United States Patent

[11] **3,580,549**

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[21] Appl. No. **846,362**
[22] Filed **July 31, 1969**
[45] Patented **May 25, 1971**

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[54] **GRAIN STIRRING DEVICE**
16 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **259/102,** 259/111
[51] **Int. Cl.** **B01f 7/00**
[50] **Field of Search** 259/6, 102, 21, 41, 64, 65, 99, 104, 108, 111, 5, 16, 14, 22, 40, 43, 66

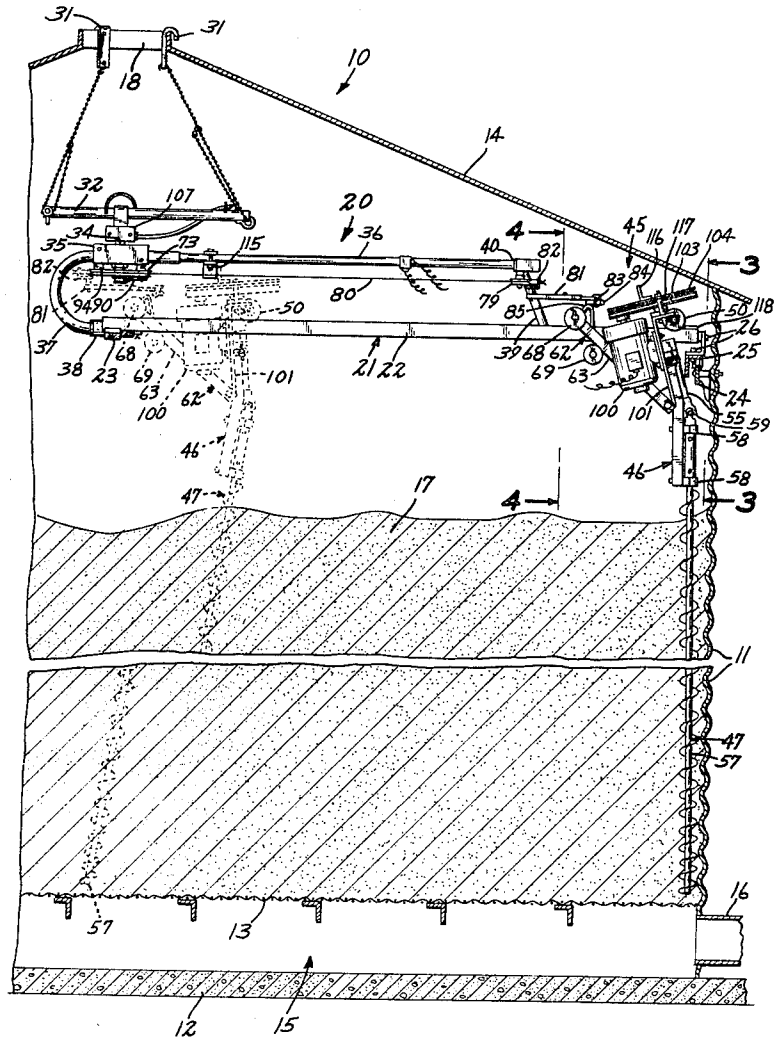
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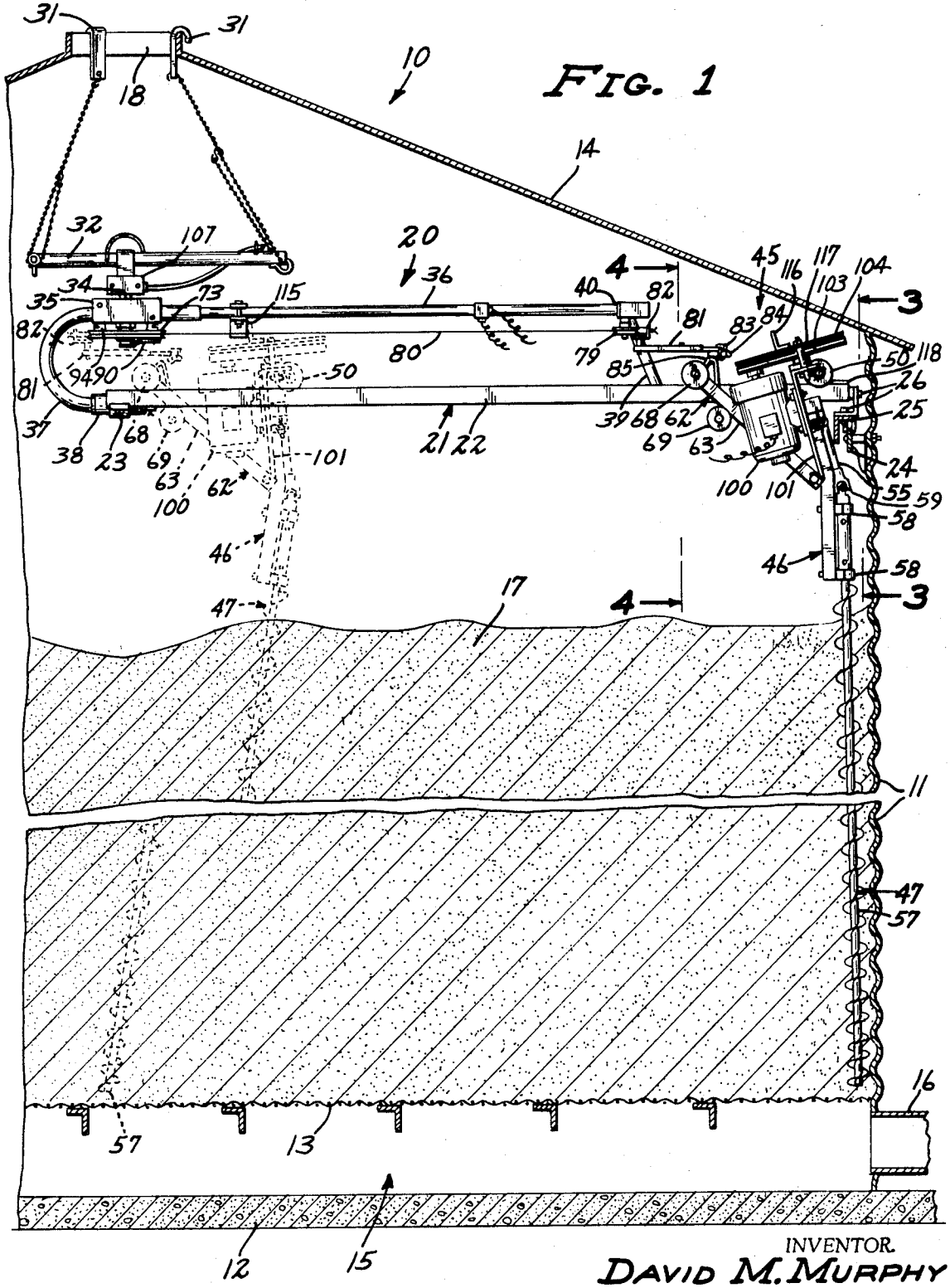
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ABSTRACT: A device for stirring material in a cylindrical container and which includes a support means mounted within the container for orbital movements about the vertical axis thereof, a trolley means mounted on the support means for movements radially toward and away from the all of the container, and a stirring auger having the upper end thereof rotatably mounted on an auger support means carried by the trolley means. The auger support means depends from the trolley means and extends laterally outwardly therefrom toward the wall of the container so as to position the auger in close proximity and substantially parallel to the wall of the container when the trolley means is fully moved radially toward the wall of the container. Drive means is connected to move the support means in its orbital path of travel, to move the trolley means radially toward and away from the wall responsive to movement of the support means, and to rotate the stirring auger.



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4 Sheets-Sheet 1



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FIG. 2

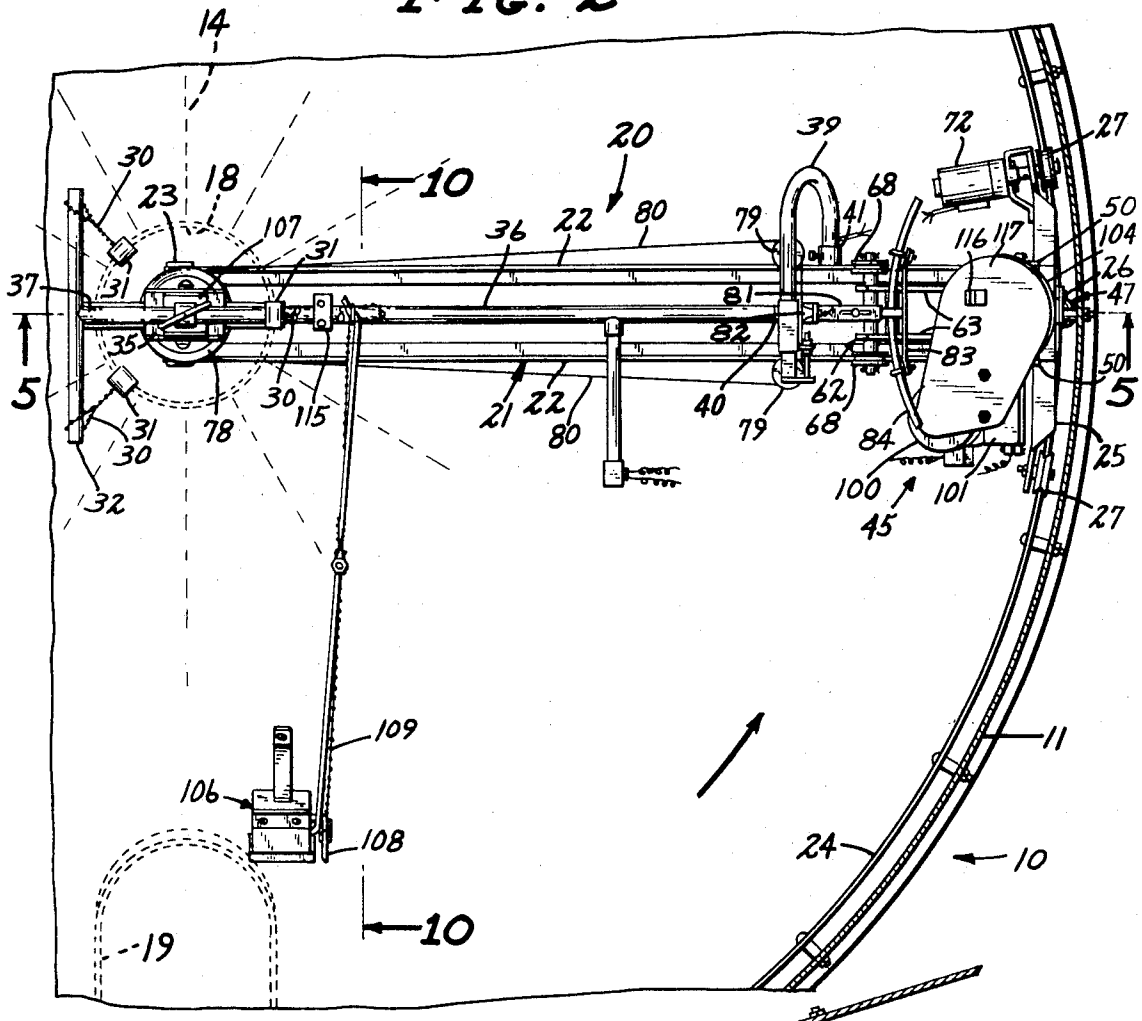
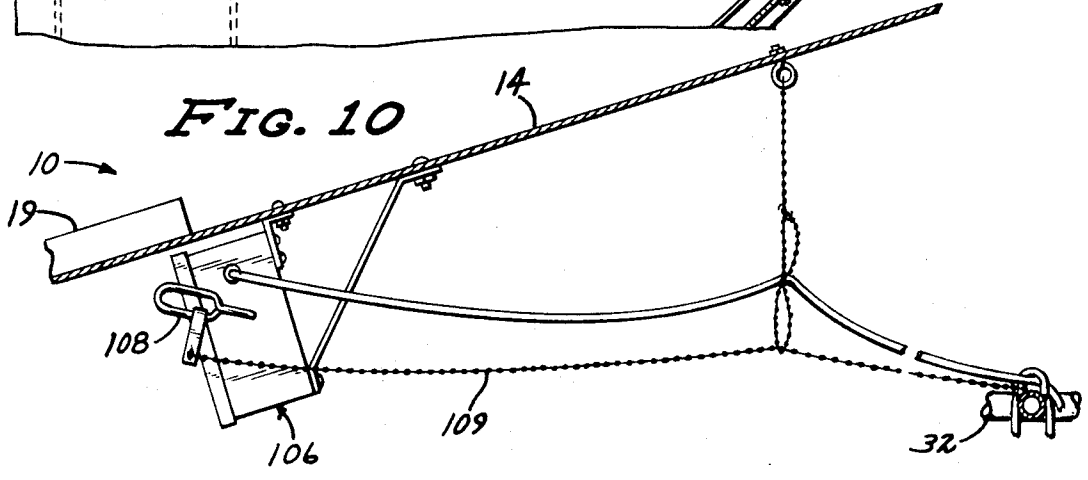


FIG. 10



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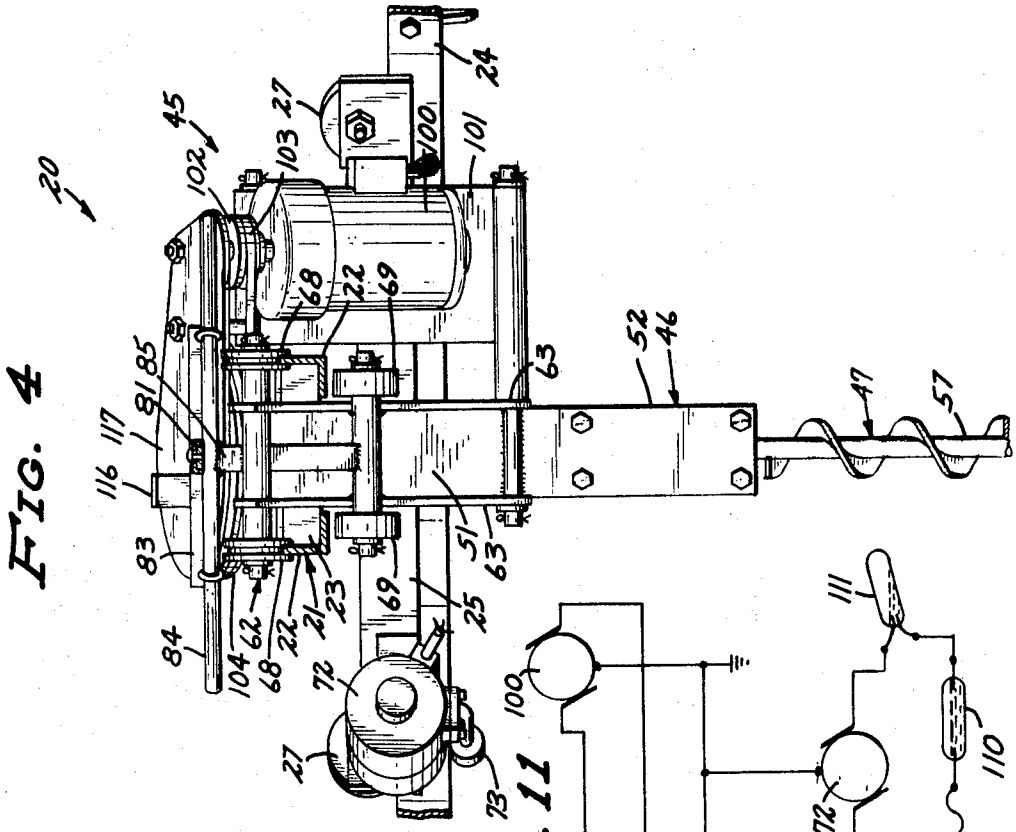


FIG. 4

FIG. 11

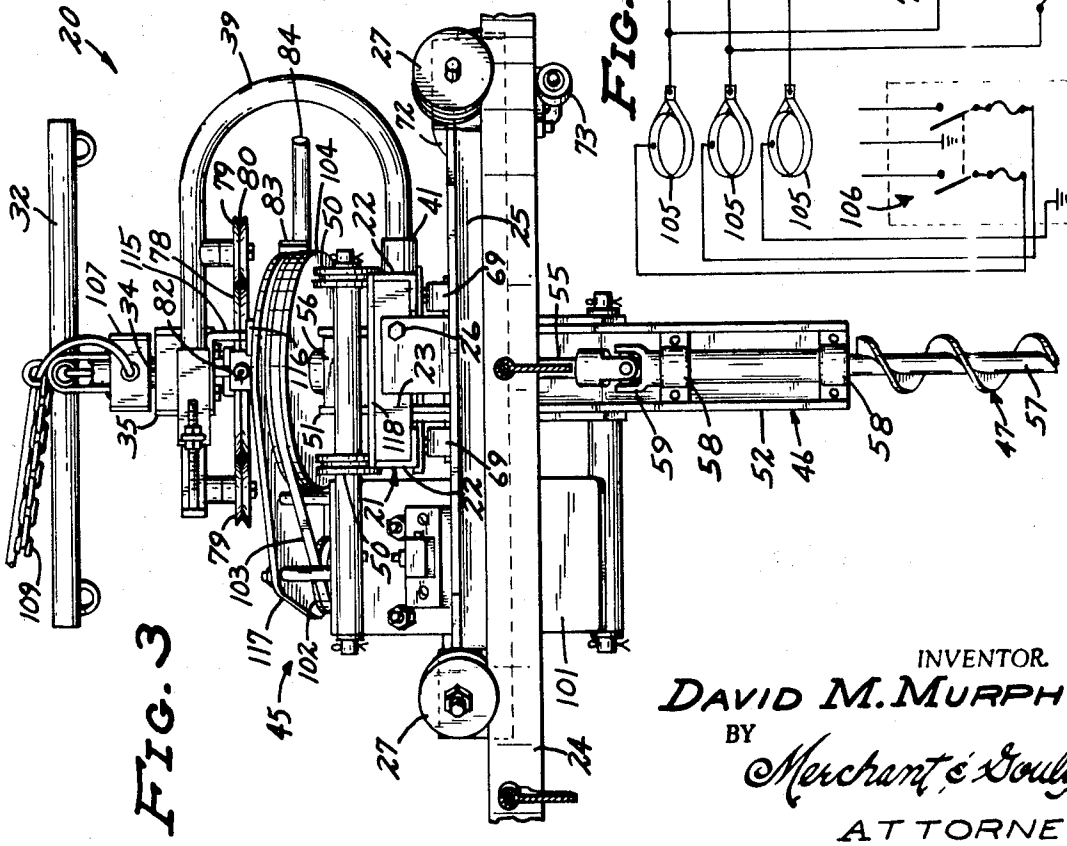


FIG. 3

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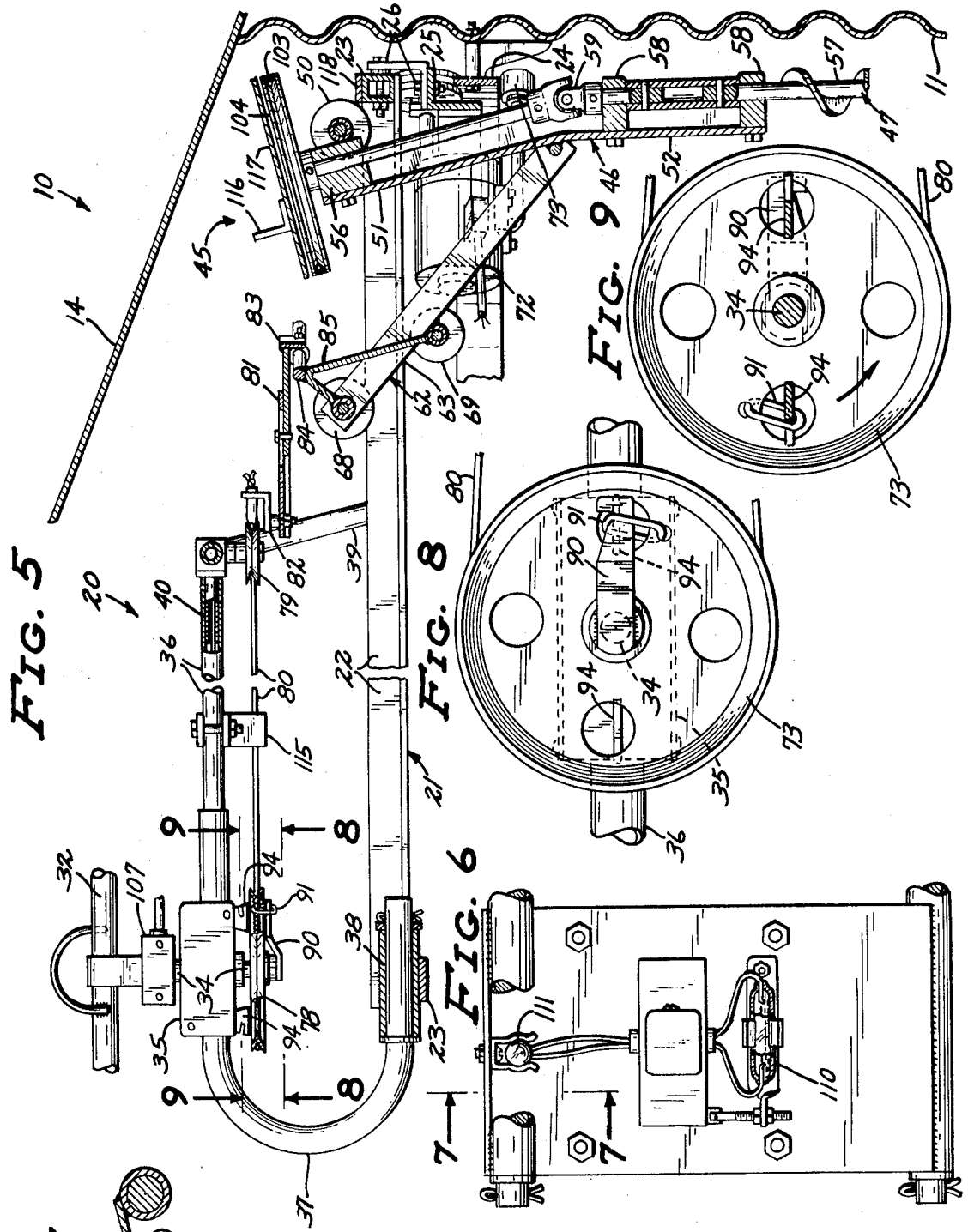


FIG. 5

FIG. 9

FIG. 8

FIG. 6

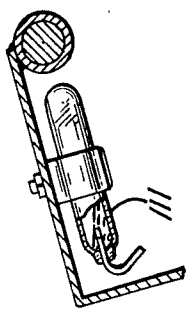


FIG. 7

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GRAIN STIRRING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

It is current practice to dry grain or other like materials by placing same in a cylindrical container and forcing heated air upwardly therethrough. Various methods of such drying have been developed to overcome problems present in such drying operations. Examples of such methods are batch drying and layer drying. Both such methods are economically unacceptable since they require considerable time and man hours of labor to complete. Additionally, problems such as uneven drying, incomplete drying, and crusting of the upper surface have further complicated such drying operations with the result that excessive insect infestation and/or spoilage and expense has occurred with the use of such methods. A more acceptable method has been deep-bed drying wherein the container is substantially filled with grain and a mixing device, such as that disclosed in my prior U.S. Pat. No. 3,251,582, issued May 17, 1966, is used to constantly stir or mix the grain throughout the drying cycle. Such devices are normally constructed to travel a predetermined path circumferentially and radially within the container during the drying cycle to overcome the above problems.

2. Description of the Prior Art

Prior art stirring devices present problems in that, due to construction, such devices have not been able to sufficiently mix or stir the grain or material in close proximity to the container wall. Such incomplete mixing or stirring results in a longer drying period and/or special manual adjustments to the stirring device to cause same to remain in the vicinity of the container wall, where moisture condensation on the interior of the metal container wall creates additional drying problems. This causes a problem in that the remainder of the dried grain or material in the container is exposed to the heated air for an excessive period of time with the result that the grain is overheated or overdried. If such adjustments are not made, the grain or material near the container wall is not dried sufficiently, and infestation and/or spoilage soon occurs.

SUMMARY OF THE INVENTION

To overcome the problems inherent in the above-described prior art grain stirring devices, the present invention is constructed to include a support means mounted in the container for orbital movements about the vertical axis of the container. A trolley means is mounted on the support means for movements radially of the container, and an auger support means, associated with the trolley means, mounts a stirring auger to depend downwardly therefrom. The auger support means depends from the trolley means laterally outwardly toward the wall of the container and positions the auger in a close proximity and generally parallel relationship to the container wall when the trolley means has reached its limit of movement radially outwardly toward the wall of the container. Drive means is connected to move the support means in its orbital path, to move the trolley means radially toward and away from the wall of the container responsive to the movement of the support means, and to rotate the stirring auger. The support means and trolley means are mounted to permit pivotal movement of the upper end of the stirring auger about generally horizontal axes, which extend in directions generally normal to each other, during orbital and radial movements of the support means and trolley means, and control means disables the drive means for the support means when the auger exceeds a given angle of inclination relative to a vertical axis during such movements.

It is an object of the present invention to provide a grain stirring device which evenly stirs and/or mixes the grain throughout the container in which it is stored to permit drying of such grain in a minimum of time and with a minimum of labor.

It is another object of the present invention to provide a device of the above character which is easily installed in cylindrical grain drying containers presently manufactured, durable in use, and dependable in operation.

It is a further object of the present invention to provide a device of the character above described which is relatively inexpensive to manufacture.

These and other important objects will become apparent to those skilled in the art upon consideration of the accompanying specification, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings, wherein like characters indicate like parts throughout the figures:

FIG. **1** is a view in vertical section of a grain drying container illustrating the present invention in side elevation and mounted therein, portions thereof being broken away;

FIG. **2** is a fragmentary view in horizontal section of the structure of FIG. **1**, portions of the grain drying container being shown by dotted lines;

FIG. **3** is an enlarged view in vertical section as seen generally from the line **3–3** of FIG. **1**, portions thereof broken away;

FIG. **4** is an enlarged view in vertical section as seen generally from the line **4–4** of FIG. **1**, portions thereof broken away;

FIG. **5** is an enlarged view in vertical section as seen generally along the line **5–5** of FIG. **2**, portions thereof broken away;

FIG. **6** is an enlarged view in elevation of a portion of the grain stirring device of FIG. **1** illustrating mechanism for controlling the degree of inclination of the auger relative to a vertical axis;

FIG. **7** is a view in vertical section as seen from the line **7–7** of FIG. **6**;

FIG. **8** is an enlarged fragmentary view in bottom plan of a portion of the mechanism utilized to impart radial movements to the stirring auger as seen generally from the line **8–8** of FIG. **5**;

FIG. **9** is a fragmentary view in horizontal section as seen generally from the line **9–9** of FIG. **5** showing a different position of the parts thereof;

FIG. **10** is an enlarged view in vertical section as seen generally from the line **10–10** of FIG. **2**; and

FIG. **11** is a schematic diagram of the electrical connections for the various drive motors of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drying of grain or other like harvested crops, it is the usual practice to provide a cylindrical drying container or bin, indicated generally by the numeral **10**. Drying bin **10** includes a sidewall **11** generally formed from corrugated sheet metal, a base **12**, a vertically spaced perforate floor **13**, and a generally conically shaped roof **14**. The lower portion of wall **11** together with the base **12** and perforate false floor **13** cooperate to define a plenum chamber **15**. Chamber **15** is adapted to be connected to a source of heated air under pressure, not shown, by means of a conduit **16** leading to the plenum chamber **15**. Grain **17** is introduced into the bin **10** through a central opening **18** formed in the roof **14**. In the drying operation heated air introduced into the chamber **15** passes upwardly through the grain **17** collecting moisture as it cools during its upward movement. Moisture laden air emanating from the grain **17** is allowed to egress from the container **10** through one or more openings **19** formed in the roof **14** radially of the opening **18**. It will be noted, that the openings **19** serve the dual function of inspection openings to ascertain the condition of the grain within the bin and/or to provide access to the interior of the bin for purposes of repair to equipment therein or for various operations on the grain **17**, such as leveling or the like.

Various methods have heretofore been employed in an attempt to provide complete and even drying throughout the grain 17 within the container 10. Such methods as layer drying, batch drying, and deep bed drying, have not been completely successful. Each thereof present various problems, such as uneven drying, incomplete drying, crusting of the upper surface area, among others. Such problems often result in infestation and/or spoilage, subsequent loss of time and undue expense.

It has been found that grain stirring devices, examples of which may be found in prior patents such as that to Kalke U.S. Pat. No. 3,156,541, issued Nov. 10, 1964, and my prior U.S. Pat. No. 3,251,582, issued May 17, 1966, have substantially overcome the above-mentioned disadvantages. Such devices normally follow an orbital path both circumferentially and radially with respect to the container 10 so as to provide for stirring and mixing of the grain 17 throughout the drying cycle to dry the grain 17 thoroughly in a minimum amount of time and with a minimum amount of effort on behalf of the operator. One serious problem of the prior art grain stirring devices is their inability to provide stirring of the grain in close proximity to the bin wall 11. Due to construction of the above devices, dictated by manufacturing expenses and the necessity to make same as durable as possible, it has been somewhat of a problem to construct same in a manner to cause stirring action in very close proximity to the container wall 11.

The present grain stirring device, indicated generally by the numeral 20, is constructed to overcome the above problem in addition to the previously mentioned problems. Device 20 includes support means in the nature of a bridge frame 21 having a pair of laterally spaced rails 22 connected at opposite ends thereof by crossmembers 23. A circular track 24 is mounted near the upper end of the wall 11 of the container 10 and provides a support for the outer end of the support means 21. The laterally spaced rails 22 of support means 21 extend radially of the bin 10 and support means 21 moves about a vertical axis in an orbital path above the material. A carriage 25 is pivotally secured to the radially outer end of the support means 21, as at 26 and supported on the circular track 25 for movements therealong by a pair of grooved wheels 27 rotatably carried by the carriage 25 at longitudinally spaced opposite ends thereof.

The inner end of the bridge frame support means 21 is suspended by flexible suspension means in the nature of a plurality of chains 30 engaged at one end in the opening 18 through the medium of hook elements 31. The opposite ends of the chains 30 are adjustable secured to end portions of a generally horizontally disposed T-bar 32. A depending shaft 34, carried by the T-bar 32, is rotatably journaled in a generally rectangular journal portion 35 on the inner end of a longitudinally extended frame element 36. A gooseneck portion 37 of frame 36 depends from the rectangular journal 35 and is rotatably mounted to the radially inner end of the bridge frame 21, as at 38. A yoke 39 is pivotally secured to the outer end of the frame element 36, as at 40, and fixedly secured to one of the rails 22 of the bridge frame 21, as at 41. The above-described structure generally coincides with that disclosed in my above-identified prior patent and further detailed description relative thereto will be eliminated in the interest of brevity.

Trolley means, indicated generally by the numeral 45, is mounted on the bridge frame 21 for movements longitudinally therealong in directions radially toward and away from the wall 11 of the container 10. The trolley means 45 includes a depending leg 46, positioned between the rails 22, which forms an auger support means for a stirring auger 47. A first pair of laterally spaced grooved wheels 50 are rotatably mounted on the upper end of the depending leg 46 in a manner to engage an upper edge of each of the rails 22 and support the trolley means 45 for movements along the bridge frame 21. Depending leg 46 includes an upper leg portion 51 and an angularly disposed lower leg portion 52. The upper leg portion 51 is disposed along an axis which extends laterally downwardly toward the wall 11 of the container 10 and the lower leg portion 52 is disposed along an axis which extends downwardly and generally parallel to the wall 11 of the container 10. The angular relationship of the upper and lower leg portions 51 and 52, respectively, positions the lower leg 52 in close proximity to the wall 11 when the trolley means 45 is in the radially outermost position of FIGS. 1, 5. Stirring auger 47 includes an upper auger portion 55 journaled for rotation along an axis generally parallel to the axis of the upper leg portion 51 by means of a bearing block 56, and a flight-equipped lower auger portion 57 journaled for rotation on an axis generally parallel to the longitudinal axis of the lower leg portion 52 by means of spaced bearing elements 58. A universal pivotal connection 59 connects adjacent ends of the upper and lower auger portions 55, 57 for common rotation thereof.

Stabilizer arm means 62 for stabilizing the trolley means 45 against rotational forces of the stirring auger 47 includes a trolley arm 63. Trolley arm 63 has one end thereof pivotally secured to the depending leg 46 for pivotal movements about an axis parallel to the axis of rotation of the wheels 50. The pivotal axis of trolley arm 63 is located in vertically downwardly spaced relation to the rotary axis of the first pair of wheels 50. A second pair of laterally spaced wheels 68 is mounted on the opposite end of the trolley arm 63 for rotation on an axis parallel to the axis of rotation of the wheels 50. One each of the wheels 68, like wheels 50, engage an upper edge of one of the rails 22 for movement therealong. As shown, all of the wheels 50, 68 are provided with grooves to prevent lateral displacement thereof from the rails 22 and are maintained in such an engagement with the rails 22 by means of roller elements 69. Roller elements 69 are rotatably carried by the trolley arm 63 in a manner to engage an under surface of the rails 22.

Drive means, connected to move the bridge frame 21 in its orbital path of travel, includes a gear head electrical motor 72. Geared motor 72 is mounted to one end of the carriage 25 with the rotary output shaft thereof having one of the grooved wheels 27 fixedly secured thereto for driving engagement along the circular track 24. A roller element 73 carried by the gearhead motor 72 underlies circular track 24 to maintain the driving wheel 27 in engagement with the upper edge of the circular track 24.

Drive means connected to move the trolley means 45 radially toward and away from the wall 11 includes a sheave 78 which is rotatably mounted by means of the depending shaft 34 for rotation on the vertical axis of rotation of the bridge frame 21. A pair of rotatable sheaves 79 are mounted on the yoke 39 for rotation on vertical axes. Sheaves 79 are spaced from each other transversely of the bridge frame 21 and from the sheave 78 longitudinally of the bridge frame 21. An endless flexible drive element 80 is entrained over the sheaves 79 and sheave 78. A connection between the drive element 80 and the trolley means 45 is made by means of a pitman arm 81. Pitman arm 81 is pivotally connected at one end thereof to a fixed point on the flexible drive element 80 by a pivotal connection 82. The other end of the pitman arm 81 includes a cross head 83 which is slidably mounted to an arcuate element 84 fixedly connected to the trolley arm 63, as at 85. Arcuate element 84 is mounted to extend transversely of the bridge frame 21.

In order to impart movement to the fixed point or pivotal connection 82 of flexible drive element 80 and consequently, movement of the pitman arm 81 and trolley means 45 longitudinally of the bridge frame 21, sheave 78 is immobilized relative to the rotation of the bridge frame 21 about the vertical axis of the bin 10. To immobilize the sheave 78 an arm 90 is fixedly mounted on the depending shaft 34 to extend radially of the sheave 78 in closely underlying relationship thereto. Detachable means, in the nature of a metal loop 91, is pivotally carried by the sheave 78 and is adapted to engage the outer end of the radial arm 90 to prevent rotation of the sheave 78. Immobilizing of the sheave 78 causes the drive element 80 to wrap about the pulley 78 and the fixed point or

pivotal connection 82 to travel in a path between the sheaves 79 and between the sheave 78 and sheaves 79. It will be appreciated that such movement of the fixed point or connection 82 between the sheaves 78, 79 causes the trolley means 45 to move longitudinally of the bridge frame 21 and that movement of the fixed point between the sheaves 79 positions the trolley means 45 at the radially outer end of the bridge frame 21 with little or no movement longitudinally of the bridge frame 21 during orbital movements of the bridge frame 21 in the container 10. In this manner when the trolley means 45 and auger 47 carried thereby reach the position shown in full lines in FIGS. 1, 2, they are maintained in such position for a predetermined period of orbital movement of the bridge frame 21. This arrangement assures that grain 17 adjacent the wall 11 is completely stirred by the auger 47 during each cycle of the trolley means 45 inwardly and outwardly longitudinally of the bridge frame 21, as will be more fully described hereinafter in the operation of the device 20.

If it is desired to position the trolley means 45 at any given point along the bridge frame 21, orbital movement of the bridge frame 21 is terminated by deenergizing the gearhead motor 72 when the trolley means 45 reaches such point. At this time an operator disengages the detachable latch means or loop 91 from the radial arm 90 and causes same to be engaged with latch means in the nature of hook elements 94. Hook elements 94 are affixed to the under surface of the rectangular pivot connection 35 of frame element 36, see FIGS. 5, 8, and 9. Connection of the loop 91 to the hook elements 94 causes the sheave element 78 to rotate commonly with the bridge frame 21 and frame element 36 and the fixed point or pivotal connection 82 is maintained in a fixed position relative to the sheaves 78, 79 since the drive element can no longer wrap about the sheave 78. An electrical motor 100 provides drive means for imparting rotation to the auger 47. Motor 100 is mounted on the trolley means 45 in cantilever fashion by means of a laterally projecting plate 101. As shown particularly in FIGS. 2—4, plate 101 is mounted on the trolley means 45 in a manner to project laterally rearwardly therefrom with respect to the direction of orbital movement of the trolley means 45 for reasons which will become apparent hereinafter. A sheave 102 mounted on the output shaft of the electrical motor 100 has an endless flexible belt 103 entrained thereon and on a second sheave 104 fixedly attached to the upper end of auger 47.

As the bridge frame 21 and trolley means 45 move in their respective directions of travel during operation thereof, natural forces of the auger traveling through the grain 17 cause the auger 47 to assume an angle of inclination, relative to a vertical axis, which extends downwardly and rearwardly with respect to the direction of movement of the bridge frame 21 and trolley means 45. Pivotal movement of the bridge frame 21, to permit such angle of inclination of the auger 47, is permitted through the medium of the pivot connections 26, 38 and 40. Inclination of the auger 47, relative to the radial movements of the trolley means 45, is permitted by pivotal movements of the trolley means 45 about the axis of rotation of the wheels 50.

As seen particularly in FIG. 11 of the drawings, electric motors 72, 100 are adapted to be connected to a source of electrical power, not shown, by means of a plurality of slip rings 105 and a switching mechanism 106. Sliprings 105 are normally mounted within the rectangular rotary connection 35. The conduits connecting the switch 106 extend from the sliprings 105 through a junction box 107, through a loop on one of the arms of the T-bar support 32; and thence to the switch 106. Switch 106 is normally mounted on the roof 14 of the container 10 adjacent one of the openings 19 and includes a housing having a lever arm 108 exterior of the housing. The housing of switch 106 and lever arm 108 are positioned relative to the T-bar support 32 to permit extension therebetween of a flexible connecting member 109. Any malfunction of the stirring device 20, which causes displacement of the T-bar 32 from its normal position, automatically trips the lever arm 108 and deenergizes the motors 72, 100, see FIGS. 2, 10.

Should the auger 47 exceed a given angle of inclination, due to various conditions set up by travel of the auger through the grain 17, means is provided for disabling the electrical gearhead motor 72 until the auger 47 returns to a lesser angle of inclination. Such means is in the nature of a pair of mercury switches 110, 111. It will be seen, by reference to FIGS. 6, 7, that switches 110, 111 are mounted on the motor mounting plate 101 in a manner such that switch 100 will sense an angle of inclination imparted by movement of the auger 47 circumferentially of the bin 10, and switch 111 an angle of inclination imparted by movements in directions longitudinally of the bridge frame 21 or radially of the bin 10. Mercury switch 110 is normally set to sense a degree of inclination of approximately 5° relative to movements circumferentially of the bin while mercury switch 111 is adapted to normally sense a degree of inclination of approximately 16° from vertical relative to movements radially of the bin 10. It will be here noted that inclination of the auger 47 relative to movement thereof circumferentially of the bin 10 is normally resisted by the cantilever mounting of the motor 100 together with the particular positioning of the pivots 26, 38 and 40.

In order to insure proper mixing of the grain 17 in the area of the vertical axis of the container 10, stop means in the nature of a depending ear 115 is fixedly attached to the frame element 36 in radially spaced relation to the pivot shaft 34. As the trolley means 45 moves from the full line position of FIG. 1 toward the dotted line position thereof, an upstanding ear 116 carried by a guard plate 117 on the trolley means 45 engages the depending ear 115 causing the trolley means 45 to pivot on the axis of the rotary connection of the wheels 50. Such pivotal movement of the trolley means 45 moves the auger 47 to the dotted line position of FIG. 1 wherein the lower end thereof is positioned to generally intersect the vertical axis of the container 10. In this position, the auger 47 draws the grain 17 at the center of the container 10 downwardly and away from the center, avoiding the usual center heaping commonly experienced with devices of this nature.

When the trolley means 45 is moved to its radially outermost position shown by full lines in FIGS. 1 and 5, it is desirable to position the lowermost end of the auger 47 in as close a position as possible to the wall 11 of container 10. To accomplish this, stop means in the nature of a plate 118 is affixed to the cross member 23 in a manner to be engaged by the wheels 50. Pitman arm 81 is shown as being an extensible retractable member, and longitudinal adjustment thereto causes the trolley arm 63 to exert a force at its point of connection to the depending leg 46 in a manner to cause the depending leg 46 and auger 47, carried thereby, to tilt outwardly toward the wall 11 about the axis of the wheels 50 when the same engage the stop 118.

OPERATION

A brief description of the operation of the stirring device 20 is as follows. Stirring device 20 is positioned within the container 10, as shown in FIGS. 1, 2 of the drawings, with the auger 47 depending into the grain 17. Switch 106 is then closed to energize motors 72, 100 to cause movement of the bridge frame 21 in an orbital path within the container 10 and rotation of the auger 47, respectively. Movement of the bridge frame 21 in its orbital path of travel, indicated in FIG. 2 by the arrow, causes the flexible drive element to wrap itself on the sheave 78 and impart movements to the trolley means 45 in a direction longitudinally of the bridge 21.

In a cycle of operation of the stirring device 20, wherein the fixed rotatable connection 82 moves from the position shown in FIG. 2 around the sheaves 78, 79, of the trolley means 45 is as follows. During movement of the fixed point or pivotal connection 82 between the pulleys 79, trolley means 45 maintains a relatively fixed position radially of the container 10 in close proximity to the wall 11. The spacing between the sheaves 79 is normally sufficient to position the trolley means 45 and auger 47 adjacent the wall 11 for approximately 180° of travel

within the container 10. As the connection 82 reaches the pulley 79 and moves toward the sheave 78, trolley means 45 likewise starts its movement radially inwardly away from the wall 11 along the bridge frame 21. Such radially inward movements of the trolley means 45, together with orbital movements of the bridge frame 21 causes the auger 47 to describe a generally involute spiral path radially inwardly through the grain 17. Trolley means 45 moves radially inwardly until the upstanding ear 116 engages the depending ear 115 whereupon it assumes the dotted line position of FIG. 1 with the lower end of the auger 47 intersecting the vertical axis of the container 10. Movement of the connection 82 around the sheave 78 positions the trolley means 45 at the radially inner end of the bridge frame 21 for a sufficient time to provide proper mixing of the grain 17 in the area of the vertical axis of the container 10 by the auger 47 thus avoiding center heaping of grain 17. Natural forces imparted to the trolley means 45 in the dotted line position of FIG. 1, by movement of auger 47 through grain 17, tends to cause further tilting of the depending leg 46 radially inwardly toward the axis of the container 10. When the inclination of the auger 47 exceeds a given angle relative to a vertical axis, such as the above-mentioned angle of 16°, mercury switch 111 operates to disable or deenergize the gearhead motor 72 and terminate orbital movements of the bridge frame 21 until the auger 47 and trolley means 45 returns to the dotted line position of FIG. 1. When such a position is attained, the motor 72 is again energized by closing of switch 111 and orbital movement of the bridge frame 21 is again initiated.

When the connection 82 has moved approximately 180° around the sheave 78, connection 82 together with the trolley means 45 and auger 47 move toward the uppermost sheave 79 of FIG. 2. As the trolley means 45 begins movement radially outwardly of the container 10 upstanding ear 116 disengages from stop 115, and auger 47 assumes a generally vertical position. Further movement of the connection 82 and trolley means 45 radially outwardly of the bridge frame 21, during orbital movements of the bridge frame 21 causes the auger 47 to describe generally involute spiral path radially outwardly in the grain 17 until the connection 82 reaches the uppermost sheave 79. At this time the trolley means 45 and auger 47 again assume the full line position of FIG. 1. During the above-described movement of the trolley means 45 and auger 47, forces exerted on the auger 47 by the grain 17 have a natural tendency to cause the auger 47 to trail rearwardly with respect to the direction of movement thereof. Certain conditions of the grain 17 may cause the auger 47 to assume an angle of inclination relative to a vertical axis greater than that desired, such as the above-mentioned angle of 5°. On such occurrence mercury switch 110 operates to disable or deenergize the motor 72 to terminate orbital movement of the bridge frame 21 and permit the auger 47 to catch up or assume its normal angle of inclination.

As described in my above-mentioned prior patent, continued movement of the stirring device 20 through further cycles causes the auger 47 to describe radially inwardly and outwardly involute spiral paths of travel somewhat offset from preceding inwardly and outwardly involute spiral paths of travel with the result that the entire contents of the container 10 are completely stirred or mixed. If for any reason it is desired to immobilize travel of the trolley means 45 radially of the container 10, while still permitting orbital movement of the bridge frame 21, the operator may position the trolley means 45 longitudinally of the bridge frame 21, disengage the loop 91 from arm 90, and reconnect the loop 91 to one of the elements 94. Such action connects the sheave 78 for common rotary movements with the bridge frame 21 and supporting frame element 36 on the shaft 34. Such rotary movements of the sheave 78 terminates wrapping action of the drive element 80 thereon and movements of the trolley means 45 longitudinally of the bridge frame 21.

The above-described combination of parts provides a stirring mechanism which achieves the desired objects set forth. That is, a device is provided in which the stirring auger thereof is so mounted as to be closely positioned parallel to the cylindrical sidewall of a container, filled with grain or the like, without interference from operating parts of the stirring device. Thus, complete stirring or mixing of the grain within the container at the sidewall of the container is assured.

I claim:

1. Apparatus for stirring material in a cylindrical container comprising:
   a. support means;
   b. means mounting said support means for movement about a vertical axis in an orbital path above the material to be stirred in the container;
   c. trolley means mounted on said support means for movements radially toward and away from the wall of the container;
   d. said trolley means including auger support means depending from and extending laterally outwardly from said trolley means toward the wall of the container whereby said auger support means will be positioned in close proximity to the wall of the container when said trolley means is fully moved radially toward the wall of the container;
   e. a stirring auger;
   f. means rotatably mounting the upper end of said stirring auger on said auger support means whereby said stirring auger extends downwardly from said auger support means substantially parallel to the wall of the container; and
   g. drive means connected to move said support means in said orbital path, to move said trolley means radially toward and away from the wall of the container, and to rotate said stirring auger.

2. The structure of claim 1 in which said upper end of said auger is mounted for pivotal movement on generally horizontal axes which extend in directions generally normal to each other.

3. The structure of claim 2 in further combination with means for disabling said drive means for said support means when said auger exceeds a given angle of inclination relative to a vertical axis upon pivotal movements of said auger on said horizontal axes during said orbital and radial movement of said support and trolley means.

4. The structure of claim 3 in which said means for disabling said drive means for said support means is switch means connected to be operable responsive to pivotal movement of said auger about said horizontal axes in a direction generally parallel to the orbital movement of said support means.

5. The structure of claim 3 in which said means for disabling said drive means for said support means is switch means connected to be operable responsive to pivotal movement of said auger about said horizontal axes in a direction generally parallel to the movement of said trolley means toward and away from the container wall.

6. The structure of claim 1 in which said trolley means includes:
   a. a depending leg;
   b. a first pair of laterally spaced wheels rotatably carried by the upper end of said depending leg and adapted to engage an upper surface of said support means to support said trolley means for said radial movements thereof toward and away from the wall of the container;
   c. stabilizer arm means having one end thereof pivotally secured to said trolley means in vertically downwardly spaced relation to the rotary axis of said laterally spaced wheels for pivotal movements about an axis parallel to the axis of rotation of said wheels;
   d. a second pair of laterally spaced wheels carried by the opposite end of said stabilizer arm means for rotation on an axis parallel to the axis of rotation of said first pair of laterally spaced wheels and engageable with said support means; and
   e. means mounted on said trolley means for maintaining engagement of said first and second pairs of wheels with said

support means during said orbital movements of said support means and said radial movements of said trolley means.

7. The structure of claim 6 in which said depending leg is said auger support means and includes an upper leg portion and an angularly disposed lower leg portion, said upper leg portion being disposed along an axis which extends downwardly toward the wall of the container and said lower leg portion being disposed along an axis which extends downwardly and generally parallel to the wall of the container.

8. The structure of claim 7 in which said auger includes an upper auger portion and a lower auger portion, a universal pivot joint connecting adjacent ends of said upper and lower auger portions, said upper auger portion being journaled on said upper leg portion for rotation on an axis generally parallel to said axis of said upper leg portion and said lower auger portion being journaled on said lower leg portion for rotation on an axis generally parallel to said axis of said lower leg portion.

9. The structure of claim 1 in which said support means includes:

a. a bridge frame having a pair of laterally spaced rails which extend radially of the container and in which the means mounting said support means includes a and in track mounted on the upper end of the wall of the container;

b. a carriage movable on said track and supporting the outer end of said bridge frame; and

c. means including flexible suspension means for supporting the inner end of said bridge frame.

10. The structure of claim 9 in which said trolley means includes:

a. a depending leg;

b. a first pair of laterally spaced wheels rotatably carried by the upper end of said depending leg and adapted to engage one each an upper surface of one of said rails to support said trolley means for said radial movements thereof toward and away from the wall of the container;

c. stabilizer arm means having one end thereof pivotally secured to said depending leg for pivotal movement about an axis parallel to the axis of rotation of said wheels and in vertically spaced relation to the rotary axis of said laterally spaced wheels;

d. a second pair of laterally spaced wheels carried by the opposite end of said stabilizer arm means for rotation on an axis parallel to the axis of rotation of said first pair of laterally spaced wheels and one each engageable with said upper surface of one of said rails; and

e. means mounted on said stabilizer arm means for maintaining said first and second pairs of wheels in engagement with said upper surface of said rails.

11. The structure of claim 9 in which said means connected to move said trolley means radially toward and away from the wall of the container includes:

a. a sheave mounted for rotation on said means for supporting the inner end of said bridge frame on the axis of orbital movement of said support means;

b. a pair of rotatable sheaves supported by said support means;

c. an endless flexible drive element entrained over said sheaves;

d. a Pitman arm connected between said stabilizer arm and a fixed point on said flexible drive element; and

e. means carried by said first-mentioned sheave and said means supporting the inner end of said bridge frame connected to immobilize rotation of said first-mentioned sheave relative to orbital movement of said support means whereby to cause radial movement of said trolley means during said orbital movement of said support means.

12. The structure of claim 11 in further combination with latch means carried by said support means and engageable with said detachable means associated with said first-mentioned sheave whereby to cause concerted movement of said first-mentioned sheave and said support means and immobilize movement of said trolley means radially on said support means.

13. The structure of claim 11 in further combination with an arcuate element fixedly carried by said stabilizer arm means to extend transversely of said bridge frame, said Pitman arm being slidingly connected to said arcuate element to permit lateral movement thereof along the arc of said arcuate element.

14. The structure of claim 11 in which said Pitman arm is adjustable longitudinally thereof to limit movement of said trolley means toward the wall of the container.

15. The structure of claim 14 in further combination with stop means carried by said bridge frame and engageable by said trolley means upon longitudinal adjustment of said Pitman arm whereby to cause pivotal movement of said trolley means on the axis of said first-mentioned pair of laterally spaced wheels and movement of the lower end of said stirring auger toward the vertical wall of the container.

16. The structure of claim 11 in further combination with adjustable stop means carried by said support means and engageable with said trolley means during movement thereof along said bridge frame towards the vertical axis of the container, said engagement of said stop means by said trolley means causing pivotal movement of said trolley means about the axis of said first-mentioned laterally spaced wheels and movement of the lower end of said stirring auger to a position to intersect the vertical axis of the container.