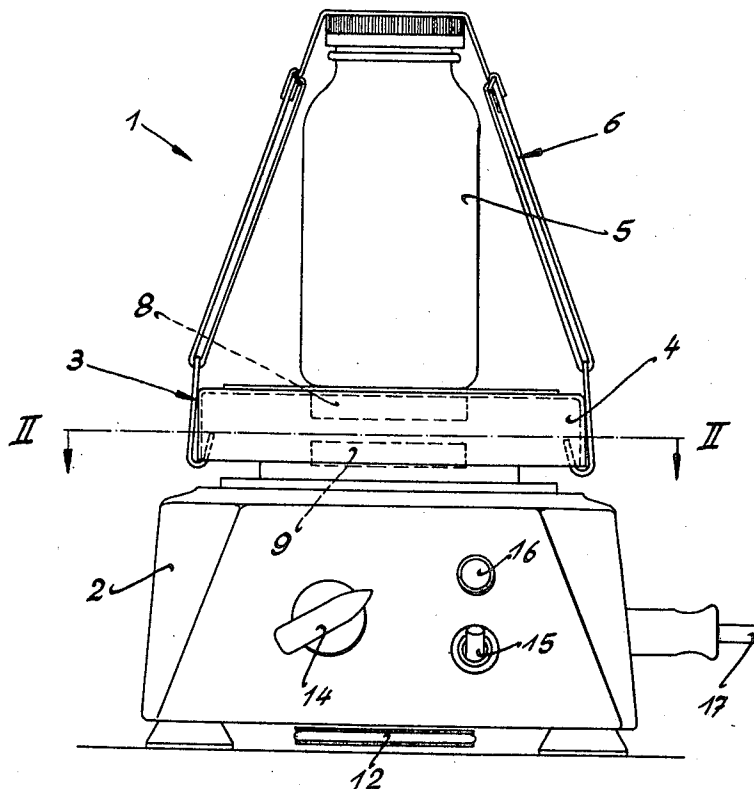


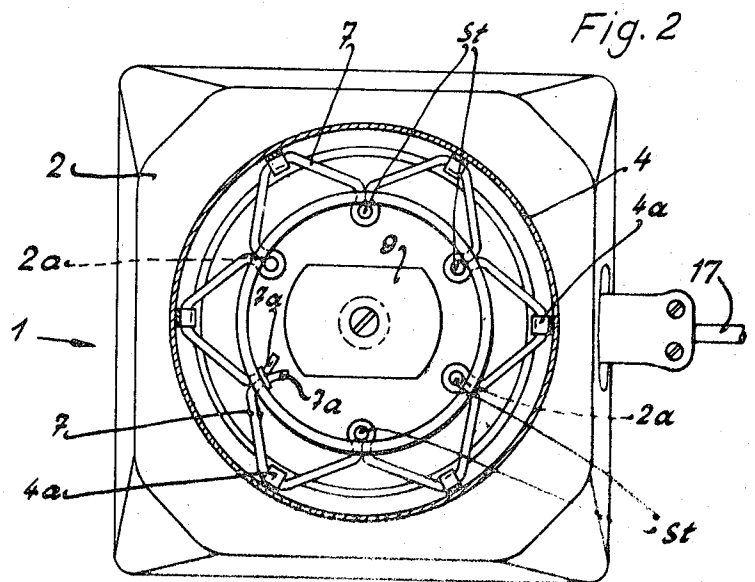
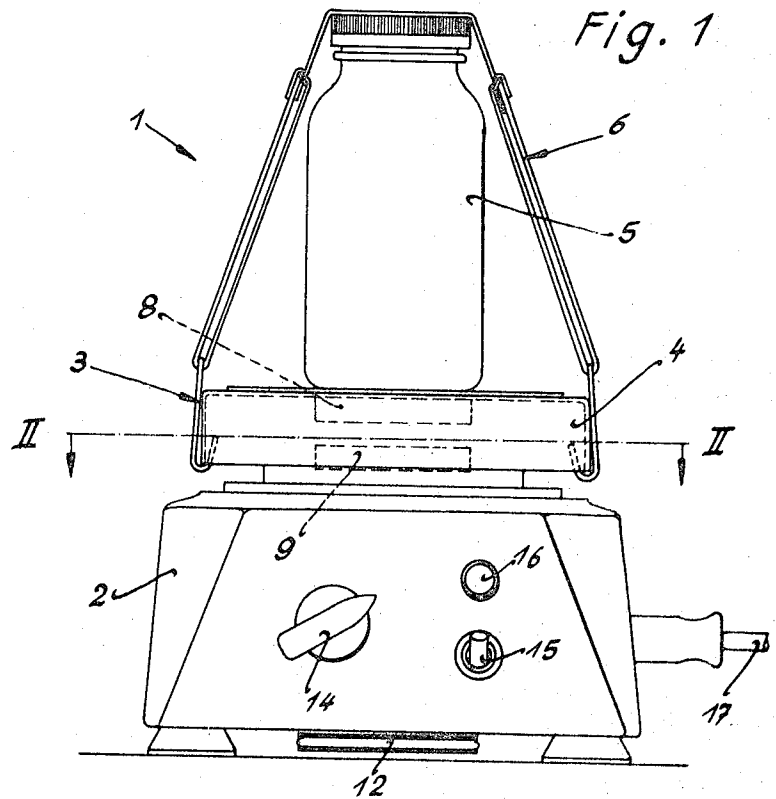
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 [22] Filed **Jan. 16, 1968**
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 [32] Priority **Jan. 17, 1967, May 5, 1967, April 24, 1967**
 [33] **Germany**
 [31] **38,877, 12,816 and 43,916**

[56] **References Cited**
UNITED STATES PATENTS
 2,945,682 7/1960 Hollingsworth 259/81
 2,875,989 3/1959 Toulmin 259/72
 3,184,222 5/1965 Aronowitz 259/72
 3,304,990 2/1967 Ontko 233/26
 3,352,311 11/1967 Murphy 259/72
 3,353,796 11/1967 Roberts 259/72
Primary Examiner—Robert W. Jenkins
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[54] **VIBRATOR OR SHAKER**
4 Claims, 13 Drawing Figs.
 [52] U.S. Cl. 259/72
 [51] Int. Cl. B01f 11/00
 [50] Field of Search 259/72, 73,
 75, 81, 91, 54, 55, 56; 233/26

ABSTRACT: This invention provides a vibrator or shaker comprising a pedestal, support means resiliently suspended in said pedestal, fixing means for rigidly locating a material that is to be vibrated on said support means, and means for applying a deflecting force to said support means which cyclically varies at a frequency controllable to generate resonant vibrations of the vibratory system constituted by said resiliently suspended support means and said vibrated material located thereon.





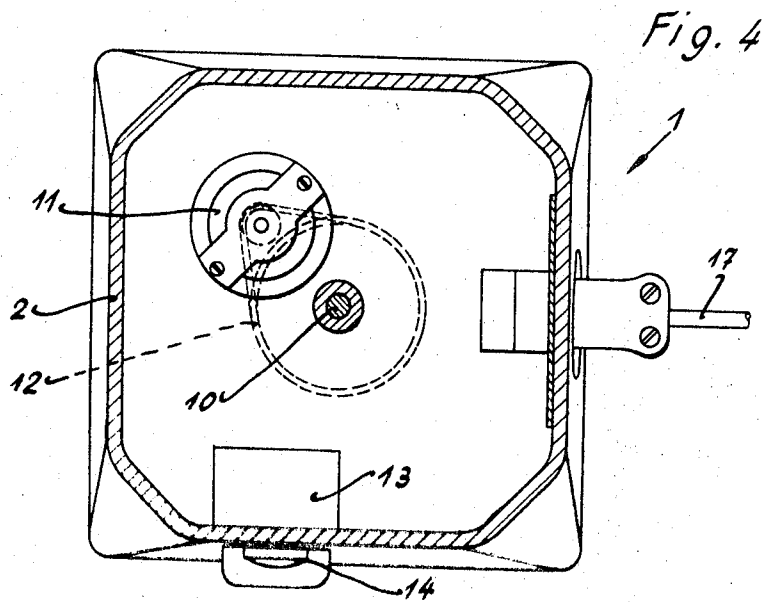
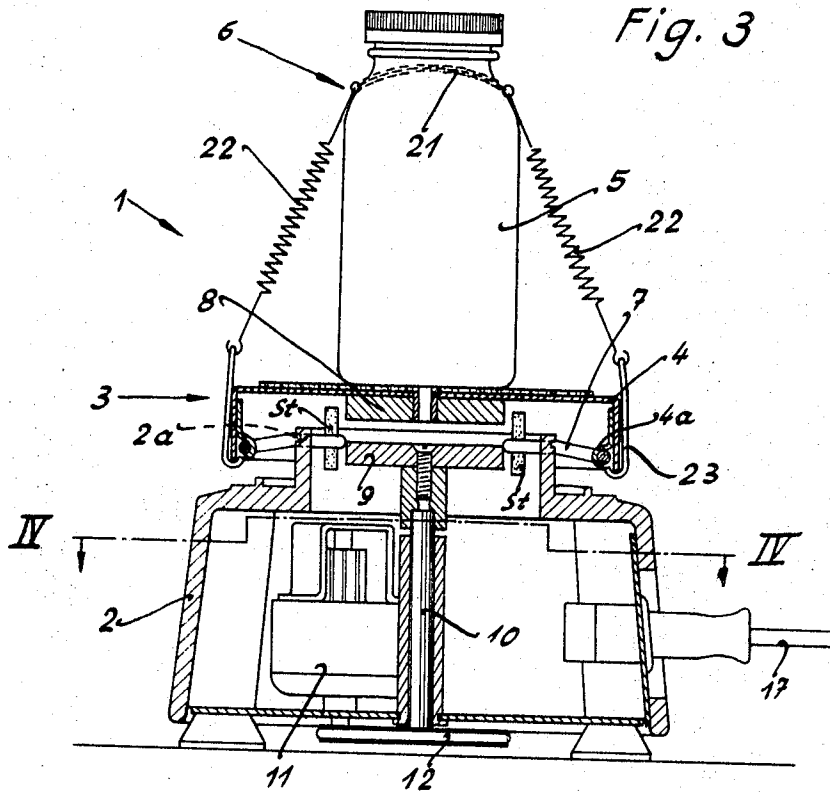


Fig. 5

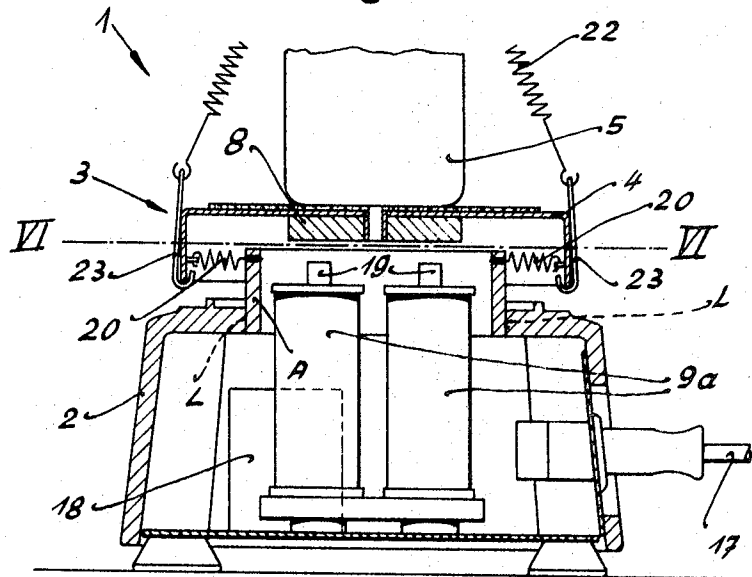
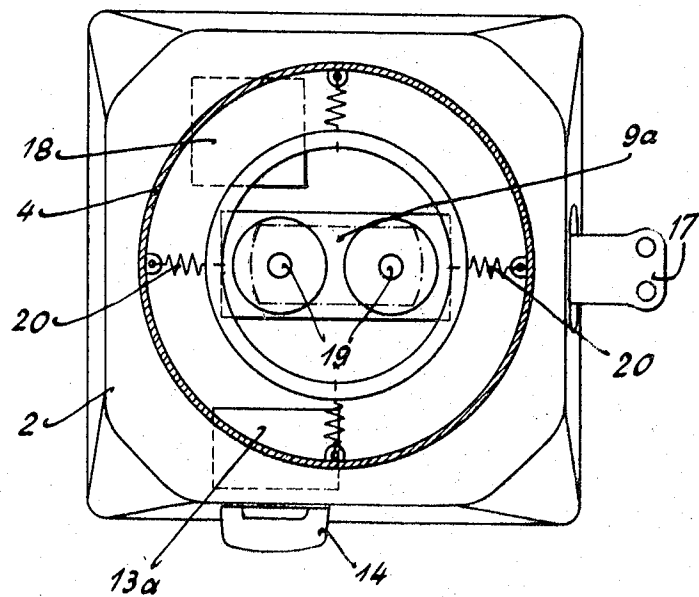


Fig. 6



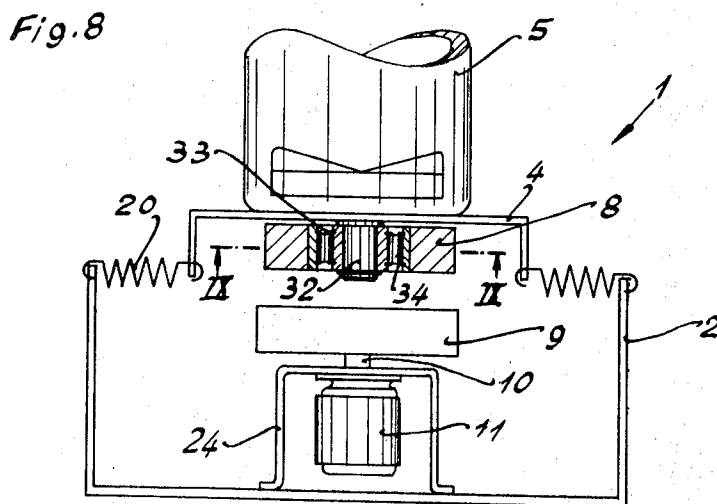
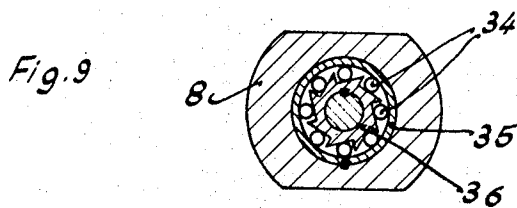
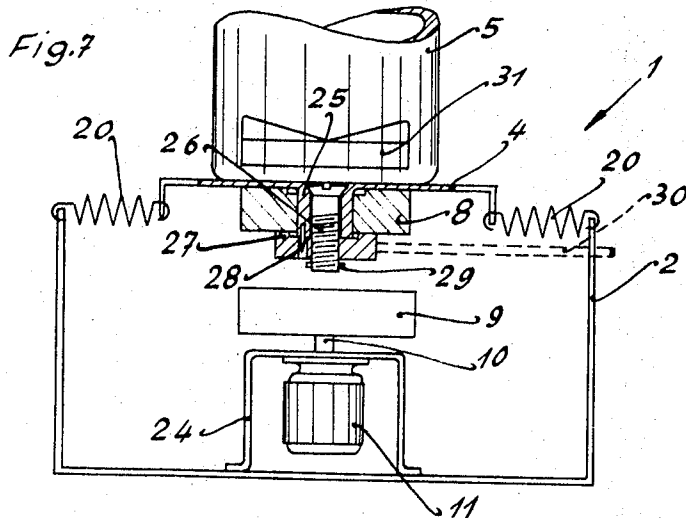


Fig. 10

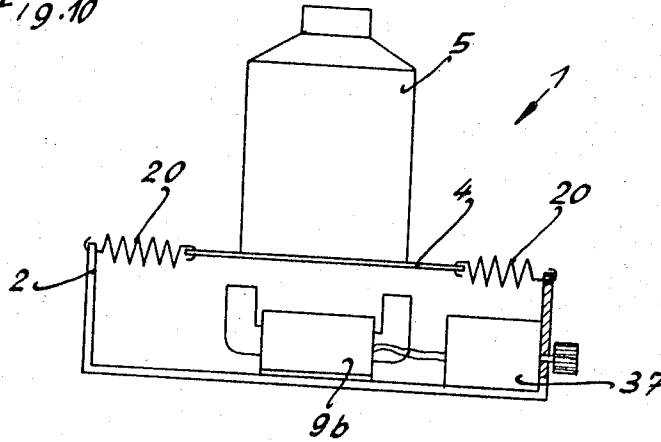


Fig. 11

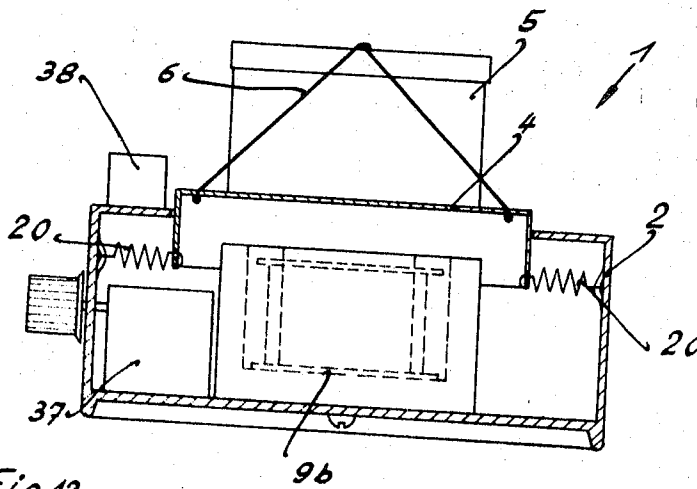


Fig. 12

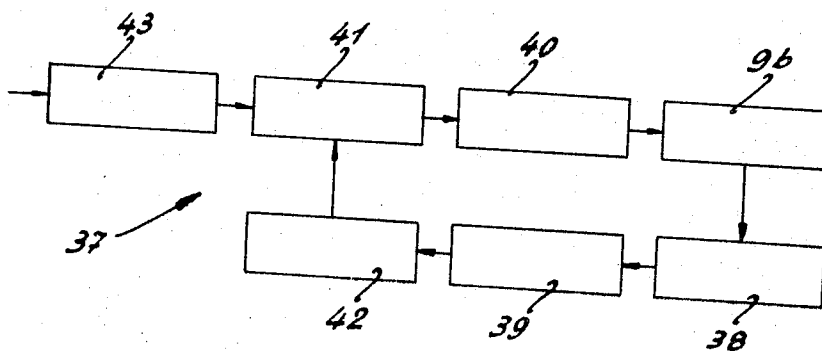
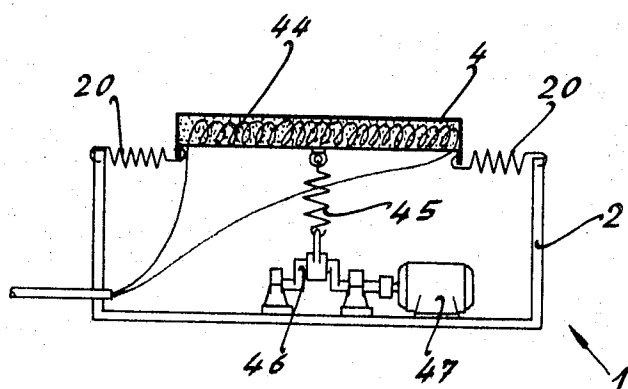


Fig. 13



VIBRATOR OR SHAKER

BACKGROUND OF THE INVENTION

This invention relates to a shaker or vibrator comprising support means for the material that is to be vibrated.

Such vibrators are needed for thoroughly mixing solutions, suspensions, loose flowable bulk materials and so forth. Conventional vibrators perform a horizontal reciprocatory movement generated by eccentrics, push rods or cable and chain drives. Hydraulically and pneumatically operated vibrators are likewise known in the art. Usually these comprise rigid transmission means for applying a vibratory drive to the support means that are to be shaken. In such vibrators the entire mass of the vibrated material and of the vessel containing the same must first be accelerated in one direction, decelerated and stopped and then reaccelerated again in the opposite direction and so forth. Drive means developing considerable power are needed to overcome the resultant inertial forces. Another major drawback of such vibrators is that the transmission of the drive by rigid mechanical elements limits the amplitude of vibratory motion. Moreover, costly and heavy forms of constructions are needed for the transmission of the vibratory motion because of the magnitude of the inertial forces that are involved.

In another known type of vibrator the vibratory motion is generated by electromagnetic means. However, the frequency of vibration is exactly determined and can be varied only within the narrowest limits. The power requirements are disproportionately high for achieving the desired vibratory effect. Frequently such apparatus merely generates vibratory motions of very small amplitude.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a shaker or vibrator of the specified kind in which a relatively low input power is capable of producing a satisfactory vibratory effect, in other words to provide a vibrator of greatly improved efficiency.

Another object of the invention is to eliminate the need for rigid transmission members and thereby to reduce wear and noise to a minimum.

Yet another object of the invention is so to contrive the vibrator that it can be used not only for shaking but also for stirring liquids of flowable solid materials.

Finally, it is an object of the invention to provide a vibrator which besides shaking and stirring can also heat the vibrated or stirred material and keep it at a desired temperature level during vibration.

For achieving these objects the vibrator proposed by the present invention substantially comprises a pedestal, support means resiliently suspended in said pedestal, fixing means for rigidly locating a material that is to be vibrated on said support means, and means for applying a deflecting force to said support means which cyclically varies at a frequency controllable to generate resonant vibrations of the vibratory system constituted by said resiliently suspended support means and said vibrated material located thereon.

The resilient suspension of the support means permits the latter to be excited to vibrate at its natural frequency, provided the frequency of the exciting force is kept in step with this natural frequency. Under resonant conditions a very high vibratory output can be achieved with a very small input. In a preferred form of construction such a vibrator may comprise magnet means for applying a cyclically changing exciting force to said support means. The use of magnetic forces for this purpose has the advantage that it eliminates the need for mechanical transmission members between the drive and the vibrating system.

Moreover, the vibratory system may be resiliently suspended to vibrate substantially in the vertical. The vibratory system in the context of the specification is understood to comprise said support means and its suspension as well as the material that is to be vibrated and the means for locating the

material on said support means. A suspension which is adapted to permit vertical vibratory motion of the support means has the advantage of being particularly easy to provide and of permitting material such as a liquid to be fixed and located on the support means in the most convenient way.

In a useful embodiment of the invention the resiliently suspended support means may contain a ferromagnetic material responsive to the field of an exciting magnet in proximity with said support means, and control means may be provided for controlling the magnetic field, the purpose of the control means being to vary the magnetic field in such a way that deflecting forces can be cyclically applied to the support means at a desired rate. By so controlling the periodicity of change of the magnetic field, that it is in step with the natural frequency of the vibratory system, the desired conditions of resonance can be established and an efficient vibratory effect achieved by a low input power which need merely be sufficient to overcome the natural damping of the vibrating masses. The effect of varying mass of the vibrated material upon the natural frequency of the vibratory system can be readily compensated by suitably adjusting the control means.

A particularly useful and simple embodiment of the proposed vibrator comprises a first magnet directly and rigidly affixed to said resiliently suspended support means, an exciting magnet rotatably mounted in close proximity with and parallel to said first magnet and drive means for rotating said rotatable magnet. The term parallel in this context is understood to mean that the two magnets are so mounted that rotation of the exciting magnet alternately brings poles of like and opposed polarity of said two magnets into cooperating juxtaposition. Hence rotation of the exciting magnet causes a cyclic variation of the magnetic field which reverses its direction at the frequency of rotation of the rotating magnet.

The exciting magnet may be driven by a controllably variable speed motor which will permit the periodicity of the driving force to be conveniently adjusted to bring it into step with the natural frequency of the vibratory system, like and unlike poles cooperating alternately to apply forces of attraction and repulsion to the mounting means. Owing to the resilient suspension of the mounting means the latter can thus be excited to swing up and down at the natural frequency of the vibrating system.

Hence a preferred embodiment of the invention may comprise a support means in the form of a resiliently suspended horizontal mounting plate, a first magnet in the form of a bar magnet rigidly affixed to the underside of said mounting plate, and an exciting magnet in the form of a bar magnet of the same shape and configuration as said first magnet so mounted that rotation of said exciting magnet alternately brings poles of like and opposed polarity of said two magnets into cooperating juxtaposition. If desired the mounting plate and fixing means could be replaced by a resiliently suspended container for the vibrated material, and the first magnet could be directly affixed to said container. In such forms of construction the downward pull exerted on the vibrating system when unlike poles of the two magnets attract each other will be augmented by the pull of gravity, whereas the upward thrust when like poles of the magnets repel each other will be assisted by the restoring pull of the resilient suspension. The speed of the driving motor should then be so adjusted that the consecutive pulls and thrusts are in step with the natural frequency of the resiliently suspended vibratory system. Wear due to the action of inertial forces generated in the vibrating system is nearly completely absent in a vibrator of the above proposed kind. Moreover, the vibratory motion is generated and proceeds substantially without the creation of noise.

In a particularly useful further development of the above described vibrator the first magnet may be optionally releasable for rotation underneath said support means. So long as this magnet remains fixed, a vibratory motion will be imparted to the vibratory system as already described. However, when it is released for rotation it will be entrained by magnetic coupling by the rotating exciting magnet underneath. The two magnets

together will then generate an intensified rotating magnetic field. This can be conveniently used for stirring a liquid or like material in a container on the mounting plate by inserting a freely rotatable magnet into the container roughly parallel to the two magnets under the mounting plate. The magnet inside the container will likewise participate in the rotation of the two latter magnets and thus stir the contents of the container without the necessity of providing a mechanical drive means. The provision of an optionally releasable first magnet on the underside of the mounting plate thus permits the vibrator to be optionally also used as a stirrer.

The exciting magnet may with advantage be an electromagnet and the first magnet on the underside of the mounting plate may likewise be an electromagnet.

In such a case a modified form of construction of the proposed vibrator may comprise a stationary electromagnet to serve as the exciting magnet and electrical or electronic means associated with a controller for cyclically reversing the polarity of the exciting magnet which cooperates with a magnet affixed to the mounting plate. Alternatively the mounting means may consist of a ferromagnetic material in which case a cyclic increase and decrease of the intensity of the magnetic field will already be sufficient to attract and release the mounting means and to cause it to build up vibrations in its resilient suspension.

For instance, the mounting means may have the form of a mounting plate made of soft iron which responds to the field of the electromagnet. The latter will then periodically attract and release the resiliently suspended soft iron plate to which the material that is to be vibrated is firmly attached. The vibratory motion which can thus be built up is thus transmitted to the material. The amplitude as well as the frequency of the intensity variations of the magnetic field may both be adjustable by control means associated with the electromagnet. With advantage the preferably electronic control means may be adapted to generate and maintain the frequency of the magnetic field variations in step with the natural frequency of the vibrated system. It may be an advantage to provide the mounting plate with heating means, since it is often desirable to heat a vibrated material such as a liquid or to maintain it at a given temperature whilst it is being vibrated for the purpose of reducing its viscosity to a level at which vibration will be fully effective. The heating means may be built into the mounting plate or attachable thereto.

Finally, the principal advantage of the proposed vibrator will still be secured if the forces applied to the vibrating system are transmitted thereto by elastic mechanical transmitting means. An elastic transmission is still capable of transmitting cyclically varying forces in such a way that the frequency of the latter can be brought into step with the natural frequency of the vibratory system to achieve maximum vibratory output with a minimum input energy. In a preferred arrangement of this kind at least one spring extending in the direction of deflection may be attached to the mounting plate and a cyclically varying force applied to the free end of said spring, the frequency of said latter force being varied until it is in tune with the natural frequency of the system.

It might be mentioned that forces for building up a vibration or natural frequency may also be applied by periodical impact. Such impact forces may have a desirable indirect effect on the material that is to be vibrated or stirred.

BRIEF DESCRIPTION OF THE DRAWINGS

Several preferred embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

FIG. 1 is a side elevational view of a vibrator according to the invention, comprising mounting means in the form of a horizontally suspended plate;

FIG. 2 is a section taken on the line II-II of FIG. 1;

FIG. 3 is a vertical longitudinal section of the vibrator according to FIG. 1;

FIG. 4 is a cross section thereof taken on the line IV-IV of FIG. 3;

FIG. 5 is a longitudinal section of another embodiment comprising a fixed exciting electromagnet;

FIG. 6 is a schematic cross section taken on the line VI-VI of FIG. 5;

FIGS. 7 and 8 are two further embodiments of a vibrator according to the invention;

FIG. 9 is a section taken on the line IX-IX of FIG. 8;

FIG. 10 is a side elevation of a vibrator according to the invention provided with an electronically controlled electromagnet;

FIG. 11 is a cross section of a vibrator according to FIG. 10 comprising a slightly modified mounting means;

FIG. 12 is a schematic representation in block form of electronic control means for the electromagnet; and

FIG. 13 is a vibrator provided with heating means and a mounting plate that can be excited to vibrate by a rotating crank connected thereto by a spring.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A shaker and vibrator generally indicated by the reference numeral 1—hereinafter referred to as a vibrator—comprises mounting means 3 resiliently suspended on a pedestal 2. The mounting means 3 consists of a horizontally disposed mounting plate 4 and a harness 6 for holding and securely locating a vessel 5 that is to be vibrated. In the embodiment according to FIG. 1 the harness has the form of an elastic strap which passes over the top of the vessel 5 and which is attached to the mounting plate 4 by hooks.

As shown in FIGS. 2 and 3, the resilient suspension of the mounting plate 4 in the illustrated embodiment comprises a rubber ring 7 formed by joining together the ends 7a of an elastic rubber cord. The rubber cord 7 is pushed alternately into openings 2a in the pedestal 2 and threaded through hooks 4a on the mounting plate 4. The loops of the cord 7 that project through the openings are held in position by pins 8 transversely passed through the loops.

Attached to the underside of the circular mounting plate 4 roughly in the center thereof is a magnet 8 which has the form of a relatively broad bar magnet. Directly below this magnet 8 and parallel thereto is an exciting magnet 9 of approximately the same shape and size as the magnet 8. The exciting magnet 9 is mounted on the freely projecting end of a shaft 10 which is driven by an electric motor 11 through a belt transmission 12 or the like.

When the electric motor 11 and the exciting magnet 9 rotate, like and unlike poles of the two magnets 8 and 9 are carried alternately into juxtaposition. Consequently the resiliently suspended mounting means 3 will be alternately pulled roughly vertically downwards and pushed vertically upwards by the cyclic attraction and repulsion between the poles of the two magnets. In other words, the interaction of the magnetic forces generates a vibratory motion.

The speed of the electric motor is continuously adjustable by a regulator 13 which may be a potentiometer controlled by a rotatable knob 14. The frequency of the cyclic attraction and repulsion can thus be varied until this is in step with the natural frequency of vibration of the system comprising the mounting means 3, the vessel 5 and its contents. In FIGS. 1 and 3 the poles of the magnets 8 and 9 are shown at the instant of vertical register and their mutual attraction or repulsion will therefore at this instant be a maximum. The maximum vibratory effect naturally occurs at the point of resonance, but by varying the speed of the electric motor 11 the system can be made to vibrate at less than the maximum possible amplitude.

Instead of providing a particular transmission ratio by the provision of a belt 12 between the electric motor 11 and the rotatable exciting magnet 9, the latter may also be directly mounted on the output shaft of the electric motor 11, in which case the motor 11 in the illustrated embodiment would be located roughly in the center of the pedestal 2. It should be

mentioned that the two magnets 8 and 9 which in the drawing are represented to be permanent magnets could be replaced by two electromagnets. In FIG. 1 a tumbler switch 15 is fitted into the side of the pedestal for switching the vibrator on and off. The reference numeral 16 denotes a warning light which comes on when the apparatus is in operation. The necessary current is supplied from the side by cable and plug 17.

FIGS. 5 and 6 illustrate a modified embodiment of the proposed vibrator 1. In this embodiment the electric motor 11 is replaced by an electrically or electronically operable pole-reversing device 18 which cyclically reverses the polarity of two poles 19 for alternately attracting and repelling a magnet 8 attached to the mounting plate 4. The frequency of pole reversal can again be tuned by regulating means 13a to the natural frequency of the resiliently suspended mounting means 3. The pole-reversing device 18 which cooperates with an electromagnet 9a avoids the need for rotating parts in the vibrator 1.

In this modified embodiment according to FIGS. 5 and 6 the resilient suspension consists of four springs 20 placed in quadrature, each attached at one end to the pedestal 2 and at the other end to the mounting plate 4. This type of suspension could also be used in the first described embodiment and conversely the previously described suspension is the form of a rubber ring 7 might also be used in the present embodiment.

The harness 6 for holding the vibrated article in FIGS. 3 and 5 is likewise somewhat different and consists of a chain 21 which can be placed around the neck of a jar 5 and resiliently secured to the mounting plate 4 by tension springs 22 and hooks 23.

A particularly useful feature of the hitherto illustrated embodiments of the vibrator 1 is that the force of attraction between the two magnets 8 and 9 contrary to the forces engendered by the springs 20 or the rubber ring 7 is augmented by the force of gravity. When the exciting magnet 9 has rotated through 180°, or when the polarity of the two poles 19 has been reversed by the pole-reversing device 18, the forces of repulsion between facing like poles of the magnets will be assisted by the restoring pull of the springs. When the frequency of the cyclic attraction and repulsion is in step with the natural frequency of the resiliently suspended mounting means 3 and its load, the vibration of the vibrator 1 can be maintained merely by forces sufficient to overcome the natural damping of the resilient suspension. These forces are relatively small, but a high vibratory output will nevertheless be achieved because the natural frequency of vibration of the suspension is utilized for this purpose, and only small impulses are needed for making good the frictional loss.

Apart from the advantage that for transmitting the vibratory motion the vibrator is free from rigid moving parts that consume considerable power and that are mounted in bearings subject to wear, the apparatus has the further advantage that the vibratory action can be easily stopped since, as has been mentioned, only minor impulses are needed to overcome frictional energy loss. The dangers of injury and damage are thereby reduced.

It should be noted that the mounting means 3 may conveniently also be resiliently mounted on an adapter A or the like which is itself detachably affixed to the pedestal 2, as illustratively indicated by the dotted lines L in FIG. 5. Such an arrangement simplifies assembly and an existing pedestal 2 with an exciting magnet 9 of which the mounting means have been damaged, or which is to be provided with a different type of suspension can be easily fitted with a fresh adapter permanently associated with a mounting means of the required kind. Conversely—for instance in the event of the pedestal or the drive means of the exciting magnet having been damaged—the adapter including the mounting means can be fitted to a fresh pedestal. The adapter A may simply be a tight push-on fit or it may be threadedly secured to the pedestal.

The embodiment schematically illustrated in FIG. 7 is of slightly modified construction. Analogously to the arrangements described with reference to FIGS. 1 to 4 the horizontal

mounting plate 4 in the vibrator according to FIG. 7 is likewise horizontally resiliently suspended in the pedestal 2. However, the suspension consists of tension springs 20. The exciting magnet 9 is attached to the free projecting end of the output shaft 10 of an electric motor 11. This electric motor 11 is bolted to a bracket 24. According to a special feature of the invention the magnet associated with the mounting plate 4 is secured in such a way that it can be rotatably adjusted. In the illustrated embodiment the magnet 8 is therefore mounted on a bush 25 axially traversed by a bolt 26. The bolt projects from the underside of the magnet for the reception of a nut 27 which supports the magnet 8 from below. By rotation of the bolt 26 the nut 27 can be pulled up tightly against the magnet 8 and the latter firmly secured in any desired orientation to the mounting plate 4. The arrangement according to FIG. 7 operates as a vibrator in the same way as in FIGS. 1 to 4. In order to prevent the nut 27 from being entrained by the bolt 26 the bush 25 is provided with a key 28 which engages the nut 27. Moreover, a pin 29 fitted transversely into the threaded end of the bolt prevents the nut 27 from accidentally riding off the bolt.

It should be mentioned that the bolt 26 might alternatively be keyed to the mounting plate 4 and the key 28 omitted, in which case the magnet 8 could be tightened against the underside of the mounting plate 4 by rotating the nut 27 with the aid of a lever 30 indicated in broken lines. The magnet in such an arrangement could be adjusted and locked in any desired position and it could also be released to rotate freely, merely by deflectably moving the lever 30 which is appropriately offset from the spring suspension.

The advantage of the vibrator illustrated in FIG. 7 is that besides generating a purely vibratory motion it is also capable of producing a rotary stirring action in say a liquid contained in the vessel 5.

The stirring action is obtained by releasing the magnet 8 for free rotation and inserting a stirrer magnet 31 in the vessel, likewise having the form of a bar magnet and thus similar in shape to the two magnets 8 and 9. When the exciting magnet 9 rotates, the magnet 8 which has been released participates in this rotation as a result of the magnetic coupling effect. An intensified rotating magnetic field is thus produced which in turn imparts rotation to the stirrer magnet 31 inside the vessel 5.

A vibrator of somewhat simplified form which can also be used for stirring is illustrated in FIG. 8. In this embodiment the magnet 8 is mounted under the mounting plate 4 on a one-way coupling 33 which is fast on a central fixed pin 32, and the driving motor 11 is reversible. The one-way coupling 33 permits the magnet 8 to rotate in one direction but prevents it from rotating in the opposite direction. The one-way coupling in conventional manner comprises rollers 34, an outer ring 35 and a locking member 36. Alternatively, the one-way coupling 33 comprising rollers 34 could have the form of a ratchet and pawl coupling. The changeover from vibration to stirring or conversely in this apparatus according to FIG. 8 can be easily effected by reversing the direction of rotation of the motor 11.

FIGS. 10 to 12 illustrate a vibrator 1 which comprises a mounting plate 4 made of soft iron and therefore capable of being excited by the field of a stationary electromagnet 9b. The frequency and amplitude of the forces acting on the mounting plate 4 can be varied with the aid of electronic control means 37. The magnetic field of the electromagnet excites the soft iron plate which is suspended in proximity therewith between springs 20 and which carries a vessel 5 containing the material that is to be vibrated. The pedestal 2 in FIG. 11 is of slightly modified form and adapted to prevent the mounting plate 4 from performing lateral movements. The electromagnet 9b is likewise of modified construction. The drawing further shows a pickoff or sensor 38 on one side of the plate 4 for photoelectrically, inductively, magnetically or in some other way generating a monitoring signal representing the vibrations of the plate.

FIG. 12 is a schematic representation of control means for the electromagnet 9b. According to a feature of the invention the vibrator 1 is fitted with the above mentioned pickoff for sensing the vibratory motions as well as with a controller 39 which in response to the signal from the pickoff regulates the magnet 9b for the generation of the vibratory frequency. By comparing the frequency of vibration of the plate 4 with the excitation frequency of the magnet, the controller automatically adjusts the vibratory frequency of the vibrator to resonance. To this end the electromagnet 9b which cyclically deflects the mounting plate 4 is associated with an amplifier and regulator 40 for regulating the field intensity which is fed with a variable frequency generated by an oscillator 41 of conventional kind. The controller 39 which receives the signal from the pickoff 38 is simultaneously connected to the oscillator 41 thereby permitting the frequencies to be compared and matched in a simple manner. In the illustrated circuit this connection contains a switch 42 which permits the automatic control of the exciting frequency to be inactivated if required. In the form of a block FIG. 12 also shows a source of current 43 for driving the electromagnet 9b, the current being first fed to the oscillator 41. The circuit arrangement schematically indicated in FIG. 12 permits the vibrator to adjust itself automatically to the optimum vibratory frequency and to maintain this frequency. Moreover, any changes in the conditions which may occur during the vibratory treatment are likewise automatically compensated.

The mounting plate 4 which supports the vibrated object may be provided with heating means 44 as illustratively shown in FIG. 13. Such heating means 44 could also be provided in the embodiments that have already been described. In the illustrated case the heating element is a resistance wire inside the plate 4. However, the plate 4 might also be heated by infrared, inductive high frequency or like electric heating means. In the embodiment illustrated in FIGS. 10 to 12 a high frequency heater might be useful because the high frequency for heating can be easily and conveniently impressed on the frequency required for generating the vibrations. The provision of heating means in the plate 4 permits the temperature in the vibrated or stirred material to be adjusted to and kept at selectable levels.

IN FIG. 13 mechanical means are provided for transmitting the cyclic deflecting forces to the resiliently suspended mounting plate 4. At least one spring 45 extending in the direction of vibratory motion is attached to the plate, the cyclic forces for deflecting the plate being applied to the other end of this spring 45. An elastic mechanical transmission of this latter kind is likewise capable of impressing a vibratory frequency

on the vibratory system in step with the natural frequency of the system. The advantages of the invention can thus also be secured by making use of such a mechanical transmitting system.

In the vibrator according to FIG. 13 the cyclic forces are injected into the spring 45 by a crank 46 to which the free end of the spring is attached, and which is driven by an electric motor 47. Rotation of the crank 46 by the motor 47 provides the oscillatory drive which is transmitted by the spring 45 to the plate 4. The frequency of the oscillatory drive can be matched with the natural frequency of the resiliently mounted plate and the vibrated material by suitably varying the speed of the driving motor 47.

While this invention has been described and illustrated by the embodiments shown, it is not intended to be strictly limited thereto, and other modifications and variations may be employed within the scope of the following claims.

We claim:

1. A vibrator or shaker, comprising a pedestal, support means resiliently suspended in said pedestal, fixing means for rigidly locating a material that is to be vibrated on said support means, and means for applying a deflecting force to said support means which cyclically varies at a frequency controllable to generate resonant vibrations of the vibratory system constituted by said resiliently suspended support means and said vibrated material located thereon, said means for applying a deflecting force comprising a first magnet directly and rigidly affixed to said resiliently suspended support means, an exciting magnet rotatably mounted in close proximity with and parallel to said first magnet and drive means for rotating said rotatable magnet.

2. A vibrator as defined in claim 1, wherein the drive means of said rotatable magnet is a controllable variable speed electric motor.

3. A vibrator as defined in claim 1, wherein said support means is a resiliently suspended horizontal mounting plate with a harness, said first magnet is a bar magnet rigidly affixed to the underside of said mounting plate, and said exciting magnet is a bar magnet substantially of the same size and configuration as said first magnet so mounted that rotation of said exciting magnet alternately brings poles of like and opposed polarity of said two magnets into cooperating juxtaposition.

4. A vibrator as defined in claim 1, wherein said resilient suspension is a rubber ring threaded alternately through fastening means provided at equidistant intervals around the periphery of said support means and through fastening means equidistantly disposed around the periphery of said pedestal.