

Feb. 22, 1944.

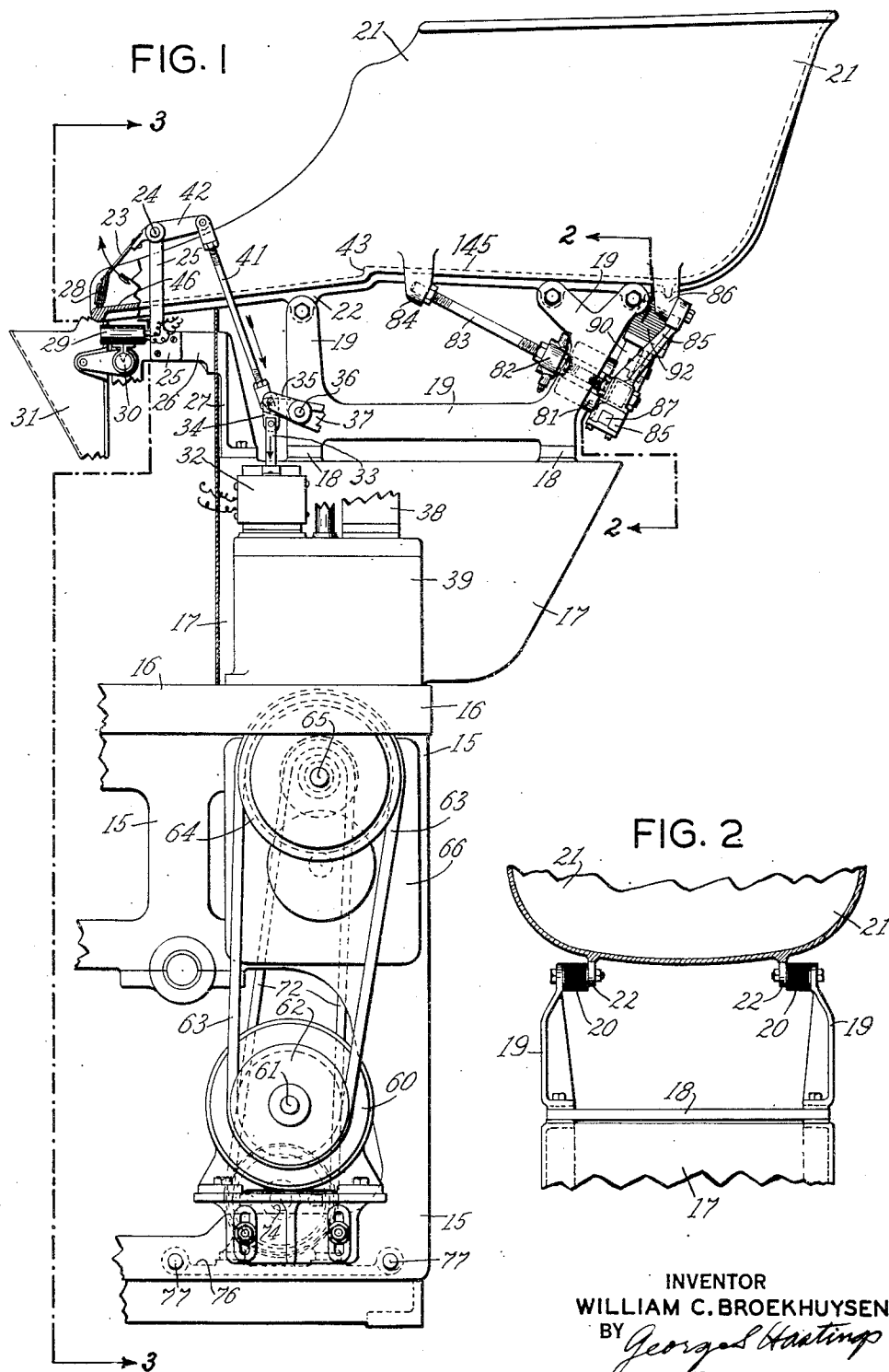
W. C. BROEKHUYSEN

2,342,116

VIBRATING FEED FOR CIGAR MACHINES

Filed June 28, 1938

4 Sheets-Sheet 1



Feb. 22, 1944.

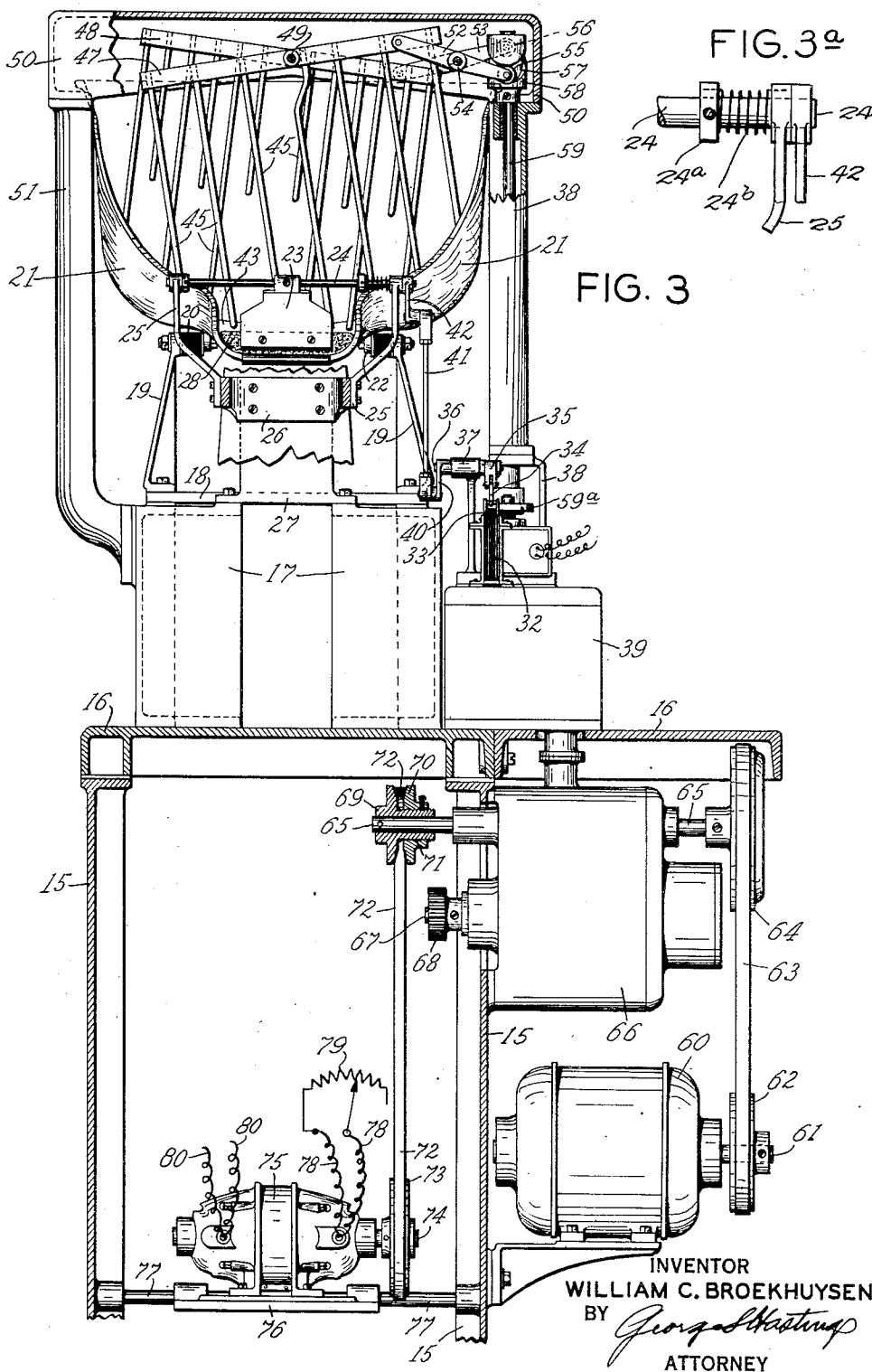
W. C. BROEKHUYSEN

2,342,116

VIBRATING FEED FOR CIGAR MACHINES

Filed June 28, 1938

4 Sheets-Sheet 2



Feb. 22, 1944.

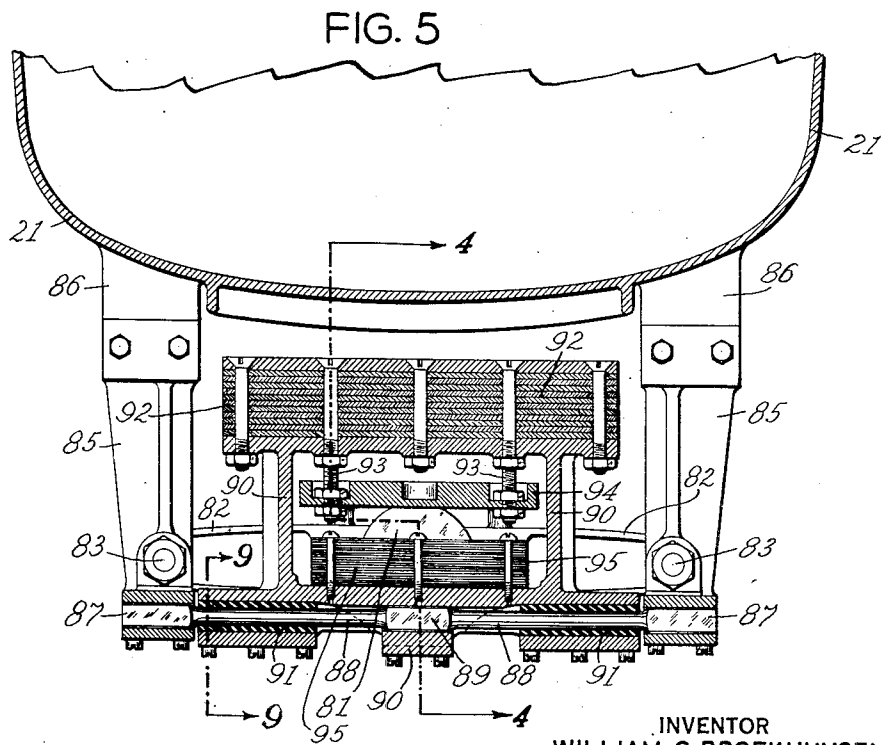
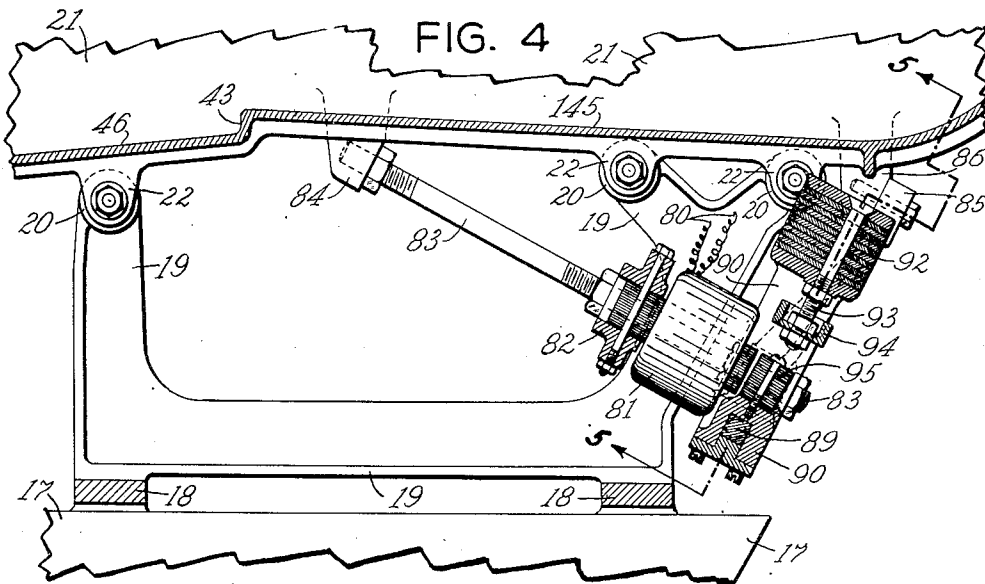
W. C. BROEKHUYSEN

2,342,116

VIBRATING FEED FOR CIGAR MACHINES

Filed June 28, 1938

4 Sheets-Sheet 3



INVENTOR
WILLIAM C. BROEKHUYSEN
BY *George Hastings*
ATTORNEY

Feb. 22, 1944.

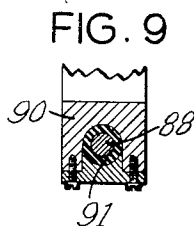
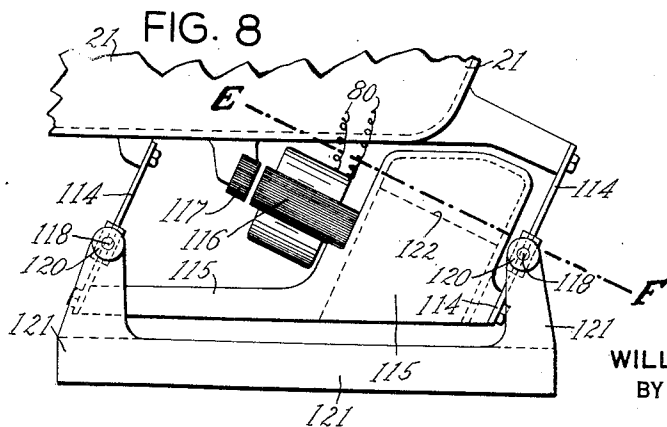
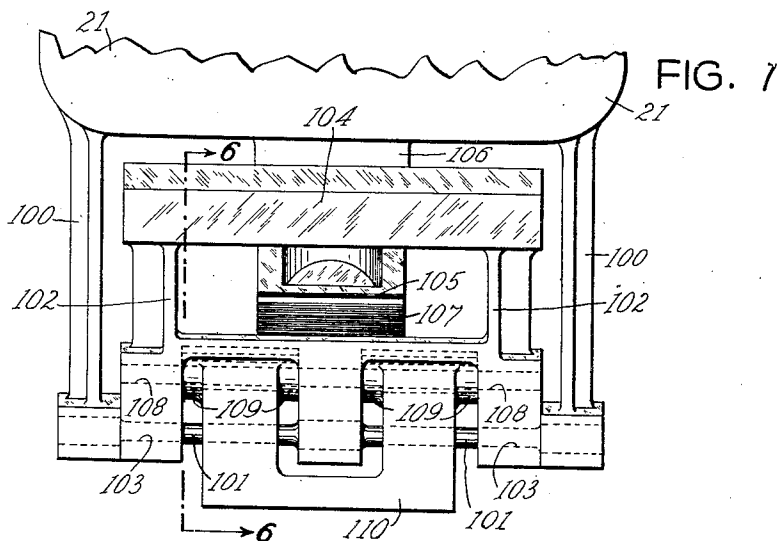
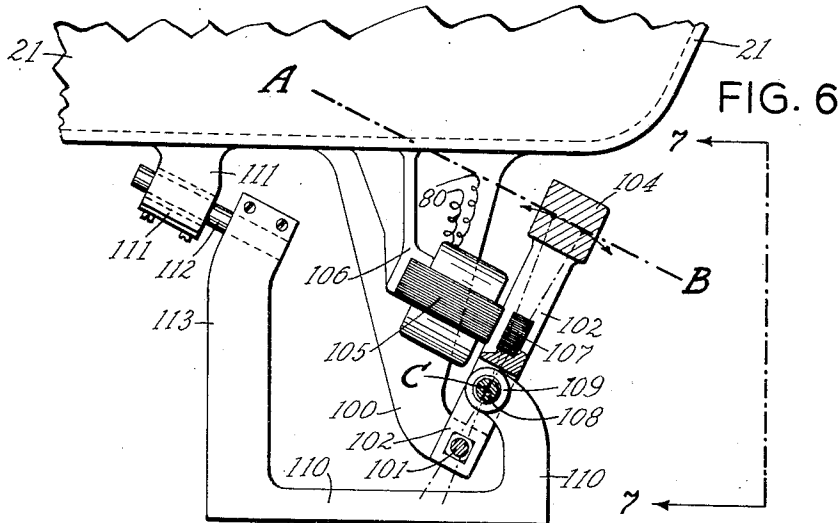
W. C. BROEKHUYSEN

2,342,116

VIBRATING FEED FOR CIGAR MACHINES

Filed June 28, 1938

4 Sheets-Sheet 4



INVENTOR
WILLIAM C. BROEKHUYSEN
BY *George S. Hastings*
ATTORNEY

UNITED STATES PATENT OFFICE

2,342,116

VIBRATING FEED FOR CIGAR MACHINES

William C. Brockhuysen, Brooklyn, N. Y., assign-
or to International Cigar Machinery Company,
a corporation of New Jersey

Application June 28, 1938, Serial No. 216,244

32 Claims. (Cl. 198—220)

This invention relates to material handling machines, and more particularly to a tobacco feeding mechanism for feeding short filler tobacco to a bunch forming device of a cigar machine.

The invention relates to a tobacco feeding mechanism wherein there is provided a source of supply of tobacco consisting of an open hopper having a bottom portion, tobacco confining walls, a discharge end, and an improved vibrating device affixed thereto for vibrating the hopper at predetermined periods in the operation of the machine in order to feed tobacco from the hopper into a bunch making machine.

According to the present invention the vibrator construction which is used for effecting the feed of short filler tobacco from the hopper has been constructed with the idea of reducing the weight thereof by eliminating the heavy base which has formerly been used as a part of a vibrator structure, and also to obtain uniformity of vibration in the front and back portions of the hopper without the necessity of providing a base or support extending beyond the back portion of the hopper.

In practically all of the electro-magnetic units or reciprocating electric motors used for feeding materials such as short filler tobacco, there are provided two weights or masses connected to each other by resilient means, such for instance as springs, and supported by vibration insulating means, usually formed of rubber. The electro-magnetic vibration inducing mechanism consists generally of two main parts: the electro-magnet, and the armature, one connected to each of the respective masses.

If the proportion of the masses, and the stiffness of the springs is such that the natural frequency of vibration of the unit is the same as the frequency of the magnet, the amplitude of the relative motion between the two masses for a given magnetic pull set up by the magnet, will be a maximum. This condition is called resonance. When the vibrating insulating supports may be termed perfect, that is, when they do not present any substantial interference to movement, the center of gravity of the system as a whole does not move, but the centers of gravity of the two masses will move along a straight line through these two centers. The total amplitude of motion will be divided over the two masses in inverse proportion of the weight or mass of each.

In some constructions it has been proposed to use a relatively heavy base which is considerably,

say at least twice as heavy, as the hopper or deck. In such a case the amplitude of vibration of the base might be one-third and that of the hopper or deck two-thirds of the total amplitude

between them. Naturally this relationship will vary according to the weights used. In the improved construction, disclosed in this application, the weight of the hopper or deck is approximately the same as in earlier constructions, but the second mass is considerably lighter than the weight of the hopper or deck, say one-fourth the weight thereof. Under these conditions it will be seen, therefore, that the amplitude of vibration of the block or the second mass which moves relatively to the hopper or deck is four-fifths while that of the hopper or deck is one-fifth of the total amplitude between the two. However, it is to be noted that the total weight of the two masses is considerably lower than the total weight of earlier known devices, while the total amplitude of vibration between the two masses is substantially greater. If then, resonance is to be obtained in the improved construction at this larger total amplitude, it is impractical to utilize leaf springs since it would be necessary to use springs impractically larger particularly at higher operating frequency, and for that reason it is proposed to use a torsion spring which makes it possible to obtain the most desirable results with a minimum of spring volume.

According to the present invention, the electro-magnet of the hopper or deck vibrating mechanism is connected to a source of alternating current or pulsating direct current and at proper times torsional vibrations are induced in the torsion spring or springs which form a part of the vibratory mechanism.

It is proposed to support the hopper or deck by means of rubber cylinders and the hopper or first mass will vibrate in an opposite direction to the block or second mass above referred to, with an approximate amplitude, for example, one-fifth the amplitude between the hopper and block as mentioned above.

The angle of the arc described by the center of gravity of the block is so small that it may be considered to be a straight line. If the center of gravity of the hopper is located on an extension of this line, the hopper will vibrate uniformly. If, however, the center of gravity of the hopper is located above or below this line a rotary vibration will be superimposed on the straight line vibration as the center of gravity of the hopper and the block move along their connecting line. This relationship naturally

would cause the different parts of the hopper to vibrate through different angles and hence the speed of feeding would not be uniform over the whole hopper bottom.

By placing bearings in the proper location on a vibrating unit, the floating rubber supports, above described, can be eliminated and the required vibratory effect obtained without transmitting any appreciable vibration to the frame of the machine. This makes it possible to maintain accurate alignment between the vibrating parts and stationary parts.

According to the improved construction, as shown in the accompanying drawings, it is much easier to obtain the proper relationship between the centers of gravity of the two masses without having any base or support projecting beyond the rear edge of the hopper.

As previously mentioned, the maximum vibration for a certain magnetic pull is obtained when the system is in resonance. Resonance can be obtained by adjusting the natural frequency of the system or by adjusting the frequency of the magnet. The natural frequency of the system can be changed by changing the weight of the two masses, or by changing the location of a part or all of one of the two masses in relation to the spring or springs, or by changing the stiffness thereof. The magnet frequency can be changed by changing the frequency of the source of current to which the magnet is connected.

If an electro-magnet of a vibrating structure is connected to a source of alternating current of frequency F , the magnetic pull reaches a maximum twice during each cycle of the current or $2F$ times per second. For instance, with a 60 cycle current the magnetic frequency will be $2 \times 60 \times 60$ or 7200 vibrations per minute. It has been found that this high frequency causes a great deal of noise. The magnetic frequency can be cut in half by placing a half-wave rectifier in series with the magnet which will reduce its frequency to 3600 vibrations per minute. In feeding short filler tobacco, it has been found desirable to eliminate substantially all noise by using an even lower frequency for effecting the vibration and feed of the tobacco. Therefore, in order to obtain the desired lower frequency, and also be independent of the frequency available from commercial electric supply, it is an object of the present invention to provide mechanism for obtaining practically any frequency desired. In order to effect this desired result, it is proposed to use a self-excited alternator driven by suitable means. As the frequency of an alternator is determined by its speed and number of poles, this provides a convenient means for obtaining the particular frequency desired. It is also proposed to utilize driving means which can be adjusted to vary the speed within any desired range as a means for obtaining resonance. The use of a rheostat in the field circuit of the alternator is also contemplated in order to control its output and thereby regulate the amplitude of vibration.

It is a further object of this invention to provide an improved feeding material mechanism consisting of a vibrating mechanism, and to furnish more flexible means for controlling both the amplitude of vibration and the frequency of the current which effects the vibration.

It is an added object of the invention to provide an improved vibratory feeding mechanism wherein a part of the vibratory structure, respon-

sible for the vibration and feed of material, has been reduced to a minimum weight.

It is a further object of the invention to provide a vibratory feeding mechanism having a considerably lighter total weight than heretofore known in vibrating units.

In order to obtain practically any desired vibratory frequency, the invention is further characterized by the provision of means for generating current of suitable frequency. This may assume the form of a self-excited alternator for generating current of the frequency desired.

As mentioned previously the noise heretofore experienced in the operation of most vibrating feeds has been extremely unpleasant and hence it is a further object of this invention to provide means for operating the vibrator in such a way that the amount of noise is reduced to a minimum, and substantially eliminated.

It is a further object of the invention to provide a vibrating mechanism in which the vibratory handling element thereof is so mounted that practically no vibration is transmitted therefrom to the frame of the machine, and one in which means are provided for maintaining accurate alignment at all times between the vibrating and stationary parts.

The invention is also characterized by the provision of an adjustable driving pulley for the alternator which makes it possible to obtain resonance in the vibratory feed by changing the frequency of the current instead of by changing the natural frequency of the vibrating unit.

In order to insure automatically that no tobacco will be fed to the bunch forming machine at the end of each series of feeding vibrations, means are provided for positively shutting off the source of supply from the bunch forming machine. In the present application this structure assumes the form of a movable shutter so located with respect to the discharge end of the tobacco feeding surface that it can move relative to the feeding surface itself and actually block off the stream of tobacco which is arranged to move thereover into the bunch forming machine.

It is a further object of the invention to provide an adjustable weight for changing the natural frequency of the vibrating hopper and which furnishes therefore another mode of obtaining resonance in the vibratory unit.

With these and other objects not specifically mentioned in view, the invention consists in certain combinations and constructions which will be hereinafter fully described, and then specifically set forth in the claims hereunto appended.

In the accompanying drawings, which form a part of this specification, and in which same or like characters of reference indicate the same or like parts:

Fig. 1 is a side elevation, parts broken away, of the short filler feed;

Fig. 2 is a partial sectional end elevation of the support for the vibrating hopper;

Fig. 3 is a front elevation, of the short filler feed, taken taken on line 3—3 of Fig. 1;

Figure 3a is a view showing a detail of the shutter operating mechanism;

Fig. 4 is a partial sectional side elevation of the vibrating hopper, illustrating the supporting as well as the vibrating means of the same;

Fig. 5 is a partial sectional end elevation of the vibrating means of the hopper, taken on line 5—5 of Fig. 4;

Fig. 6 is a partial side elevation of the vibrat-

ing hopper illustrating a modified form of support for the same;

Fig. 7 is a partial end elevation of the same, taken on line 7—7 of Fig. 6;

Fig. 8 is a partial side elevation of the vibrating hopper, illustrating another modified form of support for the same; and

Fig. 9 is a sectional end elevation of the torsion spring, taken on line 9—9 of Fig. 5.

Referring to Figs. 1, 2 and 3, the machine consists of a frame 15, carrying a platform 16 to which is secured a hopper or deck supporting frame 17. The latter carries a pair of supporting bars 18 to which are mounted a pair of hopper or deck supports 19. Each vertical projecting arm of these members carries a resilient cushion 20, which mount the hopper or deck 21 by means of lugs 22 formed on the hopper or deck body, thereby providing resilient support for the same for movement relative to the support. The open end of the hopper or deck is provided with a movable shutter or gate. In the illustrated embodiment this shutter is fixed to a shaft 24 held by bearings in a pair of supporting arms 25 attached to a horizontal bracket 26 secured to bracket 27 which is fixed to supporting frame 17. Shutter 23 which swings to and from the feeding surface of the hopper may also be provided with a sealing member or plate 28. If desired, this plate may be made wholly of one material such for instance as metal, or as in the form illustrated, it may be composite in construction and be provided with a sealing portion of felt or other suitable material in order to insure a closer engagement between the opening of the hopper or deck and shutter when it is in its "closed" position. The composite type gate is especially desirable when the discharge portion of the hopper or deck surface is somewhat curved as in the construction shown in the drawings.

The gate or shutter is operated by means of a switch 29, preferably of the mercury type, attached to a knife shaft 30 of a scale pan 31 (Fig. 1). When the scale pan 31 has received a predetermined quantity of tobacco from the hopper, it moves downwardly on its supports and trips the switch. This breaks the circuit, thereby de-energizing the solenoid 32, which releases the armature 33 thereof, and thereby allows a spring, such as coil spring 24b mounted on shaft 24 having one end fixed to a collar 24a fast on shaft 24 and the other secured to one of the arms 25, to move the gate to "closed" position to stop the flow of additional tobacco over the hopper feed surface and into the scale pan. The switch 29 is responsible for both the movement of the gate into "closed" position and also for the termination of the vibratory movement of the hopper which feeds tobacco therefrom into the scale pan 31. It can be seen that the main function of the gate 23 is to prevent the discharge of tobacco from the hopper to the scale 31 after the positive driving operations of the vibrating unit has ceased, such for instance, as when the flow of current through the electromagnet has been interrupted and the magnet has been de-energized, but before the continuing movement of the hopper, due to its supports and inertia, has been brought to a standstill. Armature 33 through a link 34 is connected to an arm 35 mounted on a shaft 36 supported by a bearing lug 37 of a supporting bracket 38 mounted on a variable speed drive housing 39 secured to platform 16. To shaft 36 is fastened a lever 40 which, through an adjustable rod 41, is connected with the gate open-

ing lever 42 mounted on shaft 24. The bottom portion of hopper 21 is provided with a step 43 (Figs. 1 and 3) which, in conjunction with oscillating rakes 45, divides hopper 21 into a storage chamber 145, in which the mass of tobacco is deposited, and a feed trough 46 which during vibration periods, feeds a stream of scrap tobacco to the scale pan 31. The vertical rakes 45 are arranged in two rows, each row being held at its upper end by means of arms 47 and 48, respectively (Fig. 3), for movement one relative to the other. It has been found advisable to pivot each arm at its center portion, to a stud 49 which is held by a housing 50 supported by vertical U-shaped brackets 38 and 51. The latter is fastened to frame 17. One end of operating arm 47 is pivoted to a lever 52, and one end of arm 48 is pivoted to a lever 53. Both levers 52 and 53 are loosely mounted on a stud 54 supported by housing 50. Lever 52 carries a cam follower 55, while lever 53 carries a cam follower 56, both of which engage in track 57 of a cam 58 mounted on the upper end of a vertical shaft 59 which is supported by suitable bearings of bracket 38. During the operation of the machine, the two rows of rakes are oscillated in opposite directions, thereby scraping the tobacco pieces, which protrude through said rakes, from the feeding face of the tobacco mass in the storage chamber portion 145. The step 43 in hopper 21 will prevent any tobacco from getting under the ends of the oscillating rake bars, thereby assisting in achieving the important object of feeding a thin layer of scrap tobacco from the storage chamber portion 45 onto feed trough section 46 of the vibrating hopper 21.

The entire short filler cigar machine is driven by a motor 60 (Figs. 1 and 3). To motor shaft 61 is fastened a pulley 62 driving, through a belt 63, a pulley 64 mounted on a continuously driven shaft 65. Shaft 65 also actuates a set of reduction gears of conventional design (not shown), supported and concealed by means of housing 66 mounted on frame 15. The gear housing 66 also carries and conceals a clutch, which may be of any well known design (not shown), or may be similar to that equipped with a magnet control (not shown), which operates the clutch. The variable speed drive for the rakes in housing 39, is suitably connected with the driving means concealed in housing 65. Vertical shaft 59 driving the rakes is connected with the variable speed drive in housing 39 by means of a ball clutch (not shown) in ratchet 59a which is controlled by means of the solenoid 32. As mentioned heretofore, solenoid 32 is actuated from mercury switch 29 on knife shaft 30 of scale pan 31. This arrangement, together with the construction of the mechanism which operates gate 23, assures substantially an instant stop of the flow of tobacco at the moment the scale pan 31 trips.

A shaft 67 projecting from housing 66 carries a gear 68 which is provided for driving other parts of the bunch making machine (not shown). To the continuously rotating shaft 65 is also fastened a flange 69 of a V-shaped pulley (Fig. 3). The other flange 70 of said pulley engages with a threaded section 71 of the hub of flange 69, so that one flange of the pulley is adjustable relative to the other, thus providing means to vary the effective diameter of the pulley and thereby furnish means for an easy adjustment in the driving speed of the same. This pulley, by means of a V-belt 72 drives a pulley 73 mounted on a

shaft 74 of an alternator 75 fixed to a platform 76 supported by a pair of rods 77 held by frames 15. The tension of belt 72 is kept constant by the use of conventional means, such as an adjustable idler pulley (not shown). One pair of wires 78 of alternator 75 are connected with a rheostat 79 provided for the purpose of regulating the output of the alternator. Another pair of wires 80 lead from the alternator to a magnet 81 (Fig. 4) of a reciprocating electric motor, which in conjunction with an armature 95, provides the vibrating means for the hopper 21. Magnet 81 is held by a supporting bracket 82 adjustably mounted on a pair of rods 83. Each rod 83 at one end is anchored to a lug 84 of hopper 21, while the other ends of the rods are fastened to brackets 85, fixed to lugs 86 of hopper 21. To the lower portion of each bracket 85 is clamped one end 87 of a torsion spring 88. In the preferred embodiment, as illustrated, the spring consists of a straight, round bar with square ends 87 and a square center portion 89. As mentioned heretofore, the square ends 87 of said spring are clamped in brackets 85 which are rigidly attached to the bottom of hopper 21 and braced by rods 83. To the square center portion 89 of spring 88 is clamped a bracket 90. The latter is also supported on spring 88 by means of a pair of round rubber bushings 91 tightly clamped around the round portions of the spring. These bushings offer practically no resistance to twisting forces exerted upon spring 88, but greatly minimize the bending stresses imposed thereon due to centrifugal forces, magnet pull, or any other forces that may be present. In some instances, it may be desirable to eliminate the rubber bushings and provide a metal to metal contact between the bearings of spring 89 and bracket 90. To the upper end of bracket 90 is attached a counterweight or block 92 which, as illustrated in Fig. 5, may consist of a number of plates to facilitate regulating the desired weight of the block 92. From the latter, by means of a pair of bolts 93 (Figs. 4 and 5) is adjustably suspended a weight 94, through which, by raising or lowering the same, the natural frequency of the vibrating system can be changed within narrow limits. A similar adjustment can be made by changing the weight of block 92. Also, instead of changing the latter or adjusting plate 94 to vary the natural frequency of the vibrator to obtain resonance, it is also possible to allow the natural frequency of the hopper to remain unchanged and adjust the frequency of the alternator 75 by changing its speed. This can be accomplished by changing the diameter of the V-belt pulley described heretofore.

Attached to bracket 90 is the armature 95 consisting of a stack of magnet steel laminations. As the current is applied to the magnet 81, the armature 95 will be attracted thereto and cause a torsional vibration in spring 88 which in turn will force block 92 to describe an arc around the center of spring shaft 88, and, since hopper 21 is supported by means of the cushions 20, the hopper will vibrate in opposite direction to block 92. The angle of the arc described by the center of gravity of block 92 is so small that it may be considered a straight line. The current supply to the magnet 81 is also controlled through the switch 29 which is directly connected with said magnet, so that when loaded scale 31 trips this switch, the magnet is de-energized, and vibratory impulses to hopper 21 cease.

By placing bearings in the proper location on a

vibrating unit, the resilient rubber supports for the hopper can be eliminated without danger of transmitting appreciable vibration to the frame of the machine. For this purpose, the bottom of the vibrating hopper 21, in the form illustrated in Figs. 6 and 7, is provided with a pair of brackets 100, rigidly supporting at their lower ends a torsion spring 101, similar in construction to torsion spring 88. Torsion spring 101 supports vibrator arm 102 which is pivotally supported on frame 110 and clamped to the square center of the spring and has either fixed thereto or formed thereon bearings 103 on the rounded sections of the spring near the ends. A weight 104 is attached to the vibrator arm 102 preferably at the top end thereof. A magnet 105 is fastened to a lug 106 extending from the bottom of hopper 21 and an armature 107 is secured to vibrator arm 102. When the magnet 105 is supplied with alternating current with a frequency of F , it will set up torsional vibrations in spring 101 with a frequency of $2F$, due to the fact that there are two impulses for each cycle of the current. If hopper 21 is mounted for movement relative to a support, the amplitude of vibration of hopper and weight will be inversely proportional to their weights, and they will vibrate in opposite directions. In the embodiment shown in Figs. 1, 2, 3, 4 and 5, the hopper is resiliently supported for such movement on rubber cushions 20. Figures 6-9 show other satisfactory modes of mounting the hopper. For uniform vibration in front and back of the hopper, the line connecting the centers of gravity of the hopper and the weight should be tangent to the arc described around the torsion spring in relation to the hopper. By properly proportioning the weights of the hopper and the weight, and the diameter and length of the round sections of the torsion spring, the vibrating system can be made substantially resonant to the frequency of $2F$, resulting in the building up of vibrations of relatively large amplitude for a small amount of power in the magnet. In the embodiments of the present invention, it is proposed that the weight of the hopper 21 and weight shall be in an approximate ratio of 4:1. Since the torsion spring is rigidly connected to the hopper, it vibrates parallel to a line A-B (Fig. 6) and in opposite direction to the center of gravity of weight 104. From this it follows that there must be a point C on arm 102 between the torsion spring 101 and the weight 104, which is completely at rest at all times. The distance from point C to the center of torsion spring 101 and from C to the center line of gravity of the weight 104 is again inversely proportional to the weights of the hopper 21 and the weight 104. Therefore, in this modification vibrator arm 102 is pivoted at the point C to a shaft 108 supported by bearings 109 of a frame bracket 110 without danger of any vibration being transmitted to the frame bracket 110. The front end of the hopper 21 in this modification is supported in such a way that it is free to move in the direction of the vibration. In this case hopper 21 is equipped with a bearing lug 111 slidably mounted on a rod 112 which is clamped to an arm 113 of frame bracket 110 and parallel to line A-B. The bearings 103 serve merely to take up all radial stresses caused by the weight of the hopper and by the vibration of weight 104, leaving only uniform torsional stresses in torsion spring 101. Bearings 103, and 109 may be metal to metal, or either or both may consist of rubber bushings clamped tightly around the shaft as shown in Figs. 5 and 9. The use of rubber bushings in this manner

does not defeat the original purpose of these bearings, as might appear at first glance. This purpose is to eliminate the resilient supports 20, such as shown in Figs. 1 to 5, inclusive, for maintaining accurate alignment between the vibrating elements and coacting stationary parts constituting the vibratory unit. The angular motion of torsion spring 101 in bearings 103, and of shaft 108 in bearings 109 is so small, that even a relatively thin bushing of stiff rubber will offer little resistance to this angular motion, but will offer a very high resistance to any radial displacement of the shafts in the bearings.

Figure 8 illustrates another modification of hopper support for a vibrating system. This figure shows that the hopper, using a heavy base and leaf spring, may be also supported in bearings. In this case, the hopper 21 is attached to a heavy base 115 by means of a number of leaf springs 114. The magnet 116 is attached to the base 115 and the armature 117 to the bottom of hopper 21. If the hopper 21 and base 115 are vibrating uniformly in front and back, there will be a point on each leaf spring which is completely at rest. This point is provided with a pivot 118, each of which is supported in a bearing 120 of a frame bracket 121 which can be mounted directly upon the frame of the cigar machine without transmitting any vibration to the latter. It is essential, however, that the line E-F connecting the centers of gravity of the hopper 21 and the base 115, be parallel to the direction of vibration or at right angles to said leaf springs 114. The base 115 is shown as a hollow casting with a heavy weight 122 cast in the upper portion in order to raise the center of gravity of the weight as much as possible.

Heretofore, where I have referred to the two relatively vibrating masses with particular reference to their relative weights or amplitudes of vibration and the one mass has been called the "hopper" or "deck" and the other the "block" or "weight," it is to be understood that the expression "hopper" or "deck" includes not only the actual hopper or deck 21 but also all parts rigidly connected thereto including brackets 85, rods 83, bracket 82 and magnet 81, and the expression "block" or "weight" includes not only the actual weight or block 92 but also all parts rigidly connected thereto including bracket 90, bolts 93, weight 94 and armature 95 in the embodiment disclosed in Figures 1 to 5, inclusive, of the drawings.

The invention above described may be varied in construction within the scope of the claims, for the particular device, selected to illustrate the invention, is but one of many possible concrete embodiments of the same. The invention is not, therefore, to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. In a feeding mechanism, the combination with a hopper constructed and arranged to contain a supply of material to be fed, of a support, means for resiliently mounting said hopper on said support, brackets mounted on and depending from said hopper, spring means extending between and fixed to said brackets, arms secured to and extending outwardly from said spring means, a weight supported by said arms for free movement in space, and means coacting with said hopper and arms for vibrating the hopper and supply of material contained therein to effect the feed of material therefrom.

2. In a material feeding mechanism, the com-

bination with a hopper constructed and arranged to contain a supply of material to be fed, of a support, means for resiliently mounting said hopper on said support, brackets mounted on said hopper, spring means fixed to and extending between said brackets, arms secured to said spring means and extending outwardly therefrom, a weight supported by said arms for free movement in space, and a reciprocating electric motor cooperating with the said hopper and the arms for vibrating said hopper and supply of material to feed material therefrom.

3. In a material feeding mechanism having a material feeding deck, a support for said deck, means for resiliently mounting said deck on said support, brackets carried by said deck, a torsion spring fixed in said brackets, a member provided with arms carried by said spring, a weight mounted on said arms, said weight being relatively lighter than said deck, an armature fixed to said member, a magnet carried by said deck, and means for energizing said magnet to cause it to cooperate with said armature, and vibrate said deck and supply to feed material therefrom.

4. In a material handling machine, a material handling surface, a support, means for mounting said surface for movement relative to said support, brackets depending from said surface, an electric vibratory unit for vibrating the surface, said unit including a torsion spring extending between and supported by said brackets, a magnet and an armature carried by said brackets and spring, and means for energizing said magnet to cause said spring to effect the vibration of said surface.

5. In a vibrating unit, a vibratory feeding surface, an electro-magnet, and an armature, a torsion spring, arms connected to said surface and supporting said spring, support means carried by said surface and arms mounting said magnet and armature in operative position, and means for energizing said magnet to intermittently stress said spring and thereby vibrate said surface to feed material thereover.

6. In a vibrating unit, a vibratory feeding surface, a support depending from said surface, a torsion spring mounted in said support, arms mounted on said torsion spring, a weight carried by said arms, and a reciprocating electric motor having one operative part mounted on said support, and another associated with said arms for effecting relative vibratory motions between said support and arms to vibrate said surface.

7. In a vibrating unit, a vibratory feeding surface, a support depending from said surface, a torsion spring mounted in said support, arms fixed to said spring, a frame, means for pivotally mounting said arms in said frame at a point on said arms where the vibration is substantially zero, a weight carried by said arms, and means for effecting vibratory movement between said support and weight to energize said spring and vibrate said surface.

8. In a vibratory system, a vibrating material feeding surface, comprising two masses, one of said masses including said surface, resilient members mounting said masses for movement relative to one another, a frame, means for pivotally connecting said members to said frame at a point on said members where the vibration is substantially zero, and means for inducing vibration between said masses for feeding material over said surface.

9. In a cigar machine, the combination with a hopper having a discharge end, of a support,

resilient means connecting said hopper to said support for movement relative thereto, arms depending from said hopper, a torsion spring mounted in said arms, supporting members carried by said spring, a counterweight fixed to said members, and vibrating mechanism mounted on said hopper and members for vibrating said hopper to feed tobacco therefrom into said machine.

10. In a cigar machine, the combination with a hopper having a discharge end, of a support, resilient means connecting said hopper to said support for movement relative thereto, arms depending from said hopper, a torsion spring mounted in said arms, supporting members carried by said spring, a counterweight fixed to said members, vibrating mechanism mounted on said hopper and members for vibrating said hopper to feed tobacco therefrom into said machine, means for operating said mechanism, including a driving motor, an alternator furnishing current to said mechanism, and an adjustable driving pulley connected to said alternator for varying the frequency of the current generated thereby, whereby the frequency of the vibrations of said hopper is likewise varied.

11. In a cigar machine, the combination with a tobacco feeding surface having a discharge end, of a support, resilient means connecting said surface to said support for movement relative thereto, arms depending from said surface, a torsion spring mounted in said arms, supporting members carried by said spring, a counterweight fixed to said members, vibrating mechanism mounted on said surface and members for vibrating said surface to feed tobacco therefrom into said machine, and means for operating said mechanism including an alternator for furnishing current of any desired frequency to said mechanism.

12. In a feeding mechanism, the combination with a vibratory mechanism having a feeding surface, and a support, of means for mounting said surface on said support for movement relative thereto, arms depending from said surface, a torsion spring mounted in said arms, supporting members carried by said spring, a counterweight fixed to said members, vibrating mechanism mounted on said surface and members for vibrating said surface to effect the feed of material therefrom, and means for controlling the natural frequency of vibration of said mechanism.

13. In a material feeding machine, the combination with a vibratory feeding mechanism, comprising a surface and a support, of means for mounting said surface on said support for movement relative thereto, a counterweight coacting with and moving in opposition to said surface, arms supporting said counterweight, a torsion spring mounting said arms, supporting means carried by said surface mounting said spring, a reciprocating electric motor coacting with said surface and arms for imparting rapid intermittent flexings to said shaft to vibrate said surface and thereby feed material thereover, means for varying the natural frequency of vibration of said mechanism, said last-named means including an auxiliary adjustably mounted weight, and means for moving said auxiliary weight to and from said counterweight.

14. In a material feeding mechanism, the combination with a vibratory material feeding surface, and a support, of means for mounting said surface on said support for movement relative

thereto, a weight movable in opposition to said surface, arms supporting said weight, a torsion spring mounting said arms, a spring support mounted on said surface, a reciprocating electric motor cooperating with said arms and surface for imparting rapid intermittent flexings to said spring to vibrate said surface and feed material thereover, means for energizing said motor, means for controlling the natural frequency of vibration of said mechanism, and means for varying the amplitude of vibration of said surface.

15. In a material feeding machine, the combination with a hopper and a feeding surface, of a support for said hopper, means for mounting said hopper in said support for movement relative thereto, a member coacting with and movable in opposition to said hopper, arms supporting said member, a spring mounting said arms, means carried by said surface supporting said spring, a reciprocating electric motor coacting with said surface and arms for imparting rapid intermittent flexings to said spring to vibrate said surface and thereby feed material thereover, a separate alternator for operating said reciprocating motor, means for controlling the driving speed of the alternator, thereby to control the frequency of vibration of said surface, and means for adjusting the amplitude of vibration of said surface.

16. In a cigar machine, the combination with a tobacco hopper provided with a feeding surface, of a support, means for mounting said hopper on said support for movement relative thereto to effect the feed of tobacco over said surface, supporting members depending from said hopper, spring means carried by said members, a weight carried by said spring means, and a reciprocating motor connected to and cooperating with said hopper to rock said weight on said spring means for vibrating said hopper.

17. In a vibrating unit, a vibratory feeding surface, brackets depending from said surface, a torsion spring carried by said brackets, arms fixed to said spring, a support, bearings formed in said support and pivotally mounting said arms at a point where the vibration of said arms is substantially zero, and reciprocating mechanism carried by said brackets and arms for rapidly twisting and untwisting said spring and thereby impart vibratory motion to said surface.

18. In a vibrating unit, a vibratory feeding surface, a support mounting said surface for movement relative thereto, spaced brackets depending from the underside of said surface, a torsion spring extending between and clamped in said brackets, arms, provided with bearings having bushings of yieldable material, mounted on said spring, a weight secured to the free ends of said arms, a reciprocating electric motor mounted on said surface and said arms, and means for energizing said motor to oscillate said weight freely in space and intermittently stress said spring and thereby vibrate the surface.

19. In a material feeding device, a feeding surface, a support, means for mounting said surface on said support for movement relative thereto to feed material over said surface, brackets depending from said surface, a torsion spring secured to said brackets, a weight supported on said torsion spring, a reciprocating electric motor mounted on said surface and weight, and means for energizing said motor to oscillate said weight freely in space on said spring and vibrate said surface and thereby feed material thereover.

20. In a material feeding device, a feeding surface, a support, brackets depending from said surface, a torsion spring extending between and fixedly mounted in said brackets, a weighted lever pivotally mounted in bearings on said support and fixed to said torsion spring, said bearings being provided with bushings of elastic material, a reciprocating electric motor mounted on said surface and weighted lever, and means for energizing said motor to rock said weighted lever freely in space on said spring and effect the feed of material over said surface.

21. In a material feeding surface, a support, means for mounting said surface in said support for movement relative thereto, arms depending from said surface, a torsion spring fixedly mounted in said arms, a weighted lever fixed to said torsion spring and pivotally mounted on said support at a point where its movement is substantially zero, a reciprocating electric motor mounted on the underside of said surface and said weighted lever, a rod extending from said support, a bracket provided with a bearing depending from said surface and movable on said rod, and means for energizing said electric motor to rock said weighted lever freely in space and vibrate said surface and effect the feed of material thereover.

22. In a material feeding surface, a support, means for mounting said surface on said support for movement relative thereto, arms depending from said surface, a torsion spring fixedly mounted in said arms, a weighted lever secured to said torsion spring and pivotally mounted in bearings in said support at a point where the vibratory movement is substantially zero, a reciprocating electric motor mounted on the underside of said surface and the weighted lever, and means mounted on said support and coacting with the discharge portion of said surface for maintaining said surface in a substantially horizontal plane at all times.

23. In a vibrating unit, a vibrating feeding surface, a support, means for mounting said surface on said support for movement relative thereto, arms depending from said surface, a torsion spring fixedly mounted in said arms, a weighted lever pivotally mounted on said support and secured to said torsion spring, a reciprocating electric motor mounted on the underside of said surface and the weighted lever, and means mounted on said support and coacting with the discharge portion of said surface for maintaining said surface in a substantially horizontal plane at all times, said means including a bracket depending from the front end of said surface, a bearing carried by said bracket and a rod mounted on said support journaled for movement in said bearing.

24. A vibratory feeder comprising a deck adapted to support and feed material, means mounting said deck for vibratory movement, a non-rotary vibratory electro-magnetic motor including a non-rotary field structure and a non-rotary vibratory armature movable toward and from each other when said motor is energized, energy storing spring means interconnecting said field structure and said armature, means rigidly connecting one of said vibratory parts to said deck to impart feeding vibratory movement thereto when said motor is operating, said deck and rigidly connected parts forming one vibratory mass, the other of said vibratory parts comprising at least part of a reaction mass supported by said spring means to vibrate freely in space when said motor is operating and having contact with said one vibratory mass only through said energy storing spring

means whereby the vibratory movement imparted to said deck by said one mass is not disturbed, said reaction mass having a weight equal to not more than one-half that of the one mass whereby the vibratory movement of said reaction mass will be greater than that of said deck.

25. A vibratory feeder comprising a deck adapted to support and feed material, means mounting said deck for vibratory movement, a non-rotary vibratory electro-magnetic motor including a non-rotary field structure and a non-rotary vibratory armature movable toward and from each other when said motor is energized, energy storing spring means interconnecting said field structure and said armature, means rigidly connecting one of said vibratory parts to said deck to impart feeding vibratory movement thereto when said motor is operating, said deck and rigidly connected parts forming one vibratory mass, the other of said vibratory parts comprising at least part of a reaction mass supported by said spring means to vibrate freely in space when said motor is operating and having contact with said one vibratory mass only through said energy storing spring means whereby the vibratory movement imparted to said deck by said one mass is not disturbed, said reaction mass having a weight equal to not more than one-fourth that of the one mass whereby the vibratory movement of said reaction mass will be greater than that of said deck.

26. A vibratory feeder comprising a deck adapted to support and feed material, means mounting said deck for vibratory movement, a non-rotary field structure and a non-rotary vibratory armature movable toward and from each other when said motor is energized, energy storing spring means interconnecting said field structure and said armature, means rigidly connecting one of said vibratory parts to said deck to impart feeding vibratory movement thereto when said motor is operating, said deck and rigidly connected parts forming one vibratory mass, the other of said vibratory parts comprising at least part of a reaction mass supported by said spring means to vibrate freely in space when said motor is operating and having contact with said one vibratory mass only through said energy storing spring means whereby the vibratory movement imparted to said deck by said one mass is not disturbed, said reaction mass having a weight equal to not more than that of the one mass whereby the vibratory movement of said reaction mass will be greater than that of said deck.

27. In vibratory apparatus, the combination with a non-rotary vibratory electromagnetic motor comprising two relatively vibratory masses interconnected solely by energy storing torsion spring means, one of said masses including a load supporting deck, the other a reaction weight, means resiliently supporting said one mass for vibration, said one mass having a weight equal to at least four times that of said second mass.

28. In vibratory apparatus, the combination with a non-rotary vibratory electromagnetic motor comprising two relatively vibratory masses interconnected solely by energy storing torsion spring means, one of said masses including a load supporting deck, the other a reaction weight, means resiliently supporting said one mass for vibration, said one mass having a weight equal to at least twice that of said second mass.

29. In vibratory apparatus, the combination with a non-rotary vibratory electromagnetic motor comprising two relatively vibratory masses interconnected solely by energy storing torsion

spring means, one of said masses including a load supporting deck, the other a reaction weight, means resiliently supporting said one mass for vibration, said one mass having a weight equal to at least that of said second mass.

30. In vibratory apparatus, the combination with a non-rotary vibratory electromagnetic motor comprising two relatively vibratory masses interconnected solely by energy storing spring means, one of said masses including a load supporting deck, the other a reaction weight, means resiliently supporting said one mass for vibration, said one mass having a weight equal to at least four times that of said second mass.

31. In vibratory apparatus, the combination with a non-rotary vibratory electromagnetic motor comprising two relatively vibratory masses

interconnected solely by energy storing spring means, one of said masses including a load supporting deck, the other a reaction weight, means resiliently supporting said one mass for vibration, said one mass having a weight equal to at least twice that of said second mass.

5
32. In vibratory apparatus, the combination with a non-rotary vibratory electromagnetic motor comprising two relatively vibratory masses interconnected solely by energy storing spring means, one of said masses including a load supporting deck, the other a reaction weight, means resiliently supporting said one mass for vibration, said one mass having a weight equal to at least
10 that of said second mass.

15
WILLIAM C. BROEKHUYSEN.