June 29, 1943. C. E. KERR 2,323,092

UNIVERSAL CORN CUTTER

Filed June 23, 1941 4 Sheets-Sheet 1

FIG_1_

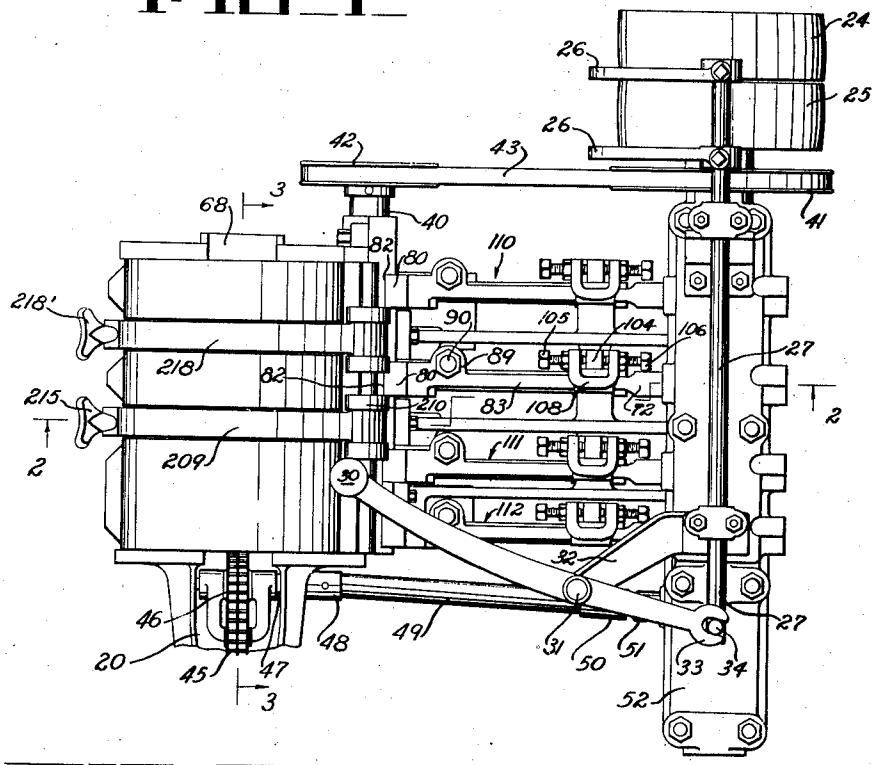


FIG_2_

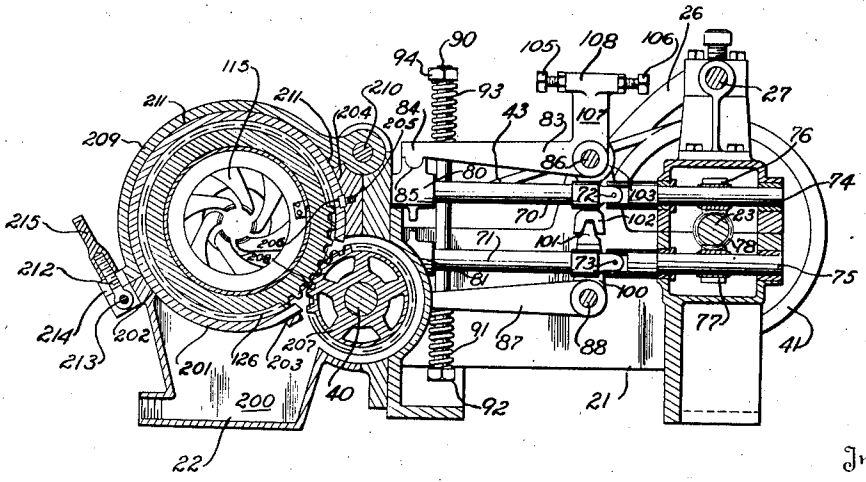
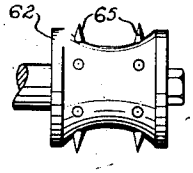


FIG_13_



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UNIVERSAL CORN CUTTER

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FIG. 5

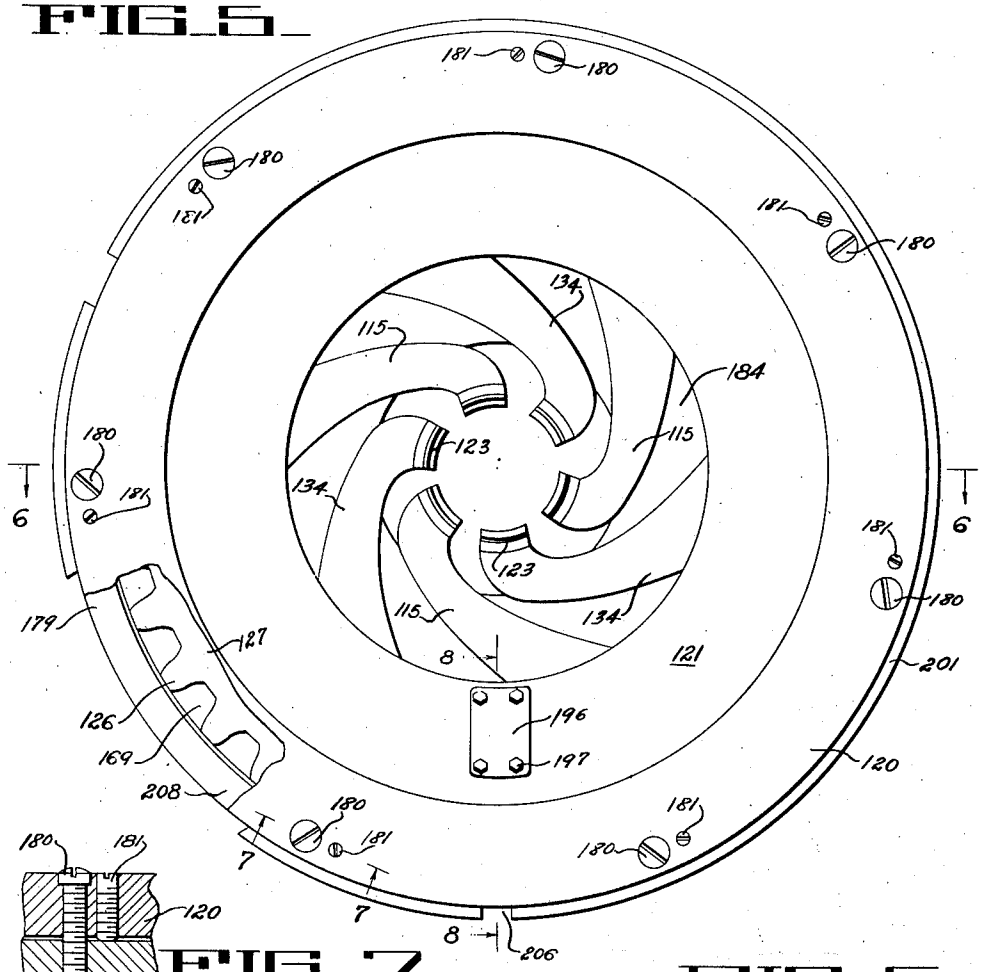


FIG. 7

FIG. 6

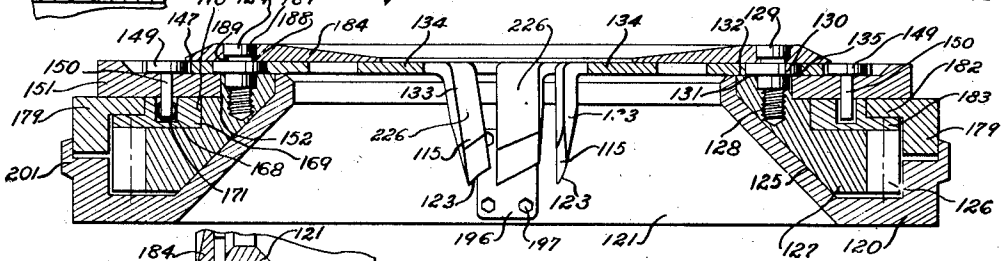
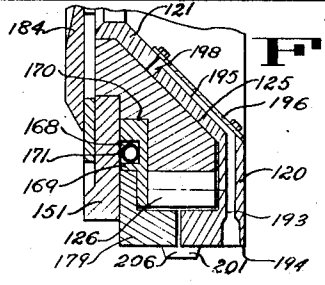


FIG. 8



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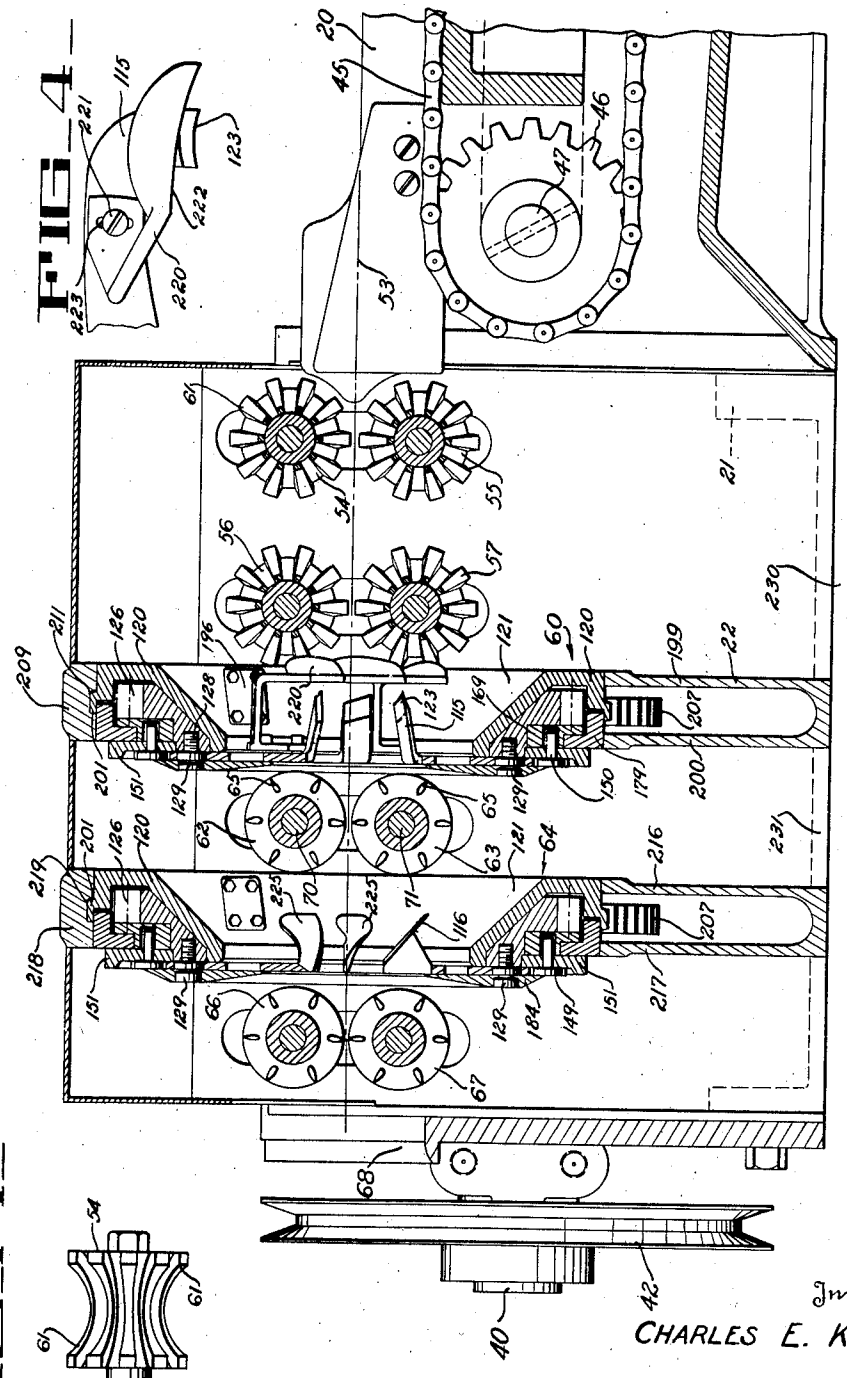


FIG. 3

FIG. 4

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FIG. 9.

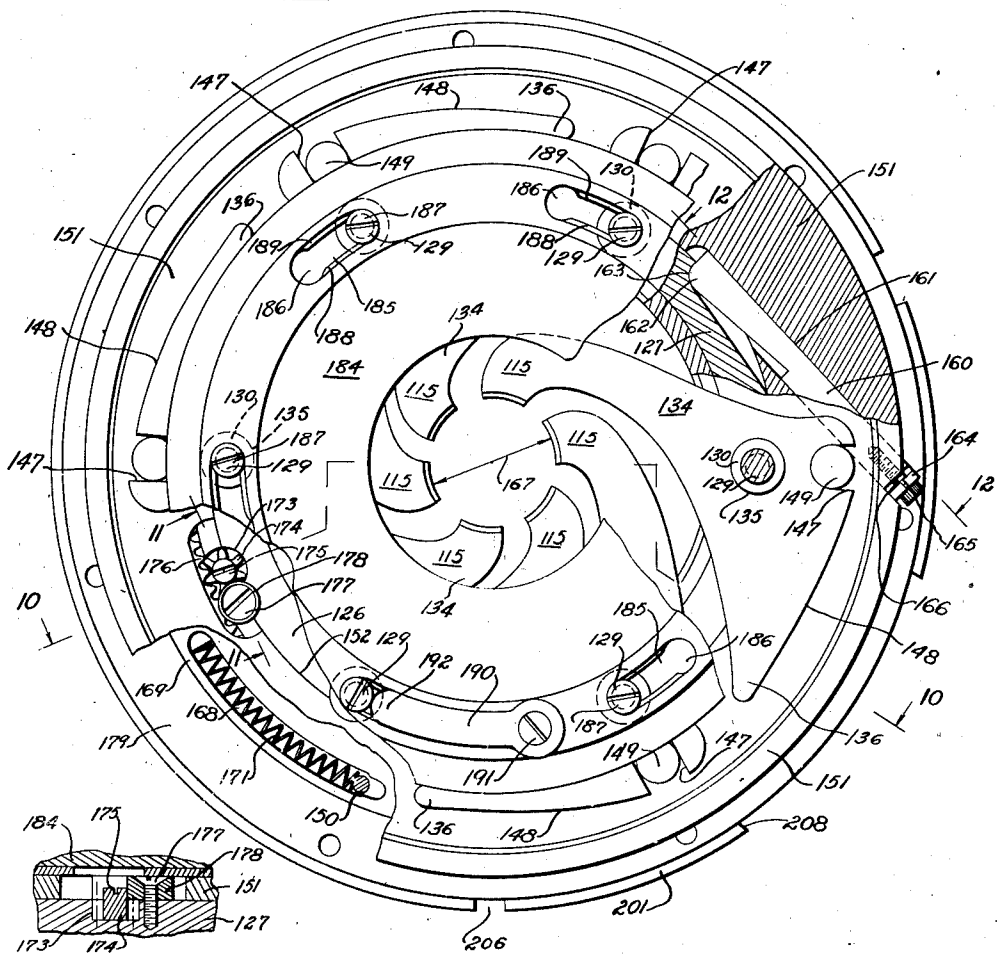


FIG. 11.

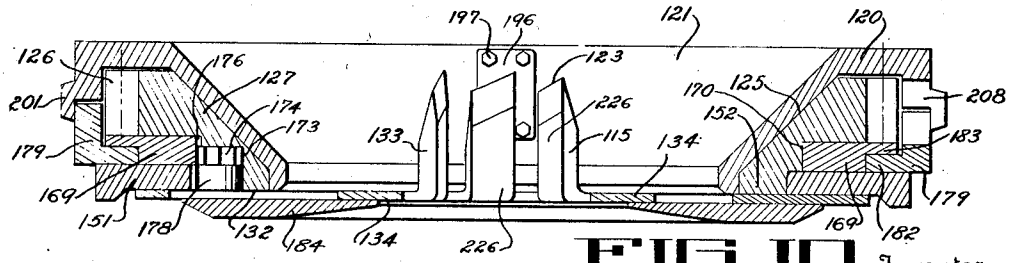
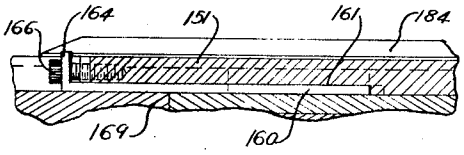


FIG. 10.

FIG. 12.



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2,323,092

UNITED STATES PATENT OFFICE

2,323,092

UNIVERSAL CORN CUTTER

Charles E. Kerr, Hoopeston, Ill., assignor to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Application June 23, 1941, Serial No. 399,337

26 Claims. (Cl. 130—9)

This invention relates to a machine for cutting green corn from the cob for canning purposes.

The invention will be disclosed as embodied in a machine of the universal type shown in the patent to Schmidt No. 2,034,993, issued March 24, 1936.

One object of the invention is to provide an improved design of cutting head which will enable the corn to be cut from the cob with a minimum of injury to the kernel. Heretofore, the kernels, after being cut from the cob, were thrown into contact with a revolving surface of the head, and since these cutter heads are usually rotated at speeds from 1000 to 1800 R. P. M., when the kernels struck this rapidly moving surface the impact sometimes bruised the kernels and loosened the starch which washed out, thus reducing the yield per ton. With my improved construction the kernels, after they are cut from the cob, do not come in contact with any moving part.

A further object of my invention is to provide an improved means for adjusting the spring pressure on the cutting knives.

Another object of the invention is to provide improved means for adjusting the minimum opening of the knives.

Other objects will become apparent after the following disclosure of a machine in which the invention has been embodied.

In the drawings:

Fig. 1 is a plan view of the machine showing a portion of the feed trough in the lower left hand corner by means of which the ears of corn are fed into the machine.

Fig. 2 is a vertical transverse section taken as indicated by the line 2—2 in Fig. 1.

Fig. 3 is a vertical longitudinal section taken as indicated by the line 3—3 in Fig. 1.

Fig. 4 is a detail view of an external gauge attached to a knife.

Figs. 5 to 12 disclose in detail the construction of my improved cutting head.

Fig. 5 is a plan view thereof as it appears when removed from the machine.

Fig. 6 is a section taken as indicated by the line 6—6 in Fig. 5.

Fig. 7 is a fragmentary section taken as indicated by the line 7—7 in Fig. 5.

Fig. 8 is a fragmentary section taken as indicated by the line 8—8 in Fig. 5.

Fig. 9 is a bottom view of the cutting head with parts broken away to disclose certain parts within.

Fig. 10 is a section taken on the lines 10—10 in Fig. 9.

Fig. 11 is a fragmentary section taken on the line 11—11 in Fig. 9.

Fig. 12 is a fragmentary section taken on line 12—12 in Fig. 9.

Figs. 13 and 14 are detail views of feed rolls.

The general construction and operation of the machine as a whole will be described first, and then the detailed construction of the improved cutting head will be described more in particular.

The machine is adapted to be mounted on a suitable base (not shown) which supports the machine at a convenient height for the operator to deposit the ears of corn in the feed trough 20 (Figs. 1 and 3). The framework of the machine comprises a main casting 21 (Fig. 2) to which is attached a housing 22 in which the cutting heads are mounted, as will presently be described more in detail.

The main drive shaft 23 (Fig. 2) is supported for rotation in the frame of the machine, and at one end is provided with an idler pulley 24 (Fig. 1) and a driving pulley 25 adapted to be driven from a source of power by means of a belt (not shown) which is shifted from one pulley to the other by means of a shifting fork 26 actuated by means of a shifting rod 27 in order to stop and start the machine. A lever 30 is disposed within reach of the operator's hand and is pivoted at 31 on a bracket 32. The lever 30 has a jaw 33 in which a pin 34 secured to the shifting rod 27 is received. Thus, by swinging the lever 30 the operator is able to start and to stop the machine.

An auxiliary drive shaft 40 (Figs. 1 and 2) is driven from the main drive shaft 23 by means of a pulley 41 secured to the main drive shaft which is connected to a pulley 42 secured to the auxiliary drive shaft by means of a belt 43. The cutting heads receive their power from the auxiliary drive shaft 40, while the means for feeding the ears of corn through the machine receive their power from the main drive shaft 23. The latter will now be described.

A chain 45 (Figs. 1 and 3) is provided in the feed trough 20 for carrying the ears of corn into the machine. This chain passes over a power-driven sprocket 46 on a shaft 47. A universal joint 48 connects the shaft 47 with a shaft 49 connected by a universal joint 50 with a shaft 51 that is driven from the main drive shaft 23 by means of worm gearing (not shown) which is located inside the housing 52.

The ears of corn are carried along the trough 20 (Fig. 3) with their axes disposed in the line 53, and the ears are fed through the cutting heads in this same straight line. A pair of feed rolls 54, 55 receives each ear of corn as it emerges from the trough 20 and feeds it into the machine. A second pair of feed rolls 56, 57 cooperates with the first pair 54, 55 to align the axis of the ear with the axis of the first cutting head 60, whose axis is coincident with the line of feed 53, and to feed the ear into the cutting head.

The feed rolls 54, 55, 56, 57 are similar in construction, each being preferably made of rubber and provided with upstanding ribs 61. Each roll is also spool-shaped (Fig. 14) so that each pair of rolls centers the ear of corn horizontally, placing it in alignment with the axis of the cutting head 60. By employing ribbed rubber feed rolls good traction is obtained on the ear of corn without injuring the kernels.

As the ear leaves the first head 60 it passes between another pair of feed rolls 62, 63 which feed it into the second head 64. These feed rolls may be constructed of metal and provided with prongs or teeth 65 (Fig. 13) which penetrate the ear of corn and aid the feeding thereof. The diameter of the rolls 62, 63 is preferably less than that of the preceding rolls to accelerate the feed of each ear in order to make way for the following ear. After the cob leaves the second head 64 it passes between the rolls 66, 67 which are of less diameter than the rolls 62, 63 to further accelerate the feed. This pair of rolls discharges the cob from the machine through the outlet 68.

Each of the four pairs of feed rolls just described has a means for resiliently urging the rolls into contact with the ear of corn and is provided with means for equalizing the movement of the two rolls of the pair. Since the means employed for each pair of rolls is identical with that employed for the other pairs, a description of one will suffice. The feed rolls 62, 63 (Fig. 3), for example, are secured to shafts 70, 71, respectively. As shown in Fig. 2, the shafts 70, 71 are connected by means of universal joints 72, 73 with stub shafts 74, 75 which are suitably journalled in the frame of the machine. The shafts 74, 75 have worm gears 76, 77 secured thereto which mesh with a worm 78 cut in the main drive shaft 23. Upon rotation of the drive shaft the stub shafts 74, 75 are rotated in opposite directions, causing rotation of the feed roll shafts 70 and 71 which are free to swing up and down on account of the universal joint connections 72, 73.

The feed roll shafts 70, 71 (Fig. 2) are confined to swinging movement in a vertical plane by bearing blocks 80, 81 in which the shafts 70, 71 are rotatable, which bearing blocks are guided for vertical movement in a channel 82 (Fig. 1) formed in the frame work. An upper equalizing arm 83 (Fig. 2) has a trunnion 84 which fits in an arcuate groove 85 in the bearing block 80. The arm 83 is pivoted on a shaft 86 which is rigidly mounted in the frame work. A similar equalizing arm 87 engages the lower bearing block 81 and this arm is pivotally mounted on a fixed shaft 88. The equalizing arm 83 has an apertured lug 89 (Fig. 1) through which a bolt 90 passes. The bolt 90 (Fig. 2) extends vertically downward through a similar apertured lug (not shown) on the lower equalizing arm 87. A compression spring 91 is interposed between the lower equalizing arm 87 and the head 92 of the bolt, and a similar compression spring 93 is interposed between the arm 83 and the nut 94. The springs 91, 93 press inwardly on the equalizing arms 83, 87 which urge the bearing blocks 80, 81 toward each other, thus urging the feed roll end of the feed roll shafts 70, 71 toward each other to press the feed rolls into engagement with the ear of corn.

To equalize the swinging movement of the shafts 70, 71 the arms 83, 87 are interconnected for equal movement. The lower arm 87 has a short upstanding arm 100 provided with a tooth 101 which engages in a jaw or tooth space 102 formed on the lower end of a lever 103 rotatably mounted on the shaft 86. The lever 103 extends upwardly above the shaft 86 and the upper end (which appears at 104 in Fig. 1) is disposed between the adjusting screws 105, 106. The arm 83 has formed integrally therewith an upstanding arm 107 which has formed at its upper end a U-shaped portion 108 through the parallel flanges of which the screws 105, 106 are threaded. By turning the screws 105, 106 the angular position of the arm 83 relative to the arm 103, and thus relative to the arm 87, can be adjusted.

When this mechanism has been properly adjusted the feed rolls 62, 63 are normally disposed as shown in Fig. 3 at equal distances above and below the line of feed 53. When an ear of corn emerging from the head 60 engages either or both the feed rolls 62, 63 they resiliently yield and move vertically, the roll 62 moving upwardly and the roll 63 moving downwardly. On account of the interconnected equalizing arms 83, 87 (Fig. 2) the feed rolls will always be disposed at equal distances from the feed line 53, so that the ear of corn is maintained with its axis coincident with this line of feed.

As previously stated a similar mechanism is provided for each of the other three pairs of feed rolls. These mechanisms can be seen in Fig. 1 and are indicated generally by the reference numerals 110, 111, 112. Likewise, there are four similar worms, of which the worm 78 (Fig. 2) is one, cut in the driving shaft 23 for driving the four pairs of feed roll shafts. The feeding mechanism will not be described in any further detail because it corresponds in general with the construction employed in machines of this type, as illustrated by the patent to Schmidt referred to above.

Proceeding now with the description of the cutting head construction, it is to be noted that the basic structure of the head is so designed as to permit the use of different instrumentalities such as the knives 115 (Fig. 3) employed in the first cutting head 60 and the scrapers 116 employed in the second head 64. The interchangeability of the tools which may be mounted in the head will become more apparent after the detailed description of the construction of the head itself. The head, after it has been removed from the machine, appears as shown in the plan view (Fig. 5) and is further illustrated by the succeeding views (Figs. 6 to 12). The mechanism of the head is supported on an annular bearing member 120 which is adapted, as will presently be explained, to be secured in a fixed position in the machine.

The bearing member 120 has a conical portion 121 (Fig. 6) which is disposed co-axially with the axis of the head and surrounding the cutting edges 123 of the knives 115, so that it encompasses the cutting zone, that is, the zone in which the kernels are cut from the cob. The outer face 125 of this conical portion provides the bearing and supporting surface for a rotatable gear 126, having a hub 127 provided with an annular coni-

cal surface adapted to fit the bearing face 125. It will be understood that when the cutting head is mounted in the machine the bearing member 120 remains fixed and the gear 126 rotates thereon.

There are a plurality of identical knives 115, each pivotally mounted on the gear 126 and rotatable therewith. The hub 127 of the gear 126 has a series of tapped holes 128 (Fig. 6) in which the knife pivot pins 129 are threaded. Each pin 129 has an annular bearing portion 130, the under side of which forms a shoulder 131 which engages the face 132 of the hub 127 when the pivot pin 129 is screwed into the hole 128, so that the pivot pin 129 is rigidly mounted in the hub of the gear 126.

Each knife 115 (Figs. 6 and 9) comprises a portion 133 adjacent the cutting edge 123 which is disposed longitudinally of the axis of the cutting head and a portion 134 integral therewith which extends radially and outwardly from the axis of the head. This portion 134 has an aperture 135 into which the bearing portion 130 of the pivot pin 129 fits, so that the knife 115 is rotatable on the pivot pin 129. As shown in Fig. 9, the knife 115 has a portion 136 which extends beyond the pivot 129 to provide a weight in the knife on the opposite side of the pivot 129 which tends to balance the weight of the knife in the portions 133, 134 on the other side of the pivot 129 when the knives are under the influence of centrifugal force resulting from the rapid rotation thereof in operation.

Each knife has a notch 147 (Fig. 9) in the peripheral portion 148 which fits around the head 149 of a pin 150 (Fig. 6) secured in an equalizing ring 151. An annular shoulder 152 is formed on the hub 127 of the gear 126 to provide a bearing seat for the equalizing ring 151 which is rotatable relative to the gear 126. This arrangement serves to equalize the movement of the six knives because a movement of any one about its pivot pin results in a corresponding movement of the other knives due to the fact that when any knife is rotated on its pivot it shifts the equalizing ring by reason of the engagement of its notch with the pin in the ring, thus rotating the other knives an equal amount on their pivots. When an ear of corn is fed through the cutting head it presses the knives outwardly, and through the action of the equalizing ring 151, the knives expand in iris fashion, their cutting edges 123 always being equidistant from the axis of the head.

Means are provided for adjustably determining the minimum opening of the knives. A finger 160 (Figs. 9 and 12) is slidably disposed in a slot 161 formed in the under side of the equalizing ring 151. The finger 160 has a rounded end 162 which engages in the end of a notch 163 formed in the hub 127 of the gear 126. The outer end of the finger 160 has an up-turned flange 164 formed integrally therewith, which is apertured and split at 165 to receive an adjusting screw 166 which is threaded into the equalizing ring 151. When the screw 166 is turned the finger 160 is either projected inwardly in the slot 161 or is withdrawn outwardly therefrom. This results in locating the end 162 of the finger 160 in a selected position, so that, upon engagement with the end of the notch 163 in the gear hub 127, it determines the minimum opening of the knives. For example, in Fig. 9, assuming the gear hub 127 is standing motionless, the knife pivots 129 will also be stationary. Now, if the equalizing ring 151 is turned counterclockwise it will turn the knives counterclockwise on their pivots 129, causing the cutting edges to be moved inwardly. The rotation of the ring and the movement of the knives ceases when the finger 160 engages the end of the notch 163 in the gear hub. Therefore, by turning the screw 166 the minimum diameter of the knife opening, indicated by the line 167, can be adjusted. The equalizing ring 151 is urged in this counterclockwise direction in Fig. 9 by a spring means which will now be described.

Referring to Figs. 6 and 9, it will be noted that the pins 150, whose heads 149 engage in the notches 147 of the knives, project into arcuate cavities or slots 168 formed in a ring 169, which is disposed immediately adjacent the equalizing ring 151 and which is rotatably mounted on an annular shoulder 170 formed on the hub 127 of the gear 126. Disposed in the slots 168 are springs 171 which exert pressure on the pins 150. As a result the equalizing ring 151 is urged counterclockwise in Fig. 9 and each of the knives is urged counterclockwise on its pivot pin 129. The compression of the springs 171 can be adjusted by means which will now be described.

Referring to Figs. 9, 10, and 11, the hub 127 of the gear 126 has a cylindrical recess 173 formed therein and a pinion 174 is loosely disposed in said recess. The pinion 174, which is provided with a slotted head 175 to permit the turning thereof by means of a screw driver, meshes with a segment of rack teeth 176 formed on the ring 169. Therefore, when the pinion 174 is turned the ring 169 is turned relative to the gear 126. For example, in Fig. 9, if the pinion 174 is turned counterclockwise the ring 169 will be turned counterclockwise. This will result in compressing the springs 171, thus putting a greater pressure on the knives. A lock screw 177 is threaded into the hub 127 and passes through a washer 178 which is clamped against the pinion 174 when the screw 177 is tightened. In this manner the pinion 174 and the rack 176 can be locked in adjusted position, thus fixing the ring 169 with respect to the hub 127 to maintain the desired compression of the springs 171.

In practice the springs are adjusted to the point where they will exert just sufficient pressure on the knives to prevent the knives from opening under centrifugal force alone when the head is in operation. As a result the knives have a delicate floating action which enables them to respond sensitively to the uneven contour of the ear, instantly opening and closing in order to accurately follow the shape of the ear. In addition, the screw 166 is adjusted to determine the minimum opening 167 of the knives. The operator in making this adjustment is guided by the shape and size of the ears of corn. This adjustment enables him to set the knives at whatever opening will facilitate the beginning of the cut by the knives. It will be apparent that the provision of an adjusting screw, which is accessible from the exterior of the head and which permits the adjustment to be made without disassembling the head, results in greater ease of adjustment and enables the operator to make accurate adjustments for varying conditions.

The ring 169 (Fig. 6) and the gear 126 are retained in the head with the conical surface of the gear hub 127 against the conical bearing surface 125 of the bearing member 120 by means of a thrust bearing 179 which is a ring of L-section. A series of screws 180 (Figs. 5 and 7) equally spaced around the periphery of the bearing member 120, secure the bearing member 120

and the thrust bearing 179 together. Set screws 181 adjacent each of the screws 180 can be adjusted to determine the clearance between the bearing members 120, 179 and the parts rotatable therein, namely, the gear 126 and the ring 169. It will be noted that the inwardly-extending flange 182 of the thrust bearing 179 overlaps the outwardly-extending flange 183 of the ring 169. The axial thrust is taken between these two overlapping surfaces.

The equalizing ring 151 and the knives are held in place by means of a retaining ring 184 which is provided with arcuate slots 185 (Fig. 9) which are formed at one end 186 to admit the heads 187 of the pivot pins 129. The remainder of the slot on either side is provided with shoulders 188, 189 (Figs. 6 and 9) which engage beneath the head 187 of the pin to retain the retaining ring 184 in place. It will be understood that the ring is first placed over the heads of the pins and then is rotated counterclockwise in Fig. 9 to locate the pins in the other ends of the slots and engage the shoulders of the slots under the heads of the pins. The ring is held in this position by means of a leaf spring 190 (Fig. 9) which is attached to the retaining ring by means of a screw 191, the end 192 of the leaf 190 dropping behind the head of the adjacent pivot pin and thus preventing the retaining ring from coming loose by rotating clockwise.

In order to lubricate the bearing surface 125 (Fig. 8) an oil passage is provided which comprises a drilled hole 193 which extends from the periphery 194 of the bearing member 120 to the conical portion 121 where it communicates with a channel 195 which is covered by a plate 196 secured to the bearing member by cap screws 197. A drilled passage 198 connects the other end of the channel 195 with the bearing surface 125.

Thus it will be seen that the cutting head is a unit comprising the bearing members 120 and 179 within which the gear 126 is rotatable, the knives and the equalizing ring 151 being retained on the gear by the retaining ring 184. The cutting head as a unit is adapted to be mounted in the housing 22 which has two walls 199, 200 (Fig. 3) provided with ledges on which the peripheries of the bearing members 120, 179 rest. To accurately locate the unit in position the bearing member 120 has a rim 201 formed thereon which fits in grooves formed in the housing at 202, 203, and 204 (Fig. 2). A dowel pin 205 secured to the housing and disposed in the groove 204 fits into a notch 206 in the rim 201 to locate the unit in a predetermined position in the housing where the gear 126 can be enmeshed with the driving pinion 207 on the drive shaft 40. The bearing members 120, 179 are cut away at 208 to permit engagement of the gears.

After the unit has been placed in the housing with the gears in mesh an arcuate cover 209 hinged to the housing at 210 is swung down over the unit to hold it securely in place. The cover has a groove 211 (Fig. 3) into which the rim 201 fits. A clamping bolt 212 (Fig. 2) pivoted to the housing at 213 is adapted to be swung up into a slot 214 formed in the cover and has a wing nut 215 which is screwed down to clamp the cover on the cutting head. When it is desired to remove the head from the housing the cover is unclamped and swung up, after which the unit can be lifted out of the housing.

Substantially identical means are provided for mounting the second cutting head in the housing. These comprise, briefly, the walls 216, 217 (Fig. 3) formed in the housing on which the unit rests and a hinged cover 218 having a groove 219 to fit the rim 201 adapted to be secured in place by means of a clamping bolt 218' (Fig. 1).

The heads 60 and 64 shown in Fig. 3 are structural duplicates of the head which has been described in detail by reference to Figs. 5 to 12. However, to illustrate the different instrumentalities which can be used in this head construction the knives in the head 60 in Fig. 3 are shown equipped with external gauges. Each of these knives has a gauge 220 which is attached thereto by a screw 221 (Fig. 4). The gauge has an arcuate surface 222 disposed in advance of the knife which engages the ear of corn externally. It will be noted in Fig. 4 that the screw 221 passes through a slot 223 in the gauge which permits the surface 222 to be adjusted relative to the cutting edge 123 of the knife to determine the depth of cut. The head 64 (Fig. 3) is shown equipped with scrapers 116 which have surfaces 225 that engage the cob to press out the cream remaining in the base of the kernels after the tops have been cut off in the first head 60.

As shown in Fig. 3 the machine is equipped for cutting cream-style corn. If whole grain corn is to be cut the gauges are removed from the knives which then gauge from the cob in a well-known manner. When cutting whole-grain corn the scraper head is removed from the machine.

The knives and the scrapers differ only in the structure of the parts which come into engagement with the ear of corn. Otherwise, they are identical in construction so that any head can be fitted with whichever instrumentality is desired. Furthermore, on account of the removability of the heads as units, the conversion of the machine for cutting one style of corn to another is readily effected. The operator merely has to release the wing nuts, open the covers, and lift the heads out of the machine. The replacement heads are then inserted in the manner previously described and are secured in place by clamping down the covers again.

After the desired heads have been placed in the machine the operator swings the lever 30 (Fig. 1) to move the belt to the driving pulley 25 which causes the various mechanisms for feeding and cutting the corn shown in Fig. 3 to be set in motion. He then places the ears of corn in the feed trough 20 with the tips of the ears pointing toward the machine, that is, to the left in Fig. 3. The chain 45 carries the ears one after another in succession to the first pair of feed rolls 54, 55 which resiliently engage each ear and feed it into the second pair of feed rolls 56, 57 which align the ear with the first cutting head 60 and feed the ear into the knives 115.

The knives 115 open by turning on the pivot pins 129. The opening of the knives is equalized by the engagement of each knife with one of the pins 150 in the equalizing ring 151 so that the cutting edges of the knives are maintained equidistant from the axis 53. As the knives whirl around the advancing ear the kernels are cut off.

The cut kernels strike the conical or dished face 121 of the stationary bearing member 120 which shields the knife carrier 127 from contact

by them and directs them away from the knives and carrier. The kernels then drop through the opening **230** in the bottom of the housing **22**. Thus it will be seen that by employing this construction of cuttting head a stationary surface encompasses the cutting zone so that the kernels which are cut from the ear do not come into engagement with any moving part, the advantage of this construction being that the kernels are removed from the cutting zone with a minimum of bruising, injury and loss of starch. This is particularly advantageous when cutting whole-grain corn when it is desirable to preserve the whole kernel intact after it has been cut from the cob.

The ear is drawn out of the first cutting head by the feed rolls **62**, **63** which feed it with accelerated speed into the second cutting head. The material removed by the second head drops downwardly through the opening **231** in the housing **22** for removal from the machine. The cobs are discharged from the machine by the last pair of feed rolls **66**, **67**.

It is to be noted that the stationary member **120** of the cutting head which is so designed as to present a stationary surface against which the cut kernels are thrown, serves a triple function in that it also serves as the means for mounting the head in the machine and provides the support and bearing for the gear **126** which in turn carries all the other moving parts of the head. I have also provided an improved and efficient means for bearing the thrust and means for adjusting the clearance between the moving parts and the bearing surfaces in the screws **180** and set screws **181**. The minimum opening of the knives can be quickly and easily adjusted by means of the adjusting screw **166**. Likewise the spring pressure on the knives can be readily altered to meet the different requirements of use by turning the pinion **174**.

Having thus described my invention and in what manner the same may be used, what I claim as new and desire to protect by Letters Patent is:

1. In combination, a gear, a plurality of knives pivoted thereon, means to support said gear for rotation, means including a ring rotatable with respect to said gear to equalize the pivotal movement of said knives, spring means to urge said ring in a direction to close said knives, and cooperating means on said gear and said ring to limit the closing of said knives, including a finger slidable in said ring, the tip of said finger being disposed in the path of an obstruction on said gear, and a screw to adjustably slide said finger.

2. In combination, a rotatable element, a knife pivoted thereon, a compression spring adapted to urge said knife in a direction on said pivot to move the cutting edge toward the axis of rotation of said element, and means to vary the force exerted by said spring on said knife including a spring carrying member adjustable with respect to said element and means for locking said member relative to said element.

3. In combination, a rotatable element, a plurality of knives pivoted thereon, means including a ring rotatable with respect to said element to equalize the pivotal movement of said knives, spring means engaging said ring to urge said ring in a direction to close said knives, and means to vary the force exerted by said spring means on said equalizing ring including a member adjustable with respect to said element.

4. In combination, a rotatable element, a plurality of knives pivoted thereon, an equalizing ring on said element rotatable with respect thereto for equalizing the pivotal movement of said knives, a spring ring rotatable with respect to said element having spring means engaging and applying rotative force to said equalizing ring in a direction to close said knives, and means to prevent rotation of said spring ring relative to said element.

5. In combination, a rotatable element, a plurality of knives pivoted thereon, an equalizing ring on said element rotatable with respect thereto for equalizing the pivotal movement of said knives, a spring ring rotatable with respect to said element having spring means engaging and applying rotative force to said equalizing ring in a direction to close said knives, and means in positive engagement with said spring ring to rotate said spring ring relative to said element to alter the amount of force applied by said spring means on said equalizing ring.

6. In combination, a rotatable element, a plurality of knives pivoted thereon, an equalizing ring on said element rotatable with respect thereto for equalizing the pivotal movement of said knives, a spring ring rotatable with respect to said element having spring means engaging and applying rotative force to said equalizing ring in a direction to close said knives, and positive means to rotate said spring ring relative to said element to alter the amount of force applied by said spring means on said equalizing ring comprising a rack on said spring ring, and a pinion on said element.

7. In combination, a rotatable element, a plurality of knives pivoted thereon, an equalizing ring on said element rotatable with respect thereto for equalizing the pivotal movement of said knives, a spring ring rotatable with respect to said element having spring means engaging and applying rotative force to said equalizing ring in a direction to close said knives, and means to rotate said spring ring relative to said element to alter the amount of force applied by said spring means on said equalizing ring comprising a rack on said spring ring, and a pinion on said element, and means to prevent rotation of said pinion.

8. In combination, a rotatable element, a plurality of knives pivoted thereon, an equalizing ring for equalizing the pivotal movement of said knives, a spring ring having spring means engaging and applying a rotative force on said equalizing ring in a direction to close said knives, means to adjust the position of said spring ring on said element to determine the amount of said force, and means to limit the closing of said knives comprising an adjustable stop on said equalizing ring and interposed between said equalizing ring and said element.

9. A green corn cutting apparatus comprising a rotary knife carrier journalled for rotation about a substantially horizontal axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary shield surrounding the path of revolution of said knife and disposed intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening, said shield having an

axially inclined kernel receiving surface to direct said kernels away from said carrier.

10. A green corn cutting apparatus comprising a rotary knife carrier journalled for rotation about a substantially horizontal axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, means for feeding ears of corn along said axis and through the opening in said carrier, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary shield surrounding the path of revolution of said knife and disposed to that side of the carrier from which the ears are fed and intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening, said shield having an axially inclined kernel receiving surface to direct said kernels away from said carrier in a direction opposite to the direction of feed of said ears.

11. A green corn cutting apparatus comprising a rotary knife carrier journalled for rotation about a substantially horizontal axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary bearing on which said carrier is journalled, said bearing being provided with a shield portion surrounding the path of revolution of said knife and disposed intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening, said shield portion having an axially inclined kernel receiving surface to direct said kernels away from said carrier.

12. A green corn cutting apparatus comprising a rotary knife carrier journalled for rotation about a substantially horizontal axis and having a central passageway therein to permit ears of corn to be passed endwise therethrough, means for feeding ears of corn along said axis and through said passageway, a kernel cutting knife mounted on the cob discharge side of said carrier for rotation therewith and projecting into said passageway in position to shear kernels from the ears of corn passed through said passageway, said knife being mounted for movement toward and away from the axis of said passageway, and a stationary bearing on which said carrier is journalled, said bearing being provided with a shield portion disposed in said passageway and surrounding the path of revolution of said knife to shield the carrier from kernels cut by said knife from ears of corn passing through said passageway, said shield having an axially inclined kernel receiving surface to direct said kernels out of said passageway away from said carrier in a direction opposite to the direction of feed of said ears.

13. A green corn cutting apparatus comprising a rotary knife carrier having a central opening therein to permit ears of corn to be passed endwise therethrough, and provided with an annular bearing surface surrounding said opening, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary annular bearing on which the bearing surface of said carrier is journalled for rotation of the carrier about a horizontal axis, said bearing surrounding the path of revolution of said knife and disposed intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening, and said bearing also having an axially inclined kernel receiving surface to direct said kernels away from said carrier.

14. A green corn cutting apparatus comprising a rotary knife carrier having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary annular bearing on which said carrier is journalled for rotation about a horizontal axis, said bearing having at least a portion thereof in the general form of a truncated cone, the outer surface of which forms a tapered bearing surface for said carrier, and the inner face of which forms a coned kernel receiving surface surrounding the path of revolution of said knife and disposed intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening and to receive and direct said kernels away from said carrier.

15. A green corn cutting apparatus comprising a stationary framework, a bearing removably mounted in said framework in fixed position, a rotary knife carrier journalled on said bearing for rotation about a substantially horizontal axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, means for feeding ears of corn along said axis and through the opening in said carrier, and a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, said bearing having a shield portion surrounding the path of revolution of said knife and disposed to that side of the carrier from which the ears are fed intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening, said shield portion having an axially inclined kernel receiving surface to direct said kernels away from said carrier.

16. A green corn cutting apparatus comprising a stationary framework, a stationary bearing removably mounted therein, a cover to hold said bearing in place in said framework, said bearing having an annular rim adapted to fit in a groove in said cover, a knife carrier journalled on said bearing for rotation about a substantially horizontal axis and provided with a central opening therein to permit ears of corn to be passed endwise therethrough, and a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said bearing being provided with a tapered kernel receiving surface surrounding the path of revolution of said knife and disposed intermediate said path and said carrier to shield the carrier from kernels cut by

said knife from ears of corn passing through said opening and to receive and direct said kernels away from said carrier.

17. A green corn cutting apparatus comprising a rotary knife carrier having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, a stationary bearing for said carrier formed to partially enclose said carrier to shield it from kernels cut by said knife from ears of corn passing through said opening, an annular thrust bearing attached to said first mentioned bearing to retain said carrier therein, and adjustable means to limit the clearance between said thrust bearing and said carrier.

18. A green corn cutting apparatus comprising a knife carrier journalled for rotation about an axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, means for feeding ears of corn along said axis and through said opening, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, a stationary bearing for rotatably supporting said carrier having a portion encompassing the cutting zone of said knife and having a periphery disposed at a greater distance from said axis than the periphery of said carrier, said bearing enclosing the feed side of said carrier and providing a surface intermediate the cutting zone and carrier to shield the carrier from kernels cut by said knife from said ears passing through said opening and to receive and direct said kernels away from said carrier, an annular thrust bearing engaging the other side of said carrier, and means for securing said thrust bearing to said peripheral portion of said first mentioned bearing.

19. A green corn cutting apparatus comprising a housing having a discharge port, a cutter head removably mounted in said housing to one side of said port and including a stationary bearing and an apertured rotary knife carrier journalled in said bearing for rotation about a horizontal axis, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from ears of corn passed through the aperture for said carrier, and means for feeding ears of corn through said aperture, said bearing being formed to fit against the inner wall of said housing to form a shield for the feed side of said carrier, and to cooperate with the housing to form a stationary enclosed discharge chamber for the cut kernels, said bearing also being disposed to encompass the cutting zone of said knife and being provided with an inclined surface for receiving the cut kernels and directing them away from the carrier to said discharge port.

20. A green corn cutting apparatus comprising a rotary knife carier having a central opening therein to permit ears of corn to be passed endwise therethrough and provided with an annular tapered bearing surface surrounding said opening, a kernel cutting knife carried by said carrier for rotation therewith and positioned to cut kernels from ears of corn passed through said opening, and an annular stationary bearing for said knife carrier immediately encompassing the cutting zone of said knife to shield the carrier from kernels cut by said knife and having a tapered bearing surface complementary to that of the carrier and on which the latter surface is rotatably journalled.

21. A green corn cutting apparatus comprising a rotary knife carrier journalled for rotation about a substantially horizontal axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary annular shield having a conical kernel receiving surface surrounding the cutting zone of said knife and disposed intermediate said zone and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening and to receive and direct said kernels away from said carrier.

22. A green corn cutting apparatus comprising a housing having a kernel discharge port, a rotary knife carrier journalled within said housing to one side of said port for rotation about a substantially horizontal axis and having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, said knife being mounted for movement toward and away from the axis of said opening, and a stationary shield surrounding the path of revolution of said knife and disposed intermediate said path and said carrier to shield the carrier from kernels cut by said knife from ears of corn passing through said opening, said shield having an axially inclined kernel receiving surface to direct said kernels away from said carrier, and to said discharge port.

23. A green corn cutting apparatus comprising a rotary knife carrier journalled for rotation about a substantially horizontal axis and having a central passageway therein to permit ears of corn to be passed endwise therethrough, means for feeding ears of corn along said axis and through said passageway, a kernel cutting knife mounted on the cob discharge side of said carrier for rotation therewith and projecting into said passageway in position to shear kernels from the ears of corn passed through said passageway, said knife being mounted for movement toward and away from the axis of said passageway, and a stationary shield disposed in said passageway and surrounding the path of revolution of said knife to shield the carrier from kernels cut by said knife from ears of corn passing through said passageway, said shield having an axially inclined kernel receiving surface to direct said kernels out of said passageway away from the carrier.

24. A green corn cutting apparatus comprising a rotary knife carrier having a central opening therein to permit ears of corn to be passed endwise therethrough, a kernel cutting knife carried by said carrier for rotation therewith and positioned to shear kernels from the ears of corn passed through said opening, a stationary housing for said carrier including a cover having a funnel-shaped opening in alignment with the opening in said carrier and an annular bearing surrounding said opening within said cover, said knife carrier being rotatably journalled on said bearing, the inner surface of said funnel-shaped opening projecting into the opening in said carrier and forming a shield to receive kernels cut

by said knife from ears of corn passing through said carrier and direct them away from the carrier.

25. A green corn cutting head comprising a rotary knife carrier having opposite ends a central opening therein to permit ears of corn to be passed endwise therethrough and provided with an inner annular bearing surface surrounding said opening, and a stationary housing for said carrier including a cover for one end of the carrier having an opening in registry with the opening in said carrier, and having an annular portion extending toward the other end of said carrier and within the same providing on its inner face a bearing on which the bearing surface of said carrier is rotatably journalled, a thrust bearing positioned against the other end of said carrier, and cooperating with said cover to form the housing, and means for securing said cover and thrust bearing together to retain said carrier on said bearing in said housing.

26. In combination, a rotatable knife carrier, a plurality of cutting knives pivotally mounted therein in iris arrangement, a removable retaining plate for said cutting knives, an equalizing ring on said carrier, rotatable with respect thereto and having pins engaged with said knives for equalizing the pivotal movement of said knives to cause them to move iris fashion, a spring ring interposed between said carrier and equalizing ring and including spring slots, springs positioned in said slots and engaging projections of said equalizing pins for urging said equalizing ring in a direction to close said cutting knives, means for varying the force exerted by said springs on said equalizing ring, and means for limiting the extent of closure of said cutting knives.

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