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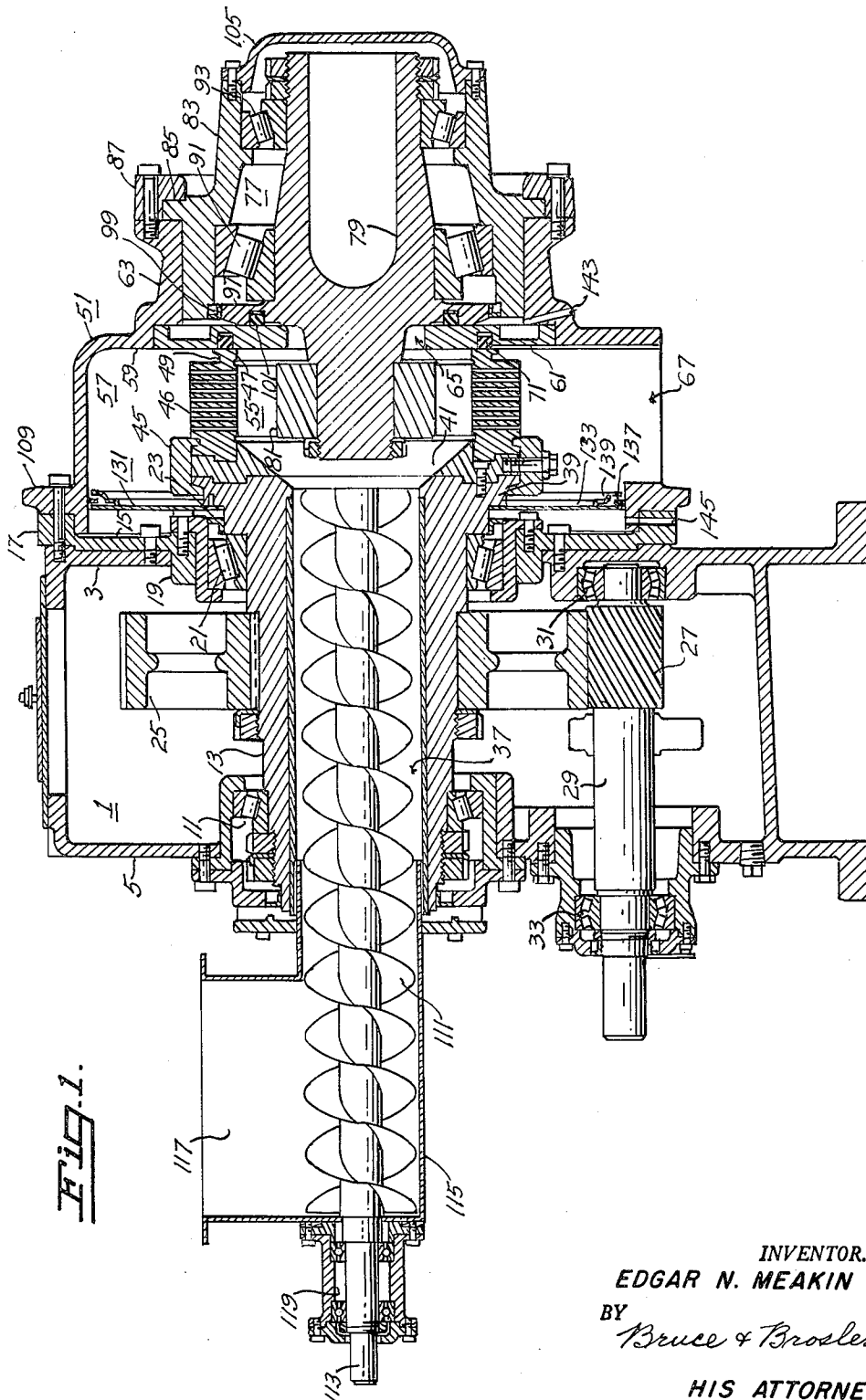
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3,010,150

CONTAMINATION FREE EXTRUSION MILL

Filed July 14, 1959

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

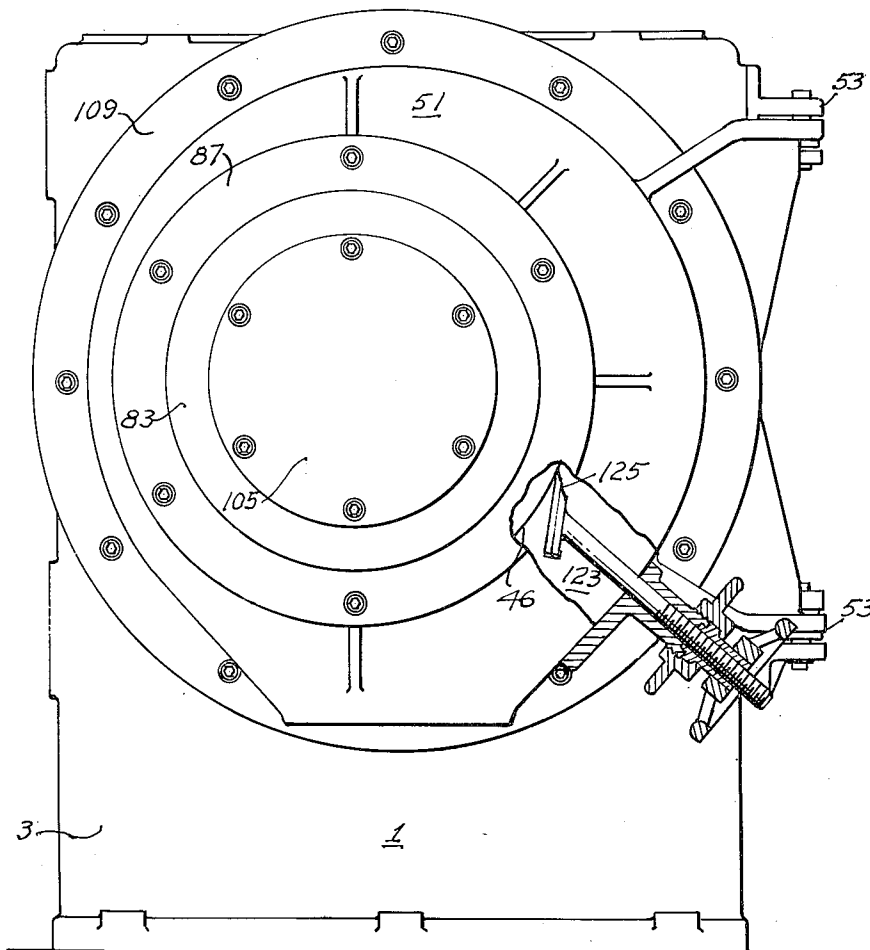


Fig. 2.

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CONTAMINATION FREE EXTRUSION MILL
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 6 Claims. (Cl. 18-12)

My invention relates to extrusion apparatus and more particularly to a mill for the pelleting of extrudable material.

In the pelleting of material, where such material is of a finely divided nature, lubrication problems often arise, due to the fact that lubrication seals are not wholly immune to penetration by such finely divided material, and ultimately, servicing of the machine becomes necessary.

Further, certain materials, as a pelleted product, must retain their initial purity, and contamination by oil from bearings in the machine cannot be tolerated.

Conventional pellet mill design offers no solution to these problems.

Among the objects of my invention are:

(1) To provide a novel and improved extrusion mill adapted for use in pelleting of finely divided extrudable material;

(2) To provide a novel and improved extrusion mill which will minimize the probability of interference with lubrication through leakage of the extrudable material past the lubrication seals;

(3) To provide a novel and improved extrusion mill which will minimize contamination of the extrudable material through leakage of lubricating oil from the bearings of such machine.

Additional objects of my invention will be brought out in the following description of a preferred embodiment of the same, taken in conjunction with the accompanying drawings, wherein;

FIG. 1 is a vertical view in section through a machine embodying the present invention;

FIG. 2 is a front elevational view of the same, partly broken away to expose a detail therefor.

Referring to the drawings for details of my invention in its preferred form, the extrusion mill depicted therein comprises a housing 1 having a front wall 3 and a rear wall 5, each of which walls has a shaft opening therethrough, with the opening in the front wall of substantially greater diameter than that of the rear wall.

Mounted within the shaft opening of the rear wall is a bearing assembly 11 to support the tail end of a drive shaft 13 while to the front wall, is affixed a face plate 15 having a forwardly directed peripheral rim 17 and a rearwardly directed flange 19 extending into the shaft opening of the front wall, in which to mount a front bearing assembly 21 to support the front end of such drive shaft, such bearing assembly including a seal 23.

Intermediate the bearing assemblies 11 and 21 and mounted on the drive shaft 13 is a drive gear 25 in engagement with a drive pinion 27 carried by a shaft 29 supported in bearing assemblies 31, 33 carried by the front and rear walls respectively.

The drive shaft 13 is of hollow construction providing an axial passage 37 therethrough, the shaft itself being of an increasing outside diameter toward its front end, where it terminates in an outside flange 39 and the passage ends in a conical discharge outlet 41.

Removably affixed to the front end of the drive shaft 13 by a suitable conventional clamping ring 45, is a ring die 46 which will rotate with the drive shaft. This ring die is preferably formed at its free end in a frontal rib 47 having a groove 49 along the base of such rib.

A chamber type door 51 mounted on hinges 53 along a front vertical edge of the machine housing, is adapted

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in its closed position, to enclose the ring die 46 and engage the free edge of said die to complete a die chamber 55, and at the same time mesh with the flanged face plate to provide for an extruded product chamber 57 about the die.

The door is basically cylindrical in shape and includes a front circular wall 59 having an insert 61 eccentrically located therein and bounded by a cylindrical flange 63, said insert having a shaft opening 65 concentric with the cylindrical flange 63 but eccentric to the axis of the die chamber. At its lower end, the door has a discharge opening 67 through which is discharged the extruded product of the machine.

Along the circle of contact with the free edge of the die, the door insert carries a spring pressured ring seal 71 in a groove provided for such seal.

The cylindrical flange on the front wall of the door constitutes means for supporting a bearing assembly 77 externally of the machine, in which to rotatably mount a shaft 79 which extends through the opening 65 in the door and into the die chamber, where it mounts an extrusion element 81 in the form of a roll.

The roll shaft bearing assembly 77 includes an outer bearing shell 83 adapted to smoothly fit within the cylindrical flange 63, said outer shell being provided with an intermediate outside flange 85 adapted to engage the exposed end of the cylindrical flange where, by means of a clamping ring 87, the bearing assembly may be securely retained in position. Longitudinally spaced bearings 91, 93 within the outer shell 83 support the roll shaft in proper aligned position.

Adjacent the surface of the door, the roll shaft is formed with a laterally extending flange 97. Between the peripheral edge of this flange and the outer shell 83 of the bearing assembly, is a leak seal 99 while mounted in a groove in the face of the flange, is a spring pressured ring seal 101 maintained in frictional contact with the door insert.

An end cap 105 bolted to the outer shell, permits, in conjunction with the leak seal 99, of the retention of lubricant in the bearing assembly 77.

The roll is preferably keyed or otherwise affixed against rotation on the shaft, and is adjustable into and out of extrusion contact with the die, by making the outer shell 83 of the bearing assembly, of gradually varying thickness, whereby the roll shaft will be eccentrically disposed with respect to the outside diameter of the outer shell. Upon loosening the clamping ring 87, the entire bearing assembly 77 can then be angularly rotated sufficiently to adjust the roll with respect to the die, and when properly adjusted, its position may be fixed by again tightening the clamping ring.

To relieve the strain placed on the door hinges by reason of the combined weight of the door and mounted bearing assembly and roll shaft, a peripheral flange 109 on the door adapted to abut the rim 17 of the face plate, permits of the door, in its closed position, to be bolted to the front wall of the machine housing.

Material to be extruded, is fed into the die chamber through the hollow drive shaft 13 by means of a feed screw 111 lying within the hollow shaft and protruding beyond the tail end thereof where it terminates in a stub shaft 113 for coupling the screw to a source of drive power. A screw housing 115 for the exposed end of the feed screw, includes a feed hopper 117, and enters at one end, the drive shaft passage to guard against loss of material being fed from the screw housing. A bearing assembly 119 for the drive end of the screw is affixed to a wall of the screw housing.

Material fed into the die chamber, will accordingly be

extruded through the ring die and emerge therefrom as strings of extruded material which may be severed into pellets by a knife assembly 123 adjustably mounted in the cylindrical wall of the door, with the knife component 125 held in substantial contact with the discharge side of the die.

The material to be extruded is loaded into the hopper 117 of the screw housing and fed by the rotating screw 111 through the hollow drive shaft 13 from which it is discharged into the die chamber 55 and then extruded through the die from which the extruded material is severed into pellets and discharged through the lower opening 67 in the door.

Movement of the extrudable material into the die chamber will cause some of the material to pile up against the door and more specifically the insert 61 in the front wall of the door and around the exposed end of the roll shaft 79, but escape of such material from the die chamber at this point is discouraged by the ring seal 101 in the flange of the roll shaft.

In like manner, pellet dust or other fines created in the extrusion chamber 57 are blocked from filtering back into the die chamber 55 by the similar ring seal 71 in the engaging side of the front door insert.

Access of such dust or fines from the extrusion chamber to the region of front supporting bearing assembly 21 for the drive shaft, is avoided by the provision of a blocking wall assembly 131 including a blocking wall 133 affixed to the flange 39 at the front end of the drive shaft 13 and extending substantially to the inner peripheral wall surface of the extrusion chamber 57. Adjacent the front surface of this blocking wall and affixed to the inner peripheral surface of the extrusion chamber, is a ring or rib 137 which will block movement of dust or fines by the free edge of the blocking wall along the inner surface of the extrusion chamber. To discourage escape of dust or small particles by way of the extremely narrow space between the blocking wall 133 and the rib 137, a shroud 139 of ring shape is affixed to the blocking wall and in overhanging relationship to the rib.

The aforementioned seal means 101, 71 and 131 serve to preclude contamination of the lubricating oil in the bearings of the machine by the material under extrusion.

Contamination of the material itself by oil employed in lubricating the bearings of the machine, is precluded primarily by the design of the machine which enables the bearing assemblies to be located outside of the die chamber and extrusion chamber, whereby, even should one of the lubrication seals 23 or 99 go bad, leakage of oil from the associated bearing assemblies is not likely to result in such oil finding its way into the die chamber or into the extrusion chamber to contaminate the material.

To further minimize probable contamination of the material by such lubricating oil in the event of a leaky seal, escape openings are provided to permit such oil to discharge from the machine and not accumulate therein. One or more such escape openings 143 are located in the door at the junction of the cylindrical flange 63 with the front wall thereof, while a similar discharge opening or openings 145 are provided through the cooperating rim portions of the face plate 15 and the door at the lowermost point thereof.

While only one extrusion roll is provided for in the above embodiment of the invention, as many may be incorporated as the door can accommodate.

From the foregoing, it will be apparent that the extrusion mill of the present invention will fulfill all the objects attributable thereto and while I have disclosed my invention in its preferred form, it will be apparent that the same is subject to change and modification without departing from the underlying principles involved. I accordingly do not desire to be limited in my protection to the specific details illustrated and described except as may be necessitated by the appended claims.

I claim:

1. An extrusion mill comprising a housing having front and rear walls, a hollow shaft rotatably supported by said walls and extending beyond said front wall, a ring die carried on an end of said hollow shaft beyond and adjacent said front wall, a door hinged to said housing and adapted to enclose said die and engage the edge thereof to complete a die chamber, extrusion means within said die chamber carried by said door and adapted for withdrawal with opening of said door, and means for feeding extrudable material through said hollow shaft into said die chamber for extrusion through said die.

2. An extrusion mill comprising a housing having front and rear walls, a hollow shaft rotatably supported by said walls and having a flange at one end beyond and adjacent said front wall, a ring die carried by said flange, a door hinged to said housing and adapted to enclose said die and engage the edge thereof to complete a die chamber, extrusion means within said die chamber carried by said door and adapted for withdrawal with opening of said door, and means for feeding extrudable material through said hollow shaft into said die chamber for extrusion through said die, said feed means including a feed screw lying within said hollow shaft and extending beyond the other end thereof, and a feed screw housing for the extended portion of said feed screw, said screw housing including a feed hopper, and means for rotating said hollow shaft and said feed screw.

3. An extrusion mill comprising a housing having front and rear walls, a hollow shaft rotatably supported by said walls and having a flange at one end beyond and adjacent said front wall, a ring die carried by said flange, a chamber type door hinged to said housing and adapted to enclose said die to form an extruded product chamber thereabout and to engage the edge of said die to complete a die chamber, extrusion means within said die chamber, means for feeding extrudable material through said hollow shaft into said die chamber for extrusion through said die, and means for protecting the rotatable shaft supporting means of said front wall from material in said extruded product chamber, said protecting means including a blocking wall affixed to said flange and extending substantially to the inner peripheral wall surface of said extrusion chamber, a rib along said inner peripheral wall surface adjacent said blocking wall, and a shroud on said blocking wall overhanging said rib.

4. An extrusion mill comprising a housing having front and rear walls, a hollow shaft rotatably supported by said walls and extending beyond said front wall, a ring die carried on an end of said shaft beyond and adjacent said front wall, a door hinged to said housing and adapted to enclose said die and engage the edge thereof to complete a die chamber, extrusion means within said die chamber, said extrusion means including a roll fixedly secured to a shaft extending through said door, bearing means carried by said door externally of said die chamber for rotatably supporting said roll shaft, and means for feeding extrudable material through said hollow shaft into said die chamber for extrusion through said die.

5. An extrusion mill comprising a housing having front and rear walls; a bearing assembly in said front wall; a bearing assembly in said rear wall in alignment with said first bearing assembly; a hollow shaft passing through and supported by said bearing assemblies; said hollow shaft having a flange at one end beyond and adjacent said front wall; a ring die carried by said flange; a chamber type door hinged to said housing and adapted to enclose said ring die and engage the edge of said die to complete a die chamber and at the same time form an extruded product chamber about said die, said door having an external cylindrical flange on the front wall thereof and an insert in the front wall having an opening concentric with said cylindrical flange and a discharge opening at the lower end of said door; extrusion means supported with-

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in said cylindrical flange and extending through said door opening into said die chamber, said extrusion means including a sleeve fitting into said cylindrical flange and removably secured therein, spaced bearings within said sleeve, a shaft journaled in said bearings and extending into said die chamber, and an extrusion roll affixed to said shaft within said die chamber, said shaft having a flange adjacent said door; leak seal means between the edge of said shaft flange and said sleeve and between said shaft flange and said door insert; said door, at the lowermost point of the junction of said cylindrical flange and door insert, having a passage for discharge of material escaping past said seals; and means for feeding extrudable material into said die chamber, said means including a feed screw lying within said hollow shaft and protruding beyond the back wall supported end of said hollow shaft, and a screw housing for the extended portion of said feed screw.

6. A pellet mill comprising a cylindrical die, means rotatably supporting said die at one end thereof, a closure for the opposite end of said die, an extrusion roll

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supporting shaft journaled in said closure with the roll supporting end of shaft terminating within said die and the opposite end terminating in said closure, an extrusion roll fixedly mounted on said shaft within said die and in extrusion engagement therewith, means for driving said die, and means for adjusting said extrusion roll with respect to the proximate surface of said die, said adjusting means comprising a bearing housing on said closure, a bearing assembly in said bearing housing and including an angularly adjustable eccentric bushing and spaced roller bearings surrounding the associated roll supporting shaft within said eccentric bushing, whereby angular rotation of said eccentric bushing will shift slightly the included roll supporting shaft.

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