

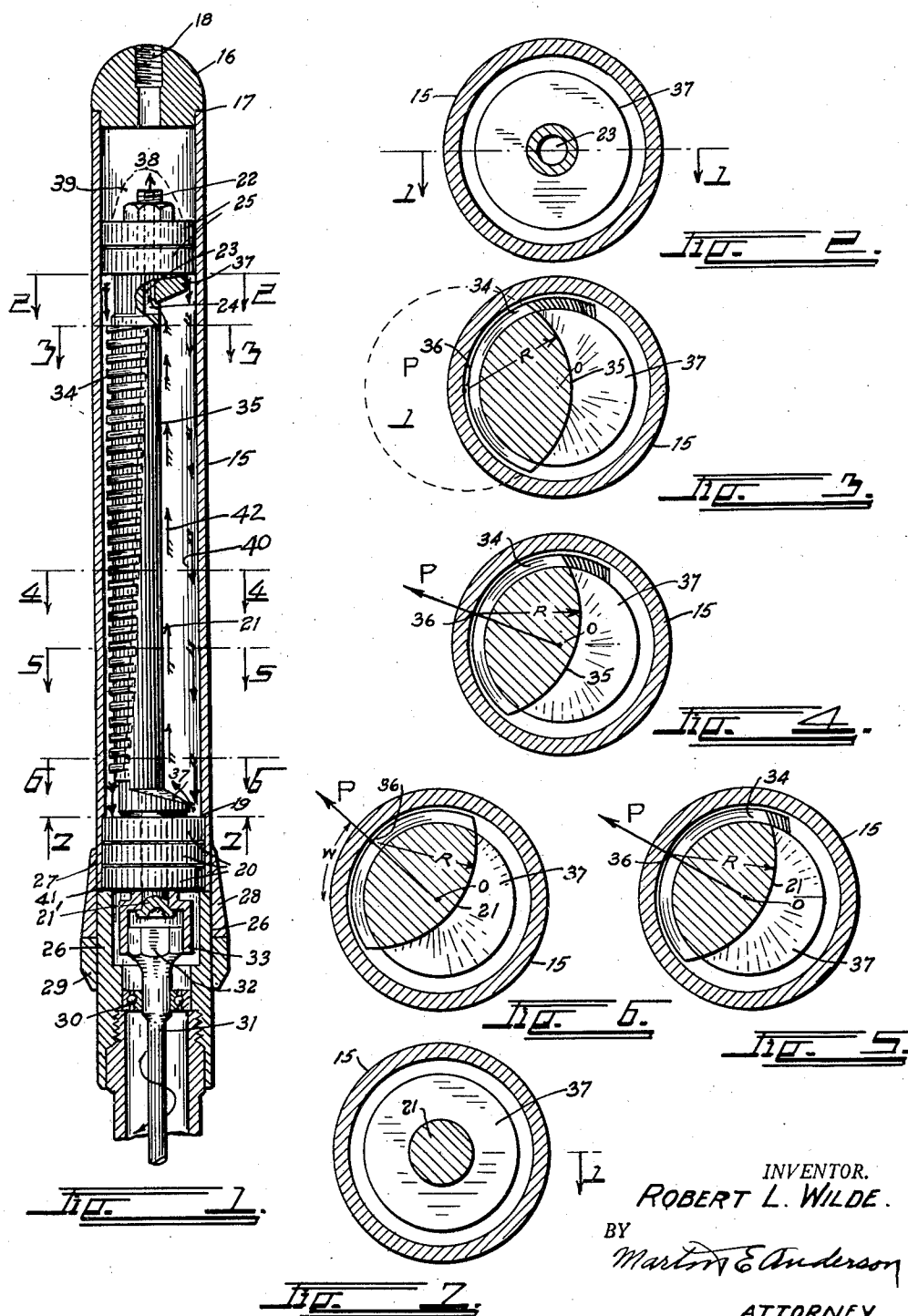
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R. L. WILDE

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ECCENTRIC ROTOR FOR VIBRATING DEVICES

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INVENTOR.
ROBERT L. WILDE.

BY
Martin E. Anderson

ATTORNEY.

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ECCENTRIC ROTOR FOR VIBRATING DEVICES

Robert L. Wilde, Englewood, Colo.

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7 Claims. (Cl. 259—1)

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This invention relates to improvements in vibrators of the type employed for vibrating cement grout.

It has been recognized for a considerable length of time, that in order to get the best results from a Portland cement concrete, it is necessary to subject the concrete grout while in unsettled state to a high frequency vibration and for this purpose various specific types of vibrators have been invented and are in use.

In order to get the best results, the rate of vibration must be very high and it is nearly always effected by rotating an eccentric rotor at a very high speed within a cylindrical housing.

The very high speed of rotation uses up the lubricating film very quickly and it has therefore been found that the ordinary type of cement vibrator will wear out very rapidly, if used for any considerable length of time, without subjecting it to lubrication.

In my copending application, Serial No. 720,455, filed January 6, 1947, a vibrator has been illustrated and described which is provided at one end with an oil reservoir that communicates with the rotor chamber through an axial opening in the corresponding end of the same. By the means described in that application, the rotor bearings are thoroughly lubricated every time the rotor is laid down.

The rotors employed to provide vibrations in cement vibrating devices are eccentric, that is, the center of mass is positioned on one side of the axis of rotation. When such vibrator rotates at a high speed, the eccentricity produces a centrifugal force that urges the trunnions of the rotor against the bearings with high pressure and since the center of mass of adjacent transverse layers are all in a line parallel to the axis of rotation, the centrifugal force is all concentrated in one direction which acts uniformly at both ends of the rotor which therefore is subjected merely to a vibrating force acting in a plane perpendicular to the axis.

It is the object of this invention to produce a vibrating device of such construction that in addition to the radially acting centrifugal forces that are all in a diametrical plane, other forces are produced that act in angularly related directions, thereby subjecting the rotor and the rotor housing to forces that tend to produce a gyratory movement.

Another object of the invention is to produce a rotor for the purpose indicated, that shall be provided on its outer surface with helical thread-like grooves and projections that give to the rotor

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the properties of a screw pump which facilitates the movement of oil and assures satisfactory lubrication of the parts at all times during operation.

The above and other objects that may become apparent as this description proceeds and to which reference may hereinafter be made are attained by means of a construction and the relationship of parts that will now be described in detail and for this purpose reference will be had to the accompanying drawing in which the invention has been illustrated, and in which:

Figure 1 is a diametrical longitudinal section taken on lines 1—1, Figures 2 to 7, inclusive;

Figure 2 is a section taken on line 2—2, Figure 1;

Figure 3 is a section taken on line 3—3, Figure 1;

Figure 4 is a section taken on line 4—4, Figure 1;

Figure 5 is a section taken on line 5—5, Figure 1;

Figure 6 is a section taken on line 6—6, Figure 1; and

Figure 7 is a section taken on line 7—7, Figure 1.

Referring now to the drawing, reference numeral 15 designates a cylindrical housing that is provided at one end with a plug 16 that is preferably sweated in place so as to provide a joint that permits the plug to be removed when the parts are heated above the temperature of the solder employed to make the joint at 17. This plug is also provided with a removable threaded plug 18. It may be mentioned at this point that plug 16 is normally at the lower end of the vibrator when the same is in use, but has been shown at the top of the drawing for the purpose of convenience. The inner surface of the housing is provided near its lower end with a shoulder 19 that forms an abutment for the antifriction bearings 20 of which three have been shown. Positioned within the housing is an elongated rotor that has been designated in its entirety by reference numeral 21. The rotor is provided at each end with a trunnion, the two trunnions being in axial alignment, the one at the lower end of the drawing has been designated by reference numeral 21' and the one at the upper end of Figure 1 by reference numeral 22. The latter trunnion is tubular, the opening therein having been designated by reference numeral 23 and this is in communication with the interior of the housing at 24. Trunnion 22 is positioned in the inner ball races of antifriction bearing 25. Bearings

26 are held in place by means of a tubular member 26 that is thicker than the wall of housing 15, whereby a shoulder 27 is formed that engages the lowermost ball race and serves to hold the ball races in engagement with shoulder 19. Sleeves 28 and 29 are sweated to the outer surface of member 26 and to the abutting end of housing 15 and serves to hold the parts in assembled relation, but permits them to be separated by raising the temperature above the melting point of the solder employed. A ball bearing 30 is positioned in sleeve 26 and forms a bearing for the inner end of a flexible shaft 31 that terminates in a hexagonal plug 32. Trunnion 21 has secured thereto a cup 33 having a hexagonal opening of the proper size to receive plug 32 which therefore forms a coupling that prevents relative rotation, while permitting slightly longitudinal movement. A flexible shaft is rotated by a suitable motor which has not been shown.

The parts that have just been described are shown in the application above identified. The invention to which this application relates has reference to the specific construction of the rotor which will now be described in detail. The rotor is formed from a cylindrical steel bar of the proper diameter and is machined in a lathe so as to provide the two trunnions 21 and 22. The outer surface is then provided with threads 34 which may be double pitch square threads, or threads of any other shape which, however, should preferably be quite coarse. A helical strip is now removed from the rotor. The surface of the rotor that is left after the strip has been removed has been designated by reference numeral 35. Surface 35 is arcuate and is formed by a point rotating around a center positioned on the outside of the rotor the center moving longitudinally in a helical path. In Figure 3 the center point has been designated by reference numeral 36 and is positioned in the outer surface of the threaded section. The radius of surface 35 has been designated by R and the completed circle has been indicated by broken lines in Figure 3. In the embodiment illustrated in the drawing center 36 is shown in Figure 3 as being on the diameter I—I. At section point 4—4, the center has moved so that it now lies on a diameter indicated by force line P. In Figure 5, the center has moved so that line OP makes a greater angle with the diametrical plane I—I, while at section 6—6 the center point 36 has moved upwardly to its maximum point. The helical strip thus removed is twisted in a helical direction the amount of angle w shown in Figure 6.

It is to be understood that the helical displacement of the center can be greater than that shown in the drawing which is merely illustrative. It may at times be preferable to increase angle w to ninety degrees instead of as shown. The actual value of angle w is not critical and can be selected as determined by practical experience and operation. That part of the rotor that has been designated by reference numeral 37 is of smaller diameter than the threaded portion and serves as a flange and an abutment.

The part between the upper ball bearing 25 and the inner surface of plug 16 is an oil reservoir and this has been designated by reference numeral 38. When the device is in use plug 16 is at the lower end and the oil will naturally flow into this part of the housing. It has been found that when the rotor is turning at a high speed in the direction of the arrow, there is a pumping action taking place that tends to move the oil

upwardly from reservoir 38 and bring some of it into engagement with the bearing 20 so as to produce a continuous lubrication.

Referring now more particularly to Figures 3 to 6, inclusive, it will be seen that the centrifugal force P of each longitudinal section extends radially and it will also be evident that at each differential layer the centrifugal forces will operate in a slightly different radial direction. This is apparent from the four sections illustrated on the drawing. It is therefore evident that the centrifugal force nearest the trunnions will be directed in angular different directions and will therefore set up forces tending to produce a gyratory movement of the housing when it is positioned in the cement grout. This gyratory movement, in addition to the regular transverse vibration, produces a greater effect on the grout for producing a settling of the particles therein than that which can be obtained by the simple vibration due to a straight unbalanced part of the rotor such as has been formerly employed and which is shown, for example, in the application above identified.

Let us now assume that the vibrator is in use and rotating at a high speed, sometimes as high as ten thousand R. P. M. The vibration and the gyratory action will change the upper surface into a depression indicated by broken line 39 and oil will move upwardly through bearings 25. The helical threads whose tops lie close to the inner surface of the housing will act as a screw pump and move the oil upwardly along the inner surface of the housing. The path of the upwardly moving oil has been shown by arrows 40. When the oil reaches bearings 30 it will lubricate them and turn inwardly because seal 41 stops further upward movement of the oil.

The high speed at which the rotor turns leaves a low pressure area in the center of the housing through which the oil returns along the path indicated by arrows 42. The oil returns to sump 38 through opening 24 in trunnion 22.

In the drawing arrows 40 and 42 have been shown straight, as they are intended to show the general direction of movement; as a matter of fact the path of the oil is a helix of small pitch being the resultant of the longitudinal and the rotary forces to which it is subjected.

The specific construction of the housing can be selected to obtain the desired results and the one shown in the drawing is illustrative only.

It is evident that the screw pump action due to threads 34 is independent of the pitch angle of the unbalanced portion and will produce the desired pumping action with a rotor where the centers of mass of the eccentric portion all lie in the same diametrical plane.

Having described the invention what is claimed as new is:

1. An elongated rotor for use in concrete vibrators having an elongated cylindrical housing in which the rotor is rotatably mounted, said rotor having axial end trunnions, whereby the instantaneous centrifugal forces will be angularly distributed between the trunnions.

2. A rotor in accordance with claim 1 in which the outer surface of the rotor is provided with coarse threads adapted to pump lubricant axially of the rotor.

3. In a vibrator mechanism having an elongated cylindrical housing adapted to be immersed in a mass of material to be vibrated, an elongated rotor mounted for rotation in the housing, said rotor having each end provided with an

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axial trunnion for mounting a bearing, that portion of the rotor between the trunnions being eccentric with respect to the axis of rotation, the centers of mass of adjacent transverse layers being in a helical line whereby the instantaneous centrifugal forces adjacent each trunnion will act in angularly displaced radial directions, thereby imparting to the housing a vibratory motion due to the eccentricity of the rotor and a helical gyratory motion due to the angularly displaced centrifugal forces.

4. A rotor in accordance with claim 3 in which the outer surface of the rotor is provided with coarse deep helical threads adapted to pump lubricant axially of the rotor.

5. An elongated unbalanced rotor for use in vibrating concrete and which is adapted to be rotatably mounted in an elongated cylindrical housing having longitudinally spaced bearings, the rotor having its ends provided with coaxial trunnions for cooperative engagement with the bearings, that portion of the rotor between the bearings having a cross section bounded by a curved cylindrical surface concentric with the trunnions and an intersecting surface generated by a curved line turning about a center moving in a helical path concentric with the axis of the rotor, the radius of the helix being greater than one-half of the diameter of the rotor.

6. A rotor for use in a cement vibrator comprising an elongated rotor element having its ends provided with coaxial trunnions, that portion between the trunnions being eccentric with

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respect to the axis of rotation, the centers of mass of adjacent transverse layers lying in a helical line whereby the angularly directed centrifugal forces will impart to the rotor a tendency to gyrate.

7. An elongated unbalanced rotor for use in vibrating a plastic mass and which is mounted for rotation about its longitudinal axis in a housing having a cylindrical opening of a diameter slightly greater than twice the maximum radius of the rotor, comprising an elongated member provided with coaxial end trunnions, that portion of the rotor between the trunnions having its center of mass on one side of its longitudinal axis, the outer surface of the eccentric portion being concentric with the trunnions and provided with helical threads for moving oil longitudinally in the housing.

ROBERT L. WILDE.

REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
1,459,841	Mitchell	June 26, 1923
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FOREIGN PATENTS

Number	Country	Date
767,356	France	July 17, 1934

Certificate of Correction

Patent No. 2,479,799

August 23, 1949

ROBERT L. WILDE

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 4, line 64, after the word and comma "trunnions," insert *that portion of the rotor between the trunnions being eccentric with respect to the axis of rotation, the centers of mass of adjacent transverse layers being in a helical line;*

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of January, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.