This invention relates to a vibrator and more particularly to improvements in a vibrator mechanism whereby the internal parts are cooled by air streams induced or created by rotating parts of the mechanism.

Those versed in the art are familiar with the aims, functions and purposes of vibrator mechanisms in expediting the movement of fluent material in the material-handling field, and from this it will be appreciated that these mechanisms are subjected to relatively heavy duty service over considerable periods of time. At the same time, it is quite frequently desirable that the vibrator be portable so that it may be moved from object to object or container to container, and for this reason it must be easily handled, which means that its structure must involve a substantial high strength-to-weight ratio. It has been found that the most frequent failures in vibrator mechanisms are those arising from destruction of the bearings and other parts by high temperatures and accordingly it is a specific object of the present invention to provide an improved vibrator mechanism in which means is provided for reducing temperatures to a tolerable level. It is a significant object of the invention to accomplish this by utilizing the rotor or eccentric, together with additional air moving means, for inducing currents of air to flow over the bearings and out of the casing in which the rotor is housed. A still further object is to utilize this air moving means in conjunction with a drive means mounted on and operative to drive the rotor or eccentric. It is a still further object to provide improved mounting means for the drive means and to utilize the bearings for the rotor shaft to provide a substantial portion of the support for the drive shaft, thereby simplifying the construction of the drive means by eliminating at least one of the bearings that would normally be provided therefor. Subsidiary objects reside in the specific design of the present invention which cooperate in providing the improved vibrator.

The foregoing and other important objects and desirable features inherent in and encompassed by the invention will become apparent to those versed in the art as a preferred embodiment thereof is disclosed, by way of example, in the ensuing description and accompanying sheet of drawings, the figures of which are described below.

FIGURE 1 is a sectional view, with portions broken away and other portions shown in elevation, illustrating a typical construction involving the salient features of the invention.

FIGURE 2 is an end view, partly in section, and drawn to a reduced scale, as seen from the left-hand end of FIGURE 1.

FIGURE 3 is an elevation of the bearing ring for the bearing at the left-hand side of FIGURE 1.

FIGURE 4 is an elevation of the bearing ring closure for the bearing ring of FIGURE 3, as seen from the right or inner side thereof.

FIGURE 5 is an elevation of the additional air moving means appearing to the right of the right-hand bearing in FIGURE 1.

FIGURE 6 is an enlarged section on the line 6—6 of FIGURE 2.

The vibrator itself comprises basically wall means making up a casing 10 having first and second spaced apart and generally parallel side walls 11 and 12 which are cross connected by a peripheral wall 13, the upper portion of which is provided with an air outlet opening 14 covered by a screen 15 which is in turn covered by a protective grille 16. The screen 15 protects the interior of the casing against the entrance of dirt and other foreign material and the grille in turn protects the screen against damage from contact with heavy objects.

The wall means embodies relatively high-strength low-weight steel and may be constructed in any suitable manner to assume the shape illustrated; although, other shapes may be utilized. In the present instance, the peripheral wall means continues at the bottom or under side of the casing to afford a base 17 on which is provided means for mounting the vibrator on an object or container to be vibrated. The mounting means here takes the form of a pair of blocks 18 rigidly secured to the wall means as by welding at 19. Each block is bifurcated so as to provide a pair of opposed legs 20 which provide between them a space for receiving a flange or rib on the object to be vibrated. The spaces between the legs of the two blocks are of course aligned in the median plane of the casing 18.

An improved mounting arrangement is illustrated, which exploits the fact that when the two legs are clamped in position, they will tend to spread apart to a limited extent. Therefore, the mounting set screws 21 are arranged on non-parallel or outwardly divergent axes, the arrangement being such that when the two legs 20 spread as the set screws 21 are tightened, the axes of the set screws will ultimately become coaxial. A further improvement in this respect is that each set screw 21 is carried by a relatively hard steel insert 22, which is internally threaded at 23 to receive the respective set screw and which is externally threaded at 24 to be received in a correspondingly threaded tapped bore, which in the present case is preferably tapered so that the insert may take the form of a standard pipe plug. When a set screw or insert wears because of use, it may be readily replaced.

The first wall 11 of the casing has therein a circular central aperture 25 in which is received a bearing-mounting ring 26, which may be welded in place about its periphery. The ring in turn carries a rotating bearing 27, which may be of any conventional anti-friction construction. This bearing is coaxial with a bearing 28 carried by the second side wall 12 by means of a second ring 29 received in an aperture 30 in the second wall. The axis on which the coaxially positioned rings 27 and 28 are located is of course transverse or normal to the planes of the walls 11 and 12. The ring 29 may be secured in place by any suitable means, not material here. These bearings coaxially journal a hollow rotor shaft 31 which has first and second ends 32 and 33, respectively, axially exposed through the centers of the respective bearings 27 and 28. A cap or outer element 34 is mounted externally of the wall 11 in radially overlapping relation to the ring 26, bearing 27 and shaft end 32. This element is preferably circular (FIGURE 4) and is secured in place by cap screws 35 which pass through apertures 36 in the element 34 and into tapped bores 37 in the ring 26. The inner face of the element 34 is provided with a plurality of uniformly circumferentially or annularly spaced spacers or bosses 38, each in the area of a bolt hole 36. This provides at the inner face of the element 34 a plurality of arcuately shaped spaces 39 which respectively correspond to the number of openings 40 in the annulus of the ring 26. Therefore, the spaces 39 and openings 40 provide a plurality of air inlet openings leading to the interior of the casing. These air inlets are in surrounding relationship to the bearing 27 and in relatively close proximity thereto. At the same time, the element 34 locates the bearing 27...
against outward displacement and also protects the end 32 of the shaft 31. The shaft 31 serves to carry, within the casing 10 and between the bearings 27 and 28, a rotor designated in its entirety by the numeral 41, the hub of which spaces the bearings 27 and 28 apart. A snap ring 42 locates the outer race ring of the second or right-hand bearing 28. The rotor 41 in this case is of novel construction, in that it combines a weight portion and air moving means. In the present instance, the rotor is of integral cast construction and the weight portion, which is eccentric to the shaft axis, is shown at 43 and the air moving means comprise a plurality of radial arms in the form of vanes or blades. Two of the vanes, as at 44, are formed integrally at angular extremes of the weight portion 43 and two additional vanes, as at 45, are diametrically opposed to the vanes 44. In other words, the weight 43 is located between a pair of neighboring vanes (here 44).

The purpose of the eccentrically located weight is of course to establish vibratory forces as the rotor 41 rotates within the casing, the casing being of course secured to an object to be vibrated and rotation being imparted to the rotor by suitable means, a representative example of which will be described subsequently. At the same time, the air moving means as represented by the vanes 44 and 45 will create a current of air which enters the interior of the casing at the left-hand side thereof through the inlets or passage means established at 39-40, this air exiting through the peripheral wall screened outlet 14. As the cool air is drawn in through the passage means 39-40 it is of course flowing proximate to the peripheral ring of the bearing 27, thereby effecting a reduction in temperature of this bearing. In addition to the outlet at 14, the peripheral wall 13 may be provided with additional outlets as at 46 (FIGURE 2).

Additional movement of air through the right-hand side of the casing is accomplished by the provision in the right-hand wall 12 of a plurality of air inlet openings 47, which openings are preferably arranged in a circle radially outwardly of the right-hand or second bearing ring 29. Air drawn inward through these openings enters the casing to cool the bearing 28 and to exit through the casing outlets 14 and 46. The movement of air is represented by the arrows in FIGURE 1. Since the openings 47 and 39-40 are radially inwardly of the shafts 31 and 41, the low pressure area in the casing will exist in proximity to the shaft and rotor, thereby efficiently effecting a reduction in temperature of the bearings.

It is another feature of the invention to provide an improved mounting for drive means for rotating the rotor 41 and in so doing in conjunction the already described air moving means associated with additional means for cooling not only the bearings 27 and 28 but also the internal parts of the drive means.

For purposes of representative illustration, there is shown, as the drive means, an electric motor, including a cylindrical housing 48, a right-hand outer end cap 49, a remote bearing 50, an armature 51, a field at 52 and a drive shaft at 53. The end cap 49 is centrally formed to receive the bearing 50 which in turn journals the remote or outer end of the drive shaft 53. The shaft 51 for the rotor being shown, telescopically receives the left-hand end of the drive shaft 53 and the two are appropriately interconnected for rotation in unison as via a driving key 54. A snap ring 55 is used at the right-hand end of the rotor shaft for locating the inner race ring of the bearing 28. One advantage of this construction is that there may be omitted from the motor an inter-bearthing that would otherwise extend adjacent to the left-hand end of the shaft 53, and instead the shaft 53 is carried solely by the rotor shaft and the outer or remote bearing 50, the end cap 49 being located relative to the housing 48 in a coaxially or concentric manner which is facilitated by the provision of an intervening cup-shaped mounting member 56 for mounting the drive means on the right-hand side wall of the casing 10.

The mounting member 56 has an annular rim or flange 57 and a central plate 60 which is provided with a central relatively large circular aperture or opening 59. A spacer ring 61 is interposed between the outer surface of the side wall 12 and the inner surface of the member rim 57 and the mounting member 56 is rigidly secured to the side wall via the spacer 60 and the plurality of cap screws 62. The member 56 may be peripherally welded or otherwise rigidly secured to the side wall 12, which thus enables the ring to provide not only the tapped bores for the cap screws 62 but also to provide reinforcement for the wall 12. The outer wall 58 of the member 56 may be thickened at circumferentially spaced intervals, as at 63, and these portions have tapped bores therein which receive relatively long screws 63 for securing the end cap 49 in place with the housing 48 axially compressed between the end cap and the mount 56. In a preferred construction, it is desirable to provide an arrangement of this type so that when the cap screws 63 are removed, the end cap 49 and housing may be removed to expose the drive shaft and its armature.

To provide for the circulation of cooling air through the housing 48 and over the bearing 50 as well as over the armature 51 and field 52, the housing 48 is peripherally pierced about its outer wall 13 to create a flow of cooling air over the bearings for the rotor, as well as over the bearing or bearings for drive means.
associated with the vibrator. It will be further seen that the improved arrangement incorporates a novel mounting for the drive means as well as novel and improved means for augmenting the circulation of cooling air. Features and advantages other than those enumerated will readily occur to those versed in the art, as will many modifications in the preferred embodiment disclosed, all of which may be achieved without departure from the spirit and scope of the invention.

What is claimed is:

1. Vibrator mechanism of the class described, comprising: a casing having wall means including first and second spaced apart side walls; first and second bearings respectively in the side walls and relatively closely coaxially spaced apart on an axis generally normal to said side walls; a shaft coaxially journaled in the bearings and having a portion exposed axially through the center of the second bearing; each of said side walls having an air inlet opening therein proximate to its bearing and said wall means having an air outlet opening therein radially outwardly of said inlet openings; and a rotor carried by the shaft within the casing between the bearings and having a weight portion eccentric to the shaft axis for causing vibratory forces during rotation thereof, said rotor including air moving means thereon in addition to the weight portion and of an axial width but slightly less than the axial spacing of the bearings; for causing air to enter the casing via said inlet openings and to leave the casing via said outlet openings.

2. The invention defined in claim 1, including: a cup-like member secured to the second wall externally thereof and having an outer wall spaced outwardly from said second wall, the interior of said member providing a chamber surrounding the exposed portion of the shaft and being of sufficient area to overtake and communicate with the second wall inlet opening, said outer wall having an opening therein leading to said chamber whereby said rotor and air moving means draws air through said outer wall opening and into the chamber and thence through said second wall inlet opening.

3. The invention defined in claim 2, including: additional air moving means within the chamber and connected to the shaft at the exposed portion thereof for rotation therewith.

4. The invention defined in claim 3, in which: the outer wall opening is relatively radially close to the shaft axis, the second wall inlet opening is relatively radially remote from the shaft axis, and said additional air moving means has vanes therein operative to move incoming air radially outwardly in the chamber for entry into said second wall inlet opening.

5. Vibrator mechanism of the class described, comprising: a casing having wall means including first and second spaced apart side walls; first and second bearings respectively in the side walls and relatively closely coaxially spaced apart on an axis generally normal to said side walls; a shaft coaxially journaled in the bearings and having a portion exposed axially through the center of the second bearing; each of said side walls having an air inlet opening therein proximate to its bearing and said wall means having an air outlet opening therein radially outwardly of said inlet openings; and a rotor carried by the shaft within the casing between the bearings and having a weight portion eccentric to the shaft axis for causing vibratory forces during rotation thereof, said rotor including air moving means thereon in addition to the weight portion and of an axial width but slightly less than the axial spacing of the bearings; for causing air to enter the casing via said inlet openings and to leave the casing via said outlet openings.

6. Vibrator mechanism of the class described, comprising: a casing having wall means including first and second spaced apart side walls; first and second bearings respectively in the side walls and relatively closely coaxially spaced apart on an axis generally normal to said side walls; a shaft coaxially journaled in the bearings and having a portion exposed axially through the center of the second bearing; each of said side walls having an air inlet opening therein proximate to its bearing and said wall means having an air outlet opening therein radially outwardly of said inlet openings; and a rotor carried by the shaft within the casing between the bearings and having a weight portion eccentric to the shaft axis for causing vibratory forces during rotation thereof, said rotor including air moving means thereon in addition to the weight portion and of an axial width but slightly less than the axial spacing of the bearings; for causing air to enter the casing via said inlet openings and to leave the casing via said outlet openings.
moving means operative to draw air in at the first wall via the passage means and first ring opening and at the second wall via the housing inlets, outer wall opening, chamber and second wall opening for exit through the air outlet.

9. The invention defined in claim 8, including: additional air moving means in the chamber and connected to one of the shafts for rotation therewith to expeditiously movement of air into the chamber from the housing and out of the chamber and into the casing via the second wall opening.

10. The invention defined in claim 8, including: a covering of filter material surrounding the housing in the area of the housing air inlets.

11. The invention defined in claim 8, in which: the rotor shaft is axially hollow and the drive shaft is telescopically received in the rotor shaft and is supported solely by said rotor shaft and said third bearing.

12. The invention defined in claim 8, in which: the air moving means on the rotor includes a plurality of angularly spaced radial vanes and the weight means is located between a pair of neighboring vanes.

13. Vibrator mechanism of the class described, comprising: housing wall means including first and second spaced apart side walls, each side wall having a circular bearing-mounting aperture and said apertures being coaxial on an axis transverse to the side walls, said second side wall having an opening therein radially outwardly of its aperture and said wall means having an air outlet therein radially outwardly of said apertures and said second side wall opening, first and second bearing-mounting rings coaxially received respectively in the apertures, said first ring having an axially directed through opening in its annulus; first and second annular bearings carried respectively by the first and second rings; a rotor shaft coaxially carried by the bearings and having first and second ends exposed respectively at the first and second bearings; a closure mounted externally of the first wall in radially overlapping relation to the first ring, first bearing and first end of the shaft and having passage means therein leading to the aforesaid opening in the first ring; a cup-like member mounted externally of the second wall in radially overlapping relation to the second wall opening, second bearing and second ring and the second end of the shaft and having an outer wall spaced outwardly from said second wall, said member providing a chamber leading to the second wall opening and said outer wall having a central opening substantially larger than and concentric with said second end of the shaft; and a rotor within the casing and carried by the rotor shaft for rotation therewith, said rotor including weight means eccentric to the shaft for creating vibratory forces and air moving means operable to draw air in at the first wall via the passage means and first ring opening and at the second wall via the outer wall opening, chamber and second wall opening for exit through the air outlet.

14. The invention defined in claim 13, including: additional air moving means in the chamber and connected to the shaft for rotation therewith to expeditiously movement of air through the chamber and into the casing via the second wall opening.

15. The invention defined in claim 13, in which: the air moving means on the rotor includes a plurality of angularly spaced radial vanes and the weight means is located between a pair of neighboring vanes.

16. Vibrator mechanism of the class described, comprising: a casing having wall means including first and second spaced apart side walls, each side wall having a circular bearing-mounting aperture and said apertures being coaxial on an axis transverse to the side walls, said second side wall having an air passage therethrough, and said wall means having an air outlet therein radially outwardly of said apertures and said second side wall opening, first and second bearing-mounting rings coaxially received respectively in the apertures, first and second annular bearings carried respectively by the first and second rings; a rotor shaft coaxially carried by the bearings and having one end exposed axially at the second wall via the second bearing; a drive means externally of the casing and including a housing mounted on the second wall and extending axially outwardly therefrom, said housing having an axially opening inner portion proximate to said second wall and of such radial dimensions as to overlap and to axially communicate with the second wall opening, second bearing and said end of the rotor shaft and said housing further having an end bearing coaxially outwardly remote from said second bearing, a relatively elongated drive shaft having an outer end supported in and journaled by said end bearing and an inner end coaxially connected to and supported by said end of the rotor shaft exclusively of further support from the casing or housing, and said housing having air inlets therein for leading air into the housing; and a rotor within the casing and carried by the rotor shaft for rotation therewith, said rotor including weight means eccentric to the shaft for creating vibratory forces and air moving means operable to draw air in through the housing inlets and axially inwardly of the housing and into the casing via said second wall opening for exit through the casing outlet.

17. Vibrator mechanism of the class described, comprising: a casing having wall means including first and second spaced apart side walls, each side wall having a circular bearing-mounting aperture and said apertures being coaxial on an axis transverse to the side walls, said second side wall having an air passage therethrough, and said wall means having an air outlet therein radially outwardly of said apertures and said second side wall opening, first and second bearing-mounting rings coaxially received respectively in the apertures, first and second annular bearings carried respectively by the first and second rings; a rotor shaft coaxially carried by the bearings and having one end exposed axially at the second wall via the second bearing; an electric motor externally of the casing and including a housing mounted on the second wall and extending axially outwardly therefrom, said housing having an axially opening inner portion proximate to said second wall and of such radial dimensions as to overlap and to axially communicate with the second wall opening, second bearing and said end of the rotor shaft and said housing further having an end bearing coaxially outwardly remote from said second bearing, a relatively elongated drive shaft having an outer end supported in and journaled by said end bearing and an inner end coaxially connected to and supported by said end of the rotor shaft exclusively of further support from the casing or housing and an armature between said ends, and said housing having air inlets therein for leading air into the housing; and a rotor within the casing and carried by the rotor shaft for rotation therewith, said rotor including weight means eccentric to the shaft for creating vibratory forces and air moving means operable to draw air in through the housing inlets and axially inwardly of the housing and over the armature and into the casing via said second wall opening for exit through the casing outlet.

18. The invention defined in claim 17, including: impeller means coaxially carried by and for rotation with the rotor shaft closely axially outwardly of the second wall and surrounded by said inner portion of the housing for expeditiously the flow of air into the housing and through the housing and into the casing.

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