

Aug. 4, 1953

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2,647,474

FEED COMPRESSING MACHINE

Filed Sept. 30, 1949

2 Sheets-Sheet 1

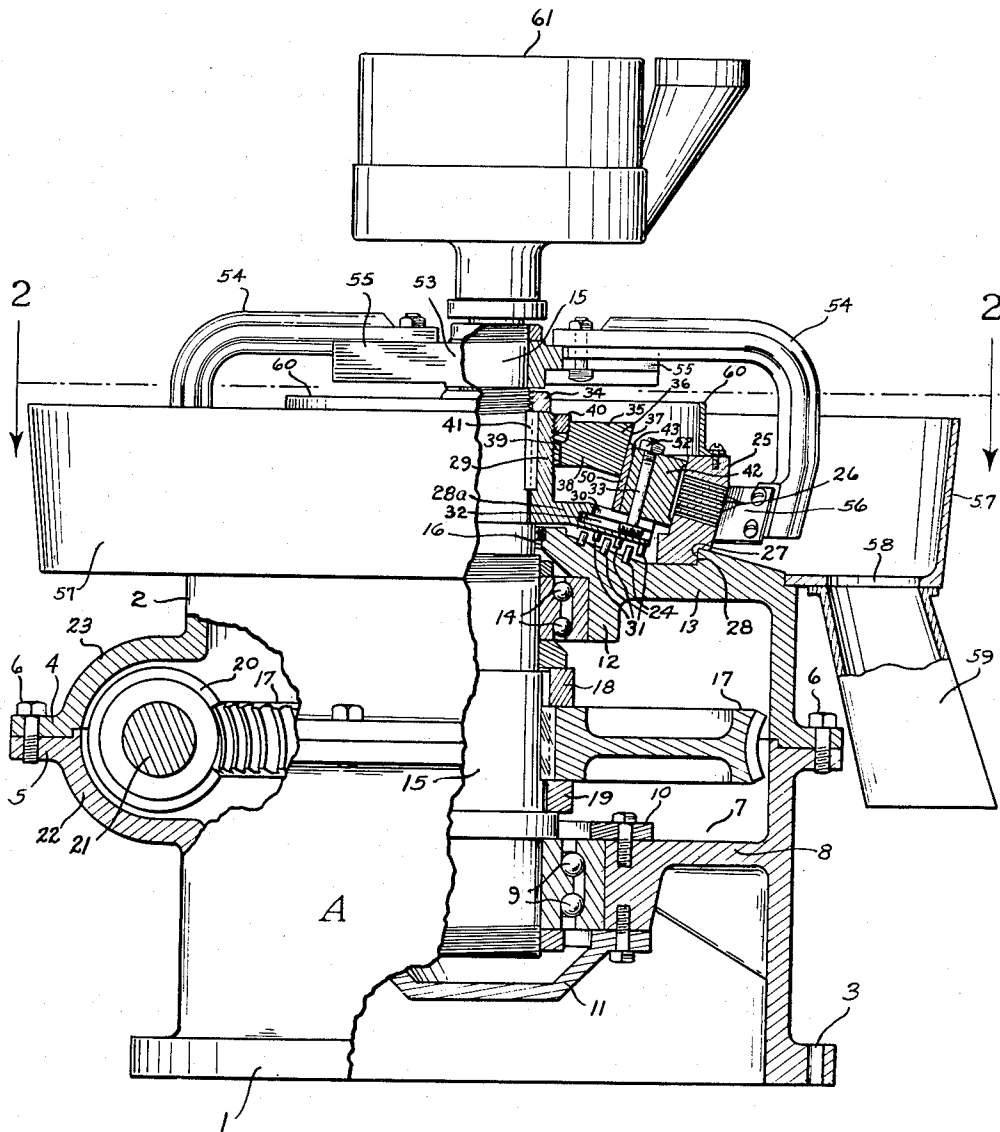


Fig. 1.

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2 Sheets-Sheet 2

Fig. 2

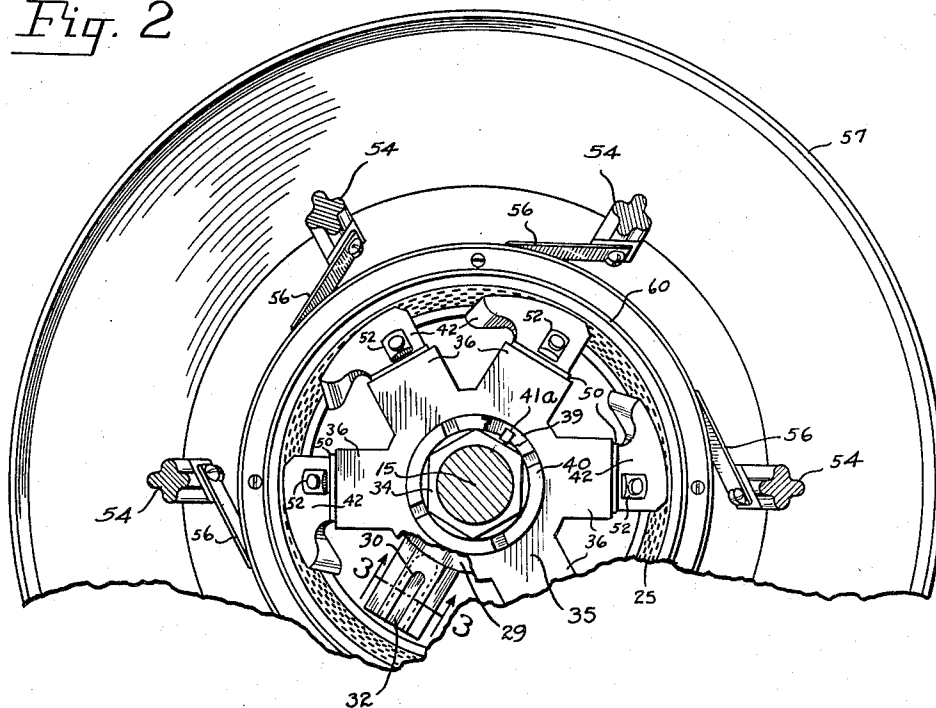


Fig. 4.

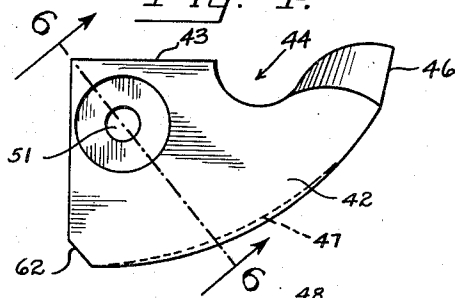


Fig. 3.

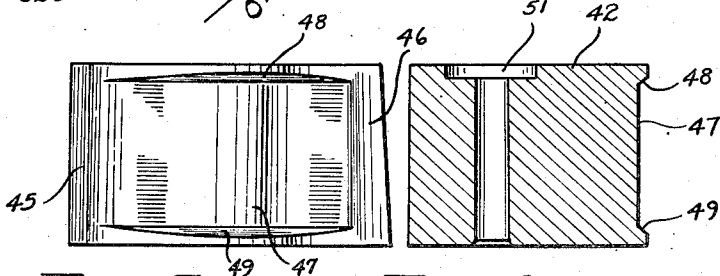
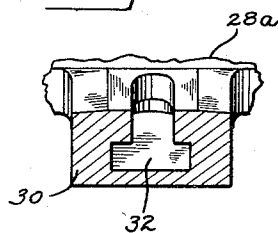


Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE

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FEED COMPRESSING MACHINE

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9 Claims. (Cl. 107-14)

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In its broadest scope this invention relates to machines for processing a conglomerate, pliable or semipliable mass into compressed pellets, cakes, or other shapes and of suitable sizes and consistency for use as fowl and animal foods.

The invention has a close affinity to feed compressing machines employing ring dies to form the conglomerate mass into pellets, cakes and other desirable shapes. It is particularly indistinguishable with the invention described and claimed in United States Patent Number 2,160,302, granted to John W. Billows on May 30, 1939 on a Compressed Feed Machine.

In fact, the general objects and advantages enumerated in the foregoing patent, apply with equal effect to the present invention. However, in applying the teachings of the foregoing patent to practical tests, certain inherent disadvantages were revealed, all of which have been overcome by the present invention, and, in addition, other desirable objects, advantages and features result from this invention as will be pointed out forthwith.

As pointed out in Patent No. 2,160,302, one of the features of that invention is that, subject only to commercial practicability, its basic design and principles of operation are in no way affected by the size of the unit. The very essence of that invention lies in the provision of means for permitting adjustments of the distance between the interior of the die and the shoe portion of the compressing means in order to control the volume of feed which may be forced through a die possessing perforations in a predetermined area and thus insuring that sufficient material will be fed through the die in order to produce feeds of uniform size, density, and quality. This applies equally as well as to the present invention with the added features of permitting the use of a greater number of shoe portions of the compressing means to increase the productivity of the machine without increasing its workload and providing simpler and more effective means for permitting the adjustments of the distance between the interior of the die and the shoe portions of the compressing means.

One of the difficulties discovered in the use of a machine embodying the principles disclosed and claimed in Patent No. 2,160,302, was that, in spite of the uniform feeding of the materials to be compressed into the machine, the shoes used to compress the materials through the die did not wear off evenly, nor did the interior of the die wear evenly. It is, therefore, one of the important objects of the invention to provide com-

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mon and variable means for compensating for the uneven wear of these shoes and die and thereby insure the production of compressed feeds uniform in size, density and quality.

Still another equally important object of the invention is to provide, in a machine having a ring die through which a pliable or semi-pliable material may be continuously extruded, a plurality of uniformly spaced shoes which operate within the area surrounded by the die and which frictionally force the material through the die by a wiping action exerted against the material and preventing said material from escaping gradual compression and final exudation from said die.

An equally important object of the invention is to provide one or more shoes which have the structural characteristics permitting greater productivity of the machine with less wear on the shoes and die.

Other objects and advantages of the invention will undoubtedly become apparent as the following detailed description is read in conjunction with the accompanying drawings, forming a part of the specification herein, in which there is shown the preferred embodiment of the invention, but only for the purpose of illustrating one mode of embodying the principles of the invention.

In the accompanying drawings, in which the same reference characters are uniformly employed to designate the same parts throughout:

Figure 1 is a side elevation, partly in section and broken away, of a machine embodying the principles of my invention;

Figure 2 is a top plan view taken on line 2-2 of Figure 1 looking in the direction indicated, partly in section and broken away, showing the structural characteristics of the interior of the machine embodying the principles of the invention;

Figure 3 is a sectional, end view, partly in section and broken away, taken on line 3-3 of Fig. 2 looking in the direction indicated, to show the structural features of one of the legs of the shoe holding spider;

Figure 4 is a top perspective of one of the shoes employed in my invention showing some details of construction;

Figure 5 is a plan view of the working face of the shoe shown in Fig. 4; and

Figure 6 is a sectional view of a shoe taken on line 6-6 of Fig. 4, looking in the direction indicated to graphically show the side configuration of the working face of the shoe.

The machine embodying the principles of the

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invention is confined in a casing, generally designated by reference character A, and is composed of sections 1 and 2. Section 1 of the casing has the usual openings 3 to provide satisfactory anchorage between the casing and its support.

The bottom flange 4 of section 2 of the casing is disposed upon and tightly secured to the top flange 5 of section 1 with the usual gasket therebetween, and these are secured to each other in any desirable manner, as by bolts 6. When sections 1 and 2 are thusly secured an oil chamber 7 is provided having sufficient area therein to house the shaft, bearings, and gearing shortly to be described.

A bearing support 8 extends inwardly from the inner wall of section 1 and possesses the structural requirements for securely supporting suitable bearings 9 therein as well as help carry the thrust load. A circular plate 10 is removably secured to the top of support 8 to hold the bearings 9 in place. A gasketed plate 11 is removably secured to the under side of the bearing support 8 to give access to the bearings and permit removal of the lubricant, if desired. Section 2 of the casing also has a bearing support 12 extending downwardly from its top 13 and possesses the required structural elements to support suitable bearings 14 therein. Support 8 and top 13 are adequately reinforced to withstand the normal upward thrust incident to the operation of the machine and bearings 9 and 14, employed in the machine embodying the invention, are preferably thrust bearings of any well-known type to resist this normal upward thrust.

A shaft 15 extends vertically in relation to sections 1 and 2 and passes through a centrally located opening 16 having an appropriate oil seal surrounding the shaft. Bearings 9 and 14 have their respective inner races secured to shaft 15 by the employment of means too well-known to warrant description. A gear wheel 17, completely confined in chamber 7, is keyed or otherwise firmly secured to shaft 15 and has bearing spaces 18 and 19 above and below it. A helical pinion 20 is at all times in mesh with gear wheel 17 and is mounted on a shaft 21 journaled within the casing, as shown in Figure 1, in bearings (not shown) at each end of the transverse cylindrical portions 22 and 23 of casing sections 1 and 2, so that the shaft 21 extends beyond the casing A. Since the gear wheel and pinion are both confined in chamber 7, they are at all times in a bath of oil. The source of power for driving the pinion has been purposely omitted, since any power source may be employed without altering the basic construction of the machine embodying the invention.

Only a slight change has been made in the structural characteristics of the top 13. A plurality of pins 24, in parallel transverse alignment extend upwardly from the top and then only at substantial intervals. These pins, in cooperation with a plurality of complementary pins extending downwardly from the compressing shoes supporting spider hereinafter to be described, prevent the material being processed to become compacted on the top 13. Except for this slight change, the top 13 has the same configurations as disclosed by the Billows patent and will therefore not be described in detail.

No change at all has been made in the die 25, therefore the description of the die in the Billows patent fits the die employed in this machine embodying the invention. The die consists of an annular tapered ring which is removably posi-

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tioned with respect to top 13 and has a plurality of openings 26 formed therethrough. These openings are radially disposed with relation to the die and are inclined proportionately to the taper of the die shown in the drawings. The size and shape of the openings are different for each die and depend largely upon the type of compressed feeds that it is desired to have manufactured. More will be said later about the interchangeability of dies. By cutting out from the die an annular portion as shown at 27, corresponding and complementary to the height of the annular wall 28 formed on the top 13, anchorage for the die is provided and some of the thrust resulting during the compression of the material, is taken up when the machine is operated.

A compression shoe supporting spider 28a is keyed, as at 41 Figure 1, or otherwise firmly secured to shaft 15 so that it may rotate with the shaft as its axis. The supporting spider consists of an externally threaded hub 29 and of a plurality of arms 30 radiating from the base of the hub. Whether there are two or more arms employed, they all are positioned equidistant from each other about the hub and lie in the same lateral plane. One or more of arms 30 may have a plurality of pins 31 extending downwardly from its underside in complementary relation to the pins 24. Each arm 30 has an open-ended slot 32 formed within the inclined portion, as shown in Figure 3, to receive the head of a compressor shoe holding bolt 33. A nut 34 is threaded on shaft 15 and positioned against the top of the hub 29 of the compressor shoe supporting spider 28a so that the supporting spider is securely held in place on shaft 15 and yet may be readily removed therefrom when desired.

A wedge carrying plate 35 is slideably positioned about and keyed to the hub 29 of the compressor shoes supporting spider 28a. Plate 35 has a plurality of wedges 36 radiating therefrom each equally spaced from the other and their number equalling the number of arms 30 radiating from the hub 29 of supporting spider 28a. The face 37 of each of the wedges 36 is inclined inwardly at an angle equal to the inclination of the interior face of the die 25 and the underside 38 of each of the wedges has the same contour as the top contours of arms 30. An annular recess 39 is formed in the top of plate 35 adjacent to its juncture with the hub 29 and a wedge plate nut 40 fits therein and is threadably positioned about the hub 29 of spider 28a. The plate nut 40, when threaded about the hub 29 prevents the upward movement of plate 35 and holds it snugly in place. From the foregoing, it will be noted that plate 35 may be slideably positioned at any point on the hub 29 and held against rotation in relation thereto by the key, as shown at 41a Figure 2. The plate 35 is always positioned with respect to spider 28a so that its wedges are aligned with the arms of the spider and, except for this adjustment provision, the plate and spider operate as a single assembly.

Figures 4, 5 and 6 reveal the structural characteristics of each compressor shoe 42 shown in working position in Figures 1 and 2 and, since they all possess the identical contours, the detailed description of one should suffice for all. Each compressor shoe 42 has a vertical face 43 which is normally contacted by the corresponding face 37 of the wedge 36 when the shoe is placed on its appropriate arm 30 of spider 28a. An involuted cut out 44, S-shaped in top plan view, is formed within each shoe 42 adjacent

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face 43. This cut out portion in each shoe allows more room for the conglomerate material in the process of being compressed. The compressing face 45 has a general convex contour approximating the curvature of the inner face of the die. The meeting edge 46 of face 45 and cut out 44 is angularly disposed to add to the need for more room for the conglomerate in the compressing stage.

In the practical application of the principles disclosed and claimed in the Billows patent it has been discovered that as the material being processed is progressively confined between the compressing face of the shoe and the inner face of the die, much of the material is forced out from the compression area over and below the shoes and only a portion finally is exuded through the openings in the die. This condition was caused not only by the natural effort of the material being compressed to escape from the compression area, but by the smooth contours of the compressing face of the shoe and the inner face of the die. In addition, it was discovered that excessive friction between two case hardened metals not only caused premature and excessive wear of the shoe face and die but resulted in the creation of frictional heat which damaged to some extent the resulting product. To overcome all of these objectionable conditions, the compressing face 45 of the shoe 42 has been changed in some degree. An arcuated shallow recess 47 is provided in the compressing face 45 beginning almost imperceptibly slightly in back of edge 46 and ending as imperceptibly adjacent the rear edge 62 of the shoe. Fig. 4 shows, in dotted line, the approximate outline of the recess in relation to the face 45 and the approximate depth of this recess is best shown in Fig. 6. The top and bottom walls 48 and 49 of this recess are oppositely inclined leaving only narrow edges. Rear edge 62 is rounded to permit any material escaping initial exudation to escape rearwardly during compression and to mix with the conglomerate about to be compressed by the compressor shoe immediately in rear thereof.

By employment of this type of construction it has been discovered that the materials being compressed between each shoe and the inner die surface immediately is packed into this recess and become extremely compacted but never to the hardness of the metal of the shoe.

This compacted material presents a much rougher surface to the remaining conglomerate being compressed and acts as a strong retardant for the materials seeking to avoid exudation through the die openings except such as is permitted to escape rearwardly by rounding edge 62. In fact, by the use of this type of shoe construction, the capacity of the Billows machine has been increased many fold. In addition, the die and shoe wear incident to the wiping action between two case hardened metals has been appreciably reduced.

Wear nevertheless does take place and, when it does occur, plate 35 is positioned in relation to spider 28a so that wedges 36 fit snugly adjacent face 43 of each shoe. However, experience has shown that the shoes and the die do not wear out in the same degree, hence provision is made to compensate for the varying wear of each shoe and each die. This is accomplished by placing a removable shim plate 50 between each wedge 36 and the face 43 of each shoe 42. These shim plates are not of the same thickness, since their thickness depends upon the

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wear of the respective shoes. Shim plates 50 are removably secured to the respective face of each shoe in any desirable manner not shown.

A shoe 42 is adjustably positioned on each arm 30 of spider 28a by insertion of shoe holding bolt 33 into opening 51 so that the head of the bolt sits in slot 32 and the threaded portion extends beyond opening 51 for engagement by nut 52.

It is obvious from the foregoing that each compressor shoe is subject to three adjustments, namely, one accomplished at the time the shoe is positioned on its respective spider arm, another by the use of the wedge supporting plate and the third by individually placed shim plates. Each of these adjustments is employed not only to compensate for wear incident to the operation of the machine but also to control flow of conglomerate between the compressor shoes and inner die face to produce feeds of the desired size and density. The necessity for such adjustments becomes obvious when consideration is given to the fact that it is within the contemplation of the invention to use dies having openings of different sizes and shapes in order to produce feeds of different sizes, shapes, and consistency. This in turn results in varying types of wear on the shoes requiring common and varying means for their adjustment.

Attention is now turned to the means for severing the material as it is extruded in compressed form through the openings 26. This is accomplished by providing knife holding spider 53 which is keyed or otherwise secured to shaft 15. A plurality of knife arms 54 are adjustably secured to the spokes 55 radiating from the hub of the spider. Each arm 54 has a downwardly extending elbow to the end of which is removably secured a stripping knife 56. The sharp edges of stripping knives 56 contact the outer face of the die at a tangent and cut the compressed material into small portions as it is extruded through the openings 26.

A trough 57 is removably secured to and is disposed upon the peripheral edge of section 2 and has an outlet 58 therein to which a compressed feed chute 59 is secured. Sweeper blades, not shown, move the compressed feed to this chute. A skirt 60 is secured to the top of the die to permit confinement of the materials being processed as it comes from the feeder 61, the structural features of which will be the subject of another application and therefore will not be described herein. The meal formed by combining various animal, vegetable, grain, or other sundry material, or a combination of these, depending upon the type of feeds to be manufactured, is delivered into the space thus formed and between the space found between the die and the shoes and then gradually confined between the shoes and die and finally extruded as ribbons to be cut into the desired size and shapes.

The operation of the machine embodying the invention is substantially similar to the mode of operation disclosed in the Billows patent. The differences may be found only in the manner of securing and adjusting the compressing members and the novel construction features of the compressing members themselves. It is believed that the foregoing detailed description reveals the nature of the invention and its application.

Having thus described my invention, what I claim is:

1. In a machine of the character described, a stationary, annular die provided with a plurality

of spaced, radially disposed openings, means for supporting said die, a shaft journaled within said means and disposed axially with relation to said die, a supporting spider secured to said shaft and confined entirely within the space surrounded by said die, a plurality of compressing members supported upon said supporting spider, each of said compressing members being disposed with relation to the inner face of the die so that its forward end is slightly spaced from the inner face of the die and the rearward end is positioned in close proximity to the inner face of the die, means associated with each of said compressing members for adjusting their spacing with relation to the inner face of the die, independently actuated means associated with said supporting spider for adjusting the spacing of said feed compressing members with relation to the inner face of the die, and means secured to the supporting spider and to the die supporting means for scarfing any of the materials deposited below the compressing members.

2. In a machine of the character described, a stationary ring die provided with a plurality of spaced, radially disposed openings, means for supporting said die, said means adapted to absorb a portion of the radial pressure created during the operation of the machine, means for locking said die on said first-mentioned means, a shaft journaled within said first-mentioned means and disposed axially with relation to said die, a supporting spider secured to said shaft, said supporting spider having a plurality of open-ended slots therein, a wedge carrying member supported upon the hub of said supporting spider and movable relative thereto, a plurality of compressing members supported upon said supporting spider, each compressing member comprising a body member, wedge shaped in general contour, having a face normally contacted by one of the wedges of the wedge carrying member, an inclined edge at the apex portion of the wedge form of said body member, an involuted cut-out, approximately S-shaped in contour, formed within said body member between said face and said inclined edge and a convex compressing face approximating the curvature of the inner face of the die, said compressing face possessing an arcuate shallow recess beginning almost imperceptibly slightly in back of said inclined edge and ending as imperceptibly adjacent the rear of said body member ending in a rounded edge, a bolt carrying opening formed through the body member for adjustably securing the same to its respective arm of the supporting spider, and each compressing member having one of their sides positioned against said wedge carrying member and having one of its ends in close proximity to the inner face of the die and the other of its ends disposed in slightly spaced relation to the inner face of the die, independently actuated means associated with said supporting spider for adjusting the spacing of said feed compressing members with relation to the inner face of the die, and means for locking the wedge carrying member in position when the desired adjustments have been made.

3. In a machine of the character described, a stationary tapered ring die provided with a plurality of spaced, radially disposed openings, means for supporting said die and for providing a confined area into which the extruded cut material may fall, said means adapted to absorb a portion of the radial pressure created during the operation of the machine, a shaft extending

upwardly from and journaled within said means and disposed axially with relation to said die, means for driving said shaft, a supporting spider secured to said shaft and confined entirely within the space surrounded by said die, said supporting spider having a plurality of open-ended slots therein, an adjustable wedge carrying member disposed upon said supporting spider and movable relative thereto, compressing members adjustably supported on said supporting spider, in relation to said slots and adapted to contact the wedge face of said adjustable wedge carrying member, said compressing members being at all times disposed in close proximity to the inner face of the die, means associated with each of said compressing members for adjusting their spacing with relation to the inner face of the die, a lock nut surrounding said shaft and associated with said wedge carrying member adapted to prevent disengagement between the wedge faces of said member and said compressing members, and independently actuated means associated with said supporting spider for adjusting the spacing of said compressing members in relation to the inner face of the die.

4. A machine characterized as in claim 3 including means secured to the underside of the supporting spider and to the top of the die supporting means for scarfing any of the material which packs therebetween.

5. In a machine of the character described, a stationary tapered ring die provided with a plurality of spaced, radially disposed openings, means for supporting said die and for providing a confined area into which the extruded cut material may fall, a shaft extending upwardly from and journaled within said means and disposed axially with relation to said die, means for driving said shaft, a supporting spider secured to said shaft and confined entirely within the space surrounded by said die, said supporting spider having a plurality of open-ended slots therein, an adjusting member disposed upon said supporting spider and movable relative thereto, said adjusting member having a plurality of wedge shaped arms the faces of which are parallel to the inner face of the die, compressing members movably supported on said supporting spider in relation to said slots and adapted to contact the wedge faces of said adjusting member, said compressing members being at all times disposed in close proximity to the inner face of the die and subject to adjustment by the movement of the adjusting member, means associated with each of said compressing members for independently adjusting them in relation to said wedge faces, a spider having downwardly extending arms secured to said shaft and having their ends positioned in spaced parallel relation to the outer face of the die, stripping members secured to the ends of the arms and angularly positioned against the outer face of the die, and sweeper blades depending from said ends of the arms.

6. In combination with a feed compressing machine of the class described, a plurality of compressor shoes each comprising, an arcuately shaped body member having a cut-out S shaped in general contour for permitting additional space for the conglomerate in process of compression, the front end of said member being downwardly inclined for the same purpose, the rear end of said body member being rounded, a shim holding face formed adjacent the cut-out position adapted for continuous control with a wedge plate embodied in said machine, and a convex compress-

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ing face formed oppositely to the shim holding face and cut-out portion, said compressing face possessing contours complementary to the inner face of the die embodied in said machine and having a shallow arcuated recess beginning imperceptibly slightly in back of the front edge and ending as imperceptibly slightly adjacent its rear end.

7. Compressor shoes characterized as in claim 6 including means rotatably secured to the driving shaft of said machine for holding said shoes in working position.

8. Compressor shoes characterized as in claim 6 including means rotatably secured to the driving shaft of said machine for holding said shoes in working position and a wedge carrying plate slidably positioned in relation to said means adapted for maintaining said shoes in appropriate working relation at all times.

9. Compressor shoes characterized as in claim

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6 including means for holding said shoes in working position, a wedge carrying plate associated with said means and said shoes for maintaining them in proper working relation at all times and shim plates of variable thickness removably secured to said shoes and contacted by the wedge carrying plate adapted to offset the uneven wear of said shoes and inner die face.

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