June 12, 1956 N. I. ENGLUND ET AL 2,750,160

ROTARY VIBRATOR WITH A ROLLING ECCENTRIC MASS

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Fig. 1.

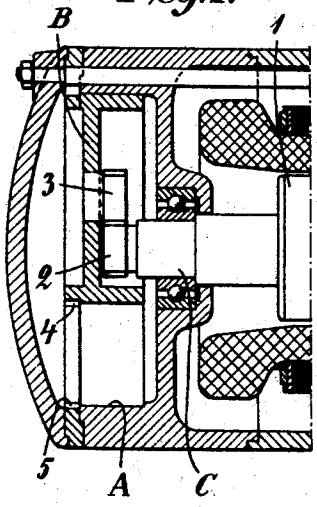


Fig. 3.

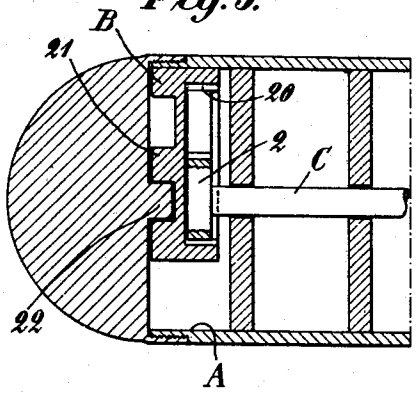
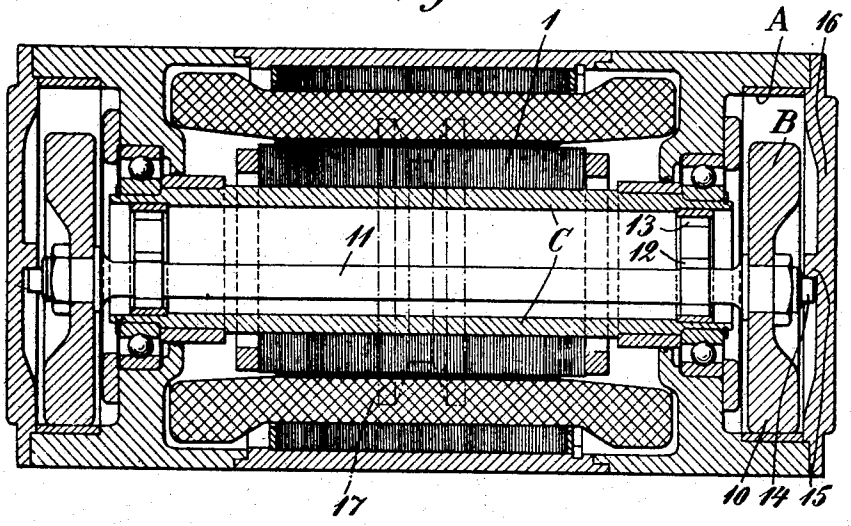


Fig. 2.



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Fig. 4.

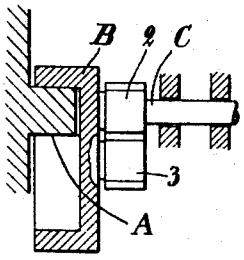


Fig. 5.

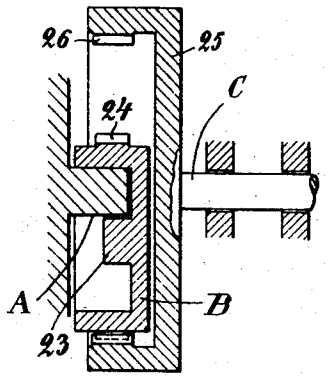


Fig. 6.

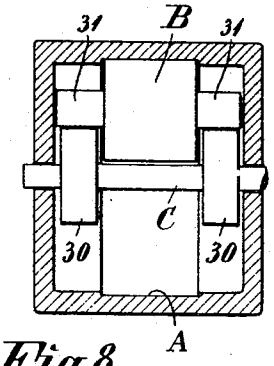


Fig. 7.

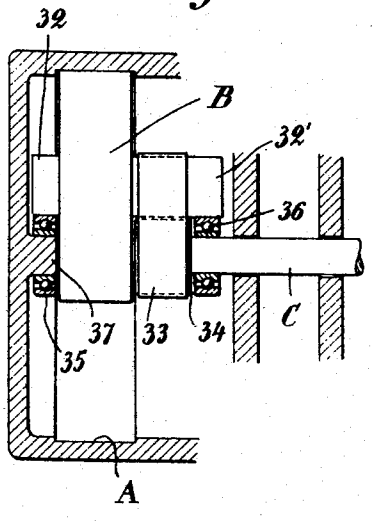
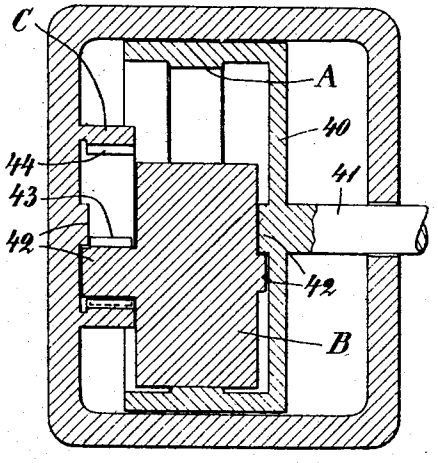


Fig. 8.



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United States Patent Office 2,750,160 Patented June 12, 1956

2,750,160

ROTARY VIBRATOR WITH A ROLLING ECCENTRIC MASS

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Application September 9, 1953, Serial No. 379,257

Claims priority, application Sweden September 11, 1952

9 Claims. (Cl. 259—1)

The present invention relates to rotary vibrators of the type including a circular roller track or race, a roller body serving as the eccentric mass of the vibrator and arranged to roll on the race for the purpose of having a vibratory movement imparted to it due to its eccentric movement relatively to the centre of said race, and a shaft coaxially mounted relatively to said race and coupled to said roller body for imparting, at relative rotational movement between said race and said shaft, a peripherial speed to the roller body at its surface cooperating with the race which is different from that produced by any movement of the race itself.

In previously known forms of such vibrators, the roller body has usually been coupled to the shaft by a spherically mounted pendulum, by a spring element or a flexible shaft, this, however, causing constructional difficulties and necessitating a relatively great axial length of the vibrator set. It has also been proposed to drive the roller body magnetically as a squirrel-cage rotor in an asynchronous electric motor, but this entails a special form of construction for the driving device.

The main object of the present invention is to produce a rotary vibrator which, if necessary, can have a very small axial extension and which, therefore, will be suitable for combination with e. g. an electric driving motor of any suitable type to form a compact vibrator set but which may also be combined with an internal combustion engine or the like. In other words, the advantages of the said type of rotary vibrator may be utilized irrespective of the available form of driving device. As is well known, these advantages consist primarily in the possibility of obtaining practically any desired frequency of vibration with a certain suitable speed of the driving device, by correctly proportioning the roller body in relation to the race. In addition, by means of the invention an increased freedom is obtained in the selection of the frequency, owing to the fact that the frequency can also be varied by making changes in the transmission employed according to the invention between the shaft and the rolling body and by a still freer selection of the diametrical relation between the roller body and the race than is possible in practice in the previously known types.

The invention is mainly characterized in that the shaft is rigid and is coupled to the roller body by a gear-wheel transmission or the like, so that the roller body will act as a planet wheel moving around the shaft. The race is preferably stationary while the shaft is driven, but the opposite arrangement is also conceivable as will be shown later on. The gearwheel transmission may be replaced by a friction transmission or a belt transmission for example if such forms should be found more suitable. However, in general, a tooth engagement between the shaft and roller body is preferred, owing to the freedom from slip, when using said arrangement.

The inventive principle, and the further objects and characteristic features of the invention will be more clearly apparent from the following description of several embodiments of the rotary vibrator according to the

invention as shown diagrammatically on the accompanying drawings, by way of example. In the drawings, all figures show axial sections of the different parts of the rotary vibrators, all said parts being generally of circular cross section.

Fig. 1 shows the end of an electric driving motor which has been combined with a rotary vibrator according to the invention,

Fig. 2 shows an electric motor with a tubular rotor shaft, the said motor being combined with a double vibrator according to the invention,

Fig. 3, Fig. 4 and Fig. 5 show alternative forms of a vibrator according to the invention, in which the shaft is driven and in toothed engagement with the roller body.

Fig. 6 shows a form of construction in which the roller body is in frictional engagement with the shaft.

Fig. 7 shows a vibrator in which the roller body is in driving engagement with the shaft through a belt transmission.

Fig. 8 is a variant of the inventive principle in which the roller track is driven, while the shaft is stationary.

In all the figures the same reference letters are used for the parts which fulfill the same function in the different forms of construction, and more particularly, A is the circular roller track or race, B is the roller body and C is the shaft cooperating with the roller body.

In Fig. 1 the shaft C is driven and consists of the rotor shaft of an electric motor **1** at one end of which the vibrator is fitted. It is obvious that a vibrator of this type may advantageously be arranged also at the other end of the motor **1**. The shaft C is provided at its one end with a gear pinion **2** which meshes with a corresponding gearwheel **3** which is rigidly attached to the centre of the roller body B forming a hub on the roller body which takes the form of a wheel. In order to prevent slip between the roller body B and the race A, the roller body is provided with teeth **4** at its periphery along the edge farthest removed from the motor, these teeth being adapted to cooperate with a preferably interchangeable ring with internal teeth **5** mounted in the vibrator casing. When the shaft C is set in rotation the roller body B will act as a planet wheel moving around the shaft C, whereby vibrations with a frequency other than that of the shaft will be produced.

In the form of construction shown in Fig. 2 the driving device also consists of an electric motor **1**, but in this case the driving shaft C is tubular. The roller body B here consists of two circular discs or wheels **10** each of which is adapted to roll on its race A at each end of the motor **1**, and the wheels **10** are rigidly interconnected by means of a roller shaft **11** which close to each wheel supports a gear pinion **12** which cooperates with an internal gear rim **13** at each end of the tubular driving or motor shaft C. A circular guide pin **14** projects in the form of an extension of the roller shaft **11** beyond each wheel **10**, the said guide pin being adapted to cooperate with a corresponding central pin **15** at the respective end **16** of the vibrator set. These guide pins serve to guide the roller body when the latter is in a position of rest and to maintain the pinions **12** in engagement with the gear rims **13**. When the shaft C rotates during the operation of the motor **1**, a rolling movement is imparted to the roller body B along the race A owing to the transmission of the motion through the gear rims **13** and gear pinions **12** so that a planetary movement is executed by the roller body. If found desirable a similar vibrator arrangement may be driven from a separate driving device, the motor **1** being then replaced by a belt pulley **17** or the like, as indicated in the drawing, and in such a case the distance between the wheels **10** can of course be appreciably reduced and

the transmission of the motion to the roller body B can take place by means of a single gear pinion **12** and a corresponding gear rim **13**.

In Fig. 3 a vibrator device according to the invention is shown which can be employed with advantage in a so-called immersion vibrator. Also in this case the shaft C is driven by a driving motor (not shown) and is concentrically mounted relatively to the race A and the immersion vibrator in general. The shaft C is provided at its one end with a gear pinion **2** which is in engagement with an internal gear rim **20** on the roller body B which, similarly to the roller body in Fig. 1, is shaped as a wheel with a hub **21** projecting from the side opposite to the shaft C, this hub, which cooperates with a fixed guide pin **22** centrally located relatively to the race A, serving to guide the roller body B in its position of rest and to maintain the gear rim **20** in engagement with the gear pinion **2**, when the vibrator is started.

In the modified arrangement shown in Fig. 4 the shaft C, as in Fig. 1, is fitted with a gear pinion **2** at its end, which meshes with a pinion **3** which projects centrally from the side of the roller body B turned towards the shaft C. The roller body B is substantially cup-shaped so that an inner surface thereof rolls against a pin-shaped race A projecting into the roller body, said race being concentric with the shaft C. It is obvious that also in this case the roller body B will execute a planetary movement around the shaft C, but owing to the reversed proportions between the race and roller body in comparison with the form of construction shown in Fig. 1 the ratio between the roller body and the driving shaft will be appreciably changed relatively to that in Fig. 1.

In the form of construction according to Fig. 5 the race A is likewise pin-shaped while the roller body B is cup-shaped and is provided with a central guiding hub **23** which cooperates with the race so that the latter will also function as a guide pin. The roller body B is fitted at its outer periphery with gear teeth **24** and the shaft C is provided at its end with a bowl-shaped extension **25** which surrounds the roller body and the race pin A, internal teeth **26** on the inside of the extension being adapted to cooperate with the teeth **24** and thus drive the roller body when the shaft rotates.

The form of construction according to Fig. 6 shows a vibrator casing with a roller race A through which the driving shaft C runs. The shaft C is fitted with two axially spaced runners **30** located on either side of the race A and having a suitable friction surface. The roller body B which is of such a small diameter that it can roll forward between the race A and the shaft C is provided at each end with a central pin **31**, with which pins the runners **30** on the shaft C make contact so that the roller body B is set in planetary movement by a relative rotation between the shaft and the race A. A tooth engagement can, of course, also be employed here in place of a frictional engagement between the runners **30** and the pins **31** and similarly the roller body B may be provided with teeth which cooperate with corresponding teeth in the race A in order to prevent slip. This applies to all the forms of construction shown. The casing or the shaft may of course be kept stationary.

In Fig. 7 the roller body B consists of a runner wheel with centrally projecting guide pins **32**, **32'** at each end, the latter of which is extended in the direction of the shaft C and is connected to the same by a transmission belt **33** which runs round the pin **32'** and over a driving roller **34** on the shaft C. In order to maintain the roller body B in contact with the race A the guide pin **32** and the outer part of the guide pin **32'** each cooperate with ball bearings **35** and **36**, of which the first-mentioned is mounted on the shaft C. The rotational movement of the shaft C is transmitted to the roller body B through the belt **33** so that the roller body is caused to roll along the race A. If the shaft C is driven in the same direction in Fig. 7 as in the example shown in Fig. 1, the roller body will move around in the opposite direction since the belt will impart the same direction of rotation to it as that of the shaft C. The belt may, of course, be replaced by a chain or the like.

The form of construction according to Fig. 8 differs from the preceding forms primarily by the fact that the race A is here set in rotation, while the shaft C is stationary. The race A is arranged inside a rotating shell **40** mounted on a driving shaft **41** and the roller body B is adapted to roll inside the said shell and is then guided by guide pins **42** at each end, as previously described. The roller body B is fitted with a gear pinion **43** projecting from the side turned away from the driving shaft **41**, this pinion cooperating with an internal gear rim **44** in the cup-shaped stationary shaft C which forms a part of the vibrator casing. By means of friction between the race A and the roller body B the latter is set in rotation by the movement of the race and owing to the engagement between the roller body and the shaft C it will be caused to execute a planetary movement.

As will be seen from the examples given here, the inventive principle may be varied within wide limits from a constructional point of view and consequently the examples referred to must not be regarded as limiting the scope of the invention. It will be immediately obvious to those skilled in the art in what manner the forms of construction shown diagrammatically by way of examples can be converted to practical designs.

What we claim is:

1. A rotary vibrator comprising a circular race, a roller body arranged to roll on said race, thereby generating vibrations, a shaft coaxial with said race, positive means including axially extending hub means coaxially mounted on the roller body for maintaining said roller body in contact with said race, and a transmission coupling between the shaft and the roller body to impart to said roller a peripheral speed at the surface engaging the race which is different from the relative rotational speed of said race and said shaft, the transmission coupling including a rotating driving surface carried by said shaft, and a rotating driven surface carried by said roller body, said driven surface being coaxial with the axis of rotation of said roller body and operatively connected to drive without substantial relative slippage the rotating drive surface carried by said shaft.

2. A rotary vibrator as set forth in claim 1 wherein the transmission coupling comprises a gear wheel transmission between said shaft and said roller body.

3. A rotary vibrator as claimed in claim 1 wherein two coaxial and axially spaced races are provided and wherein said roller body is provided with two spaced bearing surfaces contacting each one of said races.

4. A rotary vibrator as claimed in claim 1 wherein said roller body has a hub-like gear pinion and wherein said shaft has a gear rim with internal teeth meshing with the teeth of said gear pinion of said roller body.

5. A rotary vibrator comprising a circular race, a roller body arranged to roll on said race, thereby generating vibrations, a shaft coaxial with said race, positive means including axially extending hub means coaxially mounted on the roller body for maintaining said roller body in contact with said race, and a transmission coupling between the shaft and the roller body to impart to said roller a peripheral speed at the surface engaging the race which is different from the relative rotational speed of said race and said shaft, said transmission coupling including a rotating surface carried by the shaft, and a rotating surface carried by the roller body and operatively connected to be driven by the rotating surface carried by the shaft without substantial relative slippage, the said transmission coupling between the shaft

and the roller body lying in a plane perpendicular to the axis of rotation of the shaft.

6. A rotary vibrator comprising a housing, a circular race formed therein, a roller body arranged to roll on said race, thereby generating vibrations, a hollow shaft mounted within said housing, said shaft being coaxial with said race, a shaft connected coaxially to the roller body, said shaft disposed internally within the hollow shaft, and a transmission coupling between said hollow shaft and said internally disposed shaft for imparting rolling movement to the roller body.

7. A vibrator as set forth in claim 6 including circular races disposed at both ends of said housing, and roller bodies connected to both ends of said internally disposed shaft.

8. A vibrator as set forth in claim 6 including means for guiding said roller body in a circular orbit.

9. A rotary vibrator comprising a housing, a circular race formed within said housing, a roller body arranged

to roll on said race, thereby generating vibrations, a hollow shaft rotatably mounted within the housing, said shaft being coaxial with said race, gear teeth formed around the internal periphery of said hollow shaft, a shaft mounted coaxially with respect to the roller body, and gear teeth carried by said shaft and adapted to mesh with said gear teeth of the hollow shaft, whereby the rotation of said hollow shaft imparts rolling movement to the roller body.

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