reversed in its application, that is, the power being applied to the shaft 31 to drive the shaft 3 at a greatly increased rate of speed at the opposite end.

It is to be understood that the various contacting surfaces in this apparatus are formed of hard material and are preferably smooth as the parts transmit power by a pure rolling contact, the pressure being automatically varied with variations in load to such values as to eliminate the chance of slip. As above noted, moreover, all of the thrusts are balanced and the contacting members rotate about floating axes. Hence, there is no resultant tending to bend the shaft of cause friction in the bearings.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

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

1. In an apparatus of the character described, in combination, a driving member, a driven member, and a plurality of sets of coacting rollers for transmitting motion from one to the other.

2. In an apparatus of the character described, in combination, a shaft, a member eccentrically disposed thereto, and surrounding said shaft, and a plurality of sets of roller means adapted to transmit power interposed between said member and said shaft whereby said driven member assumes a different rate of rotation.

3. In an apparatus of the character described, in combination, a shaft, a second shaft eccentrically disposed thereto, a member upon said second shaft about said first shaft, and a plurality of roller means adapted to transmit power interposed between said member and said second shaft, said roller means having springs associated therewith for urging the same to gripping position at all times.

4. In an apparatus of the character described, in combination, a shaft, a member eccentrically disposed thereto, and a plurality of roller means adapted to transmit power interposed between said member and said shaft, said roller means comprising a plurality of rollers, and spring means within said roller means for forcing said rollers into frictional engagement with the driving and driven parts.

5. In an apparatus of the character described, in combination, a shaft, a member eccentrically disposed thereto, and a plurality of sets of roller means adapted to transmit power interposed between said member and said driving shaft, said roller means comprising a plurality of rollers held against rotation about said shaft, and means urging the rollers into frictional engagement with the driving and driven parts.

6. In an apparatus of the character described, in combination, a shaft, a member about said shaft, and a plurality of roller means adapted to transmit power interposed between said member and said shaft, said roller means comprising a plurality of sets of ball-bearing rollers, studs upon which said rollers are mounted to prevent a relative rotation thereof about the shaft, and

means for urging said rollers into frictional contact with the driving and driven parts.

7. In an apparatus of the character described, in combination, a shaft, a member about said shaft and a plurality of roller means adapted to transmit power interposed between said member and said shaft, said roller means comprising a plurality of sets of ball-bearing rollers, studs upon which said rollers are mounted to prevent a relative rotation thereof about said shaft and spring means within said rollers and studs urging the same into frictional engagement with the driving and driven parts at all times.

8. In an apparatus of the character described, in combination, a shaft, a member about said shaft, a plurality of sets of rollers adapted to transmit power and a floating ring interposed between said member and said shaft, studs upon which said rollers are mounted to prevent a relative rotation thereof about the shaft and springs mounted within said studs acting against the rollers mounted thereon adapted to urge the same into frictional contact with the driving part and said floating ring.

9. In an apparatus of the character described, in combination, a shaft, a roller keyed thereto, a member surrounding said shaft, roller means interposed between said first-mentioned roller and said member adapted to transmit power, and a floating ring on the member surrounding said roller means.

10. In an apparatus of the character described, in combination, a shaft, a roller keyed thereto, a member surrounding said shaft, and roller means interposed between said first-mentioned roller and said member adapted to transmit power from one to the other, one of said rollers having a curved periphery forming single point contact with said other roller.

11. In an apparatus of the character described, in combination, a shaft, a set of rollers keyed thereto, an annular member surrounding said rollers, a floating ring mounted upon said annular member, and rollers interposed between said first-mentioned rollers and said ring.

12. In an apparatus of the character described, in combination, a shaft, a set of rollers keyed thereto, an annular member surrounding said rollers, a floating ring mounted upon said annular member, a plurality of sets of rollers interposed between said first-mentioned rollers and said ring, and means for holding the same against relative rotation about said driving shaft.

13. In an apparatus of the character described, in combination, a shaft, a set of rollers keyed thereto, a member surrounding said rollers, a ring coacting with said member, a plurality of sets of rollers interposed between said first-mentioned rollers and said ring, and means for holding the same against relative rotation about said shaft.

14. In an apparatus of the character described, in combination, a shaft, a set of rollers keyed thereto, a member surrounding said rollers, a ring coacting with said member, a plurality of sets of rollers interposed between said first-mentioned rollers and said ring, and means for holding the same against relative rotation about said shaft, said shaft and member being eccentrically disposed whereby the sets of rollers may wedge into frictional contact with the driving and driven parts.

15. In an apparatus of the character described, in combination, a shaft, a member surrounding said shaft, a plurality of sets of rollers of different size interposed between the driving and driven parts, and springs associated with some of said rollers adapted to urge the same into frictional contact with the driving and driven parts.

16. In an apparatus of the character described, in combination, a member, a member surrounding the same, a plurality of sets of rollers interposed between said members, means for holding said rollers against relative rotation about said member, a second set of rollers positioned about the first set, and spring means associated with some of said rollers for urging the same into frictional contact with the driving and driven parts whereby a reverse rotation of the device may be accomplished.

17. In an apparatus of the character described, in combination, a shaft and a member, a plurality of stationary members, loosely mounted rollers upon said members adapted to engage one of said members, a roller frame, rollers therein surrounding and engaging said rollers and spring means associated with some of said rollers and the parts upon which they are mounted adapted to urge the rollers into engagement with said members.

18. In an apparatus of the character described, in combination, driving and driven members, a plurality of stationary members, loosely mounted rollers upon said stationary members adapted to engage the driving member, intermediate rollers engaging said first mentioned rollers and driven member and springs associated with two of said rollers adapted to urge one or the other of said rollers into engagement with driving and driven parts depending upon the direction of rotation of the driven member.

19. In an apparatus of the character described, in combination, a driving and a driven member positioned slightly eccentric to each other, a plurality of stationary members, loosely mounted rollers upon said members adapted to engage the driving and driven members, springs associated with two

of said rollers and the parts upon which they are mounted adapted to urge one or the other of said rollers into engagement with the driving and driven member depending upon the direction of rotation of the driven member, and a third roller adapted to move in a radial direction only.

20. In an apparatus of the character described, in combination, driving and driven members eccentrically disposed to each other, a plurality of rollers interposed between the driving and driven members, two of said rollers being freely movable into engagement with the driving and driven members, and a third roller movable in a radial direction only.

21. In an apparatus of the character described, in combination, a shaft, an intermediate rotary member, a second shaft, roller means between one shaft and said member for transmitting power, and roller means between said member and the other shaft for turning the latter.

22. In an apparatus of the character described, in combination, a shaft, an intermediate rotary member, a second shaft, roller means between one shaft and said member for transmitting power, and roller means between said member and the other shaft for turning the latter, both of said roller means comprising a plurality of rollers adapted to wedge between the driving and driven parts.

23. In an apparatus of the character described, in combination, a driving shaft, a driven shaft, an intermediate rotary member, roller means between the driving shaft and member for driving said member, and roller means between said member and said driven shaft for turning the latter, said roller means being so positioned and arranged to permit a reversal of the direction of rotation of said parts.

24. In an apparatus of the character described, in combination, a shaft, a member eccentrically disposed thereto, a plurality of roller means intermediate the shaft and said member whereby motion is transmitted from one to the other, and a second member positioned partially about said first member and having a plurality of rollers interposed between the same and said first member whereby motion is transmitted through said rollers from one to the other.

25. In an apparatus of the character described, in combination, a shaft, a member eccentrically disposed thereto, a plurality of roller means intermediate the shaft and said member whereby motion is transmitted from one to the other, and a second member positioned partially about said first member, and a plurality of rollers interposed between the same and said first member whereby motion is transmitted through said rollers from one to the other, said last-mentioned roller means comprising a frame having a plurality of sets of rollers and means coacting with said frame for moving the same through an angle of rotation to cause a reverse movement of said last-mentioned member.

26. In an apparatus of the character described, in combination, a shaft, a member, an intermediate frame, a plurality of rollers carried on said frame coacting with said shaft and member, and means whereby said frame is turned through an angle of rotation to permit a reverse movement of said member.

27. In an apparatus of the character described, in combination, a shaft, a plurality of rollers co-acting therewith, a frame, rollers carried on said frame coacting with said first-mentioned rollers, a member in engagement with the rollers carried by the frame and adapted to be driven thereby, and reversing rollers coacting with the rollers and said frame whereby a reverse movement of the rollers will cause said frame to move to a shifted position whereby the direction of rotation of said member is reversed.

28. In an apparatus of the character described, in combination, a roller, a second roller, a shaft positioned between said rollers, and reversing rollers positioned upon said shaft, one of said reversing rollers coacting with one roller and the other with the second roller whereby movement is transmitted from one to the other.

29. In an apparatus of the character described, in combination, a driving roller, a driven member, a frame, a plurality of driven rollers carried thereby for driving said driven member, intermediate reversing rollers between the driving roller and said frame coacting with both whereby a reversing movement of the driving roller tends to rotate said frame to shift its relative position of the driven member and the means for driving the same.

30. In an apparatus of the character described, in combination, a frame, a shaft on said frame, a rubber bearing about said shaft, and a roller loosely mounted on said rubber bearing.

31. In an apparatus of the character described, in combination, a shaft, an eccentric roller positioned upon said shaft, spring means intermediate the roller and the shaft adapted to be compressed when the roller is rotated at a high rate of speed whereby the roller and the shaft are maintained substantially concentric.

32. In an apparatus of the character described, in combination, a casing having end plates and a central partition, a driving member passing through one end plate, an intermediate driven member in the partition adapted to be rotated by the driving member and a driven shaft passing through the op-

posite end plate, said driven shaft having a driven member thereon surrounding said intermediate driven member, a plurality of rollers on said intermediate member, rollers secured to said partition coacting with said first-mentioned rollers, and other rollers coacting with said second-mentioned rollers and the driven member.

33. In an apparatus of the character described, in combination, a casing having end plates and a central partition, a driving member passing through one end plate, an intermediate driven member in the partition adapted to be rotated by the driving member and a driven shaft passing through the opposite end plate, said driven shaft having a driven member thereon surrounding said intermediate driven member, a plurality of rollers on said intermediate member, rollers secured to said partition coacting with said first-mentioned rollers, and a frame and rollers carried thereby coacting with the driven member and said second mentioned rollers.

34. In an apparatus of the character described, in combination, a casing having end plates and a central partition, a driving member passing through one end plate, an intermediate driven member in the partition adapted to be rotated by the driving member and a driven shaft passing through the opposite end plate, said driven shaft having a driven member thereon surrounding said intermediate driven member, a plurality of rollers on said intermediate member, rollers secured to said partition coacting with said first-mentioned rollers, a frame and rollers carried thereby coacting with the driven member and said second mentioned rollers, and means coacting with the intermediate driven member and said frame for moving the same relatively to the driven member whereby the direction of rotation is reversed.

35. In an apparatus of the character described, in combination, a casing having end plates and a central partition, a driving member passing through one end plate, an intermediate driven member in the partition adapted to be rotated by the driving member and a driven shaft passing through the opposite end plate, said driven shaft having a driven member thereon surrounding said intermediate driven member, a plurality of rollers on said intermediate member, rollers secured to said partition coacting with said first-mentioned rollers, a frame and rollers carried thereby coacting with the driven member and said second mentioned rollers, and driven means comprising a plurality of eccentric rollers having springs associated therewith for urging the same into contact with said frame and the intermediate driven member whereby said frame is moved through an angle of rotation to cause a reverse movement of said driven member.

36. In an apparatus of the character described, in combination, a casing having end members, and a plurality of sets of rollers therebetween contacting with each other, the outer set of rollers contacting with one of said members and the inner set of rollers contacting with the other.

37. In an apparatus of the character described, in combination, driving and driven members, rollers therebetween, a second driven member, and rollers between the first and second driven members.

38. In an apparatus of the character described, in combination, driving and driven members, and a plurality of sets of rollers substantially concentrically disposed positioned therebetween.

39. In an apparatus of the character described, in combination, driving and driven members, and a plurality of sets of rollers substantially concentrically disposed positioned therebetween, one of said sets being relatively fixed and the other movable whereby the direction of rotation of the driven member may be reversed.

40. In an apparatus of the character described, in combination, driving and driven members, and a plurality of sets of rollers substantially concentrically disposed positioned therebetween, one of said sets being relatively fixed and the other revoluble thereabout whereby the rollers of the second set coact with different rollers of the first set to reverse the direction of rotation of the driven member.

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

LUDWIG M. DIETERICH.

Witnesses:
P. A. BLAIR,
L. A. WATSON.