

April 1, 1952

R. F. MARKEN
GRAIN CONDITIONER

2,591,173

Filed Jan. 31, 1949

2 SHEETS—SHEET 1

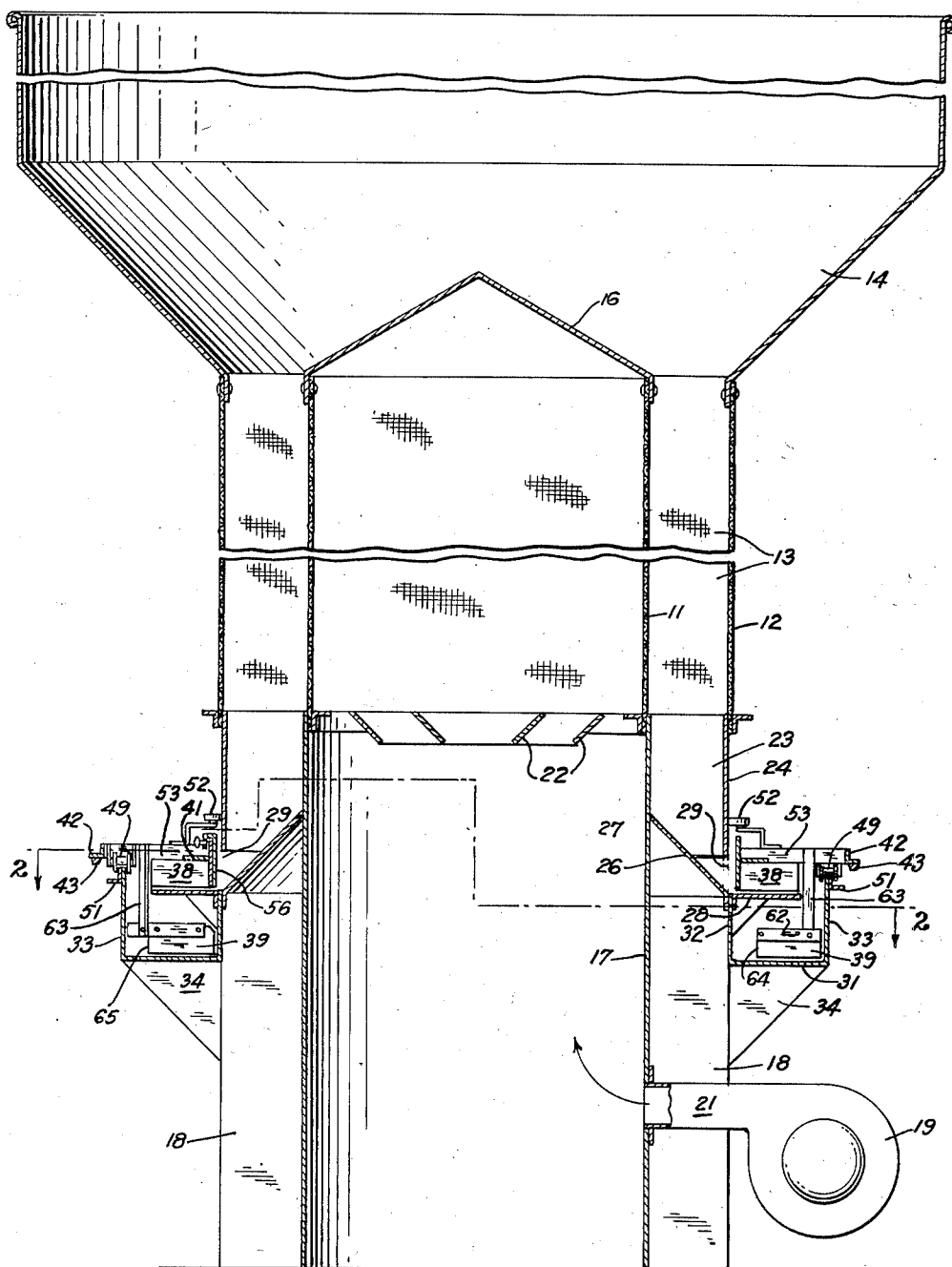


Fig. 1.

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2 SHEETS—SHEET 2

Fig. 2.

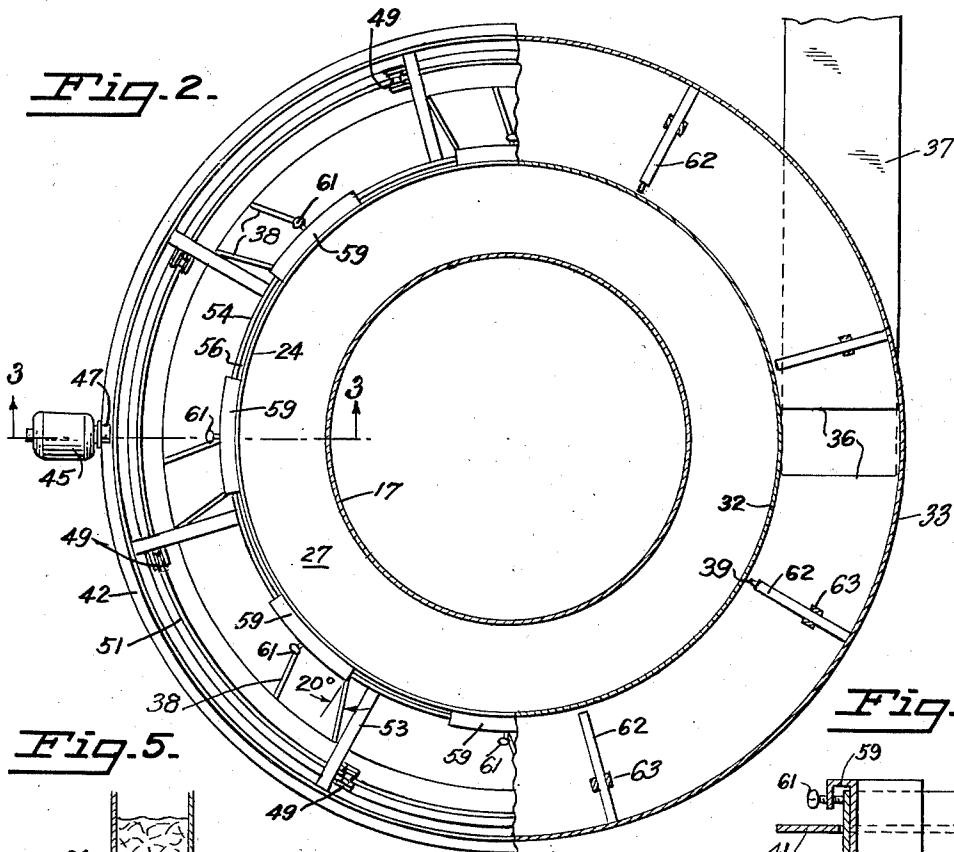


Fig. 5.

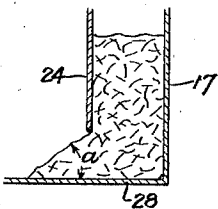


Fig. 4.

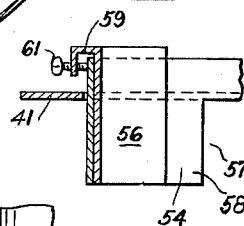
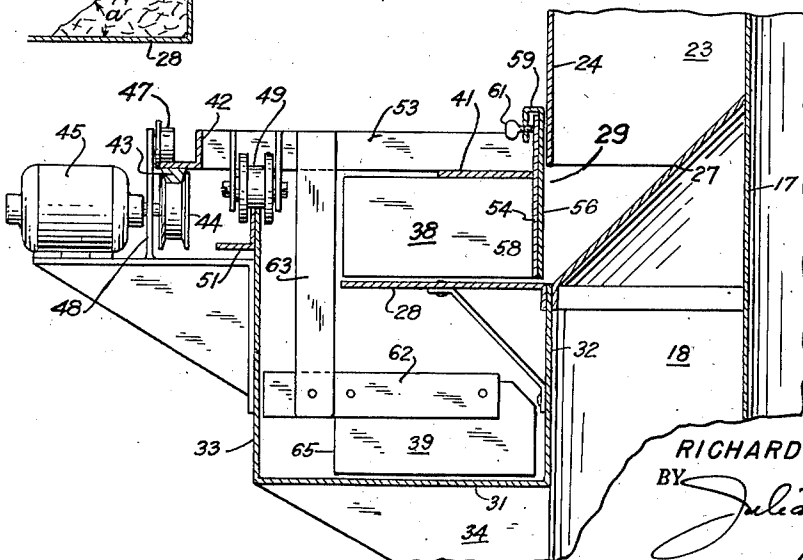


Fig. 3.



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GRAIN CONDITIONER

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10 Claims. (Cl. 34-174)

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This invention relates to new and useful improvements in grain conditioner whereby grain or similar granular material may be dried, cooled or otherwise treated.

One of the principal objects of the present invention is to feed grain or similar material from the bottom of a conditioning tower in such manner that the rate of discharge may be adjusted to suit the characteristics of the particular material being conditioned and the length of time required suitably to condition the material and the invention has a further advantage in that the variable rate of discharge may be accomplished with the use of a constant speed source of power.

Another object of the invention is the provision of a conditioning tower consisting of a pair of screens with means for feeding the grain into the space between the screens and means for blowing air through the screens and grain to condition the grain, and means for feeding the grain out of the bottom of the tower.

A further object of the invention is to adjust the rate of flow of grain through the conditioning tower with a minimum of attention from the operator.

Further objects and advantages of the invention are the ease with which the rate of flow of grain through the machine may be adjusted while the machine is in operation, the low cost of construction and operation and the simplicity of construction and facility of repair.

With the above and other objects and advantages in view, the invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which:

Fig. 1 is a vertical section through the machine;

Fig. 2 is a section taken substantially along the line 2-2 of Fig. 1;

Fig. 3 is a section taken substantially along the line 3-3 of Fig. 2;

Fig. 4 is an enlarged section of a portion of the machine showing a part of the adjustable discharge device including a rotatable apertured skirt and closure therefor; and

Fig. 5 is a schematic view illustrating the angle of repose of grain flowing through a gap onto a horizontal surface.

It will be understood that the present invention is particularly adapted to use in conditioning grains such as rice, corn, barley, milo, wheat, oats, other cereals, peanuts, and similar granular materials. Such materials are subject to deteriora-

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tion during storage if they are not dried and cooled and the present invention is designed to dry, cool or otherwise treat these substances.

The conditioning tower which is used in accordance with the present invention is subject to considerable modification, but in the form shown in the accompanying drawings consists of a pair of concentric screens 11 and 12 of circular cross-section. Such screens may be made up from sections of wire mesh suitably joined together and supported. The annular space 13 between the screens provides a passageway through which the grain may move downwardly from a hopper 14 at the top of the tower and be subjected to a conditioning treatment. A deflector 16 is arranged to close off the top of the inner screen 11 and to direct the grain into the annular space 13. The inner screen 11 is supported by a cylindrical base 17, the diameter of which is equal to that of inner screen 11, which is strengthened by radially extending webs 18 so as to provide a firm foundation for the tower. One or more fans 19 of large capacity are positioned in proximity to the base and the discharge of the fans is led by ducts 21 into the base to force the air upward inside the inner screen 11, through the grain in the annular space 13, and thence out through the outer screen 12. The grain may be dried, cooled or otherwise treated by preheating, cooling, drying or humidifying the air. Deflector vanes 22 are positioned near the bottom of the inner screen 11 to direct the air uniformly around the periphery of the screen and insure that all of the grain is subjected to uniform treatment, for uniformity of treatment is one of the important features of the invention. The deflector 16 functions to insure that air passes outwardly through the screens instead of passing out through the top of the tower.

The grain flows downwardly from the hopper 14 and into the annular space 23 between the cylindrical base 17 and outer cylindrical shell 24, the diameter of the latter being about equal to that of outer screen 12. A deflector 26 which is in the form of a truncated cone 27 with a wide, horizontal flange 28 closes off the lower end of the annular space 23 and directs the grain downwardly and outwardly in the gap 29 between the bottom edge of the shell 24 and the deflector 26.

It is a characteristic of grain and similar material that if it is permitted to flow out through such a gap 29 onto a horizontal surface it will assume an angle of repose as indicated schematically in Fig. 5 by the letter "a." The angle of repose differs with various grains and the con-

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dition (e. g. dryness) of the grain. Another important feature of the present invention is that the grain which flows out through gap 29 at the lower end of shell 24 is conveyed or fed away at an adjustable rate so that the length of time during which the grain travels through the annular space 13 and is subjected to treatment may be varied to suit conditions.

The grain flowing out of the gap 29 between the shell 24 and deflector 26 and outwardly upon the horizontal flange 28 is moved outwardly by mechanism hereinafter described until it falls over the outer edge of the flange 28 and into the annular trough 31 made up of a channel member with upstanding vertical flanges 32 and 33 and supported by a plurality of radial webs 34 joined to webs 18, the inner flange 32 having a diameter substantially equal to that of shell 24 and having its upper edge joined to deflector 26.

The grain is moved outwardly over the edge of flange 28 and around trough 31 to a discharge port 36 and into a conveyor 37 which carries it to a bin or other receptacle (not shown) by a plurality of rotating vanes 38 and scrapers 39 hereinafter described which are affixed to a rotating frame. The rotating frame surrounding the tower is made up of circular frame members which are shown in the drawings as angle bar 41 and a member 42 generally T-shaped in cross-section formed into circular shape and connected together. A number of different means may be used to rotate the frame, one means, shown in detail in Fig. 3, being the use of a V-belt 43 affixed to the underside of the horizontal flange of angle 42 and being conformed to circular shape. The belt is engaged by sheave 44 of a constant speed motor 46 so that as the sheave rotates the belt and frame also rotate. In order to hold the belt in engagement with the sheave, an idler roller 47 is attached to a bracket 48 connected to a stationary part of the device and arranged to prevent the angle 42 from canting out of position and raising the belt 43 from engagement with the sheave 44. It will be understood that the means illustrated and described herein for rotating the frame is only one of several means which may be employed to accomplish this function. The revolving frame is supported for free rotation upon the stationary part of the tower, as is also best shown in Fig. 3, by a plurality of idler sheaves 49 having horizontal axes suitably bracketed to the frame of the rotating part of the device and engaging between their flanges the upper edge of the outer flange 33 of trough 31 as reinforced by circular angle bar 51. The frame is also held against rocking and swaying movement by a plurality of rollers 52 having vertical axes bearing against the periphery of shell 24 and suitably bracketed on the revolving frame (see Fig. 1). It is obvious that other means might be employed to support the frame for free rotation. Whatever the means used to support the frame, it is desirable that it be such that the frame rotate with a minimum of friction and be held as level as possible.

The members 41 and 42 are joined together by a plurality of radially extending braces 53 which join the two members into a rigid frame. The vanes 39 and scrapers 39 which move the grain depend from the braces 53 and rotate therewith. Depending from the inner member 41 is a castellated skirt 54, the function of which is partially to close off the gap 29 so as to cooperate with collar segments 56 (hereinafter described) to regulate the rate of discharge of

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grain from the tower. The number of open portions 57 of the skirt may be varied to suit the particular needs but in the preferred embodiment there are eight openings 57 equally spaced circumferentially and of equal arcuate length separated from one another by closed portions 58 also of equal arcuate length. The vertical flange of member 41 supports a plurality of sliding, arcuate collar segments 56, the upper ends of which are turned over as indicated by reference numeral 59 so as to be suspended from the vertical flange of member 41. Thumb screws 61 or equivalent means are arranged to cause the collar segments to turn with member 41 except when it is desired to adjust the positions of the collars about the circumference of the flange, in which case the thumb screws are loosened and the collars moved manually to new position. The frame ordinarily rotates slowly enough so that the collars may be adjusted while the conditioner is operating. In the preferred embodiment there are eight such collar segments, each having a length slightly greater than that of the openings 57 in skirt 54. Thus each collar may be adjusted completely to close off one of the openings 57. If desired, the combination of eight collars may be used to close every skirt opening and thus prevent any discharge of grain out of the gap 29. On the other hand, the collars may be adjusted to such position that all of the openings in the skirt are open, in which case there is a maximum discharge through the gap equal to about one-half the amount of discharge there would be were there to be no obstruction to free discharge through the gap. It will be observed that one or more of the openings 57 may be completely or partially opened and the others closed. As the skirt 54 rotates about gap 29 the rate of flow through the gap may be adjusted so that the operator of the conditioner has a wide choice of adjustments to suit the characteristics of the particular grain being conditioned. This feature of the device insures that the grain is fed at an equal rate throughout the entire circumference of the tower and the grain moves down in the tower at an equal rate at every point on the circumference. Such equal movement is one of the important features of the present invention since it insures that all of the grain passing through the towers is subjected to identical treatment and no portion of the grain is subjected to air currents for a shorter period of time than any other. Hence the grain discharged from the towers is of uniform characteristics within practical limits. Since the skirt 54 rotates with the revolving portion of the machine instead of being attached to the tower, the possibility that part of gap 29 will become clogged with straw, sticks or other debris is largely reduced. It is preferred, in the event that it is necessary in operating the machine to feed the grain at slow speed, that there be only a few openings 57 in use and that these be fully opened. This is for the reason that there is greater likelihood of a partially open hole being clogged than there is that one fully opened will be obstructed. By the use of a substantially continuous gap 29 around the circumference of the tower and a revolving skirt 54 with the amount of opening adjustable, it is possible to regulate the rate of flow of grain through the tower but at the same time insure that the flow is uniform about the entire circumference.

In order to feed the grain outwardly over the horizontal flange 28 so that it drops into the

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trough 31; vanes 38 of sheet metal or rubber are affixed to braces 53. The height of such vanes is about equal to the height of openings 57 in the skirt and the vanes extend outwardly so that their outer edges are about on a line with the outer edge of flange 28 and inwardly so that their inner edges touch the skirt 54. The vanes may have pitch, i. e. they do not necessarily extend radially outwardly; in the preferred embodiment shown in Fig. 2 the vanes 38 form an angle with respect to a radius of about 20°. Assuming the direction of rotation as viewed from above as in Fig. 2 is clockwise, the vanes angle backward and thus as they rotate feed the grain over the edge of flange 28 and down into trough 31. It will be understood that, if desired, the vanes may be made with adjustable pitch so that the rate at which the grain is carried away may be adjusted. It is desirable that there be a vane associated with and slightly to the rear of each opening 57 in the skirt so that as the grain flows out onto flange 28 it is picked up by the vane and carried away. To increase the feeding capacity, it is desirable that there be additional vanes used, one being immediately behind an opening 57 and the other extending outwardly from about the middle of an opening. Thus for eight openings 57 there may be sixteen vanes, it being understood that this detail is subject to wide modification.

Rotating along the bottom of the trough 31 are a plurality of scrapers 39 which move the grain in the trough around to the discharge port 36 whence it may be conveyed away by conveyor 37. The scrapers, preferably of rubber, are radially disposed and equiangularly spaced from one another. They are attached to radially disposed stiffening elements 62 along their upper edges which are fixed to vertical hangers 63 suspended from brackets 53. In order to prevent overloading of that part of the revolving frame which is closest to the openings 57 which are uncovered, alternate scrapers are cut away at their heels 64 and toes 65 as is shown by comparison of the right-hand scraper with the left-hand scraper in Fig. 1. Thus part of the grain instead of being moved by the scraper may escape through the cut-out portion and be picked up by the following scraper.

The present invention, therefore, consists of a conditioning tower suitable for complete treatment of grain by means of mechanism constructed to feed the grain out of the tower at an adjustable rate of flow but with all the grain in the tower subjected to substantially equal treatment.

What is claimed is:

1. Discharge mechanism for a conditioner for granular material for discharging said material away from a tower having an aperture proximate the bottom of said tower, said discharge mechanism comprising an annular flange below said aperture, vanes movable in proximity to said aperture over the upper surface of said flange and arranged to feed said material away from said aperture, and means movable with said vanes and adjustable to restrict flow from said aperture.

2. Discharge mechanism for a conditioner for granular material for discharging said material away from a tower having an aperture proximate the bottom of said tower, said discharge mechanism comprising an annular flange below said aperture, vanes movable in proximity to said aperture over the upper surface of said flange

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and arranged to feed said material away from said aperture, means movable with said vanes and adjustable to restrict flow from said aperture, and second means movable with said vanes to transport said material to a receptacle.

3. Discharge mechanism for a conditioner for granular material for discharging said material away from a stationary tower having an inner and an outer perforate, circular cylindrical casing, the space between which forming a conduit through which said material may move having a substantially continuous aperture extending circumferentially about the bottom of one of said casings, said discharge mechanism comprising a frame rotatable with respect to the vertical about said tower at the elevation of said aperture, a skirt carried by said frame and in substantially horizontal registry with said aperture, said skirt having at least one opening therein, adjustable means for restricting said opening to restrict flow of said material from said aperture, a substantially horizontal flange below said aperture, and at least one vane carried by said frame and arranged to move said material over the upper surface of said flange away from said aperture.

4. Discharge mechanism for a conditioner for granular material for discharging said material away from a stationary tower having an inner and an outer perforate, circular cylindrical casing, the space between which forming a conduit through which said material may move having a substantially continuous aperture extending circumferentially about the bottom of one of said casings, said discharge mechanism comprising a frame rotatable with respect to the vertical with respect to said tower at the elevation of said aperture, a skirt carried by said frame and in substantially horizontal registry with said aperture, said skirt having at least one opening therein, a collar segment supported by said skirt and adjustable circumferentially about said skirt to restrict said opening and restrict flow of said material from said aperture, a substantially horizontal flange below said aperture, and at least one vane carried by said frame and arranged to move said material over the upper surface of said flange away from said aperture.

5. Discharge mechanism for a conditioner for granular material for discharging said material away from a stationary tower having an inner and an outer perforate, circular cylindrical casing, the space between which forming a conduit through which said material may move having a substantially continuous aperture extending circumferentially about the bottom of one of said casings, said discharge mechanism comprising a substantially horizontal flange extending from said tower below said aperture arranged to receive said material flowing from said aperture, a frame rotatable with respect to a vertical axis about said tower at the elevation of said aperture, a skirt carried by said frame and in substantially horizontal registry with said aperture, said skirt having at least one opening therein, adjustable means for closing off said opening to restrict flow of said material from said aperture, and at least one vane carried by said frame and arranged to move said material outwardly over the periphery of said flange.

6. Discharge mechanism for a conditioner for granular material for discharging said material away from a stationary tower having an inner and an outer perforate, circular cylindrical casing, the space between which forming a conduit

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through which said material may move having a substantially continuous aperture extending circumferentially about the bottom of one of said casings, said discharge mechanism comprising a substantially horizontal flange extending from said tower below said aperture and arranged to receive said material flowing from said aperture, a trough surrounding said tower below said flange, a frame rotatable with respect to a vertical axis about said tower at the elevation of said aperture, a skirt carried by said frame and in substantially horizontal registry with said aperture, said skirt having at least one opening therein, adjustable means for closing off said opening to restrict flow of said material from said aperture, at least one vane carried by said frame and arranged to move said material over the periphery of said flange, and at least one scraper carried by said frame and arranged to move said material around said trough to a discharge port.

7. Discharge mechanism as characterized in claim 6 and in which there is a plurality of said scrapers, some of said scrapers being apertured in the region of the toes thereof and others of said scrapers being apertured in the region of the heels thereof.

8. Discharge mechanism as characterized in claim 6 and in which said adjustable means includes a collar segment supported by said skirt and adjustable circumferentially about said skirt.

9. Feeding means for feeding granular material comprising a casing forming an aperture substantially horizontal annular flange disposed below said aperture onto which said material is deposited upon discharge through said aperture, a frame rotatable about a vertical axis about said flange parallel to the plane of said flange,

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a skirt rotatable with said frame and in registry with said aperture, said skirt having openings therein, adjustable means selectively adjustable to close off one or more of said openings, fully or partially, to restrict flow of said material onto said flange, and at least one vane carried by said frame and arranged to move said material over the periphery of said flange.

10. Feeding means for feeding granular material comprising a casing forming an aperture substantially horizontal annular flange disposed below said aperture onto which said material is deposited upon discharge through said aperture, a frame rotatable about a vertical axis about said flange parallel to the plane of said flange, a skirt rotatable with said frame and in registry with said aperture, said skirt having openings therein, adjustable means selectively adjustable to close off one or more of said openings, fully or partially to restrict flow of said material onto said flange, at least one vane carried by said frame and arranged to move said material over the periphery of said flange, a trough below said flange, and at least one scraper carried by said frame and arranged to move said material around said trough to a discharge port.

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