Feb. 17, 1953 W. MESSINGER 2,628,503

MECHANISM FOR PRODUCING SIMULTANEOUS OSCILLATING AND ROTARY MOTION

Filed Nov. 6, 1950 4 Sheets-Sheet 1

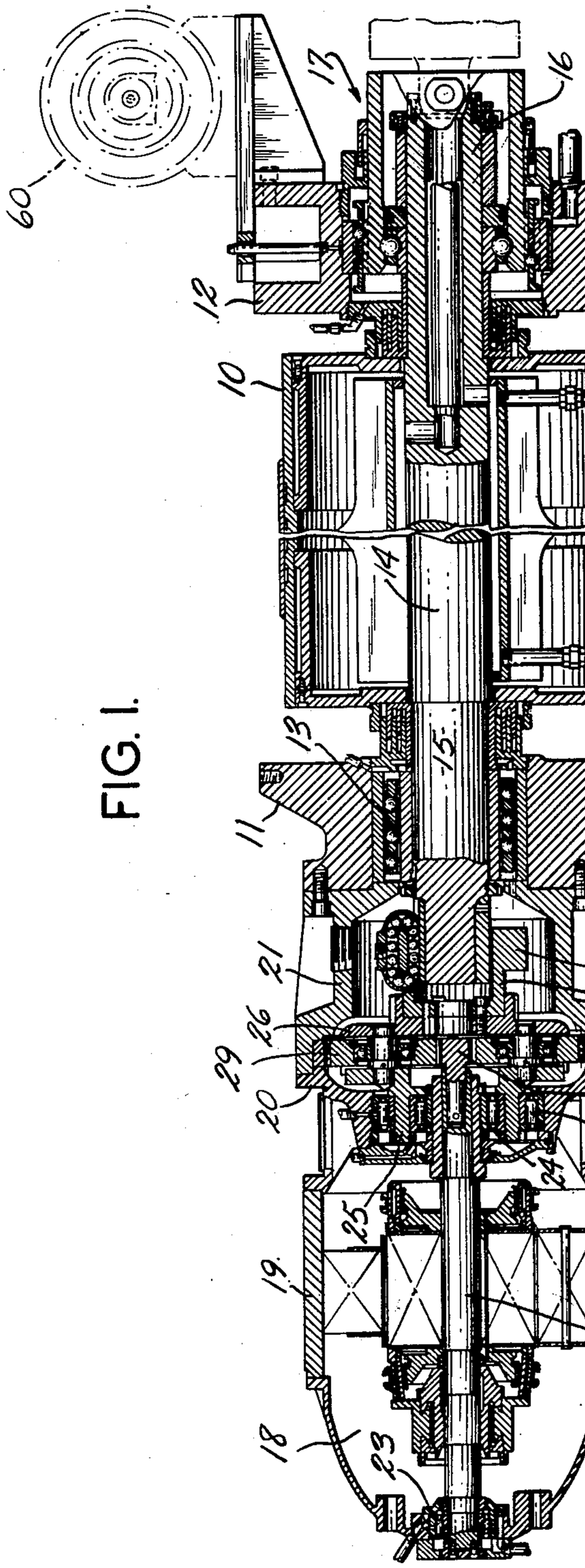

FIG. 1.

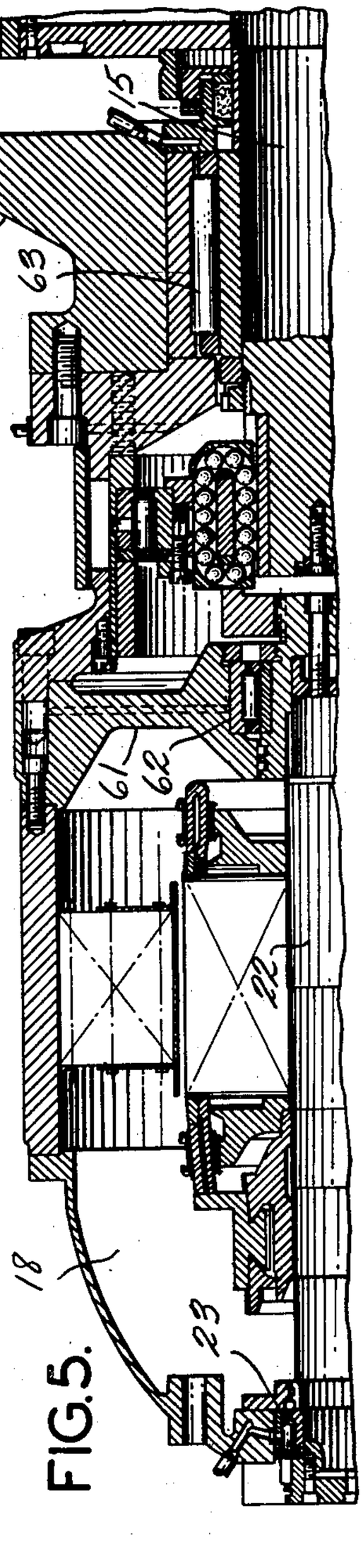

FIG.5.

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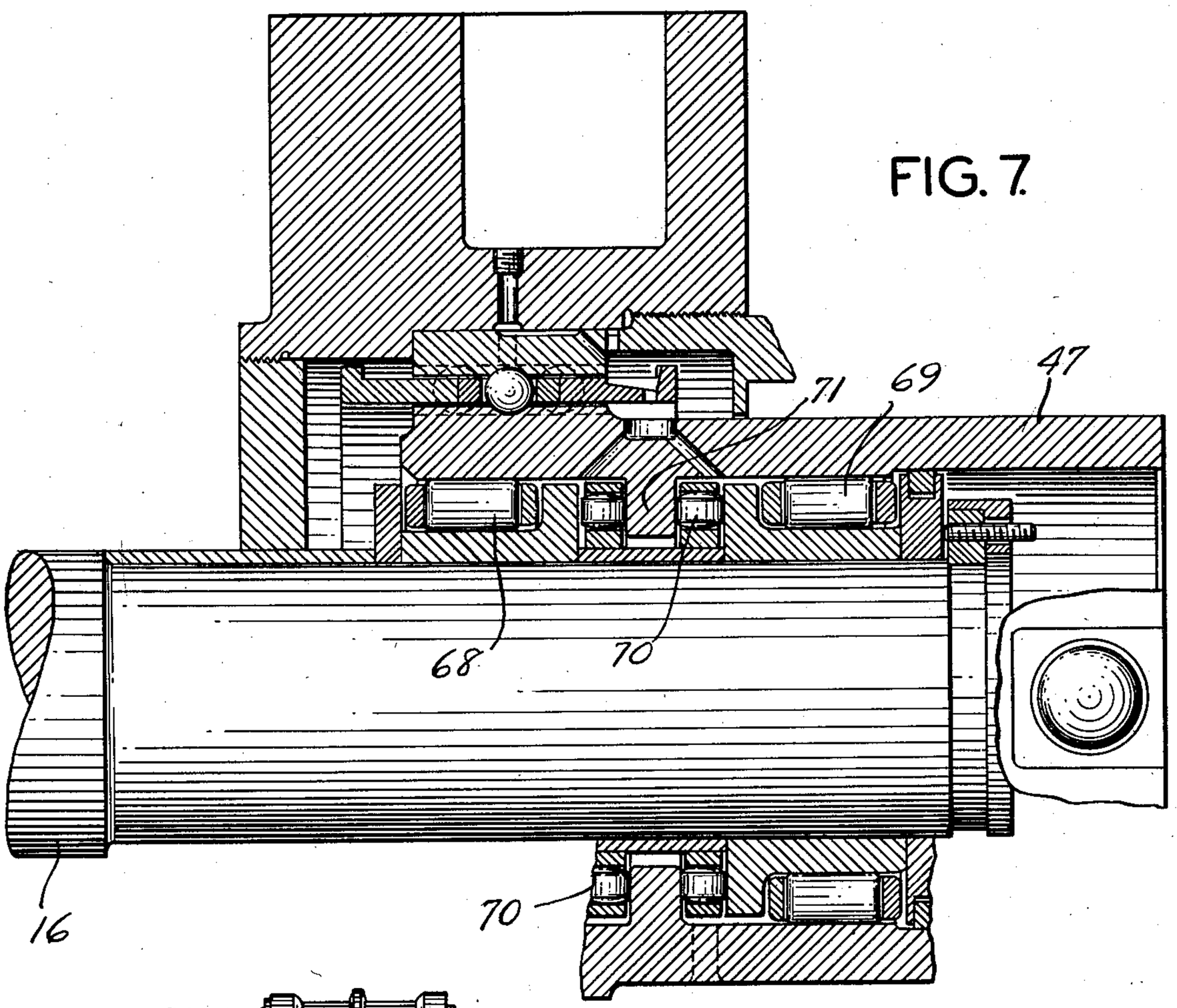

FIG. 7.

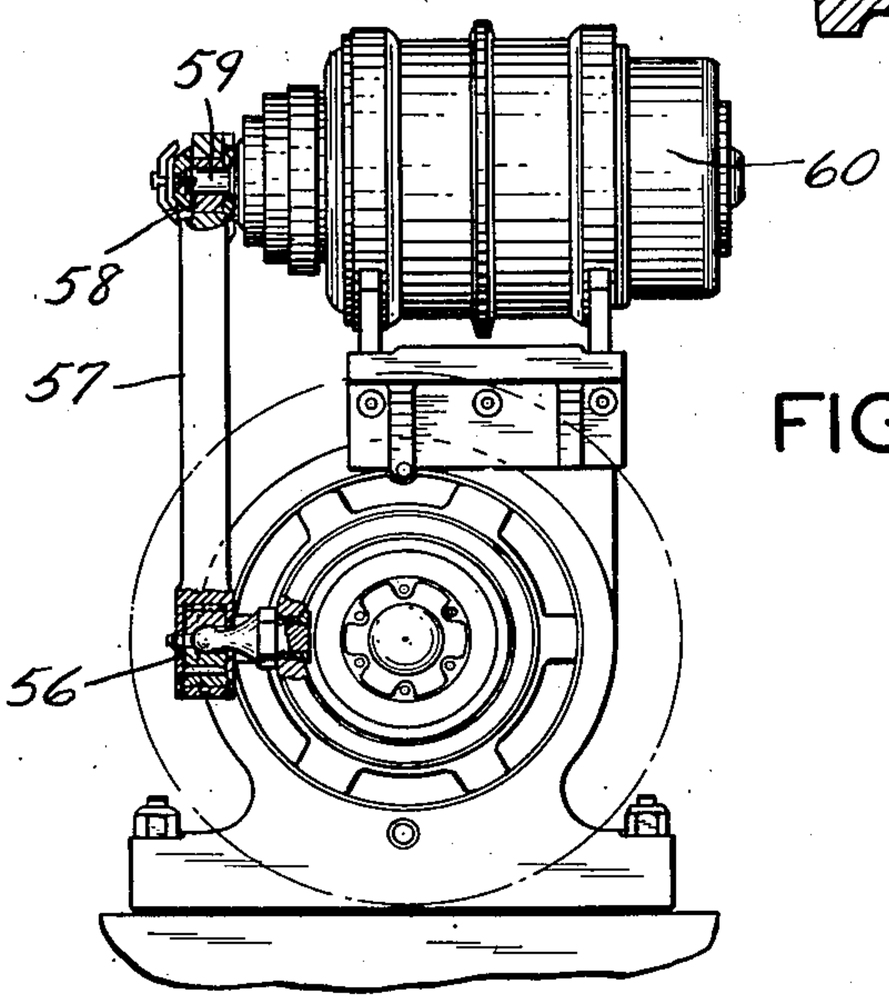

FIG. 2.

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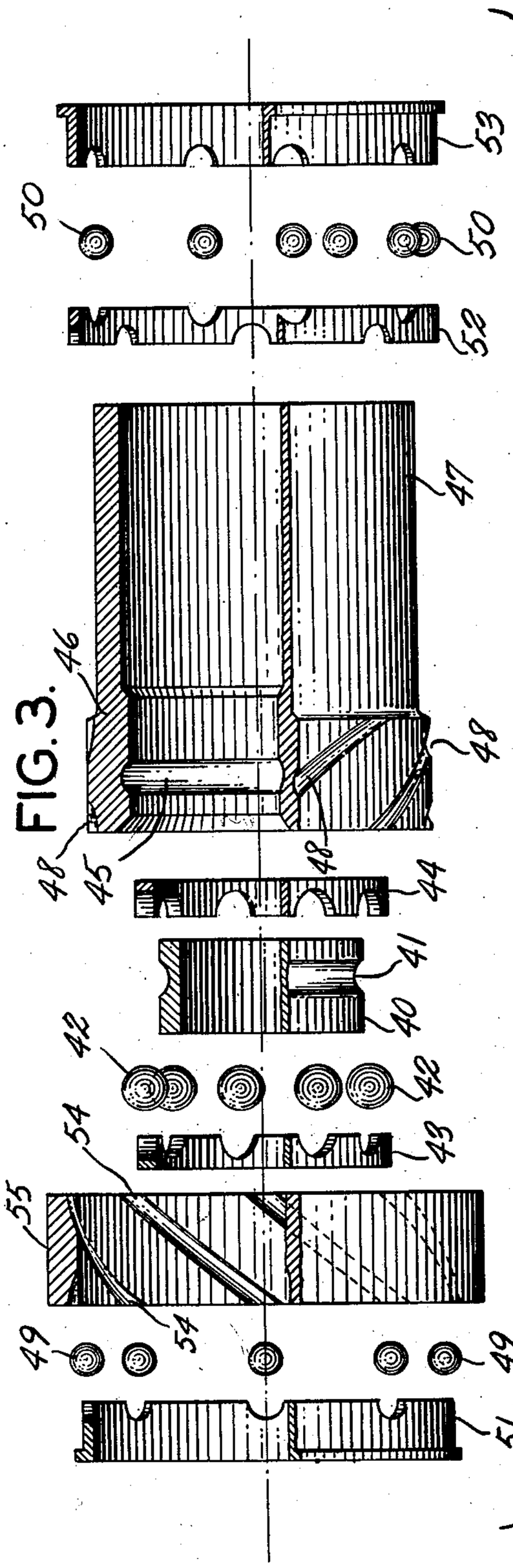

FIG. 3.

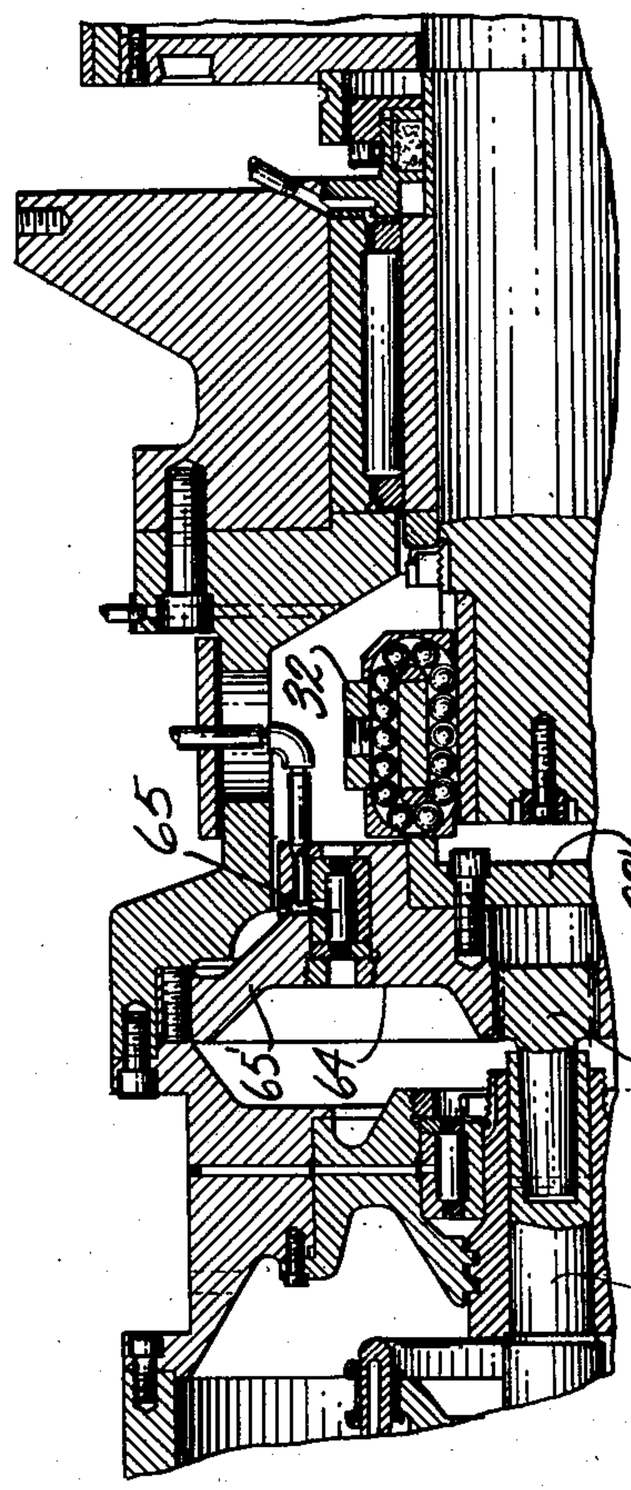

FIG. 6.

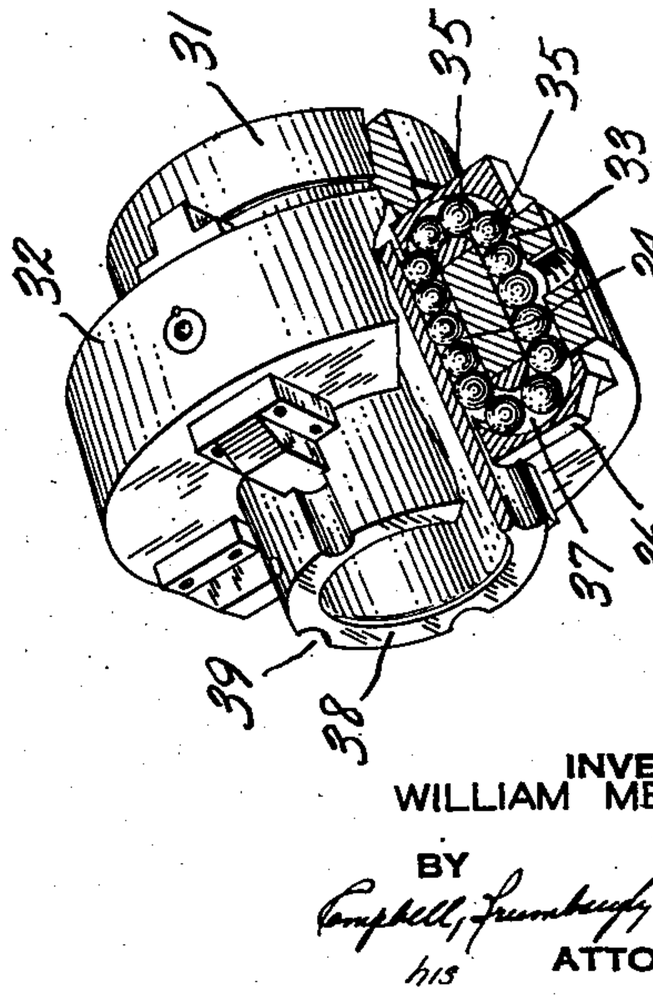

FIG. 4.

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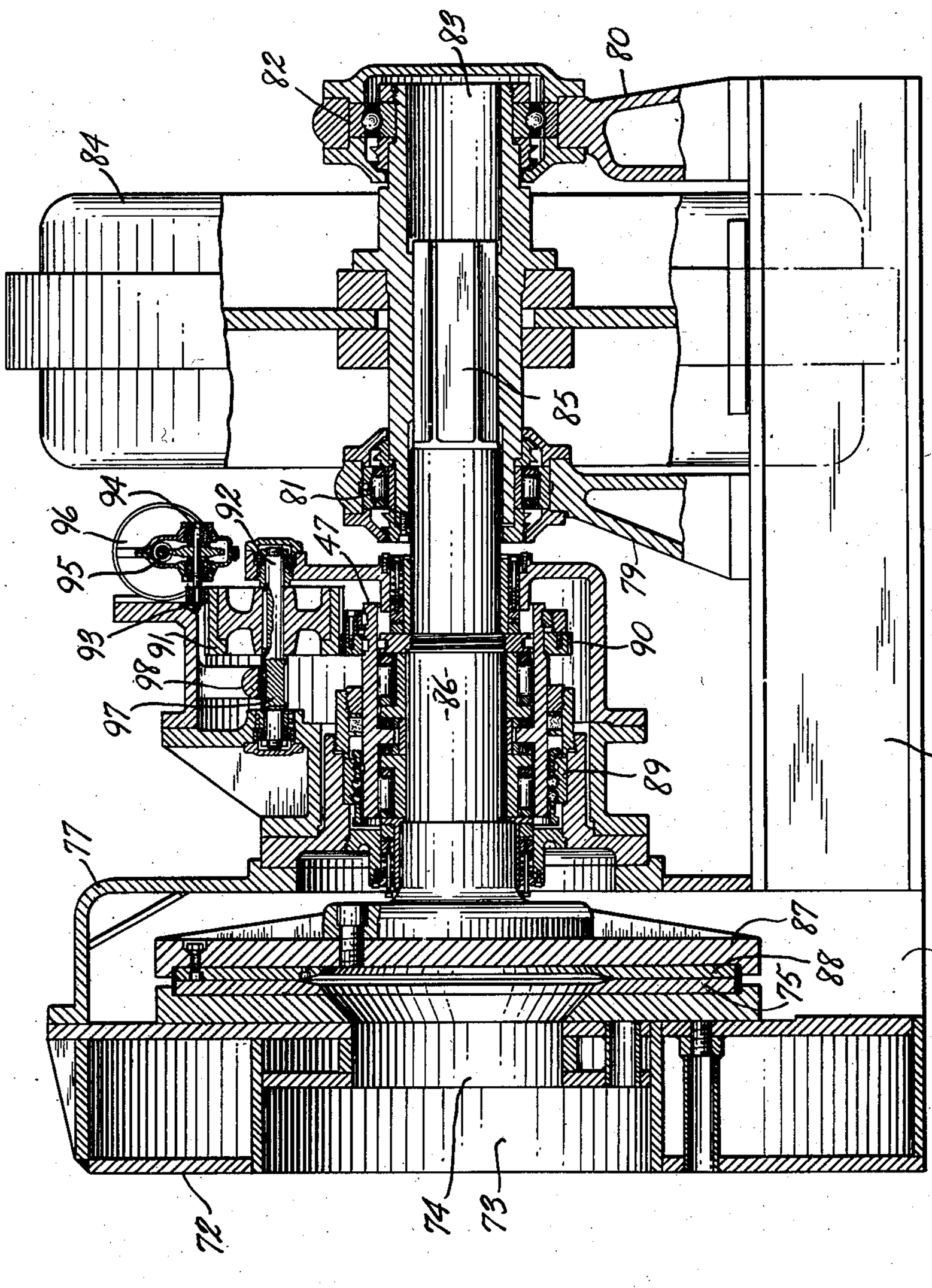

FIG. 8.

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UNITED STATES PATENT OFFICE

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MECHANISM FOR PRODUCING SIMULTANEOUS OSCILLATING AND ROTARY MOTION

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Application November 6, 1950, Serial No. 194,344

9 Claims. (Cl. 74—22)

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The present invention relates to mechanism for producing simultaneous rotation and axial movement of a driven member and embodies more specifically an improved mechanism by means of which axial movement may be imparted effectively to a driven member while it is being driven.

More particularly, the invention relates to mechanism for driving a roll and, at the same time, imparting to such roll oscillating movement in directions parallel to the axis of the roll.

Numerous examples exist of mechanism wherein a member is to be rotated and also adjusted axially, typical illustrations of such mechanism being in the paper manufacturing industry and in the materials reduction art, and it is an object of the present invention to provide mechanism by means of which a rotating element may be moved axially while it is being rotated.

In order that the invention may be more readily understood, reference will now be had to the accompanying drawings, wherein

Figure 1 is a longitudinal sectional view, taken through the axis of a device constructed in accordance with the present invention;

Figure 2 is a view in end elevation, taken from the right of Figure 1, and showing the mechanism by means of which the axial oscillation of the rotating element is accomplished;

Figure 3 is an exploded view showing the compound bearing illustrated at the right-hand end of Figure 1;

Figure 4 is a perspective view in section illustrating a bearing included in the drive elements at the left-hand end of Figure 1;

Figure 5 is an enlarged view illustrating a slightly modified version of the structure shown in Figure 1;

Figure 6 is a view similar to Fig. 5, showing a further modified version of the drive mechanism for the roll;

Figure 7 is an enlarged view of a slightly modified form of oscillating mechanism similar to that illustrated at the right-hand end of Fig. 1; and

Figure 8 is a view similar to Figure 1 showing a modified form of the invention.

Referring particularly to Figures 1 to 4, inclusive, the rotatable element is illustrated as a roll 10 mounted within side frame members 11 and 12. The left-hand end of the roll is journaled in a bearing 13 which is shown as a ball bearing having a plurality of axially spaced courses of

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balls. The roll 10 is provided with an axial shaft 14 having journal shaft extensions 15 and 16, the journal shaft 15 being journaled in the bearing 13, while the shaft 16 is journaled in a compound bearing indicated generally at 17.

Rotation of the roll is accomplished by means of a drive motor indicated generally at 18, which includes a motor frame 19 secured to an adapter 20 that is mounted upon a housing extension 21, secured to the frame member 11. The armature shaft 22 of the motor 18 is journaled in a bearing 23 at the left-hand extremity thereof and at the right-hand extremity in a bearing 24 that is received within a cylindrical extension 25 carried by a planet pinion spider 26. The cylindrical spider extension 25 is journaled in a bearing 27 that is carried by the adapter 20, and the right-hand extremity of the armature shaft 22 drives a sun gear 28 which engages a plurality of planet pinions 29 journaled in the planet spider 26. Outer fixed ring gear 30 is carried by the housing extension 21, and the planet spider 26 has secured thereto a cylindrical sleeve 31 formed with an enlarged collar 32. This enlarged collar is illustrated in detail in Figure 4, and it will be seen that it is formed with a plurality of longitudinally extending ball ducts 33 and ball grooves 34. A plurality of bearing balls 35 are received within the ducts and grooves, and end caps 36 are formed with curved ball ducts 37 and are secured upon opposite faces of the collar 32 to complete the endless track within which the balls 35 move. The extremity of the journal shaft 15 has secured thereto a sleeve 38 within which longitudinally formed grooves 39 are provided. The balls 35 engage the grooves 39 and the latter thus receive the torque delivered from the collar 32 through the balls 35 that are in engagement with the grooves 39. In this fashion, the roll 10 is driven rotatably by the motor 18.

In order that the roll 10 may be oscillated in directions parallel to its axis, the journal shaft 16 is provided with the compound bearing 17 that is illustrated in Figures 1 and 3. This bearing is formed of an inner race 40 having a ball groove 41 within which bearing balls 42 are received. The bearing balls are retained in position by a retainer ring formed of ring sections 43 and 44, and the balls engage a groove 45 of a middle race 46. The middle race is formed with a sleeve extension 47 and, on its outer surface is provided with a plurality of spirally extending grooves 48 within which a plurality of courses of balls 49 and 50 are received. A compound retainer ring formed of sections 51, 52, and 53 serve to retain

the course of balls 49 and 50 in the grooves 48, and these courses of balls are received within complementary spiral grooves 54 formed in an outer race 55. The outer race 55 is secured in the supporting frame structure 12.

As illustrated in Figure 2, the sleeve extension 47 is provided with an arm 56 to which is connected a connecting rod 57, the other end of which is mounted over an eccentric 58, which is secured to the armature shaft 59 of an electric motor 60, mounted upon the frame member 12. When the motor 60 is driven, the eccentric 58 causes rotary oscillation of the sleeve 47 and middle race 56 caused by movement of arm 56 back and forth in a direction transverse to the axis of the roll 10. Such oscillation causes the middle race 46 to be oscillated in a direction axially of the roll 10 because of the structure of the outer bearing formed by the balls 49 and 50, and the spiral groves 48 and 54. Inasmuch as the balls 42 operate as elements of a thrust as well as radial bearing, the axial movement or oscillation of the middle race 46 is imparted to the roll 10.

Referring to the structure shown in Figure 5, the drive motor 18 is designed to drive the motor directly rather than through a planetary gear mechanism as illustrated in Figure 1. A supporting wall 61 carries a bearing 62 in which the right-hand end of the armature shaft is journaled, and the drive is transmitted to the journal shaft 15 through the bearing structure illustrated in Figure 4, as previously described. In the form shown in Figure 5, the journal shaft 15 is journaled in the frame structure 12 by means of a roller bearing 63 rather than the ball bearing 13.

In the form shown in Figure 6, the drive is transmitted through an intermediate drive element comprising a body member 64 journaled at 65 in a supporting wall 65'. The armature shaft 67 is provided with a splined driving head 66 which engages cooperating splines in the body member 64. The collar 32 is carried by a cup-shaped element 32' that is secured to the body member 64.

Figure 7 is an enlarged view of a slightly modified form of compound bearing similar to that shown at the right-hand end of Figure 1. The journal shaft 16 is provided with radial bearings 68 and 69 and a thrust bearing 70. The thrust bearing 70 includes an inwardly extending flange 71 formed on the sleeve extension 47 of the middle race. In other respects, the compound bearing is similar to that illustrated in Figure 1.

In Figure 8, a modified version of the invention is illustrated in which it is shown as being embodied in a materials reduction mechanism. A stationary frame member 72 is provided with a chamber 73 from which material is fed through a discharge opening 74 in order that it may move outwardly over an abrading plate 75. After the reduction of the particle size of the material is accomplished, it falls into a discharge outlet 76 formed at the bottom of a grinding chamber formed by a housing 77. The housing 77 is mounted upon a platform 78 carrying standards 79 and 80, which are provided with bearings 81 and 82. A driving sleeve 83 is journaled in the bearings 81 and 82, and is driven by a suitable source of power such as a synchronous motor 84. The sleeve 83 is formed with a squared section within which the squared end 85 of a rotatable shaft 86 is received. The left-hand end of the shaft 86 has secured thereto a plate 87 provided with a wear plate 88 that is adapted to cooperate with the stationary plate 75. The shaft 86 is journaled in a compound bearing 89 similar to the compound bearing illustrated in Figure 7.

The sleeve extension 47 of this bearing is provided with a ring gear 90 that is driven by a gear 91 mounted upon a shaft 92. The gear 91 is driven by the driving pinion 93 secured to a shaft 94 that is driven by a worm and worm gear connection 95 from an electric motor 96. The shaft 92 is formed with gear teeth 97 that engage a rack 98, and the rack 98 may be provided with an adjustable limit stop (not illustrated) to control the extent of movement of the gear train, including the gear 91 in either or both directions.

The mechanism of Figure 8 thus will be seen to provide a means not only for rotating the plate 87, but also of means for moving the plate to any desired extent toward or away from the cooperating stationary plate 75. In this fashion, a fine adjustment of the space between the friction surfaces of the cooperating plates 75 and 78 is provided.

While the invention has been described with specific reference to the accompanying drawings, it is not to be limited save as defined in the appended claims.

I claim:

1. A device for converting rotation into translation comprising a shaft, a sleeve surrounding the shaft, a thrust bearing between the sleeve and the shaft preventing relative axial movement and allowing relative rotational movement therebetween, a first grooved race on the sleeve and a second grooved race mounted on a supporting structure, at least the race on the sleeve being formed with a plurality of spiral grooves spaced around the race, at least one ball in each groove coupling the races together, and means for rotating the sleeve relative to the supporting structure.

2. A device according to claim 1 wherein a plurality of the balls coupling the races lie in a common plane perpendicular to the axis of the shaft.

3. A device according to claim 1 wherein a plurality of balls lie in each spiral groove and each groove intersects a number of oppositely-threaded grooves on the second race equal to the number of balls in each groove.

4. A device according to claim 1 wherein the means for rotating the sleeve is an arm on the sleeve perpendicular to the axis thereof, and means for oscillating the arm to reciprocate the shaft.

5. A device according to claim 1 further provided with means for rotating the shaft independently of axial movement thereof.

6. A device for converting a rotation into a translation comprising a shaft, a sleeve surrounding the shaft and coupled for axial movement therewith, means for mounting the sleeve in a supporting structure, oppositely-threaded cooperating spiral grooves on the sleeve and the supporting structure, balls in the grooves coupling the sleeve to the supporting structure whereby to move the sleeve axially upon turning the sleeve in the supporting structure.

7. A device according to claim 6 provided with bearings to journal the shaft for rotation with provision for axial movement thereof, and one of the bearings is retained in the sleeve and is axially movable therewith.

8. A device according to claim 6 wherein the cooperating spiral grooves comprise a plurality

of grooves around the periphery of the sleeve and a like number of oppositely-threaded grooves on the supporting structure facing the grooves of the sleeve, at least one ball in each groove coupling the sleeve and supporting structure together, and there is provided a thrust bearing between the sleeve and the shaft preventing relative axial movement and allowing relative rotational movement therebetween, and means for rotating the sleeve relative to the supporting structure.

9. Rotating and reciprocating mechanism comprising a rotatable member, a shaft upon which the member is mounted, a bearing for the shaft including an inner race carried by the shaft, a middle race, bearing elements between the inner and middle races, an outer race carried by a supporting structure, oppositely-threaded cooperating spiral grooves on the outer and middle races, balls in the grooves coupling the outer and middle races, and means to turn the middle race on its axis.

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