

Nov. 5, 1968

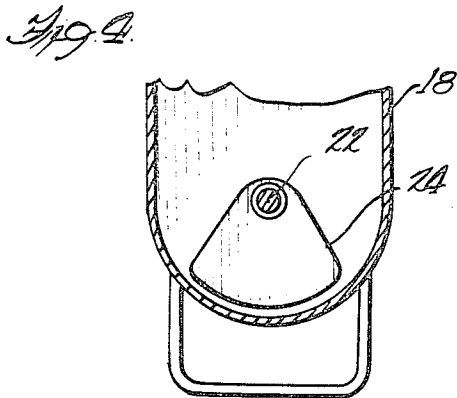
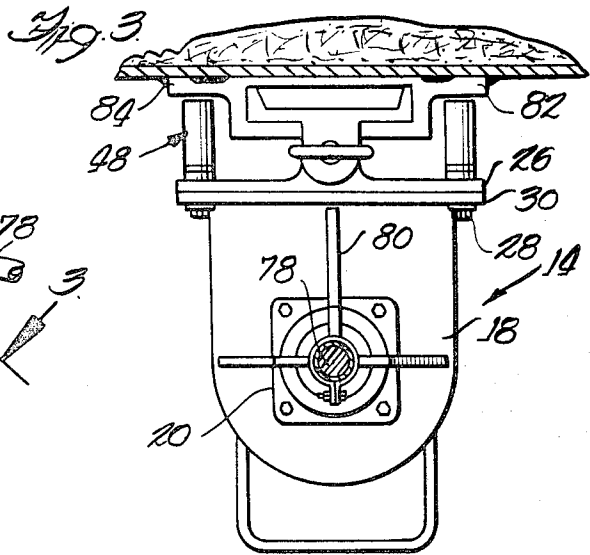
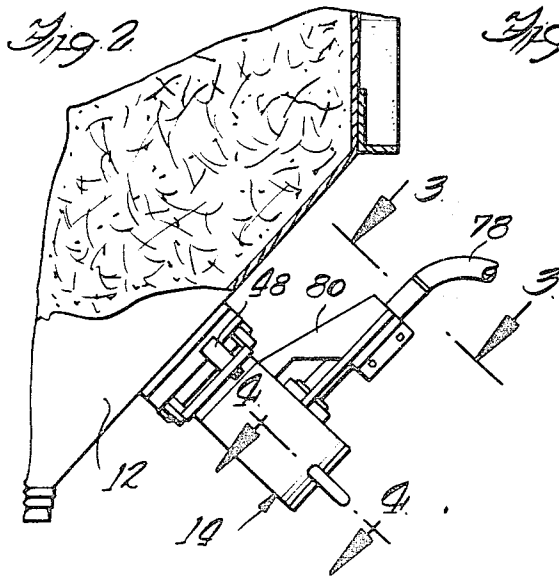
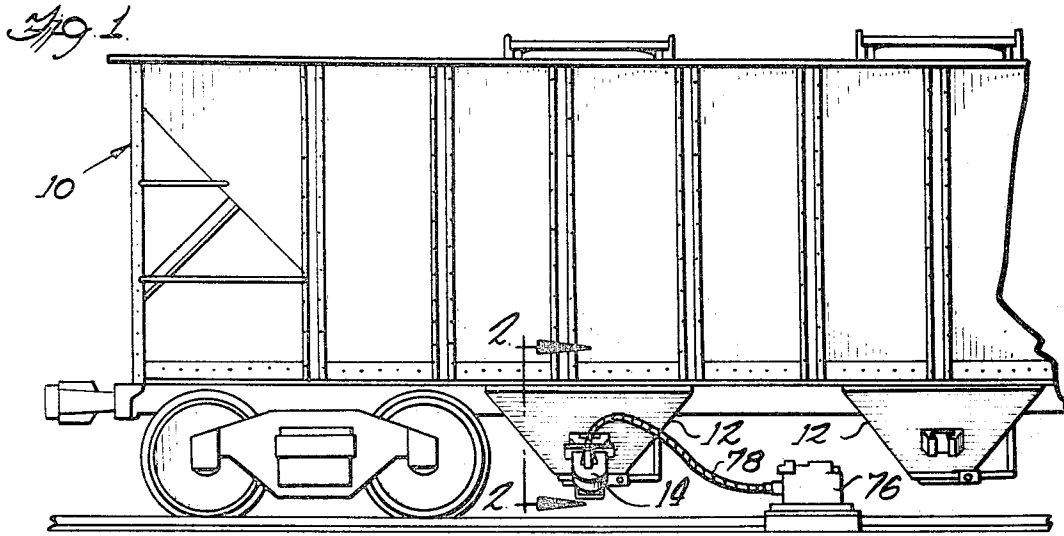
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3,408,876

CAR VIBRATOR

Filed Dec. 23, 1966

2 Sheets-Sheet 1



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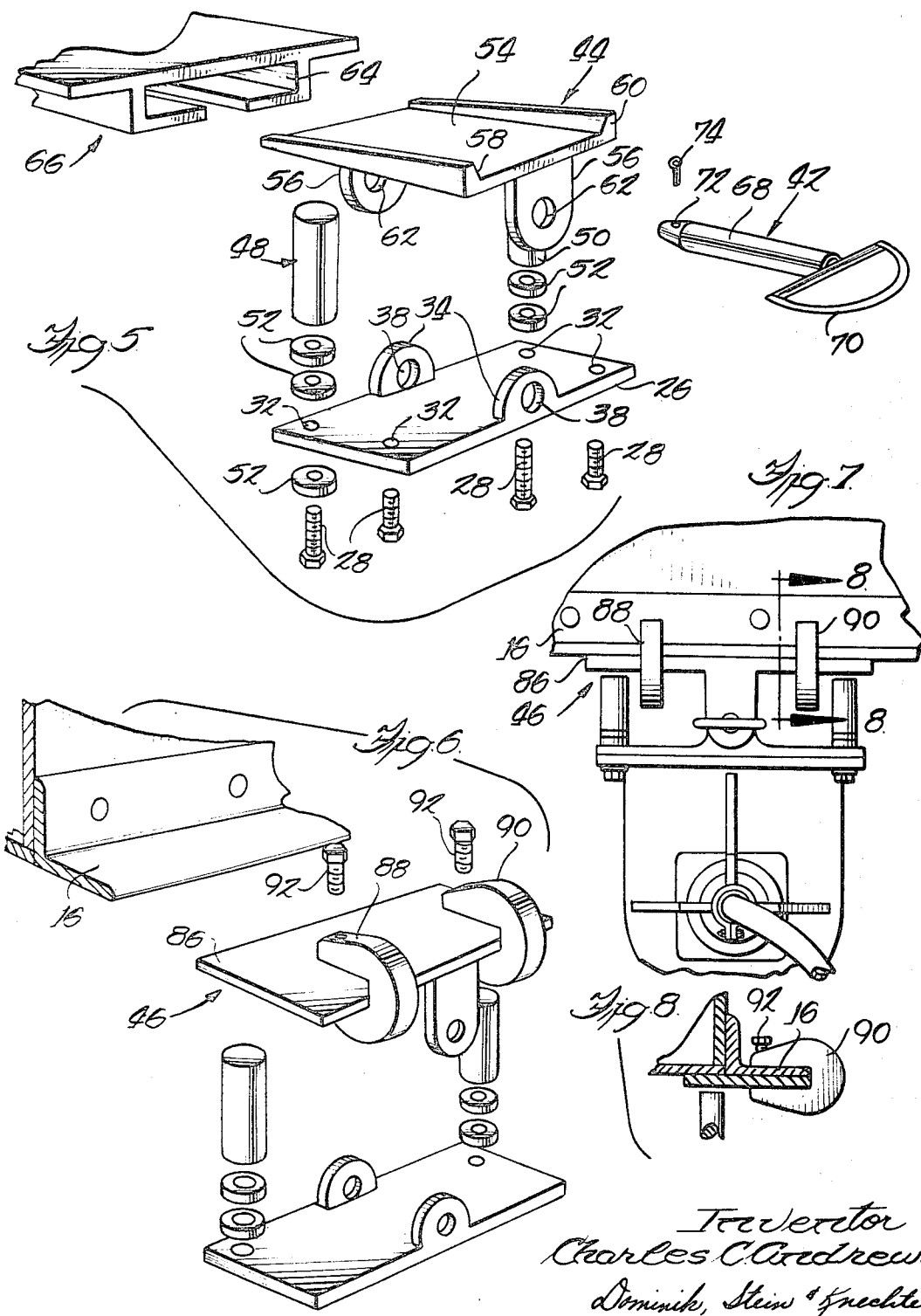
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Filed Dec. 23, 1966

2 Sheets-Sheet 2



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 Filed Dec. 23, 1966, Ser. No. 604,207
 12 Claims. (Cl. 74—61)

ABSTRACT OF THE DISCLOSURE

A vibrator having a weighted mass eccentrically affixed to a shaft which is rotated, and a pair of striker pins. The vibrator is pivotally affixed to an object, such as a hopper, by means of an adapter, and when the weighted mass is rotated, the vibrator is caused to oscillate about the pivotal connection to strike the striker pins against the object to induce the flow of materials which do not flow freely from the object. The vibrator also imparts a low frequency vibration to the object which assists in inducing the flow.

This invention relates to a vibrator for inducing or causing flow of materials which do not flow freely, such as cement, rock phosphate fertilizer, starch, flour and the like, from a supply hopper.

The vibrator of the present invention is particularly applicable for use with railway cars, road vehicles and the like, for accelerating the unloading of the contents of such vehicles. It will be apparent from the description below, however, that its design and construction is such that it is, or easily can be, adapted for use to induce the flow of material from supply hoppers of most any type.

Many vibrating devices for accelerating the unloading of the contents of vehicles, hoppers and the like have been devised, however, each of them has been generally unsatisfactory, for one reason or another. In particular, the prior vibrating devices which are intended primarily for use with railway cars are generally bulky, complex in construction and operation, and expensive. In some cases, the railway cars are bodily tilted, shook or rocked to induce or cause flow of material out of them. The vibrating devices for imparting this type of motion to the railway cars obviously must be of relatively large size and of sturdy construction. Accordingly, in addition to the disadvantages set forth above, the vibrating devices are not readily transported from one site to another, or easily affixed to the railway cars. In addition, the railway cars must be disconnected from one another, or any other vehicle.

Some of the other vibrating devices for use with railway cars are of the impact type and, while they function satisfactorily, they are not readily portable. More importantly, they tend to damage or destroy the railway car and therefore are extremely objectionable.

Accordingly, it is an object of the present invention to provide improved vibrators for inducing or causing flow of materials which do not flow freely from a supply hopper.

It is another object to provide improved vibrators of the above-described type which are easily transported.

Another object is to provide improved vibrators of the above-described type which are designed and constructed in a fashion such that they are, or easily can be, adapted for use to induce the flow of material from supply hoppers of most any type.

Still another object is to provide improved vibrators of the above-described type which are rotary actuated to impart an oscillating, adjustable impact action to the vibrator, to induce the flow of material from a supply hopper. It is further contemplated that the vibrator impart a low frequency vibration to the object to which it is affixed, to assist in inducing or causing said flow of material.

Still another object is to provide improved vibrators of the above-described type which are adapted to be remotely powered, or by means of an integral source of power.

5 Still another object is to provide improved vibrators of the above described type which are relatively compact in size, and of a relatively light weight and sturdy construction.

A still further object is to provide improved vibrators of the above-described type having relatively few moving parts, which parts are easily and readily repaired or replaced, if necessary.

15 Still another object is to provide improved vibrators of the above-described type which will not destroy or damage the objects to which they are affixed and operated to induce the flow of materials from them.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

20 The above objective are accomplished with the vibrator of the present invention which includes, generally, an eccentric mass which is fixedly and rotatably retained within a housing or casing, by means of a drive shaft rotatably supported by said casing. The casing also has a pair of striker pins affixed to it, in spaced relation, and is further adapted to be pivotally affixed to a mounting adapter for affixing the vibrator to an object, such as a supply hopper. When the drive shaft is rotated, the eccentric mass sets up an oscillating motion about the pivotal connection between the casing and the mounting adapter, to cause the striker pins to strike the object and to impart a low frequency vibration to the object. The impacts delivered by the striking pins and the low frequency vibration imparted to the object both function to induce or cause materials to flow freely from the object. The drive shaft may be rotatably driven by means of a source of power integrally formed with or as a part of the vibrator or, alternatively, it can be driven by an external remotely positioned source of power, by means of a flexible drive shaft.

25 The vibrator has only two moving or rotating elements, namely, the eccentric mass and the drive shaft to which it is affixed, hence it is easily repaired, if necessary. If the fact that the casing is oscillated with respect to the mounting adapter is considered as a moving element, the vibrator has three moving elements. In a preferred embodiment, the casing and the mounting adapter are pivotally affixed to one another by means of a removable pivot pin. If the latter is damaged, it is easily and quickly replaced merely by pulling it out and inserting a new one.

30 The impacts and the force of impact of the striking pins and the low frequency vibration imparted to the object can be adjusted by varying the rotational speed of the drive shaft and by adjusting the length of the striking pins. Accordingly, both variable speed and constant speed sources of power can be employed, and appropriate adjustments in the rotational speed or the length of the striking pins made to provide the most satisfactory operation of the vibrator, for inducing material flow.

35 The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

40 For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

45 FIG. 1 is a partial side plan view of a railway car having a vibrator exemplary of the present invention removably affixed to the hopper thereof, for inducing or causing flow of the material within the car out of the hopper;

FIG. 2 is an enlarged sectional view, taken along lines 2—2 of FIG. 1;

FIG. 3 is a top plan view of the vibrator, illustrating one manner in which it can be affixed to a hopper;

FIG. 4 is a partial sectional view of the vibrator, illustrating the eccentric mass rotatably retained within the casing thereof;

FIG. 5 is an exploded perspective view, illustrating the manner in which the striking pins are adjustably affixed to the vibrator and further illustrating one adapted and the manner in which it is removably affixed to the vibrator;

FIG. 6 is an exploded perspective view, illustrating a second adapter and the manner in which it is removably affixed to the vibrator;

FIG. 7 is a partial view of a railway car, illustrating the manner in which the vibrator is affixed to it using the adapter of FIG. 6; and

FIG. 8 is a sectional view taken along lines 8—8 of FIG. 7.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, in FIG. 1 there is illustrated a railway car 10 of the type which is adapted to transport bulk materials such as cement, rock, phosphate, fertilizer, starch, flour and the like, which materials are unloaded from the car 10 through a number of hoppers 12 on the bottom side of it. Many of these materials do not flow freely and, accordingly, some means must be provided for inducing or causing the material through and out of the hoppers 12. In accordance with the present invention, the material is induced or caused to flow out of the hoppers 12, by affixing a vibrator 14 to the hopper 12, as illustrated in FIGS. 1-3 and 5, or to a flange 16 extending along the length of the car 10, as illustrated in FIGS. 6-8. The vibrator 14 has an oscillating, adjustable impact action which is imparted to the hopper, to induce or cause the material to flow out of it. In addition, the vibrator imparts a low frequency vibration to the hopper to assist in inducing or causing the flow of material.

More specifically, the vibrator 14 has a housing or casing 18 to which are affixed a pair of bearing assemblies 20 for rotatably supporting a drive shaft 22. The shaft 22 has a substantially triangular shaped weight 24 fixedly secured to it, substantially centrally between the walls of the casing 18, in an eccentric fashion. The opposite end of the shaft 22 extends out of the casing 18 and is formed with splines or the like, to permit a source of power to be coupled to it.

A pivot plate 26 (FIG. 5) is affixed to the casing 18 by means of fastening means such as threaded bolts 28 extended through apertures (not shown) formed in a flange 30 on the lower end of the casing and apertures 32 in the pivot plate 26. The pivot plate 26 functions to seal the casing 18 and also has a pair of pivot ears 34 having apertures 38 therein for receiving a pivot pin 42 to removably and pivotally affix the casing 18 to a mounting adapter 44 or 46 (FIGS. 5 and 6, respectively).

A pair of elongated, solid, cylindrical-shaped striking pins 48 and 50 also are affixed to the pivot plate 26, by extending the threaded bolts 28 into threaded apertures (not shown) formed in them. Washer-shaped spacers 52 also are provided for adjusting the impact blows of the striking pins, in the manner described below.

The mounting adapter 44 is wedge-shaped and is formed of a flat rectangular-shaped base 54 having a pair of pivot ears 56 fixedly secured to one side thereof and a pair of tapering legs 58 and 60 affixed to the opposite side thereof, along its edges. The pivot ears 56 each have an aperture 62 for receiving the pivot pin 42, to pivotally affix the pivot plate 26 and the mounting adapter 44 to one another. The pivot ears 56 are of a predetermined length and the apertures 62 are formed therein in a fashion such that the ends of the striking pins 48 and 50

are spaced from the object against which they are caused to strike, when the vibrator 14 is affixed to the object.

The mounting adapter 44 is formed to be slidably and removably retained within a slot 64 of a pocket 66 generally provided on the hopper of most presently available covered hopper bottom railway cars, to removably affix the vibrator 14 to the hopper, as illustrated in FIGS. 1-3.

The pivot pin 42 has a shank portion 68 which is adapted to be received within the apertures 38 and 62 formed in the pivot ears 34 and 56, respectively, in a fashion such that the casing 18 can freely pivot with respect to the mounting adapter 44. A handle 70 can be affixed to one end of the shank 68 so that the pivot pin 42 can be easily removed and replaced, and the opposite end of the shank 68 can be substantially pointed to assist in extending the pivot pin through the apertures 34 and 56. Also, an aperture 72 is formed in the end of the shank 68, for receiving fastening means such as a cotter pin 74, to secure the pivot pin 42 within the apertures.

A source of power 76 (FIG. 1) which can be a gasoline engine is coupled to the drive shaft 22, by means of a flexible drive shaft 78. A support bracket 80 is affixed to the casing 18 and is adapted to support the end of the flexible drive shaft 78, in driving engagement with the end of the drive shaft 22. The source of power 76 advantageously can be derived from the conveyor used to transport the material from the hopper 12 to another station and, in this respect, the vibrator 14 is particularly adapted to be driven directly from the gear box of a P-52 conveyor manufactured by the Andrews Machine Company, Villa Grove, Illinois, by means of the flexible drive shaft 78. Alternatively, a source of power can be integrally formed as a part of the vibrator 14 and directly coupled to the drive shaft 22 thereof, thereby eliminating the remote source of power 76 and the flexible drive shaft 78.

In operation, the drive shaft 22 and hence the weight 24 eccentrically affixed thereto is rotatably driven, preferably at approximately 900 r.p.m. The rotation of the eccentric weight 24 sets up an oscillating motion about the pivot pin 42 which causes the casing 18 to pivot and strike the striking pins 48 and 50 against the outwardly extending flanges 82 and 84, or directly against the side wall of the hopper 12, with air hammer-like blows. It is also found that the rotation of the eccentrically affixed weight 24 produces a low frequency vibration which is imparted to the hopper 12 and assists in inducing or causing the material to freely flow out of the hopper 12. When rotated at approximately 900 r.p.m., approximately 1800 hammer-like blows per minute are delivered to the hopper 12.

The rate and force of the blows or impulses delivered to the hopper 12 can be controlled by adjusting the length of the striking pins 48 and 50 and by varying the rotational speed of the drive shaft 22. Increasing the rotational speed of the drive shaft will increase both the frequency of oscillation of the casing 18 about the pivot pin 42 and the low frequency vibration imparted to the hopper 12, however, it is found that a rotational speed of approximately 900 r.p.m. is preferred and the rate and force of the blows and impulses varied by adjusting the length of the striking pins 48 and 50. This is accomplished by removing or replacing the spacer 52 between the ends of the striking pins 48 and 50 and the pivot plate 26, to space the striking end of the striking pins at a distance from the flanges 82 and 84, or the side wall of the hopper 12, at a distance which provides the most satisfactory operation. In this fashion, both the rate and the force of impact of the striking pins can be controlled.

In FIGS. 6-8, there is illustrated a mounting adapter 46 which is adapted to clamp to a flange 16 extending along the length of most hopper type railway cars, to affix the vibrator 14 to the hopper car. The mounting adapter 46 includes a rectangular-shaped plate 86 having

pivot ears like the pivot ears 56 affixed to one side of it, for pivotally affixing the pivot plate 26 to the mounting adapted 46, in the same manner as described above. A pair of substantially U-shaped clamps 88 and 90 are fixedly secured to the plate 86, in spaced relation on opposite sides of the pivot ears. The plate 86 extends between the two legs of each of the clamps 88 and 89 and is fixedly secured to one of the legs of each of the clamps. The mounting adapter 46 is secured to the flange 16 by extending it into the clamps 88 and 90 between the plate 86 and the upper legs of each of the clamps, as illustrated in FIG. 8. A pair of bolts 92 are threadedly received within apertures 94 formed in the upper legs of each of the clamps 88 and 90 and the ends thereof are adapted to engage the flange 16, to fixedly secure the mounting adapter 46 to the flange.

From the above description, it can be seen that the vibrator 14 can be easily and quickly affixed to the hopper or directly to the railway car itself, simply by providing an appropriate mounting adapter such as the mounting adapters 44 and 46. Also, the mounting adapter can be easily affixed to the vibrator 14, simply by removing and replacing the pivot pin 42. The mounting adapter 14 has only two moving parts, namely the drive shaft 22 and the weight 24 eccentrically affixed thereto, so that little, if any, maintenance other than lubricating the bearing assemblies 20 is required. Once affixed to the railway car 10, the rate and impact of the blows or impulses of the striking pins 48 and 50 can be easily and quickly adjusted to provide the most satisfactory operation in inducing or causing the flow of material from the hopper. The vibrator 14 can also be remotely powered, or the source of power can be provided as an integral part of the vibrator and, as indicated above, the source of power can advantageously be derived from the gear box of a P-52 conveyor manufactured by the Andrews Machine Company, or any other type of conveyor having an output capable of rotating the drive shaft 22 at approximately 900 r.p.m.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. A vibrator for inducing or causing flow of materials which do not flow freely from an object comprising, in combination: a housing; an eccentric mass rotatably supported by said housing; striker means affixed to said housing for striking said object; and a means for pivotally affixing said housing to an object; said eccentric mass upon being rotated causing said housing to oscillate about said pivotal connection with said object, the oscillatory motion of said housing imparting a low frequency vibration to said object.

2. The vibrator of claim 1 wherein said means for pivotally affixing said housing to an object comprises a mounting adapter and a pivot pin, said housing and said mounting adapter each being formed to removably receive said pivot pin to pivotally affix them to one another.

3. The vibrator of claim 2 wherein said striker means

comprises a pair of striker pins affixed to said housing in spaced relation, on opposite sides of said pivotal connection between said housing and said mounting adapter.

4. The vibrator of claim 2 wherein said striker pins are adjustably and removably affixed to said housing.

5. The vibrator of claim 1 further including a source of power; and flexible drive shaft means for coupling said source of power to said vibrator to rotate said eccentric mass.

6. The vibrator of claim 1 further including a drive shaft rotatably supported within said housing, said eccentric mass being fixedly secured to and rotated by said drive shaft; and a source of power coupled to said drive shaft for rotating it.

7. The vibrator of claim 1 further including a cover removably affixed to said housing for enclosing and concealing said eccentric mass therein.

8. The vibrator of claim 2 wherein said mounting adapter comprises a flat plate having a pair of tapered legs and a pair of flanges which have apertures therein for receiving said pivot pin, said housing having a pair of flanges which have apertures therein affixed to it for receiving said pivot pin, whereby said mounting adapter is removably affixed to said vibrator by extending said pivot pin through said apertures in said flanges on both said mounting adapter and said housing.

9. The vibrator of claim 2 wherein said mounting adapter comprises a flat plate having a pair of legs affixed to it which overlie said plate so as to form a slot for receiving a flange therein and fastening means for securing said flange within said slot.

10. The vibrator of claim 9 wherein said fastening means comprises a threaded screw adjustably and threadedly received in an aperture in each of said legs, said threaded screws being engageable with said flanges to secure said flange within said slot.

11. The vibrator of claim 10 wherein said flat plate is engaged by said striker means, whereby said flange is not engaged thereby.

12. A vibrator for inducing or causing flow of materials which do not flow freely from an object comprising, in combination: a housing, a drive shaft extending through said housing and being rotatably affixed therein; an enlarged mass retained within said housing which is eccentrically affixed to and rotated by said drive shaft; a cover removably affixed to said housing for enclosing said mass therein; a pair of flanges affixed to said housing; a pair of striker pins affixed to said housing on opposite sides of said pair of flanges; a mounting adapter for affixing said vibrator to an object having a pair of apertured flanges affixed to it; and a pivot pin removably received within said apertures in said flanges on both said housing and said mounting adapter for pivotally affixing said housing to said mounting adapter; said mass upon being rotated causing said housing to oscillate about said pivot pin to cause said striker pins to strike said object.

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