

July 10, 1962

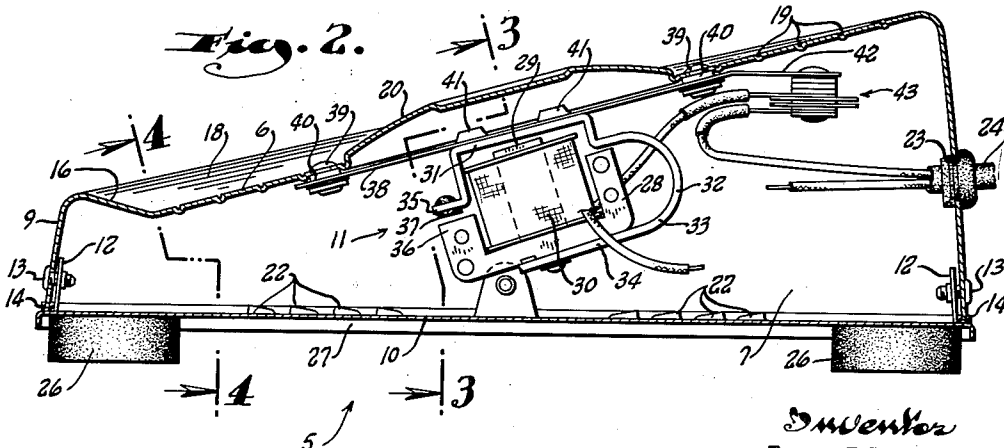
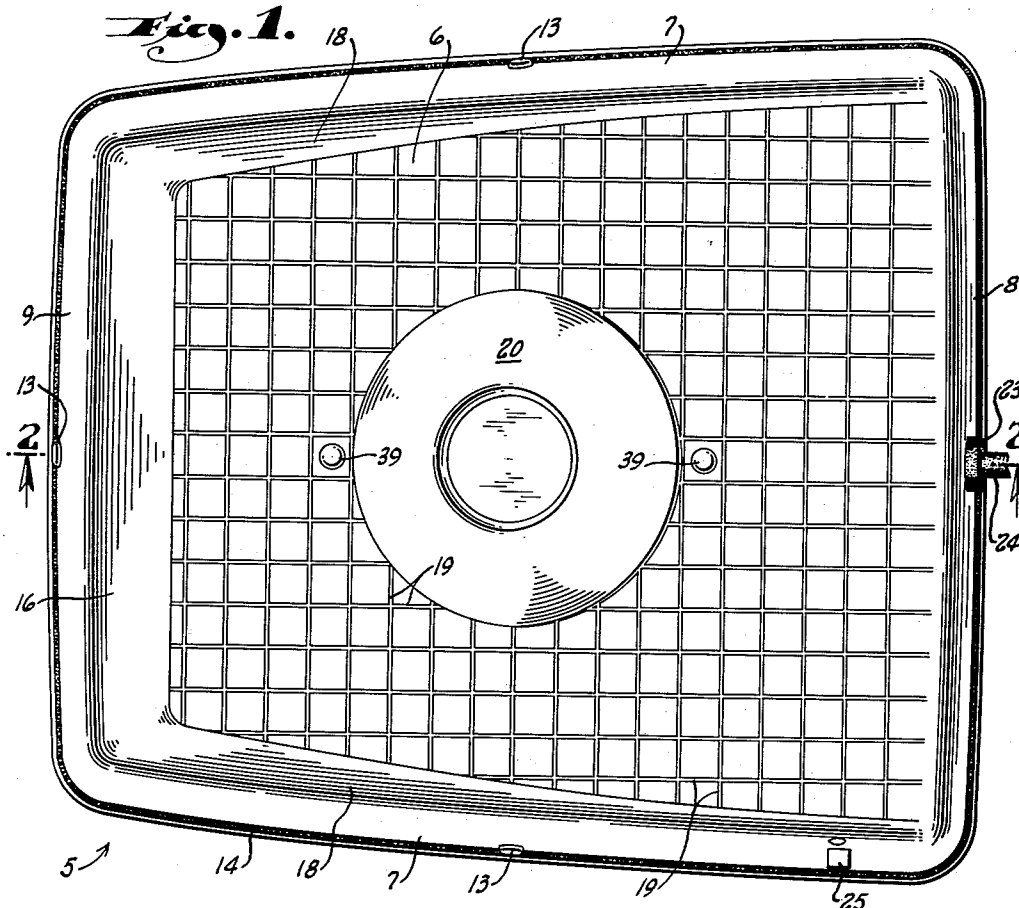
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3,043,294

VIBRATORY FOOT MASSAGING MACHINE

Filed Oct. 15, 1959

3 Sheets-Sheet 1



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July 10, 1962

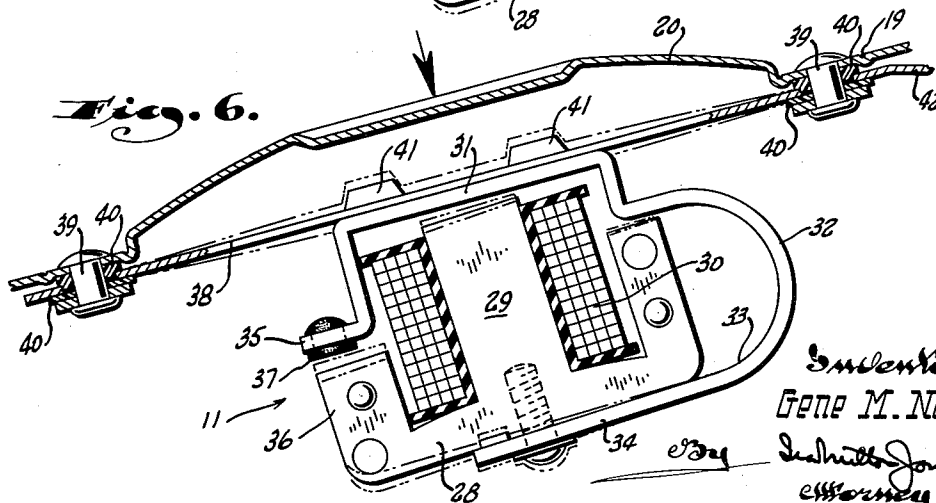
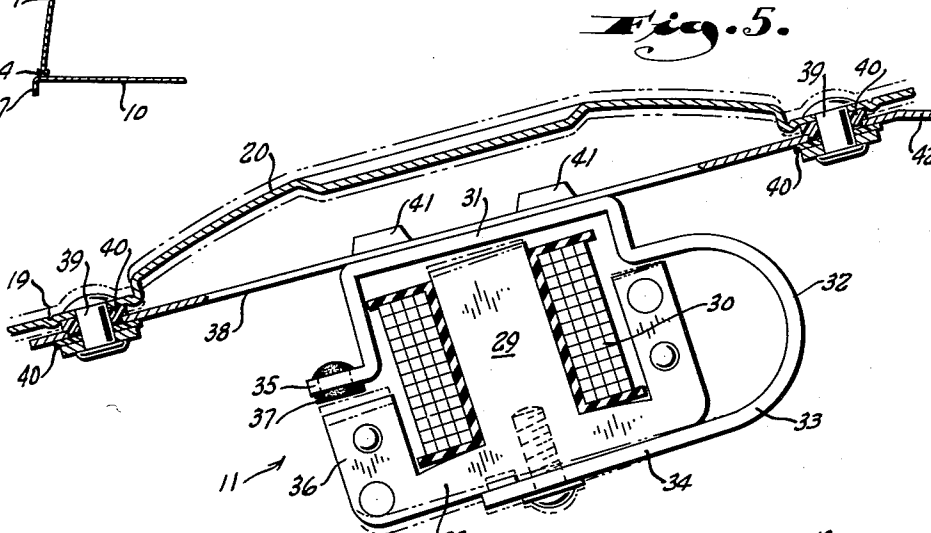
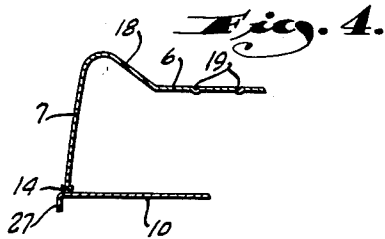
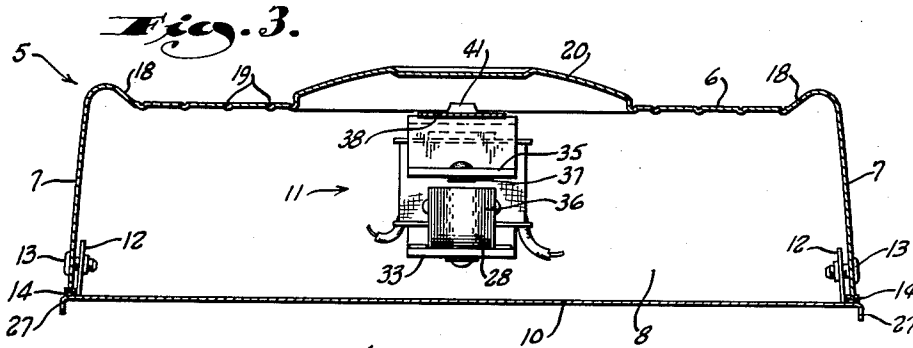
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VIBRATORY FOOT MASSAGING MACHINE

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3 Sheets-Sheet 2



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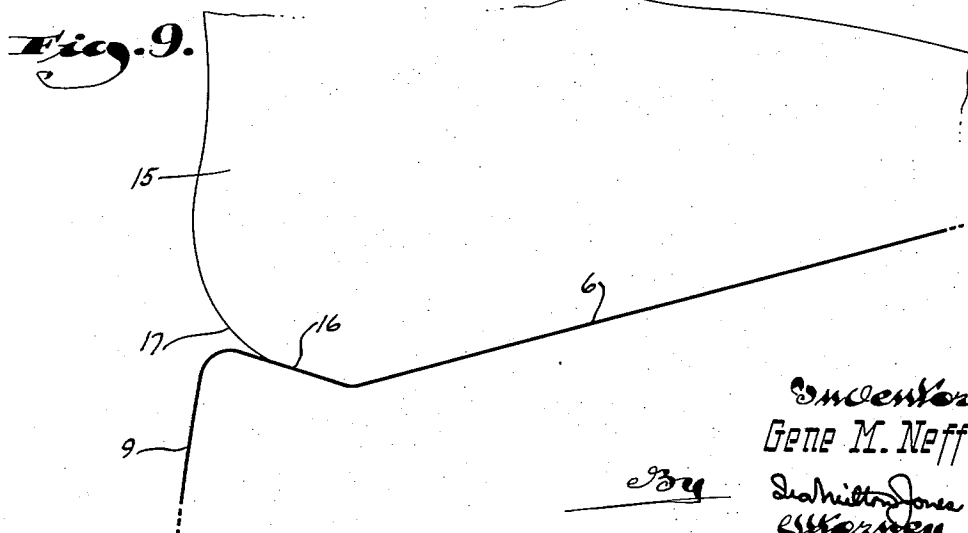
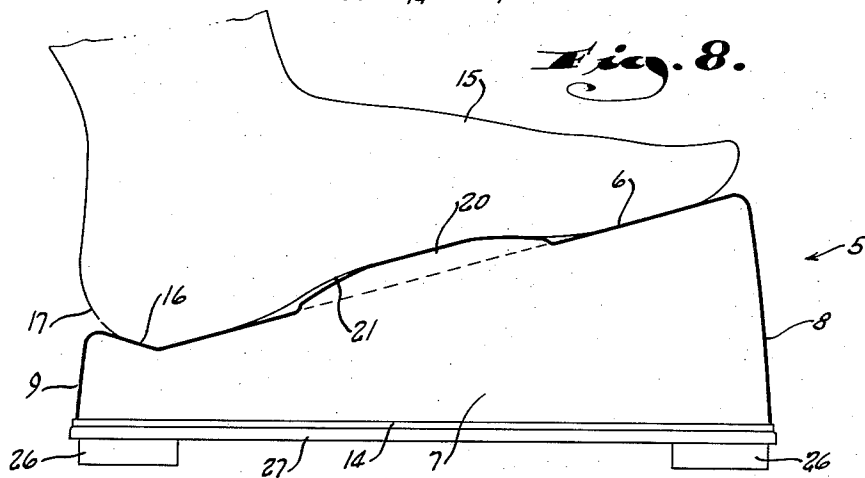
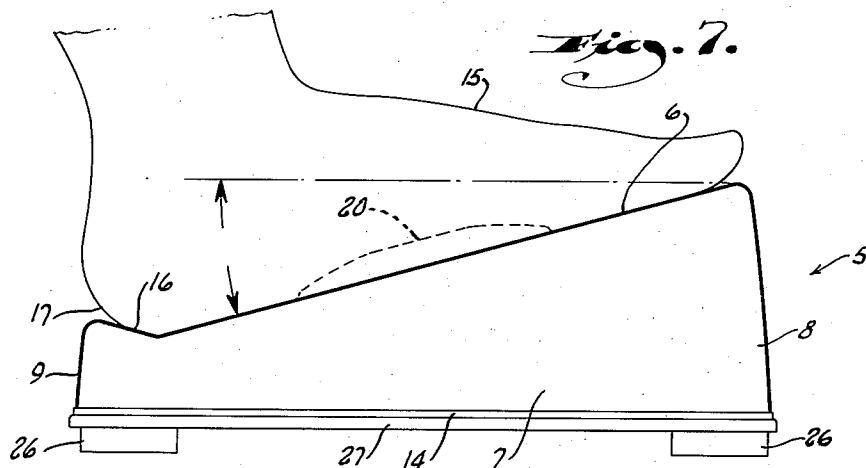
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VIBRATORY FOOT MASSAGING MACHINE

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3 Sheets-Sheet 3



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3,043,294

VIBRATORY FOOT MASSAGING MACHINE
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This invention relates to vibratory devices and refers more particularly to a vibratory foot massaging machine.

In general it is an object of the invention to provide a machine having a panel upon which a person's feet may be comfortably rested, and means for imparting to the panel a vibratory motion whereby the soles of the feet are massaged.

A more specific object of this invention is to provide a vibratory massage machine which is compact, inexpensive and light in weight, and which has a vibratory foot supporting panel that is shaped to conform substantially to the contours of the foot soles so that vibratory motion of the panel can be imparted to the feet over the whole area of their bottoms.

It is also a specific object of this invention to provide a vibratory foot massaging machine having a foot supporting panel to which vibratory motion is imparted by means of a simple and inexpensive vibration motor comprising a solenoid wound on a core of substantial mass and adapted to be energized by alternating current, an armature magnetically attractable to the core, and a resiliently flexible hinge connection between the core and the armature.

A vibration motor of the type just described produces vibratory motion in consequence of periodic magnetic attraction between the core and the armature upon energization of the solenoid by a pulsating current. The core and armature move relatively toward and from one another in response to such attraction and to the oppositely directed biasing force of the resilient hinge connection which urges them apart. The vibratory forces that such a motor can exert upon a panel with which it is connected are proportional to the mass of the core and its attached solenoid and to the magnetic forces attracting the armature and core toward one another. Since such magnetic attracting force, at any instant that the solenoid is energized, is a function of the distance across the air gap between the core and the armature at that instant, the structure of the motor must be such that the air gap will have a rather accurately predetermined size when the motor is unenergized.

Bearing in mind that this invention has for another of its objects the provision of a vibratory foot massaging device of the character described which is adapted to be used both by a person who is seated with his feet resting relatively lightly upon the foot supporting panel, and by a person who is standing, with his entire weight resting upon said panel, it will be apparent that the attainment of the objectives of simplicity and low cost in the machine of this invention requires that it have its vibration motor secured to and supported only by the foot supporting panel, so that the air gap between the armature and core of the motor will not be varied by the flexure of the panel due to the imposition of different weights thereon.

However, with the vibration motor suspended from the foot supporting panel, it will be apparent that when a substantial weight is placed upon the panel, as by a person standing thereon, the vibration of the panel will tend to be very substantially damped, and unless the vibration motor can be caused to overcome such damping force to a substantial extent the device will not have satisfactory utility under all of the conditions of its normally expected use.

With the foregoing in mind, it is another and very im-

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portant object of this invention to provide means for connecting a vibration motor of the character described with a panel to be vibrated, by which means the motor is supported from the panel and vibrations generated by the motor are transmitted to the panel, and which means enables the motor to produce vibration forces and effectively transmit them to the panel despite the imposition of substantial damping force upon the panel.

Thus it is another object of this invention to provide a vibratory massage device having a foot supporting panel which is adapted to be vibrantly agitated by a simple and inexpensive vibration motor, and which may be used with substantially equal effectiveness by a person who is seated with his feet resting relatively lightly upon the panel and by a person who is standing upon the panel in order to have the effects of its vibratory motion imparted to his legs and body.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate complete examples of the physical embodiment of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIGURE 1 is a plan view of a vibratory foot massaging device embodying the principles of this invention;

FIGURE 2 is a vertical sectional view taken on the plane of the line 2—2 in FIGURE 1;

FIGURE 3 is a sectional view taken on the planes of the line 3—3 in FIGURE 2;

FIGURE 4 is a fragmentary sectional view taken on the plane of the line 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary sectional view, taken on the same plane as FIGURE 2 but on a larger scale, showing the motion of the foot supporting panel and vibration motor when little or no load is imposed upon the panel;

FIGURE 6 is a view similar to FIGURE 5, but showing the motion of the vibration motor when a substantial load or damping force is imposed upon the foot supporting panel;

FIGURE 7 is a more or less diagrammatic side view of the device with a person's foot supported thereon, particularly illustrating the inclination of the foot supporting panel;

FIGURE 8 is a view similar to FIGURE 7 but taken on the same plane as FIGURE 2, particularly illustrating how the contour of the foot supporting panel corresponds to the contour of a person's foot sole; and

FIGURE 9 is a fragmentary diagrammatic sectional view, taken on the same plane as FIGURE 8 but on a larger scale, showing how the rear portion of the foot supporting panel accommodates the heel of the foot.

Referring now more particularly to the accompanying drawings, in which like numerals designate like parts throughout the several views, the numeral 5 designates generally a vibratory foot massaging machine embodying the principles of this invention and which comprises, in general, a substantially rectangular foot supporting panel 6 upon which a person's feet are adapted to rest, upright side walls 7 and end walls 8 and 9 connected with the panel and extending downwardly from its edges, a bottom wall 10 cooperating with the panel 6 and the upright walls 7, 8 and 9 to define an enclosure, and a vibration motor 11 supported by the foot supporting

panel at its underside and housed within the enclosure.

The panel 6 and the side and end walls 7, 8 and 9 may be readily formed as parts of a unitary sheet metal stamping, and the bottom wall 10 may likewise be stamped from sheet metal. Adjacent to each edge of the bottom wall, intermediate the ends thereof, is an upright lug 12 which lies behind its adjacent upright wall, and a sheet metal screw 13 or the like extends through each upright wall and into one of said lugs to secure the two stampings together. A resilient molding strip 14 of rubber or the like is confined between the bottom edge of each upright wall and the top surface of the bottom wall to provide a trim which permits the upper stamping, comprising the foot supporting panel and its connected upright walls, to have some degree of vibratory motion relative to the bottom wall.

The foot supporting panel is substantially rectangular, but for the sake of appearance it may have its side edges converged slightly toward its rear, as shown in FIGURE 1, so that it is more accurately characterized as trapezoidal. The front upright wall 8 is somewhat higher than the rear end wall 9, so that when the device is resting on a level surface, such as a floor, the foot supporting panel will be forwardly and upwardly inclined at an oblique angle to the horizontal, being thus disposed to support the foot 15 or feet of a seated user in a position, which, as may be seen from FIGURE 7, is both comfortable and natural and which thus promotes relaxation.

The rear marginal edge portion 16 of the foot supporting panel is disposed at an oblique angle to the main part of the panel, so as to slope rearwardly upwardly and thus form a heel rest which substantially conforms to the curvature of the rear heel portion 17 of a person's foot, comfortably supporting the foot against sliding rearwardly off of the inclined foot supporting panel and providing for the engagement of vibratory panel surface with the rear portion of the heel, as may be seen from FIGURE 9, to insure good conduction of vibration to the vicinity of the tendon of Achilles. The marginal side edge portions 18 of the foot supporting panel have a similar oblique inclination to the panel at the rear thereof, so as to merge smoothly into the heel supporting portion 16 and provide for good engagement with the outer edges of the foot soles, but they decrease in width toward the front of the enclosure so as to merge into the general plane of the panel near its front edge.

The medial portion of the panel, within the marginal edge portions 17 and 18, has small parallel ridges 19 bent downwardly out of its general plane and extending along its length and across its width, spaced apart at regular intervals to form a pattern of squares. Besides improving the appearance of the panel, the intersecting parallel ridges 19 stiffen and strengthen it and tend to prevent the feet from sliding over its surface under the influence of vibratory massaging action.

The pattern of ridges is interrupted at the central portion of the foot supporting panel, which is upwardly dished to provide a shallow dome-like arch support 20 having a circular outline. As may be seen from FIGURE 8, this portion of the panel is adapted to conform to the contour of the arch 21 of the foot, insuring that vibratory surface engages substantially all portions of this elevated portion of the sole. The circular domed arch support also tends to stiffen the central portion of the panel to insure good transmission of vibrations to the entire panel from the vibration motor 11 mounted therebeneath.

The bottom wall 10 of the enclosure has a plurality of louvres 22 through which air may enter and leave the enclosure to provide for cooling of the vibration motor 11, and an aperture 23 in the front end wall 8 allows a conductor cord 24 to extend into the interior of the enclosure to provide for connecting the vibration motor with a source of alternating current. A switch 25 may be

mounted on one side wall 7 of the enclosure and connected with the conductor cord and the motor to permit the motor to be readily and conveniently turned on and off with the foot.

Secured to the underside of the bottom wall are a plurality of resilient pads 26 of rubber or the like, there being preferably one at each corner of the bottom wall. These pads support the enclosure on a floor or similar surface, providing a space beneath the bottom wall through which air can circulate to and from the louvres 22. The pads, because of their resilience, also perform the important function of permitting the entire housing to have up and down vibratory motion relative to a floor or other surface on which it is supported. The marginal edge portion of the bottom wall is bent downwardly to provide a peripheral flange 27 which stiffens and reinforces the bottom wall.

The vibration motor by which the vibratory motion of the panel is produced is of a known type having a substantially E-shaped core 28, preferably comprised of laminations of magnetically permeable material, upon the center leg 29 of which is wound a solenoid 30. A magnetically permeable armature 31 is adapted to be magnetically attracted to the core upon energization of the solenoid, and the core and solenoid are connected by means of a resilient hinge 32 for motion in opposite directions toward and from one another. In this instance the resilient hinge comprises the right portion of a substantially U-shaped spring 33, one leg of which comprises the armature 31, although obviously the armature could comprise a separate member, such as a soft iron bar, anchored to the spring. The other leg 34 of the U-shaped spring is secured to the stem portion of the core, and supports the core with its legs extending toward, but normally spaced from, the armature. In addition to connecting the core and armature, the resilient hinge 32 also serves to bias them apart and to normally hold the armature and the center leg 29 of the core spaced apart by a predetermined distance which constitutes the nominal air gap of the motor.

Preferably the armature 31 (or the armature-defining leg of the U-shaped spring) extends entirely across the core to have its outer end portion 35 disposed adjacent to the core leg 36 which is farthest from the resilient hinge 32, and this extended portion of the armature cooperates with the outer end of said core leg in defining a secondary air gap which decreases the reluctance of the magnetic circuit through the core and armature. A soft, resilient bumper 37 in the outer end portion of the armature, comprising a rivet or grommet of rubber or the like engaged in a hole in the armature, is adapted to engage the adjacent end of the core leg 36 to prevent hammering between the core and armature as they are drawn together by the initial surge of power when the motor is started.

The vibration motor is supported from the foot supporting panel by means of a resiliently flexible spring strap 38 secured to the panel, as by means of rivets 39, at opposite sides of the arch support 20, and which spans the concavity of the arch support substantially diametrically thereacross. To insure good electrical insulation of the motor from the panel, the spring strap is insulated from the panel and from the rivets by means of insulating washers 40 of fibre or the like.

The unsupported span of the spring strap is substantially longer than the armature, and the armature is anchored to the spring strap intermediate its ends, as by means of rivets 41. Preferably the armature extends lengthwise along the spring strap, but in any event it is disposed at the side of the spring strap remote from the panel (i.e., at the underside of the strap) and the motor is thus supported from the strap with its core at the side of the armature remote from the strap; hence flexing of the spring strap can carry the motor bodily toward

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and from the panel thereabove, and during operation of the motor its armature and core move relatively toward and from one another in the same directions that the medial portion of the spring strap flexes. It will be observed that the dome-like arch supporting portion 20 of the panel provides a concavity at its underside which affords substantial clearance for such flexing of the spring strap. It will also be noted that neither flexing of the panel nor movement of the enclosure wall portions relative to one another can in any wise affect the size of the air gap in the motor, due to the fact that the panel is the only wall of the enclosure with which the motor is directly connected.

One end portion of the spring strap projects beyond the adjacent rivet, as at 42, and is bent downwardly away from the panel to provide a bracket or support for a half-wave rectifier 43 which is connected with the conductor cord 24 in the energizing circuit for the solenoid. Alternating current brought to the machine by the cord 24 is converted to pulsating current by the rectifier, and therefore the solenoid is alternately energized and de-energized at regular intervals, the frequency of such energizations being one-half of the frequency of the A.C. power.

During each energization of the solenoid magnetic attraction between the core and armature draws them together, against the yielding bias of the resilient hinge 32. Upward movement of the solenoid and core are opposed by their inertia to some extent, and the armature therefore tends to be drawn downwardly toward them, transmitting its downward force to the foot supporting panel through the spring strap. Upon de-energization of the solenoid, the armature and core are biased apart by the resilient hinge. Now the inertia of the core and solenoid permits the resilient hinge to impose an upward reaction force upon the spring strap and thus upon the panel. To some extent the successive upward and downward relative forces upon the core and armature tend to be reinforced by the resilient hinge, the resilience of which is such that it is nearly resonant with the masses connected to it.

The vibratory motion of the foot panel is composed in part of up and down flexing of the panel relative to the remainder of the enclosure, and in part of bodily up and down motion of the enclosure as a whole, upon the resilient pads 26. It will be apparent that when there is no load upon the panel, or merely a light load, it can be easily put into vibratory motion in response to the vibration forces produced by the motor. The spring strap 38 should be stiff enough to have practically no flexure under these conditions. The strap then acts as if it were an integral part of the panel, and vibratory forces generated by the motor are transmitted to the panel through the strap, the motions of the panel and motor being as illustrated in FIGURE 5.

However, when a substantial downward load is imposed upon the panel, as indicated by the large arrow in FIGURE 6, the panel is thereby flexed or "oil canned" downwardly, substantially to its limit of downward flexing motion, and bodily up and down motion of the entire enclosure likewise tends to be substantially inhibited or damped. If, under these conditions, the armature were anchored directly to the panel, as has been the practice in prior vibratory machines having a vibration motor of the type here under consideration, the armature would be substantially immobilized by such damping force, and all of the relative attracting motion between the core and the armature in response to solenoid energization would have to be provided for by upward movement of the core. The core, however, has substantial mass and inertia, and therefore it can move through only a relatively small distance during the brief energizing pulse of the solenoid, and the air gap would be left very wide toward the end of each such stroke. Bearing in mind that the magnetic attractive force between the

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core and solenoid varies inversely as the square of the distance across the air gap, it will be apparent that under the conditions just described the attracting forces between the armature and core would be very feeble, and would therefore be quite insufficient to effect vibration of the panel against the damping force of the load thereon.

The spring strap of this invention, however, provides a flexible connection between the armature and the panel whereby the armature is permitted to move up and down relative to the panel despite any inhibition of vibratory motion of the panel by imposition of a load thereon. Hence, when the solenoid is energized by a current pulse, the relative attracting motion between the armature and the core consists not only of upward movement of the core but also of downward movement of the armature relative to the panel, to the extent permitted by flexing of the spring strap. This condition is illustrated in FIGURE 6. The consequence of this relative freedom of motion of the armature is that the core and armature can approach each other more closely during each energizing pulse, and, because of the decreased size of the air gap toward the end of each pulse, can exert an attractive force upon one another which is sufficiently large to overcome to a substantial extent the load or damping force upon the panel. The reaction forces of the armature are, of course, transmitted to the panel through the spring strap under loaded or damping conditions in the same manner as when no load is imposed upon the panel.

The spring strap is of such stiffness that it is slightly out of tune with the frequency of the vibration motor, and it may have either a higher or a lower resonant frequency. If it were tuned exactly to resonance, it would be substantially incapable of transmitting vibration forces from the motor to the panel.

From the foregoing description, taken together with the accompanying drawings, it will be apparent that this invention provides a simple, compact, rugged and inexpensive vibratory foot massaging device featuring a foot supporting panel upon which the feet may be comfortably rested and which provides effective vibratory massage of the entire bottom surface of the feet, both when the user is sitting with his feet resting lightly on the panel and when he is standing on the panel to obtain the benefits of the vibratory action in his legs and body.

What is claimed as my invention is:

1. In a device of the type having a panel mounted for vibratory motion normal to its faces and a vibration motor for imparting vibration to the panel comprising a core on which is wound a solenoid adapted to be energized by pulsating current, an armature adapted to be magnetically attracted toward the core at each energization of the solenoid, and a flexible hinge connecting the core and the armature of the vibration motor for movement relatively toward and from one another and yieldingly holding them apart: means providing a resilient connection between the armature and the panel by which the motor is supported from the panel for movement of the core and armature relative to the panel and to one another in directions normal to the surfaces of the panel and which yieldingly permits movement of the armature relatively toward and from the panel in said directions to enable the armature to be attracted toward the core and away from the panel with each energization of the solenoid when substantial vibration damping force is imposed upon the panel, thus permitting the armature and core to closely approach one another during each such energization despite the inertia of the core, so that the vibration motor can magnetically generate vibration forces of substantial magnitude which are transmitted to the panel through said resilient connection and which overcome the damping force to a substantial extent, said resilient connection comprising a spring strap having the armature secured to its medial portion and having its end portions spaced substantial distances from the armature and secured to the panel.

2. In a vibratory device of the character described: a panel mounted for vibration in directions normal to its surfaces; a leaf spring secured to the panel and having a portion flatwise overlying and spaced from one surface of the panel and resiliently flexible toward and from the same; a magnetically permeable armature secured to said portion of the leaf spring; a magnetically permeable core; a solenoid wound on the core and adapted to be energized by pulsating current; and a substantially U-shaped spring having its legs respectively connected with the core and the armature to provide a resilient hinge connection between them whereby the core is disposed at the side of the armature remote from the panel and by which the core and armature are yieldingly held apart, said U-shaped spring being yieldable to permit the armature and core to be attracted toward one another upon energization of the solenoid.

3. In a vibratory device of the type comprising a panel mounted for vibratory motion in directions normal to its surfaces and a vibration motor for vibrating the panel comprising a core on which is wound a solenoid adapted to be energized by pulsating current, an armature adapted to be magnetically attracted to the core upon energization of the solenoid, and a resilient hinge connecting the core and armature for relative movement toward and from one another and yieldingly holding them apart, means providing a connection between the panel and the vibration motor by which the vibration motor is supported for relative movement of its core and armature in directions normal to the panel and through which vibratory forces generated by the vibration motor are transmitted to the panel, said means comprising: a spring strap having its end portions secured to the panel at spaced apart locations thereon and having its medial portion spaced from one face of the panel and flexible toward and from the same; and means anchoring the armature to the medial portion of the spring strap, at the side thereof remote from the panel, the flexibility of the medial portion of the spring strap permitting the armature to be attracted away from the panel in response to energization of the solenoid so that when substantial damping force is imposed on the panel the armature and core can nevertheless approach each other closely during each solenoid energization despite the inertia of the core, and the magnetic motor can magnetically generate vibration forces which are transmitted to the panel through the spring strap and which are of substantial magnitude so as to be able to overcome the damping force to a substantial extent.

4. The vibratory device of claim 3, further characterized by the fact that said spring strap has a stiffness such that it is slightly out of resonance with the vibration frequency of the vibratory motor.

5. In a vibratory foot massage machine of the character described: a foot supporting panel mounted for vibratory motion in directions normal to its surfaces and having a medial dome-like upwardly dished portion adapted to closely underlie the arches of a pair of feet resting on

the panel; a resiliently flexible strap; means securing said strap to the panel at substantially diametrically opposite sides of its upwardly dished medial portion and with the strap spanning the concavity thereof, the medial portion of said strap being flexible toward and from the panel, and said strap having an end portion which projects beyond one of the securement means and is bent away from the adjacent surface of the panel to provide a bracket; a half-wave rectifier secured to said bracket; and a vibration motor electrically connected with the half-wave rectifier and secured to the strap intermediate its points of securement to the panel and at the side of the strap remote from the panel.

6. A foot massage device comprising: a foot supporting panel having a medial upwardly dished portion adapted to closely underlie the arches of a pair of feet resting on the panel and a rear marginal edge portion inclined obliquely upwardly from the remainder of the panel to accommodate the heels of the feet; wall means cooperating with the foot supporting panel to provide an enclosure of which the panel forms the top wall, and disposing the panel at a forwardly and upwardly inclined angle to the bottom of the enclosure; a plurality of resilient pads on the bottom of the enclosure, upon which the enclosure is adapted to rest and which permit the enclosure to have vibratory up and down motion relative to a surface upon which it is supported; a vibration motor in the enclosure comprising a core on which is wound a solenoid adapted to be energized by pulsating current, an armature magnetically attractable to the core, and a U-shaped spring hinge having the armature secured to one of its legs and the core secured secured to its other leg to connect the core and armature for relative motion in opposite directions toward and from one another and by which the core and armature are biased apart, said U-shaped spring hinge being yieldable to permit the core and armature to be attracted toward one another upon energization of the solenoid; a spring strap having its ends secured to the foot supporting panel at opposite sides of its medial upwardly dished portion, with the medial portion of the spring strap flexible toward and from the underside of said panel; and means anchoring the armature of the vibration motor to the medial portion of the spring strap and disposing the U-shaped spring hinge in a plane substantially normal to that of said panel, with the core at the side of the armature remote from said panel, so that the core and armature are relatively moveable in directions substantially normal to the surfaces of said panel.

References Cited in the file of this patent

UNITED STATES PATENTS

2,107,718	Sperti	Feb. 8, 1938
2,235,158	Krenzke	Mar. 18, 1941
2,265,729	Hall	Dec. 9, 1941
2,840,071	McNair	June 24, 1958