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(54) GYRATOR FEEDER

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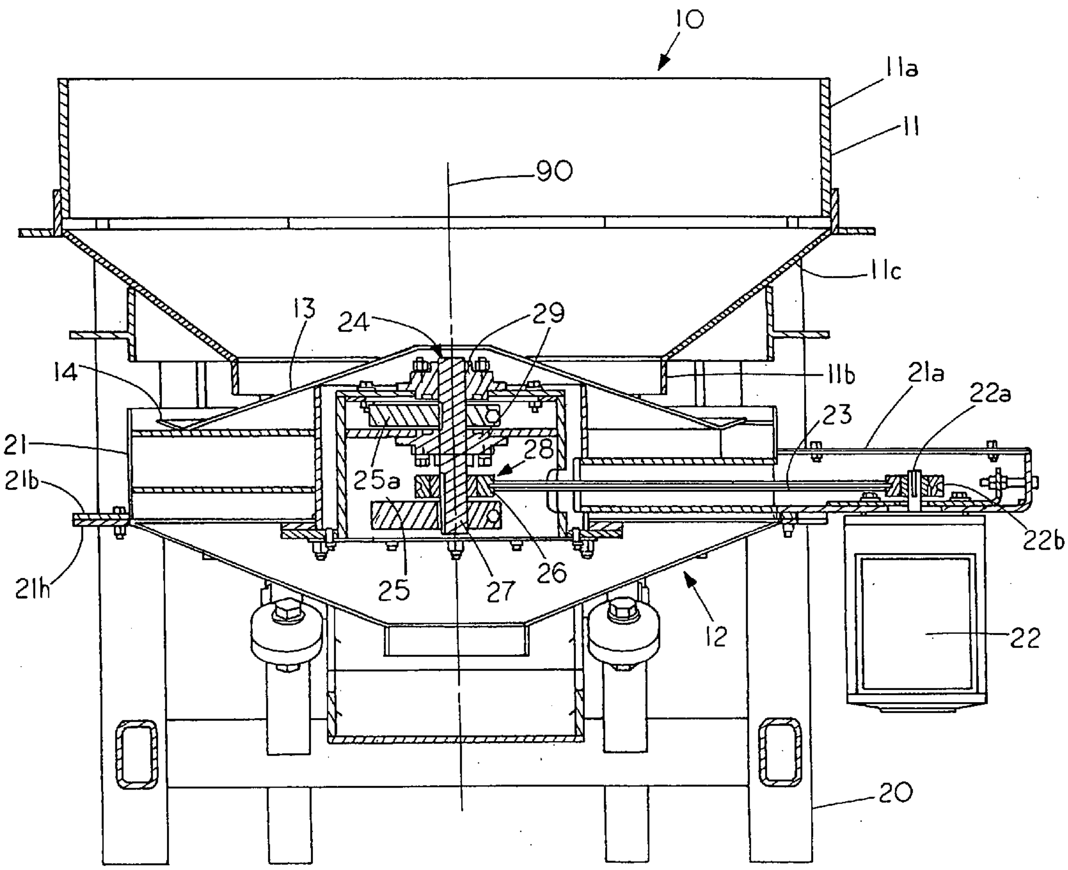
USPC **414/304**; 414/808; 222/161; 222/1

(57) **ABSTRACT**

A gyrator feeder that gyrates a dispensing member to uniformly and circumnavigating dispense material by generating a true circular orbital vibratory motion in the dispensing member by either rotating an offset weight along a vertical central axis of the dispensing member or by positioning vibratory motors diametrical opposite from each other on a gyrator housing and synchronizing the vibratory motors with each other to thereby dispense material.



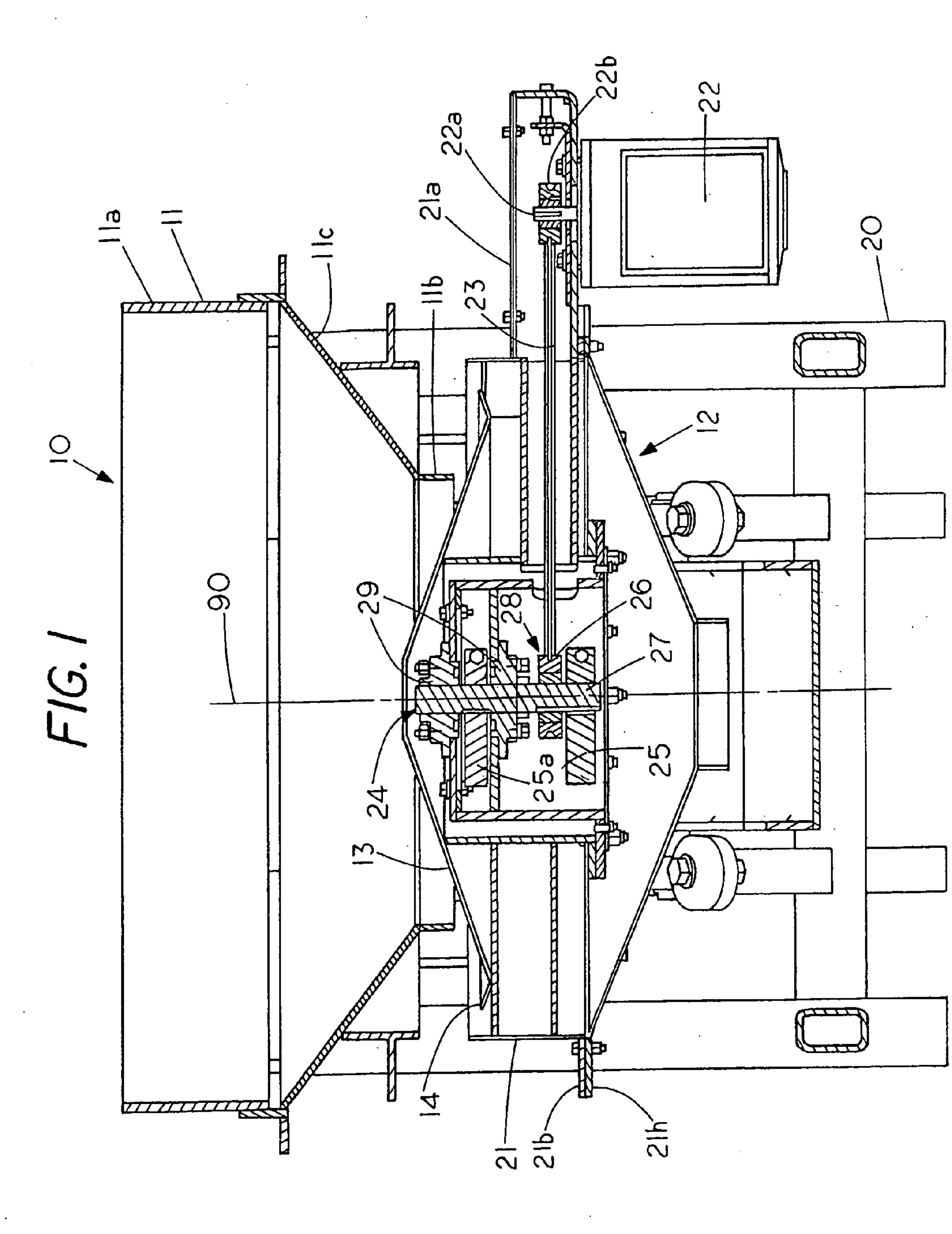

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FIG. 1

FIG. 2

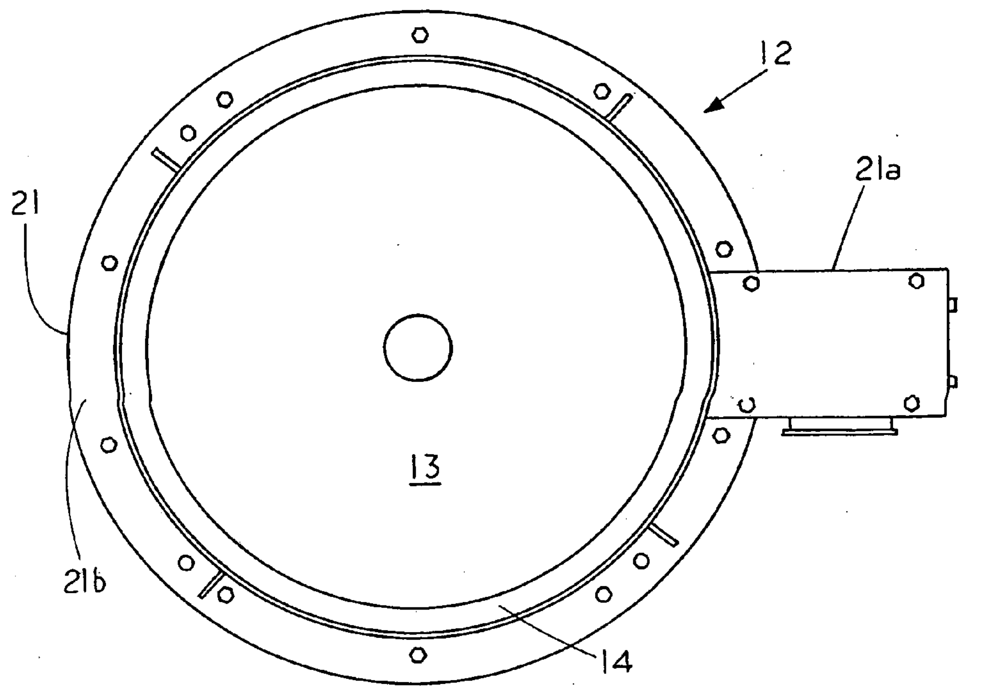


FIG. 3

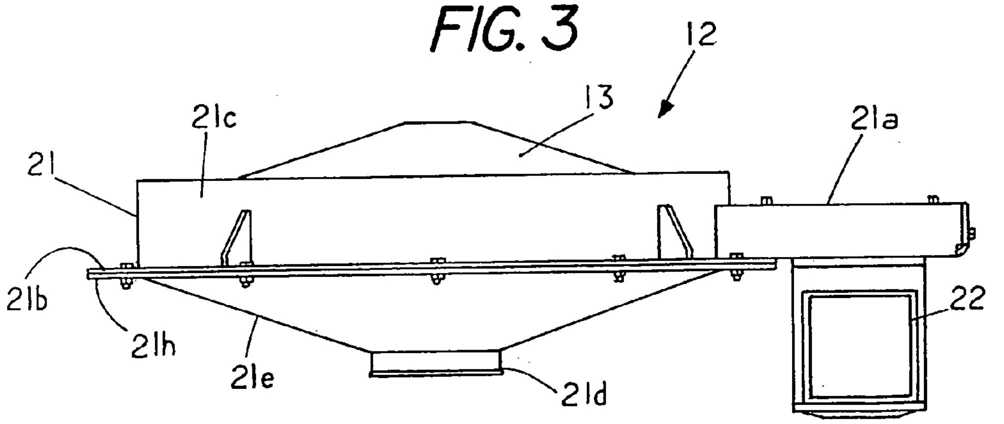


FIG. 4

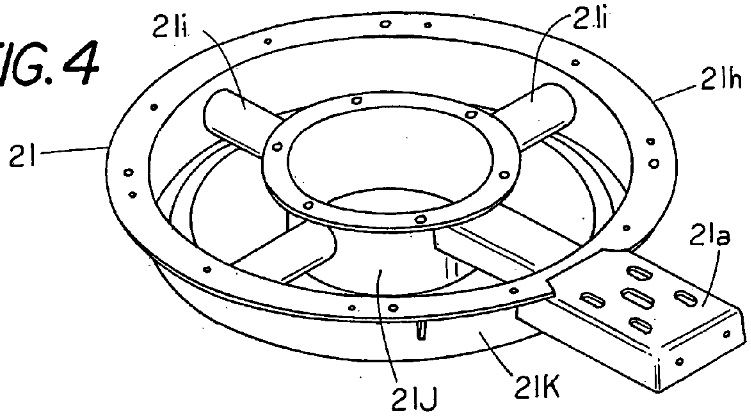


FIG. 5

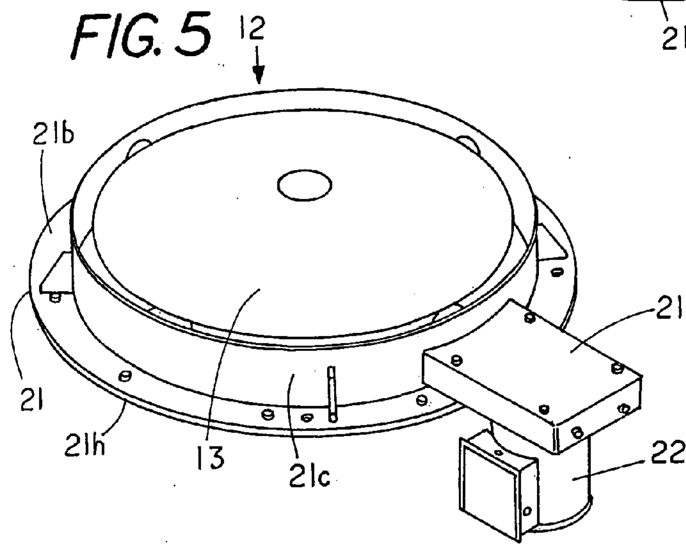
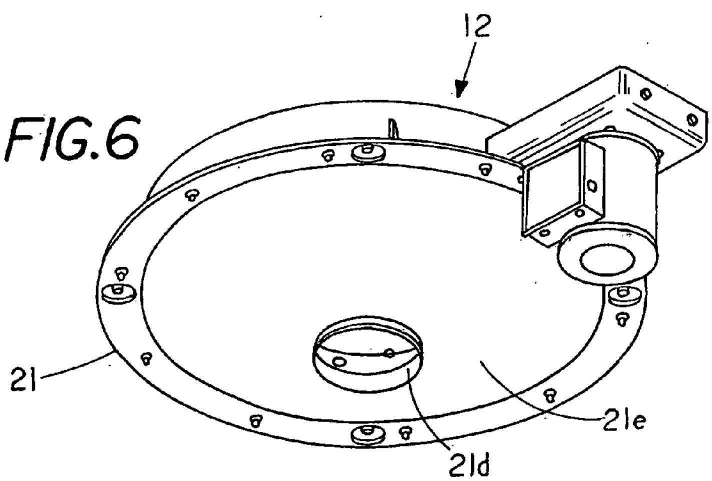


FIG. 6



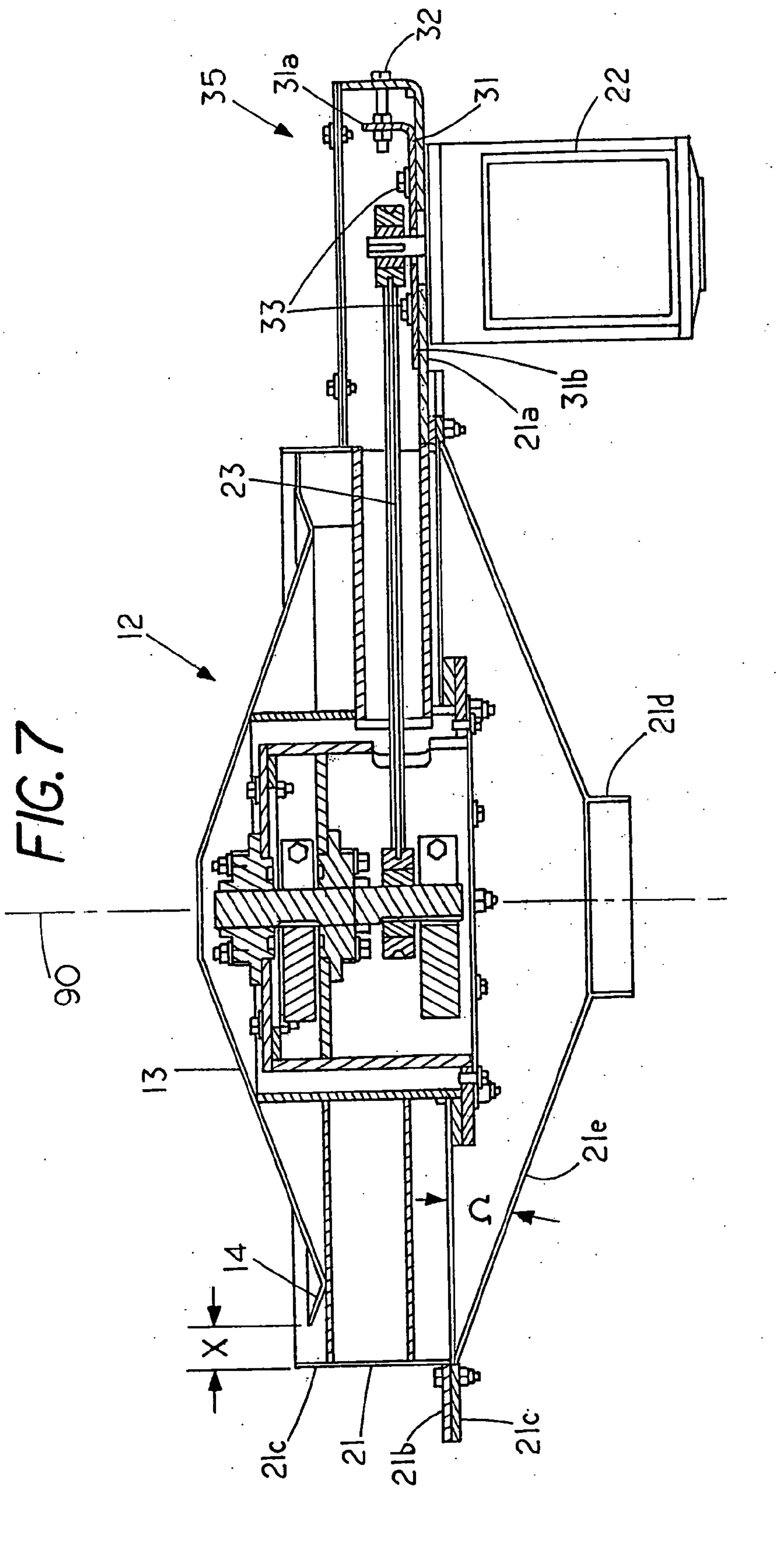
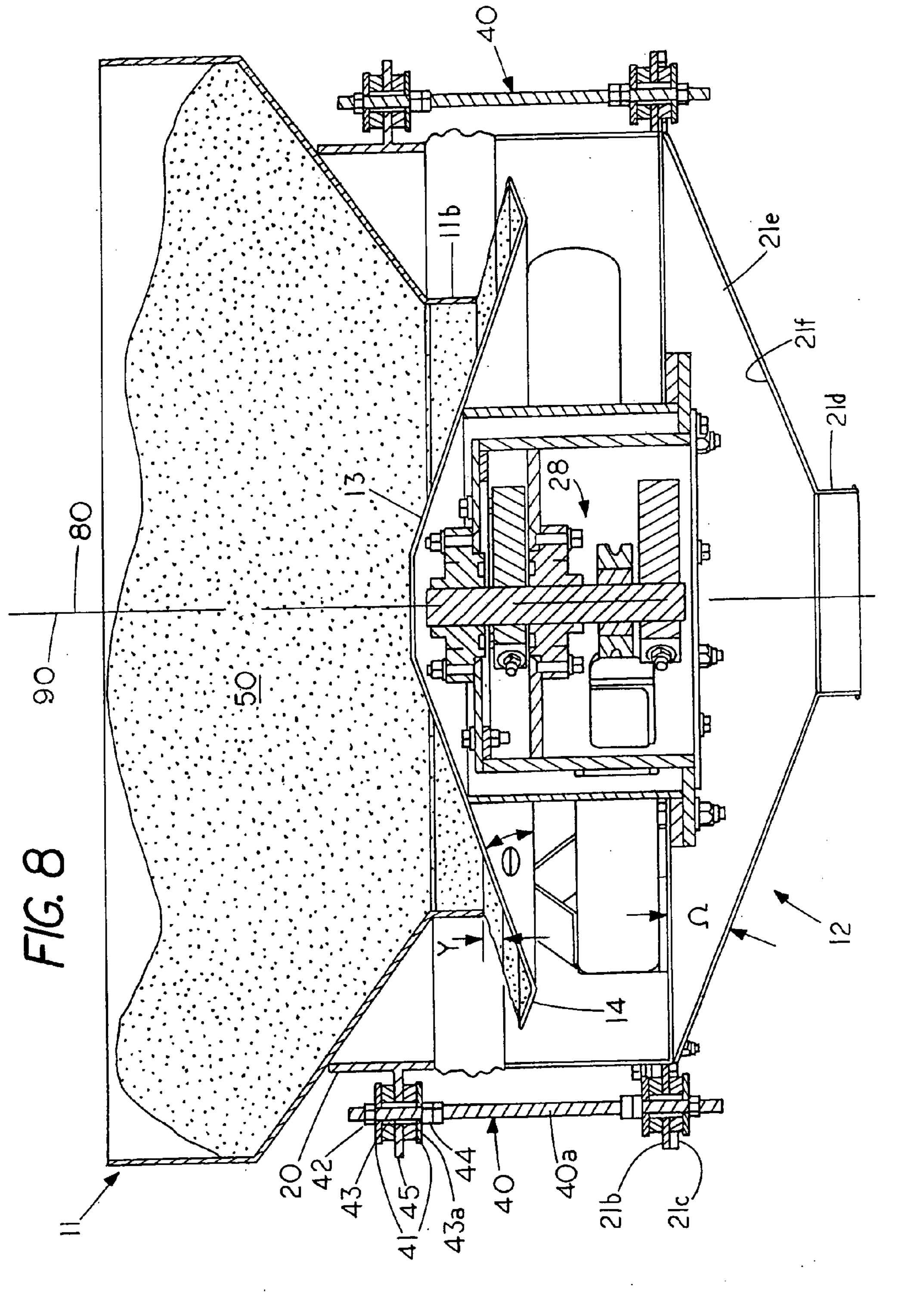


FIG. 7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21b
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21d
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42
43
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45
50
80
90
Y
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FIG. 8

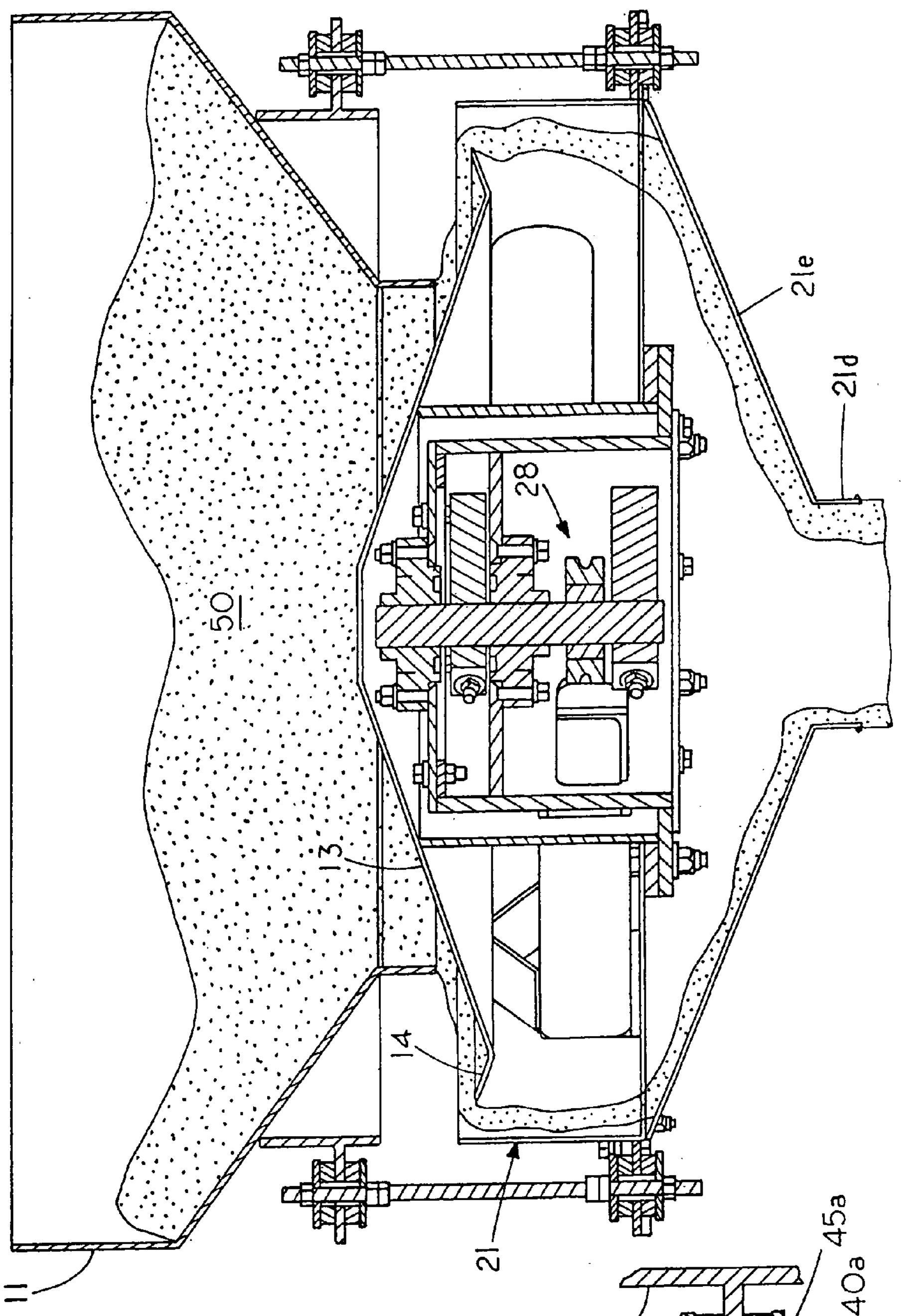

FIG. 9

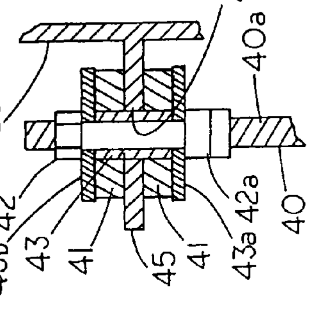

FIG. 8A

FIG. 10

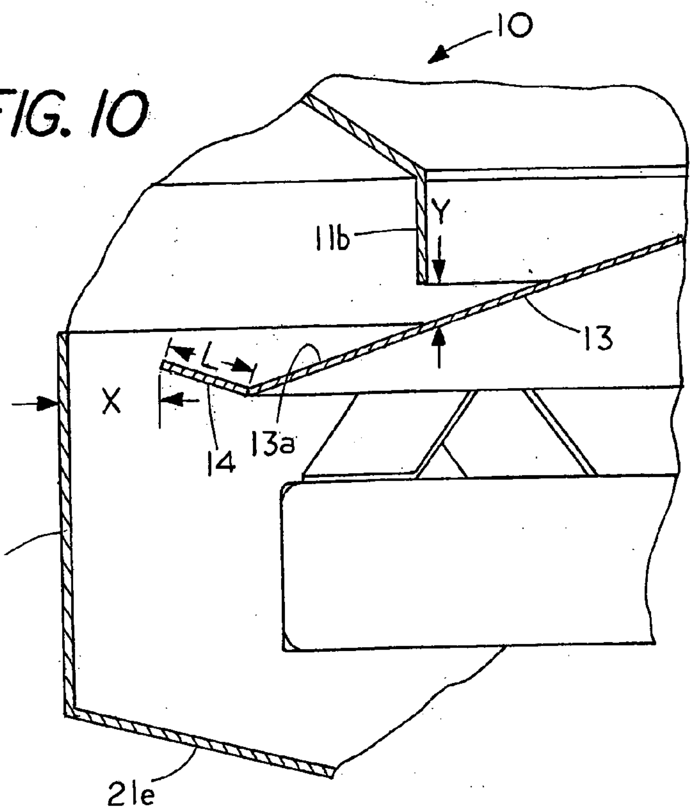

FIG. 11

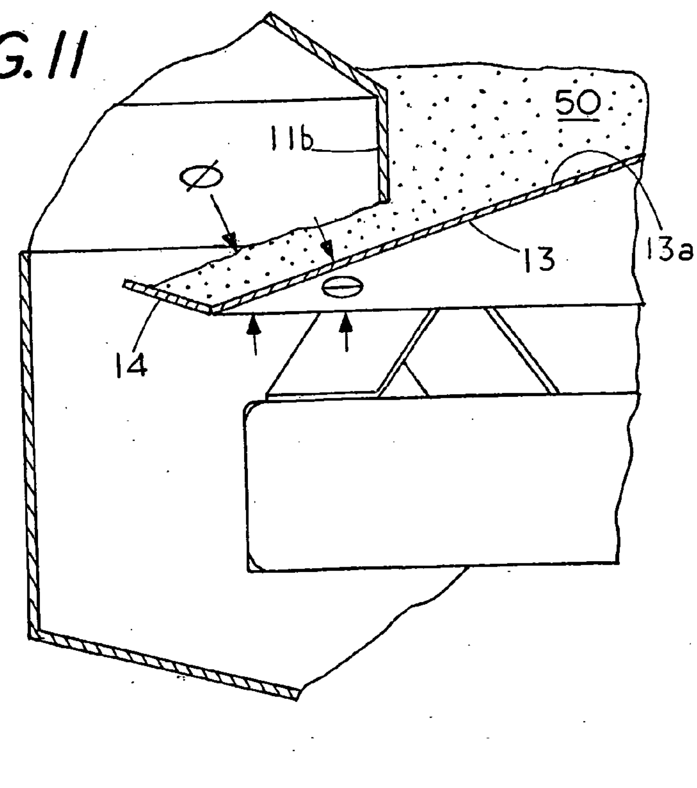

FIG. 11A

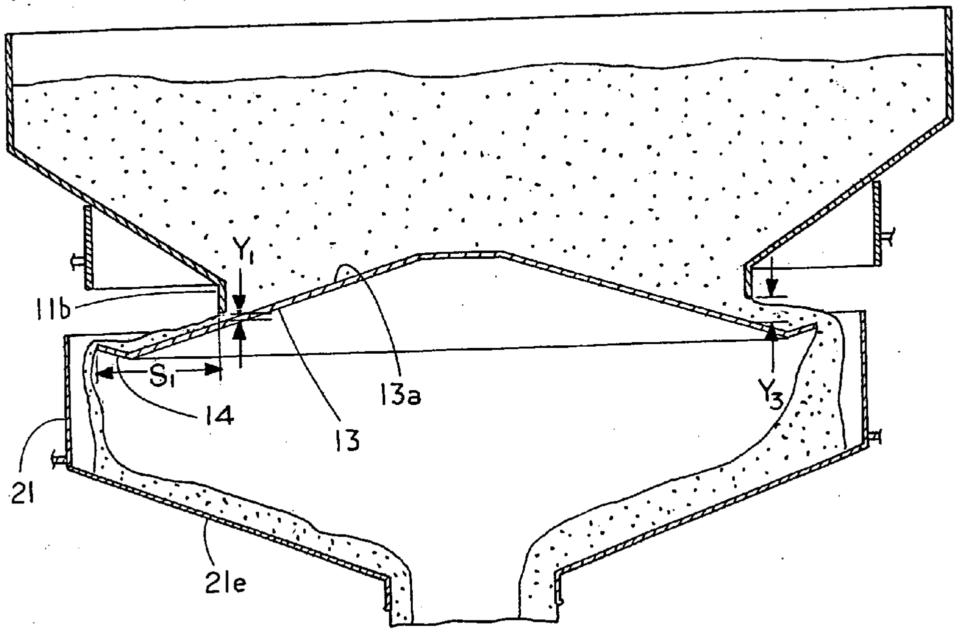

FIG. 11B

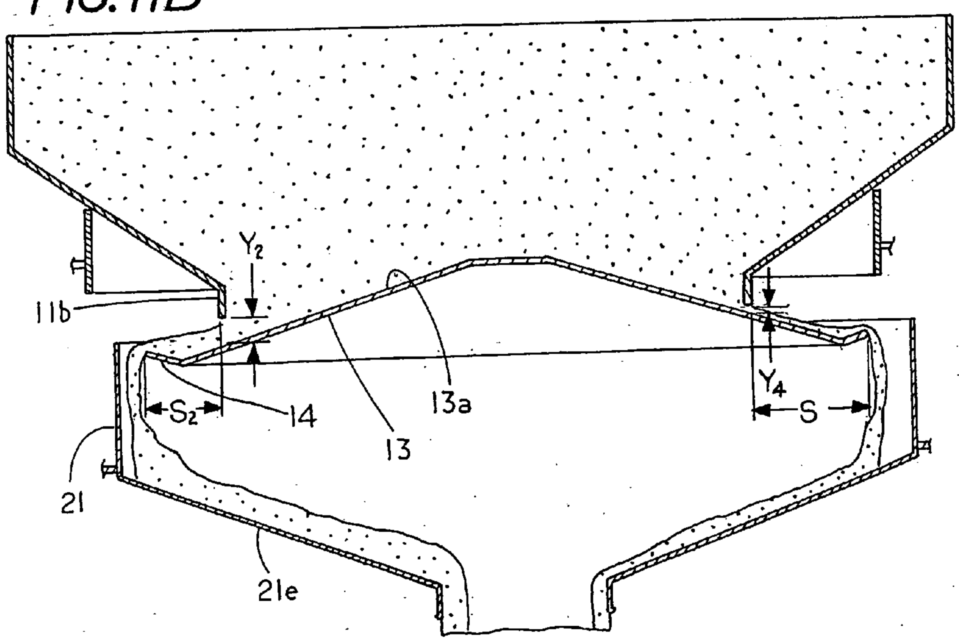

FIG. 11C

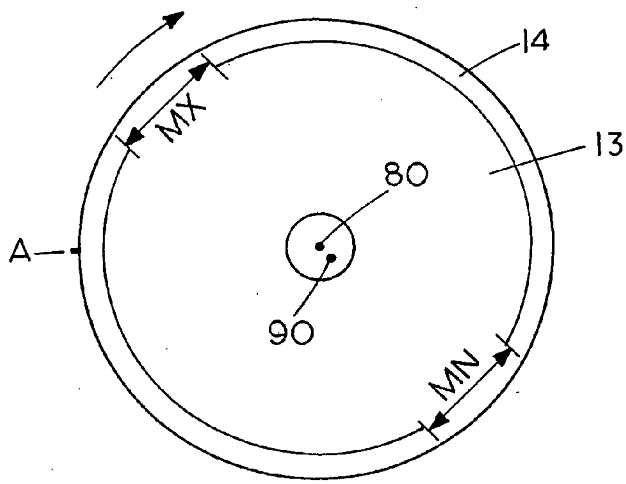

FIG. 11D

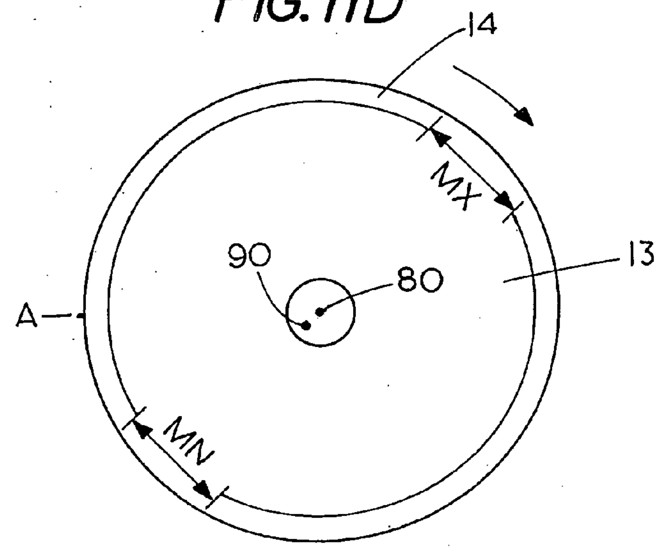

FIG. 11E

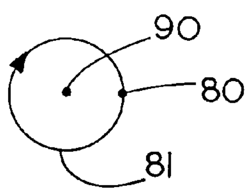

FIG. 12

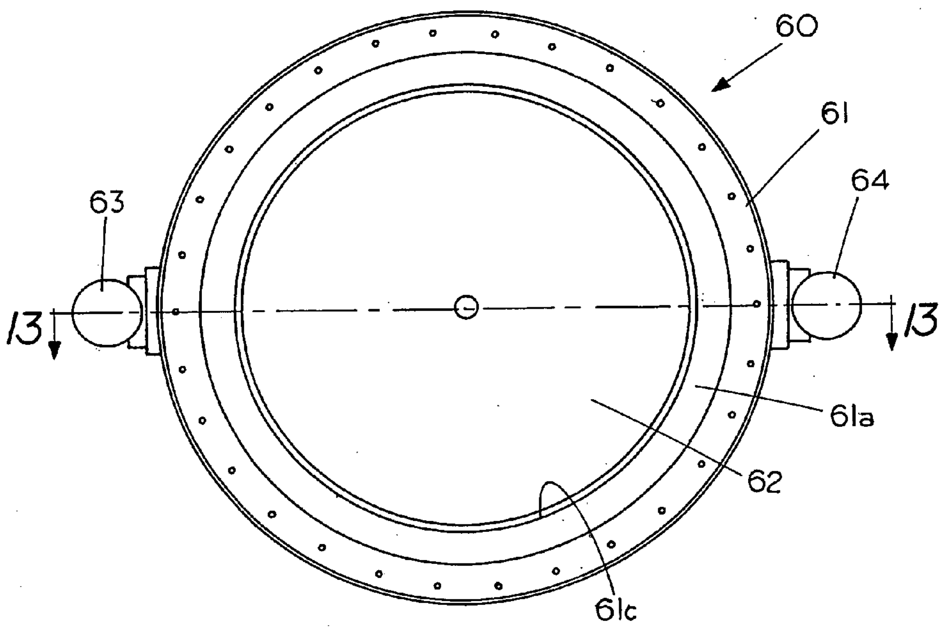
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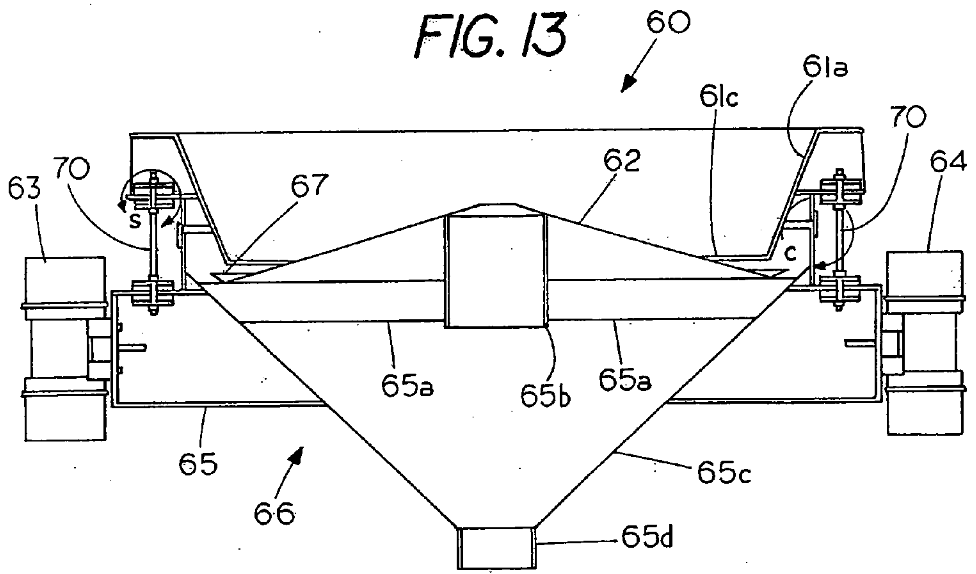
FIG. 13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GYRATOR FEEDER

FIELD OF THE INVENTION

[0001] This invention relates generally to bin feeders and, more specifically, to a gyrator feeder.

CROSS REFERENCE TO RELATED APPLICATIONS

[0002] None

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0003] None

REFERENCE TO A MICROFICHE APPENDIX

[0004] None

BACKGROUND OF THE INVENTION

[0005] The concept of vibrating bin dischargers is known in the art. Typically, a vibrating bin discharger includes a cone that is placed beneath a hopper outlet with the cone vibrating in an up and down motion to propel material from the hopper. A gate is positioned in the hopper to shut off the flow of material from the hopper when the vibrating bin discharger is not in use. One of the disadvantages of the known vibrating bin dischargers is that the material can become compacted as the bin discharger vibrates. Another disadvantage is that the vibration of the cone requires large power requirements since the material in the hopper is lifted up during the vibration cycle. Another disadvantage is that if the material contains both large and small particles the vibrator motion can cause segregation of the large and small particles through the up and down motion on the material.

[0006] U.S. Pat. No. 4,545,509 disclose a bin activator with a central feed and a vibration generator located radially offset from the center. While the vibratory action is described as generating a circular orbital motion to the lower bowl the actual motion is not a true circular orbital vibratory motion since the vibration motors are not located at the central vertical axis of the bin activator. As a result of the positioning of the vibratory motors the vibratory motion the cone does not actually follow a circular path. As a result the feeder does not generate a uniform 360-degree delivery of material from a circular opening.

[0007] A further difficult with the bin activator shown in U.S. Pat. No. 4,545,509 is that angle of the lower cone is so shallow that material is maintained in the lower bowl rather than being empted out each time the activator is shut off.

[0008] In contrast to the vibrating bin discharges the present invention uses gyrations of a dispensing member to control the flow of material with substantially true circular orbital vibratory motion.

SUMMARY OF THE INVENTION

[0009] Briefly, the present invention comprises a gyrator feeder that has a dispensing member that moves to uniformly dispense material from the hopper. To provide flow shut off without use of a gate, a lip on the dispensing ledge of the dispensing member is positioned so that material retained on the dispensing ledge is maintained at an angle less than the angle of repose of the material. The gyrator feeder dispenses material uniformly and circumnavigatingly through a gyrator that generates a true circular orbital vibratory motion in the dispensing member by either rotating an offset weight along a vertical central axis of the dispensing member or by positioning vibratory motors diametrical opposite from each other on a gyrator housing and synchronizing the vibratory motors with each other to thereby dispense material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. **1** is a partial sectional view of the gyrating bin discharger;

[0011] FIG. **2** is an isolated top view of the housing and the gyrating dispensing member;

[0012] FIG. **3** is a side view of the housing and gyrating dispensing member of FIG. **2**;

[0013] FIG. **4** is an isolated perspective of the housing without the gyrating dispensing member;

[0014] FIG. **5** is an isolated perspective view of the top of the housing with the gyrating dispensing member and the vibrator drive motor secured to the housing;

[0015] FIG. **6** is an isolated view of the bottom of the housing with the vibrator drive motor secured to the housing;

[0016] FIG. **7** is a sectional isolated view of the gyrating dispensing member and the vibrator drive motor;

[0017] FIG. **8** is a partial sectional view of the hopper and the gyrating dispensing member when the vibratory drive motor is in the off condition;

[0018] FIG. **9** illustrates the material flow when the dispensing member is gyrated in a circular motion by the vibrator drive motor;

[0019] FIG. **10** is an isolated sectional view of the dispensing ledge and lip on the gyrating dispensing member for holding the material thereon at an angle less than the angle of repose of the material;

[0020] FIG. **11** shows the isolated section view of FIG. **10** with the dispensing material thereon;

[0021] FIG. **11**A is a partial cross section view of the dispensing member as it gyrates with respect to a hopper outlet;

[0022] FIG. **11**B is identical to the view of FIG. **11**A except the dispensing member is in a different portion of the gyration cycle;

[0023] FIG. **11**C shows a top isolated view of the dispensing member with a central axis in a first off vertical condition;

[0024] FIG. **11**D shows the top isolated view of the dispensing member of FIG. **11**C with the central axis of the dispensing member in a second off vertical condition;

[0025] FIG. **11**E is a schematic of the circumnavigating path of the dispensing member axis about a vertical axis;

[0026] FIG. **12** shows a top view of an alternate embodiment of a bin discharger with two vibratory motors located diametrically opposite each other on the gyrator housing; and

[0027] FIG. **13** shows a side sectional view of the alternate embodiment of a bin discharge of FIG. **11** with two vibratory motors located diametrically opposite each other on the gyrator housing.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0028] FIG. **1** shows a sectional view of a gyrator feeder **10** comprising a hopper **11** having a top cylindrical section **11***a* or inlet for placing materials into the hopper and a lower cylindrical section forming an outlet **11***b*. A conical sidewall **11***c* has a top end mating with cylindrical section **11***c* and a bottom section mating with cylindrical section **11***b* to provide a centrally funneling flow path for material as it flows through hopper **11**.

[0029] Positioned proximate the outlet **11***b* and partially obstructing the outlet **11***b* is a gyrator **12**. Gyrator **12** includes a dispensing member **13**, which in the preferred embodiment is a an activating cone that generally has a frusto conical shape. Dispensing member **13** has an annular lip **14** that extends upward at an angle to retain material thereon. The hopper **11** is fixedly supported by a stand **20** while the gyrator **12** is flexibly supported on stand **20** with gyrator **12** positioned below hopper **11** to receive material therefrom. (See FIG. **8**) Reference numeral **90** indicates the vertical central axis **90** of the system **10**. As can be seen in FIG. **1** gyrator **12** has dispensing member **13** partially obstructing the outlet **11***b* with the dispensing member having annular lip **14** for retaining a material thereon when gyrator **12** is in an off condition and for dispensing material thereover when the gyrator **12** is gyrating.

[0030] The gyrator **12** includes a gyrator housing **21** having a radial extension **21***a* with a drive motor **22** secured to the underside of radial extension **21***a*. Motor **21** has a motor shaft **22***a* with a drive pulley **22***b* secured thereto with the drive pulley **22***b* and motor shaft **22***a* extending into the interior space in housing radial extension **21***a*. A belt **23** connects drive pulley **22***b* to a pulley **26** on a rotateable member **22** that forms part of the internal gyrating unit **28**. Rotateable member **22** comprises a vertical shaft **27** rotateable supported by bearings **29** with shaft **27** having offset weights **25** and **25***a* secured thereto. When motor **22** is activated it rotates shaft **27** through drive belt **23**, which produces vibrations. However, instead of producing an up and down vibratory motion the off balance rotation of shaft **27** at the center of the gyrator housing produces a true circular orbital vibratory action of housing **21** as opposed to bin activators that have vibrator sources that are off set from the center. Consequently, with a true circular orbital vibratory motion the gyrator feeder delivers a more uniform flow.

[0031] In the embodiment shown in FIG. **1** the offset member for inducing the gyrations is centrally positioned in housing **12** with shaft **27** rotating about a central vertical axis **90** to thereby cause the gyrator housing **15** to provide true circular orbital vibratory motion of the dispensing member **13**. That is the circular orbital vibratory motion occurs in an x-y plane because the offset weight is at the center rather than outside the center of the housing. Another embodiment for producing true circular orbital vibratory motion of the dispensing member **13** where vibrators are not located along a vertical central axis of the system is shown and described in FIGS. **12** and **13**.

[0032] FIG. **2** shows an isolated top view of the gyrator **12** showing the gyrator housing **21** with a flange **21***b* for flexibly supporting gyrator **12**. Centrally positioned within gyrator housing **21** is the cone shaped dispensing member **13** having a peripheral annular lip **14**. The annular lip is spaced from housing **21** as shown in FIG. **1** and FIG. **2** and is shown in greater detail in FIG. **10** and FIG. **11**.

[0033] FIG. **3** shows the isolated side view of the gyrator **12** with a drive motor **22** secured to the underside of the housing extension **21***a*. A cylindrical member **21***c* extends upward from housing **21** and a cone shaped discharge member **21***e* having an outlet **21***d* extends downward from housing **20** with the member **21** and **21** e secured to each other by bolts extending through flanges **21***b* and **21***h*.

[0034] FIG. **4** shows an isolated top perspective view of a portion of housing **21** without the gyration unit. A set of radial spokes **21***i* connects the inner cylindrical housing member **21***j* with the outer cylindrical housing member **21***k*. The radial supports **21***i* provide for energy transfer from the inner cylindrical housing member **21***j* where the internal gyrating unit **28** is located.

[0035] FIG. **5** shows an isolated top perspective view of gyrator **12**, which is shown in top view in FIG. **2** and side view in FIG. **3**. Dispensing member **13** is shown centrally positioned in cylindrical sidewall **21***c*. Similarly, FIG. **6** shows an isolated bottom perspective view of gyrator **12**, which is shown in top view in FIG. **2** and in bottom view in FIG. **3**. FIG. **6** shows the outlet **21** d where material is discharged from gyrator housing **21**

[0036] FIG. **7** shows an isolated sectional view of gyrator **12** showing the annular distance x between the outer peripheral lip **14** and the cylindrical **21***c* that forms an annular flow path for material as it flows through gyrator **12**. FIG. **7** also shows a belt tensioner **35** comprising an L-shaped member **31** that has one portion **31***b* secured to motor **22** and to housing **21***a* by stud bolts **33** and the other end **31***a* extending perpendicular therefrom to receive a bolt **32**. As the drive belt **23** can stretch under use one can move the motor **22** radially outward to increase the tension on belt **23** by rotating bolt **32** which pulls arm **31***a* radially outward. Similarly, one can decrease the tension on belt **23** by rotating bolt **32** in the opposite direction, which causes the motor and drive shaft to move radially inward. Thus the tension of the belt can be adjusted without having to disassemble the housing **21***a*.

[0037] FIG. **8** shows the gyrator **12** with the gyrator housing **21** flexibly supported from stand **20** by a set of radially positioned flexing members **40** that prevent rotation of dispensing member **13** but permit gyration of dispensing member **13** as well as provide uniform engagement of the flange **45** with the elastomers **41**. Flexing members **40** comprise a threaded shaft **40***a* having one end with a set of elastomers **41** that sandwichingly engage a flange **45** on stand **20** and the opposite end with an identical set of elastomers **41** that sandwichingly engage the flange formed by flanges **21***b* and **21***e*.

[0038] FIG. **8**A shows an isolated detail view of a portion of flexible support **40** revealing a rigid sleeve **43** that extends around threaded shaft **40***a* with a top end of rigid sleeve **43** engaging a rigid washer **43** and the lower end of rigid sleeve **43** engaging a further rigid washer **43***a*. The sleeve **43** is clamped between a top rigid washer **43** and a lower rigid washer **43***a* by an upper nut **42** and a lower double nut **42***a* to form a rigid housing for the annular elastomers **41**. Flange **45** has an opening **45***a* therein that allows the flange **45** to move up and down along sleeve **43**. The rigid housing with the elastomers sandwichingly therebetween allows the flange to compressively and more uniformly engage each of the entire annular elastomers **41** during the operation of the gyrator **12**. Similarly, an identical arrangement of a rigid sleeve and rigid washers is located in the lower portion of shaft **40***a* and is not described herein.

[0039] The use of elastomers **41** to interface the shaft **40***a* to both stand **20** and to gyrator **12** provides for both static and dynamic support of gyrator **12** to allow for vibration displacement of the gyrator **12** with respect to stand **20** while at the same time providing support to hold gyrator **12** in the dispensing condition proximate outlet **11***b*. An identical flexible support **40'** is located on the opposite side of gyrator **12** and in the preferred embodiment flexible supports are circumferentially positioned around the gyrator **12** to provide 360 degree support to the gyrator **12**.

[0040] FIG. **8** shows the material in hopper **50** maintaining itself in a nonflowable condition when the gyrator **12** is in the off condition. That is, the material **50** extends down along member **13** to a position were the up turned annular lip **14** retains the material thereon. A vertical distance Y denotes the distance between the bottom of outlet **11***b* and dispensing member **13** and is referred herein as the feed region height. In this condition material **50** in hopper can be maintained in an immediate ready to dispense condition without the use of a gate to shut off the flow of materials through correlation of the feed region height with the angle of repose of the material.

[0041] FIG. **8** also shows a lower dispensing cone **21** that receives material **50** forming an angle Q with the horizontal. Dispensing cone **21** has a low friction surface **21***f* to allow material **50** to slide thereon and has the angle Q greater than the angle of repose of the material to ensure that the material **50** being dispensed from hopper **11** will not accumulate thereon and can be carried quickly through outlet **21***b*. In some applications the lower dispensing cone **21** may not be used, in those cases the material is dispensed directly into another container as it falls off lip **14**. When a lower dispensing cone is used the angle of the cone is selected so material will not adhere thereon in the static condition and in addition the slope and the outlet **21***b* should allow for removal of material faster than can be dispensed to avoid accumulating material on the lower dispensing cone that could choke off the flow. In addition, with a steep slope and low friction surface **21***f* the material can not accumulate on the lower dispensing cone **21**, consequently, the lower dispensing cone will be free of material once the gyration of the feeder ceases.

[0042] FIG. **9** illustrates the flow of material **50** from hopper **11** to outlet **21***d* once the gyrator **12** is activated by powering the gyrating unit **28**. Note, the material **50** flows over annular lip **14** and falls down unto lower converging cone **21**, which directs the material to outlet **21***d*. That is, the gyrating motion of gyrator housing **21** causes the material to flow from hopper **11** to outlet **21***d*. By controlling the gyrations of housing **21** one can control the rate of material being dispensed. That is, by increasing the gyration action one can increase the flow of material while decreasing the gyration action allows one to decrease the flow of material. This is particularly useful if one is attempting to meter a precise amount of material into a container since one can decrease gyrating action as one approaches the amount of needed material to thereby provide a better topping off control.

[0043] FIG. **10** shows a cross section view of dispensing lip **14** of length L positioned in housing **21** when hopper **11** is in an empty condition. In the embodiment shown the distance L denotes the length of annular lip **14**. The distance x denotes the radial spacing between the peripheral edge of annular lip **14** and the housing **21** and Y (the feed region height) denotes the distance from the end of the outlet **11***b* to the surface **13***a* of dispensing member **13**, which is the feed region that the material must flow through to leave hopper **10**. In operation it is this distance Y, which will vary during the gyration of dispensing member **13**, and it is the variation of the distance Y as the dispensing member **13** moves in response to the true circular orbital vibratory motion of the gyrator **12**, which is illustrated in FIGS. **11**A and **11**B which causes material to flow along dispensing member **13** and over lip **14**.

[0044] FIG. **11** shows a static or no flow condition with material **50** located on the surface **13***a* of dispensing member **13**, which partially obstructs the outlet **11***b*. The material on surface **13***a* of member **13** is held from flowing off by coaction of upward extending lip **14** and the material angle of repose (the steepest angle at which a sloping surface formed of a particular loose material is stable). By extending the lip **14** a length L upward the material stops flowing when the angle Ø of the material is less than the angle of repose of the material thereon. The static or no flow condition is further illustrated in FIG. **8**.

[0045] By selecting the distance Y such that the material **50** can settle on surface **13***a* at an angle less than the material angle of repose one prevents material from continuing to flow off the end of annular lip **14** when the gyration unit is in an off condition. That is, one selects the spacing Y such that the material **50** that is on surface **13***a* will flow along surface **13***a* but does not flow over lip when the dispensing member is not subject to gyrations. It should be understood that the spacing Y will vary depending on the material angle of repose as well as the type of material. In general, an operator adjusts or calibrates the spacing i.e. the feed region height, is set sufficiently high so the material that is in hopper **10** can flow down to lip along surface **13***a* but will not flow over the annular lip **14** when the gyrator is in the off condition. The static spacing of the feed region can be adjusted though lengthening or shortening the flexible supports **40** which are located circumferentially around gyrator housing **21**.

[0046] To appreciate the gyration of the dispensing member **13** reference should be made to FIG. **8**, FIG. **11**A and FIG. **11**B which shows the static vertical axis **90** of the dispensing member in relationship to the dynamic central axis **80** of the dispensing member **13**.

[0047] FIG. **8** shows the condition when there is no gyration of dispensing member **13**, in this condition the static vertical axis **90** and the central axis **80** of dispensing member **13** are in alignment with each other.

[0048] FIG. **11** A illustrates the dispensing member **13** at one point in the gyration cycle and FIG. **11**B shows the dispensing member at a second point 180 degrees later in the gyration cycle. A reference distance S_1 indicates the distance of the vertical edge of lip to outlet **11***b* as a result of the lateral displacement (i.e. that is substantially in an x-y plane) of the dispensing member **13**. In this condition the feed height Y_1 has decreased. However, on the opposite side the feed height Y_3 has increased since the dispensing member **13** has moved away from dispensing member **13**.

[0049] FIG. **11***b* shows that the distance between the outlet **11***b* and the edge on the lip **14** is now S_2, which is less than S_1. Consequently, the feed region height Y_2 has increased and the feed region Y_4 on the opposite side has decreased through movement of the dispensing member substantially in the x-y plane.

[0050] Thus, the gyration of the dispensing member **13** in a true circular orbital vibratory motion causes a local uniform flow of material over the lip **14** as the feed region height increases. Since the feed height region increases at a uniform rate the flow over the edge of the lip remains uniform as the delivery of the material makes a 360 sweep around the dispensing member **13**.

[0051] FIG. **11**C and FIG. **11**D are schematic of the top of cone with two areas of flow designated. FIG. **11**C shows a region designated by Mx where there is maximum flow over the annular lip **14** of dispensing member **13** and the region designated by Mn, which is diametrically opposite and has minimum or no flow. A point A has been marked on cone **13** in both FIG. **11**C and **11***d* to show that the cone **13** does not rotate. As the gyration continues the region of maximum flow Mx moves clockwise around the cone **13** as illustrated in FIG. **11**D which shows that both the region Mx and Mn have rotated about 90 degrees from their original position. The dynamic position of the central axis **80** of the dispensing member **13** is indicated by reference numeral **80** while reference numeral **90** indicating the static location of dispensing member central axis if the dispensing member **13** were at rest.

[0052] FIG. **11**E shows a top view of the static vertical axis **90** with the circumnavigating path **81** of the dynamic dispensing member axis **80** about the static vertical axis **90**. The arrows indicate that the dynamic axis **80** follows a circular like path about static vertical axis **90** during the circular orbital gyration of dispensing member **13**.

[0053] As illustrated by the drawings the gyration of dispensing member **13** causes a portion of the cone surface **13** to be closer to the edge of outlet **11***b* and a portion to be further from the edge of outlet **11***b*. However, as the cone **13** gyrates the distance Y which causes flow along the cone surface **13***a* travel 360 degrees around the outlet **11***b* and in doing so cause the rate of material **50** flowing over the lip to locally increase.

[0054] Because the dispensing member **13** gyrates the maximum distance variation between the cone surface **13***a* and the outlet **11***b* circumnavigates around the outlet **11***b* thereby causing maximum material to flow when a portion of cone is in the position shown in the left side of FIG. **11**B and no flow or low flow when the cone surface **13***a* is in the position shown in the left side of FIG. **11**A.

[0055] Thus the gyration of cone **13** causes the spacing Y between the hopper lip **11***b* to vary with the variation in spacing circumnavigating around the hopper lip **11***b*. The localized flow of material increases with increased spacing Y and decreases with a decrease in spacing Y. As a result the flow of material from one portion of the hopper and then from adjacent portion of the hopper circumnavigates around the dispensing manner in a manner similar to a wave propagating.

[0056] FIG. **12** shows a sectional view of an alternate gyration bin discharge system **60** and FIG. **13** shows a section view of the bin discharge system **60** taken along lines **13-13** of FIG. **12**. Bin discharge system **60** includes a hopper **61** having a top section **61***a* or inlet for placing materials into the hopper and a lower cylindrical a hopper outlet **61***c* that funnels material into a gyrator **66**. The alternate embodiment shown in FIGS. **12** and **13** also produces a true circular orbital vibratory motion of the dispensing member even though the gyration unit is not located along a static vertical axis of the gyrator housing.

[0057] FIG. **12** shows the gyrator **66** includes a gyrator housing **65** having a first vibratory motor **63** mounted on one side of housing **65** and a second vibratory motor **64** mounted diametrically opposite. The gyrator housing **65** includes a cone shaped dispensing member **62** having an annular lip **67** and an interior radial members **65***a* with a hub **65***b*. A conical shaped member **65***c* funnels material into outlet **65***d*. In the embodiment of FIG. **13** the actual unit that produces the gyration of the gyrator housing **65** is not located in the center as shown in FIG. **1** but is located external to the gyrator housing **65**. The annular lip and the relationship to the hopper is identical that is described in FIGS. **1-11** and will not be described herein.

[0058] The gyrator feeder **60** differs from the bin gyrator feeder **10** in that the gyrator housing **12** has a single vibration producing unit i.e. the off set rotateable weights located on a vertical central axis of the gyrator with the drive motor **22** located on the peripheral portion of the housing **12**. In contrast, the gyrator housing **66** has two vibration producing units i.e vibratory motors, wherein both the vibratory motors are radially spaced from the central axis **73** of the gyrator **66**. In this embodiment a drive motor and a set of offset weights are in the same location, that is both vibratory motor **63** and vibratory motor **64** include a drive motor and a set of offset rotateable weights comprising the gyration unit that are directly coupled to the motor drive shaft. By having the vibratory motor **63** and **64** positioned diametrically opposite from each other one can induce a true circular orbital vibratory motion in gyration housing **65**, when it is flexibly suspended by flexible supports **70**, which are identical to the flexible supports shown in FIG. **8**.

[0059] In order to achieve a true circular orbital vibratory motion FIG. **12** the vibratory motors **63** and **64** are synchronized with the motors rotating in the same direction. In the synchronized condition the weights are in the same position for each vibratory motor. That is, if the offset weight in vibratory motor **63** is at the 3 o'clock position the offset weight in the motor **64** will also be at the 3 o'clock position. As a consequence the dispensing member **62** produces a true circular orbital vibratory motion in the x-y plane.

[0060] Thus, the rotation of off balance shafts at opposite sides of the gyrator housing **65** can also produces a lateral gyrating action of housing **65** i.e., a true circular orbital vibratory motion or lateral side-to-side motion as differentiated from up and down motion found in conventional vibration bin dischargers as well as elliptical orbit motion found in some units which produce non-uniform dispensing rates

[0061] Thus the invention includes the method of dispensing material comprising the steps of: placing material in a hopper having an outlet edge; and gyrating a dispensing member located below the outlet edge to cause the dispensing member to simultaneously and circumferentially vary the distance between the outlet edge and the dispensing member to thereby increase the flow along a portion of the dispensing member and decrease the material flow along another portion of the dispensing member. The invention also includes a method of stopping the gyration to shut off the flow over the dispensing member while maintaining an open spacing between the outlet edge and the dispensing member which can be obtained by having the opening spacing Y maintained at a distance such that the angle of the material on the dispensing member **13** which flows through the feed region does not exceed an angle of repose of the material.

1. A gyrator feeder comprising:

a hopper having an outlet;

a gyrator having a dispensing member partially obstructing the outlet with the dispensing member having a lip for retaining a material thereon when said gyrator is in an off condition and for dispensing material thereover when the gyrator is gyrating.

2. The gyrator feeder of claim **1** including a stand having flexible supports for said gyrator to permit gyration of said gyrator with respect to said outlet.

3. The gyrator feeder of claim **1** wherein the gyrator includes an internal gyrating unit that is centrally positioned along a vertical axis of said gyrator.

4. The gyrator feeder of claim **2** wherein the internal gyrating unit is powered by a motor located radially off center of said gyrator.

5. The gyrator feeder of claim **4** wherein the dispensing member has a dynamic central axis that circumnavigates about a static vertical axis of the dispensing member.

6. The gyrator feeder of claim **2** wherein the gyrator includes a drive belt connect to the internal gyration unit and a tensioner for adjusting the tension of the drive belt.

7. The gyrator feeder of claim **2** wherein the dispensing member includes a cone shaped member.

8. The gyrator feeder of claim **1** wherein the gyrator includes an internal gyrating unit having a rotateable shaft with an offset weight.

9. The gyrator feeder of claim **7** wherein the lip of the gyrator is an annular lip that is circumferentially spaced from a gyrator housing to permit material flow therepast.

10. The gyrator feeder of claim **1** wherein the gyration unit includes two vibration units located diametrically opposite of each other to gyrate the gyrator housing with the vibration units synchronized with each other.

11. The gyrator feeder of claim **2** wherein the flexible supports include a set of elastomers sandwiched around a flange with a sleeve extending through the set of elastomers to engage a set of washers to provide a ridge housing for displacement of the set of elastomers therein.

12. The gyrator feeder of claim **1** wherein the dispensing member is positioned a distance y below the outlet wherein the distance y is determined at least partially by the angle of repose of material to be dispensed.

13. The gyrator feeder of claim **1** including a lower dispensing member having an angle greater than the angle of repose of the material to prevent accumulation of material thereon during operation of the gyrator feeder.

14. The gyrator feeder of claim **1** wherein the dispensing member extends radially beyond the outlet but spaced from the outlet to thereby partially obstruct but not block a flow passage between the outlet and the dispensing member.

15. The gyrator feeder of claim **1** wherein the gyrator comprises a pair of vibratory motors positioned radially outward from a central axis of the gyrator.

16. A gyrator feeder comprising:

a gyrator housing flexibly suspended;

a gyration unit affixed to said gyrator housing and located along a vertical central axis of the gyration housing; and

a motor radially off set from the gyration unit for propelling the gyration unit to generate a true circular orbital vibratory motion of the gyrator housing.

17. The gyrator feeder of claim **16** wherein the gyration unit comprises a rotateable shaft having off set weights and a drive motor with the rotateable shaft centrally positioned in the gyrator.

18. The gyrator of claim **16** wherein the gyration unit comprising a first vibratory motor radially spaced from a central axis of the gyrator housing and a second vibratory motor radially spaced from the central axis of the gyrator housing.

19. The gyrator of claim **18** wherein the gyrator housing includes an annular lip for maintain a material thereon wherein the annular lip extends upwardly to maintain material on a dispensing member when the gyration unit is in an off condition.

20. The gyrator feeder of claim **19** including a stand and a gravity feed hopper wherein the gyrator is stand mounted below a gravity feed hopper with a plurality of flexible supports circumferentially positioned around said gyrator.

22. The method of dispensing material comprising the steps of:

placing a dispensable material on a dispensing member having a retaining lip;

generating a true circular orbital vibratory motion in the dispensing member by either rotating an offset weight along a vertical axis of the dispensing member or by positioning vibratory motors diametrical opposite from each other on a gyrator housing and synchronizing the vibratory motors with each other to dispense material.

23. The method of claim **22** including:

placing material in a hopper having an outlet edge;

gyrating the dispensing member located below the outlet edge to cause the dispensing member to simultaneously and circumferentially vary the distance between the outlet edge and the dispensing member to thereby increase the flow along a portion of the dispensing member spaced the farthest from the outlet edge and decrease the material flow along another portion of the dispensing member spaced the closes to the outlet edge.

24. The method of claim **22** including the step of stopping the gyration of the dispensing member to shut off the flow over the dispensing member.

25. The method of claim **24** wherein the step of stopping the gyration dispensing while maintaining an open spacing between the outlet edge and the dispensing member.

26. The method of claim **22** wherein the opening spacing is maintained at a distance such that the angle of the material on the dispensing member does not exceed an angle of repose of material.

27. The method of claim **22** wherein the gyration of the dispensing member is increased to increase a dispensing rate and the gyration of the dispensing member is decreased to decrease the dispensing rate.

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