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[54] **METHOD AND APPARATUS FOR MILLING PASTY MATERIALS**
12 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **241/30,** 241/34, 241/224, 222/56
[51] **Int. Cl.** **B02c 4/04**
[50] **Field of Search** 241/29, 30, 33, 34, 36, 37, 222, 224; 222/56, 64, 68

[56] **References Cited**

UNITED STATES PATENTS

2,327,448	8/1943	Olive	241/36 X
2,408,221	9/1946	Michel	222/56
2,689,063	9/1954	Ball	241/222 X
3,321,144	5/1967	Eppenberger	241/34

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ABSTRACT: In a method of milling pasty material, such as chocolate, having a tendency to separate out components, between one or more pairs of cooperating friction rollers associated with a pouring trough receiving the material from a supply device which can be blocked from the trough in a controlled manner in dependence on the extent to which the trough is filled with material, both the level of the material in the trough and the flow of the material into the trough are sensed in a coordinated manner and the blocking of the supply device is controlled in accordance with such sensing. The apparatus includes two feeling or sensing levers fixed to oscillate as a unit, these levers being counterbalanced in one direction. When the slide controlling blocking of the supply device is opened, the material moving into the trough engages one of the levers to swing both levers against the bias of the counterweight, moving the other lever into a position where it senses the level of the material in the trough at the nip between two cooperating friction rollers. This provides a control signal resulting in closing of the slide or gate of the supply device. When the level of the material at the nip between the two rollers falls below a predetermined point, the material disengages the other lever and the counterweight swings both levers back to a position where a control means is operated to reopen the slide controlling discharge from the supply device into the trough.

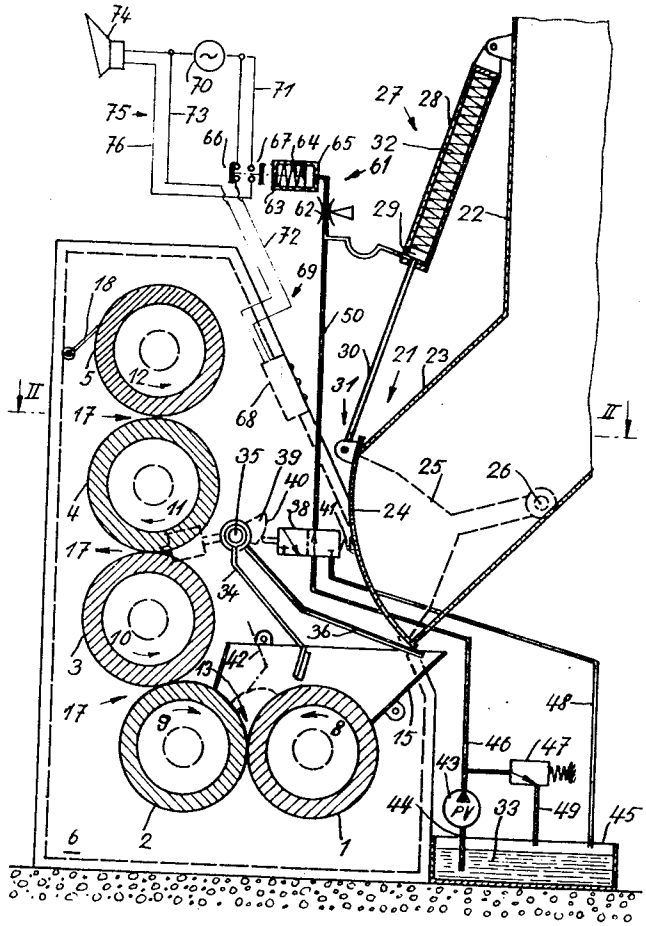

Fig. 1

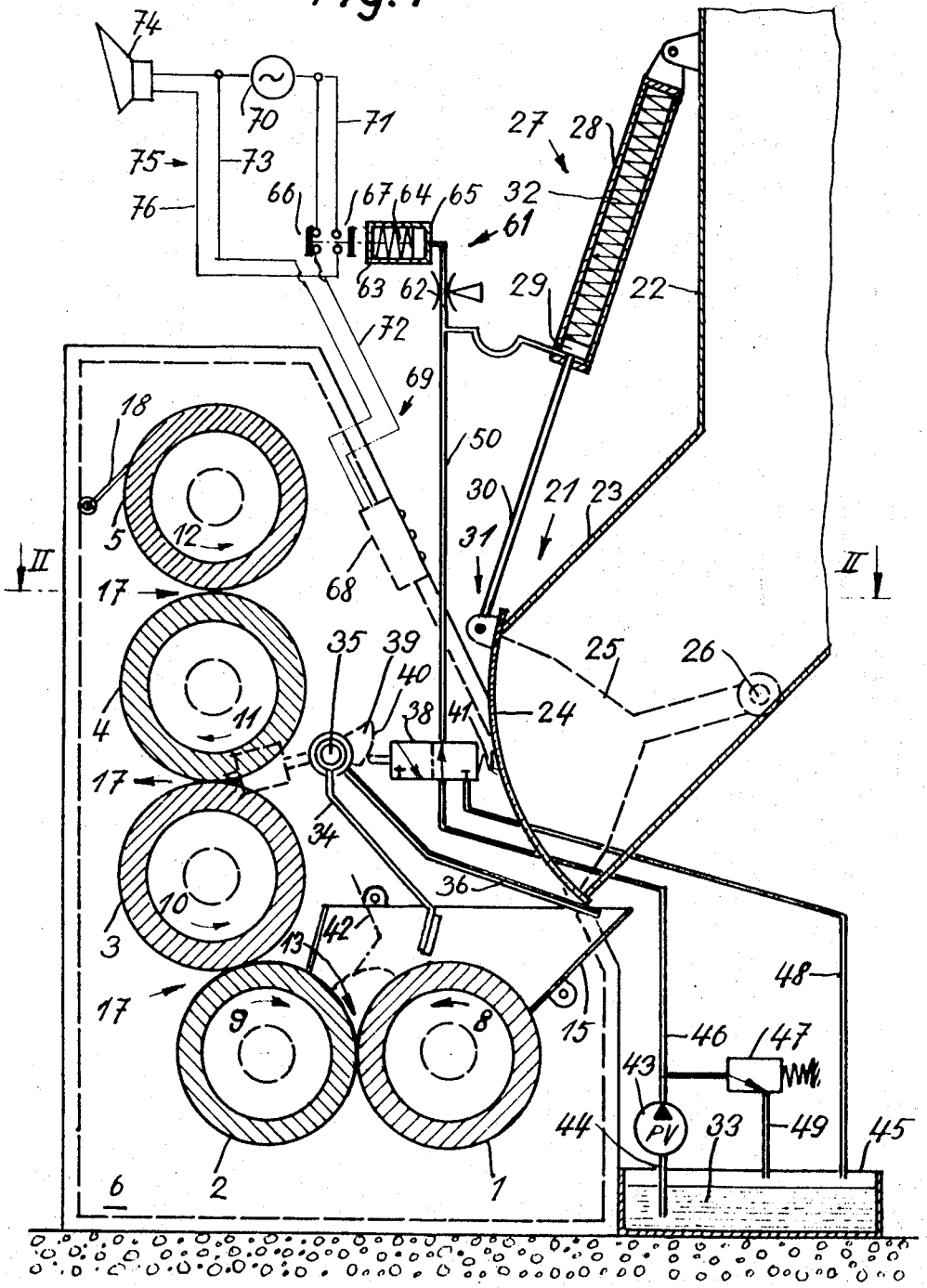

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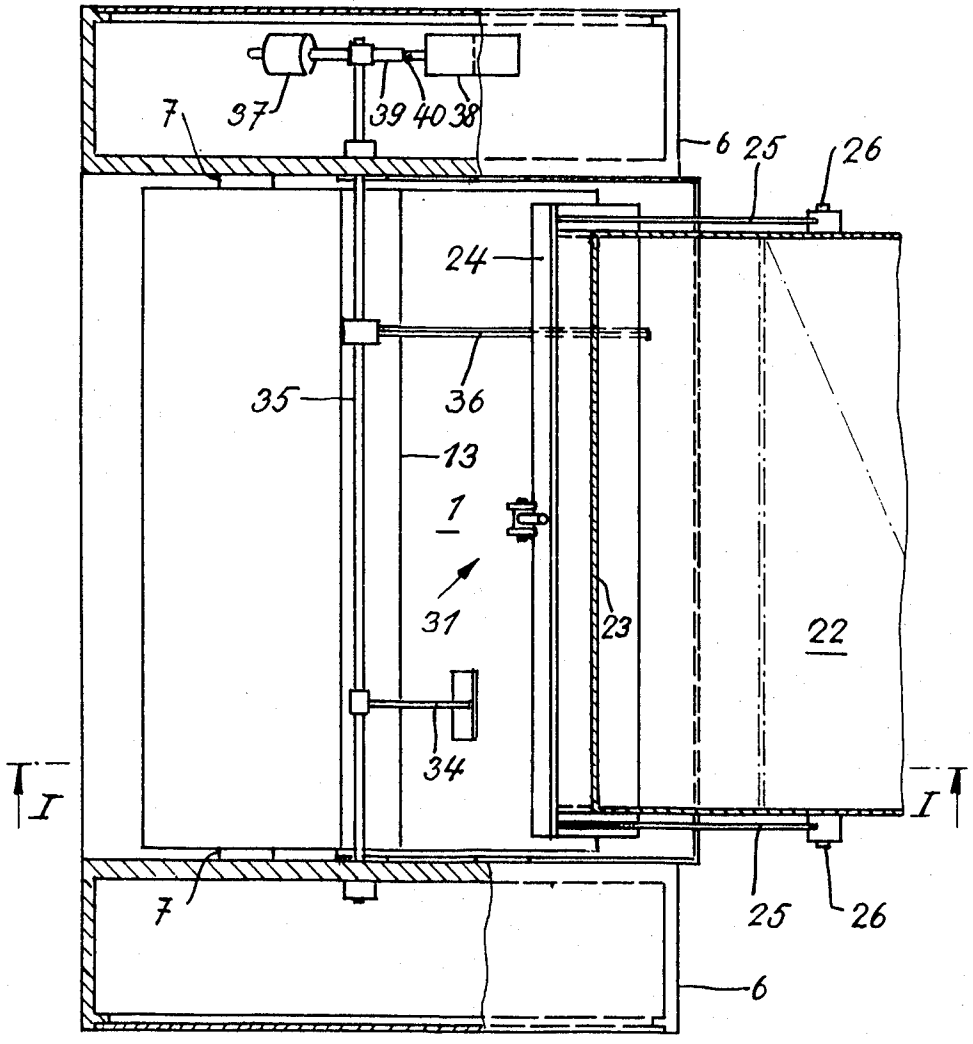
Fig.2



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METHOD AND APPARATUS FOR MILLING PASTY MATERIALS

BACKGROUND OF THE PRIOR ART

A known method for milling pasty materials, particularly those whose components have a tendency to separate out, involves feeding the pasty material to a pouring trough associated with at lease one pair of cooperating milling or friction bodies, such as milling rollers. The level of the pasty material in the pouring trough is maintained between predetermined limits by controlling supply of material into the trough from a blockable supply device.

For the purpose of regulating or controlling the feeding or supply, it has been proposed to mount the pouring trough, outside its center of gravity line, in an articulated manner so that the trough is tiltable about an axis which is parallel to the axis of the friction or milling bodies or rollers. By means of a suitable functional connection between the tiltable trough and a slide in the region of a precomminuting machine arranged above the trough, the supply of material was intended to be controlled in such a manner that the level of the material in the trough was always between two predetermined limiting values.

The disadvantages of this proposal reside, primarily, in the fact that the tiltable arrangement of the trough causes problems with respect to sealing between the trough and the milling bodies and, in turn, this affects the exactness of response to measurement of the level to which the trough is filled. In the second place, a vary complicated construction is necessary in order to be able to transmit, or provide, with the functional mechanism, such as a rod mechanism, the control value arising from the tiltable trough, and to use this control value to control operation of the feeding slide which is under the influence of the flow of material.

SUMMARY OF THE INVENTION

This invention relates to the milling of pasty materials, particularly those whose components have a tendency to separate out, and, more particularly, to a novel and improved method and apparatus in which the level of the material in the trough is controlled by sensing, in a coordinated manner, both the level of the material and the flow of the material into the trough.

The objective of the invention is to overcome the disadvantages of known prior art arrangements. An advantage of the invention is that it provides for a relatively small predetermined filling of the trough and also of controlling flow of material into the trough when such flow is required due to a predetermined decrease in the level of material in the trough. In addition, the control function dependent thereon is transmitted to the milling means. The characteristic feature of the invention is that, for the purpose of a control in dependence on the level of material in the trough, this level, on the one hand, and the flow of material from the supply device into the trough, on the other hand, are sensed in a coordinate manner and in functional connection with each other.

As mentioned, a relatively small filling of the trough is and advantage, as has been recognized by practical experience obtained in the processing of certain milling materials. If the trough is filled to too high a level, then certain portions of the milling material have to remain in the trough for a long period of time until they are drawn in between the pair of milling bodies for processing. This is a disadvantage because, during the period of rest in the trough, certain components of the material may separate out. For example, if the milling material is cacao, cacao butter may separate out and it may start floating on top of the material in the trough, which is a great disadvantage.

Such separations may lead to undesired processing because, sooner or later, the separated material will be predominantly drawn between the first pair of milling bodies relative to the major quantity of the milling material, which oftentimes is of much greater amount. It is also possible for this separated material to act in the manner of a kind of lubricating film for the milling bodies as, for example, cacao butter actually does. This lubricating film renders it impossible to draw in the milling material between the first pair of friction bodies, if the milling material does not contain the separated portion. Correspondingly, on the discharge side of the milling bodies, a final product is obtained which does not correspond to the desired composition. This is so whether or not the milling means includes one or several pairs of cooperating friction bodies.

The apparatus provided for performing the method of the invention includes at least one pair of cooperating friction bodies and a pouring trough associated with this pair. The apparatus further includes a supply arrangement, for the material, which discharges into the region of the trough and which is provided with a blocking slide or gate which is actuated in a controlled manner. The control arrangement actuates the blocking slide in dependence on the level of the milling material in the trough, and includes a control device having at lease one oscillatable sensing lever extending parallel to and above the drawing-in gap or nip of the friction bodies, such as friction rollers. The lever extends into the trough up to and into the range or region of the drawing-in nip, and also in the region of the trough into which the material supply device discharges material. Control elements, for actuating the blocking slide or gate, are actuated by the rockable or oscillatable sensing lever.

An object of the invention is to provide an improved method for milling pasty materials, particularly pasty materials having a tendency to separate out components.

Another object of the invention is to provide an improved apparatus for performing the method.

A further object of the invention is to provide such a method and apparatus in which there are sensed, in a coordinated manner, both the level of the material in the trough and the flow of the material into the trough.

Another object of the invention is to provide such a method and apparatus in which opening of the slide or gate in the supply device is controlled in accordance with such coordinated sensing.

A further object of the invention is to provide a novel apparatus for milling pasty materials which is inexpensive to construct and maintain while being simple and effective in operation.

For an understanding of the principles of the invention, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the Drawing:

FIG. 1 is a vertical sectional view of apparatus embodying the invention, taken along the line I—I of FIG. 2; and

FIG. 2 is a horizontal partial sectional view of the apparatus taken along the line II—II of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing, the invention is illustrated as applied to a chocolate rolling mill having rollers 1, 2, 3, 4 and 5 rotatably mounted in lateral machine stands or columns 6. The stub axles 7 of these rollers are fixed to rotate with gears (not shown), and are drivable, through the medium of these gears, in the sense of the arrows 8, 9, 10, 11, and 12. A moving-in and moving-out device is provided to move the rollers from the rest position into a working position, and vice versa, but has not been illustrated as it forms no part of the invention.

In the range of the lower two rollers 1 and 2, there is provided a pouring trough 15 which is secured to frame members 6. Trough 15 extends longitudinally between the frame members, and serves to receive chocolate mass up to a predetermined level. Rollers 1 and 2 conjointly define a drawing-in nip 13 which, at the same time, serves as a friction gap. Rollers 2,

3, 4 and 5 define friction gaps 17. In the region of roller 5, there is provided a stripping means 18 to remove the milled chocolate.

A supply device 21 is arranged above pouring trough 15, and includes a vertically extending supply channel 22 associated with a feeding device (not shown) opening thereinto, and further includes an oblique or slanted discharge channel 23 whose discharge opening is arranged above trough 15.

In order to obtain good distribution of the chocolate mass in trough 15, the transverse extent of the discharge opening of channel 23 is approximately equal to the length of the drawing-in nip 13. An arch-shaped blocking or closing slide or gate 24 is provided for opening and closing the discharge opening of channel 23. Slide 24 is swingable mounted by means of lever arms 25 oscillatable on pivot pins 26 secured to channel 23.

A piston device 27 is provided for opening and closing slide 24, and includes a cylinder 28 which is articulated on supply channel 22. Piston device 27 further includes a piston 29 movable in cylinder 28, and also a piston rod 30, secured to piston 29, and articulated to slide 24 at a joint 31. To effect the closing movement of slide 24, there is provided a prestressed compression spring 32 which is arranged in cylinder 28 and which acts on piston 29. To open slide 24, piston 29 can be subjected to the pressure of oil 33.

A control device is provided to supply oil 33 under pressure to piston 29 in dependence on the extent of filling of trough 15. This control device includes a level feeler sensing lever 34 fixedly connected with a pivot axle 35 extending parallel to and above the drawing-in nip 13 of rollers 1 and 2, axle 35 being mounted for oscillation in machine frame members 6, and being rockable conjointly with level feeler 34. A further supply feeler or sensing lever 36 is fixed to oscillate with axle 35, and extends into the region of the discharge opening of channel 23. An angular rotational bias is applied to pivot axle 35 by a counterweight 37 secured thereto.

The conjoint movement of feeler levers 34 and 36 effects operation of a hydraulic control valve 38 which is under the bias of a spring 41 and, for this purpose, a control segment or cam 39 is secured on axle 35 and has a cam surface 40 which is eccentric with respect to the axis of axle 35. Level feeling lever 34 is movable between the full line rest position shown in solid lines in FIG. 1, and the working position 42, indicated in dot and dash lines. The amplitude of oscillation of sensing levers 34 and 36 is limited by suitable stop means on axle 35, and which have not been shown.

The hydraulic pressure for the control device is provided by a pump 43 having a suction line 44 connected to a tank 45. A pressure line 46 extends from pump 43 to control valve 38, and is also connected to an overflow valve 47. Return lines 48 and 49 extend, respectively, from control valve 38 and overflow valve 47 to tank 45. A control line 50 extends from control valve 38 to cylinder 28, and to a hydraulically operated time switch 61 including a flow throttling valve 62 having an adjustable cross section. Switch 61 includes a cylinder 63 in which there is displaceable a piston 65 spring-loaded by a spring 64. Piston 65 serves to actuate the switch 65 from the rest position 66 to the operating position 67.

A switching box 68, which contains control means which have not been shown in detail, is connected to a control circuit 69 controlling the supply of control current to the control means. Switching box 68 has the function of controlling the chocolate rolling mill and the in and out movement of the rollers. A current source 70 is provided and is connected, through the rest contacts 66, when closed, to a line 72 connected to the control means. A line 73 connects the control means with the opposite terminal of current source 70. A signal horn 74 provides an audible signal if the level of the material in trough 15 is too low and, at the same time, signalizes the necessity for resupplying trough 15 with chocolate mass. Horn 74 is connected to a signal circuit 75 which is controlled by closing of the contacts 67. Thus, a conductor 71 connects one side of contacts 67 to one terminal of current source 70, and a conductor 76 connects the other side of contact 67 to horn 74 which, in turn, is connected to the other terminal of source 70.

The described apparatus operates in a manner which will now be set forth. The drive for the chocolate rolling mill is initiated or activated by the control means. Responsive to such activation, the rollers 1 through 5 rotate in the sense indicated by the respective arrows 8 through 12. Rotation of rollers 1 and 2 effects drawing in of chocolate mass from trough 15 through nip 13. The drawing-in causes the formation of a film of chocolate mass on the rollers 1 – 5, and the chocolate mass is thus milled through the gaps 13 and 17 and processed. The processed chocolate mass is stripped from the last roller 5 by means of stripper 18.

When the level of chocolate in trough 15 is very small (low lever) and when slide 24 is closed, sensing levers 34, 36 and control sector or cam 39 assume the rest position, illustrated in the drawing, under the bias of counterweight 37. Pressure line 46 is in communication with control line 50 through valve 38 and return line 48 is closed.

By operation of pump 43, control valve 38 is charged, through pressure line 46, with oil under pressure, and oil under pressure is applied to piston 29 also through control line 50. Thereby, piston 29 is moved gradually in cylinder 28 against the bias of spring 32, so that slide or gate 24 slowly clears the discharge opening of channel 23 to such and extent that some chocolate, to be processed, flows into trough 15 from channel 22 through the discharge opening of channel 23. In so doing, a certain amount of this chocolate mass flows over the edge of supply feeler or sensing lever 36, whereby lever 36, sensing lever 34, segment 39 and counterweight 37 are rocked into the operating or working position 42 illustrated in dot and dash lines.

The chocolate mass then flows first into that portion of trough 15 which is in the region of roller 1, whereby the level feeling or sensing lever 34 is, at first, still in a region which is free of chocolate mass. The angular displacement of control segment 39 reverses control valve 38 to shut off pressure line 46 and connect control line 50 to return line 48. Spring 32 moves piston 29 immediately into the rest position, so that rocking slide or gate 24 immediately closes the discharge opening of channel 23. The oil displaced by piston 29 returns through line 48 to tank 45. The supply of chocolate mass into trough 15 is interrupted immediately. The turning or rotary force acting, from supply sensing lever 36, on pivot axle 35, returns to a zero value due to the interruption of the flow.

Dependent on the flow characteristics, which are inherent in the chocolate mass, on the one hand, and the rotation of roller 1, which is directed from trough 15 toward the drawing in gap or nip 13, on the other hand, the chocolate mass supplied to trough 15 forms, above nip 13, a beadlike material concentration or collection which is distributed over the entire length of nip 13. This mass is, more or less, bead-shaped in cross section, in a damming-up manner, as shown in dot and dash lines in FIG. 1.

Due to the material collection or concentration, level feeler lever 34 remains in the operating or working position 42 to which it has been moved by the supply feeler or sensing lever 36 through axle 35. This is due to the retaining force of the concentration of material. As a result of the drawing-in of the chocolate into the first friction gap or nip 13, and the resulting withdrawal of chocolate mass from trough 15, the level of the mass in the trough is, of course, lowered. Due to the lowering of the level of chocolate in the trough, level sensing lever 34 finally is freed or cleared when a predetermined lower level has been attained, so that the retaining force of the chocolate mass on level feeler lever 34 is no longer effective. By virtue of the rotational bias provided by counterweight 37 to pivot axle 35, the parts are moved back into the rest position illustrated in FIG. 1, with spring 41 biasing control valve 38 back into the rest position to follow the rotation of cam or control segment or sector 39.

If, in spite of slide or gate 24 being open, control valve 38 should remain open for a prolonged period of time, which may be due to no charge of material engaging supply sensing lever 35 and level sensing lever 34, which may occur when there is not a sufficient supply of chocolate mass in supply channel 22, then there flows, from the lower control line 50 which is subjected to the pressure at the output of pump 43, a larger oil volume through flow throttle valve 62 into cylinder 63. This oil or hydraulic fluid volume moves piston 65, in cylinder 63, against the bias of spring 64, to open the rest contacts 66 and engage the operating contacts 67. Due to opening of rest contacts 66, the control means are disconnected from current source 70, and thus movement of rollers 1–5 is interrupted or these rollers are moved to their inoperative position.

Upon closing of switch contacts 67, signal circuit 75 is closed so that horn 74 is connected, through lines or conductors 71 and 76, across current source 70 to signal the lack of chocolate mass in supply channel 22 and also, if applicable, movement of rollers 1–5 into the inoperative position. Due to such movement of the rollers, a dry run, and thus damage to the roller surfaces, can be prevented.

As level feeling lever 34 is oscillatably mounted closely adjacent nip 13, the chocolate mass available above nip 13 is limited to a very small amount. Additionally, the chocolate milling mechanism, due to the advantageous combination of level feeler lever 34 and supply feeler lever 36, can be operated with only a small amount of chocolate mass in the trough 15. Due to the small mass in trough 15, separating out of millable material in trough 15, for example, cacao butter, as previously mentioned, is substantially completely prevented. Thus, the millable material which emanates from a feeding or operating stage can be drawn into gap 13 without any change in composition and is homogeneously milled in the friction gaps or nips 13 and 17. Thus the final products stripped from roller 5 by stripper 18 will have the desired composition during the entire operation and thus will correspond to the desired result in respect to that entire amount of material delivered into the trough.

Since the millable material, very soon after having entered trough 15, effects rocking of supply sensing level 36, the time constant for reversal of control valve 38 is very small. Due to the small time constant, the closing movement of the blocking slide or gate 24 is initiated at the beginning of the flow period. Furthermore since, due to the required small supply material in trough 15, a relatively frequent replenishing feeding is required, also, in the supply channel, there will not be retained the same amount of chocolate supply over a long period of time. By virtue of this, any separating out of components is prevented effectively. Any material remaining in the supply channel is displaced or move out by the frequently supply of new material, so that no portion of the mass will remain undisturbed in the supply channel over a prolonged period of time.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a method of milling pasty material, particularly material having a tendency to separate out components, between at lease one pair of cooperating friction bodies associated with a pouring trough receiving the material from a supply device which can be blocked from the trough in a controlled manner in dependence on the extent to which the tough is filled with the material, the improvement, comprising sensing, in a coordinating manner, both the level of the material in the trough and the flow of the material into the trough; and controlling the blocking of the supply device in accordance with such coordinated sensing.

2. In apparatus for milling pasty material and of the type including at lease one pair of cooperating friction bodies defining a drawing-in gap, a pouring trough associated with the friction bodies, a supply device for discharging the material into the pouring trough, gate means controlling discharge of the material from the supply device to the pouring trough, and a control device actuating the gate means in dependence on the extent to which the trough is filled with the material: an improved control device comprising, in combination, at lease one sensing lever means extending parallel to and above said drawing-in gap; means mounting said sensing lever means for oscillation about a pivot axis; said sensing lever means extending, in said pouring trough, into the region of said drawing-in gap and also into the region of the discharge opening of said supply device; and control elements actuated by said sensing lever means controlling opening and closing of said gate means.

3. Apparatus for milling pasty material, as claimed in claim 2, in which each sensing lever means comprises two sensing levers secured to a pivot shaft for conjoint oscillation; said two sensing levers including a level sensing lever extending from said shaft into the region of said drawing-in gap, and including a supply sensing lever extending into the region of the discharge opening of said supply device.

4. Apparatus for milling pasty material, as claimed in claim 3, in which said level sensing lever, in the region of said drawing-in gap, is provided with an elongated plate extending substantially parallel to said drawing-in gap.

5. Apparatus for milling pasty material, as claimed in claim 3, in which said supply sensing lever has a relatively small edge extension extending substantially parallel to said drawing-in gap.

6. Apparatus for milling pasty material, as claimed in claim 3, in which the free end of said level feeling lever extends into said pouring trough into the range of said drawing-in gap.

7. Apparatus for milling pasty material, as claimed in claim 3, in which said supply feeling lever is arranged in that lateral range of said supply device which is near said drawing-in gap.

8. Apparatus for milling pasty material, as claimed in claim 2, including a shaft forming said pivot axis; each sensing lever means being adjustably secured to said shaft; a pair of laterally spaced structural members of said apparatus oscillatably supporting said shaft and mounting said friction bodies; operating means connected to said gate means to open and close said gate means; an energy supply line connecting said operating means to a supply of operating energy; energy supply switching means incorporated in said energy supply line; and actuating means secured to said shaft and controlling said switching means in accordance with the position of said sensing lever means.

9. Apparatus for milling pasty material, as claimed in claim 8, in which said energy supply is a source of fluid under pressure; said operating means comprising a piston and cylinder device; said switching means comprising a control valve.

10. Apparatus for milling pasty material, as claimed in claim 2, in which said apparatus includes control arrangements controlling driving of said friction bodies and controlling the friction gaps between said friction bodies; a switch controlled by movement of said sensing lever means and included in said control arrangement; said switch, when operated by said sensing lever means, operating through said control arrangement to control said friction bodies to a condition in which they are no longer in effective milling cooperation with each other.

11. Apparatus for milling pasty material, as claimed in claim 10, in which said switch includes contact closing means connected to a piston displaceable in a cylinder; and a fluid pressure medium supply line connecting said cylinder to a source of fluid under pressure.

12. Apparatus for milling pasty material, as claimed in claim 11, in which said switch is controllable with a time delay through the medium of a throttling section in said pressure medium supply line.

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