Feb. 21, 1950

E. A. WAGNER

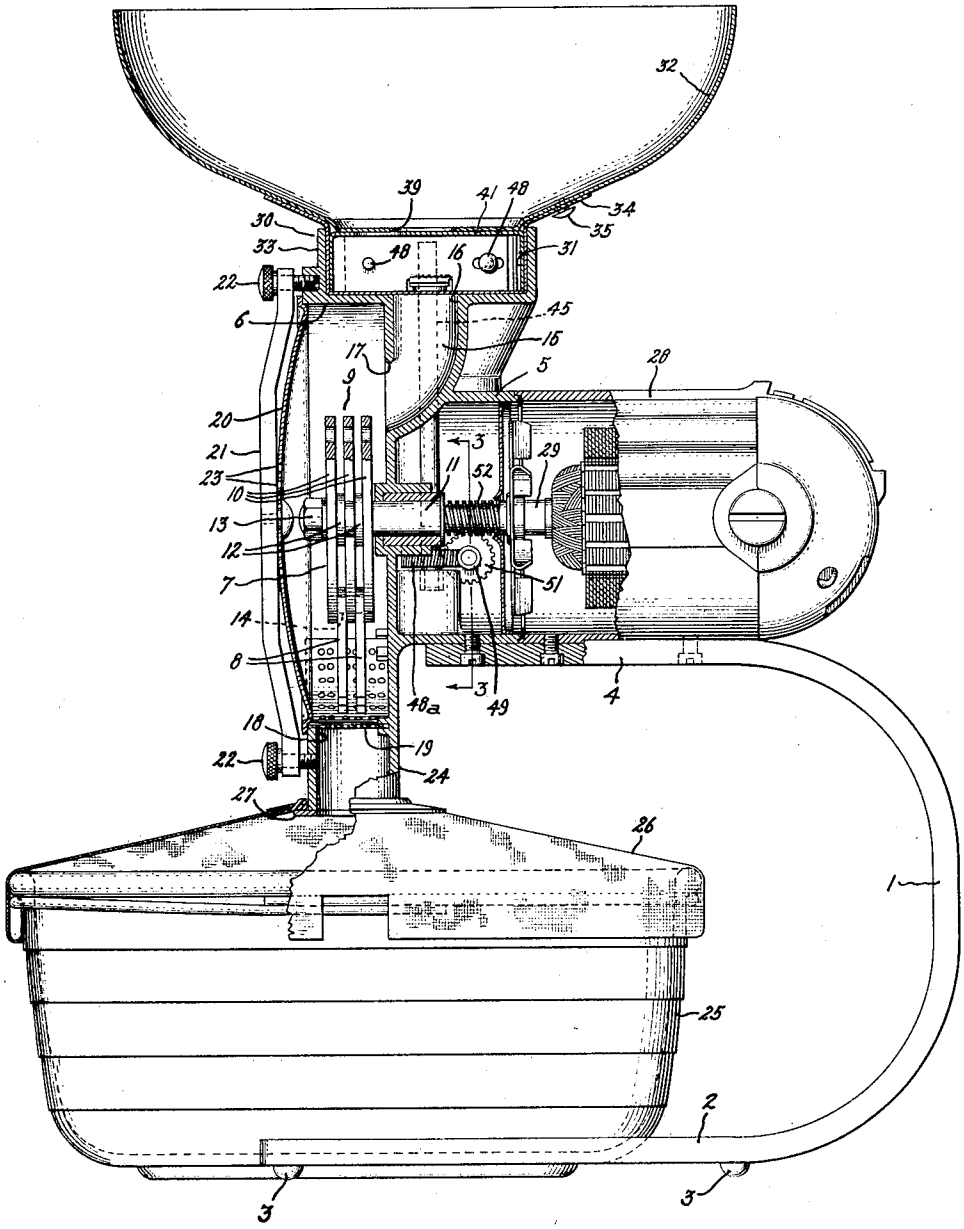
2,498,515

MEANS FOR FEEDING GRANULAR MATERIAL TO MILLS AND THE LIKE

Filed Oct. 14, 1944

4 Sheets-Sheet 1

Fig. 1.



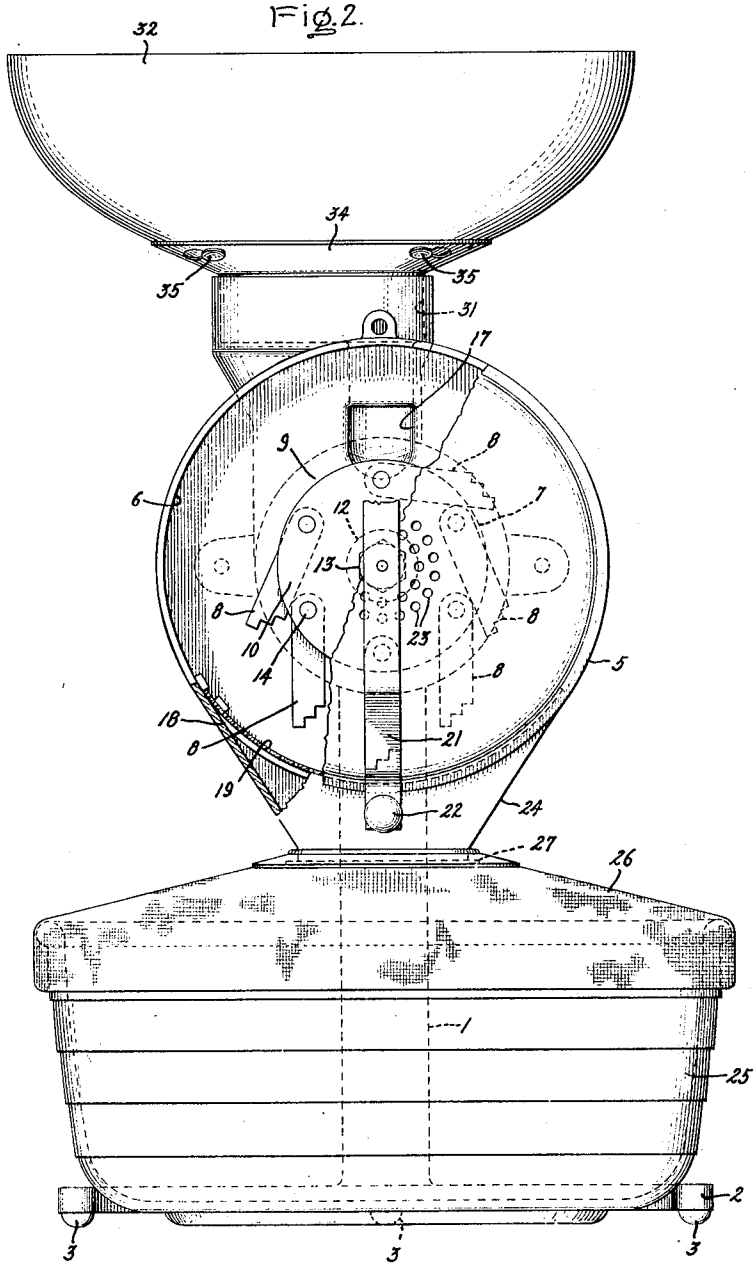
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MEANS FOR FEEDING GRANULAR MATERIAL TO MILLS AND THE LIKE

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Fig. 2.



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MEANS FOR FEEDING GRANULAR MATERIAL TO MILLS AND THE LIKE

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Fig. 3.

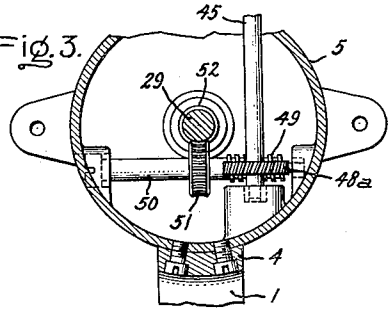


Fig. 7.

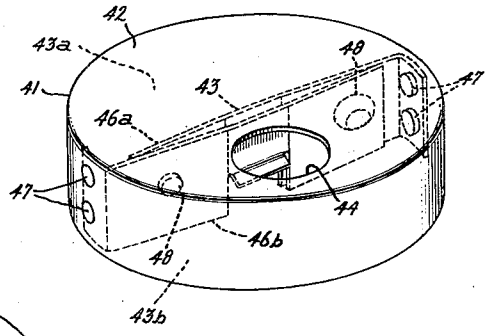


Fig. 4.

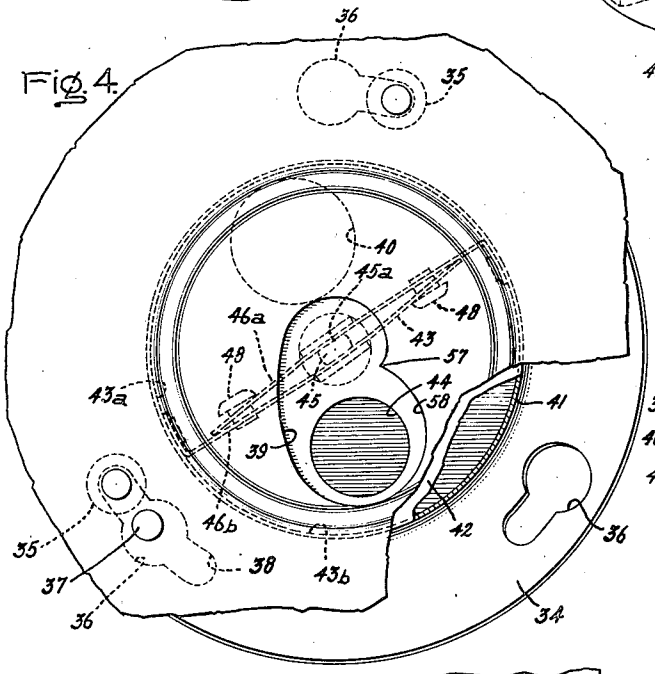


Fig. 5.

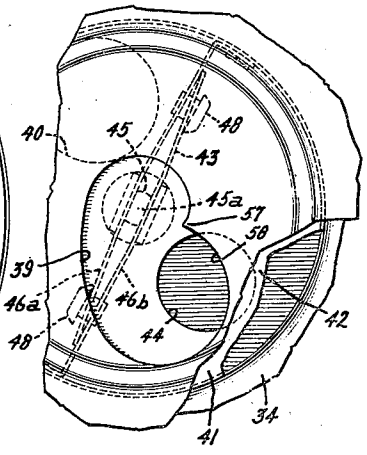
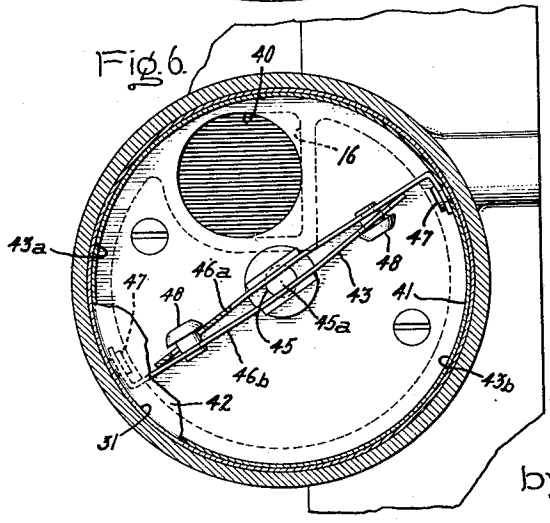


Fig. 6.



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Fig. 8.

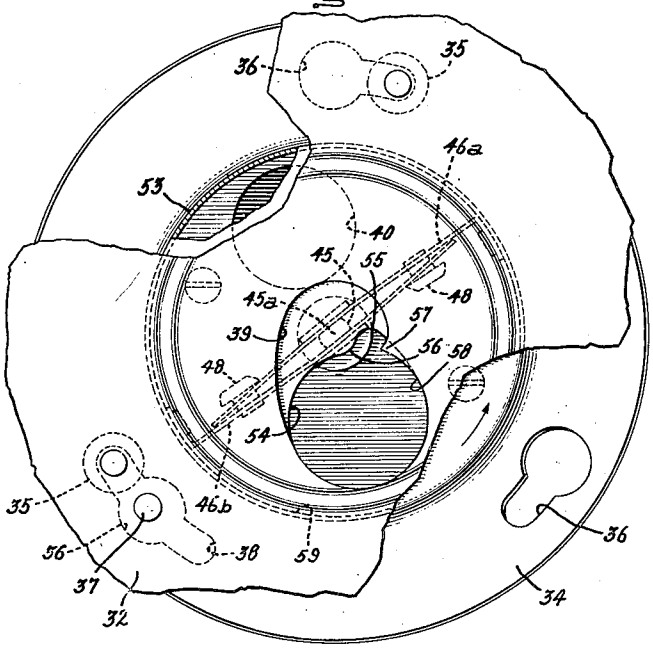


Fig. 9.

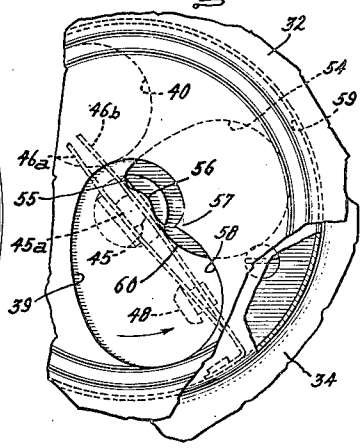


Fig. 10.

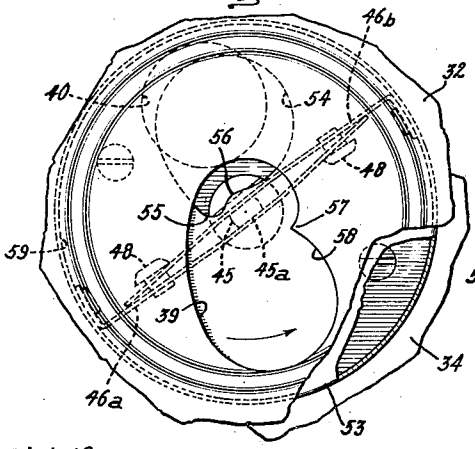


Fig. 11.

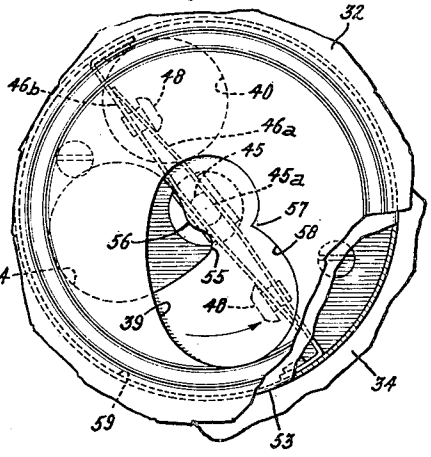
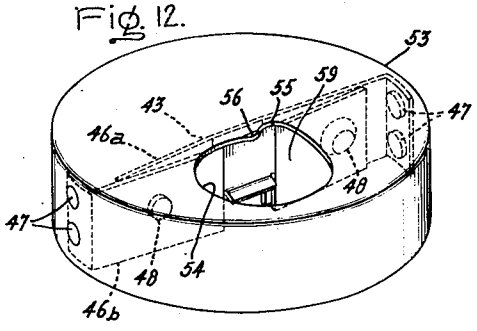


Fig. 12.



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UNITED STATES PATENT OFFICE

2,498,515

MEANS FOR FEEDING GRANULAR MATERIAL TO A MILL AND THE LIKE

Ernest A. Wagner, Stratford, Conn., assignor to General Electric Company, a corporation of New York

Application October 14, 1944, Serial No. 558,622

6 Claims. (Cl. 222—370)

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This invention relates to means for feeding granular material, such as grain kernels, to a mill and the like, and it has for its object the provision of improved means of this character.

More particularly, this invention contemplates the provision of improved means for feeding the granular material at a predetermined rate.

The feeding mechanism, in accordance with this invention, includes a hopper from which the granular material is supplied. Interposed between the hopper and the grinding section of the mill is a rotatable feed control member. This member has a surface which masks the hopper discharge opening during a portion of a revolution of the control member, but also has an opening in the surface which registers with the hopper opening during another portion of the revolution to permit the grain to discharge from the hopper. The feed control member is constructed and arranged so as to feed the grain which has been fed to it into the grinding section of the mill during that portion of its rotation that it masks the hopper discharge opening. In this way, during each revolution of the feed control member a predetermined quantity of material is fed into the feed chamber and from there is discharged into the grinding section.

The feed control member is connected to the main mill driving motor so that it is rotated at a predetermined speed. And interposed between this motor and the control member is a spring friction clutch. In the event there is a jam of the granular material in the openings, the clutch permits the control member to stop and as the motor continues to operate the clutch is conditioned to "back up" the control member and thereby increase the effective area between the openings to cause the jam to clear itself.

Where relatively large kernels, such as corn, are to be ground the control member and the hopper have peculiarly shaped openings—the openings being so shaped that in the event a kernel tends to be caught between the edges of the openings they will force the kernel inwardly toward a central area where the openings are always in registered relation. In this case, repeated jamming of relatively large kernels is prevented.

For a more complete understanding of this invention, reference should be had to the accompanying drawings in which Fig. 1 is a vertical sectional view taken through a grain grinding mill embodying this invention; Fig. 2 is a front elevation of the grain mill of Fig. 1, parts being broken away so as to illustrate certain details of

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construction; Fig. 3 is a sectional view taken through the line 3—3 of Fig. 1, and looking in the direction of the arrows; Fig. 4 is an enlarged plan view of a portion of the mill shown in Figs. 1 and 2; Fig. 5 is a fragmentary view similar to Fig. 4, but illustrating certain elements in different operative positions; Fig. 6 is a sectional view taken through a grain feed control mechanism arranged in accordance with this invention and illustrating it in its relation to a certain other part of the mill; Fig. 7 is a perspective view of the feed control member of Fig. 6; Fig. 8 is a view similar to Fig. 4 but illustrating a different form of feed control member; and Figs. 9, 10 and 11 are views similar to Fig. 8 but illustrating the feed control member of Fig. 8 in different operative positions; and Fig. 12 is a perspective view illustrating the feed control member of Figs. 8–11 inclusive.

Referring to the drawings, this invention has been shown in one form as applied to a grinding mill for grinding grain such as wheat, corn and the like.

This mill comprises a U-shaped standard 1, which has a U-shaped base 2 at the bottom that rests upon feet 3. Mounted upon the upper arm 4 of the standard 1 is a mill housing 5. The housing 5 has formed therein a drum-shaped grinding chamber 6, and mounted to operate within this chamber is a grinding member 7. The grinding drum 6 and the grinding member 7 constitute a mill of the "hammer" type.

As shown, the section 7 comprises a plurality of hammers 8 mounted in pairs (Fig. 1) and swinging from a central rotatable section 9 formed of a plurality of circular disks 10 mounted on a shaft 11 and held in spaced relation by suitable washers 12. The disks and washers 12 are secured to the shaft 11 by means of a single nut 13. Each pair of hammers 8 is mounted for swinging movement on the disks by means of a pin 14.

The mill housing 5 further has an inlet passageway 15 which at the top has an inlet opening 16 and at the bottom has an outlet 17 opening into the drum 6 through its inner end wall, as clearly shown in Figs. 1 and 2. At the bottom of the drum chamber 6 there is an elongated discharge opening 18 for the ground material. Spaced over this opening 18 is an arcuate-shaped screen 19. The front of the drum is substantially completely closed by a cover member 20 which is secured by means of a supporting bar 21 to which the cover is attached and which bar has its ends secured to the mill housing 5 by means of thumb screws 22. At the center of the cover

there are provided a series of relatively small openings 23.

The ground flour discharged through the opening 18 enters a chute 24 which discharges it into a collecting bowl 25. The bowl 25 is covered by a cloth cover 26 which prevents the scattering of the flour and which is secured to a flange 27 on the lower end of the chute 24 and it is draped about the upper edges of the bowl 25.

The shaft 11 is driven by a motor 28, the shaft 29 of which is connected with the shaft 11—preferably integrally therewith. This motor drives the hammer shaft 11 at a relatively high speed, such as 17,000 R. P. M.

The motor 28 also drives suitable grain feed mechanism 30 arranged in accordance with this invention. The feed mechanism 30 comprises a feed chamber 31 which receives grain in measured quantities from a supply hopper 32. The chamber 31, as shown, is formed integrally with the mill housing 5. Mounted within the chamber 31 is a cup-shaped hopper support member 33. As shown, this member has an upwardly and outwardly flared flange 34, which flange functions as a seat for the hopper 32. The hopper 32 is detachably secured to the flange 34 by pin and slot connections comprising headed pins 35 attached to the hopper and pin slot openings 36 formed in the flange 34. One of the pin and slot connections is different from the remainder so that the hopper can be placed upon the proper support flange 34 in only one relative angular position. This connection, as shown at the lower left of Figs. 4 and 8, comprises in addition to the pin 35, a straight unheaded pin 37 spaced from its associated pin 35 and which permits only the entry of this pin 35 into the left keyway 36, and this is by virtue of an extension 38 formed in this keyway. The reason for this connection will be pointed out in greater detail hereinafter.

The hopper 32 is provided in its bottom wall with a discharge opening 39 for discharging grain into the feed chamber 31, and the bottom wall of the cup-shaped hopper support 33 is provided with an opening 40 which registers with the opening 16 in the top of the feed passageway. The opening 39 is off-set laterally from the opening 40, as shown in Figs. 4 and 5.

Fixed predetermined quantities of grain are permitted to enter the feed chamber 31 from the hopper 32 and these in turn are fed through the opening 40. The feed is under the control of a feed control member 41 shown most clearly in Fig. 7. As there shown, this member is in the form of a cylindrical cup having an open bottom and a closing top wall 42. This member is mounted within the feed chamber 31 with the top surface of wall 42 uppermost. Furthermore, the cup member 41 is provided with a diametral dividing wall 43 dividing the volume of the cup into two cavities or chambers 43*a* and 43*b*, and in addition, it is provided with an opening 44 in its top wall 42 communicating with chamber 43*b*.

The feed member 41 rotates within the feed chamber 31 counterclockwise as viewed in Figs. 4 and 5, and during the major portion of a revolution the top surface 42 masks the discharge opening 39 of the hopper so as to prevent discharge of feed from the hopper. However, eventually the opening 44 in the top surface 42 will register with the discharge opening 39 as shown in Fig. 4, and permit grain to flow from the hopper and fill the cavity 43*b*. This quantity of grain will then be swept along by the dividing wall 43 as the control member 41 rotates, and eventually when the control member reaches its position of Fig. 5 and positions beyond, it will be discharged through the opening 40, the inlet opening 16 and thence through the supply channel 15 to the grinding drum 6. Thus, during each revolution of the control member, grain is fed into one-half thereof and this quantity is delivered into the grinding section of the mill.

It will be understood that the volume of the chamber which includes the opening 44 may have any proportion of the total volume of the cup member. Thus, for example, it may have but one-fourth of the volume of this member instead of one-half and thus, the rate of feed can be controlled by supplying control members 41 having grain receiving cavities of varying proportions.

The cup-shaped member 41 is rotated at a greatly reduced speed by means of the motor 28, and for this purpose there is mounted in the mill housing 5 an upright drive shaft 45 which has its axis coincident with the axis of rotation of the control member 41. The upper end of this shaft is provided with a flattened section 45*a*, as shown more clearly in Fig. 6, so as to provide a pair of opposed flat driving surfaces. And the transverse wall 43 is formed of spaced-apart flat members 46*a* and 46*b*. Each of these members has one end anchored to the side wall of the control member 41 by means of rivets 47 while the other end is interconnected with the other of the members adjacent its fixed end by means of a pin 48. The two arms 46 and 47 are formed of a spring material so that they resiliently engage the two surfaces of the flattened end 45*a* of the shaft. This flattened end and the two members 46*a* and 46*b* form a spring friction drive between the shaft and the feed control member. The shaft 45 at its lower end is provided with a worm wheel 48*a* which meshes with a worm 49 formed on a transverse shaft 50 which shaft is driven through the motor shaft 29 by means of a worm wheel 51 mounted on the shaft and which meshes with worm 52 formed on motor shaft 29.

It will be understood that as the motor 28 rotates the hammers 8, it will at the same time rotate the feed control cup 41, but at a greatly reduced speed.

At times there is a tendency for the grain discharging through the openings 39 and 44 to bind or jam between the advancing edge of the opening 44 and the edge of the opening 39 which it approaches. If this occurs, the feed control member 41 is stopped, while the motor 28 continues to operate the shaft 45; the spring members 46*a* and 46*b* yield, that is bend outwardly, and thereby permit the flattened section 45*a* of the shaft 45 to rotate between them. Then when the shaft 45 has advanced through approximately 90° the springs bend inwardly again and flip the cup member backwards; that is they "back up" this member, and thereby increase the effective area between the two openings and thus permit the jam to clear itself. Then the motor drives the cup forwardly and the operation continues as before.

Where large sized kernels, such as corn, are being fed to the feed chamber 31 from hopper 32, such jams are likely to occur with rather great frequency, and to obviate this I have provided a special feed control cup 53 which is shown most clearly in Fig. 12, but also in Figs. 8 to 11. This cup 53 is identically the same as cup 41, ex-

cept for the shape of the grain admission opening **54** in its top wall. This opening **54** in general has a circular shape, but it is provided adjacent the axis of rotation of the cup member with a protuberance **55** which has an inverse curved section **56**. It is for cooperation with this opening **54** specifically that the discharge opening **39** of the hopper is given its peculiar shape; as shown, this opening **39** is roughly in the shape of a cardiod whose reentrant section **57** is somewhat off-center. The lobes of the cardiod, as shown, are arranged generally along a diameter of the control cup, one on one side of the axis of rotation of the cup and the other in the center of the cup to embrace or include the axis of rotation; and the lobes are shaped so that when the opening **54** is in full registry with the opening **39**, as shown in Fig. 8, the opening **54** lies substantially on one side of the axis of rotation and is in full registry with the lobe on that side; the protuberance **55** of opening **54**, however, extends forwardly adjacent the axis of rotation so as to be in registry with the other lobe in the center of the control chamber. That is, the two lobes of opening **39** and the opening **54** are so shaped with relation to each other that the protuberance **55** always uncovers or registers with at least a portion of the area of the opening **39**—see Figs. 8–11 inclusive. Furthermore, the curved section **58** of the opening **39**, and the curves of the opening **54** are such that if a kernel of corn, for example, tends to be bound between the two edges this kernel will be advanced forwardly and radially inwardly as the cup member advances counterclockwise because the point of intersection between the edges will advance radially toward the center, and eventually it will be caused to drop in the central registered sections between the protuberance **55** and the inner lobe of the opening **39**. Fig. 8 illustrates the openings **39** and **54** in their position of maximum registration and where the corn flows freely from the hopper **32** into the chamber **59** of the feed control member. In Fig. 9, the feed control member has advanced 90° in its counterclockwise direction; it will be observed here that the curved edge **60** of the opening **54** will have advanced along the curved edge **58** of the outer lobe in such a way that it will have squeezed any kernel which tends to stick between opening edges radially inwardly, and eventually will cause it to drop off the reentrant point **57** and through the registered area between the openings at the center. In Fig. 10, the feed control member has advanced through another 90° of motion and is in its substantially cut-off position although there still remains the registered shaded area between the two openings; and here also it will be seen that the control member is pushing the grain into discharge opening **40**. Fig. 11 illustrates still another 90° movement of the control member, and here the registered area between the two openings is enlarging. Another 90° movement returns the control member to its fully open position shown in Fig. 8.

The reason for the specific interlock structure between the hopper **32** and its supporting flange **34**, comprising the special pin and slot arrangement shown at the left of Figs. 4 and 8, will now be understood, because the opening **39** must be positioned with reference to the discharge opening **40** so as to prevent grain from passing directly through these openings to the grinding section of the mill.

It will be observed that in addition to the means for preventing small and large sized grain kernels from causing a jam in the feed mechanism, the mill is set up for very rapid cleaning of all of the parts that contact the flour and the grain. To clean, it is merely necessary to rotate the hopper **22** to unlock its pin and slot connection and then lift it off. The feed control member, whichever it may be, may readily be removed by slipping it from its flat section **45***a* of its drive shaft, while the hammers **8** and their disks **10** can be removed merely by unscrewing the single nut **13**. Of course, this latter can be accomplished only after the thumb screws **22** have been turned so as to release the cover **20**.

While I have shown particular embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Feeding mechanism for granular material comprising a feed chamber having a discharge opening, a supply hopper having a discharge opening discharging into said feed chamber at a point offset laterally from said first-named opening, a feed control member rotatable in said feed chamber having a cavity for receiving a predetermined quantity of granules from said hopper, said feed control member having a surface which masks said hopper discharge opening for a portion of a revolution of said control member and further, having an opening in said surface which registers with said hopper discharge opening in order to load the cavity as the control member rotates, and the cavity having a discharge opening at the bottom which upon rotation of the control member moves into registry with said first-named opening so as to discharge the granules therein, and means for rotating said feed control member including a drive shaft, means for driving said shaft, and a friction clutch formed by a pair of flat surfaces, one on said shaft and the other comprising a resilient member secured to said feed control member, and said latter surface biased to engage said one surface on said shaft depending upon the angular relation of said shaft and feed control member so as to effect a driving connection between said shaft and feed control member.

2. Feeding mechanism for granular material comprising a feed chamber having a discharge opening, a granule supply hopper having a discharge opening discharging into said feed chamber at a point offset laterally from said first-named opening, a feed control member rotatable in said feed chamber having a cavity for receiving a predetermined quantity of granules from said hopper, said control member having a surface which masks said hopper discharge opening for a portion of a revolution of said control member, and further, having an opening in said surface which registers with said hopper discharge opening in order to load the cavity as the control member rotates, and the cavity having a discharge opening at the bottom which upon rotation of the control member moves into registry with said first-named opening so as to discharge the granules therein, and means for rotating said feed control member including a drive shaft extending into said feed chamber in the axis of rotation of said feed control member and having a flat section thereon located in said

chamber, a pair of flat spring members positioned diametrally of said feed control member and receiving between them said flat section of said shaft, and means fixedly attaching the ends of said flat springs to said feed control member, said springs thereby forming a yieldable friction drive between said shaft and feed control member.

3. Feeding mechanism for granular material comprising a feed chamber having a discharge opening, a supply hopper above said feed chamber having a discharge opening leading to said chamber, a feed control member rotatably mounted in said feed chamber having a surface masking said hopper discharge opening, and further having in said surface an opening which is moved into registry with said hopper discharge opening by the rotation of said control member to permit granular material to flow into said feed chamber, said control member being further constructed and arranged to carry said material around to said feed chamber discharge opening, a motor having a driving shaft, and a clutch effecting a driving connection between said shaft and said control member, said clutch being defined by a flat section on said shaft and a pair of elongated members connected to said control member and bearing against the opposite sides of said flat section so that when said shaft rotates said elongated members together with said control member are rotated with it, and at least one of the elongated members being resilient so as to yield in the event granular material jams between the edges of said openings and tends to stop said control member.

4. Feeding mechanism for measuring and feeding granular material at a predetermined rate comprising a feed chamber having a discharge opening, a supply hopper having a discharge opening discharging into said feed chamber, a feed control member rotatably mounted in said feed chamber having a surface masking said hopper discharge opening to prevent the flow of said material into said feed chamber but having an opening in said surface which when said control member rotates, moves into registry with said hopper discharge opening to permit material to flow into said feed chamber as long as said openings are in registry, said control member further being constructed and arranged to force said material to said feed chamber discharge opening as the member rotates, a motor for driving said control member having a drive shaft having thereon a plurality of flat surfaces, and said control member having a plurality of flat members for engaging said flat surfaces to effect a driving connection between said shaft and control member, at least one of said flat members being resilient so that in the event granular material jams between the edges of said hopper opening and that in said control member, said control member stops while said shaft continues to rotate and when said shaft rotates independently of said control member through a predetermined angle said resilient member engages another of said flat surfaces on said shaft to shift the control member backward to thereby tend to release said jam.

5. Feeding mechanism for measuring and feeding granular material at a predetermined rate comprising a feed chamber having a discharge opening, a supply hopper having a discharge opening discharging into said feed chamber, a feed control member rotatably mounted in said feed chamber having a surface which in one position of said control member substantially masks said hopper discharge opening substantially to prevent the flow of said material into said feed chamber but having an opening in said surface which when said control member rotates from said position moves into full registry with said hopper discharge opening to permit material to flow into said feed chamber and thence as the member continues to rotate moves substantially out of registry therewith substantially to shut off the flow of material, said control member further being constructed and arranged to force said material to said feed chamber discharge opening as the member rotates, the edges of said discharge opening of said supply hopper and of said opening in said surface of said feed control member having lengths thereof which intersect as the feed control member rotates to move said openings out of registry and the point of intersection between them advancing in toward the center of said control member as said member so rotates so as to force a granule that tends to jam between them in toward said center, and said openings always registering throughout a limited area thereof at said center, whereby a granule forced by said edges in toward said center is allowed to drop through said limited area.

6. Feeding mechanism for measuring and feeding granular material at a predetermined rate comprising a circular feed chamber having a discharge opening at the bottom, a supply hopper having a discharge opening discharging into the top of said feed chamber, a circular feed control member rotatably mounted in said feed chamber on a predetermined axis of rotation provided with a top wall having an opening therein for registering with said hopper discharge opening to permit material to flow freely from said hopper into said feed chamber thereby to feed a predetermined quantity of material into said feed chamber as said control member rotates and said top wall substantially closing said hopper discharge opening to shut off the feed as said control member continues to rotate, said control member further being constructed and arranged to force said material fed to it to said feed chamber discharge opening as the control member rotates, said opening in said hopper having roughly the shape of a cardioid extending generally along a diameter of said control member, one lobe of said cardioid being on one side of said axis of rotation and the other lobe being over the center of said control chamber to include said axis, and said opening in said control chamber top wall being generally in the form of a circle, the circular portion thereof being located at one side of a diameter of said control member and having an area substantially coextensive with that of said one lobe when said openings are in full registry, and also having curved edges forming an area protruding from said circular portion at a point adjacent said axis so as always to be in registry with at least a part of said other lobe, and curved edges of said circular portion intersecting the curved edge of said one lobe as said control member rotates from its position wherein said openings are in full registry to move to their position of minimum registry and shaped so that the point of intersection between said curved edges advances in toward said protruding area as said openings move to said position of minimum registry whereby they coact to force the granules that tend to jam between them in to-

ward said protruding area where they drop through said protruding area and the hopper opening in registry with it.

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