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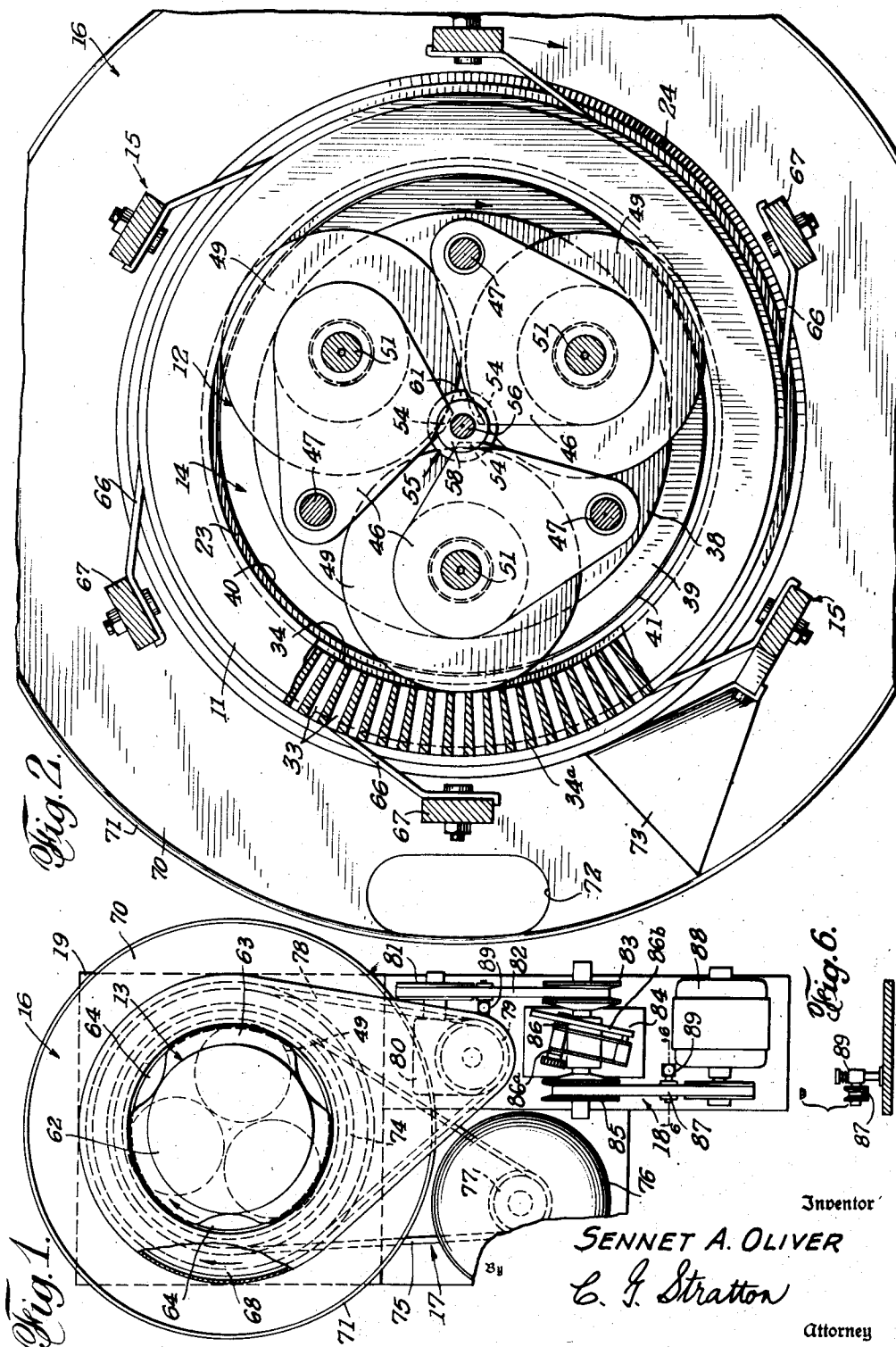
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PELLET MILL

Filed May 29, 1948

2 Sheets-Sheet 1



Inventor

SENNET A. OLIVER

C. F. Stratton

Attorney

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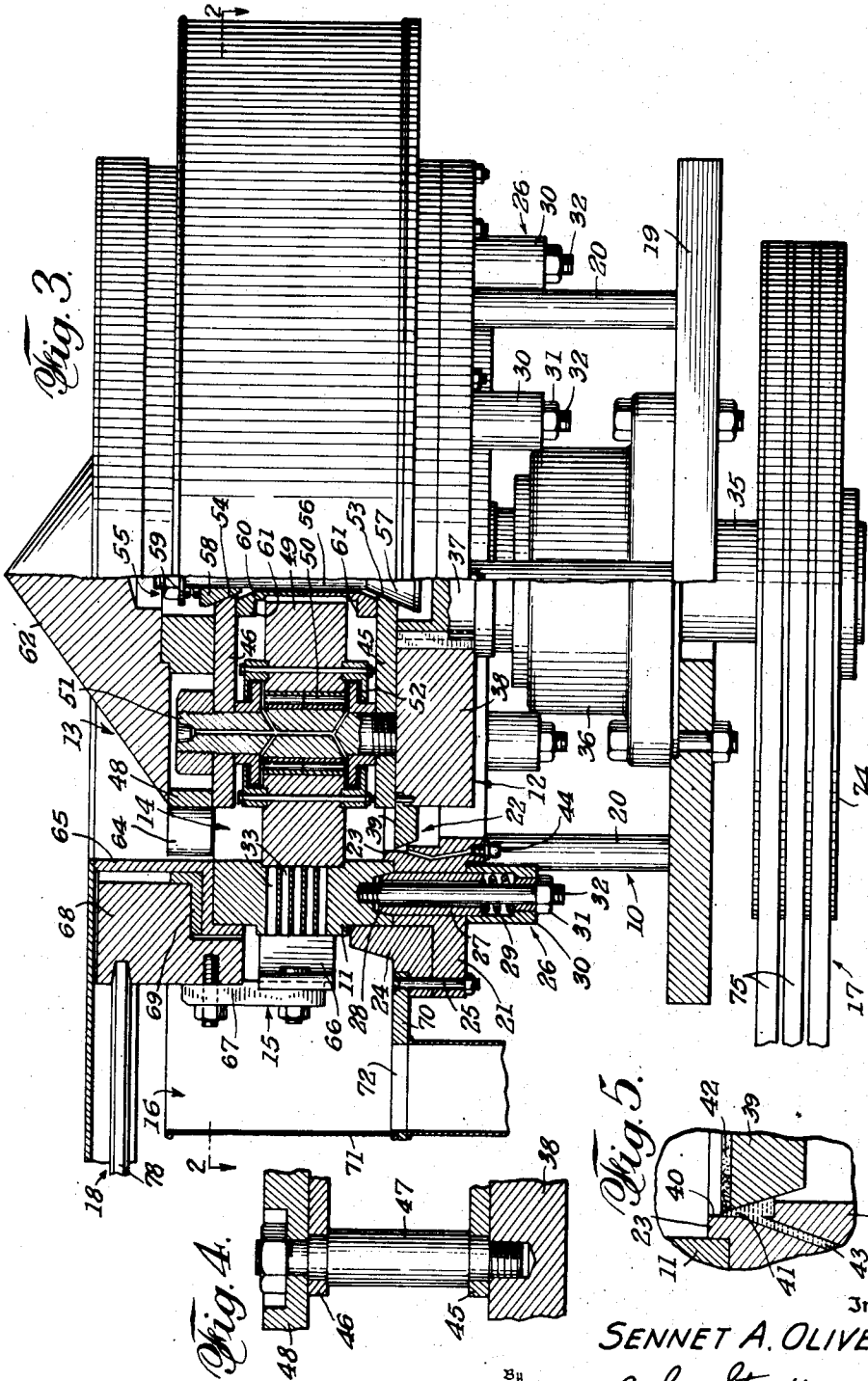
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INVENTOR
SENNET A. OLIVER
C. L. Stratton

Attorney

UNITED STATES PATENT OFFICE

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PELLET MILL

Sennet A. Oliver, Montebello, Calif.

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11 Claims. (Cl. 107-8)

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This invention relates to a machine for producing pellets from a mash or mixture of stock feed and for like purposes. More particularly, this invention deals with a mill for producing feed pellets for consumption by rabbits raised for food.

Rabbits, more particularly, if fed food pellets that are too long, will bite off part of a long pellet and drop the remainder. The sanitary screen flooring provided in rabbit hutches permits such dropped pellets to fall out of reach of the animal and is, therefore, wasted. Thus, it is important to provide pellets of a size acceptable to the animal and it is an important object of this invention to provide a pellet mill that can be accurately controlled, while the same is in operation, to obtain pellets of a desired size.

A pellet mill of the nature herein contemplated embodies a perforated die ring and one or more rolls within the ring for pressing mash into and through the perforations of the die ring. The high speed of the rolls results in their hammering against high spots of said ring should there be any inaccuracies in the mounting of the rolls relative to the ring and/or to each other. Another object of the invention is to provide novel means that effects a common adjustment among all the rolls mutually, whereby they roll smoothly along the inner face of the die ring irrespective of whether said inner face is truly circular or not to thereby eliminate the heretofore objectionable hammering that deleteriously affected both the die ring and the rolls.

A further object of the invention is to provide, in a pellet mill, novel means sealing off the mash-receiving chamber to obviate mash falling therefrom during operation of the machine, said means yet permitting free and frictionless high speed rotation of the roll or impactor means that extrudes the mash through the die ring.

My invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes one embodiment of the present invention, which is given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a partly broken plan view of a pellet mill according to the present invention.

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Fig. 2 is an enlarged plan sectional view of the mill, said view being taken on line 2-2 of Fig. 3.

Fig. 3 is a side elevational view, in quarter section, of said mill.

Figs. 4 and 5 are fragmentary detail sectional views showing structural features of the mill.

Fig. 6 is a fragmentary cross-sectional view on line 6-6 of Fig. 1.

The pellet mill that is illustrated comprises, generally, a stationary frame 10 that mounts a fixed die ring 11, a rotary impactor unit 12 mounted in the frame and having operative engagement with said die ring, hopper means 13 carried by the impactor unit for feeding mash into a chamber 14 encircled by the die ring, cutter means 15 for severing pellets extruded through the die ring by the impactor unit, a pellet-receiving annular chamber 16 surrounding the die ring, a drive 17 for the impactor unit, and a variable speed drive 18 for the cutter means.

The mill frame 10 comprises a support plate 19 from which upwardly extend a plurality of parts 20 that space a ring 21 from said plate 19. The central opening 22 in ring 21 is somewhat smaller than the inner diameter of die ring 11, the latter being mounted on ring 21 and located between an annular lip 23 on the latter ring, and a second ring 24 bolted to said latter ring as at 25. The lip 23 and ring 24 serve to center the die ring on opening 22.

Means 26 is provided for fixing the die ring to ring 21, said means comprising a plurality of like elements uniformly spaced around said latter ring. Because of the forces involved that seek to rotate the die ring, each element of means 26 comprises a sleeve 27 slidably fitted in a bore in ring 21 and having a conical end 28 extending into a conical seat provided in the bottom edge of the die ring. Said conical end 28 is firmly urged into its seat by a spring 29 that is retained by a collar 30, a nut 31 engaged with said collar, and a stud 32 extending through sleeve 27 and threaded into the die ring. It will be seen that by taking up on nut 31, spring 29 is loaded to exert an end pressure on sleeve 27 to press its conical end 28 into its seat. The several such elements provided insures a firm non-displaceable fastening for the die ring.

The die ring 11 is generally conventional for the type of mill herein disclosed, is provided with a multiplicity of die orifices 33, arranged in plural rows, through the wall thereof, and, in practice, has its inner face 34 and its outer face 34a machined for respective engagement with the impactor unit 12 and the cutter means 15.

The impactor unit 12 is mounted on a central shaft 35 that rotates in a bearing 36 fixed on

support plate 19 and residing between said plate and ring 21. Thus, the portion 37 of shaft 35 that projects upwardly from bearing 36 is relatively short and lends accuracy to the impactor unit carried by said shaft. A relatively heavy plate 38 is keyed to the portion 37 of said shaft and forms the sturdy support member for said impactor unit. Said plate 38 constitutes the bottom for chamber 14 and, in practice, an annular extension flange 39 is fastened thereon and extends as close as practicable to the wall of a counterbore 40 formed in opening 22. The plate 38 and its flange 39 are thus freely rotatable in opening 22, there being no friction involved.

As contemplated herein, the small annular space 41 between flange 39 and counterbore 40 is filled with a lubricant of low viscosity so that the same will not readily flow. As shown at 42, said lubricant will receive a coating of the mash material in the chamber 14 to provide an adequate seal that prevents mash from falling through annular space 41. The lubricant can be introduced through a suitable number of passages 43 each fitted with a self-closing pressure fitting 44.

The impactor unit 12 is shown as comprising three pairs of similar plates of each of which plate 45 is the lower and 46 the upper, a pivot bolt 47 for each pair of plates 45 and 46 and threaded into plate 38, at the bottom, and into a top plate 48 parallel to said plate 38, and an impactor roll 49 carried by and mounted between each pair of plates 45 and 46. Each roll 49, by means of suitable anti-friction bearings 50, rolls on a stud 51 that ties the free ends of the plates 45 and 46 together. In this manner, each pair of plates 45 and 46 and the roll 49 carried thereby comprises a frame that is swingable on pivot bolt 47. Fig. 2 clearly shows this arrangement wherein the frames are uniformly arranged about the axis of rotation of the impactor unit.

As best seen in Fig. 3, the necessary lubricant provided for bearings 50 is prevented from contaminating the mash in chamber 14 by labyrinth seals 52 provided between stationary and rotational parts of the roll mounting means.

The present mill is designed for clockwise rotation. Although a reverse arrangement would be effective, it is preferred to have the rolls 49 travel in advance of their respective pivots 47 and, by rolling engagement with inner face 34 of the die ring, effect a gathering of mash against said face and then a forcing of the mash through the orifices 33. As the rolls progress at high speed, their continuous engagement with the die ring will result in a continuous and rapid extrusion of the mash through the orifices.

While the rolls will be centrifugally forced into engagement with the die ring, positive means is provided for effecting uniform pressure of all three rolls against the die ring irrespective of such variations that there may be in the form of said die ring and in the mounting of the rolls. To this end, each lower plate 45 is provided with a beveled edge 53 and each upper plate 46 with a similar but oppositely beveled edge 54, and a cam wedging unit 55 is provided centrally or axially of the mill to engage said beveled edges and thereby press the rolls simultaneously against the die ring.

Said unit 55 comprises a rod 56, a fixed conical cam 57 that engages the beveled edges of the three lower plates 45, a relatively movable conical cam 58 on said rod that engages the beveled

edges of the three upper plates 46, and resilient take-up means 59 on the rod for exerting a pressure to urge the cams 57 and 58 toward each other. In this manner, the rolls 49 mutually and simultaneously are outwardly pressed. It will be noted that the means 55 has no fixed position but rather floats in a position centrally of the roll frames. Consequently, the same is free to shift in any direction to find a position of adjustment that is controlled by the three points of contact between the die ring and the three rolls. Thus, should the rolls vary in size among themselves, they would yet be adjusted by the means 55 to have uniform rolling engagement with the die ring. It will be evident, therefore, that the three rolls, bodily, and notwithstanding the fixed pivot bolts 47, will accommodate themselves within the die ring, regardless of whether the face 34 of the latter is truly round or not.

The pressure of cams 57 and 58 may tend to flex plates 45 and 46 inwardly toward each other. To counteract this, a sleeve 60 is strung over rod 56 to serve as a spacer for said plates. Said sleeve, of course, floats with the rod and, accordingly, is formed with flanged ends 61 for ample bearing engagement with said plates.

The hopper means 13 comprises a conical member 62 that is mounted on top of plate 48, the base of said member being smaller than the diameter of said plate to define a peripheral ledge 63. This ledge, in advance of each roll 49, is provided with a passage 64 through which mash, fed to the conical member 62 and directed thereby to the ledge, falls into the chamber 14. Thus, almost immediately, the mash is compressed between the rolls 49 and the die ring to be extruded through the orifices of the latter. An upper annular extension 65 is provided for the die ring to cooperate with the ledge 63 for enclosing passages 64 and also to retain from spillage of mash as the same descends toward said passages.

The means 15 is provided for severing the extruded mash to form them into pellets as contemplated herein. As shown, means 15 comprises a plurality of uniformly spaced blades or cutters 66 that are angularly directed toward and having sliding or wiping engagement with the outer face 34a of the die ring. In the present mill, the cutters are mounted to rotate in the same direction as the impactor unit 12.

Each cutter 66 is carried by a bracket 67 and said brackets are mounted on a pulley 68 that, through the medium of a bearing ring 69, rotates on the annular extension 65 that is fixed to the die ring. The cutters are arranged so that their leading or cutting edges sever the pellets as they are extruded.

The several pellets fall into annular chamber 16, the same being formed by a ring plate 70 that is a horizontal extension of ring 24 and an annular wall 71 extending upward from the outer peripheral edge of said ring plate. One or more discharge openings 72 may be provided in chamber 16, and one or more blades 73 may be mounted, as on brackets 67, to shovel the several pellets so they fall through discharge opening or openings 72. It will be noted that wall 71 extends considerably above the orifices 33 and, in practice, is made as high as practicable to insure that none of the severed pellets fly outward of chamber 16.

The drive 17 for the impactor unit 12 comprises a grooved pulley 74 on shaft 35 for a plu-

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ality of V-belts 75, and an electric motor 76 having a smaller grooved pulley 77 over which said belts are trained. This drive effects a uniform rotational speed of the impactor unit and remains constant unless the speed of the motor is changed.

The variable speed drive 18 is provided for controlling, while the mill is in operation, the size of the pellets produced thereby. Temperature conditions, variations in the material comprising the mash and other factors may contribute to variations in the speed of extrusion of said mash through the die ring. Said variations may occur even during a continuous run of the mill. Inspection of the pellets produced is readily accomplished by sampling them as they are severed. If too short or too long, the means 18 is quickly adjusted to change the speed of rotation of the cutters accordingly.

As shown, the drive 18 includes the mentioned pulley 68 which is grooved for a V-belt 78 that is trained over a smaller pulley 79 of a speed reducer 80. The latter is provided with a pulley 81 over which is trained a V-belt 82 that extends around a tapered flange expansion pulley 83 of a "varidrive" unit 84. This unit is provided with a second tapered flange expansion pulley 85 on the same shaft with pulley 83 and with means 86 that is manually adjustable to simultaneously bring closer together the tapered flanges of either pulley 83 or 85 and, correspondingly, separate the tapered flanges of the other. By shifting handle 86a of means 86 relative to plate 86b, the flanges of one pulley are separated and the flanges of the other are correspondingly brought together. A V-belt 87 is mounted on pulley 85 to be driven from an electric motor 88. The above spreading and contracting of the pulley flanges enlarges the arc of contact of one belt 82 or 87 and diminishes the other, thus varying the drive transmitted from motor 88 to pulley 81. Suitable tension means 89 may be provided for each belt 82 and 87 to automatically take up slack in one or the other of said belts as the unit 84 is adjusted. One such tension means 89 is shown in Fig. 6, the other being similar. The unit 84 is one of several such devices that are available on the open market and requires no further explanation, except that the means 86 is adjusted in one direction to enlarge the effective operative size of pulley 83 and contract the effective operative size of pulley 85 to speed up rotation of the cutters, and in the other direction to contract the effective operative size of pulley 83 and enlarge the effective operative size of pulley 85 to slow up rotation of the cutters.

In the construction of the "varidrive" unit 84, the outer flanges of pulleys 83 and 85 are fixed on their shaft and the inner flanges of said pulleys are connected to each other and slidable by manipulation of handle 86a. The inwardly directed faces of the flanges of the respective pulleys are oppositely tapered to receive V-sectioned belts 82 and 87. Reference is made to the inner two pages of the four-page catalogue of Standard Transmission Equipment Co., Pasadena, California, and titled "Standard Transmissions," which was filed in this application with the amendment of June 4, 1952. In said catalogue it is seen that by moving control handle 86a the shaft and pulleys are moved toward or away from motor 88 or pulley 81, resulting in tension on one belt 82 or 87 and slack on the other as the tapers of the pulley flanges are adjusted to give a new ratio between the

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effective or running diameters of said pulleys. This mutual compensation of pulley sizes and belt tensions gives the mentioned speed variations and controls desired.

In this manner the speed of the cutters 66 can be adjusted while the mill is in operation to obtain pellets of a desired length.

While I have illustrated and described what I now regard as the preferred embodiment of my invention, the construction is, of course, subject to modifications without departing from the spirit and scope of my invention. I, therefore, do not wish to restrict myself to the particular form of construction illustrated and described, but desire to avail myself of all modifications that may fall within the scope of the appended claims.

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

1. In a mill of the character described having a stationary die ring with material-molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising a plurality of swingable frames each having an impactor roll engaged with the inner face of the die ring to press material into and through said orifices and a floating unit embodying wedge means located centrally of the frames to engage all of them simultaneously to urge the rolls into rolling engagement with the inner face of the die ring.

2. In a mill of the character described, having a stationary die ring with material-molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising a plurality of swingable frames each having an impactor roll engaged with the inner face of the die ring to press material into and through said orifices, each frame including upper and lower plates above and below the roll thereof, a floating unit having a wedge in common engagement with all of the upper plates and a wedge in common engagement with all of the lower plates, and means embodied in said floating unit for adjusting the wedges relatively to urge said upper and lower plates of the frames in a direction to press the rolls thereof into rolling engagement with the inner face of the die ring.

3. In a mill of the character described, having a stationary die ring with material-molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising a plurality of swingable frames each having an impactor roll engaged with the inner face of the die ring to press material into and through said orifices, each frame including upper and lower plates above and below the roll thereof, a floating unit having a wedge in common engagement with all of the upper plates and a wedge in common engagement with all of the lower plates and resilient means engaged with one of said wedges and embodied in said floating unit for adjusting the wedges relatively to urge said upper and lower plates of the frames in a direction to press the rolls thereof into rolling engagement with the inner face of the die ring.

4. In a mill of the character described having a stationary die ring with material-molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising three symmetrically arranged rolls each engaged with the inner face of the die ring, three frames each having upper and lower portions and mounting each roll, a pivot for each

frame, a rotatable plate for pivotally supporting the ends of said pivots, and centrally disposed cam wedging means for simultaneous engagement with the three frames to urge the same to swing on their respective pivots and thereby press the rolls into rolling engagement with the die ring, said cam wedging means including spaced conical wedges, one engaging the upper and the other the lower portions of the frames.

5. In a mill of the character described having a stationary die ring with material-molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising three symmetrically arranged rolls, each engaged with the inner face of the die ring, three frames each having upper and lower portions and mounting each roll, a pivot for each frame, a rotatable plate for pivotally supporting the ends of said pivots, and centrally disposed cam wedging means for simultaneous engagement with the three frames to urge the same to swing on their respective pivots and thereby press the rolls into rolling engagement with the die ring, said cam wedging means including spaced conical wedges, one engaging the upper and the other the lower portions of the frames, said conical wedges being relatively adjustable.

6. In a mill of the character described, having a stationary die ring with material-molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising a plurality of swingable frames each having an impactor roll engaged with the inner face of the die ring to press material into and through said orifices, each frame including upper and lower plates above and below the roll thereof, a floating unit having a wedge in common engagement with all of the upper plates and a wedge in common engagement with all of the lower plates means embodied in said floating unit for adjusting the wedges relatively to urge said upper and lower plates of the frames in a direction to press the rolls thereof into rolling engagement with the inner face of the die ring, and means concentric with said floating unit and between the wedges thereof for spacing the upper and lower plates of the frames.

7. In a mill of the character described, having a stationary die ring with material molding orifices extending therethrough, an impactor unit rotatably mounted within said die ring and comprising a plurality of swingable frames each having an impactor roll engaged with the inner face of the die ring to press material into and through said orifices, each frame including upper and lower plates above and below the roll thereof, a floating unit having a wedge in common engagement with all of the upper plates and a wedge in common engagement with all of the lower plates means embodied in said floating unit for adjusting the wedges relatively to urge said upper and lower plates of the frames in a direction to press the rolls thereof into rolling engagement with the inner face of the die ring, and means concentric with said floating unit and between the wedges thereof for spacing the upper and lower plates of the frames, said latter means comprising a sleeve having upper and lower flanges for respective engagement with the under face of the upper plates and the upper face of the lower plates.

8. In a mill of the character described, a material-molding die ring, a fixed ring mounting the same and having a central opening, a rotatable impactor unit extending through said

opening and embodying rolls engaged with the inner face of the die ring, and a circular plate embodied in said unit and provided with a ring flange spaced from the wall of said opening to define an annular space, said fixed ring having a passage extending therethrough and opening into said annular space and adapted to conduct low viscosity lubricant to fill said annular space and thereby seal the chamber defined by said die ring and circular plate.

9. A mill of the character described comprising a die ring, impactor means for pressing material through the die ring from the inside through the outside thereof, means for rotating said impactor means at a constant speed, cutter means for severing the material extruded from the die ring to form pellets, and variable speed drive means for rotating the cutter means relatively to the die ring to control the length of said pellets, said latter means comprising an electric motor, and an adjustable drive connection between said motor and the cutter means, said adjustable drive connection embodying a pair of pulleys and means for simultaneously increasing the effective operative size of one of said pulleys and decreasing the effective operative size of the other.

10. A mill of the character described comprising a die ring, impactor means for pressing material through the die ring from the inside through the outside thereof, means for rotating said impactor means at a constant speed, cutter means for severing the material extruded from the die ring to form pellets, and variable speed drive means for rotating the cutter means relatively to the die ring to control the length of said pellets, said latter means comprising an electric motor, a unit embodying a pair of variable pulleys and means for simultaneously enlarging the effective size of one pulley and reducing the effective size of the other, a drive connection from the motor to one of said pulleys, and a drive connection from the other pulley to the cutter means.

11. A mill of the character described comprising a die ring, impactor means for pressing material through the die ring from the inside through the outside thereof, means for rotating said impactor means at a constant speed, cutter means for severing the material extruded from the die ring to form pellets, and variable speed drive means for rotating the cutter means relatively to the die ring to control the length of said pellets, said latter means comprising an electric motor, a unit embodying a pair of variable pulleys and means for simultaneously enlarging the effective size of one pulley and reducing the effective size of the other, a drive connection from the motor to one of said pulleys, a speed reducing unit, a drive connection from the other pulley to the speed reducing unit, and a drive connection from the latter unit to the cutter means.

SENNET A. OLIVER.

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