

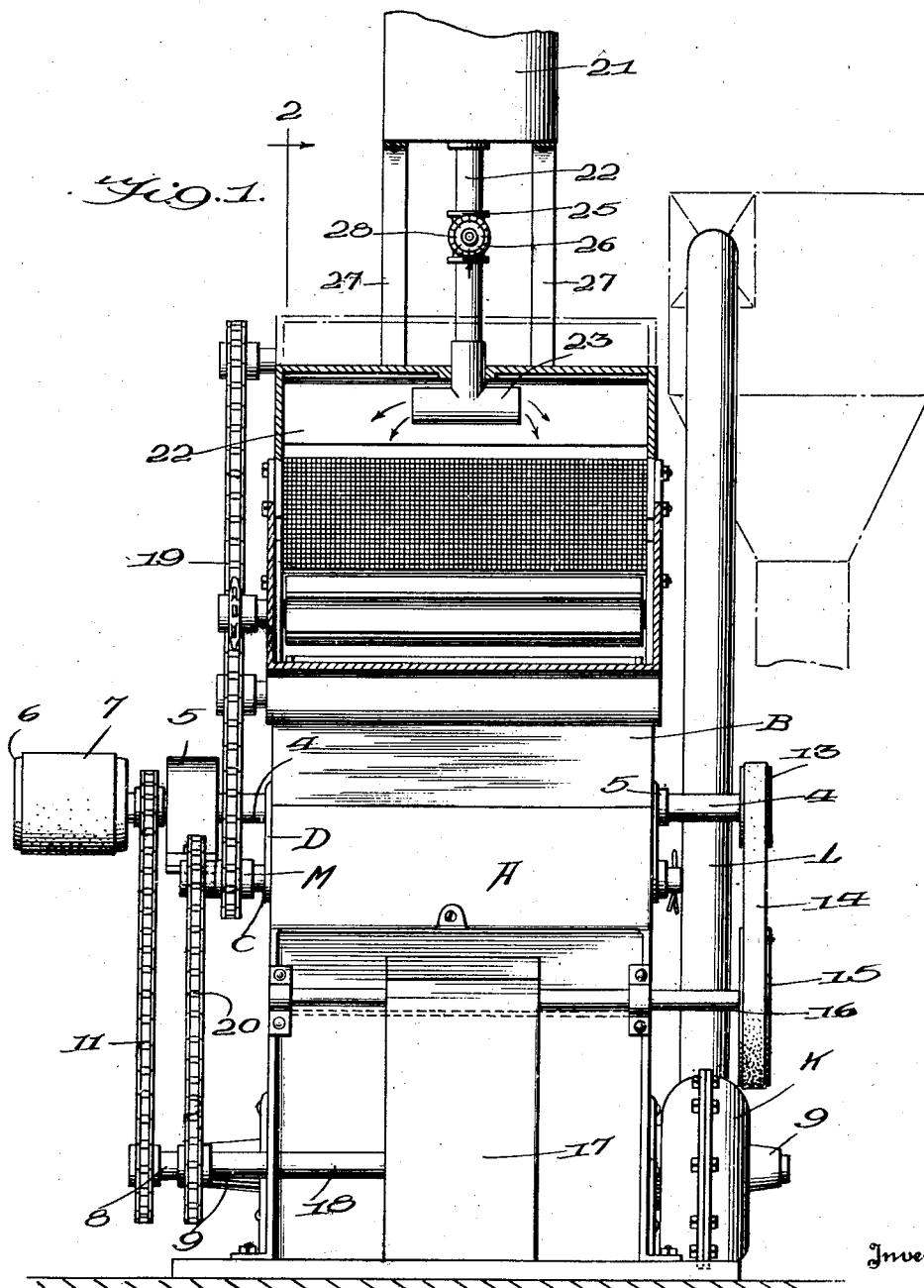
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MOLASSES FEED COMBINED GRINDING AND MIXING MILL

Original Filed Oct. 31, 1931 2 Sheets-Sheet 1



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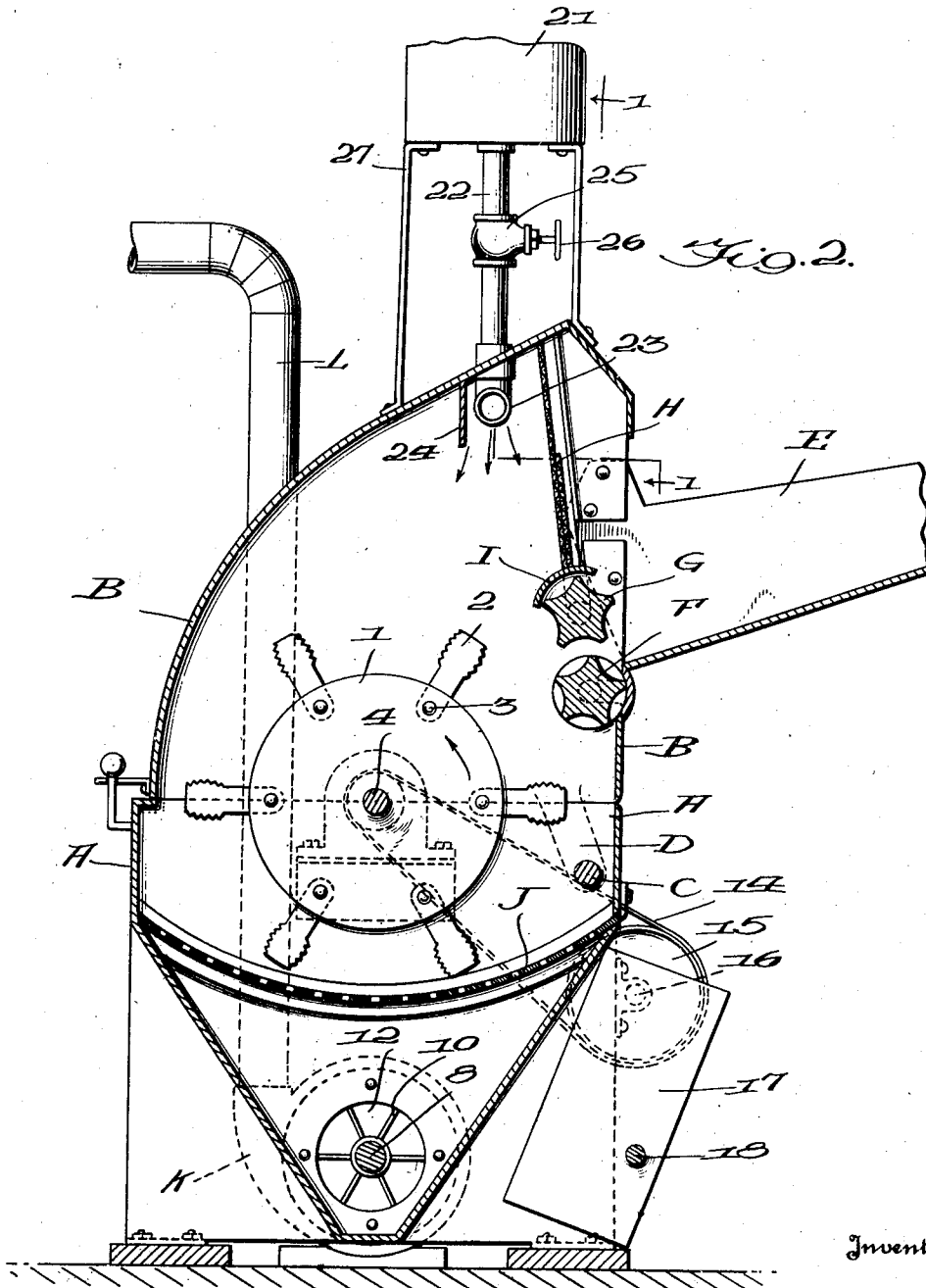
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UNITED STATES PATENT OFFICE

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MOLASSES FEED COMBINED GRINDING
AND MIXING MILL

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to Dellinger Manufacturing Company, a cor-
poration of Pennsylvania

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6 Claims. (Cl. 83-11)

This invention relates to grinding and mixing mills of the rotary hammer type and is intended particularly for the grinding of feed for live stock and the simultaneous mixing therewith during the process of grinding of liquids, in particular molasses, for the production of what is commonly referred to as molasses feed for live stock.

Heretofore it has been the usual practice to grind the grain and/or vines, hay, corn stalks and cobs as one distinct operation and to thereafter mix the ground product with molasses in a mixer. This has required the expenditure of about equal lengths of time for each operation and the expenditure of about equal amounts of power, and the resultant product has often not been as thoroughly intermingled or mixed as desired, and for a given proportion of molasses and granular ingredients the resultant product has not been as dry as desired.

The present invention has been developed with the above considerations in mind and has for its primary objects to eliminate the need for a separate mixing apparatus; to perform the two operations of grinding and mixing in the same time as heretofore sufficed for the grinding operation alone, and with no greater expenditure of power than is required under the same conditions for the grinding operation alone; to explode by violent impact the granular ingredients in suspension in an atmosphere surcharged with the molasses or other liquid in a very finely divided spray or misty condition, or in the presence of molasses or other liquid in a misty or finely divided spray condition, whereby the particles of the disintegrated grain will immediately absorb the finely divided liquid in suspension in the atmosphere; to violently force the liquid or molasses into the granular material by actual impact of the hammers of the rotor with the molasses and granular material both maintained in suspension in the mill; to provide in combination means for simultaneously feeding granular material into the mill at one point, the molasses at another point, grinding and mixing the molasses and granular material previously charged into the mill, and evacuating from the mill in a relatively dry state the ground and mixed product; to provide means for guarding the liquid or molasses inlet against clogging while the material is under violent agitation; to so locate the liquid or molasses inlet with relation to the rotating hammers and with the rotating mass of material maintained in suspension thereby as to exert by said rotating mass an aspirating effect upon the molasses issuing from said inlet; to so

locate the molasses inlet with relation to the point of feed of the granular material and the point of discharge of the mixed product as to insure ample time for the very complete and thorough grinding and mixing of the grain with the molasses before the resultant product is discharged through the usual screen; and to provide means for regulating the amount of molasses charged into the mill with relation to the amount of granular material fed into the mill in a given time.

In the accompanying drawings:

Figure 1 represents a front elevation of a mill illustrating one embodiment of my invention, with the upper part thereof shown in vertical section on the line 1-1 of Figure 2; and

Figure 2 represents a vertical sectional view taken on the line 2-2 of Figure 1 and looking in the direction of the arrows.

Referring now in detail to the drawings, A designates the lower portion of the casing; B, the upper portion of the casing hingedly connected to the lower portion by means of hinge straps D which receive the end portions of a shaft C passing through section A; E designates the usual feed chute for directing the grain, vines, etc. to the reversely rotating feeding rolls F and G; H represents a slidably adjustable guard screen closing the space between the upper feed roll G and the top of the casing section B; and I designates a guard for preventing the escape of material being ground. Said feed rolls F and G, the guard screen H and the guard plate I may be of any construction suitable to the purpose but will preferably be constructed, and preferably will operate, as shown and described in my Patent No. 1,744,299, granted January 21, 1930.

J designates a removable screen which may be mounted in any suitable manner so as to be easily removable and interchangeable with any one of a plurality of screens and of different size mesh or perforations in accordance with well known practice. For instance, it may be slidably mounted in a pair of opposed arcuate grooves or grooved fittings shown in the patent to Shelton No. 1,311,535, granted July 29, 1919, though while preferred, it is not essential that this screen shall be interchangeable, but in such case only one size of feed can be ground.

The rotor, generally designated as 1, will rotate in the direction indicated by the arrow in Figure 2 and has its shaft 4 mounted for rotation in the bearings 5 secured to the lower casing section A, a pulley 6 keyed to said shaft 4 being driven from any suitable source of power by a belt

7, which serves as the sole driving power for all moving parts of the mill. The rotor 1 may be of any usual and suitable construction, but preferably will be constructed in accordance with my Patent No. 1,757,452, granted May 6, 1930. Rotor hammers 2 are swingably mounted in the rotor between adjacent discs thereof by means of connecting rods 3 extending through said discs adjacent the periphery thereof at a plurality of equi-distantly spaced points, the discs being mounted to turn with the shaft 4. A fan shaft 8 extending parallel to the shaft 4 and through the lower portion of the casing section A and centrally of the fan casing K, and having a fan 10 disposed in said fan housing K and mounted on said shaft 8 to turn therewith is driven by a chain 11 which passes over cog wheels keyed to the shafts 4 and 8, so that the fan 10 is driven by the rotor shaft 4 to suck the ground and mixed product through the screen J and through the fan intake 12 and to discharge said products through the usual discharge delivery pipe or flue L to a dust collector indicated in light outline in Fig. 1. Said shaft 8 is mounted in suitable bearings 9, each rigid with the section A and said fan housing K respectively.

A pulley 13 mounted on the other end portion of shaft 4 serves to drive the driving chain 19 of the feed rolls F and G through a belt 14 passing over the pulley wheel 15 on shaft 16, said shaft 16 having a small pinion slidably mounted thereon to turn therewith and, through reduction gearing indicated by the gear box 17, driving the shaft 18 which has a sprocket wheel driving the chain 20, which in turn passes over a sprocket wheel keyed to the shaft C. A sprocket wheel M is mounted on shaft C to turn therewith and engages and drives the chain 19. While the speed reduction driving connections for the feed rolls F and G may be of any suitable construction and operation, the above generally indicated driving connections are preferred, and said driving connections will preferably be as shown and described in more detail in my Patent No. 1,754,267, granted April 15, 1930.

A molasses inlet nozzle 23, preferably of T form, is introduced through the upper portion of the top of the upper section B, closely adjacent the upper portion of the guard screen H, and has its ends wide open for the unobstructed discharge of molasses supplied to the nozzle 23 through a supply pipe 22, which will preferably receive molasses under ordinary gravity flow, from supply tank or reservoir 21 preferably supported by the stand or bracket 27 secured to the section B. A valve coupling 25 will preferably be interposed in the pipe 22 to control the amount of molasses passing therethrough or to entirely shut off the flow of molasses there-through by means of a valve 26, a gage 28 of any usual and suitable construction being provided to visually indicate to the operator the position of the valve, that is whether it is entirely closed or, if not, how far open the valve is, in order that he may have a correct indication as to how much molasses is being delivered into the mill, so that he can correctly adjust the rate of flow of the molasses into the mill with relation to the rate of feed of the granular material between the feed rolls F and G into the mill, it being noted that the most desirable proportions of the molasses and granular material are from 250 to 300 pounds of molasses to a ton of feed.

In actual practice or tests with a full size ap-

paratus in the actual simultaneous grinding and mixing with molasses of the granular material in the process of being ground, it has been found that where the molasses nozzle 23 has been located approximately in a vertical plane intersecting the axis of the rotor, the nozzle 23 was actually located in a zone subject to great pressure or subject to the rotating atmosphere generated by the rapid rotation of the rotor and the materials held in suspension thereby, with the result that the pressure so exerted not only would not permit the escape of molasses into the mill, but in fact forced the molasses back up into the pipe and filled the lower portion of the pipe 22 and also the nozzle 23 with granular material. Also, in such tests it was found that where the nozzle 23 was located at a higher point and substantially in front of the vertical plane of the rotor axis, the materials being ground were thrown with such great impact upon the inner face of the upper section B that they were deflected and bounced back forwardly and laterally toward the screen H and the nozzle 23, with the result that the nozzle 23 was very quickly clogged up with such granular material which effectually prevented the introduction of molasses into the mill, notwithstanding that at such higher and forward position the nozzle 23 was removed from the zone of pressure and was even subjected to an aspirating effect by the whirling mass. It was found that by moving the nozzle 23 up closely adjacent to the screen H and then providing a baffle plate 24 secured to the section B, extending from the inner top surface thereof well below the nozzle 23 and located to the rear thereof and extending well beyond the ends thereof, preferably from side to side of the section B, and very closely adjacent to the nozzle 23, the nozzle 23 was entirely protected against such deflected or rebounding granular products and it was found that there was no further defect in introducing the molasses in any desired quantity.

In practicing the invention, the molasses may be used in either a cold or a heated condition and may be introduced by ordinary gravity flow pressure or may be supplied under greater pressure by any usual means suitable to the purpose. Of course, if it is supplied under greater pressure or is used in a heated condition, a greater flow of molasses per second and per given size of pipe discharge nozzle 23 may be obtained and under given conditions this may enable the granular material to be fed faster and the rotor to be driven faster, with a consequent increase in the quantity of production in a given unit of time.

By way of illustration, we will assume that the power is sufficient to drive the rotor 1 at a sufficient speed to grind a given material at the rate of two tons of granular material per hour. On this basis the reduction speed gearing will be set to drive the feed rolls F and G at the correct speed to feed in two tons of granular material per hour, and the valve 26 will be set to permit the passage through the pipe 22 of between 500 to 600 pounds of molasses per hour.

In operation the power will be delivered to shaft 4 by belt 7 and will be taken from shaft 4 by chain 11 to drive the fan 10 and by belt 14 to drive the feed rolls F and G through the drive connections stated, so that with the shaft 4 in rotation the valve 26 will be opened to the appropriate degree, depending upon the quantity of granular material ground per hour, and the granular material and molasses will be simulta-

neously fed into the mill and while some is being fed in, other portions will be in the process of grinding and mixing and other portions in the form of finished product will simultaneously be in the process of evacuation and still other portions will be in the process of delivery through the discharge pipe or flue L to the dust collector, where it will either be bagged or discharged into a suitable storage place.

During operation of the mill the rotor 1 will rotate at a speed of 2,000 to 2,400 R. P. M. so that the hammers 2, of which there are four to each rod 3, will be held in their farthest radially outward position by centrifugal force and will strike the grain or granular material and also the molasses in mid air with terrific force, breaking up the streams or drops of the molasses into very fine particles or more correctly into a mist, also cutting and exploding the granular material by violent impact into fine powder in the enveloping atmosphere of molasses in misty suspension, and also hammering the molasses positively into the granular material by such impact and maintaining the misty molasses and the powdered granular material in a condition of intimately associated intermingled violently agitated suspension. The hammers 2 will have serrated hammer faces and may be arranged in any desired relative arrangement, but will preferably be arranged so as to give an alternate endwise movement to the material being treated, so as to insure very thorough and complete grinding and mixing in the shortest period and with the smallest amount of peripheral movement of the mass prior to completion of the simultaneous grinding and mixing operation.

By actual use it is found that the molasses is very thoroughly absorbed by the granular material before the molasses can reach the screen and that as the ground and mixed product reaches the screen it is in a relatively dry condition such as to freely flow through any one of the different sizes of sets of screens usually provided for such mills for feed grinding purposes and without any tendency to clog up the perforations of the screen or to ball up or cake.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A mill for grinding and mixing food ingredients comprising a closed casing, a rotor mounted for rapid rotation in said casing, grinding hammers mounted in said rotor, a fan housing having its intake opening communicating with the interior of said casing and having a discharge opening, a fan shaft mounted for rotation and extending through said fan housing, a fan mounted on said shaft to turn therewith in said housing, and means for feeding material to be ground into said casing in the path of said hammers, in combination with means for introducing molasses into said casing and in the path of said hammers, means protecting said molasses introducing means from particles thrown off by the rotor hammers, and means for simultaneously with the introduction of said molasses driving said fan and said feeding means from the shaft of said rotor and at definite predetermined speeds with relation thereto.

2. A grinding and mixing mill comprising a casing, a rotor mounted for rapid rotation in said casing, hammers mounted in said rotor, and means for feeding material to be ground into said casing in the path of said hammers, in combination with a molasses nozzle mounted in the higher forward

portion of the casing so as to discharge molasses into the path of said hammers and so located as to be outside of the direct influence of the violently rotating atmosphere generated by the rotation of said rotor, and rotating therewith, and a baffle plate disposed closely adjacent to, and to the rear of, said nozzle and depending appreciably below the same to guard said nozzle against being clogged by material rebounding from the rear top wall of said casing, and a pipe supplying molasses to said nozzle.

3. A grinding and mixing mill comprising a closed casing, screen means located in the upper front portion of said casing for permitting the entrance of air thereto while preventing the discharge therefrom of material in process of being ground, a rotor mounted in said casing for rapid rotation, grinding hammers mounted in said rotor, and means for feeding into said casing in the path of said hammers material to be ground, in combination with a baffle plate disposed close to said screen means and depending downward from the top of said casing, a nozzle disposed in said casing between said screen means and said baffle plate and shielded by said baffle against rebounding particles and subject to the aspirating effect of the rapidly rotating atmosphere surrounding the rotor, a supply pipe for supplying molasses to said nozzle, and means for controlling the flow of molasses through said supply pipe.

4. A grinding and mixing mill comprising a closed casing, screen means located in the upper front portion of said casing for permitting the entrance of air thereto while preventing the discharge therefrom of material in process of being ground, a rotor mounted in said casing for rapid rotation, grinding hammers mounted in said rotor, and means for feeding into said casing in the path of said hammers material to be ground, in combination with a baffle plate disposed close to said screen means and depending downward from the top of said casing, a nozzle disposed in said casing between said screen means and said baffle plate and shielded by said baffle against rebounding particles and subject to the aspirating effect of the rapidly rotating atmosphere surrounding the rotor, a supply pipe for supplying molasses to said nozzle, means for controlling the flow of molasses through said supply pipe, and gage means for indicating the rate of flow through said control means.

5. A grinding and mixing mill comprising a closed casing, a rotor mounted for rapid rotation therein, grinding hammers carried by said rotor, and means for feeding material to be ground into said casing in the path of said hammers, in combination with means for independently introducing molasses into said casing in the path of said hammers, and means for preventing the clogging of said molasses introducing means.

6. A grinding and mixing mill comprising a closed casing, a screen disposed in the upper portion of said casing to permit the free intake of air but to prevent the escape of particles being ground, an exhaust fan disposed in a housing communicating with the lower portion of said casing and having a discharge outlet outside of said casing, a rotor mounted for rapid rotation in said casing between said screen and said fan, and means for feeding material to be ground into said casing in the path of said hammers, in combination with means for introducing molasses at a point remote from said material feeding means and closely adjacent to said screen and into the path of said grinding hammers, a baffle plate dis-

posed closely adjacent to, and to the rear of, said molasses introducing means and extending above and below and beyond both ends thereof, and means for driving said fan to draw air inward through said screen, whereby said molasses introducing means is subject to the aspirating effect

of such air current and whereby such air current aids in protecting said molasses introducing means against being clogged by the flying particles of material being ground.

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