

[54] **VIBRATORY APPARATUS**

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[57] **ABSTRACT**

The specification discloses a vibratory apparatus comprising a fixed base, a vibratory frame arranged for vibration with respect to the fixed base and mounting means for mounting the vibratory frame on the fixed base, the mounting means comprising at least one elongate member upstanding from the fixed base, the member being attached by means of a block of resilient material at its lower end to the fixed base, and being attached by means of a further block of resilient material at its upper end to the vibratory frame, the blocks of resilient material being arranged to allow the vibratory frame to vibrate horizontally, vertically or a combination thereof.

7 Claims, 2 Drawing Figures

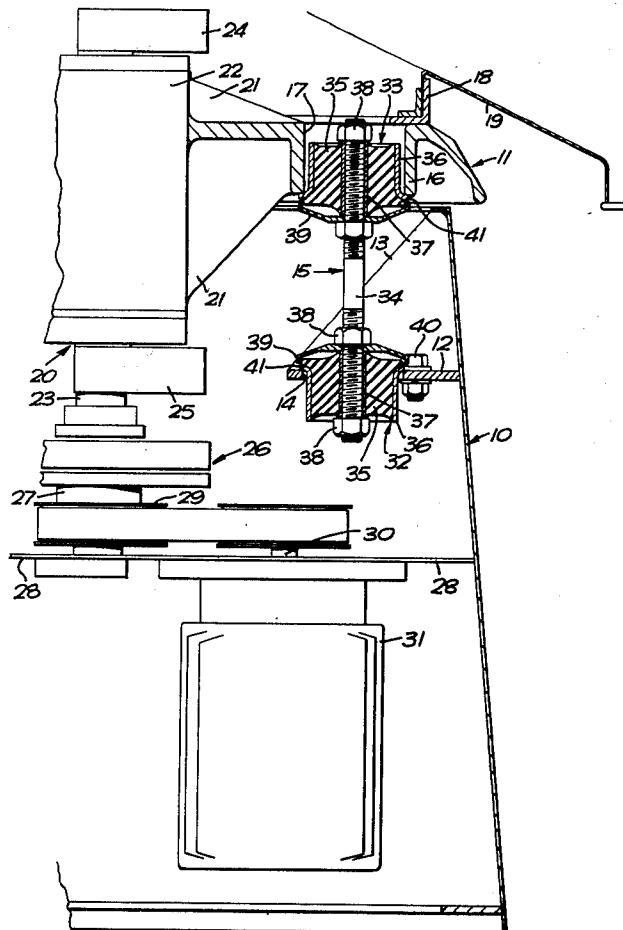
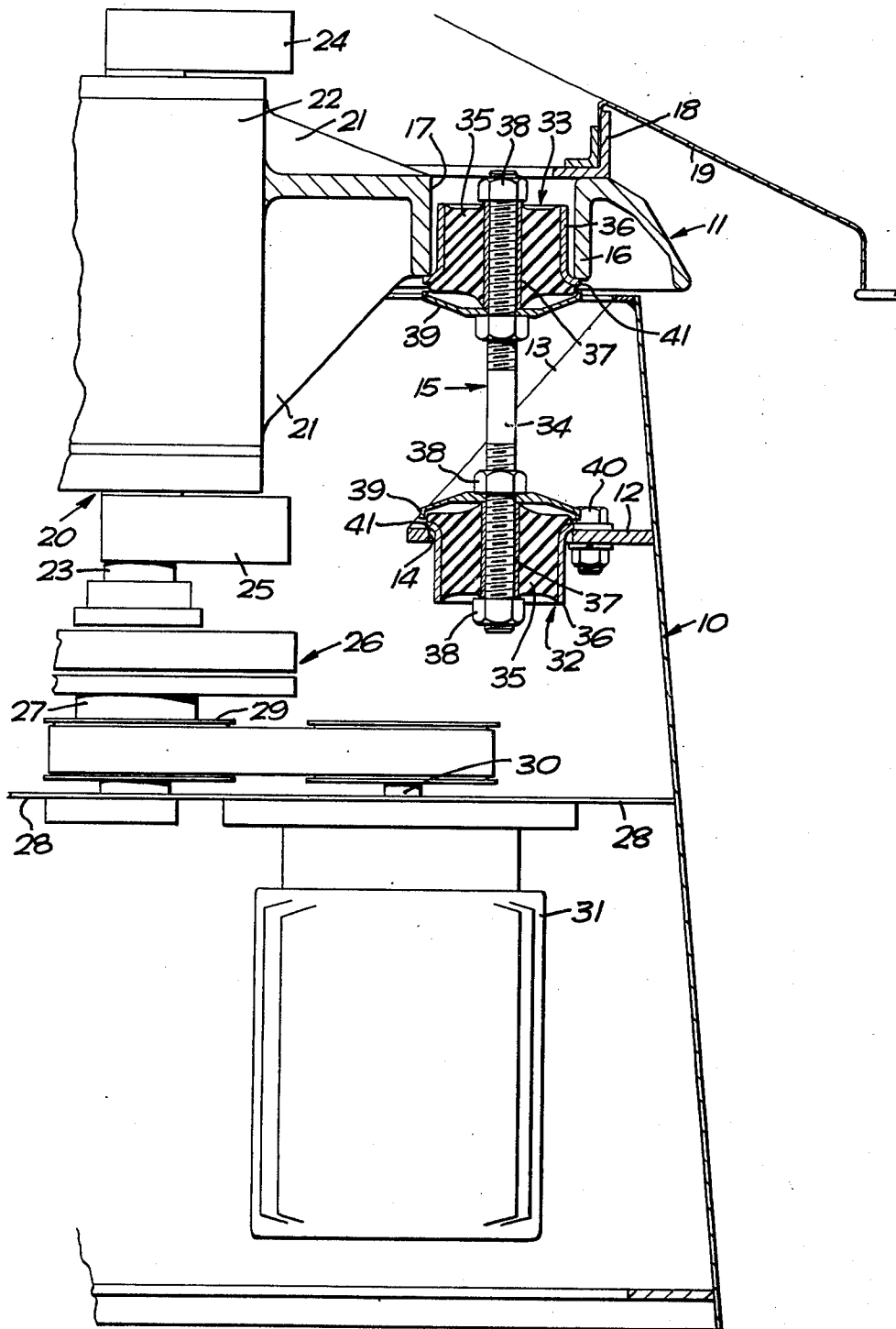
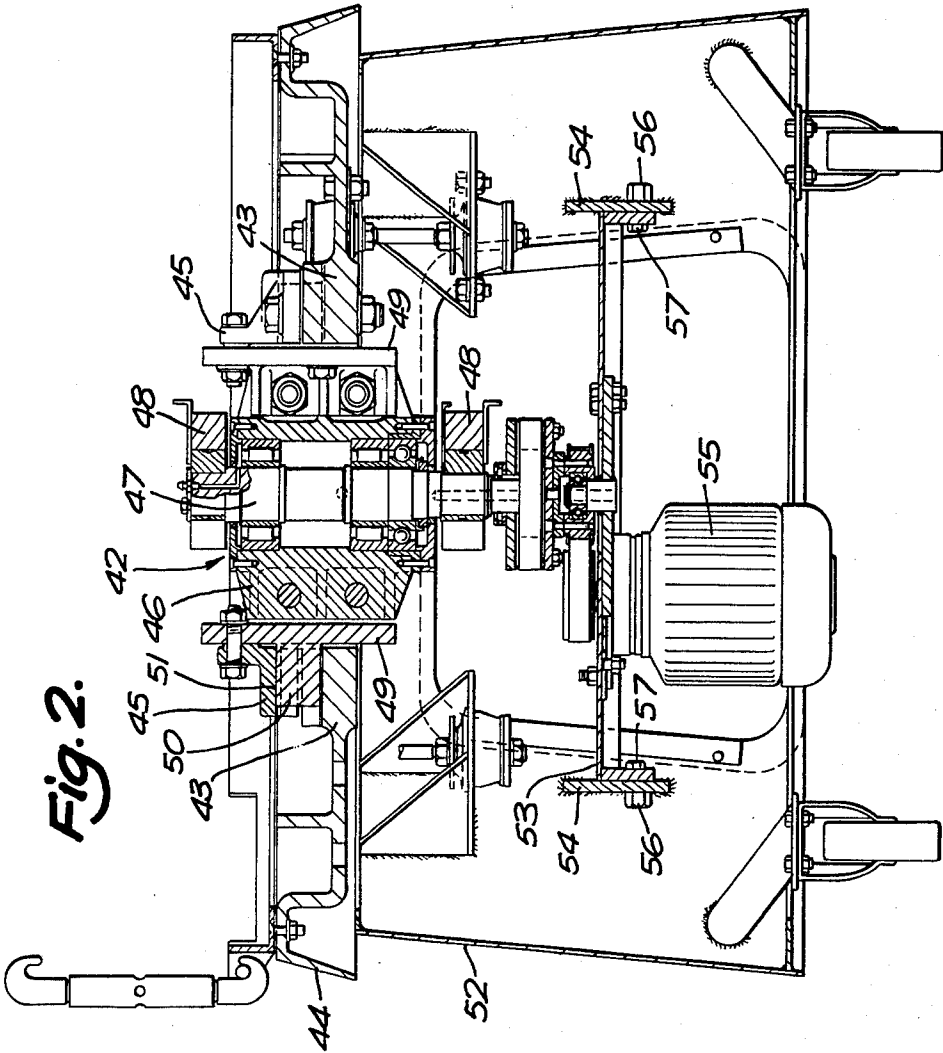


Fig. 1.





VIBRATORY APPARATUS

BACKGROUND OF THE INVENTION

The invention relates to all kinds of vibratory apparatus, such as vibration sieves, strainers, ball mills, shaking tables, ore concentrators, devices for shaking and packing powders in containers, and other like apparatus.

Suspension rod mountings for a vibratory frame in which the upper ends of the rods are located at the upper end of tubular extensions upstanding from the base and the lower ends of the rods are carried by legs downwardly depending from the vibratory frame are known. However although these arrangements are suitable for gyratory vibrations in a horizontal plane they cannot accommodate the large vertical components of vibration necessary for achieving better scrolling of oversize materials and throughputs required on more recent vibratory apparatus.

The object of the invention is to provide a vibratory apparatus having an improved mounting arrangement for the vibratory frame on the fixed base.

SUMMARY OF THE INVENTION

The invention provides a vibratory apparatus comprising a fixed base, a vibratory frame arranged for vibration with respect to the fixed base and mounting means for mounting the vibratory frame on the fixed base, the mounting means comprising at least one elongate member upstanding from the fixed base, the member being attached by means of a block of resilient material at its lower end to the fixed base, and being attached by means of a further block of resilient material at its upper end to the vibratory frame, the blocks of resilient material being arranged to allow the vibratory frame to vibrate horizontally, vertically or a combination thereof.

The block of resilient material and/or the further block of resilient material may comprise a bushing of an elastomeric material.

Each bushing may have a bore through which the end of the respective member is attached, the outer surface of the bushing being attached to the associated base or vibratory frame as the case may be.

The bore of the bushing may be of uniform cross-section, and may be bonded to a cylindrical sleeve, the elongate member passing through and attached to the sleeve.

Alternatively, the bore of each bushing may be tapered, and a tapered sleeve may be bonded to the bore of the bushing, the elongate member passing through and attached to the tapered sleeve. In the last described arrangement, it is preferred that the tapered bores of the two bushings at opposed ends of the elongate member are arranged to taper inwardly towards the adjacent free end of the associated member.

Preferably means are provided to vibrate the vibratory frame horizontally, vertically or a combination thereof.

The means for vibrating the vibratory frame may comprise at least one out-of-balance weight mounted for rotation on the vibratory frame, there being means to rotate the or each out-of-balance weight.

The means for vibrating the vibratory frame may be located within the periphery of the vibratory frame.

Three or more mounting means may be provided and arranged in a spaced apart relationship around the periphery of the vibratory frame.

A vibratory apparatus according to the invention has the advantage over known suspension rod support arrangements that the mounting points are closer to the points of usage so that the top of each rod is mounted directly on the vibratory frame without the need for long suspension legs and the lower end of the rod is mounted directly on the base with the need of tubular extension members. Furthermore, the resilient bushings permit the absorption of greater vertical components of vibration and the length of the rod permits the absorption of the horizontal gyratory vibrations and the very large low frequency resonance vibrations when stopping and starting the larger machines now in operation.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a vertical sectional view through part of a vibratory sieve embodying the invention; and

FIG. 2 is a side view partly in section of a second embodiment.

DESCRIPTION

The sieve comprises a fixed base 10 having a vibratory frame 11 supported on the fixed base. The fixed base 10 is generally annular, and has an inwardly directed horizontally disposed flange 12 attached to the wall of the base adjacent the upper end thereof. Bracing plates 13 are attached to the wall of the fixed base and to the flange 12 in order to restrain the flange against movement relative to the base. The flange 12 has a plurality of spaced apart holes 14 therearound, in which are located mounting means 15 (described in detail below) for the vibratory frame 11.

The vibratory frame 11 comprises a generally annular member 16 having formed therein a plurality of spaced apart apertures 17 in which the mounting means 15 are also being located. Support brackets 18 are attached to the upper side of the annular member 16, and support a sieve, only the discharge spout 19 of which is shown.

An outer balance weight vibrator assembly 20 is located centrally within the annular member 16 by means of webs 21 attached to a housing 22 in which is rotatably mounted a shaft 23 carrying out-of-balance weights 24 and 25. The lower end of the shaft 23 carries one half of a resilient coupling 26, the other half of the coupling being provided on the upper end of a stub shaft 27 rotatably supported on a member 28 forming part of the fixed base 10. The stub shaft 27 also carries a pulley 29 which is connected by means of a belt to a further pulley 30 provided on the end of the shaft 30 of an electric motor 31, the electric motor also being clamped to the member 28. The resilient coupling 26 is capable of transmitting drive from the stub shaft 27 to the shaft 23 when the two shafts are coaxial, eccentric, at an angle to one another, moving relatively vertically, or any combination of these.

As mentioned above, the vibratory frame 11 is connected to the fixed base 10 by means of a plurality of mounting means 15, each mounting means being located in one of the holes 14 in the flange 12, and in an associated aperture 17 in the annular member 16 of the vibratory frame 11. Each mounting means 15 comprises two rubber bushings 32 and 33, bushing 32 being

mounted in a hole 14 and bushing 33 being mounted in an aperture 17, the two bushings being connected together by means of a support rod 34. Each bushing 32 or 33 comprises a block of rubber 35 bonded to an external sleeve 36 and to a cylindrical internal sleeve 37. The support rod 34 passes through the internal sleeve 37 of the associated two bushings 32 and 33, and is attached rigidly thereto by means of two nuts 38 screwed on to threaded parts of the support rod 34. The two bushings are positioned such that a flange 41 provided on each of the sleeves 36 face one another and engage the respective flange 12 or annular member 16. Dished washers 39 are located on the support rod between the innermost nuts 38 and the associated internal sleeve 37. The upper and lower bushings 32 and 33 are clamped to the flange 12 and annular member 16 respectively by means of a nut and bolt 40, which is shown only on the lower bushing 32.

In use, the out-of-balance weights 24 and 25 may be adjusted so that the vibratory frame tends to vibrate with a "scrolling" action, i.e. so that it vibrates simultaneously both horizontally and vertically. The mounting means 15 allow the vibratory frame to vibrate relative to the base 10 horizontally, vertically, or a combination thereof.

It will be appreciated that the bushing 32 and 33 need not have the form shown in the drawings, and may have alternatively, for example, a tapered internal sleeve bonded in a rubber block having a tapered bore. The tapers of the two bushings of each support means 15 may be opposed to one another and this arrangement may give advantageous results. The use of more resilient bushings 32 or 33 will allow the vibratory frame to vibrate with a greater vertical component vibration, and the length of the support rod 34 may be adjusted, or the support rod 34 replaced by a rod of different length, to permit absorption of horizontal gyratory vibrations and the very large low frequency resonance vibrations which occur when stopping and starting such an apparatus. Since the centre of the vibrating mass of the out-of-balance weight assembly is low and is located between the mounting means 15, the tendency for the vibratory frame 11 to buckle sideways is very small, and the mounting means 15 have adequate sideways stability to withstand the overturning couple on the rods 34.

FIG. 2 shows a second arrangement which is similar to the embodiment of FIG. 1 except that the out-of-balance weight assembly 42 is mounted for adjustment about a horizontal axis, so that the amplitude of the vertical component of vibration may be adjusted with respect to the horizontal component.

In this embodiment two diametrically opposed radially inwardly extending brackets 43 are provided on the annular member 44 of the vibratory frame. Angle trunnion brackets 49 are attached to the upper side of the brackets 43 respectively, and are clamped to the vibratory frame by a pair of clamp brackets 45.

The housing 46, which carries a shaft 47 on which the out-of-balance weights 48 are mounted, is located between the pairs of brackets 49. The housing 46 has opposite vertical faces which abut against portions of the trunnion brackets 49 and trunnion pins 50 which project from the trunnion brackets 49 and locate in horizontally disposed bores 51 provided in the extended brackets 43 and clamp brackets 45. The opposed faces of trunnion brackets 49 and the extended

brackets 43 and clamp brackets 45 have a plurality of holes arranged on a common pitch circle about the axis of the pins 50 so that the housing can be adjusted about that axis and located in any one of a number of positions about that axis.

The base 52 of the vibratory apparatus has a swinging frame 53 which is mounted on brackets 54 on the base for pivotal movement about the same axis as the trunnions 50 about which the out-of-balance weight assembly may be adjusted. An electric motor 55 for driving the out-of-balance weight assembly is mounted on the frame.

The opposed faces of the frame 53 and the brackets 54 are provided with corresponding arcuate slots centred on the aforesaid horizontal axis. Bolts 56 extend through the slots and the frame 53 can be clamped to the brackets 54 in any desired position by nuts 57 which are screwed onto the projecting ends of the bolts.

We claim:

1. A vibratory apparatus comprising a base, a vibratory frame superimposed on the base, and means for mounting the frame on the base for vibration with respect thereto, which means is provided by a plurality of mounting devices each located between the frame and the base, and comprising a pair of opposed elastomeric bushes which are spaced from one another at a substantial distance and are secured by their outer peripheries one to the frame and the other to the base, an elongate member extending in a generally vertical direction between the bushes, the lower end of the member being attached to the bush secured to the base and the upper end of the member being attached to the bush secured to the frame, whereby the bushes can deform in shear to accommodate large vertical components of vibration and whereby the elongate member acts as a lever extending between the bushes to permit the absorption of large movement of the frame relative to the base with the bushes being subjected to only relatively small deflections, each bushing having a bore in which the respective end of the corresponding member is secured and the bore of the bushing being of uniform cross-section and being bonded to a cylindrical sleeve, the elongate member passing through and being secured in the sleeve.

2. A vibratory apparatus as claimed in claim 1 wherein means are provided to vibrate the vibratory frame horizontally, vertically or a combination thereof.

3. A vibratory apparatus as claimed in claim 1 wherein means for vibrating the vibratory frame comprise at least one out-of-balance weight mounted for rotation on the vibratory frame, there being means to rotate the or each out-of-balance weight.

4. A vibratory apparatus as claimed in claim 3 wherein the means for vibrating the vibratory frame are located within the periphery of the vibratory frame.

5. A vibratory apparatus as claimed in claim 1 wherein three or more mounting devices are provided and are arranged in a spaced apart relationship around the periphery of the vibratory frame.

6. A vibratory apparatus comprising a base, a vibratory frame superimposed on the base, and means for mounting the frame on the base for vibration with respect thereto, which means is provided by a plurality of mounting devices each located between the frame and the base, and comprising a pair of opposed elastomeric bushes which are spaced from one another at a substan-

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tial distance and are secured by their outer peripheries one to the frame and the other to the base, an elongate member extending in a generally vertical direction between the bushes, the lower end of the member being attached to the bush secured to the base and the upper end of the member being attached to the bush secured to the frame, whereby the bushes can deform in shear to accommodate large vertical components of vibration and whereby the elongate member acts as a lever extending between the bushes to permit the absorption of large movement of the frame relative to the base with the bushes being subjected to only relatively small de-

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flections, each bushing having a bore in which the respective end of the corresponding member is secured and the bore of each bushing being tapered, and a tapered sleeve being bonded to the bore of the bushing, the elongate member passing through and being secured in the tapered sleeve.

7. A vibratory apparatus as claimed in claim 6 wherein the tapered bores of the two bushings at opposed ends of the elongate member are arranged to taper inwardly towards the adjacent free end of the associated member.

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