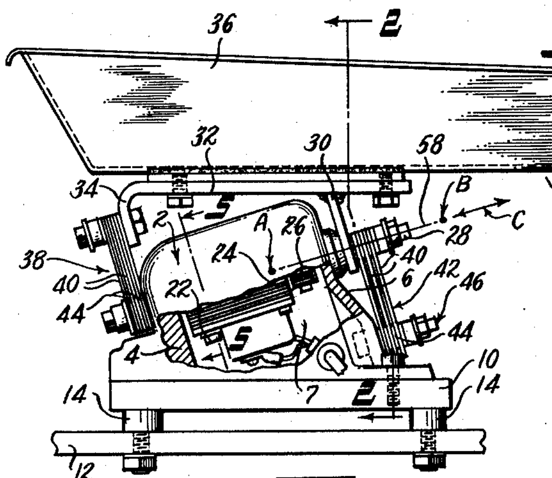
April 30, 1963 J. C. PETREA 3,087,603

VIBRATORY FEEDER

Filed July 11, 1961

Fig.1.



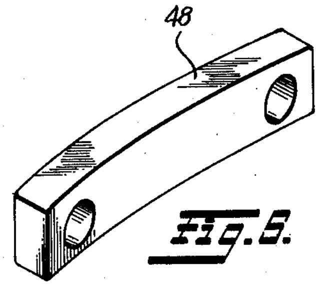


Fig.6.

Fig.2.

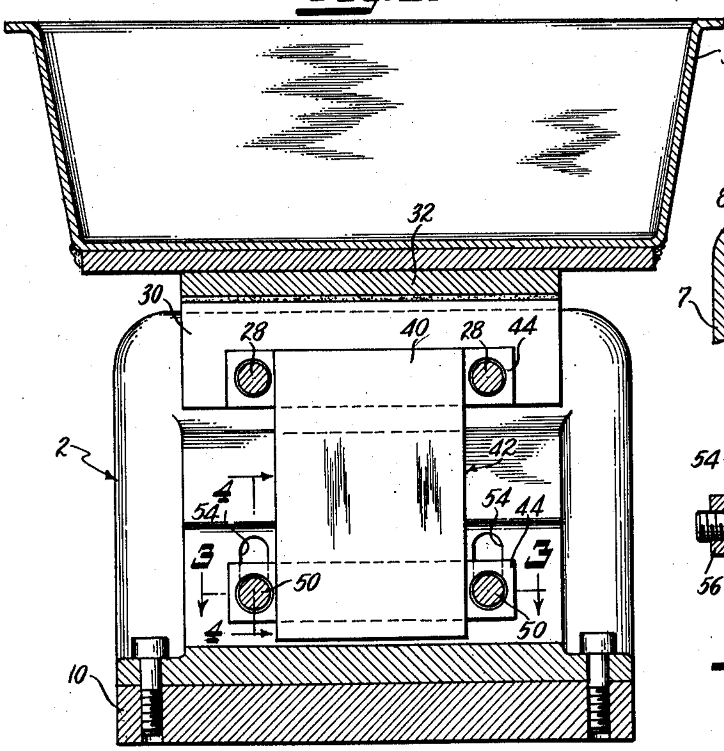
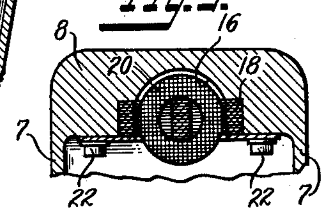


Fig.5.



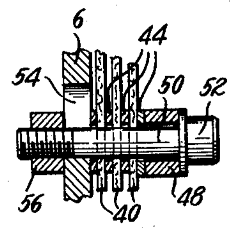
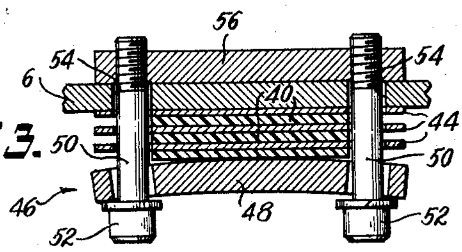


Fig.4.

Fig.3.



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VIBRATORY FEEDER

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This invention relates to vibratory feeders or conveyers of a type wherein an electromagnetic motor causes vibration of an armature which is secured to a trough or the like supported by leaf springs for movement in a direction to advance fluent material thereover. The present invention comprises improvements in such a feeder device.

In brief, the improvements in the present invention comprise a novel spring feature wherein the effective length of at least one of the supporting leaf springs may be changed, without disturbing the spatial relationship between the trough and motor, for the purpose of "tuning" the vibratory elements to a natural period of vibration equal to the frequency of vibrations generated by the electromagnetic motor. Further features of the invention reside in a novel clamping structure for the leaf springs to eliminate wear between adjacent springs as a result of their vibratory flexure and the design and arrangement of the parts so that the center of gravity of the stationary base is aligned with the center of gravity of the moving assembly in the line of the direction of vibration of the trough.

It is therefore an object of this invention to provide a vibratory feeder having a material directing means supported by leaf springs and in which the springs may be tuned to regulate the natural period of vibration.

Another object of the invention is to provide a feeder of the type set forth wherein the tuning of the leaf springs is accomplished by a releasable clamp which is further so configured as to clamp the leaf spring against a base with uniform pressure across the entire width thereof and permit tuning of the spring without disturbing the physical relationship between the feed trough and its base.

Still another object of the invention is to provide a novel feeder of the type set forth wherein the center of gravity of the base and that of the trough and its associated elements are in alignment in the direction of movement to eliminate unwanted vibrations and to largely eliminate unnecessary dissipation of energy.

A further object is to provide a novel vibratory feeder that is simple and economical to manufacture and yet reliable and efficient in operation.

Further and additional objects and advantages will become apparent to those skilled in the art as the description proceeds with references to the accompanying drawings wherein:

FIG. 1 is a side elevational view of a preferred embodiment of the invention, with parts broken away to show internal construction.

FIG. 2 is a vertical sectional view taken along the line 2—2 of FIG. 1 but on an enlarged scale.

FIG. 3 is a transverse sectional view through the adjustable clamp, taken along the line 3—3 of FIG. 2.

FIG. 4 is a sectional view along the line 4—4 of FIG. 2.

FIG. 5 is a fragmentary sectional view taken along the line 5—5 of FIG. 1, and

FIG. 6 is a perspective view of a novel clamping bar employed with the present invention.

Referring to FIG. 1, a stationary base housing **2** is shown as comprising a downwardly open hollow housing having relatively thin rear and front walls **4** and **6** and side walls **7** (FIG. 5) but having a solid, thick and heavy upper wall portion **8**. The downwardly open housing is closed by a suitable base plate **10**, which may be of

2

lighter weight material than the housing **2**, held to the housing by suitable bolts, not identified. Preferably the housing **2** is formed of relatively heavy metal such as cast iron or the like. In use, the base is supported on a supporting frame **12** by means of resilient pads or the like **14**.

The upper thickened wall of the housing **2** is formed with a recess **16** therein (see FIG. 5) in which an electromagnetic motor is nested, the motor comprising a core piece **18** and a coil **20**. The electromagnetic motor is supported and fixed in the recess **16** by bolts **22**. The core piece **18** terminates in pole faces (see FIG. 1) adjacent and opposite a face of a movable armature **26**. The armature **26** is provided with a pair of driving rods **28** extending through openings in the housing **2**. The rods **28** are secured to a bracket **30** and serve as upper clamping means for a leaf spring **42**, to be described. The bracket **30** is rigidly fixed to a further bracket bar **32** provided with a down-turned flange **34** at its rear end. The bracket bar **32** supports and is fixed to a feeder trough **36**. The flange **34** is fixedly secured to the upper end of a leaf spring **38** comprising spaced-apart plates **40** which are preferably of Fiberglas, a well known product having known characteristics of resilience and comprising glass fibers reinforcing a resin sheet. The lower end of the leaf spring **38** is secured to the base housing **2** against the rear wall **4** thereof and is so arranged as to extend upwardly and rearwardly at an oblique angle to the vertical. A front leaf spring **42** is secured at its upper end to the bracket **30** and is clamped at its lower end to the front wall **6** of the base housing **2** to extend in a direction parallel to the leaf spring **38**. The leaf spring **42** is likewise constructed of spaced Fiberglas plates and each leaf spring is provided with spacers **44** between adjacent plates at both of their ends. The lowermost clamp **46** for the front leaf spring comprises an outer clamp bar **48** (see FIG. 3) having an opening through each end thereof through which clamping bolts **50** extend. The clamping bolts **50** are provided with heads **52** bearing against the outer face of the bar **48** and extending outwardly of the side edges of Fiberglas plates **40** but through openings in the projecting end portions of spacers **44**. The front wall **6** of the housing **2** is provided with vertical slots **54** through which the bolts **50** extend. Inside the housing **2** the bolts **50** threadingly engage openings in a slidable rear clamping bar **56** whereby to clamp the spring **42** against the housing.

The driving rods **28** extend through openings in the upper end of leaf spring **42** and nuts threaded nuts on said rods serve to clamp the upper end of leaf spring **42** against bracket **30**.

As will be apparent, the bolts **50** may be loosened whereupon the entire clamping structure may be moved vertically along the slots **54** and again clamped to thereby adjust or change the effective length of the leaf spring **42**. As is known, the natural period of vibration of a leaf spring is dependent upon its length. Therefore, the spring **42** may be adjusted to such length that the natural period of vibration of the trough **36** and its associated elements can be brought into exact correspondence with the frequency of the alternating current applied to the electromagnetic motor so as to most efficiently drive the vibrator and with the lowest possible dissipation of energy.

As indicated in FIG. 1, the center of gravity of the base housing **2** is quite near the top of the housing, for example, at the point marked "A." Likewise, the center of gravity of the assembly comprising trough **36**, brackets **30** and **32**, and the moveable portions of the springs **38** and **40** is at such a point as indicated at "B." Preferably the parts are so proportioned and designed that the line **58** joining at points A and B, extends through the point of connection between armature 26 and bracket 30 and extends in the direction of vibration of the trough 36. Double-headed arow C indicates the direction of vibration, which is perpendicular to the plane of the springs 40 and 42 and extends slightly oblique to the horizontal. The mode of operation of such a feeder-conveyor for advancing fluent material is well known and need not be explained in detail herein.

Referring again to FIG. 3, if the outer clamping bar 48 were straight, tightening of the bolts 50 would first clamp at outer edge portions of the spring plates 40 and those outer edge portions would always be clamped tighter than the intermediate portions. Under such conditions, vibration of the springs under the influence of the driving motor would cause continuous flexing and stressing of the inner and outer surfaces of those plates in the region of the clamp and would result in relative movement of the intermediate portions of the plates where they engage their respective spacers with resulting wear and disturbance of the operating characteristics of the device. By forming the outer clamping bar 48 to a slightly bowed configuration with its convex face inwardly, the first effect of tightening the bolts 50 is to clamp the intermediate portions of the spring plates, and only after further pressure is applied are the ends of the clamping bar sprung inwardly far enough to clamp the edge portions of the plates. Thus, the bolts 50 may be tightened to the degree necessary to effect uniform clamping pressure across the entire width of the leaf spring 46 and eliminate uneven wear due to flexure.

It will also be obvious that the alignment of the centers of gravity of the stationary and moveable portions of the apparatus in the direction of vibratory movement results in the elimination of undesired forces tending to cause the entire apparatus to vibrate in torsion about some horizontal axis. The action and reaction against the centers of gravity are directly in line with the direction of movement and there is thus no tendency to develop unwanted vibrations in any other plane, and there is a more efficient utilization of the motor energy without dissipating same in unwanted flexure of any of the parts.

While a single specific embodiment of the invention is shown and described herein, it is to be understood that the same is merely exemplary rather than limiting, that other embodiments may be employed without departing from the scope of the appended claims.

I claim:

1. In a vibratory feeder having a rigid base, a feeder trough, and upstanding leaf springs fixedly secured at their upper ends to said trough and supporting said trough on said base for vibratory movement in a direction slightly oblique to horizontal, the improvement comprising:

clamping means releasably clamping the lower end of at least one of said leaf springs to said base, the said lower end being otherwise free of securement to said base, said clamping means being adjustable relative to said base and said leaf spring in a direction along said leaf spring whereby to selectively adjust the length of said spring and thereby adjust the natural period of vibration of said trough.

2. A vibratory feeder as defined in claim 1 wherein said clamping means comprises a pair of bolts threadedly engaging a member slidably abutting a portion of said base, said bolts being spaced apart outwardly of the opposed side edges of said leaf spring and through a clamp bar extending across the outer face of said leaf spring; and heads on said bolts engaging the outer face of said clamp bar.

3. A vibratory feeder as defined in claim 2 wherein said leaf spring comprises a plurality of superposed spring plates; spacer means between adjacent plates at the upper and lower ends of said leaf spring, the spacer means at said lower end being substantially directly inwardly of said clamp bar; said clamp bar being bowed slightly and convex toward said leaf spring whereby, when said bolts are tightened, the clamping pressure applied to said plates and spacers is substantially uniform across the width of said leaf spring.

4. In a vibratory feeder having a base, a feeder trough, and upstanding leaf springs supporting said trough on said base for vibratory movement in a direction slightly oblique to horizontal, and opposed magnetic drive means on said base and said trough for vibrating the same in said direction, said drive means having opposed magnetic pole forces extending transverse to said direction, the improvement comprising: said trough including an assembly of elements, including means connected to said leaf spring, so proportioned and arranged that a line joining the center of gravity of said assembly and the center of gravity of said base extends substantially parallel to said direction of vibratory movement of said assembly and substantially through the center of said opposed magnetic pole faces.

References Cited in the file of this patent

UNITED STATES PATENTS

263,375	Wilson	Aug. 29, 1882
2,187,717	Weyandt	Jan. 23, 1940
2,342,116	Broekhuysen	Feb. 22, 1944
2,602,350	Marcellus	July 8, 1952
2,630,211	Carrier	Mar. 3, 1953
2,967,434	Mahfeldt	Jan. 10, 1961