

Oct. 2, 1956

C. D. FISHER

2,764,951

PELLET MILL

Filed April 25, 1952

2 Sheets-Sheet 1

FIG-1

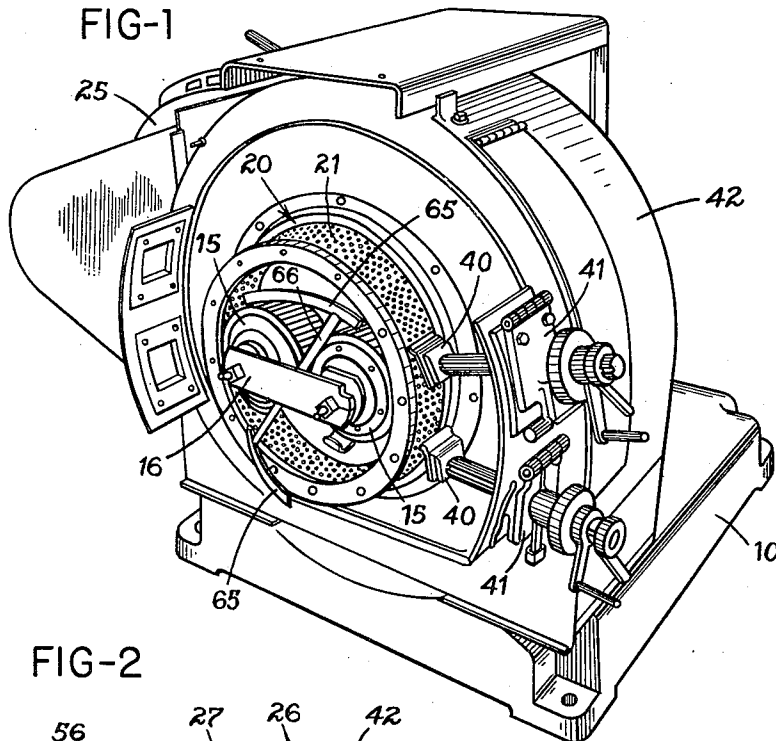
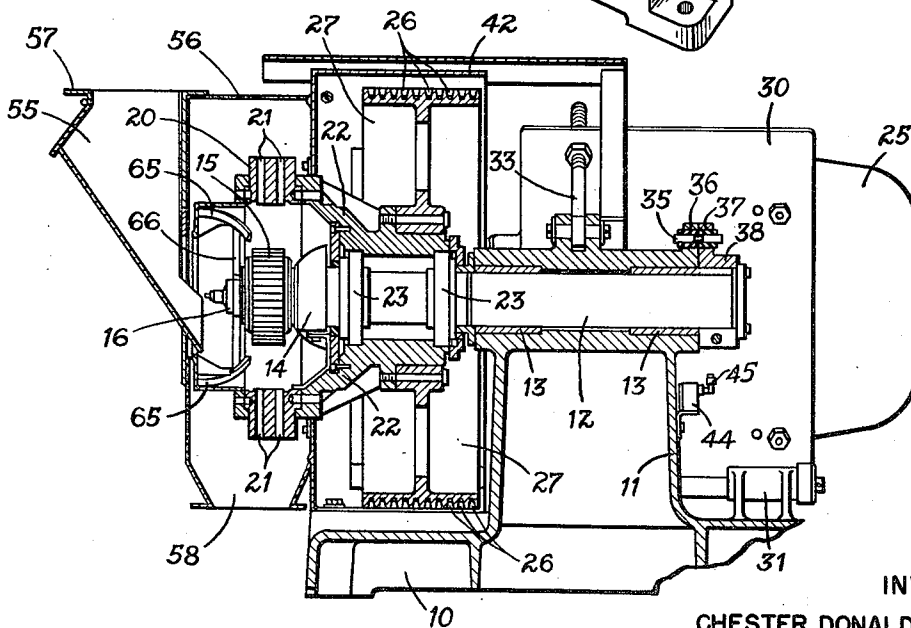


FIG-2



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2 Sheets-Sheet 2

FIG-3

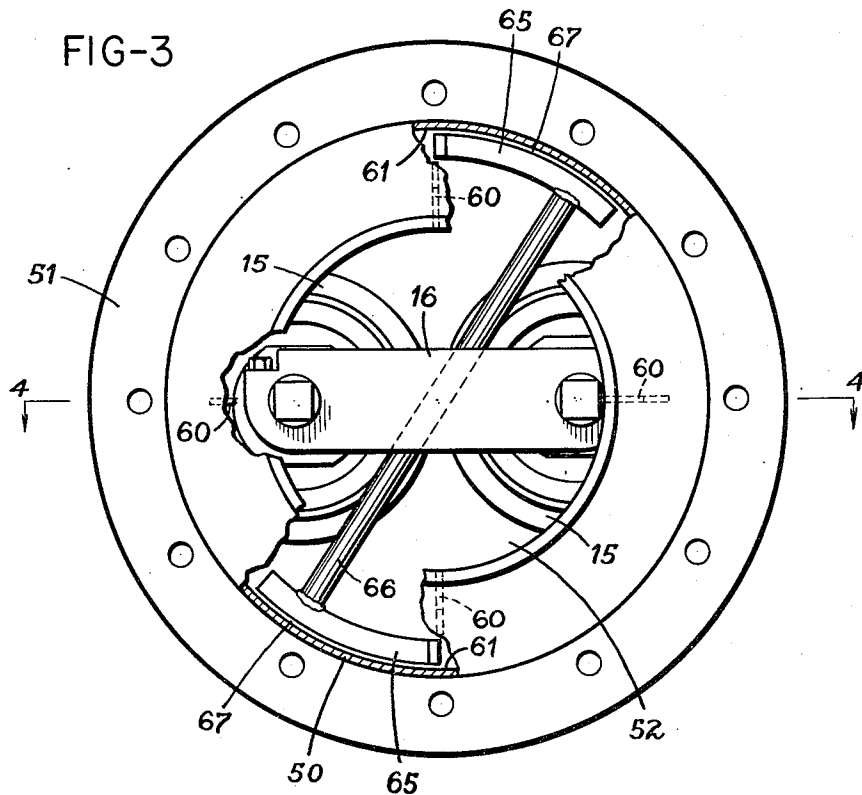
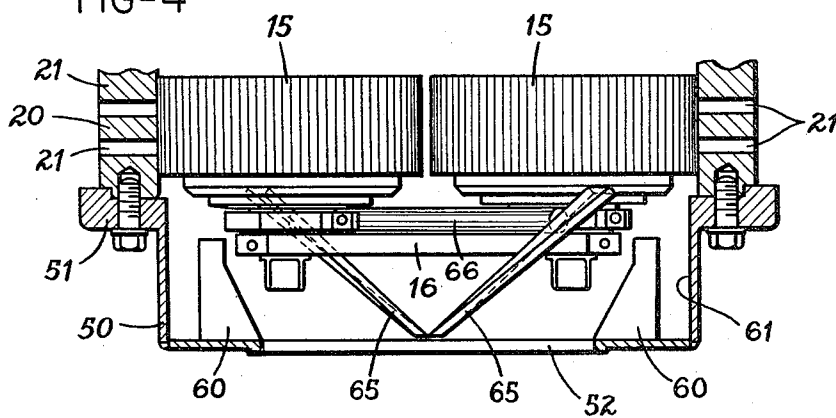


FIG-4



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2,764,951

## PELLET MILL

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Application April 25, 1952, Serial No. 284,431

8 Claims. (Cl. 107-14)

This invention relates to pellet mills of the type employing a perforated annular die and a plurality of rolls mounted within the die for forcing the material to be pelleted through the perforations in the die.

The invention has special relation to pellet mills wherein the die is mounted for rotation on a horizontal axis and the rollers are mounted on a stationary support within the die. In operation, a damp, soggy mass of grain or other material to be pelleted is introduced into the interior of the die, and as the latter rotates, it carries the material through the nips formed by its inner surface and the rollers, thus forcing the material through the perforations or extrusion openings in the die. Knives are mounted adjacent the outer surface of the die to cut off the extruded material in the form of pellets of the proper length, which may then be dried for packaging.

It is common practice with pellet mills of this general type to feed the material to be pelleted into the interior of the die through an end cover, which may rotate with the die, and the rotation of the die causes this material to be carried with it into the nips between the rollers and the die for pelleting. However, if the feed is by gravity action through the cover, as is a convenient arrangement, there is a tendency for unequal distribution of the material between the respective rollers. Thus since the entering material tends to fall into the lower portion of the die, it is carried up by the rotating die so that the larger portion is acted on at the nip of the die with the first roller, and the result is to reduce the capacity of the mill as well as often to cause uneven wear of the respective rollers.

It is accordingly the primary object of the present invention to provide a pellet mill construction such that material fed into the rotating annular die is distributed equally to the respective pelleting rollers within the die in such manner as to promote maximum capacity for the pellet mill and also correspondingly to effect even distribution of wear between the respective rollers.

In accordance with the invention, the annular perforated die is provided with a cylindrical cover attached thereto for rotation therewith, and this cover has a feeding opening through approximately the center thereof for admitting the material to be pelleted to the interior of the die. In order to distribute this material equally between the upper and lower portions of the die, and thus to effect the desired even distribution of the material between the rollers, guide or scraper members are provided which extend into the cover but which remain stationary and do not rotate with the cover, there being one of these guide members opposite each space between adjacent rollers. These guide members are formed to lie close to the rotating surface of the cover, and they are curved to have an action similar to that of a screw conveyor with respect to the rotating material in the cover. Thus as the rotating cover throws the material against the guide members, the material is caused to travel axially into the interior of the die, and with one guide member located in advance of each of the stationarily mounted

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rollers, the desired equal conveying of the material to the respective rollers is obtained. The inside of the cover may be provided with one or more axially projecting paddle members located radially inwardly of the stationary guide members to engage the material being fed to the die and thus to urge it positively into engagement with the stationary guide members which are located radially outwardly of the paddles and have a close running clearance with respect to the cylindrical cover.

One of the objects of the invention is therefore to provide a pellet mill in which guide members mounted in stationary relation with the rollers extend into the interior of a cover mounted for rotation with the perforate die and cooperate with the rotating cover to convey the material to be pelleted towards the inner surface of the die in substantially equally distributed positions between the respective rollers and thus to maintain maximum capacity for the pellet mill.

It is also an object of the invention to provide such a pellet mill in which the guide members are carried by a stationary tie bar extending between the axially outer ends of the rollers and in which the guide members are formed similarly to a section of a screw conveyor and lie opposite the spaces in advance of each roller for cooperation with the rotating cover of the die to effect even distribution of the material to be pelleted between the rollers.

Other objects and advantages of the present invention will be apparent from the following description, the accompanying drawings, and the appended claims.

In the drawings:

Fig. 1 is a perspective view of a pellet mill constructed in accordance with the invention and having the cover and outer housing for the die removed;

Fig. 2 is a view in vertical section through the pellet mill of Fig. 1 with the die cover and feed spout in place;

Fig. 3 is an elevational view of the die unit of the pellet mill of Figs. 1 and 2 looking from left to right in Fig. 2 with the feed spout removed and with portions of the cover broken away to show the internal construction; and

Fig. 4 is a fragmentary section on the line 4-4 of Fig. 3.

Referring to the drawings, which illustrate a preferred embodiment of the invention, the base 10 includes a stand 11 in which a shaft 12 is mounted at its rearward end by bushings 13. At the forward end of the shaft 12 is the fork 14 which forms the support for the shaft portions of two rollers 15, and the shaft 12 is normally held stationary in such position that the fork 14 extends horizontally to support the rollers 15 in side by side relation in a substantially horizontal plane. A tie bar 16 extends between the forward ends of the rollers to maintain them in proper parallel alignment.

The annular die 20 having multiple perforations 21 therethrough is bolted to a housing 22 mounted for free rotation on shaft 12, as by means of bearings 23. The drive motor for rotating die 20 is shown at 25, and its shaft carries a pulley (not shown) connected through belts 26 with a large pulley 27 pinned or otherwise secured to the housing 22 which carries die 20. The motor 25 is shown as carried by a plate 30 hinged at 31 on base 10 and provided with a threaded rod 33 for adjusting the tension of belts 26. The shaft 12 is shown as normally held stationary in stand 11 by means of a shear pin 35 carried by a boss portion 36 of the stand and a similar boss portion 37 of a shear pin collar 38 keyed or otherwise secured to the shaft.

In normal operation, rotation of the die 20 causes material supplied to the interior to be carried into the nips formed by the inner surface of the die and the rollers 15, and this material is thus forced through the

perforations 21 to the outside of the die, where it is cut off in the form of pellets by means of the knives 40 shown as mounted on brackets 41 on the belt guard housing 42 carried by base 10. If in the illustrated construction the shaft 12 should begin to rotate instead of remaining stationary, as a result of breakage of the shear pin 35, the shear pin collar 38 will rotate with the shaft and operate a microswitch 44 mounted on the stand 11. As shown, the switch 44 has the usual movable switch arm 45 which extends into the path of rotary movement of the boss portion 37 of collar 38, and the switch 44 is so connected in the operating circuits for the motor 25 that the motor is shut off when the switch arm 45 is thus engaged by the boss portion 37.

A cylindrical cover 50 for the die 20 includes a flange portion 51 by which it is bolted to the front face of die 20 for rotation with the die. The cover 50 has a circular opening 52 through the outer end thereof which receives the material to be pelleted from a feed spout or hopper 55 carried by the outer housing 56 for the die which is suitably secured to housing 42. The spout 55 is fitted at 57 for attachment to any suitable supply means for the material to be pelleted, and the housing 56 has a discharge spout 58 at its lower end for the pellets cut off by knives 40.

The rotating die cover 50 carries a plurality of paddle members 60 which are secured to the inner surface of its outer end portion and project axially towards the die but terminate in a plane spaced forwardly from the outer end face of the die 20. These paddle members are shown as arranged radially with respect to the axis of die 20 and cover 50, and thus as the die and cover rotate, they act to throw the materials received from spout 55 towards the inner surface 61 of cover 50, it being noted that the radially outer edges of the paddle 60 are spaced inwardly from the surface 61 by an appreciable margin, for example approximately one inch in the case of a cover having an overall diameter of approximately 16 inches.

With the construction and arrangement of the cover 50 as thus far described, material to be pelleted which is fed in through the spout 55 tends to be distributed unequally between the rollers 15, with the major proportion of the material normally being deposited in the space within the lower part of the die below the rollers 15 and tie bar 16, presumably as a result of gravity action. Under these conditions and with the die rotating in clockwise direction as viewed in Fig. 3, it will be seen that this major proportion of the material will be operated on at the nip of the inner surface of the die with the roller to the left in Fig. 3, which is the first roller encountered by the material being carried upwardly in the die. This in turn tends to reduce the capacity of the device as a whole, since maximum capacity is obtained with equal feed to both rollers, and also to cause uneven wear of the two rollers, the roller to the left in Fig. 3 being subjected to materially increased wear as compared with the other roller, and the principal object of the present invention is to obtain maximum capacity for the mill by establishing effectively uniform distribution of the material to be pelleted between the two rollers 15, which also has the effect of eliminating this uneven wear condition.

This desired result is obtained in accordance with the invention by the provision of stationary guide or scraper members within cover 50 which act as conveyors with respect to the material rotating with the cover in such manner as to separate this material into major portions of substantially equal size and to guide one of these separated portions into each of the spaces between the rollers, i. e., the spaces above the tie bar 16 as well as the space below it in the illustrated construction. Guide members 65 having these operating characteristics are shown in the drawings as located respectively above and below the level of tie bar 16, and they are secured to opposite ends of a supporting rod or bar 66 which is in

turn welded or otherwise secured to tie bar 16 to support guide members 65 in stationary relation with the base of the machine.

In a pellet mill of the construction and proportions noted above, satisfactory results have been obtained with each of the guide members 65 constructed of bar stock of rectangular section approximately  $\frac{1}{4}$  inch thick and  $\frac{3}{4}$  inch wide, and each guide member is curved similarly to a section of a screw conveyor. In addition, each guide member 65 is so arranged with respect to its supporting parts that it extends axially through the cylindrical portion of the cover 50 in inclined relation with the axis of rotation of the cover and with its outer surface substantially concentric with the inner surface portion 61 of the cover but spaced inwardly therefrom by a sufficient amount to assure running clearance at 67, for example approximately  $\frac{1}{16}$  inch.

With the guide members 65 constructed and mounted as described to extend into the radial clearance spaces between paddles 60 and the cover surface 61, and with the bottom guide member located as shown on substantially the bottom center line of the device, then as the cylindrical cover rotates, substantially one-half of the entering ingredients engage the bottom guide member and are flung by the paddles 60 against and along this guide member up to the left hand roller 15 as viewed in Fig. 3. The remaining one-half of the ingredients miss the bottom guide member 65 but are forcibly flung against the inner surface 61 of the rotating cylindrical cover and are thus carried by centrifugal force to the top guide member 65 by which they are positively conveyed to the right hand roller 15. Thus with the entering ingredients equally distributed to the two rollers, both rollers operate on substantially the same amounts of material in order to obtain maximum capacity for the apparatus as a whole, and this equal action of the rollers has the further desirable effect of effectively equalizing the wear thereon and thus promoting the operating life of the apparatus before servicing is required.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a plurality of rollers mounted within said die in angularly spaced relation on fixed axes, the combination of a cover for said die including a cylindrical portion extending axially outwardly from said die and having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion within said holes, means securing said cover to said die for rotation therewith, and stationary guide members mounted in fixed relation with said base and extending axially outwardly of said die within said cylindrical portion of said cover in inclined relation with respect to the rotational axis of said die to cause said material rotating with said cover to be guided axially into said die, and there being one said guide member opposite each space between said rollers to cause said guided material to be distributed substantially equally to said rollers.

2. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a plurality of rollers within said die, in combination of a support for said rollers carried by said base and constructed to maintain said rollers in angularly spaced relation, a cover for said die including a cylin-

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drical portion located axially outwardly of said die and having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, means securing said cover to said die for rotation therewith, and stationary guide members mounted in fixed relation with said roller support and extending axially outwardly of said die into said cylindrical portion of said cover in closely adjacent relation with said cylindrical cover portion, said guide members being inclined with respect to the rotational axis of said die to engage said material rotating with said cover and to guide said material axially into said die, and there being one of said guide members opposite each space between said rollers to cause substantially equal portions of said material to be guided into each said space.

3. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes, therethrough, and a plurality of rollers within said die, the combination of a support for said rollers carried by said base and constructed to maintain said rollers in angularly spaced relation on substantially fixed axes, a cover for said die including a portion located axially outwardly of said die and having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, means securing said cover to said die for rotation therewith, and stationary guide members mounted in fixed relation with said base and extending into said cover, each of said guide members having the configuration of a section of a screw conveyor and lying in inclined relation with the rotational axis of said die to engage said material rotating with said cover and to guide said material into said die, and there being one of said guide members opposite each space between said rollers to cause substantially equal portions of said material to be guided axially into each said space.

4. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a plurality of rollers within said die, the combination of a support for said rollers carried by said base and constructed to maintain said rollers in angularly spaced relation on substantially fixed axes, a cover for said die including a cylindrical portion located axially outwardly of said die and having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, means securing said cover to said die for rotation therewith, stationary guide members mounted in fixed relation with said base and extending into said cover in closely adjacent relation with said cylindrical cover portion, each of said guide members being a bar curved to form a section of a screw conveyor having the outer surface thereof substantially concentric with said cylindrical portion of said die, and means maintaining said outer surfaces of said bars in radially spaced relation with said cylindrical portion of said cover to provide running clearance therebetween, and there being one of said bars opposite each space between said rollers to cause substantially equal portions of said material to be guided axially into each said space.

5. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a pair of rollers within said die, in combination of a support for said rollers carried by said base and constructed to maintain said rollers in side by side relation in a substantially horizontal plane, a cover for

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said die including a cylindrical portion extending axially outwardly from said die having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, and a pair of guide members mounted on said roller support and extending within said cylindrical portion of said cover axially outwardly of said die, said guide members being located between said rollers and respectively above and below said horizontal plane to engage said material rotating with said die and separate the same into two substantially equal portions, and said guide members being inclined with respect to the rotational axis of said die to guide said separated material axially into the spaces within said die between said rollers for substantially equal distribution to said rollers.

6. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a plurality of rollers mounted within said die in angularly spaced relation on fixed axes, a cover for said die including a cylindrical portion extending axially outwardly from said die and having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, means securing said cover to said die for rotation therewith, and stationary guide members mounted in fixed relation with said base and extending within said cylindrical portion of said cover axially outwardly of said die, at least one projection on said cover located radially inwardly of said guide members and in axially overlapping relation therewith to cause said material to rotate with said cover into engagement with said guide members, said guide members being inclined with relation to the rotational axis of said die to cause said material to be guided axially into said die, and there being one said guide member opposite each space between said rollers to cause said guided material to be distributed substantially equally to said rollers.

7. In a pellet mill including a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a plurality of rollers within said die, the combination of a support for said rollers carried by said base and constructed to maintain said rollers in angularly spaced relation on fixed axes, a cover for said die including a cylindrical portion located axially outwardly of said die and having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, means securing said cover to said die for rotation therewith, and stationary guide members mounted in fixed relation with said roller support and extending into said cylindrical portion of said cover in closely adjacent relation with said cylindrical cover portion, at least one projection on said cover located radially inwardly of said guide members and in axially overlapping relation therewith to cause said material to rotate with said cover into engagement with said guide members, said guide members being inclined with respect to the rotational axis of said die to engage said material rotating with said cover and to guide said material axially into said die, and there being one of said guide members opposite each space between said rollers to cause substantially equal portions of said material to be guided into each said space.

8. In a pellet mill comprising a base, an annular die mounted on said base for rotation about a horizontal axis and having generally radially arranged extrusion holes therethrough, and a pair of rollers within said die,

the combination of a support for said rollers carried by said base and constructed to maintain said rollers in side by side relation in a substantially horizontal plane, a cover for said die including a cylindrical portion of substantial extent axially of said die having a feeding opening for the material to be pelleted at approximately the center thereof, a drive for rotating said die to cause said material within said die to be carried into the nips of said rollers with the inner surface of said die for extrusion through said holes, a plurality of paddle members on said cover and extending axially inwardly thereof in radially inwardly spaced relation with said cylindrical portion of said cover to provide a clearance space along said cylindrical cover portion and to cause said material to rotate with said cover into said clearance space, and a pair of guide members mounted on said roller support and extending into said clearance space within said cover

for engagement with said material rotating with said cover, said guide members being located between said rollers and respectively above and below said horizontal plane to separate said material into two substantially equal proportions, and said guide members being inclined with respect to the rotational axis of said die to guide said separated material axially into the spaces within said die between said rollers for substantially equal distribution to said rollers.

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