Nov. 2, 1965 C. L. WELLONS 3,215,290

SILO STRUCTURE HAVING BOTTOM FEED-OUT UNIT

Filed Sept. 26, 1963 3 Sheets-Sheet 1

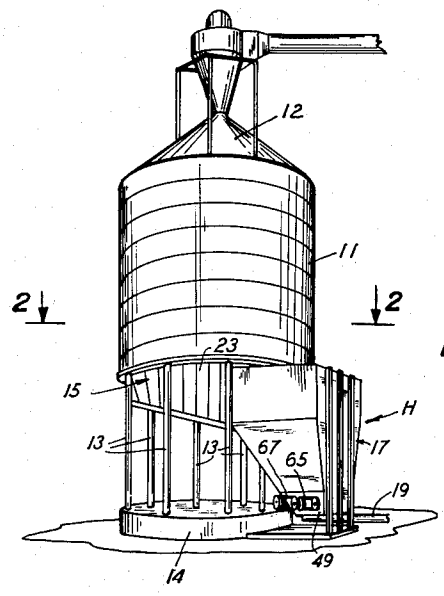


Fig. 1

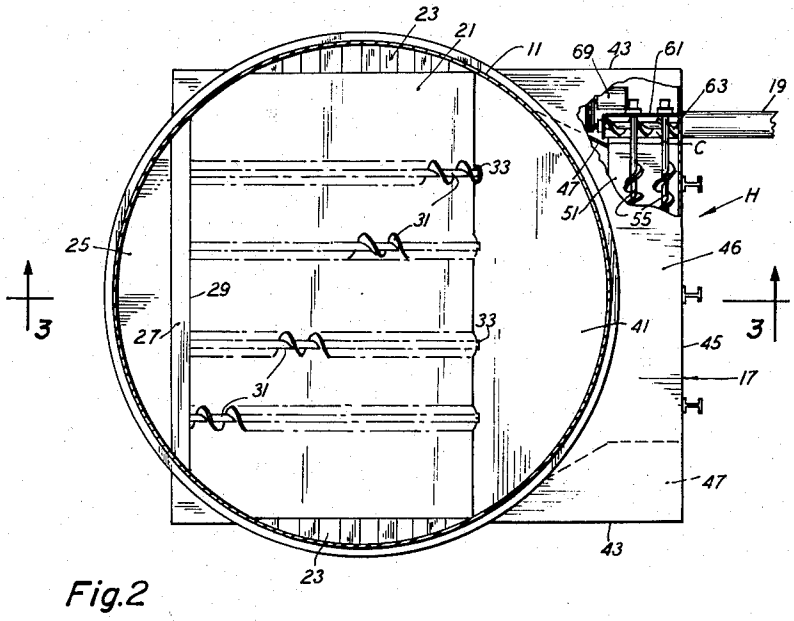


Fig.2

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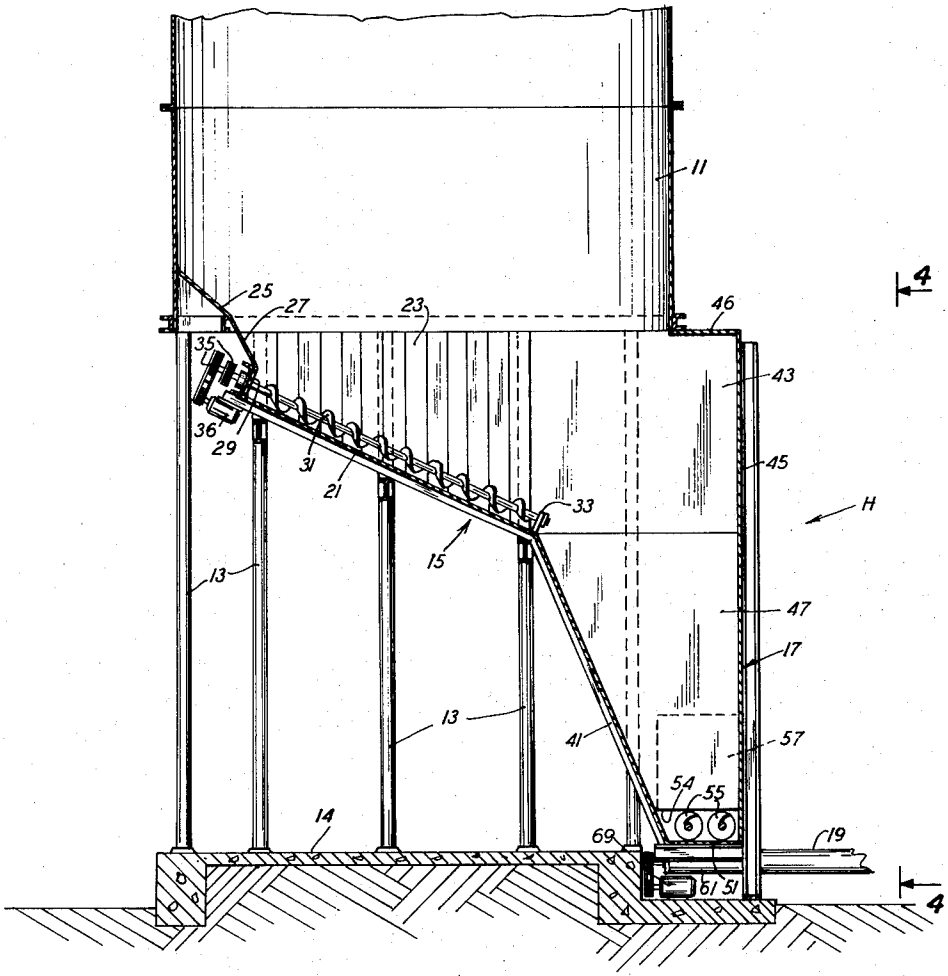


Fig. 3

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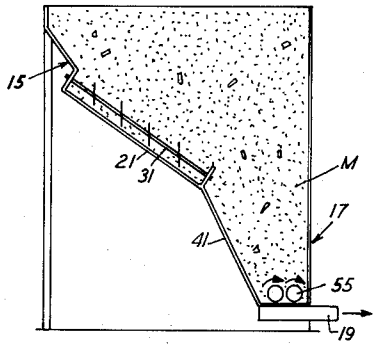


Fig. 5

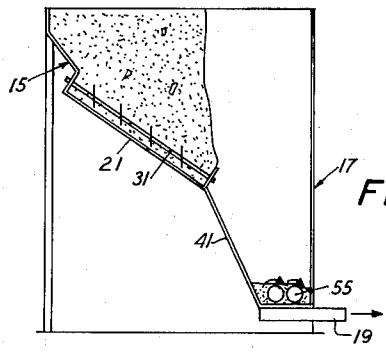


Fig. 6

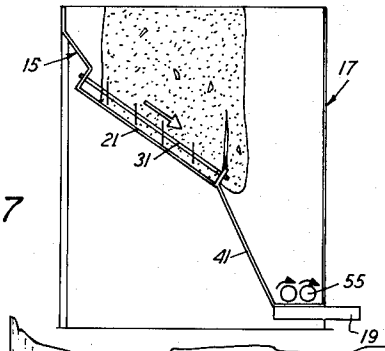


Fig. 7

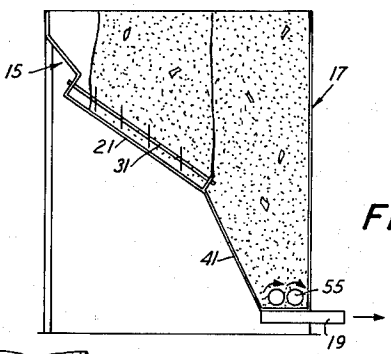


Fig. 8

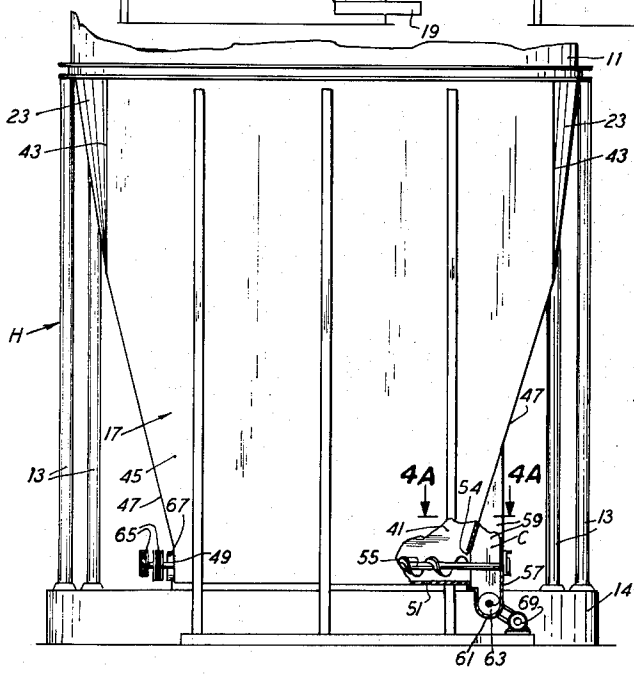


Fig. 4

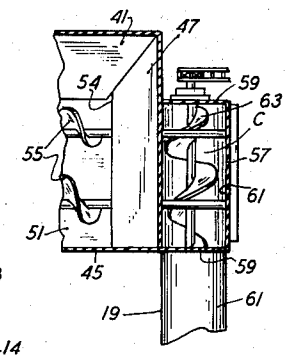


Fig. 4A

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SILO STRUCTURE HAVING BOTTOM FEED-OUT UNIT

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Filed Sept. 26, 1963, Ser. No. 311,823
8 Claims. (Cl. 214—17)

This invention relates to a silo structure and particularly to a bottom feeding unit for a silo structure.

It is now common practice to store, in silos, wood chips and sawdust which is to be used to fire boiler furnaces in lumber mills and similar places. However, such particled material tends to pack down within the silo, making it difficult to remove such material therefrom, and particularly difficult to remove it from the bottom thereof. In fact, considerable auxiliary help (manual and otherwise) is now required to cause the packed material to feed out properly at the lower end of the silo.

It is a main object of the present invention to provide a novel bottom feed-out unit for a silo structure, which unit will insure the proper feed-out of the material in the silo by eliminating hang-up of material in the silo.

Various other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of a silo structure which embodies my invention;

FIG. 2 is an enlarged horizontal sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a vertical section taken along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary elevational view taken in the direction of the arrows 4—4 of FIG. 3;

FIG. 4A is a fragmentary horizontal section taken along line 4A—4A of FIG. 4;

FIGS. 5 through 8 are diagrammatic views showing the operation of the bottom feeding unit of the silo structure.

Referring to FIG. 1, the silo structure shown includes a cylindrical bin **11** having a feed-in unit **12** at the top and being supported at its bottom by columns **13**. The columns are in turn supported by a base or footing structure **14**. Mounted on the bottom of the bin is a discharge hopper H of my invention. The hopper H includes a chute box **15** and a hopper box **17**, with the chute box directing and feeding material into the hopper box, from whence it is discharged by a conveyor **19**.

Referring now particularly to FIGS. 2 and 3, the chute box **15** has a flat bottom wall provided by a main plate **21**, which is inclined downwardly from left to right as the parts are shown in FIG. 3. The main plate **21** is of rectangular form (FIG. 2) and has a length and width less than the diameter of the bin **11**.

The main plate **21** is arranged so that the two right hand corners (FIG. 2) thereof are substantially in line with the curved wall of the bin, while the left hand corners project beyond such curved wall in a lateral direction as shown in FIG. 2.

In order to readily direct material from the lower portion of the cylindrical bin **11** onto the rectangular main plate **21**, a pair of side chute walls **23** (FIG. 2) and a rear chute wall **25** are provided. The walls **23** are below the bin (FIG. 1) whereas the wall **25** is within the bin **3** (FIG. 3). The wall **25** may be a flat plate cut to fit the contour of the bin, and directs material downwardly onto a feed-in plate **27** and a bearing plate **29** (FIG. 3), which are angularly related to one another.

The walls **23** are of compound curvature, because the upper edge of each is curved and the lower edge straight. An easy way to form such side walls is by the lapstrake method as generally indicated in FIGS. 1 and 2.

FIGS. 2 and 3 show that a plurality of pile-shifting augers **31** (four being shown) are mounted on the main plate **21** in parallel relation thereto, and are arranged and driven to cause the pile of material thereof to advance toward the bottom edge of the main plate **21**, as will be more fully explained hereinafter.

The lower ends of the spiral conveyors are rotatably mounted on supports **33** (FIG. 3) while the upper ends of such conveyors project through and are rotatably mounted on the bearing plate **29**.

The upper ends of the spiral conveyors are driven by a chain and sprocket drive system **25** (FIG. 3), which system includes a suitable prime mover such as an electrical motor **36**.

The hopper box **17** forms a continuation of the chute box **15** and comprises a main flat hopper plate **41** which is inclined more severely than main chute plate **21**, and extends upwardly to the lower edge of the chute plate. In one hopper I constructed, the slope of the chute plate **21** was approximately 25° while the slope of the main hopper box plate was approximately 66°.

Above the main hopper box plate **41** are a pair of upper side plates **43** (FIGS. 3 and 4), which are vertical and which are connected at one set of edges to walls **23**, and at their other set of edges to a vertical front plate **45** (FIG. 3). The front plate is roughly of trapezoidal shape (FIG. 1) and extends downwardly to the lower end of the hopper box **17**.

The hopper box also includes a flat top plate **46** (FIG. 2), a pair of inwardly and downwardly sloping intermediate side plates **47** (FIGS. 1 and 4), a single small lower vertical side plate **49** (FIG. 1) and a bottom plate **51** (FIGS. 2 and 4).

The lower side of the hopper box **17** opposite the lower side plate **49** is open (FIGS. 2 and 3) and material is fed along the bottom of the hopper towards this opening, identified by the reference numeral **54**, by a pair of parallel feed-out augers or screws **55** (FIGS. 2 and 4). One set of ends of the feed screws is journaled in lower side plate **49** while the other set of ends is journaled in a vertical compartment plate **57** (FIG. 4). Plate **57** together with a pair of spaced plates **59** (FIGS. 2 and 4) in part define a feed-out compartment C to receive material fed through the opening **54** by the feed screws.

Secured to the bottom of the feed-out compartment is a feed-out trough **61** (FIG. 4) which accommodates a discharge screw **63**. The trough and screw constitute the conveyor **19**, previously mentioned.

The feed-out augers **55** are driven through a chain and sprocket arrangement **65** (FIG. 1) by an electrical motor unit **67**. The discharge screw **63** (FIG. 2) is driven by an electrical motor unit **69**. Either unit may include a speed reduction device.

Operation

It may be assumed that the silo structure has been filled (FIG. 5) with particled material M to be stored, such as wood chips or sawdust (or other granular material), and that it is desired to discharge a quantity of such material. The motors for the feed-out augers **55** and the discharge auger **63** are energized to drive such augers. The feed-out augers **55** feed material, which is in direct contact therewith, into the compartment C from whence it is discharged by the discharge auger **63**. Since the material above the feed-out augers **55** is unsupported, it will shift or fall downwardly onto the feed-out augers, despite the fact that the material is in a somewhat packed-down condition (caused by its own weight). This material is discharged from the silo structure in the aforementioned fashion.

Also, the material above the hopper box plate **41** is substantially unsupported, because the sharply inclined

plate offers little resistance to downward movement of the material in contact therewith. In fact, the plate 41 (as well as plate 21) may be coated with an anti-friction coating. Thus, the material above such plate will shift or move downwardly as material is discharged from the silo structure, and will be shifted over by the hopper box plate 41 onto the feed-out augers 55.

However, the pile of material above the main chute box plate 21 is in a packed condition and at times will be sufficiently supported by the plate 21 so as to remain in position despite the discharge of all (or a large quantity) of the material above the feed-out augers 55 and the hopper box plate 41. This condition is shown in FIG. 6.

To continue the supply of material to the feed-out augers 55, the motor for the pile-shifting augers 31 is energized to drive the augers 31 in a direction to shift the pile of material above the plate 21 to the right, as the parts are shown in FIG. 7, so that a portion of such pile overhangs the lower edge of the plate 21. Since the overhung portion is unsupported, it soon breaks off from the remainder of the pile, and falls downwardly onto the feed-out augers 55 (FIG. 8). The augers 55 and 63 are now operated, and the separated material is discharged from the silo structure as desired.

After such separated material has been discharged, the above pile shifting operation is repeated to separate another portion from the pile, and the operation repeated as often as desired. Thus, all the material in the silo can be discharged without requiring other auxiliary help, such as would otherwise be the case.

It is contemplated that the discharge auger or screw 63 will be driven at a faster speed than that of the feed-out augers 55 so as to be capable of accepting the volume of material fed thereto by the feed-out augers.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. A silo structure comprising,
a cylindrical bin,
a feed-out unit at the lower end of the bin,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including conveyor means in the lower portion thereof for discharging material from said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for intermittently driving said auger means to cause a shifting of the pile of material on said chute box plate to a position where part of such pile is unsupported and breaks off,
and separate motor means for driving said conveyor means to discharge material from said hopper box.

2. A silo structure comprising,
a cylindrical bin,
column means supporting said bin,
a feed-out unit at the lower end of the bin supported by said column means and said bin,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including conveyor means in the lower portion thereof for discharging material from said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for intermittently driving said auger means to cause a shifting of the pile of material on said chute box plate to a position where part of such pile is unsupported and breaks off,
and separate motor means for driving said conveyor means to discharge material from said hopper box.

3. A silo structure comprising,
a cylindrical bin,
a feed-out unit at the lower end of the bin,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said plates forming a ledge over which a pile of material may be pushed to cause portions thereof to break off,
said hopper box including conveyor means in the lower portion thereof for discharging material from said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for driving said auger means and conveyor means independently of one another.

4. A silo structure comprising,
a cylindrical bin,
a feed-out unit at the lower end of the bin,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
said plate being rectangular,
compoundly curved side wall means connecting said rectangular plate to the lower end of said bin to direct material downwardly from said bin into said chute box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal

at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including conveyor means in the lower portion thereof for discharging material from said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for intermittently driving said auger means to cause a shifting of the pile of material on said chute box plate to a position where part of such pile is unsupported and breaks off,
and separate motor means for driving said conveyor means to discharge material from said hopper box.

5. A silo structure comprising,
a cylindrical bin,
a feed-out unit at the lower end of the bin,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including in the lower end thereof a discharge compartment and conveying means for conveying material into said compartment,
and other conveying means for discharging material from said compartment to the exterior of said hopper box.

6. A silo structure comprising,
a cylindrical bin,
a feed-out unit at the lower end of the bin,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including in the lower end thereof a discharge compartment and conveying means for conveying material into said compartment,
and other conveying means for discharging material from said compartment to the exterior of said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for intermittently driving said auger means to cause a shifting of the pile of material on said chute box plate to a position where part of such pile is unsupported and breaks off,
and separate motor means for driving said conveyor means to discharge material from said hopper box.

7. A silo structure comprising,
a cylindrical bin,
a feed-out unit at the lower end of the bin,

said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
said plate being rectangular,
compoundly curved side wall means connecting said rectangular plate to the lower end of said bin to direct material downwardly from said bin into said chute box,
an inclined flat plate projecting upwardly into said bin for directing material toward said bottom chute box plate,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including conveyor means in the lower portion thereof for discharging material from said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for intermittently driving said auger means to cause a shifting of the pile of material on said chute box plate to a position where part of such pile is unsupported and breaks off,
and separate motor means for driving said conveyor means to discharge material from said hopper box.

8. A feed-out unit for the bin of a silo,
said feed-out unit including a chute box beneath part of said bin directing stored material toward a hopper box beneath the remainder of the bin,
said chute box including a main bottom plate inclined to the horizontal in a direction to tend to feed material thereon toward said hopper box,
the inclination of said chute box plate being insufficient to prevent the build up and support of a pile of material thereon,
said hopper box including a main bottom plate angularly related to said chute box plate and forming a continuation thereof and being inclined to the horizontal at an angle sufficiently greater than that of said chute plate as to be incapable of supporting a pile of material thereabove,
said hopper box including conveyor means in the lower portion thereof for discharging material from said hopper box,
and auger means mounted adjacent the upper face of said chute plate and being parallel to said chute plate and inclined in the same direction,
and motor means for intermittently driving said auger means to cause a shifting of the pile of material on said chute box plate to a position where part of such pile is unsupported and breaks off,
and separate motor means for driving said conveyor means to discharge material from said hopper box.

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