

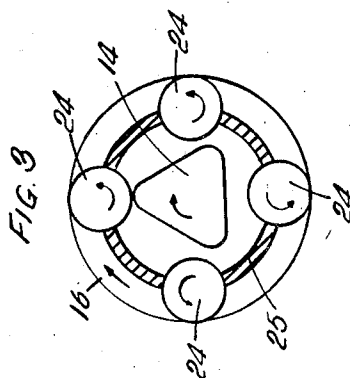
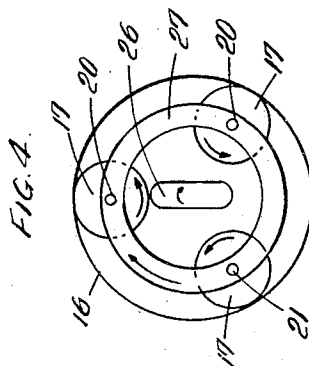
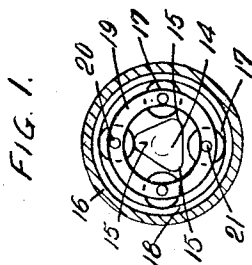
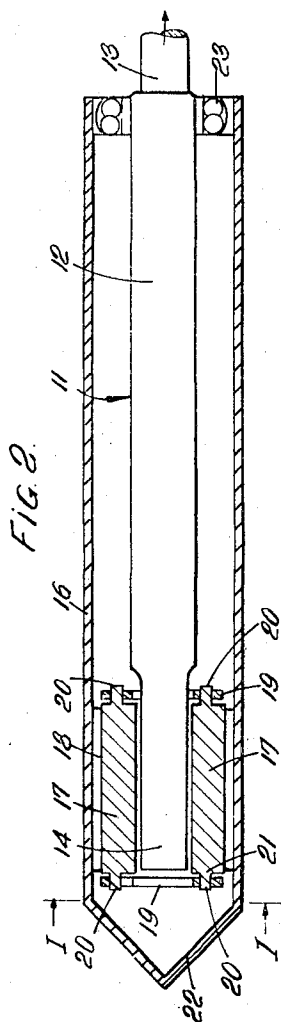
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VIBRATOR

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VIBRATOR

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6 Claims. (Cl. 259—1)

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This invention relates to vibrators—that is to say, to apparatus for originating mechanical vibrations—and its primary object is to provide vibrators having certain advantageous features, particularly the capability of originating vibrations of higher frequencies than those obtainable by known apparatus.

According to the invention, a vibrator comprises an inner member provided with a plurality of protuberances upon its periphery which protuberances are directed outwardly from the longitudinal axis of the said inner member, which inner member is contained loosely in a hollow outer member with whose inner periphery are associated a plurality of impact members which during operation of the vibrator are movable relatively to the said outer member and which form protuberances that are directly inwardly towards the longitudinal axis of the outer member, means being provided to cause such relative motion between the inner member and the outer member as shall constitute virtual rotation of the inner member within the outer member, the arrangement being such that during the said relative motion there occur rapidly repeated impacts between the inner member and the said protuberances movably associated with the outer member, which impacts originate vibrations of the outer member.

Preferably the outermost points upon the protuberances of the said inner member are arranged substantially circumferentially in respect of the longitudinal axis of the inner member, and the innermost points upon the impact members associated with the said outer member are arranged substantially circumferentially in respect of the longitudinal axis of the outer member.

The circumference around which the said outermost points of the inner member are arranged may be slightly larger than the circumferences around which are arranged the said innermost points of the outer member.

According to one embodiment of the invention, the said inner member is a rotor provided with a plurality of lobes which extend radially in respect of the axis of the rotor, are equally spaced each from the next and are of equal radial length. The said outer member is a stationary tubular casing provided with a plurality of impact members arranged circumferentially around the interior surface thereof equally spaced each from the next and movable but not radially displaceable in relation to the said tubular casing, from the longitudinal axis of which casing the

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impact surfaces of the said impact members are equidistant.

The said rotor is not only rotatable in relation to the impact members, but is also capable of oscillating or reciprocating laterally, that is, in directions transverse to its own longitudinal axis.

The arrangement is such that when the rotor is rotated the lobes thereof strike in rapid succession upon the impact members so that the tubular casing is caused to vibrate.

Other features of the invention will be particularly described hereinafter and set forth in the appended claims.

In order that the invention may be clearly understood and readily carried into effect, one embodiment of it will now be fully described with reference to the accompanying drawings, in which—

Figure 1 represents a cross-sectional end elevation of a vibrator, on the line I—I of Figure 2;

Figure 2 represents a cross-sectional front elevation of the same vibrator; and

Figures 3 and 4 are diagrammatic representations of variant forms of vibrator.

In the vibrator according to Figure 1, the inner member takes the form of a rotor 11 which comprises a spindle 12, extended at one end 13 to be connected to suitable means for driving the rotor 11, which must be so connected to the driving means as to be allowed freedom to oscillate laterally. The end 13 may, for example, be associated with a loose flexible connection such as a universal joint. At its opposite extremity the spindle 12 is formed with an operative end 14 which in the present instance is substantially triangular having three rounded corners 15. These rounded corners 15 may be regarded as protuberances or lobes extending from a reduced end portion of the rotor 11. In a slightly developed form of such a rotor the corners or lobes are so rounded as to be cross-sectionally semicircular at the ends, and the hollows between lobes are rounded to concavity.

The rotor 11 is housed within a tubular casing 16 with which the said impact members are associated. In the present instance the impact members are four rollers 17 adapted to roll upon a hardened steel sleeve 18 fitted rigidly within the casing 16. The four rollers 17 are maintained equidistant each from the next and with their axes parallel with the axis of the rotor 11 by means of two locating rings 19, each roller 17 being provided at each end with a small axial gudgeon 20 adapted to fit rotatably into a bear-

ing hole 21 in a locating ring 19, each locating ring 19 being accordingly formed with four bearing holes 21, each equidistant from the next.

The casing 16 is closed at the operative end by a conical closure 22, which may be integral with the casing 16, as illustrated, or be in any suitable manner affixed thereto. At the driving end the casing 16 is closed by a self-aligning ball bearing 23 which supports the spindle 12 in such a manner that the latter is free not only to rotate but also to move slightly out of parallel to the casing 16 in accordance with oscillations of the operative end 14.

The arrangement is such that as the rotor 11 rotates and any corner or lobe 15 makes impact with a certain impact member or roller 17 the rotor is allowed to rebound so as to make impact with another impact member or roller 17 on the opposite side of the tubular casing 16.

By modification of the form of vibrator just described, the outer member may comprise balls instead of rollers, and these balls may be adapted to revolve around the longitudinal axis of the outer member as well as rotating upon axes of their own. It is not an essential feature of the invention that such rollers or balls should revolve as well as rotate—obviously locating means for rotatable rollers or balls could easily be arranged to be fixed in relation to the outer member: it is, however, essential, whether rollers or balls are used, that they be so associated with the outer member as to be movable relatively thereto.

An arrangement in which balls are adapted to rotate and revolve simultaneously is illustrated diagrammatically by Figure 3. Here four balls 24 are arranged to roll upon the inner surface of the tubular casing 16, and are maintained equidistant each from the next by a locating cradle 25, which in this case is a hollow cylinder pierced radially with four holes adapted to hold rotatably the balls 24. The rotor 14 is exactly as that of Figures 1 and 2, and its rotatory and oscillatory function is the same. Regarded in end view, as depicted in Figure 3, if the rotor 14 revolves clockwise as indicated, the balls 24 will revolve counter-clockwise, and by rolling upon the casing 16 they will cause the locating cradle 25 to revolve clockwise.

It may be found practicable to arrange that rollers constituting impact members are power driven.

The invention is not limited to the use of a rotor with only three lobes or an outer member comprising four impact members. Thus a rotor may be of substantially square cross-section and may co-operate with either three or five impact members. It may be found practicable to use a rotor provided with lobes of any number within reason, provided that this number is either more or less than the number of impact members employed.

In Figure 4 is represented diagrammatically a construction in which a two-lobe rotor 26 is adapted to co-operate with three rollers 17 held in place by locating rings 27 which correspond generally to the locating rings 19 of Figures 1 and 2 but are formed with only three bearing holes 21 for the gudgeons 20 of the rollers 17.

It appears that if a three-lobe rotor is used in an outer casing comprising four impact members, the impact members being fixed, then a single complete rotation of the rotor causes twelve separate impacts between the rotor and impact members. If the impact members revolve with the

rotor, the number of impacts per rotation of rotor is somewhat reduced; but by suitably designing the sizes of the various components ten vibrational impulses can be obtained per rotation of rotor. As vibrators in common use produce only one vibrational impulse per rotation of shaft, it follows that by the application of the invention the vibrational frequency obtainable is multiplied by ten. Thus if by stepped-up electric drive the rotor of a vibrator according to the invention is driven at the practicable speed of about 6,000 revolutions per minute, the apparatus will produce vibrations of frequencies of the order of about 60,000 impulses per minute.

It may in some cases be found advantageous to arrange that the said inner member, instead of being a rotor, is fixed, and the said outer member is caused to revolve around it.

The invention is particularly adapted for application to vibrators used in the placing of concrete, in which application high vibrational frequencies are eminently desirable. In this connection a valuable characteristic of a vibrator according to the invention results from the fact that the vibrations produced take the form of abrupt impulses or jerks, with which is associated particularly large acceleration.

An important advantage provided by such an application is that, on account of the floating arrangement of the rotor, which member is connected to the driving shaft through a loose flexible connection, the bearings supporting the driving shaft are not subjected to the destructive stresses of the impacts, as is the case in known forms of concrete vibrator. If balls or rollers are used as impact members they can be of greater diameter and their number or length may be such that the stresses upon them are more widely distributed than in the case of the balls or rollers used in the bearings of the driving shaft. Comparatively, therefore, a vibrator according to the invention is highly economical in upkeep, in addition to possessing the outstanding advantage of providing greatly increased vibrational frequencies.

I claim:

1. A vibrator comprising a casing, a rotor in said casing, said rotor having at least one lobe disposed on its periphery, such lobe extending radially outwards from the longitudinal axis of said rotor, a plurality of impact members disposed within said casing and around the lobed portion of the rotor, and a bearing which supports the said rotor near one end thereof and allows the rotor to be rotated about its longitudinal axis whereby the rotor may whirl transversely of the casing and the said lobe may encounter the impact members and cause the rotor to strike impactively against said members, thereby producing the desired vibration of the casing.

2. A vibrator comprising a rotor, a plurality of lobes formed on a portion thereof, the said lobes projecting radially outwards from the longitudinal axis of said rotor and terminating with rounded contours, a casing housing said rotor, a plurality of impact members within the casing, means for locating said members in positions around the said lobes, said means permitting the impact members to roll on a surface associated with the inner surface of the casing, and a self-aligning bearing which supports the said rotor near one end thereof and allows the rotor to be rotated about its longitudinal axis and whirled transversely of the casing, whereby the said lobes en-

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counter the impact members and cause the rotor to strike impactively against said members, thereby producing the desired vibration of the casing.

3. A vibrator according to claim 2 in which the radially extending extremities of the lobes lie substantially circumferentially around the longitudinal axis of the rotor and the innermost points of the impact members lie substantially circumferentially around the longitudinal axis of the casing.

4. A vibrator according to claim 2, in which the means for locating the impact members in position around the lobes is a cage which is rotatable about the longitudinal axis of the casing and which maintains the said impact members around the said axis at substantially equiangular intervals between adjacent members, and in which the lobes are disposed around the rotor with equiangular intervals between adjacent lobes.

5. A vibrator according to claim 2, in which the impact members are rollers.

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6. A vibrator according to claim 2, in which the impact members are balls.

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