Feb. 22, 1927.

G. CONSTANTINESCO

1,618,915

UNIDIRECTIONAL DRIVING DEVICE

Filed April 22, 1926

6 Sheets-Sheet 1

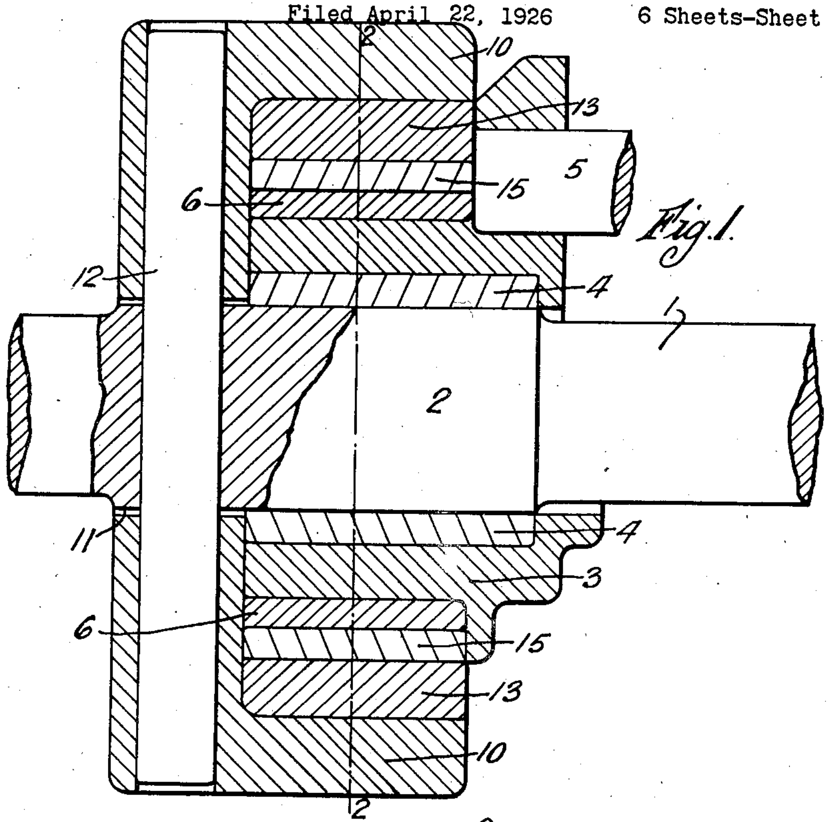

Fig. 1.

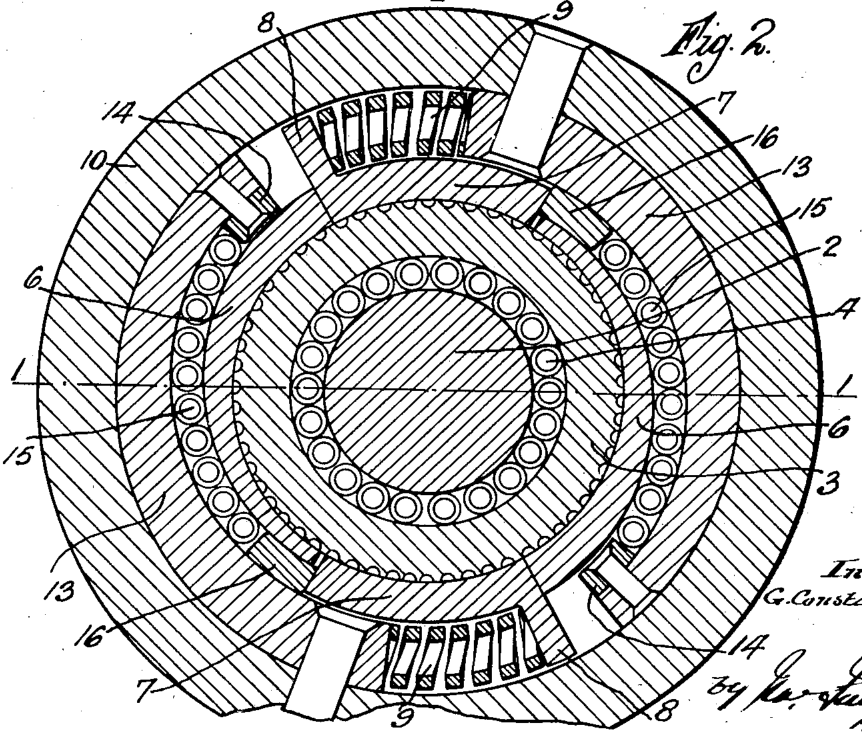

Fig. 2.

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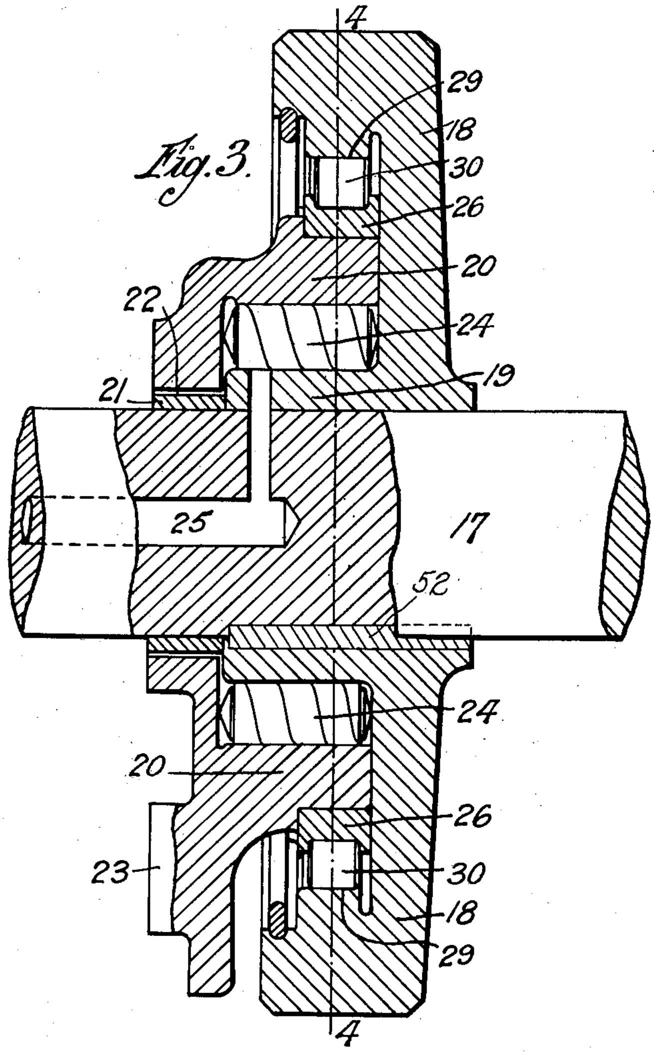

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UNIDIRECTIONAL DRIVING DEVICE

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Fig. 4.

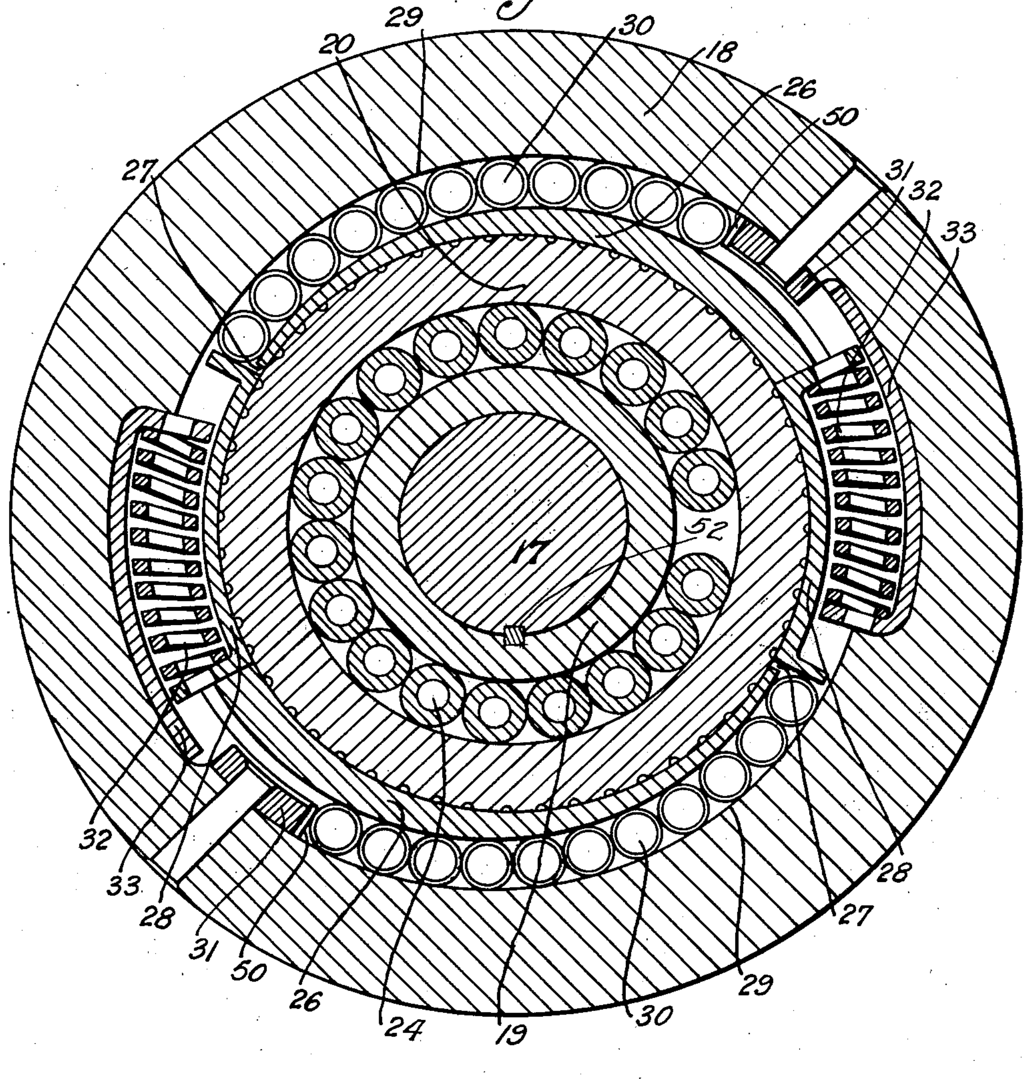

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Fig. 5.

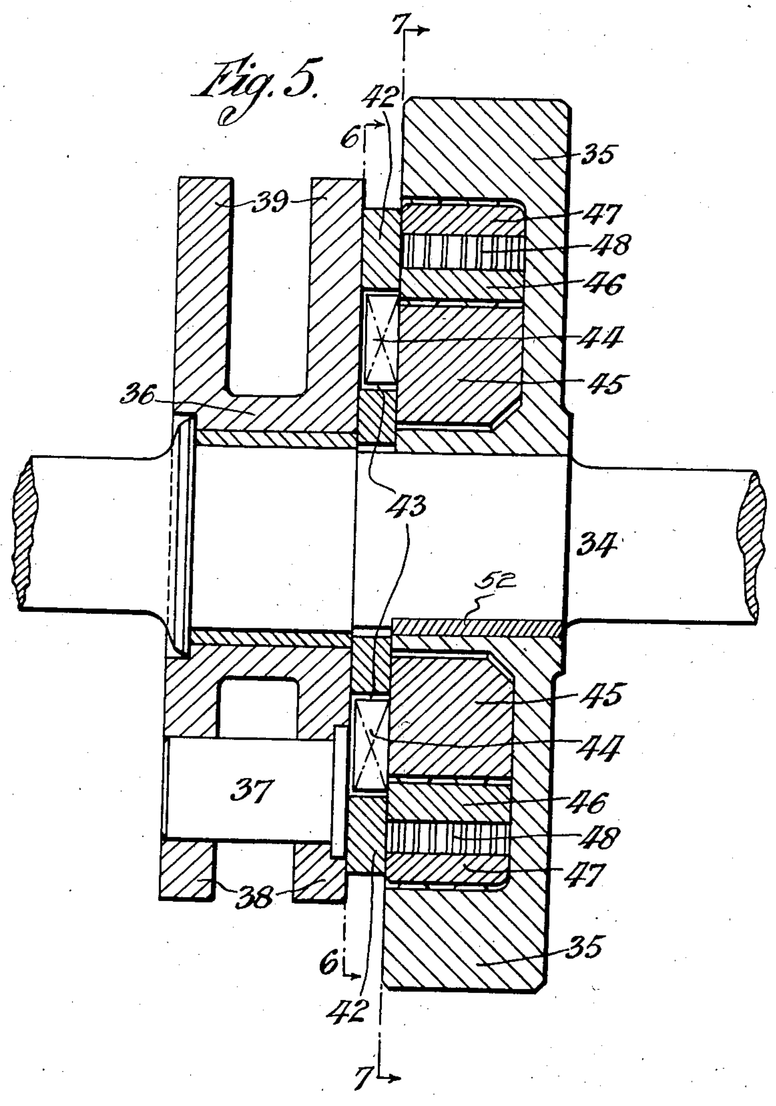

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Fig. 6.

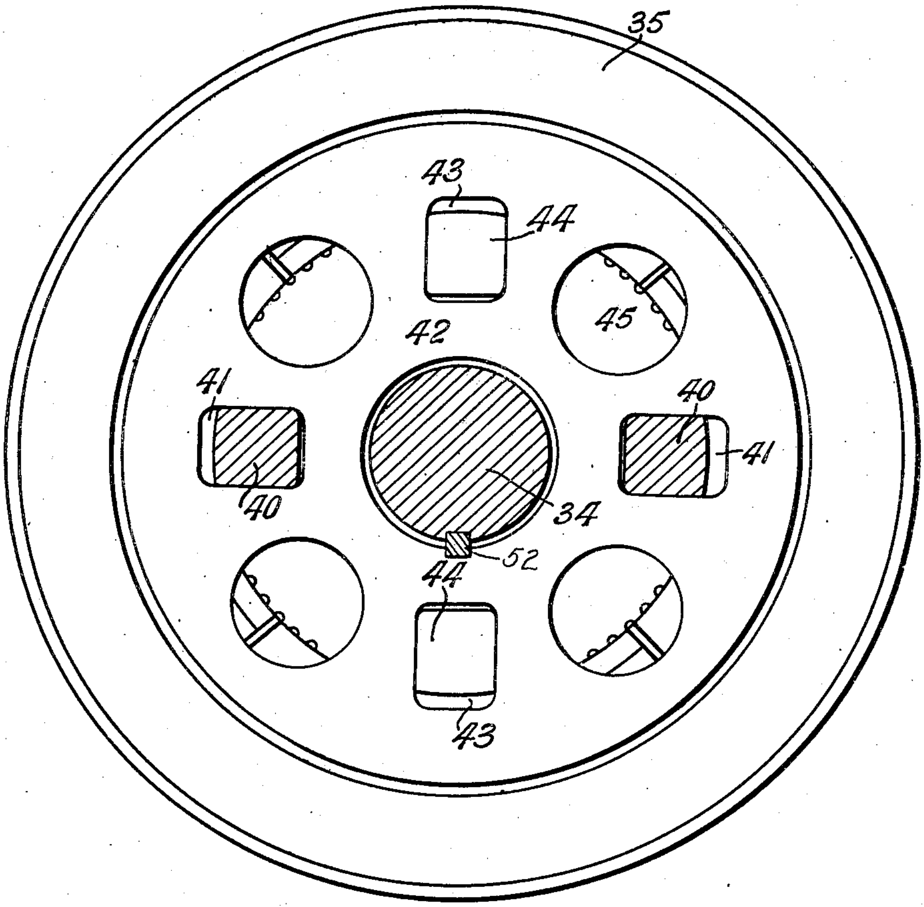

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Fig. 7.

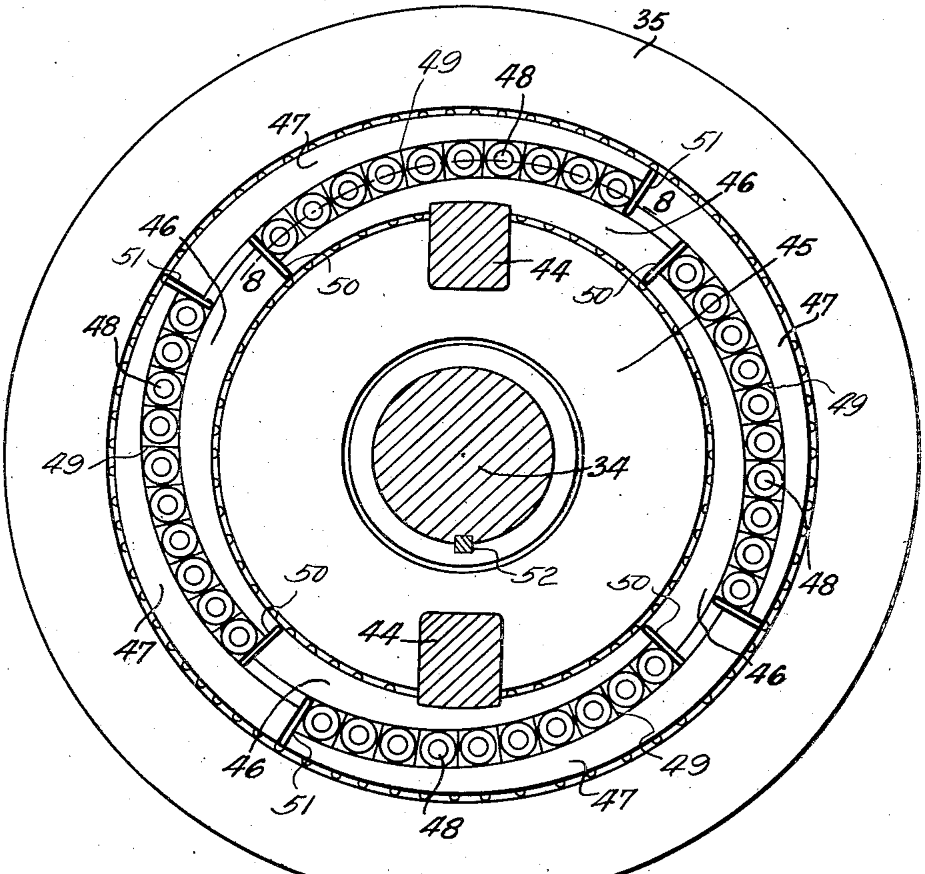
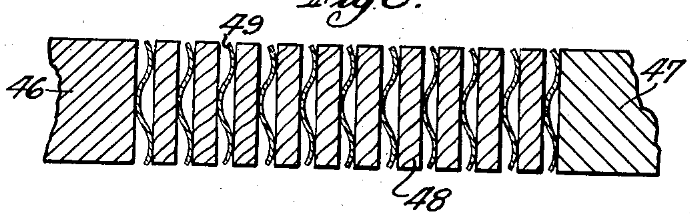


Fig. 8.



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1,618,915

Patented Feb. 22, 1927.

UNITED STATES PATENT OFFICE.

GEORGE CONSTANTINESCO, OF WEYBRIDGE, ENGLAND.

UNIDIRECTIONAL DRIVING DEVICE.

Application filed April 22, 1926, Serial No. 103,928, and in Great Britain April 29, 1925.

In my specification Serial No. 727,774, a unidirectional reversible driving device is described in which the motion communicated by the driving members to the driven rotor depends upon the torque opposing the motion of the latter, the motion communicated being small if this torque is great, and conversely.

In the above invention use is made of the elastic properties of balls or rollers or elastic bodies for obtaining driving engagement and quick release between certain of the parts. According to my present invention a similar principle is applied to a non-reversible device.

Although in my former invention the parts present a symmetry, this symmetry is consequent upon the reversibility of the device. While driving in any one direction the distribution of the stresses is non-uniform. In my present invention the parts are also symmetrically disposed, but the object is to obtain symmetrical or uniformly distributed stresses.

The invention consists of oscillating and rotor members. These members are concentric and cylindrical, and between them are disposed a number of gripping members which are in the form of curved wedges and are symmetrically arranged. These gripping members are in direct contact with the oscillator but act on the rotor through elastic ball or roller bearings. The races of these bearings are formed on the one side by the gripping members and on the other by similar but oppositely directed wedge-shaped surfaces either on the interior of the rotor or capable of frictional engagement with it. The invention also comprises spring means for ensuring the immediate engagement of the parts at the commencement of the driving stroke of the oscillator.

Although the parts are arranged as nearly as possible symmetrical, it is impossible to avoid a certain small amount of lateral play, which might have serious results at high frequencies. Even if this play could be avoided initially it would develop itself in the course of use. My invention therefore includes means for providing for this play and taking it up.

The invention will be understood from the particular description of the three following embodiments. In the accompanying drawings:—

Figure 1 is a longitudinal section of one form of the device along the line 1—1 of Figure 2, in which the lateral play above referred to is allowed for by an elastic bearing, a clearance being left between the rotor and the driven shaft.

Figure 2 is a cross section along the line 2—2 of Figure 1.

Figure 3 is a longitudinal section of a form of the device somewhat similar to that shown in Figure 1, in which the rotor is seated directly on the driven shaft.

Figure 4 is a cross section along the line 4—4 of Figure 3.

Figure 5 is a longitudinal section of a modified form of the device in which play is allowed for by a coupling of the Oldham type.

Figure 6 is a cross section along the line 6—6 of Figure 5, looking to the right.

Figure 7 is a cross section along the line 7—7 of Figure 5, looking to the right.

Figure 8 is a developed sectional plan along the line 8—8 of Figure 7.

Referring to Figures 1 and 2, the shaft 1 which is to receive unidirectional intermittent rotation is situated centrally within the device. It is mounted in suitable bearings which are not shown, and has a plain cylindrical surface 2. Surrounding the central shaft is a hollow cylinder 3 whose inner surface takes its bearing on the shaft with the interposition of elastic rollers 4. This cylinder, hereinafter called the oscillator, is oscillated from an external source of power by means of a link, not shown, engaging with a pin 5. The outer surface of the oscillator, which is concentric with its inner surface, is indented, castellated, or otherwise treated, as shown in Figure 2, to enable it to engage frictionally with curved wedge-shaped bodies 6, hereinafter called grippers, so as to drive them. These grippers, of which there are at least two, are symmetrically disposed round the oscillator, and embrace the greater part of its circumference, their section being the shape of a curved wedge, one edge being thicker than the other. It will be convenient to confine the immediate description to two grippers only, as shown in Figure 2. Interposed between the grippers and occupying the whole of the rest of the surface of the oscillator with very slight clearance between themselves and the grippers are distance pieces 7 forming parts of cylindrical shells of uniform thickness. The distance pieces are provided with outwardly directed flanges 8 at their ends adjacent to the thick ends of the grippers, to form abutments for springs 9, as will presently be described. The external organ of the device is a cylinder or cup 10 which may conveniently be called the rotor, and which has a closed end with a central hole 11. The rotor shaft passes through this hole with substantial clearance. The rotor and the rotor shaft are compelled to rotate together by a diametral pin 12 upon which one or both can slide, so as to permit of slight relative radial movement in one direction, the central hole in the rotor being large enough to allow of such movement. The axis of the pin is approximately parallel to the line through the middle points of the grippers.

Fixed to or forming part of the inner surface of the rotor and facing the grippers are two curved wedge-shaped blocks 13 similar to the grippers but oppositely directed, their thin ends being next to the thick ends of the grippers. The ends of the wedge-shaped blocks and of the grippers, however, do not coincide, for a considerable gap is left between the thin ends of the blocks and the flanges on the distance pieces above mentioned. The blocks are provided at their thin ends with retaining pieces 14 for sets of rollers 15 interposed between them and the grippers. The rollers are capable of considerable elastic compression and are retained near the thin ends of the grippers by loose blocks 16 which abut against the distance pieces above mentioned. The wedge-shaped blocks thus constitute roller tracks. The device is completed by the springs 9 interposed between the lugs on the distance pieces and the thick ends of the wedge-shaped blocks, the function of the springs being to keep the grippers in engagement with the oscillator on the one hand and the rollers adjacent to it on the other, so that at the commencement of each stroke a driving connexion is at once established. Further motion causes the grippers to become tightly wedged and to compress the rollers.

There may be any number of grippers and the same number of roller races, distance pieces, springs and other coacting parts uniformly distributed. Moreover, if there are more than two of each of these parts the connexion between the inner rotor (the cylindrical surface 2 of the shaft 1 in this case) and the outer rotor must be universal, for which purpose a joint similar to an Oldham coupling must be used.

The elasticity of the rollers and the play allowed by the clearance 11 between the rotor and the part 2 of the shaft 1, permits the grippers to bed down firmly on the rollers adjacent to them during the driving stroke. The elasticity of the rollers assists in quick disengagement of the parts during the return stroke. It is obvious that balls or other elastic bodies can be used instead of rollers if their elasticity and that of their races is sufficient.

Figures 3 and 4 show another form in which the rotor is seated directly on the driven shaft. The requisite play is provided in this case between the driven shaft and the oscillator. 17 is the driven shaft mounted as before in suitable bearings which are not shown. The rotor 18 is provided with a central sleeve 19 which is seated directly upon the shaft 17 and is secured to it so as to cause it to rotate by keys, splining or other means shown at 52. 20 is an oscillating member having an inwardly projecting flange which surrounds the shaft 1 or a collar 21 thereon, leaving a clearance 22. The oscillator is actuated from some external source of power by a link or connecting rod, not shown, which engages with a pin or projection 23. Between the oscillator and the sleeve 19 are mounted rollers 24 whose resilience is considerable, as their object is to take up the play above mentioned, as will be referred to later on. For this purpose they are preferably of large diameter and made of coiled metal. A lubricating passage 25 may be provided in the shaft 17.

Surrounding the oscillator 20 are a number of curved wedge-shaped members 26 arranged symmetrically. Two are shown in the present instance, but there may be any number of them. They are placed as shown with the thin end of each directed towards the thick end of the next. The spaces between the members 26 are occupied, with slight clearances 27, by flanged distance pieces 28. The inner surface of the rotor is formed with, or carries, wedge-shaped faces 29 corresponding to the wedge members 26, and in the spaces between are situated rollers 30, thus forming bearings, which bearings also possess resilience. The sets of rollers are retained in place at the ends by flanges on the distance pieces 28, and by blocks 31 secured to the rotor. Plate springs 50 are interposed between the blocks 31 and the adjacent rollers. The device is completed by springs 32 contained in channel pieces 33 let into the rotor, and compressed between flanges on these channel pieces as shown and on the distance pieces 28. These latter flanges are caused by the springs to bear against the larger ends of the wedge members 26 which are thus held in engagement with the rollers on one side and the surface of the oscillator on the other. This surface is castellated or corrugated as shown to secure gripping with the wedges during the driving stroke.

As before, balls or other elastic bodies, can be used instead of rollers.

Referring to Figures 5, 6 and 7, 34 is the driven shaft on which the rotor 35 is splined or secured in any suitable way, indicated at 52, as in Figures 3 and 4. 36 is an oscillating member rotatably mounted without clearance on the driven shaft, and is actuated from some external source by a link or connecting rod, not shown, which engages with a pin 37. The pin is carried between flanges 38 so as to avoid side strains and diametrically opposite the pin are flanges 39 for balancing. The oscillator 36 carries blocks 40 projecting from its face and engaging with holes 41 in a loose plate 42 so as to permit the plate to move diametrically. The plate has also holes 43 on the diameter at right angles to that of the holes 41, and in the holes there slide blocks 44 projecting from the face of an oscillating member 45 which is carried in a recess in the rotor 35. Clearance is allowed between the central hole in the plate 42 and the driven shaft, and also between the oscillating member 45 and the central portion of the rotor. The oscillator 45 is thus driven by the oscillator 36, but is allowed free play in any direction at right angles to the axis of the driven shaft.

Surrounding the oscillator 45 are a number of symmetrically arranged curved wedge-shaped blocks 46, the thin edges of each being adjacent to the thick edge of the next with a clearance in which is situated a plate spring. In the drawing four such wedge-shaped bodies are shown, but there may be any number. The springs are indicated diagrammatically at 50 in Figure 7 by radial strokes or lines. The external surface of the oscillator is castellated, grooved or otherwise formed so as to provide adequate friction between it and the wedges.

Outside these wedges but at a distance apart from them are the same number of similarly shaped wedges 47, oppositely directed to the inner set with which they break joint. Plate springs 51 are also provided between adjacent members of the set 47. The spaces between the sets of wedges are occupied by elastic rollers 48, preferably made of coiled metal, and between the rollers are interposed bow or blade springs 49 which are shown diagrammatically by radial strokes between the rollers in Figure 7. The springs 50 and 51 are sufficiently wide radially to cover the ends of the adjacent wedges and the outer rollers.

In consequence of the opposite disposal of the two sets of wedges, the outer surface of the outer set has a continuous circular contour concentric with the oscillator 45 and the driven shaft, and engages with the inner surface of the rotor 35 which is grooved or otherwise formed similarly to the outer surface of the oscillator.

Figure 8, is a developed sectional plan along the curved line 8—8, Figure 7, the rollers being shown in full plan. It shows in detail the arrangement and form of the plate springs 49. They may be of any suitable form, but as shown they consist of straight rectangular metal strips of the section shown. It will be noticed that the springs 49, 50 and 51 fulfill precisely the same function as the helical springs described with reference to Figures 1 to 4, namely, to maintain the wedges in driving engagement with the surfaces adjacent to them.

The sets of wedge-shaped bodies form grippers, the inner set of grippers being driven by the oscillator by friction, and the outer driving the rotor also by friction, while the inner set of grippers acts upon the outer set through the compressible balls or rollers. During the driving stroke there is relative angular movement between the oscillator and the rotor due to the compression of the rollers, the oscillator and the rotor each carrying its set of grippers with it. On the return stroke the relative motion is in the reverse direction. Thus the inner set of grippers will part with some of the kinetic energy which they acquire on the return stroke to the outer set of grippers through the rollers and the springs. The impulse thus given to the outer grippers enables these grippers to slip on the rotor during the return or idle stroke, and causes them to be accelerated in a direction contrary to the direction of rotation of the rotor, while at the same time the springs are accelerating the inner grippers in the contrary direction. This combined action secures a ready contact between the grippers and the adjacent surfaces at the beginning of the next driving stroke. Also the grippers rotate relatively to the rotor so that a continual change occurs between the gripping surfaces. The rollers are also subject to an alternate rotation in each direction, so that their lines or points of contact are continually changing. In all cases the motion communicated to the rotor depends upon the opposing torque. This results from the compressibility of the rollers, for the greater the opposing torque, the greater the compression of these bodies, and this compression produces a relative angular displacement between the oscillator and rotor which takes up in part the motion of the oscillator. In extreme cases the rotor might be fixed while the oscillator continues to move to its full extent. In this case the angular amplitude of oscillation must be so selected as not to exceed the elastic limit of the rollers.

What I claim is:—

1. A driving device for converting oscillating into unidirectional motion comprising a driven shaft, a driven rotor member mounted upon the said shaft, an oscillating driving member concentrically mounted

within the said rotor member, two concentric sets of curved and uniformly disposed wedge-shaped bodies situated between the oscillating member and the rotor member, the number of members in each set being the same, and the slope of the members of each set being in the same direction but in the opposite direction to that of the members of the other set, springs acting upon the thicker ends of the wedge-shaped bodies, and elastic antifriction bodies interposed between the two sets of wedge-shaped bodies.

2. A driving device for converting oscillating into unidirectional motion comprising a driven shaft, a cylindrical driven rotor member mounted upon the said shaft, a cylindrical oscillating driving member concentrically mounted within the said rotor member, two concentric sets of curved and uniformly disposed wedge-shaped bodies situated between the oscillating member and the rotor member, the number of members in each set being the same, and the slope of the members of each set being in the same direction but in the opposite direction to that of the members of the other set, springs acting upon the thicker ends of the wedge-shaped bodies, and elastic antifriction bodies interposed between the two sets of wedge-shaped bodies.

3. A driving device for converting oscillating into unidirectional motion comprising a driven shaft, a cylindrical driven rotor member mounted upon the said shaft, a cylindrical oscillating driving member concentrically mounted within the said rotor member, two concentric sets of curved and uniformly disposed wedge-shaped bodies situated between the oscillating member and the rotor member, the number of members in each set being the same, and the slope of the members of each set being in the same direction but in the opposite direction to that of the members of the other set, springs acting upon the thicker ends of the wedge-shaped bodies, elastic antifriction bodies interposed between the two sets of wedge-shaped bodies, and plate springs interposed between the elastic antifriction bodies.

4. A driving device as claimed in claim 2, in which the rotor is mounted without play on the driven shaft.

5. A driving device for converting oscillating into unidirectional motion comprising a driven shaft, a cylindrical driven rotor member mounted without play upon the said shaft, a cylindrical oscillating driving member concentrically mounted within the said rotor member, two concentric sets of curved and uniformly disposed wedge-shaped bodies situated between the oscillating member and the rotor member the outer of which sets is separate from, but capable of frictional engagement with, the rotor member, the number of members in each set being the same, and the slope of the members of each set being in the same direction but in the opposite direction to that of the members of the other set, elastic antifriction bodies interposed between the two sets of wedge-shaped bodies, and plate springs interposed between the elastic antifriction bodies.

6. A driving device for converting oscillating into unidirectional motion comprising a driven shaft, a cylindrical driven rotor member mounted without play upon the said shaft, a cylindrical oscillating driving member concentrically mounted within the said rotor member, said oscillating member being in two parts, one part mounted with and the other without lateral play upon the driven shaft, a rigid coupling connecting the parts and permitting relative lateral play between them but no relative rotational play, two concentric sets of curved and uniformly disposed wedge-shaped bodies situated between the oscillating member and the rotor member the outer of which sets is separated from, but capable of frictional engagement with, the rotor member, the number of members in each set being the same, and the slope of the members of each set being in the same direction but in the opposite direction to that of the members of the other set, elastic antifriction bodies interposed between the two sets of wedge-shaped bodies, and plate springs interposed between the elastic antifriction bodies.

In testimony that I claim the foregoing as my invention, I have signed my name this sixteenth day of March 1926.

GEORGE CONSTANTINESCO.