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RESTRAINT MEANS FOR VIBRATOR ROTORS

Filed March 19, 1962

FIG. 1

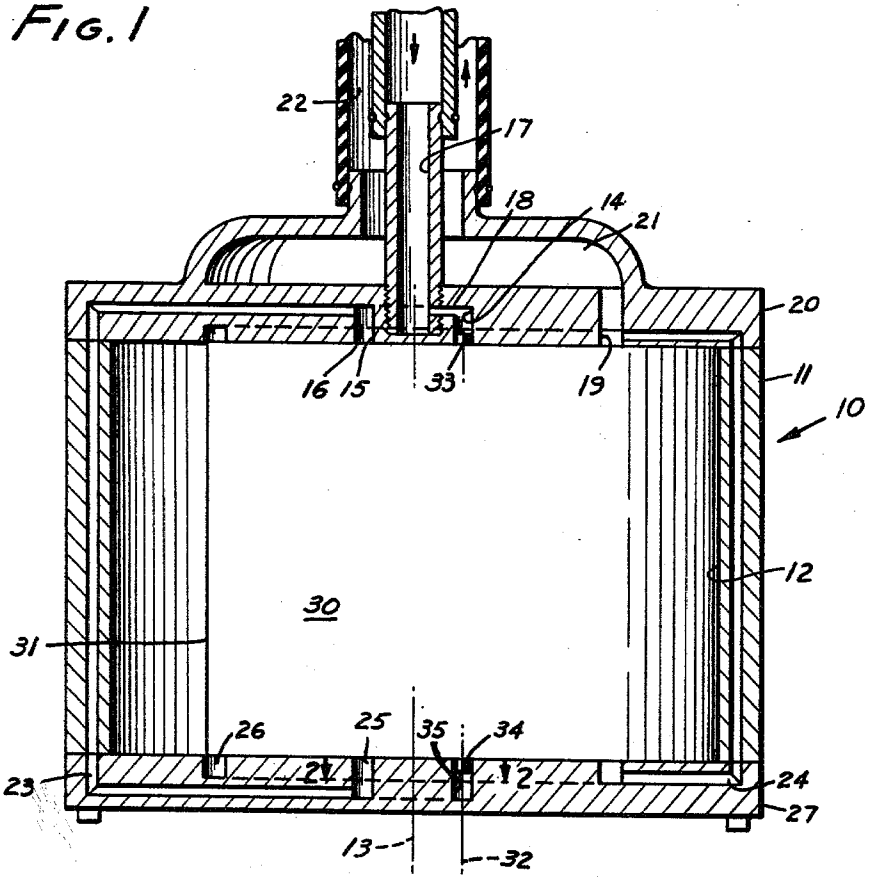


FIG. 2

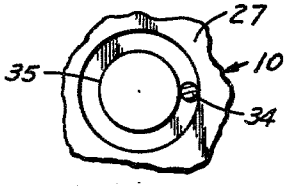


FIG. 3

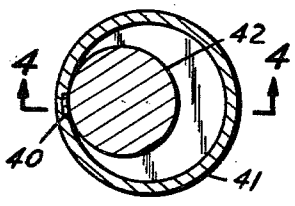
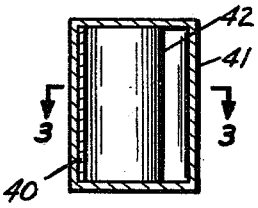


FIG. 4



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RESTRAINT MEANS FOR VIBRATOR ROTORS

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This invention relates to improvements in vibrators of the type which includes a case having an internal unbroken cylindrical race within and against which a rotor of lesser lateral dimensions rolls to create eccentric forces.

Vibrators of the above type are well known and are shown in Malan Patents Nos. 2,187,088; 2,743,090; and 2,891,775; and in Fonteyne Patents Nos. 2,763,472 and 2,967,048. Occasionally difficulty is encountered in starting of vibrators, particularly of the latter-mentioned type. When air is used for the motive fluid, then striking the vibrator against another object will usually cause the vibrator to start. However, when hydraulic liquids are used instead of compressible gases, more difficulty is encountered, because the rotor tends to be held in a central position by an incompressible fluid.

Also, in the latter-mentioned type, there appears to be a null position of the rotor within the race, at which location the rotor becomes centered, and the motive fluid simply blows through the vibrator without causing the rotor to roll inside the race.

It is an object of this invention to provide improvements to vibrators of the free-rotor class which assure the starting of all types of free rotor vibrators, even when using liquids for power, and which improvements also overcome the tendency of some types of vibrators to stop vibrating when immersed in a very stiff medium, such as concrete containing large-sized rocks, and minimum water.

The invention is carried out in a free-rotor vibrator, and comprises means which excludes the rotor from occupying certain central positions within the race, at least at the time of starting.

According to a preferred but optional feature of this invention, the aforesaid means constitutes a pin carried by the rotor which pin describes a circular path during the movement of the rotor and which means also includes a circular wall in the case which prevents the pin from reaching the center of the race.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings, in which:

FIG. 1 is a side elevation, partly in cutaway cross-section, of the presently preferred embodiment of the invention;

FIG. 2 is a cross-section taken at line 2—2 of FIG. 1;

FIG. 3 is a side elevation, partly in cutaway cross-section, of still another embodiment of the invention; and

FIG. 4 is a cross-section taken at line 4—4 of FIG. 3.

FIG. 1 shows a vibrator **10** which includes a case **11** with an internal continuous unbroken cylindrical race **12** which has a central axis **13**. The case also includes a pressure groove **14** having an inner and an outer wall **15**, **16**, respectively. A pressure supply conduit **17** feeds the groove through a side tapped passage **18**.

An annular exhaust groove **19** is also formed in end plate **20** which feeds through passage **21** to an exhaust conduit **22** which is coaxial with the pressure conduit.

Pressure and exhaust conduits **23**, **24**, respectively, are connected to pressure and exhaust grooves **25**, **26**, respectively, in end plate **27**. End plate **27** faces the inside of the race, and, together with the race and end plate **20**, forms a rotor cavity.

A free rotor **30** having a cylindrical exterior bearing surface **31** and a central axis **32** is disposed within the cavity formed by the race between the end plates. It has a lesser diameter than the race, so that it can roll around the inside thereof. As it rotates, its central axis tracks a circle on the end plates.

Means is provided for holding the rotor so that its central axis is excluded from coincidence with the central axis of the end plates. Such means includes pins **33**, **34**, which are disposed on the axis of the rotor at opposite ends thereof. Inner wall **15** of groove **14**, and inner wall **35** of groove **25** prevent the pins from reaching the central axis of the race.

The rotor is powered in the race by means of pressure and exhaust connections to the pressure and exhaust groove and also by the inclusion of vanes which are not shown here. Details of suitable rotor constructions are available in any of the aforesaid patents. The port valving and vane arrangements are of no importance to this invention, because this invention can be carried out in any type of free rotor in which a circular wall can be formed either in the rotor end or the end plate, and in which a pin can be carried by the other to limit the position of the rotor in the race.

Also, the groove need not be also usable as a pressure supply, but instead it could be supplied separately therefrom, depending on the geometry of the ports and passages in the device. Furthermore, it is possible to have all the valving ports at one end plate, and the pin and groove in only one of the other end plates. However, because of the large forces involved, it will ordinarily be found preferable to balance all end loads, and therefore to provide pins at both ends as illustrated.

The embodiments shown in FIGS. 1 and 2 will serve to exclude the rotor from central positions in the cavity at all times including the time of starting. At least in the Malan-type vibrators, there is no tendency for the rotor to centralize itself and stop under even the heaviest of loads when air is used for power. The only starting problem occurs at starting time when liquids are used for power. Therefore, this invention is useful for the Malan-type vibrator principally at the time of starting, when liquids are used for motive power. This invention is useful in other types both at the time of starting and at other times to prevent stoppage under heavy loads, regardless of the type of motive fluid used.

In FIG. 3, there is illustrated an optional means for keeping the rotor from centralizing itself, which is mainly useful in the Malan-type device because it is principally effective at the time of starting. Such means includes an electromagnet **40** in the interior wall of race **41**. The electromagnet is adapted to draw the rotor **42** against it, so that at the time of starting, the rotor will not be in a central position and therefore will be more liable to start. It is considered unnecessary to show means for activating the electromagnet as they are well known. Also, permanent magnets may be used instead of electromagnets, if preferred.

This invention thereby provides means for rendering all types of vibrators more reliably startable and for preventing certain types of vibrators from having their rotors center and stall under heavy loads.

This invention is not to be limited by the embodiments shown in the drawings and described in the description which are given by way of example and not limitation, but only in accordance with the scope of the appended claims.

I claim:

1. In a vibrator of the class which includes a case having an internal unbroken cylindrical race forming part of the boundary of a cavity, said race having a central axis and a rotor unconnected with said case but lying within

the cavity and having an external cylindrical bearing surface of lesser lateral dimensions than the race, the rotor having a central axis continuously parallel to the central axis of the race, the rotor being adapted to roll around in the race by virtue of fluid power exerted thereon, the improvement comprising means for excluding the rotor from occupying a central position in the race at least at the moment of starting the device.

2. Apparatus according to claim 1 in which said cavity is additionally bounded by at least one end plate which lies normal to the said axes, and in which a circular wall is formed therein adjacent to the circle traced by the central axis of said rotor as it rotates around the race, and a pin on the center of that end of the rotor adjacent to said circular wall, the pin axially overlapping the circular wall, and the wall preventing the pin from overlapping the central axis of the race.

3. Apparatus according to claim 1 in which said means comprises magnetic means disposed in the wall of the race, and in which the rotor comprises magnetizable material.

4. Apparatus according to claim 1 in which said cavity is additionally bounded by at least one end plate which lies normal to the said axes, one end face of the rotor being adjacent to said end plate, said end face and end plate comprising relatively slidable elements, a circular wall formed in one of said elements, and an abutment formed on the other of said elements, said wall and abutment axially overlapping each other, and the circular wall preventing the abutment from overlapping the central axis of the race.

5. A vibrator comprising a case which comprises an internal unbroken cylindrical race with a central axis, two end plates attached to the race and lying perpendicular to said central axis, the end plates and race forming an internal cavity, a rotor unconnected with said case but lying within the cavity having a pair of end faces each in sliding contact with a respective end plate, the rotor having an external cylindrical bearing surface of lesser lateral dimensions than the race, the rotor having a central axis which is continuously parallel to the central axis of the race, fluid supply and exhaust ports and pasages in one of the end plates and end faces adapted to valve and supply and exhaust fluids for rolling the rotor around in the cavity in continuous rolling contact with the race, each of said end plates and end faces comprising relatively slidable elements, a circular wall formed in one of said elements at each end of the rotor, and an abutment formed on each of the other of said elements, said walls and abutments axially overlapping each other, and the circular wall preventing the abutments from overlapping the central axis of the race.

6. A vibrator according to claim 5 in which the circular walls are formed in the end plates and in which the abutments comprise ends extending axially from the rotor.

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