May 28, 1940. W. A. PETERMAN 2,202,536

MALTING APPARATUS

Filed Dec. 10, 1938 2 Sheets-Sheet 1

FIG. 1.

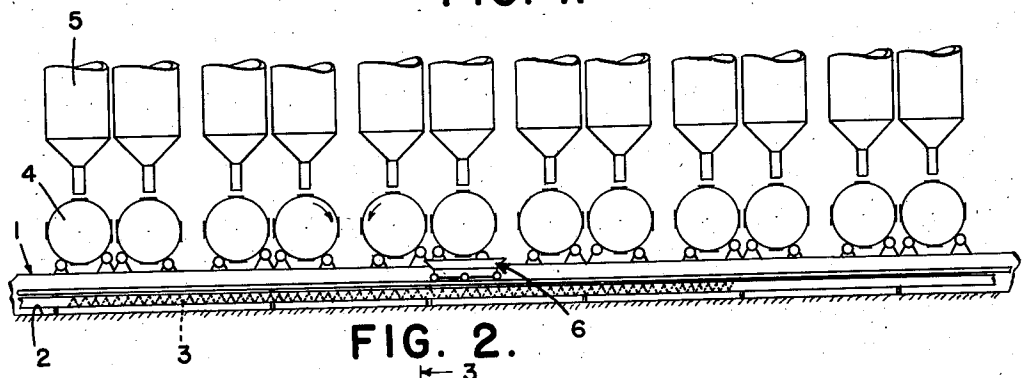
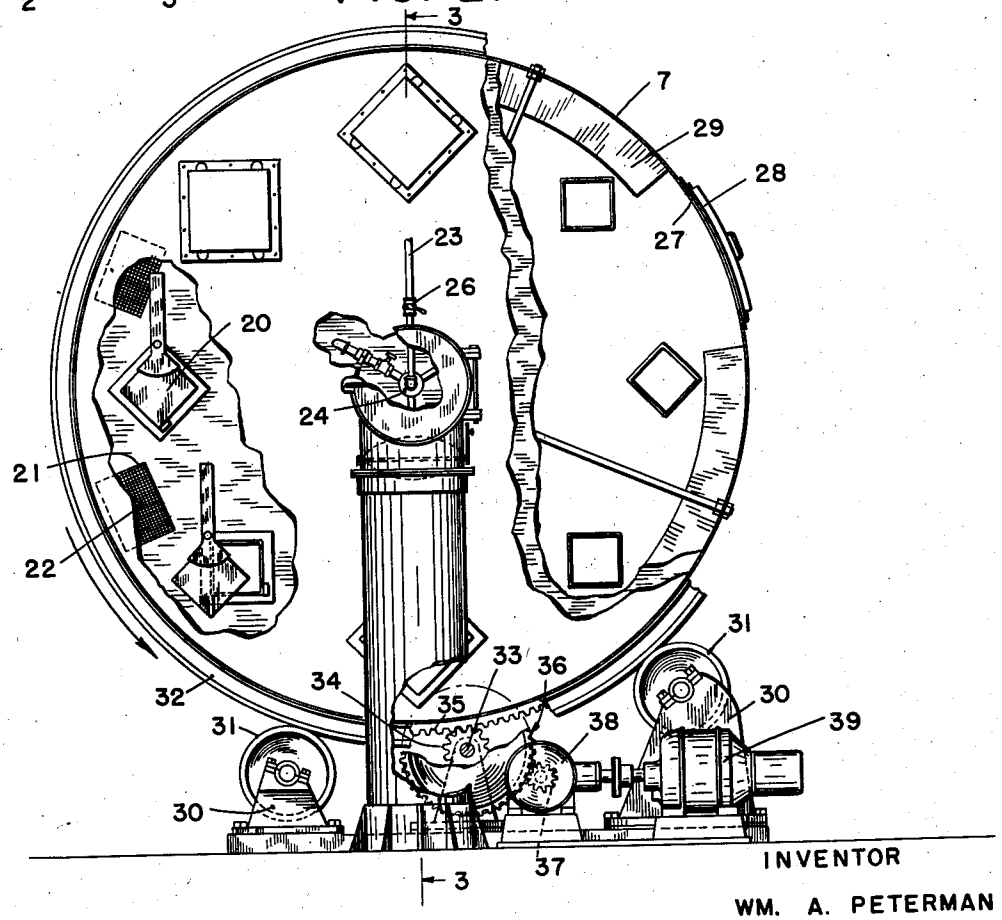


FIG. 2.



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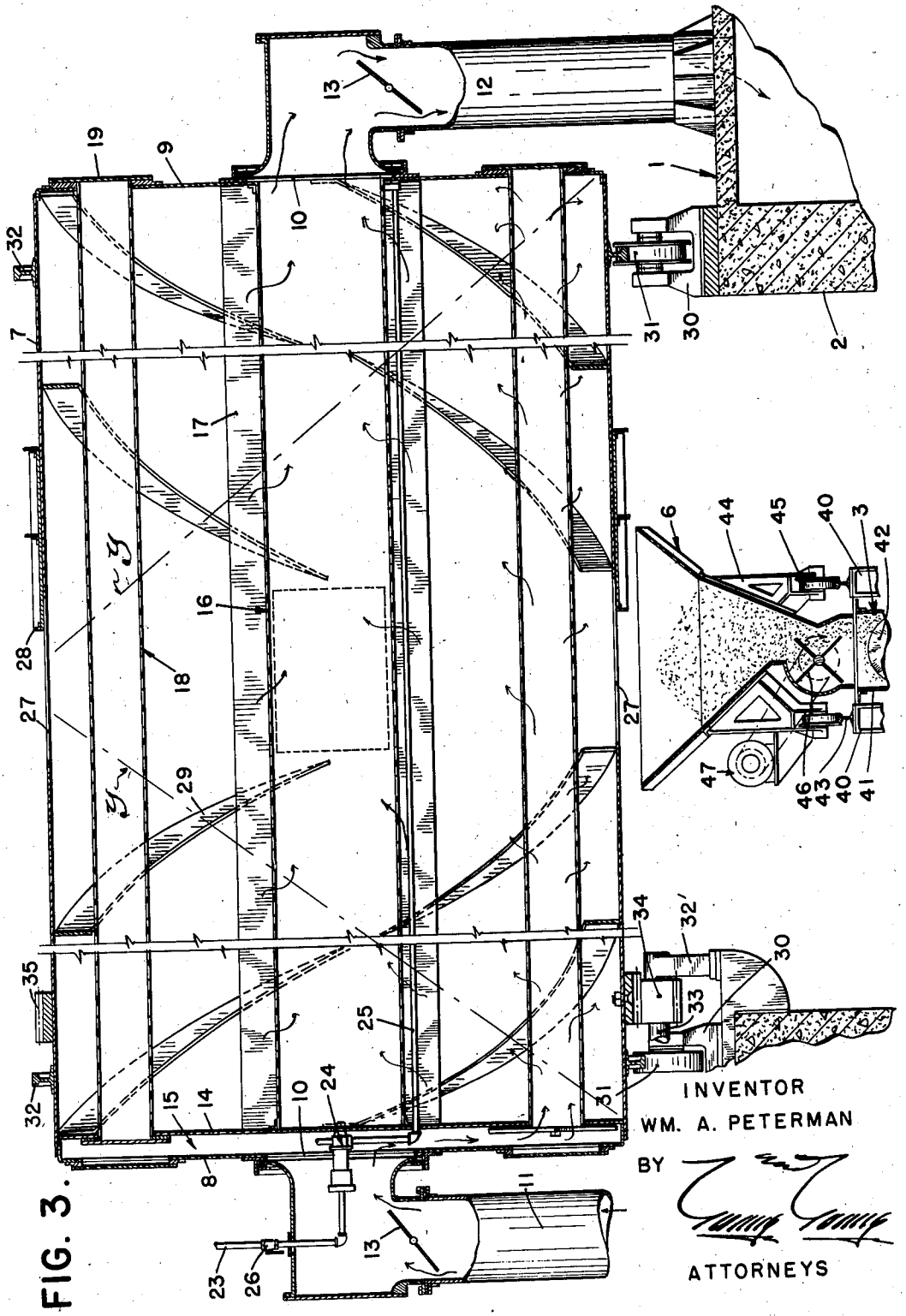


FIG. 3.

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Patented May 28, 1940

2,202,536

UNITED STATES PATENT OFFICE

2,202,536

MALTING APPARATUS

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Application December 10, 1938, Serial No. 244,874

2 Claims. (Cl. 195—131)

This invention pertains to malting apparatus, and more particularly to an installation including pneumatic malting drums.

In the conventional operation of malting drums, at the present time, considerable difficulty is encountered in removing malt from the drums upon completion of the germinating process. Such operation usually requires the entrance of workmen into the drum for the purpose of shoveling the malt from the ends of the drum to a discharge opening in the peripheral wall of the drum, it being borne in mind that conventional drums are of substantial length, while the discharge opening is necessarily relatively small, because of other factors, such as the apparatus for receiving and conveying malt from the drum.

The present invention has primarily for its object to overcome the foregoing difficulties by the provision of exceedingly simple and inexpensive means for automatically removing malt from the drum thus eliminating a tedious, costly, and highly dangerous manual operation.

Incidental to the foregoing, a more specific object of the invention is to provide a malting drum with a plurality of annularly spaced openings intermediate its ends, and means carried by the interior of the drum for directing its contents towards said openings upon rotation of the drum.

A further object of the invention resides in the provision of a comparatively simple and inexpensive mechanism for receiving and conveying the discharged contents of a gang of drums to subsequent drying apparatus.

A more specific object is to provide an installation including a plurality of axially parallel drums having a common conveyor extending longitudinally thereof, and provided with a portable hopper for selectively receiving the contents of the drums, and delivering the same to the conveyor.

A still further object resides in the provision of means for positively controlling feed of material from the hopper to a common conveyor to prevent overloading and choking.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel construction, combination, and arrangement of parts, substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings is illustrated one complete example of the physical embodiment of the present invention constructed according to the best mode so far devised for the practical application of the principles thereof.

In the drawings:

Figure 1 is a diagrammatic view of a typical installation incorporating the principles of the present invention.

Figure 2 is an end elevation of one of the malting drums, parts being broken away and in section to more clearly illustrate structural details.

Figure 3 is a longitudinal section through a drum, the same being taken on the line 3—3 of Figure 2.

Referring now more particularly to the accompanying drawings, the numeral 1 designates a suitable floor or foundation provided with a longitudinal pit 2, in which a conventional conveyor 3 of the screw type is centrally mounted. Transversely and rotatably supported above the pit 2 are a plurality of malting drums 4, in parallel axial arrangement. Positioned above each drum is a steeping tank 5, from which the steeped barley is spouted into the drums 4. Mounted upon the longitudinal conveyor 3 is a traveling hopper 6 for selectively receiving malt from the individual drums 4, and delivering the same to the longitudinal conveyor 3.

The foregoing generally describes the preferred type of installation. However, it will be apparent, as the description proceeds, that certain features of the invention are not dependent upon the arrangement shown.

Referring now to structural details, the drums 4 comprise a cylindrical shell 7 provided with front and rear heads 8 and 9, respectively, each being provided with a central opening 10 to allow the introduction and discharge of air from the drum. The front end of the drum is provided with an air inlet tube 11, the head of which is rotatably connected to the drum head 8 surrounding its central opening 10. Likewise, an exhaust flue 12 is provided for the rear end of the drum, being rotatably connected to the head 9 surrounding its discharge opening 10. Both the inlet tube 11 and exhaust flue 12 may be provided with dampers 13 for controlling circulation of air through the drum.

Mounted within the drum, adjacent its front head, is a partition 14, that cooperates with the head 8 to form an air inlet compartment 15, which serves to distribute air from the inlet tube to various parts of the drum, as will be hereinafter described.

Extending longitudinally and axially of the drum is a perforated cylindrical tube 16 communicating with the opening 10 in the rear head 9, for the purpose of exhausting air from the drum.

In operation, the drum is initially filled with grain to a level above the central tube 16, and, therefore, the tube is provided with a plurality of spaced, longitudinal fins 17, projecting radially from the periphery of the tube, for the purpose of agitating that portion of the contents of the drum immediately surrounding the tube. Here it might be explained that upon completion of the germinating process, due to growth and swelling of the grain, the drum is substantially filled to capacity.

Also, extending longitudinally through the drum, and carried by the partition 14 and the rear head 9, are a plurality of square, perforated tubes 18, open at their forward ends and closed at their rear ends by removable covers 19. The forward ends of the tubes 18 are provided with gravity actuated dampers 20, pivotally carried by the partition 14, and, as best shown in Figure 2, it will be apparent that the action of the dampers 20 is such as to open the front or inlet ends of the tubes 18 during their course of travel below the axis of the drum, and to close the same during their top travel.

This is essential during the initial period of germination, due to the fact that the drum is only partially filled with grain, and, therefore, as the tubes 18 rotate over their upper course of travel, they leave the mass of grain, and air entering the same would have a tendency to be rapidly drawn over the grain rather than through the body of the mass, thus retarding the germinating process and creating varying conditions in different parts of the drum.

In addition to the inner tubes 18, the partition 14 is also provided with annularly spaced openings 21 disposed between the tube openings, and adjacent the outer shell 7. The openings 21 are preferably covered with fine-meshed screens 22 to restrict the volume of air entering the same, and also prevent the escape of barley from the drum into the distributing compartment 15. It has been found that the openings 21 are essential for the introduction of additional air into the mass of grain adjacent the head, as well as above the grain level during the initial process of germination.

A water supply pipe 23 is introduced through the head of the inlet tube 11, and communicates with a rotatable valve 24, which is connected with a plurality of spray pipes 25 extending longitudinally through the drum adjacent the central tube 16 and between the longitudinal fins 17. The valve 24 is of such design as to provide communication between the supply line 23 and the perforated spray pipes 25 when the latter travel their course above the axis of the drum only. The water supply line is controlled by a manually operable valve 26, by which the desired amount of water required in the germinating process can be accurately and definitely controlled.

Intermediate the ends of the drum, and preferably centrally thereof, the shell 7 is provided with a plurality of annularly spaced and circumferentially alined openings 27, for which slidable covers 28 are provided. These openings serve in both charging and dumping of the drum. During the charging operation, only one opening positioned at the top of the drum is employed, but during the discharging or dumping operation, all of the openings are utilized, as will be hereinafter explained.

As heretofore explained, one of the salient features of the present invention resides in the provision of means for automatically discharging the contents of the drum, to eliminate the necessity of workmen entering the drum, for the purpose of shoveling grain from its ends to a discharge opening. In the present instance this is accomplished by means of a plurality of spiral fins 29 carried by the inner surface of the shell 7, and projected from the ends of the drum toward the openings 27 to convey the grain to the openings upon rotation of the drum. While continuous spiral fins have been shown and described, it will be understood that the same results may be accomplished by suitably spaced baffles or plates. Therefore, the invention contemplates any means carried by the interior of the drum for accomplishing the desired result.

Positioned upon the foundation 1, upon opposite sides of the pit 2, are pairs of spaced brackets 30, each of which carries a supporting roller 31 engaging annular tracks 32 secured to the outer periphery of the shell 7 to rotatably support the drum. Intermediate the forward pair of brackets 30, another bracket 32' is supported on the foundation 1, and has journaled therein a driven shaft 33, upon which a pinion 34 is fast, the pinion 34 engaging an annular gear 35 secured to the exterior of the shell 7. Also, secured on the shaft 33 is a gear 36 driven by a pinion 37 connected with a reducing transmission 38, which in turn is operated by a two-speed electric motor 39.

The conveyor 3, positioned in the pit 2, below the drums 4, is of more or less conventional structure, and consists of suitable supports 40 that carry a trough 41, in which a conveyor screw 42 operates. Mounted above the conveyor are longitudinal tracks 43, upon which the hopper 6 travels. The hopper 6 is mounted in a suitable frame 44, supported upon the tracks 43 by flanged wheels 45, which permit the hopper to be manually propelled along the conveyor, for selective alinement with the drum to be dumped.

It is highly essential to control delivery of material from the hopper to the conveyor screw, to prevent overloading and choking of the latter. Therefore, a rotatable paddle wheel 46 is mounted within the discharge throat of the hopper, and being driven at a predetermined speed by means of an electric motor 47, carried by the frame 44, the contents of the hopper are uniformly discharged into the conveyor in accordance with its capacity.

From the foregoing explanation, considered in connection with the accompanying drawings, it is thought that the operation of the present invention will be readily understood. However, in order that a full appreciation may be had of the resulting advantages, various steps in the process will be briefly described.

As heretofore explained, when it is desired to charge a drum, one of the covers 28 is removed to expose an opening 27, through which grain is spouted from the steeping tank 5, positioned above the drum, the drum being filled to a level slightly above the central tube 16, and leaving sufficient space to compensate for subsequent growth and swelling of the material as a result of the germinating process. The cover is then locked in closed position, and the drum is slowly rotated at a speed of approximately one revolution in 40 minutes throughout the germin-

ating period, which usually consumes approximately six days' time. During the germinating process enforced circulation is created through the drum, conditioned air entering the front end of the drum and the distributing compartment 15 through the inlet tube 11.

From the distributing compartment 15 the air travels through the perforated tubes 18, which are submerged in the mass of grain, the gravity dampers serving to cut off the tubes during their travel above the grain level. Consequently, air forced through the tubes 18 permeates and passes through the mass of grain, and then enters the central perforated discharge tube, which communicates with the exhaust flue 12. At the same time, an auxiliary amount of air will be drawn through the screen-covered openings 21, some of which will pass over the contents of the drum to prevent the occurrence of a stagnate pocket above the grain. Moisture required during the germination period is introduced into the top portion of the grain through the perforated spray lines 25, as heretofore explained.

Due to the fact that the speed of rotation of the drums 4, during the germinating period, is relatively slow, the spiral fins 29 are ineffective, causing little or no movement of the grain within the drum. However, the fins 17, carried by the central perforated tube 16, serve to continuously agitate the grain surrounding the tube, thus preventing the tube from merely boring within the mass, and facilitating entrance of air into the tube.

When it is desired to dump a drum, the hopper 6 is positioned directly thereunder, as shown in Figures 1 and 2, and all of the openings 27 are exposed by removal of their respective covers 28. Through the two-speed motor, the drum is then rotated at a relatively high rate of speed, approximately one revolution in ten minutes. At this speed, the spiral fins 29 become effective, particularly after that portion of the material, which would naturally flow by gravity through the openings 27, has been discharged, leaving quantities of grain in the opposite ends of the drums. As explained, the spiral fins 29 gradually pick up the grain and feed the same to the discharge openings through which it is delivered to the hopper 6, the latter, by means of the rotatable paddle wheel, controlling the rate of feed of material to the conveyor 42 that carries the grain to kiln floors for subsequent drying.

As an example, the typical installation illustrated in Figure 1 is designed for a drum malting plant having an annual capacity of one million bushels, and includes twenty-four six hundred bushel malting drums operating upon a six-day germinating basis.

During the six-day germinating period, the drums are revolved at their minimum speed, causing a uniform and continuous movement of the malt without injury to the kernels, while moist, cool air currents are constantly drawn through it. At times it may be desired to terminate the germinating process before the end of the six-day period, and this is accomplished by closing the damper, in the inlet tube of the drum, thus shutting off the moist air supply. A door in the front drum head is then opened and dry, atmospheric air is drawn through the malt to institute a withering process. In an installation of the capacity shown, it is customary to regulate the process so that the drums are serviced in gangs of four every twenty-four hours, inasmuch as the subsequent drying period on a kiln floor is approximately twenty-four hours. This allows a continuous production.

Due to the volume of material handled in a plant of the foregoing size, the advantages of the present invention, in facilitating handling of the grain and reducing manual labor required, will be readily appreciated, and it will be apparent that the present invention overcomes numerous difficulties and objections to conventional apparatus, in that it materially simplifies and reduces the cost of manufacture, installation, maintenance, and operation.

For instance, heretofore it has been common practice to provide independent receiving conveyors positioned longitudinally below each drum for receiving the contents of the drum and delivering the same to a common conveyor, all of which requires elaborate, expensive equipment, and while some attempts have been made to utilize a common conveyor for a plurality of drums, they have proved to be impractical, in that no provision was made for controlling the delivery of grain from the drums to the conveyor in relation to its capacity.

The present invention solves the foregoing problems by an exceedingly inexpensive design of portable hopper for selectively serving individual drums, and controlling delivery to a common conveyor.

Another important advantage of the present invention results in the provision of means for automatic dumping of the drums during rotation, which materially reduces the usual time required, and eliminates manual labor, with its accompanying expense and hazards.

Irrespective of means within the malting drum for feeding grain toward the discharge openings, the provision of a plurality of annularly alined openings positioned intermediate the ends of the drum results in distinct advantages, both in changing and dumping the drum.

For instance, even though the fins 29 are eliminated, rotation of the drum at relatively high speed results in constant leveling of the grain contained therein, with resultant discharge through the annular openings, and, in actual practice, although a somewhat longer period of time is required for dumping in the absence of the spirally arranged deflectors, the operation is still effective, leaving only a very limited amount of grain in the ends of the drum, which can be quickly removed or swept out by an operator.

In loading, the grain is spouted into the drum, as heretofore explained, and naturally assumes a conical form, as indicated by the dot-and-dash lines Y on Figure 3 of the drawings. To facilitate loading, the top cover is then closed and the drum is rotated to aline another opening with the spout, during which rotation the grain is automatically leveled, making room for an additional charge. This may be repeated as many times as is required to fill the drum to the desired level, thus eliminating manual spreading in order to accommodate the required spouted charge.

Lastly, the variable speed drive of the drum results in better control of the germinating process, particularly under conditions of high temperatures, such as those encountered in the summer months, and in warm climates, due to the fact that under conditions of high temperature, the growth of the grain is inclined to be rapid, which creates a tendency to mat. Under such conditions, even during the germinating period, the drum may be intermittently rotated at high

speed, causing the grain to fluff and avoid undesired matting.

Also, it has been found that moistening or watering of the grain is best accomplished at relatively high speed, in that the grain is fluffed, allowing the water to more readily and uniformly permeate the grain than under packed or matted conditions occurring at relatively slow speed.

I claim:

1. In a malting apparatus, a gang of alined pneumatic malting drums rotatably mounted in parallel axial relation upon a foundation provided with an elongated pit extending transversely below said drums, each of said drums being provided with a plurality of spaced alined circumferential openings intermediate its ends, a longitudinal conveyor positioned in said pit in alignment with the openings in said drums, and a portable hopper mounted above said conveyor and movable longitudinally of the same for selective vertical alinement with the openings in each drum for receiving grain therefrom and uniformly delivering the same to said conveyor.

2. In a malting apparatus, a gang of alined pneumatic malting drums rotatably mounted in parallel axial relation upon a foundation provided with an elongated pit extending transversely below said drums, each of said drums being provided with a plurality of spaced alined circumferential openings intermediate its ends, a longitudinal conveyor positioned in said pit in alignment with the openings in said drums, a portable hopper mounted above said conveyor and movable longitudinally of the same for selective vertical alinement with the openings in each drum for receiving grain therefrom, and driven means carried by said hopper for limiting the maximum quantity of grain delivered to said conveyor from the hopper.

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