United States Patent

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[54] **VIBRATORY DRIVE UNIT**
7 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **310/29**
[51] **Int. Cl.** **H02k 33/02**
[50] **Field of Search** 310/15, 25, 29, 21, 17

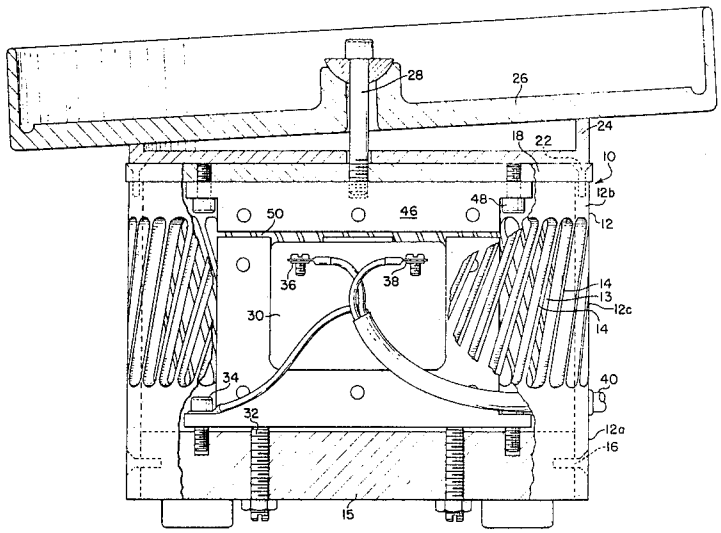
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ABSTRACT: Drive unit for vibratory part feeder utilizes a tubular cylinder as both a protective case for the unit to enclose an electromagnetic coil, and also, by angularly slotting the cylinder completely around its periphery, as a spring which cooperates with the electromagnetic coil to provide a vibratory feeding motion to parts placed in a feeder bowl which may be attached to the drive unit.



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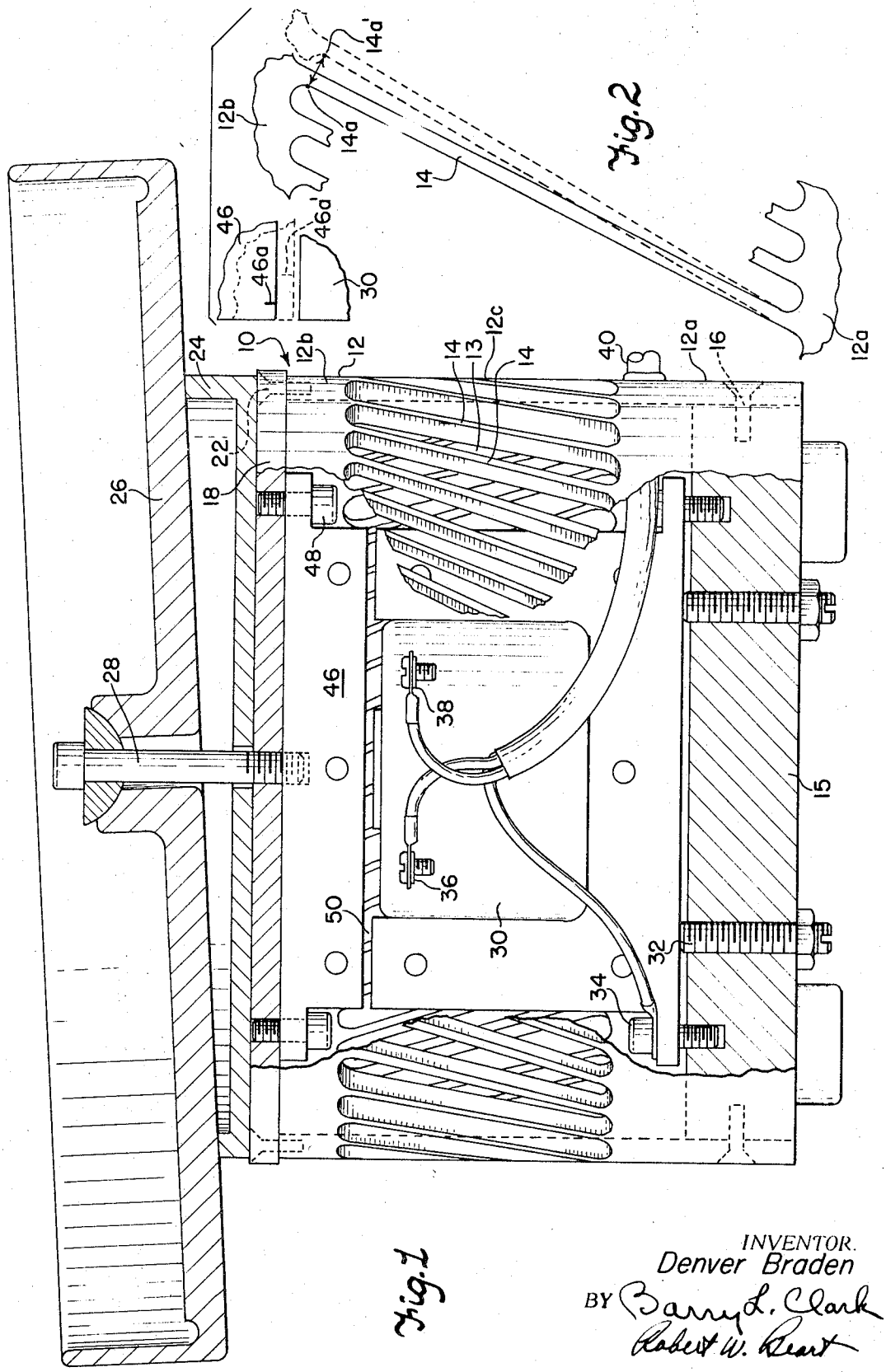


Fig. 2

Fig. 1

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VIBRATORY DRIVE UNIT

BACKGROUND OF THE INVENTION

Vibratory drive units for feeding small parts are widely known and used. Typically, these units include an electromagnetic coil for driving the device quickly in one direction and a spring for returning it to its original position. In addition, a housing must be provided to cover the internal parts including the spring. The housing which is fixed to the base of the unit, must be sufficiently close to the feeder bowl to provide protection and yet have clearance between itself and the vibrating feeder bowl in order to prevent rubbing of the relatively moving parts of the device on each other.

SUMMARY

It is an object of this invention to provide an extremely simple and compact vibratory drive unit which is not only effective for its purpose, but economical to manufacture.

These and other objects are accomplished by the device of the present invention which utilizes a plurality of helically arranged slots in a tubular cylinder to weaken the cylinder and permit it to function as a spring. Thus, the invention eliminates the necessity of providing either a separate spring or a space to put it. Attached to the lower end of the cylindrical spring is a base member which carries an electromagnetic coil. Attached to the upper end of the cylindrical spring is a feeder bowl support member which has an armature member affixed to its lower surface and is adapted to carry a feeder bowl on its upper surface. The armature and coil are adjustably positioned relative to each other so as to provide a magnetic airgap between them. Although it is desirable that the armature and coil never touch one another, they are positioned sufficiently close to each other so that the armature will be pulled toward the coil when the coil is energized by an alternating current such as conventional 60 Hz. current. The cross section of the web portions of the spring cylinder between the slots provide sufficient rigidity to the cylinder to prevent the armature from being moved so far as to touch the coil while yet providing sufficient resiliency to permit it to move relative to the coil. This movement of the armature naturally causes the upper end of the cylinder to be moved axially toward the lower end and also to rotate relative to it since the cylinder slots are arranged helically. Since conventional alternating current will result in a maximum voltage being reached in the turns of the coil at approximately one-quarter of a cycle, it is obvious that the feeder bowl will be quickly rotated to one extreme of its movement during the small portion of the AC cycle just prior to this point in the cycle as the coil acts against the spring cylinder. The spring cylinder may then return the feeder bowl to its initial or opposite extreme position over the remaining portions of the AC cycle. Since the movement of the bowl in one direction by the coil is very fast, the bowl will be jerked under the parts within it without causing them to move. The much slower return movement of the bowl by the energy stored in the spring cylinder will cause the parts to be moved forward by the bottom of the feeder bowl as it moves.

Although the spring cylinder has been made of steel in the preferred embodiment of the invention, it is obvious that other materials, including plastics, which have either been cast, molded or machined, could be used. Depending upon the loads to be carried by the feeder bowl, the amount of web material which is permitted to remain between the slots in the spring cylinder must be matched somewhat to the strength of coil used in order that the armature can be pulled toward the coil to provide the desired feeding movement, but without bouncing against the coil.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially sectioned side view of the vibratory drive unit of the invention showing the unit in use with the feeder bowl; and

FIG. 2 is a diagrammatic view illustrating the rotary movement of the top portion of the spring cylinder when the coil is energized.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The vibratory drive unit indicated generally at **10** comprises a shell or spring cylinder **12** preferably made of steel tubing which is machined so as to provide a continuous lower portion **12***a*, a continuous upper portion **12***b*, and a central portion **12***c* in which helical slots **13** are formed between elongated narrow web portions **14**. The lower portion **12***a* of the spring cylinder **12** is integrally fastened to a base member **15** by means of fasteners **16**. The upper end portion **12***b* of the spring cylinder is fastened integrally to a feeder bowl support member **18** by means of fasteners **22**.

During use of the vibratory drive unit an adjustable mounting member **24** may be placed on top of the feeder bowl support member **18** so as to provide the desired angle of slope to a flat bottomed feeder bowl **26** mounted thereon by means of mounting bolt **28**. The details of the feeder bowl form no part of the present invention and are described in my copending application Ser. No. 706,010, filed Feb. 6, 1968.

Mounted on the base **15** of the drive unit is an electromagnetic coil **30** which may be vertically adjusted relative to the base **15** by means of a plurality of setscrews **32** and a plurality of mounting bolts **34**. Electric power is supplied to the coil **30** through terminals **36, 38** by means of a power cord **40**. An armature member **46** is mounted to the lower surface of feeder bowl support member **18** by means of a plurality of fasteners **48**.

When the coil **30** is energized by a source of alternating current, a strong magnetic force will be generated by the coil during the positive portion of the alternating current cycle which will magnetically attract the armature member **46** and cause it to move across the magnetic airgap **50**. This attractive movement will take place very quickly at a point just prior to the point in the alternating current cycle where the voltage is a maximum. As the voltage decreases from its maximum, the coil **30** has no effect on the armature. During the portion of the cycle where the coil is not fully energized, the stored spring energy introduced into the springlike web portions **14** is available to relatively slowly return the support **18** and the feeder bowl **26** thereon to its normal position. As previously noted, it is this slow portion of the vibratory cycle wherein parts placed in the bowl **26** are fed forwardly.

FIG. **2** illustrates the movement of an upper portion **14***a* of the web portion **14** to its dotted position **14***a'* when a point **46***a* on the armature **46** is pulled to the dotted line position **46***a'* it assumes when the coil **30** is energized. Since the spring cylinder **12** is round, it is obvious that the armature **46** affixed to it will rotate as well as move downwardly through the magnetic airgap **50** as the coil **30** is energized. This movement will bend each web member **14** and store energy in it which is then returned when the coil is deenergized. The airgap **50** is preferably of a width of about 0.005—0.040 inch.

I claim:

1. A vibratory drive unit for use with a parts feeding bowl comprising:

an elongated hollow cylinder member having first and second end portions and an intermediate central portion;

said first end portion being integrally fastened to a drive unit base member;

said second end portion being integrally fastened to a feeder bowl support member.

an electromagnetic coil affixed to one of said end portions and an armature member affixed to the other of said end portions, said armature member being spaced from said coil;

said central portion of said cylinder having elongated slots arranged completely around its periphery at an angle to the axis of said cylinder so as to define a plurality of web portions of narrow width which interconnect said end

portions, said plurality of web portions being sufficiently small in cross section so as to resiliently bend to permit the said end portions to move toward each other when said coil is periodically energized so as to magnetically attract and move said armature, the time required for said end portions to move toward each other by the energization of said electromagnetic coil being substantially faster than the time required for the resilient web portions to return to their unstressed positions.

2. A vibratory drive unit as defined in claim 1 wherein said cylinder comprises steel tubing.

3. A vibratory drive unit as defined in claim 1 wherein said electromagnetic coil is mounted on said drive unit base member for adjustable movement relative to said armature member in order to vary the width of the magnetic airgap between said coil and armature.

4. A vibratory drive unit as defined in claim 3 wherein said adjustable movement is provided by a first plurality of adjustable fasteners which permit said electromagnetic coil to be mounted at varying distances from said base member, and a second plurality of fasteners which serve to lock said electromagnetic coil to said base member but spaced therefrom in accordance with the setting of said adjustable fasteners.

5. A vibratory drive unit in accordance with claim 4 wherein the spacing of said coil from said armature can be varied from approximately 0.005 inch to 0.040 inch in order to vary the driving power and the amount of feed movement which may be imparted to a feeding bowl attached thereto.

6. A vibratory drive unit in accordance with claim 1 wherein the time required for said end portions to move toward each other when said coil is energized is less than one-half the time required to move away from each other due to the spring force of said web portions when said coil is deenergized.

7. A vibratory drive unit in accordance with claim 1 wherein said cylinder comprises the outer housing for said unit.