

July 26, 1938.

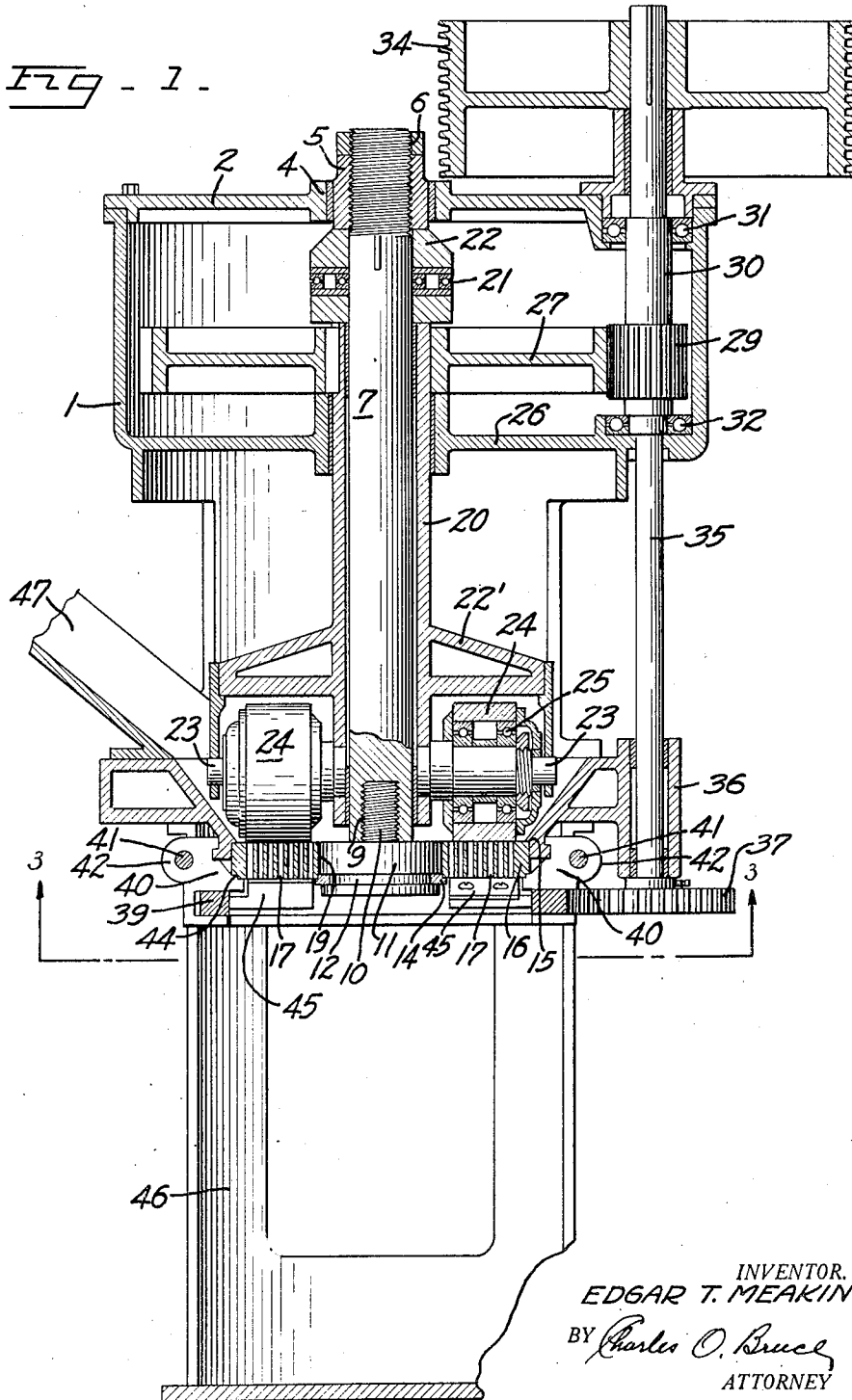
E. T. MEAKIN

2,124,744

PELLET MILL

Filed Jan. 3, 1934

3 Sheets-Sheet 1



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Fig. 4.

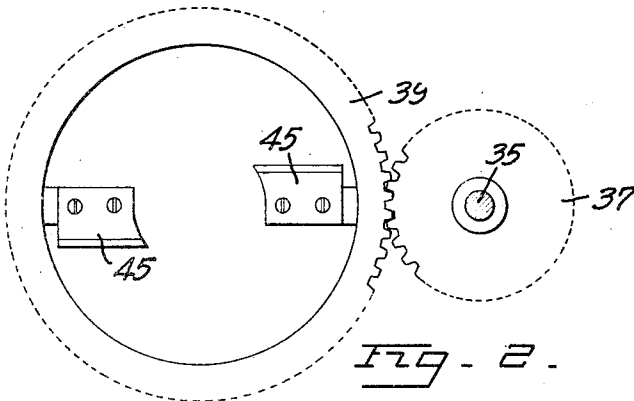
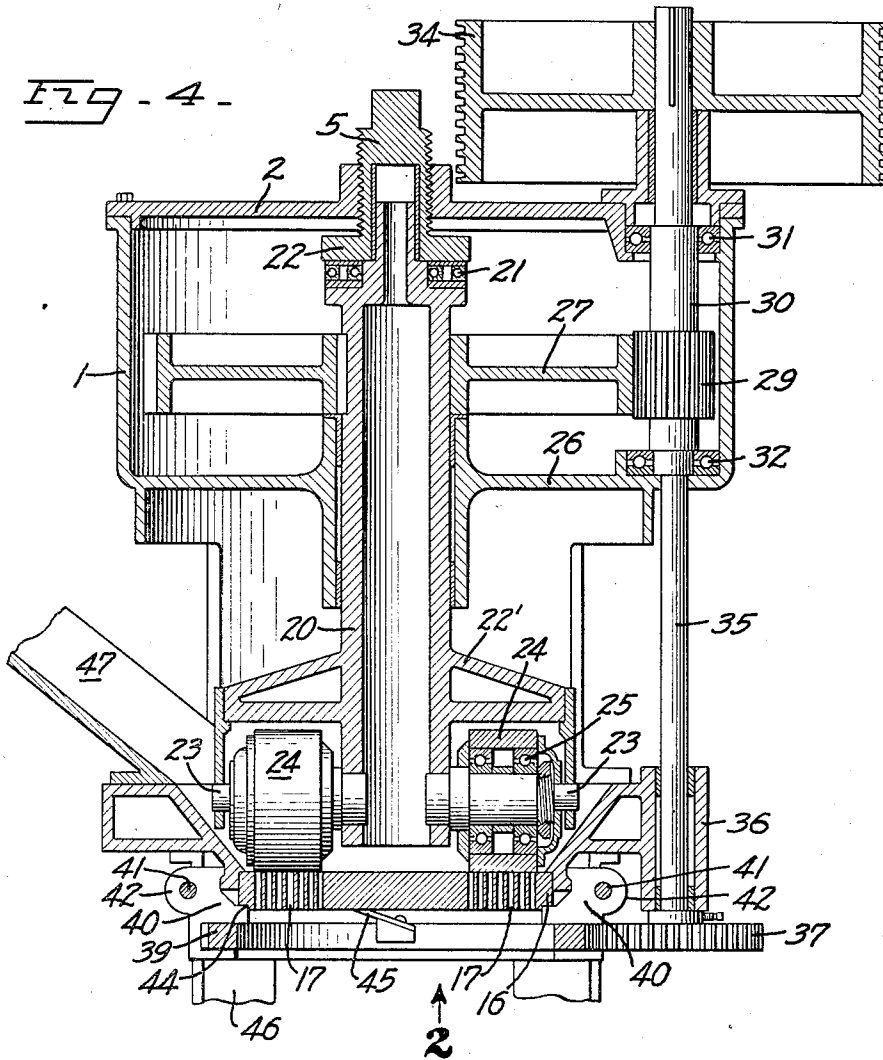


Fig. 2.

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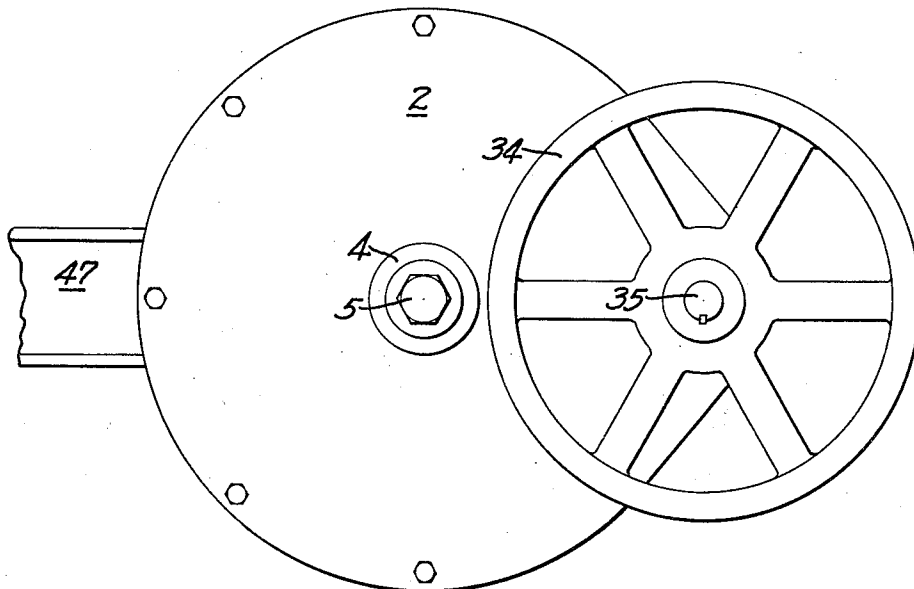
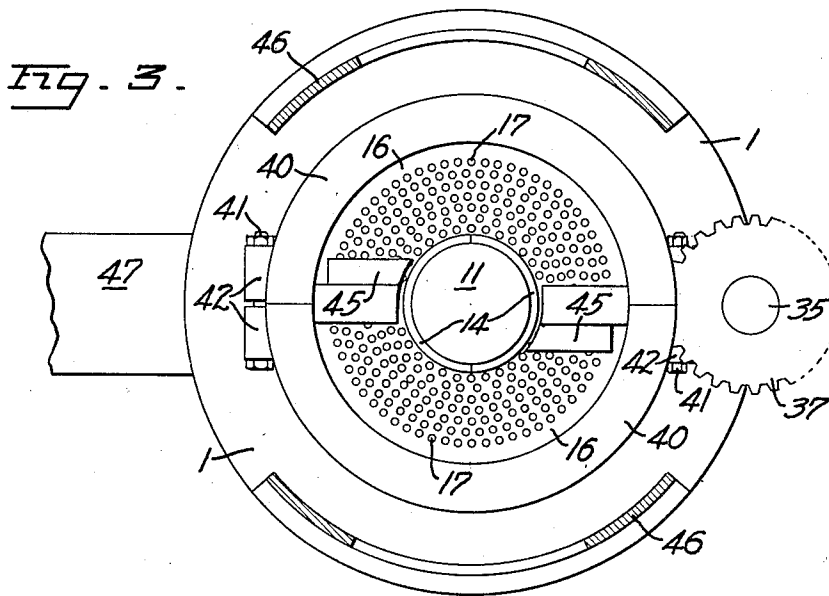


Fig. 5.

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UNITED STATES PATENT OFFICE

2,124,744

PELLET MILL

Edgar T. Meakin, Berkeley, Calif.

Application January 3, 1934, Serial No. 705,120

20 Claims. (Cl. 107—8)

My invention relates to pellet mills, and more particularly to extrusion devices whereby moldable materials may be forced through a die plate, and cut off as they emerge, to form pellets. The device is particularly adapted for the formation of pellets from feed meal and similar materials. Certain of the structure herein shown has already been described and claimed in my copending application, Serial No. 574,944, filed November 14, 1931, issued April 10, 1934 as Patent No. 1,954,086, for a "Pellet mill".

The principal object of my invention is to provide improved means for forming pellets from moldable materials.

Other objects of my invention are: to provide a vertical extrusion press wherein materials may be rolled through an apertured die plate and thereafter cut off to form pellets; to provide such a structure wherein cut-off knives may be rotated around the die plate at a rate of speed differing from that of the roller shaft; to provide a pellet mill wherein cut-off knives are operated independently of the shaft driving the extrusion means; to provide a pellet mill of the character described, having an improved cut-off knife drive; to provide means for easily removing the die block in a vertical pellet mill; to provide means for quickly removing and changing cut-off knives in a vertical pellet mill; to provide improved means for handling thrust stresses in a vertical extrusion press; to provide a means for relieving an extrusion press frame of thrust stresses; and to provide a pellet mill of simple construction.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawings:

Figure 1 is a longitudinal sectional view of one embodiment of my invention wherein the die block is fastened to a roller supporting stud.

Figure 2 is a plan view of the knife driving gears.

Figure 3 is a plan view, looking from the bottom of the mill shown in Figure 1.

Figure 4 is a longitudinal view of another embodiment of my invention, wherein the die plate is supported solely by its periphery.

Figure 5 is a plan view, looking down on the mill of Figure 4.

In broad terms, my invention comprises an apertured die block and means for forcing material through the die block, said means prefer-

ably comprising rollers operating on the top surface of the die block. Cut-off knives are mounted below the die block and are operated, preferably from an external shaft, through suitable gearing, or similar power transmitting means, whereby the knives may be rotated at a different rate of speed than the rollers. In certain instances I may prefer to lock the center of the die block to the frame through the medium of a thrust stud, and relieve the frame of thrust stresses, and in other embodiments I may desire to leave the center of the die block entirely unsupported, stress being transmitted to the frame through the periphery of the die block. In either case, I prefer to mount the cut-off knives on a ring gear held in a split ring, or similar device, which also serves to maintain the die block in position. Removal of this split ring therefore allows a quick removal of either the knives or the die block, or both, as desired.

My invention may be more fully understood by detailed reference to the figures, attention being directed first to the embodiment shown in Figure 1. Here a press frame 1, preferably of cast construction, is provided at its upper end with a top plate 2, carrying an axial positioning bearing 4. Mounted and adapted to rotate in this bearing is a thrust adjustment nut 5 having interior threads 6. Screwed into the threads is a strong thrust stud 7, extending axially through the frame. The lower end of the thrust stud 7 is provided with internal threads 9 which receive a threaded portion 10 of a die block nut 11. This die block nut is provided with a channel 12 in which is inserted a removable split ring shoulder 14. The lower end of the frame is provided with a die plate shoulder 15, machined to receive the periphery of a circular die plate 16, provided with extrusion apertures 17 and a central aperture 19, into which the main body of the die block nut is received, the split ring 14 acting as a shoulder, bearing against the lower face of the die plate. Screwing the threaded portion 10 of the die block nut into the end of the thrust stud 7 will force the die plate against the shoulder 15 and hold the die plate solidly in place against the frame.

A drive sleeve 20 surrounds the thrust stud 7, being provided at its extreme upper end with a thrust bearing 21, backed by a thrust collar 22, which in turn bears against the thrust adjusting nut 5. The lower end of the drive sleeve is expanded to form a roller frame 22', which in turn carries roller bearing studs 23 upon which extrusion rollers 24 are mounted through the medium of roller bearings 25. I prefer to set the rollers

so that they will revolve closely adjacent the top surface of the die plate. The drive sleeve is further positioned by a horizontal sleeve web 26, and is driven through a large gear 27 attached to the drive sleeve, and a small gear 29 attached to a power shaft 30. I prefer to mount the power shaft on the frame by means of ball bearings 31 and 32, and apply power to the shaft through a pulley 34.

It will be observed that the thrust bearing 21 and its associated thrust structure is enclosed in a chamber formed in the upper end of the press frame 1 between the plate 2 and the web 26. Thus positioned, the thrust structure is protected from wear and breakage caused by the entrance of dust and other destructive foreign matter which is ever present in the handling of moldable materials such as meals, mashes and the like.

The power shaft is preferably provided with an extension 35 outside of the frame which terminates at a point adjacent the plane of the lower surface of the die block, and is there provided with a bearing 36 and a knife driving gear 37. The knife driving gear 37 meshes with a floating ring gear 39, which is held in position by a split ring 40. Bolts 41, engaging lips 42, clamp the split ring around the frame and thus position the ring gear with respect to the die plate. I also prefer to provide a shoulder 44 on the split ring which engages the lower surface of the die block at its periphery. The ring gear is then used to support a pair of knives 45 which are in contact with the lower surface of the die plate below the extrusion apertures.

The frame 1 is preferably extended to form a pellet receptacle and standard 46 below the die plate. I also prefer to provide the frame 1 with an inlet chute 47 through which material may be fed in to the rollers and, by them, forced through the die apertures.

In this particular embodiment it will be seen that the thrust path is as follows: beginning with the rollers 24, through the ball bearings 25 to the roller bearing stud 23, through the drive sleeve 20 and the thrust bearing 21 to the thrust block 22, thence to the thrust adjusting nut, into the thrust stud 7, back down to the die block nut 11, and thence back to the die plate itself through the ring 14. None of the thrust is taken on the frame itself, the frame merely serving to position and maintain the thrust stud and drive sleeve in their correct axial and central position.

The embodiment shown in Figure 4 differs from that shown in Figure 1 mainly in that the thrust in this case is transferred directly to the frame, there being no thrust stud present. In this case the upper plate 2 is provided with a thrust adjusting nut 5 which bears directly on the drive sleeve 20 through the thrust bearing 21. The rollers 24 are supported in the frame in the same manner as in the previously described machine, and power is applied to the sleeve in the same manner. The knives are also driven through knife gears, as described above. The die block in this case, however, is not centrally apertured, as it is not required to receive the end of a thrust stud. In this case it will be obvious that the thrust is taken from the rollers through the sleeve and its thrust bearing 21 and passed into the top plate 2, and thence to the frame, the thrust on the die block being passed into the frame through the split ring 40.

There are no rotational parts passing through the die block in either machine, and the knives may be made to rotate at any speed desired by

the proper selection of knife gears. The main features of the two devices, therefore, are essentially the same, the only difference being the method of handling the thrust.

I have found that the presses, as described, having knives rotating at a different number of revolutions per minute than the drive sleeve, have numerous advantages over those previously described. The accessibility to the die block and knives is greatly enhanced, and pellets of different length may be readily obtained without disturbing the extrusion portion of the mill. I find that I can obtain more precise regulation of the length of pellets by regulating the rotational speed of the knives. I also find that I am able to greatly simplify die plate construction, and thus cheapen the manufacture of the device, without sacrificing any of the advantages of previous machines. It should also be noted that by driving the knives from the periphery of the die plate, all obstruction to the delivery of material has been removed from the delivery path thus greatly facilitating passage of material such as dough, or similar sticky substances. The entire set-up makes for simplicity of operation and maintenance, as well as giving the machines an adaptability for wider uses and varied products.

I claim:

1. In apparatus adapted to extrude material through an apertured die plate, means for cutting off said material mounted beneath said die plate comprising an annular bearing attached to said die plate surrounding the apertures therein and opening inwardly, a ring floating in said bearing, a knife attached to said ring and extending inwardly across said apertures, and means for rotating said ring.

2. In apparatus adapted to extrude material through an apertured die plate, means for cutting off said material comprising an annular bearing attached to said die plate surrounding the apertures therein and opening inwardly, a ring floating in said bearing, a knife attached to said ring and extending inwardly across said apertures, and means for rotating said ring, said bearing being segmentally separable to allow removal of said ring.

3. In apparatus of the class described, a housing, an apertured die plate removably disposed in said housing, a plurality of rollers disposed adjacent one face of said die plate in rotatable relationship therewith for compressing and forcing material through said apertures, a knife mounted adjacent the other face of said die plate for movement over said face in a direction transverse to the axes of said apertures, a member secured to said knife, means for rotating said rollers, means for rotating said member to move said knife, and common means for securing said die plate and said member to said housing.

4. In apparatus of the class described, a housing, an apertured die plate removably disposed in said housing, a plurality of rollers disposed adjacent one face of said die plate in rotatable relationship therewith for compressing and forcing material through said apertures, a knife mounted adjacent the other face of said die plate for movement over said face in a direction transverse to the axes of said apertures, a ring secured to said knife and surrounding said apertures, means for rotating said rollers and said ring to move said knife, and means engaging both said die plate and said ring for securing said die plate and ring to said housing.

5. In apparatus of the class described, a hous-

ing, an apertured die plate removably disposed in said housing, a plurality of rollers disposed adjacent one face of said die plate in rotatable relationship therewith for compressing and forcing material through said apertures, a knife mounted adjacent the other face of said die plate for movement over said face in a direction transverse to the axes of said apertures, a ring secured to said knife and surrounding said apertures, means for rotating said rollers and said ring to move said knife, an arcuate member engaging said ring and said die plate for securing said ring and plate to said housing in spaced parallel relationship, and means for rotating said rollers and said ring to move said knife.

6. In apparatus of the class described, a housing, an apertured die plate removably disposed in said housing, a plurality of rollers disposed adjacent one face of said die plate in rotatable relationship therewith for compressing and forcing material through said apertures, a knife mounted adjacent the other face of said die plate for movement over said face in a direction transverse to the axes of said apertures, an arcuate member securing said die plate to said housing, said member having an arcuate groove therein, a ring slidably mounted in said groove and secured to said knife, means for rotating said rollers, and means for moving said ring in said groove for moving said knife over the face of said die plate.

7. In apparatus of the class described, a housing, an apertured die plate removably disposed in said housing, a shaft supported in said housing adjacent said die plate, a roller mounted on said shaft and disposed in tangent peripheral relationship with the apertured surface of said die, means for rotating said shaft and said roller to compress and force material deposited on the surface of said die through said apertures, a split ring having a portion thereof securing said die plate and housing together, and a portion provided with a peripheral groove, an annular member mounted in said groove in rotatable relationship with said die, a knife secured to said member and projecting over the lower surface of said die, and means projecting into said groove and engaging said member for rotating said member and moving said knife over the surface of said die plate in a plane transverse with the axes of said apertures.

8. In apparatus of the class described, a housing, an apertured die plate removably disposed in said housing, a shaft supported in said housing adjacent said die plate, a roller mounted on said shaft and disposed in tangent peripheral relationship with the apertured surface of said die, means for rotating said shaft and said roller to compress and force material deposited on the surface of said die through said apertures, a split ring having a pair of parallel circumferential upper and lower grooves therein and a radially disposed aperture entering said lower groove, said upper groove engaging and securing together said housing and said die plate, an annular member having gear teeth on the periphery thereof rotatably mounted in said lower groove, a knife disposed on said member for severing the material extruded through said apertures, a shaft connected for rotation with said roller shaft and journaled on said housing adjacent said annular member, and a pinion secured to said shaft and engaging the teeth of said annular member through said aperture.

9. In apparatus of the class described, a hous-

ing, an upright member adapted to be rotated mounted in said housing, a horizontally positioned apertured die plate, means for supporting said die plate, a plurality of rollers mounted on said upright member adapted to compress and force material through said die plate, a ring gear positioned substantially at the surface of the die plate to rotate parallel and co-axially therewith, a knife carried by said ring gear and movable therewith for severing at the surface of the die plate the material as it is extruded therethrough said knife being the only element overlying the surface of said die plate, means for rotating said rotating member, and means outside the discharge path of the material for rotating said ring gear.

10. In apparatus of the class described, a housing, an upright member adapted to be rotated mounted in said housing, a horizontally positioned apertured die plate, means for supporting said die plate, so constructed and arranged as not to overlie the apertured portion of said die plate, a plurality of rollers mounted on said upright member adapted to compress and force material through said die plate, a ring gear positioned substantially at the surface of the die plate to rotate parallel and co-axially therewith, a knife carried by said ring gear and movable therewith for severing at the surface of the die plate the material as it is extruded therethrough, means for rotating said rotating member, and means connected with the periphery of said ring gear for driving the same.

11. In apparatus of the class described, a housing, an upright member adapted to be rotated mounted in said housing, a thrust bearing mounted on and adjacent the top of the housing and in which the upper end of the rotating member is journaled, means for supporting the rotating member in upright position, a horizontally positioned die having extrusion apertures therein, means for supporting said die on said housing, a plurality of rollers mounted for movement with said rotating member and adapted to compress and force material through said apertures, a knife positioned below said die for movement about and in contact with the face thereof, means for rotating said rotating member, and means outside of the delivery path adjacent the periphery of said die for rotating said knife to cut off the extruded material, said delivery path below said knife being unobstructed.

12. In apparatus adapted to extrude material through an apertured die plate, means for cutting off said material comprising a floating ring gear attached to said plate and positioned to surround the apertures in said plate and substantially in the plane of the surface thereof, a knife attached to said ring gear and extending inwardly across said apertures, said knife being the only element in the delivery path of the extruded material and means connected with the periphery of said ring gear for rotating the same.

13. In apparatus of the class described, a perforated die plate, a column supporting said die plate, a roller mounted for orbital movement externally of said column and adjacent one face of said die plate for compressing and forcing material through said perforations, and means independent of said column for moving said roller through its orbital path.

14. In apparatus of the class described, a perforated die plate, a column centrally supporting said die plate, a roller mounted for orbital movement about said column and adjacent one face of said die plate for compressing and forcing

material through said perforations, and means independent of said column for moving said roller through its orbital path.

15. In apparatus of the class described, a perforated die plate, a stationary column supporting said die plate, a rotatable sleeve surrounding said column, a roller depending from said sleeve and adjacent one face of the die plate for compressing and forcing material through said perforations, and means for rotating said sleeve and roller about the column axis.

16. In apparatus of the class described, a perforated die plate, a stationary shaft secured to said die plate, a sleeve disposed about said shaft, means mounted on said sleeve for movement thereabout adjacent a surface of said die plate for compressing and forcing material through the perforations thereof, means for rotating said sleeve, and means disposed adjacent one end of said shaft and sleeve for preventing relative axial movement therebetween.

17. In apparatus of the class described, a perforated die plate, a column secured at one end to said die plate, a sleeve disposed about said column, means supported by said sleeve and adjacent one face of said die plate for compressing and forcing material through the perforations therein, a housing enclosing one end of said column and the adjacent end of said sleeve, a thrust bearing disposed in said housing between the ends of said column and said sleeve, and means for rotating said sleeve.

18. In apparatus of the class described, a perforated die plate, a column secured at one end to said die plate, a sleeve disposed about said column, means supported by said sleeve and adjacent one face of said die plate for compressing and forcing material through the perforations

therein, a housing enclosing one end of said column and the adjacent end of said sleeve, a thrust bearing disposed in said housing between the ends of said column and said sleeve, a prime mover, and means within the housing for connecting said prime mover with said sleeve to effect rotation thereof.

19. In apparatus of the class described, a housing, a chamber in said housing having an aperture opening into said housing, a perforated die plate mounted in said housing, a column secured to said die plate and extending through said aperture, a sleeve disposed about said column and extending through said aperture, means mounted on said sleeve and adjacent one face of said die plate for compressing and forcing material through the perforations therein, means for rotating said sleeve, and means disposed within said chamber and adjacent the ends of said column and sleeve for transmitting thrust stresses therebetween.

20. In apparatus of the class described, a housing, a rotatable upright member mounted in said housing, a horizontally positioned apertured die plate, means for supporting said die plate so constructed and arranged as not to overlie the apertured portion of said die plate, a roller mounted for orbital movement about said upright member and adapted to extrude material through said die apertures, a ring positioned substantially at the surface of said die plate and without the discharge path of the extruded material, a knife carried by said ring and movable therewith for severing the extruded material, and means outside the discharge path of the material for rotating said ring.

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