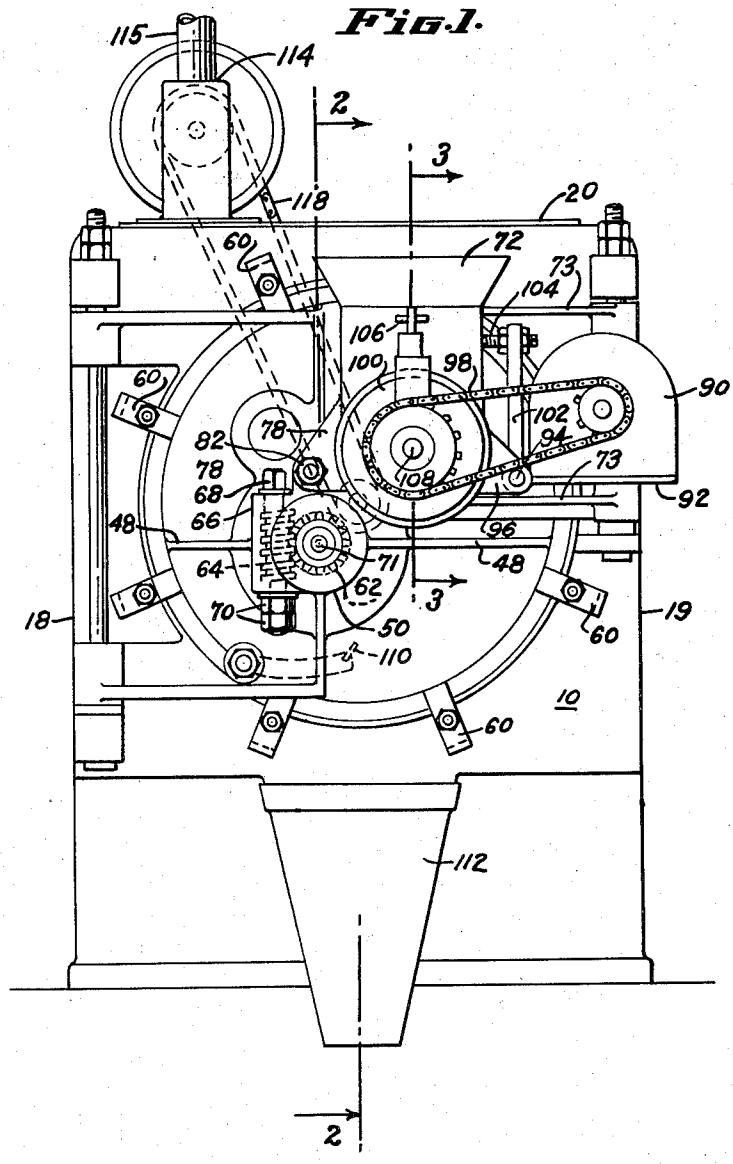
Dec. 7, 1943. E. N. MEAKIN 2,336,114

EXTRUSION MILL

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Fig. 1.



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Fig. 2.

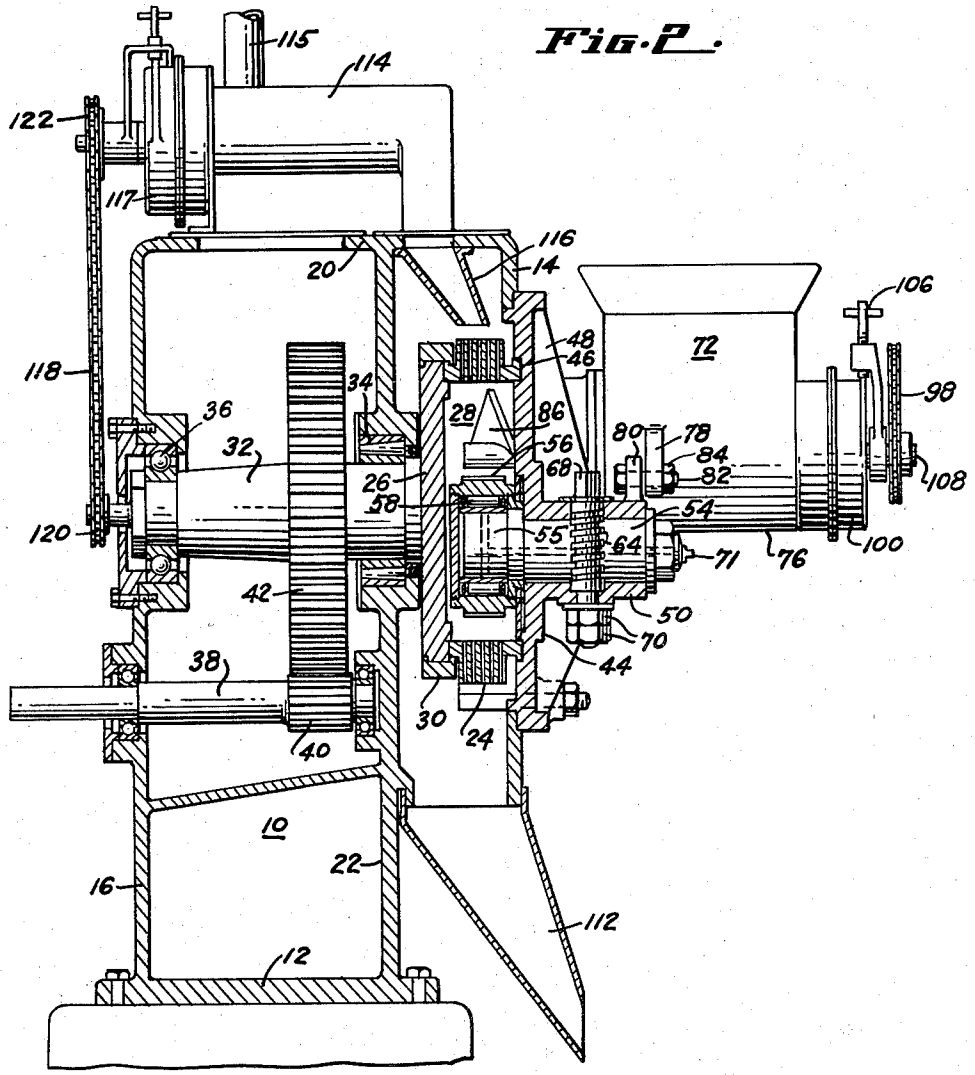
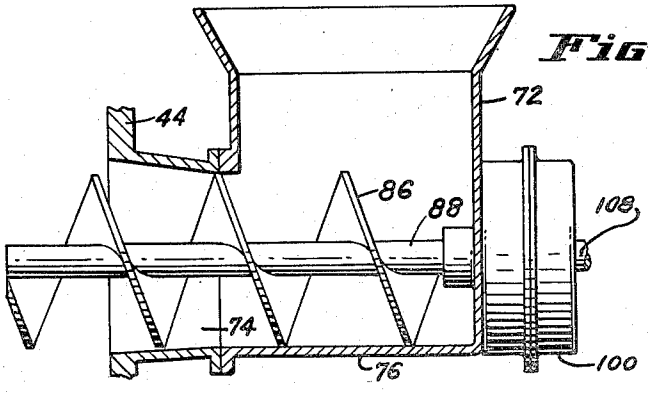


Fig. 3.



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2,336,114

EXTRUSION MILL

Edgar N. Meakin, San Francisco, Calif.

Application November 12, 1941, Serial No. 418,781

16 Claims. (Cl. 107—8)

My invention relates to extrusion mills in general, and more particularly to mills designed for the formation of pellets.

Among the objects of my invention are to provide a novel mill of the extrusion type—

(1) Capable of turning out pellets at a rapid rate,

(2) Adapted to produce a pelleted product incorporating a substantial proportion of molasses or other tacky material as an ingredient,

(3) Adapted to produce a pelleted product incorporating molasses or other tacky ingredient, and which is adapted to dust the same with a non-sticky coating material during the extrusion of the pellets and before they are severed from the die and permitted to mingle with each other,

(4) In which the various components may readily be exposed for cleaning or replacement of parts, and

(5) Adapted during the production of a coated pellet, to maintain the individual pellets more or less isolated from each other during the coating process.

Additional objects of my invention will be brought out in the following description of the same taken in conjunction with the accompanying drawings wherein—

Figure 1 is a front elevational view of my novel mill;

Figure 2 is a view in section on the line 2—2 of Figure 1, leaving certain of the elements in elevation;

Figure 3 is a view, partly in section, taken on the line 3—3 of Figure 1.

My invention in general involves the provision of an extrusion chamber in which the die element is preferably of cylindrical form and constitutes an element of the extrusion chamber, and wherein the extrusion element or roller is mounted upon a hinged door which, when closed, forms one end wall of the extrusion chamber, at the same time supporting the roller in cooperating relationship with the die. Material is fed into the extrusion chamber, preferably through an opening in the door, from a suitable hopper, which hopper is also hingedly supported and adapted to be swung into engagement with the door, with its discharge end protruding through the feed opening in the door.

Where the material to be pelleted, is to include a tacky ingredient such as molasses in substantial proportions, my invention further contemplates the provision of another hopper having a discharge opening directed against the discharge surface of the die, such hopper holding a suitable dusting material which is adapted to coat the pellets with a non-sticky coating prior to their severance from the die and before they have an opportunity to mingle with each other.

In as much as the use of a tacky substance as an ingredient in the material to be pelleted, normally requires frequent cleaning of the parts, including the die and roller as well as the hopper, the manner of supporting the feed hopper and the door to the extrusion chamber on which the roller is mounted, facilitates exposure of the various components of the mill for cleaning purposes, as well as enables a rapid replacement of parts when and if such parts need replacement.

For a more detailed description of my invention, reference will be made to the accompanying drawings. The mill comprises a housing 10 of rectangular shape, including a base 12, a body portion having front, rear and side walls, 14, 16, 18 and 19, respectively, and a top wall or roof 20. A partition 22 intermediate the front and rear walls divides the housing into a front and a rear section. The die 24 is preferably of cylindrical shape and is clamped to a backing disk 26 forming one end wall of the extrusion chamber 28, such clamping being effected by a plurality of clamping elements 30 distributed about the periphery of the disk and die, each of such elements being bolted to the edge of the backing disk and engaging in a peripheral edge groove in said disk and a corresponding groove around the die.

The backing disk is preferably integrally united to one end of the die shaft 32 which extends through the intermediate wall 22 and the rear wall 16 of the housing, and is rotatably supported therein by suitable bearing assemblies 34 and 36 carried by said walls, respectively. The die is thus adapted for rotation and is driven by a prime mover such as an electric motor (not shown), through a suitable speed reduction gear train assembly which includes a drive shaft 38 supported in bearings between the same two walls, and carrying a pinion 40 in driving engagement with a gear 42 mounted on and keyed to the die shaft 32.

The front wall 14 of the housing is provided with an opening therethrough, concentric with and of greater diameter than the entrance to the extrusion chamber. Such opening is adapted to be closed by a door 44 hinged to the front wall of the housing adjacent the front edge of the side wall 18, the door being provided with a circular groove 46 on its inner surface, adapted

to receive the free edge of the cylindrical die when the door is in its closed position, whereby the door not only provides a support for the die, but effects a closure of the extrusion chamber and constitutes an end wall thereof. The circular groove is of sufficient dimensions to permit free rotational movement of the die.

The door is strengthened by a pair of bracing ribs 48 intersecting in an eccentrically located boss 50. This boss has a longitudinal passage therethrough, and supports therein a stub shaft 54 extending into the extrusion chamber. The end 55 of this shaft which lies within the extrusion chamber is eccentric to the shaft proper and carries an extrusion element in the form of a roller 56 mounted on a bearing assembly 58. The location of the boss 50 is such as to bring the roller into cooperating position with the die when the door is swung to its closed position, the door being forcibly retained in such closed position by means of a plurality of clamping elements 60 mounted on the front wall of the housing about the periphery of the door and adapted to be bolted into engagement with the door after the same has been swung to its closed position.

The eccentric end of the roller shaft permits of adjustment of the position of the roller with respect to the die, by a partial rotation of the shaft proper, and in this manner, wear on the part of the roller or die may be compensated for. Such adjustment is effected by providing a series of teeth 62 on the peripheral surface of the shaft 54, and engaging the same with an adjusting worm 64 vertically supported in an offset 66 formed integral with the boss 50. This worm has its upper end 68 squared to receive a suitable wrench for rotating the same, whereby an angular adjustment of the shaft 54 may be effected to realize the necessary adjustment of the roller position. Suitable locking nuts 70 provided at the lower end of the worm, are adapted, when tightened, to hold the worm against accidental turning, so that any adjusted position of the roller can be maintained.

A lubricating duct drilled through the roller shaft 54 connects the bearing assembly of the roller to a lubricating fitting 71 in the center of the exposed end of the shaft, whereby lubrication may be effected, even while the mill is in operation. Suitable leak-proof seals in the roller serve to retain the lubricant in the bearing and preclude leakage thereof into the extrusion chamber.

The material to be extruded is fed from a suitable hopper 72 into the extrusion chamber 28, through an opening 74 in the door, located so as to cause the material to drop to the bottom of the chamber where, due to the rotation of the die, it will be carried toward the roller and extruded. The hopper is carried by a bracket 73 which is hingedly supported on the front wall 14 of the housing, adjacent the front edge of the side wall 19. Thus, the hopper 72 and the door 44 are connected to opposite sides of the front wall.

This hopper has a bottom 76 of trough-shape, terminating in a discharge end which is adapted to line up with the feed opening 74 in the door, when the hopper is swung into functioning position against the door. It is maintained in functioning position by suitable means in the form of a laterally extending perforated lug 78 on the hopper, which is adapted to come to rest and align with a perforated lug 80 on the boss, and these are adapted to be drawn toward each other by means of a tightening bolt 82 extending through the lugs and provided with a suitable nut 84 for tightening the same.

The feeding of the material from the hopper into the extrusion chamber is a forced feeding, accomplished through the use of a feed screw 86 disposed in the trough-shaped bottom of the hopper and terminating at one end within the extrusion chamber. At its other end, it terminates in a shaft 88 through the other end of the hopper for driving connection to a motor 90. This motor is fixedly mounted on a platform 92 which is pivotally secured to the hopper by means of a pivot shaft 94 supported between the bracket 73 and a perforated lug 96 extending laterally from the hopper. A drive connection to the hopper screw is effected through a suitable chain 98 and an adjustable speed reduction device 100, the weight of the motor serving to tension the chain.

An arm 102 extending upwardly from the pivoted edge of the motor platform 92 carries an adjustable stud 104 at its upper end, which is adjusted into contact with the hopper wall to preclude slackening of the chain due to any tendency on the part of the motor to vibrate, or from any other cause.

The speed reduction device 100 is of the type constituting the subject matter of a co-pending application of Edgar T. Meakin, for Speed change mechanism, Serial No. 321,925, filed March 2, 1940, and issued July 7, 1942, as Patent No. 2,288,824. Such device, briefly, comprises a driving shaft 108 to which the chain 98 is connected, a driven shaft which constitutes the feed screw shaft 88, and means for intermittently engaging the screw shaft to the driving shaft, such as by a pawl and ratchet. The adjustment in speed is effected by altering the periods of engagement, through a suitable adjustment of cam means which is included in the speed change mechanism and is controlled through a control handle 106. The details of construction of the speed change mechanism are not disclosed, for an understanding thereof is not essential to the invention of the present case.

Also mounted on the door and carried thereby is a severing knife 110, the blade of which is adjustably held against the outer surface of the die in position to sever the pellets therefrom. Upon severance, the pellets are caught in a chute 112 by which they are guided out of the machine where the pellets may be caught in bags and packed for the market.

The apparatus thus far described is capable of feeding material into the extrusion chamber and forming pellets therefrom, and ordinarily, nothing more is necessary in the production of a pelleted product. However, where the product is of a special nature, such as one which includes a substantial proportion of a tacky or sticky ingredient such as molasses, as an element thereof, it is very desirable to coat the freshly formed pellets with a coating of material of a non-sticky character, which shall serve to preserve the product in its pellet form, at least until the molasses ingredient therein has had a chance to age and harden, and thereby preclude adhesion of pellets one to another during handling.

In the apparatus under description, I provide for this purpose, an additional hopper 114 to receive the coating material, preferably in the form of a powder, which is supplied to the hopper through a feed pipe 115. This hopper is positioned to discharge through an opening in the roof of the housing above the extrusion chamber, and is guided to the outer surface of the die by a

chute 116. In as much as the powdered material may not of its own accord flow freely from the hopper 114 into the space about the outer surface of the die, a feed screw similar to the one incorporated in the first mentioned hopper, is preferably provided, and this is driven through a speed reduction device 117 similar to that associated with the first hopper 72, and a chain 118 connecting a sprocket 120 at the end of the die shaft 32, with a sprocket 122 associated with the speed reduction device.

This hopper arrangement will cause the material to fall upon the extruded material prior to its being severed into pellets, and preferably during the upward movement of such material to assure adequate coating of the exposed ends of the extruded material. Thus, the pellets will have received a substantial preliminary coating prior to severance, which coating is supplemented by the mingling of the severed pellets with the excess coating material during their passage down the chute, from which they may be discharged into suitable containers or bags for the market.

When the pellets to be formed call for the application of a heavier or more thorough coating of material, the pellets are preferably discharged from the chute 112 into an inclined tumbler or dusting reel (not shown) before packing the same for shipment. Under such circumstances, all excess coating material will be discharged into the dusting reel along with the pellets and a more thorough coating will be realized.

It is important to note that from the moment the pellets are severed from the die till they are discharged either from the chute 112 or the inclined tumbler or dusting reel, they are in continuous transitory movement. This serves to more or less isolate the individual pellets during mingling with the coating material; and prior to severance from the die, the pellets are also isolated from each other. Thus, throughout the coating process, the individual pellets have an opportunity to become thoroughly and completely coated before they have a chance to contact one another. This will assure a minimum of adhesion between pellets in the marketable product.

From the above description of my invention, it will be apparent that it fulfills all the objects thereof as previously set forth. Accordingly, while I have described one embodiment in detail, I do not desire to be limited in my protection, except as may be necessitated by the appended claims.

I claim:

1. An extrusion mill comprising a die, an extrusion element for cooperation with said die in the extrusion of material therethrough, and a hinged member for carrying and supporting said extrusion element to enable said extrusion element to be swung from its operating position with respect to said die, to a position of access thereto.

2. An extrusion mill comprising a die, a roller for cooperation with said die in the extrusion of material therethrough, and a hinged member for carrying and supporting said roller to enable said roller to be swung from its operating position with respect to said die, to a position of access thereto.

3. An extrusion mill comprising an extrusion chamber including a die as an element thereof, said extrusion chamber having a feed opening through a wall thereof, a roller supported in said extrusion chamber for cooperation with said die in the extrusion of material therethrough, and a feed hopper hingedly secured with respect to said chamber and having a discharge end adapted to register with said feed opening when said hopper is swung to feeding position, and means for holding said hopper in said feeding position with its discharge end in position to feed material into said chamber.

4. An extrusion mill comprising a rotatable cylindrical die, means supporting said die with its axis substantially horizontal, an extrusion element for cooperation with said die in the extrusion of material therethrough, and means for discharging a coating material toward the material extruded from said die during rotation thereof and prior to severance of said material from said die, as pellets.

5. An extrusion mill comprising an extrusion chamber including a die as an element thereof, an extrusion element for cooperation with said die in the extrusion of material therethrough, and a door to said chamber for supporting said extrusion element in cooperating position with respect to said die, said door being hingedly secured with respect to said chamber to enable withdrawal of said extrusion element from said cooperating position upon opening of said door.

6. An extrusion mill comprising a cylindrical extrusion chamber including a cylindrical die as an element thereof and having an open end thereto, an extrusion element for cooperation with said die in the extrusion of material therethrough, a hingedly secured door adapted to close the open end to said chamber, and means for supporting said extrusion element on said door in cooperating position with respect to said die, when said door is in its closed position.

7. An extrusion mill comprising an extrusion chamber including a rotatable cylindrical die as an element thereof, an extrusion roller for cooperation with said die in the extrusion of material therethrough, a door to said chamber for supporting said extrusion roller in cooperating position with respect to said die, said door being hingedly secured to said chamber to enable withdrawal of said roller from said cooperating position upon opening of said door, and means for adjusting said roller relative to said die to compensate for wear of said roller and die.

8. An extrusion mill comprising an extrusion chamber including a die as an element thereof, an extrusion element for cooperation with said die in the extrusion of material therethrough, a door to said chamber for supporting said extrusion element in cooperating position with respect to said die, said door having a feed opening therethrough into said extrusion chamber, and a feed hopper hingedly secured with respect to said door and having a discharge opening adapted to register with said feed opening when said hopper is swung to feeding position.

9. An extrusion mill comprising an extrusion chamber including a die as an element thereof; a door hingedly supported with respect to said extrusion chamber to close an end thereof, said door having a feed opening therethrough into said extrusion chamber; a roller supported by said door in cooperating relationship to said die and adapted to be withdrawn from said cooperating position upon opening of said door; and feed means hingedly secured with respect to said chamber and adapted to be moved into registry with the feed opening through said door, when said door is in its closed position.

10. An extrusion mill comprising a cylindrical extrusion chamber including a cylindrical

die as an element thereof; a door to said extrusion chamber, said door having a feed opening therethrough into said extrusion chamber; a roller supported by said door in cooperating relationship to said die and adapted to be withdrawn from said cooperating position upon opening of said door; and feed means hingedly secured with respect to said chamber and adapted to be moved into registry with the feed opening through said door, when said door is in its closed position.

11. An extrusion mill comprising an extrusion chamber including a rotatable die as an element thereof; a door hingedly secured to said chamber to close an end thereof, said door having a feed opening therethrough into said extrusion chamber; a roller supported by said door in cooperating relationship to said die and adapted to be withdrawn from said cooperating position upon opening of said door; feed means hingedly secured to said chamber and adapted to be moved into registry with the feed opening through said door, when said door is in its closed position; and means for discharging a coating or similar material against that surface of said die from which extruded material emerges.

12. An extrusion mill comprising a cylindrical extrusion chamber including a cylindrical die as an element thereof; a door hingedly secured to said chamber to close an end thereof, said door having a feed opening therethrough into said extrusion chamber; a roller supported by said door in cooperating relationship to said die and adapted to be withdrawn from said cooperating position upon opening of said door; feed means hingedly secured to said chamber and adapted to be moved into registry with the feed opening through said door, when said door is in its closed position; and means for creating an atmosphere of coating material adjacent that surface of said die from which extruded material emerges.

13. An extrusion mill comprising a die and an extrusion element in cooperative relationship to said die whereby to extrude moldable material therethrough, means for severing such extruded material to produce pellets therefrom, and means for applying a coating material to the extruded material prior to severance of such material from the die.

14. An extrusion mill comprising a die and an extrusion element, said die and extrusion element being movable with respect to each other whereby to extrude moldable material through said die, means for severing such extruded material to produce pellets therefrom, and means for applying a coating material to the extruded material during such relative movement and prior to severance of such material.

15. An extrusion mill comprising a die and an extrusion element in cooperative relationship to said die whereby to extrude moldable material therethrough, means for severing such extruded material to produce pellets therefrom, and means for applying a coating material to the extruded material prior to severance of such material.

16. An extrusion mill comprising an extrusion chamber including a cylindrical die normally closed at one end, means supporting said die at the closed end thereof, and a hinged door swingable into engagement with the open end of said cylindrical die, said door having a circular groove in the surface thereof to register with and receive the free edge of said die and provide support therefor.

EDGAR N. MEAKIN.