

Sept. 28, 1971

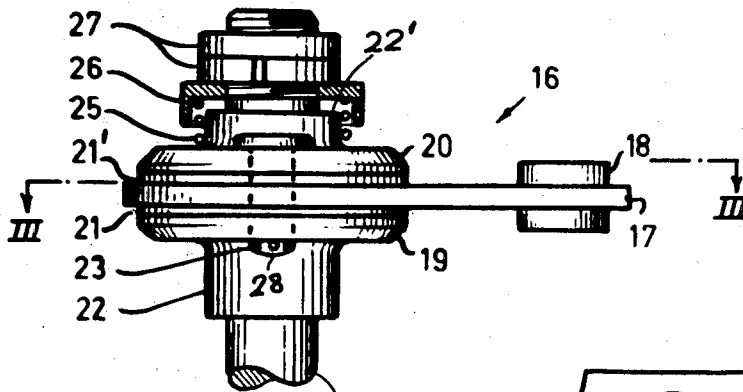
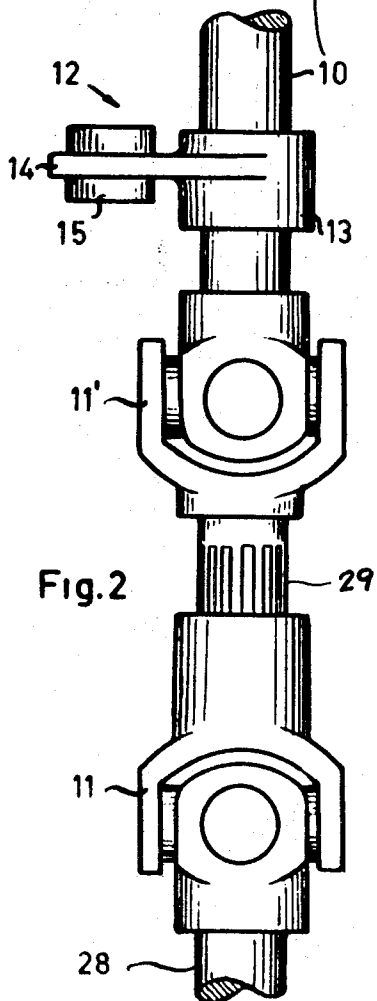
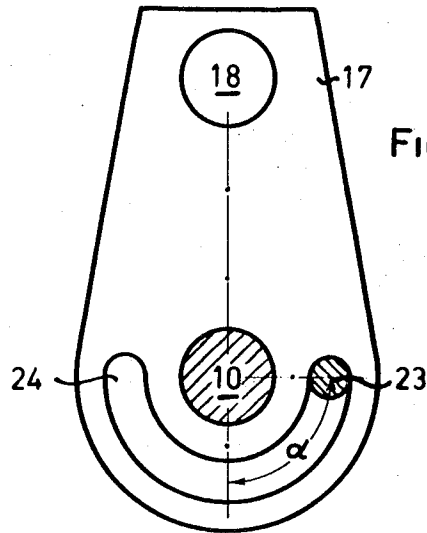
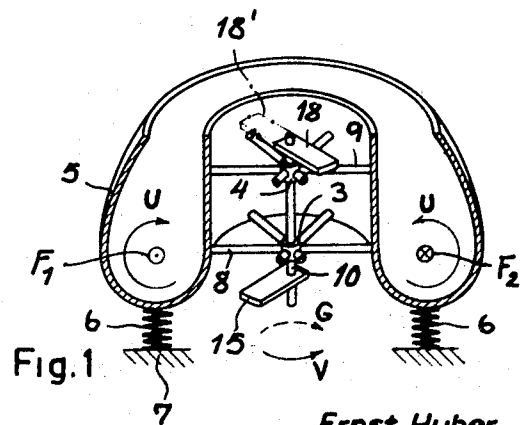
E. HUBER

3,608,388

REVERSIBLE WOBBLE DRIVE

Filed April 13, 1970

2 Sheets-Sheet 1



Ernst Huber
INVENTOR.

BY

Karl F. Ross
Attorney

Sept. 28, 1971

E. HUBER

3,608,388

REVERSIBLE WOBBLE DRIVE

Filed April 13, 1970

2 Sheets-Sheet 2

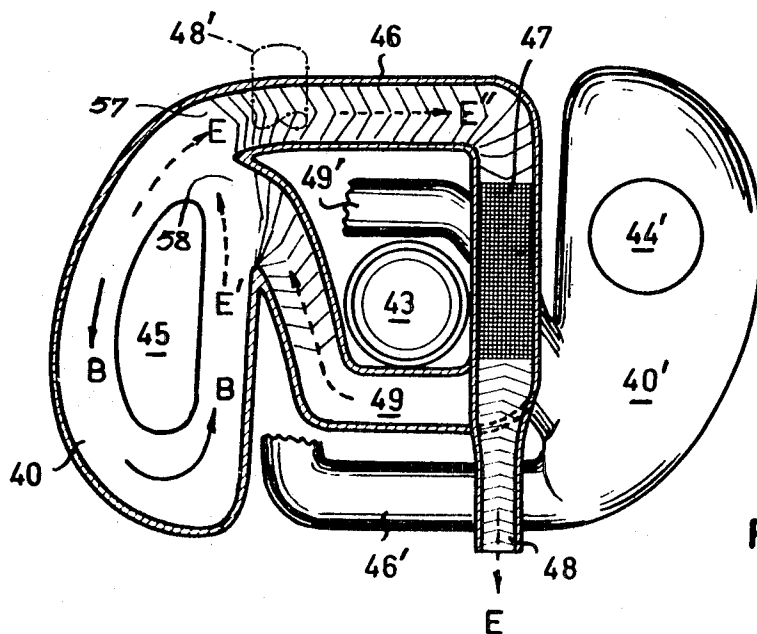


Fig. 5

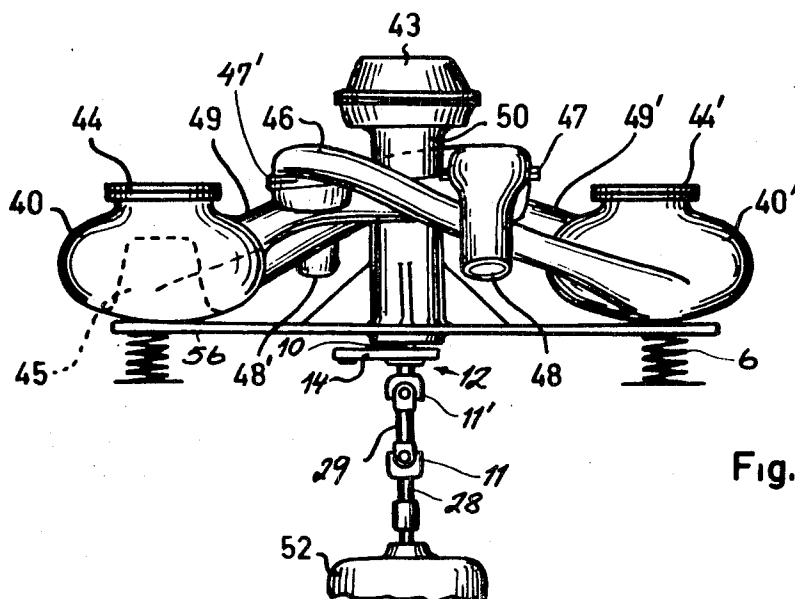


Fig. 4

Ernst Huber
INVENTOR.

BY

Karl F. Ross
Attorney

1

3,608,388

REVERSIBLE WOBBLE DRIVE

Ernst Huber, Langernstrasse 30,

CH 8037 Zurich, Switzerland

Filed Apr. 13, 1970, Ser. No. 27,484

Claims priority, application Switzerland, Apr. 11, 1969,

5,639/69

Int. Cl. B06b 1/16

U.S. Cl. 74—87

6 Claims

ABSTRACT OF THE DISCLOSURE

For imparting wobbling motion with reversible precession to a resiliently supported tumbling vessel, a generally upright impeller shaft is journaled in two bearings mechanically connected with the vessel at an upper and a lower level and is linked with the shaft of a reversible drive motor via two cascaded universal joints so as to exert independent thrusts upon the vessel through these bearings. The impeller shaft is eccentrically loaded by two weights secured to it near the two bearings, with the upper weight leading the lower weight by 90° in the direction of rotation. The upper weight is mounted on the shaft through a lost-motion coupling with 180° play whereby a reversal of shaft rotation causes this weight to swing into a diametrically opposite position.

My present invention relates to a reversible driving mechanism for imparting wobbling motion to a resiliently supported load, e.g. tumbling vessel designed for the agitation of relatively mobile turnings and other articles to be polished, deburred, coated or similarly treated.

In a copending application filed by me on even date herewith jointly with Simon Jacot, Ser. No. 29,105, there has been disclosed and claimed a tumbling vessel of this type in which the charge, i.e. a mass of articles to be treated together with abrasive chips or some other treatment agent, is agitated within an annular chamber from which an outlet port branches off in an approximately tangential direction, the motion of the mass having a circulating component in one direction or the other as determined by the sense of rotation of an eccentrically loaded impeller. During the tumbling operation, the flow of the mass along the circumference of the treatment chamber is in the direction of convergence of the outlet port with that chamber whereby the charge remains trapped in the vessel for continued recirculation; upon completion of the treatment, this flow is reversed whereby the mass is progressively discharged through the outlet port.

As further disclosed in the copending application, the impeller is a generally upright member such as a shaft driven from a motor via two cascaded universal joints, this shaft thus having two degrees of freedom so as to be able to exert separate thrusts on two levels upon the vessel with which it is linked by a lower and an upper bearing. These thrusts are generated by a pair of eccentric weights respectively positioned near these bearings, with the upper weight leading the lower weight by about 90° in the direction of rotation so that the wobbling vessel is tilted in that direction whereby the charge experiences a corresponding precession. More precisely, the particles of the charge are set in helicoidal motion along a generally toroidal path with an outward component at the bottom of the chamber and an inward component at its top.

2

In such a system, the reversal of motion designed to discharge the mass from the vessel requires a relative relocation of the eccentric weights so that the upper one should again lead the lower one by the desired phase angle, preferably by 90°.

The object of my present invention, therefore, is to provide a reversible wobble drive for the purpose set forth, or for any related purpose, having means for automatically repositioning the two eccentric weights upon a change in the direction of impeller rotation.

This object is realized, pursuant to the present invention, by the provision of a lost-motion coupling between one of the weights and the impeller member whereby this weight can swing through an arc of 2α , corresponding to the angular play of the coupling with reference to the impeller and the other weight fixedly mounted thereon. With the relatively oscillatable weight initially offset from the other weight by an angle $+\alpha$, the inertia of the first weight will place it in a position offset from the other weight by an angle $-\alpha$ upon a reversal of impeller rotation. In order to maintain the relative position of the weights even in the presence of minor speed variations, the oscillatable weight may be frictionally engaged by a pair of brake jaws on the impeller member; these brake jaws are advantageously two confronting annular flanges bracketing a carrier plate for that weight, the plate being provided with an arcuate slot traversed by a pin spanning the two flanges to form therewith the lost-motion coupling.

In the preferred embodiment, in which the two weights lie in quadrature with each other, $\alpha=90^\circ$ and the coupling slot is substantially semicircular.

The invention will be described hereinafter in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a somewhat diagrammatic perspective view of an annular vessel with a generally toroidal treatment chamber for a charge to be agitated, together with a reversible wobble drive therefor embodying my invention;

FIG. 2 is an enlarged elevational view of the wobble drive of FIG. 1;

FIG. 3 is a cross-sectional view taken on the line III—III of FIG. 2;

FIG. 4 is an elevational view of a double vessel equipped with a wobble drive similar to that of FIGS. 1-3; and

FIG. 5 is a top view, partly in section, of the assembly shown in FIG. 4.

In FIG. 1, I have diagrammatically illustrated an upwardly open annular vessel 5 resiliently supported, via an array of compression springs 6 (only two shown), on a fixed base 7. An impeller shaft 10, driven in a manner hereinafter described by a nonillustrated motor secured to the base, carries an eccentric lower weight 15 at approximately the level of the center of gravity of the vessel and an eccentric upper weight 18 at a higher level, near the top of that vessel, the two weights being relatively offset by an angle of 90°. Shaft 10 is journaled in a lower bearing 3 near the level of weight 15 and in an upper bearing 4 near the level of weight 18, the two bearings being mechanically braced against the inner peripheral wall of vessel 5 by respective spiders 8, 9.

As illustrated in FIG. 2, impeller shaft 10 is linked with a motor-driven vertical shaft 28 by means of two universal joints 11, 11' and an intermediate shaft 29. The shaft 10 is therefore laterally displaceable, with reference to the axis of input shaft 28, with two degrees of freedom whereby the two bearings 3, 4 can orbit independently about the drive axis in following the excursions of the

3

weights. With the upper weight 18 occupying the relative position indicated in full lines, this weight leads the lower weight 15 by 90° when the shaft 10 is driven in the forward direction (here clockwise) represented by an arrow V in FIG. 1. The mutually staggered thrusts delivered to the top and the bottom of the vessel by the spiders 9 and 8, respectively, impart to that vessel a circularly progressing forward tilt synchronized with a radial excursion to generate a composite wobbling motion.

As a result of this motion, a mass of relatively mobile particles in the annular treatment chamber of vessel 5 moves helicoidally along a closed path, the turns of the helicoid being represented by arrows U while the precessional movement has been conventionally symbolized at F₁ and F₂; the latter movement, of course, is codirectional with shaft rotation V.

When the sense of this rotation is reversed, as indicated by a clockwise-pointing arrow G shown in broken lines, the upper weight 18 must occupy a diametrically opposite position as also indicated in broken lines at 18'; the mass will then execute the same helicoidal motion U but with a reverse precession again codirectional with the shaft rotation.

FIGS. 2 and 3 show details of the connection between weights 15, 18 and shaft 10 designed, in accordance with my present invention, to swing the weight automatically into its alternate position 18' upon any reversal of shaft rotation. The mounting 12 for the lower weight 15 comprises a collar 13 rigid with the shaft and a side arm 14 integral with that collar. The mounting 16 for weight 18, on the other hand, comprises a flat carrier plate 17 which is rotatably seated on shaft 10 and is bracketed by a pair of annular flanges 19, 20 nonrotatably secured to that shaft. The lower flange 19 has a hub 22 which is press-fitted onto the shaft, a corresponding hub 22' of the upper flange 20 being slidable on the shaft under pressure of a coil spring 25 enclosed in a cap 26 which is held in position by a pair of lock nuts 27. A pin 23 on flange 20 traverses a semicircular slot 24 in plate 17 and is received in a bore of flange 19, being locked in position with the aid of a cotter pin 28 so as to limit the separation of brake jaws 19, 20. Brake linings 21 and 21' on the confronting faces of these jaws bear upon the carrier plate 17 under the adjustable pressure of spring 25.

In the operation of the system of FIGS. 1-3, pin 23 abuts the right-hand end of slot 24 (as shown in FIG. 3) as long as the shaft 10 rotates counterclockwise, i.e. in the direction of arrow V (FIG. 1), to entrain the carrier plate 17 with its weight 18. If the shaft stops more or less abruptly, the momentum of weight 18 entrains the plate 17 against the frictional force of brake 19, 20 in the same sense over all or part of the 180° stroke afforded by the play of the lost-motion mounting 16. The pin traverses the remainder, if any, of this stroke upon a more or less abrupt restarting of the shaft in the reverse direction (arrow G) so as to come to rest against the left-hand end of slot 24. The opposite displacement, of course, occurs when shaft rotation is once more reversed to restore the original operating condition.

In FIGS. 4 and 5, reproduced from the copending application identified above, I have shown a tumbling machine with two eccentrically positioned vessels 40, 40' driven by a wobbling mechanism of the type described in connection with FIGS. 1-3. A central housing 50 accommodates the lower bearing 3 (FIG. 1) proximal to the unbalancer 12 as well as the upper bearing proximal to the second unbalancer, not shown, which is received in an enlarged cap 43 of the housing. Vessels 40 and 40' rest on a common nonrotatable platform 56 supported by springs 6. Each of these vessels is provided with a central boss 45 defining with its peripheral wall an annular treatment chamber in which a charge moves helicoidally, in the same manner as in the vessel 5 of FIG. 1, with a precession in one direction or the other as indicated by solid arrows B and a broken arrow E in FIG. 5.

4

Each vessel is provided with a respective discharge duct 46, 46' originating at an outlet port 57 which opens substantially tangentially into the annular treatment chamber thereof and then rises above the level of the vessel, terminating in a downwardly sloping extension 48, 48'. Between this extension and the duct proper there is provided a perforated section 47, 47' whence a return duct 49, 49' extends to the corresponding treatment chamber, sloping downwardly toward that chamber and entering it at an inlet port 58 which opens also approximately tangentially into that chamber but with an orientation opposite that of outlet port 57. A drive motor for the input shaft 28 is shown at 52 in FIG. 4.

The slope of ducts 46 and 49 has been conventionally indicated in FIG. 5 by chevrons whose vertices point in the ascending direction and whose spacing varies inversely with the slope.

In the operation of the system of FIGS. 4 and 5, counterclockwise rotation of shafts 28, 29, 10 causes the charge in each vessel to move in the same counterclockwise sense about the boss 45 as indicated by the arrows B. The charge then passes the outlet port 57 without leaving the chamber whereas any particles arriving at inlet port 58 are immediately entrained along its circulating path.

After the necessary treatment time, motor 52 is reversed so that the charge begins to circulate in the opposite sense (arrow E). Since, however, any particle approaching the outlet port 57 is immediately discharged into channel 46, there is no return flow through the inner branch of the treatment chamber so that the mass present in that branch will also move toward port 57 as indicated by an arrow E'. The outflowing mass (arrow E'') arrives at the screen 47 or 47' where the smaller particles are sifted out and returned to the chamber via channel 49 or 49' whereas the remainder exits at the terminal portion 48 or 48'. The returning fraction of smaller particle size may consist, for example, of abrasive chips admixed with larger parts, such as beads, dowels or pins, to be polished or deburred.

The vessels 40, 40' have open tops 44, 44' through which they can be reloaded after the motor 52 has been arrested or restarted in the forward direction V.

The basic principles of my invention could also be realized if, contrary to the arrangement described and illustrated, the lower weight 15 were also connected with the shaft 10 through a lost-motion coupling, provided of course that the stroke lengths of the two couplings differed from each other by the desired angle 2 α .

I claim:

1. A reversible wobble drive in combination with a resiliently supported nonrotatable load, comprising an impeller member rotatable about a substantially vertical axis with freedom of limited lateral displacement, upper and lower bearing means for said member mechanically connecting same with said load at two levels, an upper weight near said upper bearing means eccentrically loading said member at one of said levels, a lower weight at said lower bearing means eccentrically loading said member at the other of said levels, one of said weights being provided with lost-motion coupling means with an angular play of 2 α enabling entrainment thereof in either of two positions offset by $\pm\alpha$ from the other of said weights, and reversible drive means for rotating said member.

2. A wobble drive as defined in claim 1 wherein said coupling means comprises a pair of confronting annular flanges on said member and a carrier plate bracketed between said flanges, said carrier plate being provided with an arcuate semicircular slot, said flanges being provided with a connecting pin traversing said slot.

3. A wobble drive as defined in claim 2 wherein said flanges are provided with brake linings frictionally engaging said carrier plate.

4. A wobble drive as defined in claim 3 wherein said flanges are axially slidable relatively to each other on said

5

member, further comprising spring means urging said flanges toward each other.

5. A wobble drive as defined in claim 1 wherein said drive means comprises a vertical input shaft, an intermediate shaft, a first universal joint linking said power shaft with said intermediate shaft, and a second universal joint linking said intermediate shaft with said member.

6. A wobble drive as defined in claim 1 wherein α is substantially equal to 90° .

6

References Cited

UNITED STATES PATENTS

883,526 3/1908 Combs ----- 209—366.5

5 MILTON KAUFMAN, Primary Examiner

U.S. Cl. X.R.

51—163; 209—366.5