United States Patent [19]

Mushrush

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[54] **ADJUSTABLE ELECTROMAGNETIC VIBRATOR**

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[52] **U.S. Cl.**.....**310/17,** 310/29
[51] **Int. Cl.**.....**H02k 33/02**
[58] **Field of Search**.....310/15, 17, 29, 32, 310/28

[56] **References Cited**

UNITED STATES PATENTS

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3,404,299	10/1968	MacBlane	310/17
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[57] **ABSTRACT**

The housing of the electromagnetic vibrator has an outer plate through which studs secured on the armature protrude. A weight is secured on the studs outside the housing. Further studs secured on the plate outside the housing mount the armature/weight assembly on the housing via counter-balancing springs. Nuts secured on the latter studs are adjustable to adjust vibration amplitude. Resilient bumpers may be provided to limit movement of the armature toward the core and coil and to limit movement of the weight toward the housing. The vibrator may use AC electric service, as is, or rectified to DC. The adjustable nuts also accommodate switching from AC to DC electrical service.

3 Claims, 2 Drawing Figures

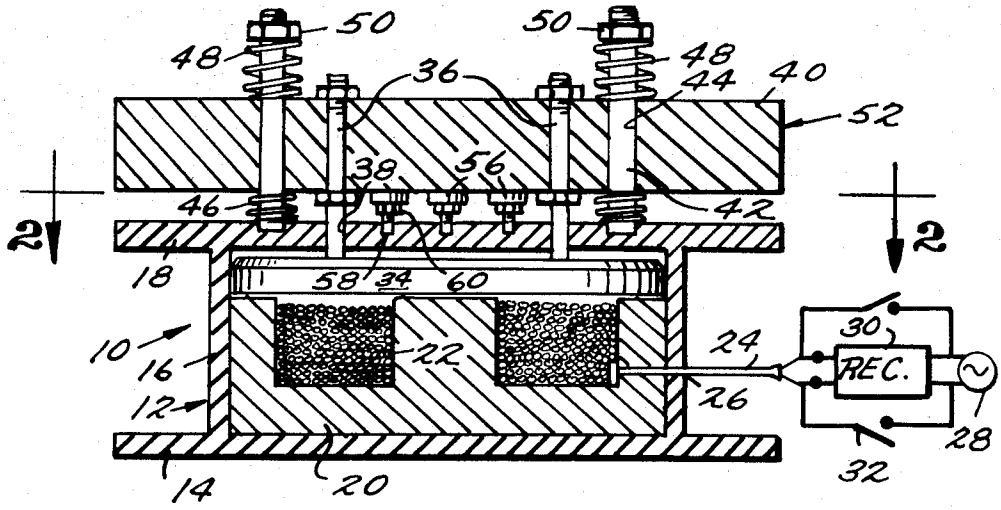


Fig. 1.

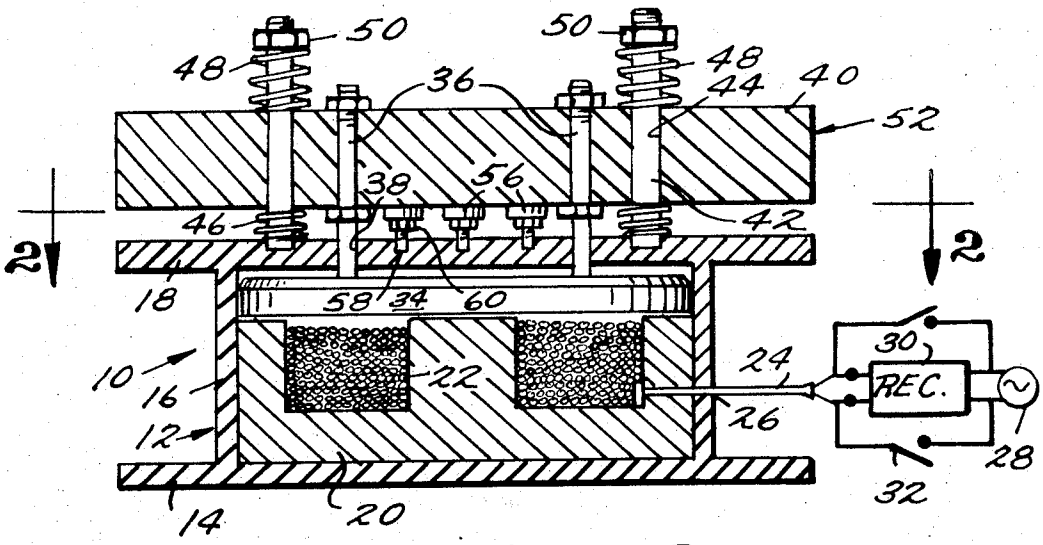
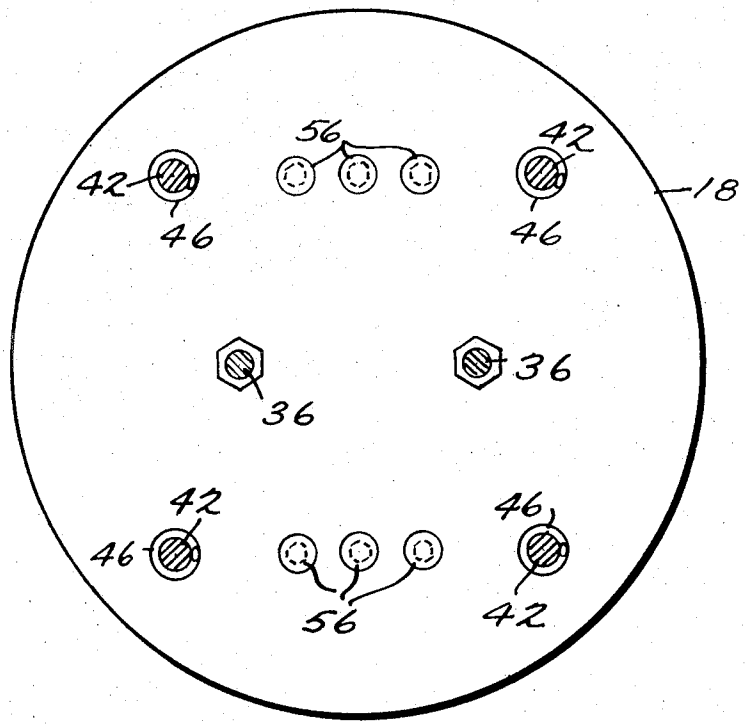

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Fig. 2.


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ADJUSTABLE ELECTROMAGNETIC VIBRATOR

BACKGROUND OF THE INVENTION

The present inventor is aware of the U.S. Pat. Nos. of MacBlane, 3,345,525, issued Oct. 3, 1967, and 3,404,299, issued Oct. 1, 1968, and the references cited therein. The vibrator of the present invention may be used for similar purposes at those disclosed in the MacBlane patents.

SUMMARY OF THE INVENTION

The housing of the electromagnetic vibrator has an outer plate through which studs secured on the armature protrude. A weight is secured on the studs outside the housing. Further studs secured on the plate outside the housing mount the armature/weight assembly on the housing via counter-balancing springs. Nuts secured on the latter studs are adjustable to adjust vibration amplitude. Resilient bumpers may be provided to limit movement of the armature toward the core and coil and to limit movement of the weight toward the housing. The vibrator may use AC electric service, as is, or rectified to DC. The adjustable nuts also accommodate switching from AC to DC electrical service.

The principles of the invention will be further hereinafter discussed with reference to the drawing wherein a preferred embodiment is shown. The specifics illustrated in the drawing are intended to exemplify, rather than limit, aspects of the invention as defined in the claims.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. **1** is a diametral sectional view of the vibrator; and

FIG. **2** is a sectional view along line **2—2** of FIG. **1.**

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

The electromagnetic vibrator **10** is shown including a spool-shaped housing **12** having a disk-shaped base plate **14,** a tubular peripheral sidewall **16** and a disk-shaped outer plate **18.** Any two adjacent ones of the components **14, 16, 18** may be permanently secured together, e.g. by welding, and the other component removably secured thereto, e.g., by being bolted, screwed or clamped together.

Within the housing **12,** an E-sectioned electromagnet core **20** is shown mounted on the base plate and provided with a wound coil **22.** The power cable **24** for the coil **22** proceeds out through the housing at **26,** to a source of electrical power **28.** As shown, the power source **28** is AC current, and a rectifier **30** has been inserted to change the current to pulsating DC. Such rectifiers are commercially available, and the design thereof forms no part of the present invention. Preferably, the rectifier **30** is a plug-in type which may be removed from the power cable, or switching means **32** are provided to isolate the rectifier so the coil is provided with AC rather than pulsating DC current, at the operator's option.

As shown, the core and coil terminate substantially below the housing outer plate **18** so a space is provided within the housing between the core/coil assembly and the housing outer plate. An armature **34** is shown disposed in that space. The armature is insufficiently thick to occupy all the space, so there is room for the armature to vibrate up and down within the space as pulsating current is sent through the coil.

Studs **36** are shown secured on the armature and projecting up through openings **38** in the housing outer plate **18** to outside the housing where the studs removably securely mount a weight **40.** The latter is shown comprising a disk-shaped metal plate. There are also a plurality of studs **42** securely mounted on the housing outer plate **18** and extending axially upwardly therefrom through appropriate openings **44** through the weight **40.** The openings **44** are oversize with respect to the studs **42** so the latter are slidably received through the former.

Each stud **42** carries a first compression coil spring **46** disposed between the housing outer plate **18** and the weight **40** and a second compression coil spring **48** disposed between the weight **40** and a nut or the like **50** adjustably secured on each stud **42.**

It should be apparent that tightening the nuts **50** will lower the assembly **52** comprising the weight **40,** studs **36** and armature **34,** and that loosening the nuts **50** will raise that assembly **52.** This provides a means for adjusting the air gap between the armature and the electromagnetic coil assembly, and thus affects the vibration amplitude of the assembly **52.** The springs **46,48** thus adjustably counter-balance the assembly **52** to a null position. In some applications, as a lower extreme of vibration, the weight **40** or its mountings may be permitted to strike the housing **12.** In other instances, that would prove too noisy or too destructive, whereupon resilient bumper means may be provided to cushion the assembly **52** at its lower extreme of vibration. In the instance depicted, the resilient bumper means are supplied by a plurality of resilient rubber plugs **56** mounted on the exterior of the plate **18** below the weight **40,** among the studs **36, 42.** Preferably, as shown, the plugs **56** are secured on threaded studs **58** provided with adjustable lock nut arrangements **60** which permit the heights of the bumpers to be adjusted.

When utilizing a rectifier the pulsations are cut in half compared to A.C. (3,600 compared to 7,200). Rectified current, however, doubles the amplitude supply, the nuts **50** would be loosened to raise the assembly **52** to produce equivalent vibration effect for the body being vibrated. When the rectifier is removed from the line, the nuts **50** would be correspondingly tightened.

A sufficient number of studs **36, 42** and resilient bumpers **56** are provided to ensure substantially straight line reciprocation of the assembly **52.**

The vibrator **10** is mounted to the apparatus to be vibrated, e.g. by bolting the housing base plate to the apparatus. It should be apparent that there is no "right-side-up" orientation for the device **10,** since the counter-balancing of the assembly **52** permits the device to function in any spatial orientation. The device **10** is made of conventional materials for such electromagnetic vibrators. The vibrator **10** can be used with a relatively small air gap compared to prior devices; this results in a power saving.

It should now be apparent that the adjustable electromagnetic vibrator as described hereinabove possesses each of the attributes set forth in the specification under the heading "Summary of the Invention" hereinbefore. Because the adjustable electromagnetic vibrator of the invention can be modified to some extent without departing from the principles of the invention

as they have been outlined and explained in this specification, the present invention should be understood as encompassing all such modifications as are within the spirit and scope of the following claims.

What is claimed is:

1. An electromagnetic vibrator for imparting vibrations to a materials handling device, said vibrator comprising:

a housing including a base plate, a peripheral sidewall projecting axially from said base plate, and an outer plate on said sidewall near the end thereof opposite the base plate;

securement means on said housing for mounting the vibrator on a materials handling device;

a ferromagnetic core secured in said housing;

a wire coil received on said core facing outwardly of the housing base plate and constructed and arranged for connection to a supply of pulsating electric current;

a ferromagnetic armature disposed in the housing adjacent the core;

a weight disposed exteriorly of the housing, adjacent the outer plate;

first opening means being defined through the outer plate;

first stud means extending through the opening means and connecting the weight to the armature to provide an assembly capable of reciprocating as a unit;

second opening means being defined through the weight;

second stud means mounted on the housing and extending through the second opening means;

first compression coil spring means carried on the second stud means between the weight and the housing;

securement means mounted on said second stud means on the opposite side of the weight from the housing, said securement means being mounted for adjustment toward and away from the housing;

and second compression coil spring means carried on the second stud means between the weight and the securement means;

whereby said assembly is counter-balanced to an adjustable level, and the securement means may be adjusted to vary said level to thereby vary the air gap between the armature and the core and coil.

2. The apparatus of claim **1** further including resilient means disposed between the weight and the housing to cushion abutment of the weight and the housing when said assembly is reciprocated toward the core and coil.

3. The apparatus of claim **2** wherein the resilient means comprise rubber bumpers and means height-adjustably mounting said rubber bumpers on the housing outer plate.

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