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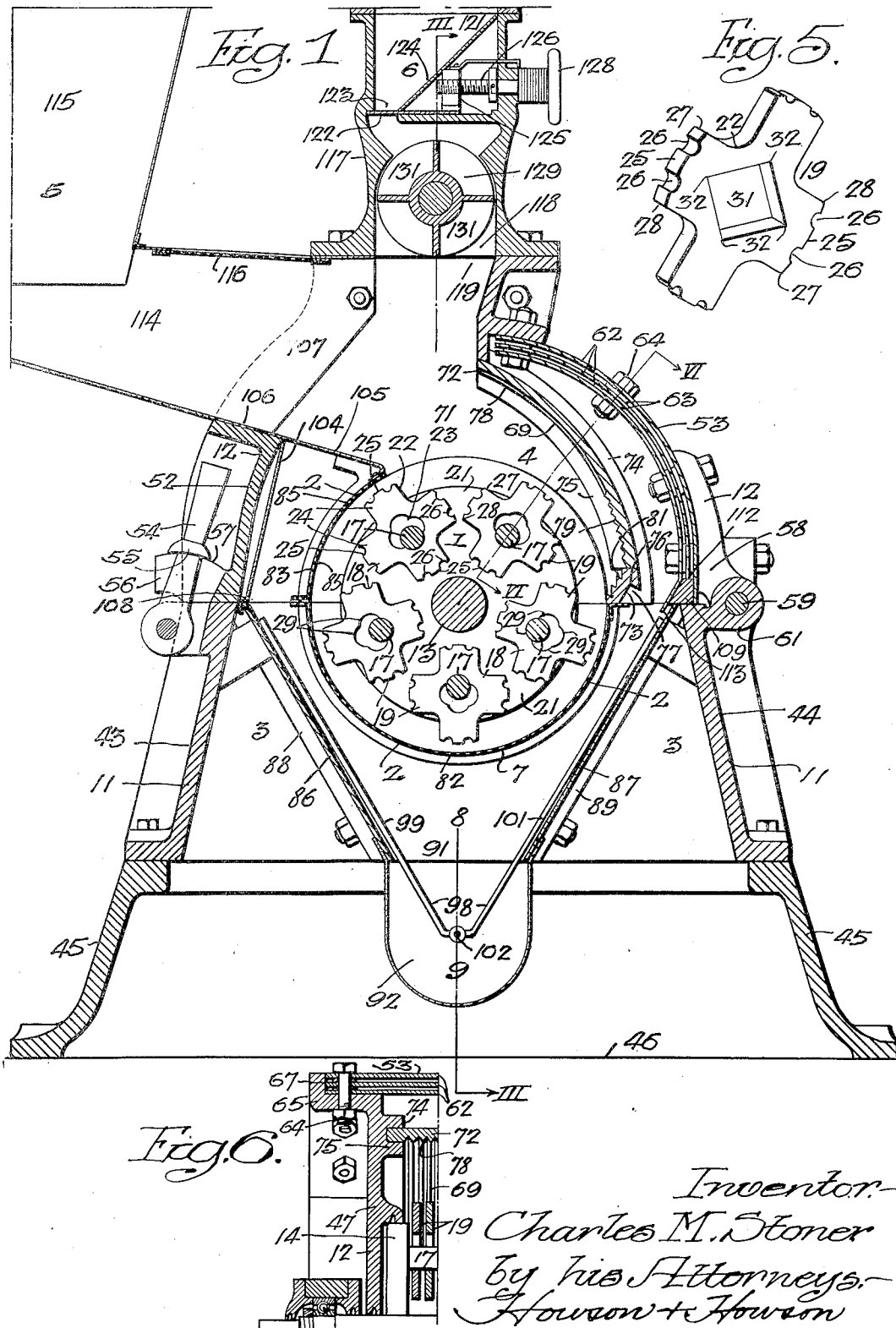
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C. M. STONER

PULVERIZER

Filed Jan. 30. 1926

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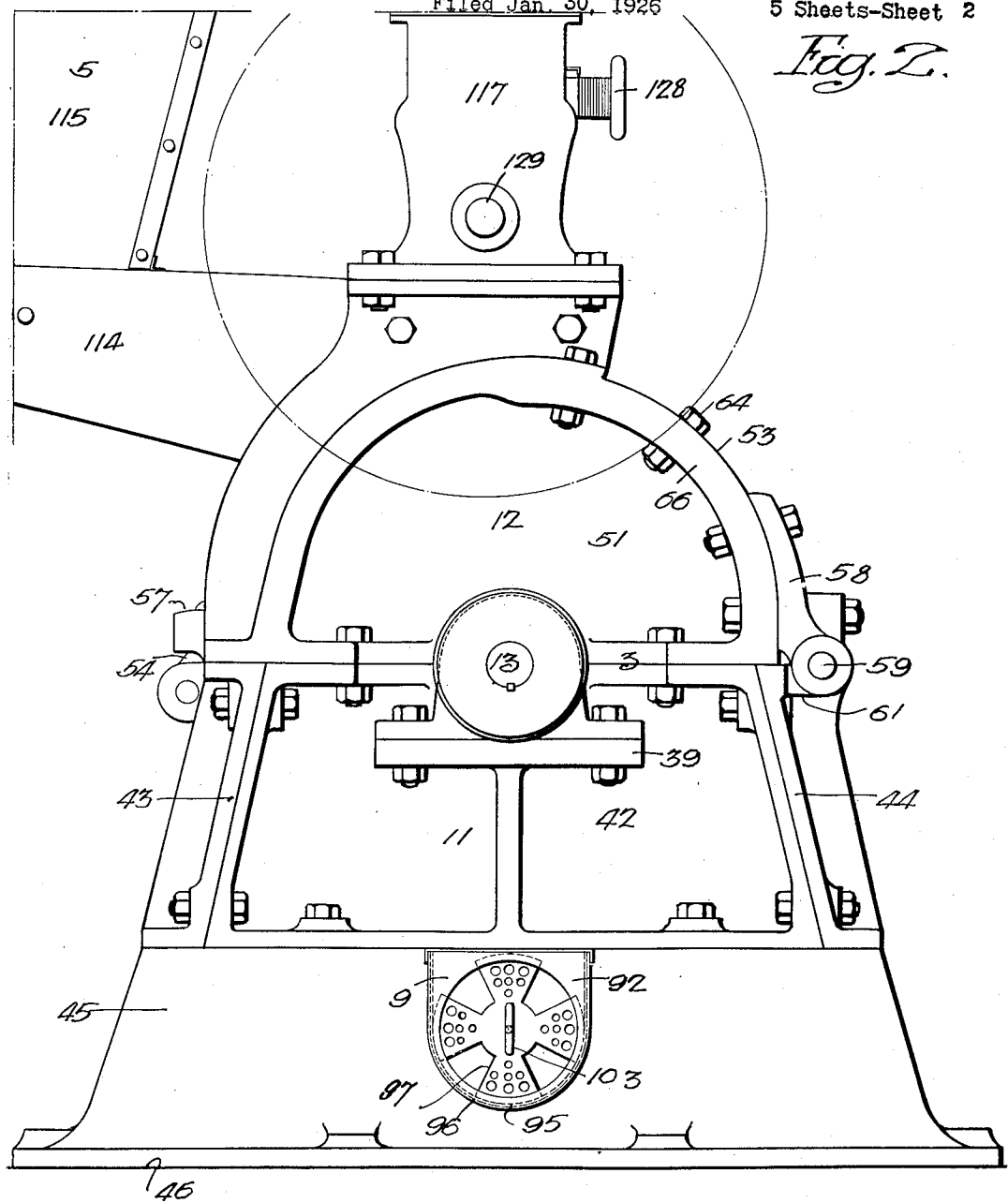
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Fig. 2.



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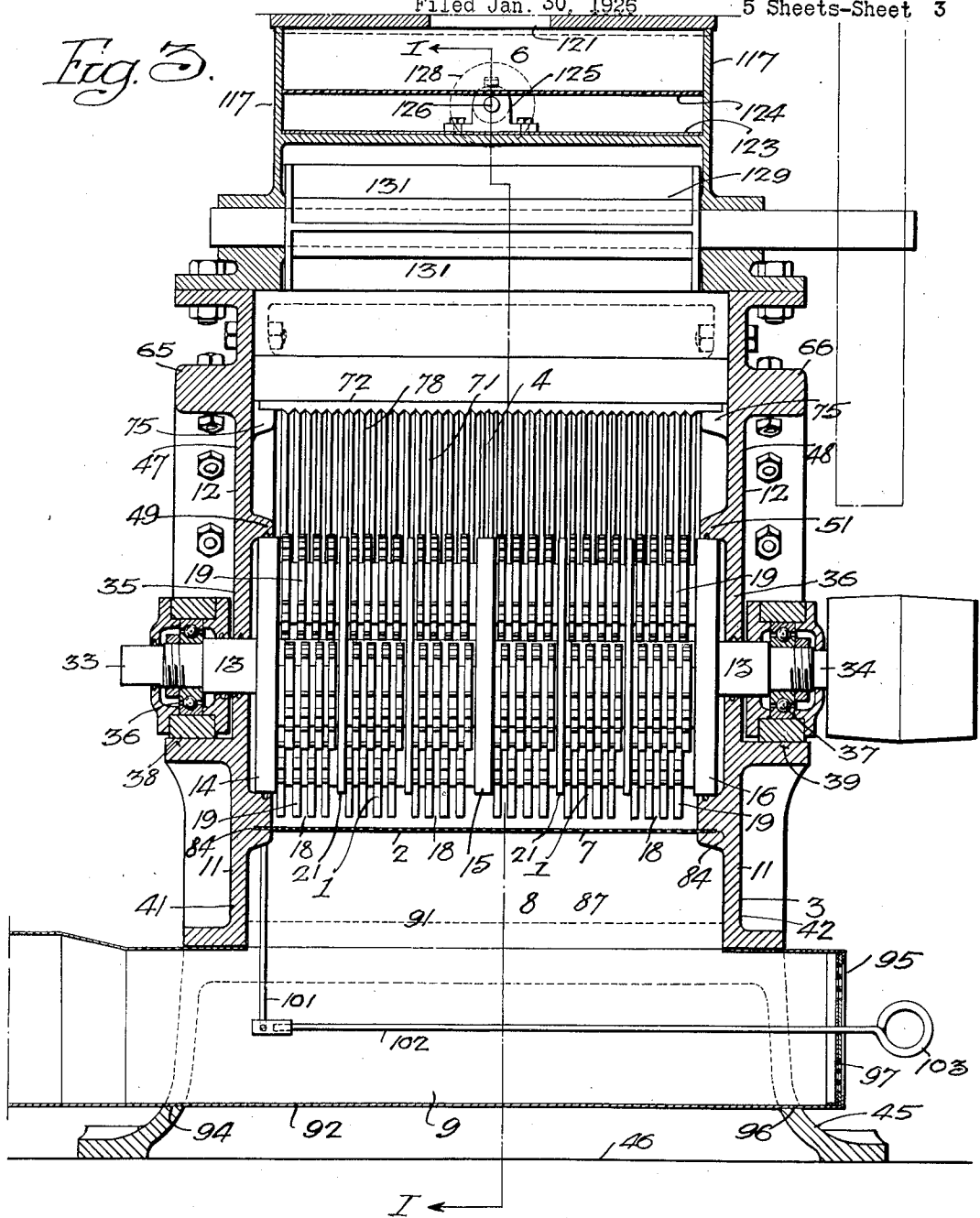
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Fig. 3.



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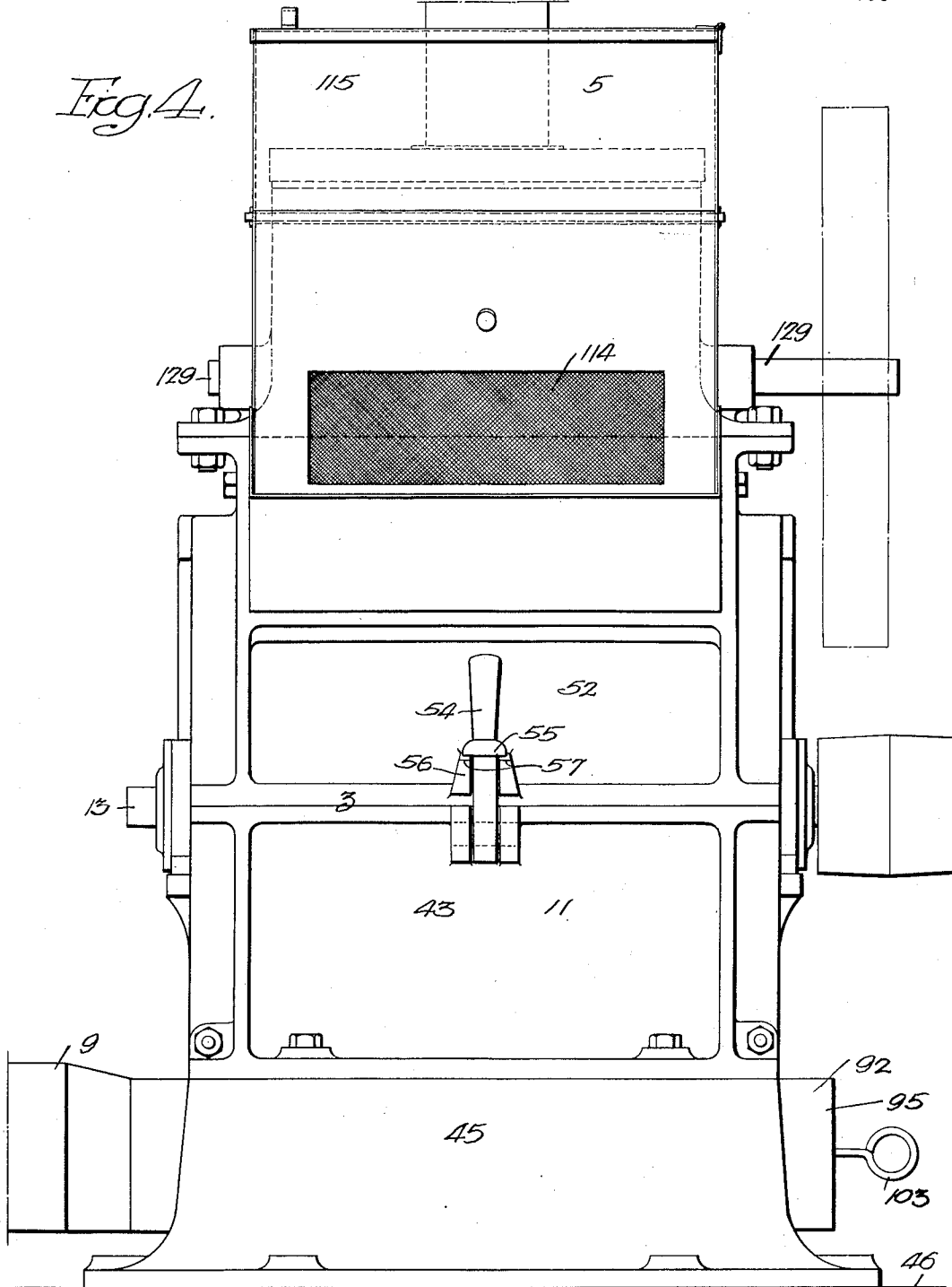
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Fig. 4.



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5 Sheets-Sheet 5

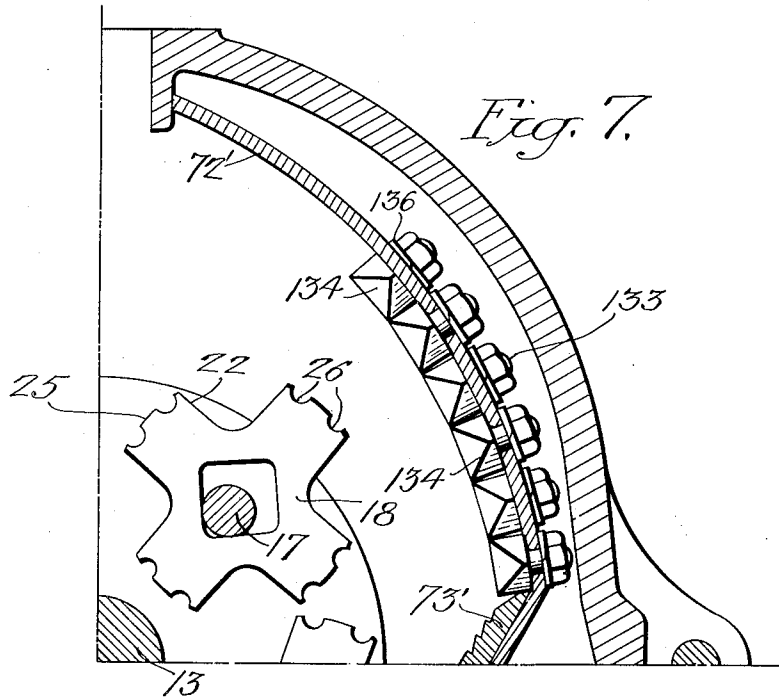


Fig. 8

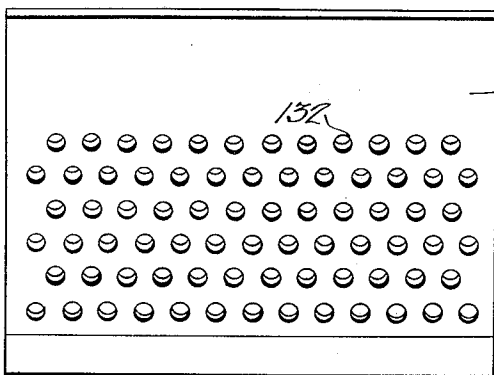


Fig. 9.

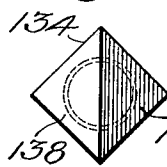


Fig. 10.

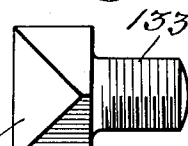


Fig. 11.

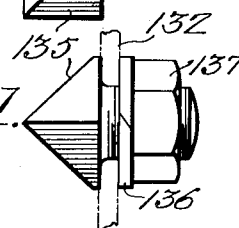


Fig. 12.

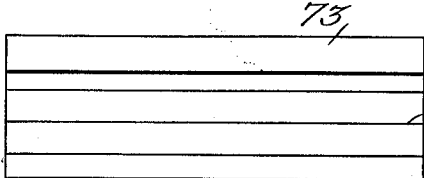
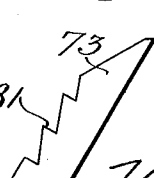


Fig. 13.



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UNITED STATES PATENT OFFICE.

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PULVERIZER.

Application filed January 30, 1926. Serial No. 84,931.

My invention relates to pulverizing machines, and it has for one object the provision of a machine that shall be adapted to convert various materials from large sizes to a pulverized or semi-pulverized condition or to any desired graded size.

Another object of my invention is to provide a combined feeding and crushing machine, whereby a number of different ingredients may be supplied to the crusher in measured quantities and thereafter pulverized or reduced to a desired degree of fineness and mixed.

A further object of my invention is to provide a rotary crusher, wherein the flails have an automatic intermittent rotary movement around their supporting spindles.

A still further object of my invention is to provide a rotary crusher characterized by the fact that the blades present a maximum flailing surface, the blades on one supporting spindle leading those on the following spindle, so that the entire face of the rotor may act on the material to be crushed.

A still further object of my invention is to provide a crusher rotor comprising a pair of driving discs, of which one constitutes a sealing element, a plurality of spindles carried by said discs, and a plurality of tension discs for further supporting said spindles and decreasing the centrifugal strains therein resulting from the flails.

A still further object of my invention is to provide a pulverizing machine which shall embody a hinged cap, whereby ready access may be had to the crusher cage and associated parts.

A still further object of my invention is to provide a crusher cage, wherein one portion defines an inlet opening for the stock, another portion constitutes a sectional crusher plate and a third permits the discharge of the ground stock.

A still further object of my invention is to provide a sectional breaker plate construction having an upper rebounding, breaking surface, an intermediate concentrating surface, and a lower baffle surface.

A still further object of my invention is to provide a rotary-crusher housing with protective means, comprising a heavy laminated plate, so that should foreign material be accidentally fed into the machine, it can-

not reach the outside without first passing through said plate.

Other objects and applications of my invention, as well as details of construction and operation, whereby my invention may be practiced, will appear more fully hereinafter, when taken in connection with the accompanying drawings, wherein

Fig. 1 is a transverse sectional view of a pulverizing machine embodying my invention, the sectional plane being taken on the line I—I of Fig. 3;

Fig. 2 is an end elevational view of the machine of Fig. 1;

Fig. 3 is a longitudinal sectional view taken on the line III—III of Fig. 1;

Fig. 4 is a front elevational view of the structure of Fig. 3;

Fig. 5 is a view in perspective of a flail;

Fig. 6 is a detail sectional view taken on the line VI—VI of Fig. 1;

Fig. 7 is a detail sectional view of a modified form of breaker plate comprising a base plate and a plurality of spikes;

Fig. 8 is a side elevational view of the plate shown in Fig. 7;

Figs. 9, 10 and 11 are top plan and side and end elevational views respectively of the spikes; and

Figs. 12 and 13 are side and end elevational views of the lower section of the breaker plate.

The illustrated embodiment of my invention shown in the drawings broadly comprises a crusher rotor 1 which is positioned in a cage 2 supported in communication with a hopper 5 and a feeding apparatus 6. The cage 2 is also provided with a perforated portion 7 through which the ground stock may be discharged into a hopper 8 which opens into a suction chute 9 adapted to convey the ground stock from the machine. The housing 3 comprises a base section 11, which supports the hopper 8, and a hinged cap portion 12, which embodies the grinding chamber 4, said cap portion 12 being directly associated with the sources of supply 5 and 6.

Considering the construction of the pulverizing machine in greater detail, the rotor 1 (Figs. 1 and 3) comprises a main driving shaft 13 and at least three spaced driving discs 14, 15 and 16 which are keyed or otherwise rigidly secured to the shaft 13. A plu-

ality of spindles 17 are mounted on the several driving discs in substantially equangular relation and extend axially of the driving shaft 13. A plurality of groups 18 of hammers or flails 19 are mounted on each spindle, the groups being operated by tension discs 21. These discs are loosely mounted on the driving shaft 13 and are apertured to receive and to support the several spindles 17. The discs 21 thus serve not only as a support for the blade spindles 17 but also to decrease the centrifugal strains in the several spindles 17 caused by the hammers or flails 19.

The blades or flails 19 of each group are spaced by washers (not shown), and the groups of blades are axially displaced to define a spiral cutting surface extending around the rotor 1, whereby the entire face of the rotor 1 may act on the material to be crushed. Assuming, for example, a rotor as shown in the drawing with five spindles, with spacers between the flails 19 one-fifth of an inch thick, and with successive groups 18 axially displaced one-fifth the thickness of said spacers, then the blade 19 of one spindle is advanced out of true alignment with that on the preceding spindle an amount equal to one-fifth the thickness of the spacing. The result of such spacing is that for one complete revolution of the rotor 1, the otherwise vacant spaces between the blades 19 are filled by succeeding blades 19 advanced to fill this space in the path of revolution. Apart from the vacant spaces due to the driving and tension discs 14, 15, 16 and 21, the entire face of the rotor 1 is therefore effective and a maximum output of ground stock thereby obtained for a given diameter and face of rotor.

Another important feature of my invention is the form of the blade 19 which affords a maximum flailing surface. Each blade or hammer 19 comprises a substantially flat disc 22 (Fig. 1) having a central opening 23 for the passage of the supporting spindle 17, and a plurality of angularly disposed arms 24, say four. The outer ends of the arms 24 define arcuate surfaces 25 which are provided with pairs of notches 26 defining cutting edges. Additional cutting edges 27, 28 are provided by the corners at the outer end of each arm. The diameter of the flail or hammer 19 is such that the unground material entering the grinding chamber 4 is subjected to the cutting action of four edges, viz, the ends of one arm and the corners of adjacent arms. Such operation is illustrated in Fig. 1, wherein the various hammers 19 are illustrated in the position assumed when the driving shaft 13 is rotated.

Since it is desirable to change intermittently the effective cutting surface 25 of the flails 17 relative to the axis of the rotor 1, said flails are so mounted on the spindles

17 as to have automatic intermittent rotary movement as the speed of the rotor 1 is varied. To this end, the aperture 23 of each flail 19 is so formed as to cause said flail to be supported loosely at points spaced 90° apart. Hence, when the rotor 1 is turned, the axis of each flail 19 assumes a radial position relative to the center of said rotor 1. In Fig. 1, the center aperture 23 comprises four arcuate sides 29 which respectively conform to the side of the supporting spindle 17. Fig. 5 illustrates a modified form of aperture 31 for the spindles 17, wherein the round portions 29 are replaced by right-angle corners 32.

When the rotor 1 is brought to rest, the blades 17 drop and therefore assume new bearings on the spindles 17. When the rotor 1 is again started, the blades 19 move outwardly under centrifugal force and again assume different bearings on the spindles 17. As a result, different cutting surfaces 25 engage the stock in the cage 2, and this occurs every time the rotor 1 is started and stopped or the speed thereof sufficiently varied. Should the blades 19 strike a foreign object, such, for example, as a bolt carried into the cage 2 by the stock passing from the hopper 5 or the feeding apparatus 6, said blades will yield and thus avoid breakage. When one set of cutting edges on the blades 19 have become dull, the spindles 17 may be removed and the blades 19 reversed, so as to present unused sharp edges to the stock. When both sets of cutting edges become dull, they may be reground. Thus the flails 19 may be used for a relatively long time before it is necessary to replace the same.

The driving shaft 13 is provided with projecting end portions 33 and 34 which extend through end walls 35 and 36 of the housing 3 and are journaled in antifriction bearings 36 and 37 carried by brackets 38 and 39 extending from the side walls 35 and 36, respectively, of the housing 3. As previously noted, the housing 3 comprises the base section 11 and the hinged cap section 12. The base section 11 comprises side walls 41 and 42 which respectively constitute the lower portions of the housing side walls 35 and 36. The supporting brackets 38 and 39 constitute integral portions of these side walls. The base section 11 also comprises front and rear walls 43 and 44 which are bolted or otherwise secured to the side walls 41 and 42. The base section 11 may be mounted on a hollow frame 45 supported by a floor 46.

The cap section 12 of the housing 3 comprises side walls 47 and 48 constituting upper portions of the housing side walls 35 and 36, respectively. These side walls are in substantial alignment with the corresponding side walls of the base section 11. The finely ground stock in the cage 2 may be prevented from escaping through the por-

tion of the side walls 35 and 36 through which the shaft 13 passes by means of annular flanges 49 and 51 which are so formed on the inner sides of said walls so as to overlap the driving discs 14 and 16, respectively.

The hinged cap 12 further comprises front and rear walls 52 and 53, respectively. These walls are rigidly bolted or otherwise secured to the side walls 47 and 48, as will appear more fully hereinafter. The several walls just mentioned, constituting the cap section 12, engage and rest on the upper edges of the walls forming the base section 11 when the cap section 12 is in the lowered position shown in Fig. 1, and it may be rigidly clamped in such position by means of a lever 54 pivotally mounted on the front wall 43 of the base section 11. The lever 54 is provided with oppositely extending flanges 55 which are respectively adapted to engage spaced members 56 carried by the front wall 52 of the cap section 12 and affording an eccentric seat 57. The rear wall 53 of the cap section 12 is provided with one or more hinge leaves 58 which embrace a pintle 59 supported by a corresponding plurality of hinge leaves 61 extending from the rear wall 44 of the base section 11.

The rear wall 53 of the hinged cap 12 comprises a plurality of curved plates 62 which are spaced by washers 63 and rigidly clamped together by bolts 64. The laminated rear wall 53 serves as protective means in the event of a bolt or other foreign material being fed into the grinding chamber 4 and subsequently thrown by the revolving rotor 1. The opposite ends of this protective wall are respectively mounted on flanged end portions 65 and 66 of the cap side walls 47 and 48. An axial movement of the rear wall 53 may be further prevented by providing the flanged portions 65, 66 with shoulders 67 (Fig. 6), which are adapted to engage the edges of the plates 62 constituting the rear wall 53.

One wall of the grinding chamber 4 is formed by the rotor 1 which serves to throw the material entering said chamber into engagement with an opposite wall 69 constituting a breaker plate. The upper end of this plate, adjacent to an inlet opening 71 for the grinding chamber 4, is spaced a maximum distance from the rotor 1, but this gradually decreases to a minimum at the lower end of said breaker plate. The breaker plate 69 may comprise two sections, viz, an upper section 72 and a lower section 73. The upper section is supported intermediate spaced flanges 74 and 75 extending inwardly from the side walls 47 and 48 of the hinged cap 12. The lower section 73 of the breaker plate 69 is provided with a groove 76 which engages complementary projecting portions 77 of the side wall

flanges 75, whereby this section may also be removably supported.

The upper breaker plate section 72 is provided with a plurality of grooves 78 (Fig. 3) in an upper portion thereof which define sharp cutting edges extending transversely of the axis of the machine. The lower portion of this section is provided with similar grooves 79, but these extend parallel to the axis of the machine. The lower breaker plate section 73 extends inwardly of the adjacent end of the upper section 72 and it is provided with a plurality of sharp teeth 81 which also extend axially of the machine. In operation, the upper portion of the upper plate section 72 serves as a rebounding breaking surface, while the lower portion of this section serves as a concentrating surface. The lower plate section 73 serves as a baffle surface, preventing material that is too large from passing to the lower portions of the cage 2, and it also causes the breaking and grinding of stock moving downwardly from the upper plate section 72. For certain classes of work, the breaker plate 69 is not necessary and may be replaced by screens.

Figs. 7 to 13, inclusive, illustrate a modified form of breaker plate comprising an upper section 72' and a lower section 73'. The upper section 72' is provided with a plurality of apertures 132 adapted to receive the threaded shanks 133 of steel spikes 134, head portions 135 of which extend outwardly from the base of the upper section 72'. The plurality of apertures 132 make possible the positioning of the spikes 134 in any desired arrangement. The spikes may be locked in position by means of a lock washer 136 and a nut 137. Each spike head 135 comprises at least five sharp angles which may be formed by beveling the spike head at 138 and 139. Thus a maximum grinding action may be exerted on the material.

As above noted, the breaker plate 69 constitutes an upper wall portion of the cage 2, the remaining portions 7, aside from the inlet opening 71, comprising screen sections 82 and 83 which permit the ground stock to be discharged from the cage 2 into the hopper 8. The bottom screen section 82 may be mounted in grooves 84 formed in the portion of the side wall flanges 41 and 42 carried by the base section 11. The upper front screen section 83 may be similarly supported in grooves 85 constituting continuations of the grooves 84, the grooves 85 being formed in the portion of the side wall flanges 49 and 51 carried by the hinged cap 12. Thus the screens 82 and 83 are so mounted as to be readily accessible and easily replaceable.

The hopper 8 comprises a pair of plate 86 and 87, which extend between the side walls 41 and 42 of the base section 11 and

are supported by inclined flanges 88 and 89 formed on the inner surfaces of said side walls. The upper edges of the hopper plates 86 and 87 are positioned adjacent to the inner edges of the front and rear walls 43 and 44 of the base section 11. The corresponding lower edges of the hopper plates 86 and 87 are relatively closely spaced and define a discharge outlet 91 which communicates with a trough 92. One end 93 of the trough 92 passes through an opening 94 in the supporting frame 45 to a vacuum pump (not shown), while the other end 95 passes through an opposite opening 96 in the frame 45 and terminates in a damper 97. The hopper plates 86 and 87 may be cleaned by a V-shaped member 98, arms 99 and 101 of which are movable over the surface of the plates 86 and 87, respectively. An operating rod 102 is connected to one end to the member 98, the other end extending through the damper 97 and terminating in a handle 103.

The escape of ground stock, which has been discharged from the cage 2, may be prevented by sealing plates 104 and 105, the latter extending between the side wall flanges 49 and 51 in the cap section of the cage 2 and secured at one edge to the cage section 83 and at the other edge to a lower wall 106 of an opening 107 in the front wall 52 of said cap section. The other sealing plate 104 is so positioned on the inner surface of the front wall 52, that a lower edge 108 thereof engages the adjacent edge of the breaker plate 86 when the cap 2 is closed, as shown in Fig. 1. The upper edge of the sealing plate 104 engages the sealing plate 105 immediately adjacent to the front wall 52.

The lower edge of the rear wall 53 of the hinged cap 12 may be provided with a sealing strip 109 which abuts against the rear wall 44 of the base section 11 and the hopper plate 87 when the hinged cap 12 is closed. The strip may be positioned in the laminated rear wall 53 by removing a portion 112 of the central lamination plate 62, an inner plate having a portion 113 inclined substantially parallel to the hopper plate 87 and projecting beyond the upper edge of the base section rear wall 44.

The opening 107 in the front wall 52 of the hinged cap 12, which is directly in communication with the opening 71 leading into the grinding chamber 4, may be connected by means of a passage 114 to a hopper 115 containing the stock to be ground. The passage 114 may be provided with a screened opening 116 for the entrance of air.

The grinding chamber 4 may also be supplied with material from the feeding apparatus 6, which comprises a casing 117 having a lower discharge opening 118 in alignment with a similar opening 119 in the

front wall 52 of the hinged cap 12. The casing 117 also has an upper inlet opening 121 for the reception of stock. The passage of the stock through the casing 117 may be controlled by a regulating disc 122 which serves to control an opening 123 formed by a deflecting plate 124 and the adjacent side wall of the casing 117. The disc 122 may be operated by means of a nut 125 to which it is secured and a bolt 126 which extends through the casing 117 and terminates in an operating handle 128.

The quantity of stock entering the grinding chamber 4 may be further controlled by a feed roll 129 having a plurality of pockets 131 rotatably mounted within the casing 117 directly below the opening 123. The feed roll 129 may be operated in the usual manner so that desired measured quantities of stock may be supplied to the grinding chamber 4. Under certain conditions, it may be advantageous to use the portion of the casing 117 above the slide 124 as a mixing chamber for measured quantities of stock fed from a number of different sources.

When material is supplied to the pulverizing machine from the hopper 5 or the feeding apparatus 6, or both, and the driving shaft 113 of the rotor 1, is actuated, the material passes into the grinding chamber 4 through the opening 71 and is pulverized by the action of the flails 19 and the breaker plate 69. The ground material is then moved by the rotary grinder 1 into the discharge portion 7 of the cage 2 formed by the screens 82 and 83. The material here discharged from the cage 2 is conveyed by the hopper 8 to the trough 92, whereupon it is removed from the pulverizer by air under suction.

While the machine has been described as a pulverizer, the product may be not only finely pulverized stock but also relatively large grain, such as cracked corn. In the course of considerable experimental work, it has been ascertained that grain, corn, and many cereals, may be pulverized at a peripheral speed of approximating 13,000 feet per minute. Moreover, at peripheral speeds approximating 2000 to 2500 feet per minute, a finely polished cracked corn with only a small percentage of flour may be produced. At the higher peripheral speeds, a finely pulverized flour with little or no chaff is obtained from corn on the cob. Oats also may be pulverized and a product obtained having a very small percentage of roughage. When it is desired to obtain cracked corn from shelled corn, the breaker plate 69 may be replaced by a screen (not shown) having, say, one-fourth inch perforations, the bottom and front screen sections 82 and 83 having five-sixteenth inch perforations. It is understood that the various sizes just mentioned are given for the purpose of showing

the flexibility of the machine as a whole and that my invention is not to be specifically limited thereby.

While I have shown only one form of embodiment of my invention, for the purpose of describing the same and illustrating its principles of construction and operation, it is apparent that various changes may be made therein without departing from the spirit of my invention, and I desire, therefore, that only such limitations shall be imposed thereon as are indicated in the appended claims or as are demanded by the prior art.

I claim:

1. A crusher roll comprising a shaft, a plurality of driving disks secured thereto and spindles extending between said disks, a driving disk, a plurality of spindles carried thereby and a tension disk carried by said spindles.

2. A crusher roll comprising a shaft, a driving disk, a plurality of spindles carried thereby and a tension disk carried by said spindles.

3. A housing provided with opposite walls, a driving shaft having the ends there-

of respectively extending through said walls, the latter being provided with annular flanges, a pair of driving disks so mounted on said shaft in operative relation to said flanges as to form walls, and tension disks, a plurality of disks so mounted on said shaft in operative relation to said flanges as to form seals, and tension disks.

4. A machine of the class described comprising a housing, a cage positioned therein having a perforated portion for the discharge of crushed material, means constituting a hopper for conveying said crushed material to a desired point, and means for cleaning said plates.

5. In a machine of the class described, a housing provided with a pair of plates converging to a desired discharge point and members positioned to be moved over said plates so as to clean the same at will.

6. A rotary crusher comprising a housing provided with a discharge trough, a pair of plates forming a hopper having an outlet in said trough, a pair of rods movable over the surface of said plates, and actuating means for said rods.

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