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E. SCHMOOK, JR

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INNOVATIONS AND IMPROVEMENTS IN CHOPPER BLADES

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Fig. 1

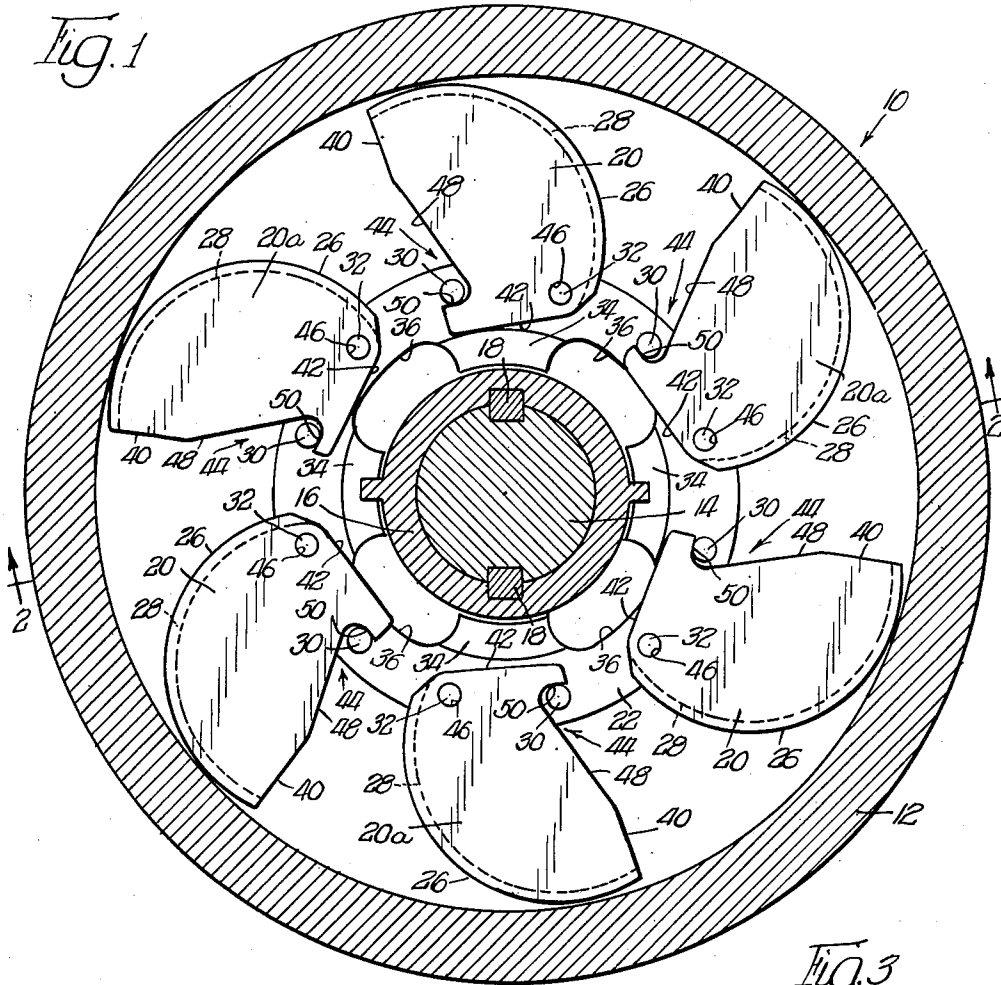


Fig. 2

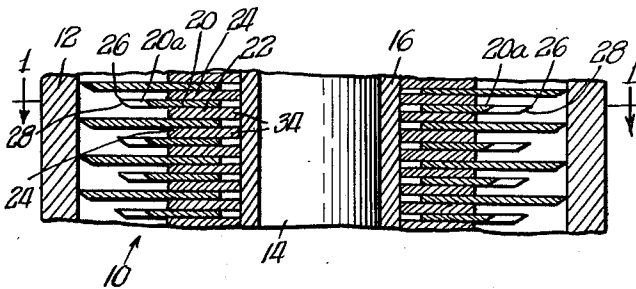
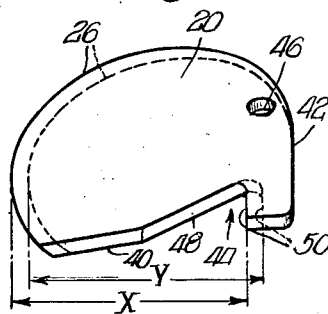


Fig. 3



INVENTOR.

Edward Schmoock, Jr.,

BY

Cromwell, Greist & Warden

Attys.

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INNOVATIONS AND IMPROVEMENTS IN CHOPPER BLADES

Edward Schmoock, Jr., Madison, Wis., assignor to Oscar Mayer & Co., Inc., Chicago, Ill., a corporation of Illinois

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The present invention relates, generally, to innovations and improvements in connection with cutting or knife blades for choppers of the type wherein the blades are mounted on a high speed rotor. For example, such a chopper is disclosed in U.S. Patent No. 2,742,937 to Herzer.

The blades of such choppers rotate with the rotor assemblies at high speeds within a cylindrical housing with the cutting edges thereof coming into close proximity to the inner surface of the housing to chop or comminute meat or other product being chopped as it passes through the housing. The cutting edges of the blades become dull and in time require sharpening. However, repeated sharpening of the blades results in removal of metal from the cutting edges and noticeably increases the normal small spacing or clearance between the cutting edges and the inner surface of the cylindrical housing, preventing proper comminution of the meat or other product. It has therefore been necessary to frequently replace the blades even though there is ample blade material remaining for sharpening. Considering the large number of blades in a chopper, the cost of frequent replacement amounts to a considerable sum.

It is therefore the general object of the invention to provide a new and improved blade and mounting assembly for continuous choppers whereby dulled cutting edges thereof may be sharpened or redressed without incurring an undesirable change in the clearance between the cutting edges of the blades and the inner surface of the cylindrical housing.

It is an important object of the invention to provide a new and improved chopper of the character described wherein the blades are pivotably connected to the rotor in a manner such that the cutting edges thereof are centrifugally urged into close proximity to the inner surface of the cylindrical housing and wherein stop means are provided on the blades to insure maintenance of the desired clearance between the cutting edges and the inner surface of the housing.

It is another important object of the invention to provide a new and improved knife blade for choppers of the character described having novel mounting means which provide accurate repositioning of the blade each time after the cutting edge thereof has been sharpened or ground down whereby the desired slight clearance between the cutting edge and the inner surface of the cylindrical housing for effective comminution of the product passing through the housing may be retained despite repeated sharpening of the blades.

A more detailed object of the invention is to provide a new and improved knife blade and mounting arrangement for continuous choppers of the character described wherein each blade is mounted on a pair of circumferentially spaced pins carried on a rotatable blade mounting ring with one of the pins being received in a drilled hole in the blade and the other pin being received in an open slot formed in the blade whereby grinding off the side of the slot held against the other pin by the centrifugal force imparted to the blade as a result of high speed rotation thereof an amount corresponding to the amount of metal removed from the cutting edge as a result of the sharpening thereof permits the sharpened cutting

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edge to advance a corresponding distance toward the inner surface of the cylindrical housing.

Certain other objects of the invention will, in part, be obvious, and will in part appear hereinafter.

For a more complete understanding of the nature and scope of the invention reference may now be had to the accompanying drawings wherein:

FIG. 1 is a horizontal sectional view taken generally on line 1—1 of FIG. 2 through a typical, commercially available chopper of the character described, with the circumferentially spaced series of blades beneath the uppermost series of blades being removed for purposes of clarity;

FIG. 2 is a fragmentary vertical sectional view, on reduced scale, taken generally on line 2—2 of FIG. 1; and

FIG. 3 is a perspective view of a knife blade embodying the invention, looking toward the slotted or recessed side thereof, and showing the original, unsharpened form of the blade in full lines and the form of the blade after repeated sharpening in broken lines.

While the chopper assembly shown in FIG. 1 is adapted for use in comminuting many materials, it is particularly adapted for comminuting meat in the preparation of sausage.

Referring particularly to FIGS. 1 and 2, the continuous chopper assembly 10 includes a cylindrical housing 12 and a concentrically arranged shaft 14 which is adapted to be driven at high rates of speed by a suitable power source (not shown). Preferably, the assembly 10 is arranged for vertical operation, as illustrated, and suitable mounting members (not shown) may be provided on the outside of the housing 12. A sleeve 16 is secured on the shaft 14 by keys 18 for rotation therewith.

A plurality of chopper or cutting blade members 20 are mounted within the chopper housing 12 on a series of blade mounting rings 22 which are fitted over and keyed to the sleeve 16. The rings 22 are separated by a series of ring spacers 24. The shaft 14, the sleeve 16, the rings 22, and the spacers 24 may be referred to as a rotor assembly. As particularly shown in FIGS. 1 and 3, each blade member 20 is shaped somewhat like a sector or quadrant with the arcuate edge thereof being sharpened to provide a cutting edge 26 having a bevel 28 on the underside thereof. Each blade mounting ring 22 carries thereon a series of circumferentially spaced blade or knife members 20 each of which is attached by a pair of circumferentially spaced dowel-like pins 30 and 32 in a manner to be described in detail hereinafter. Briefly, however, each blade member 20 is pivotably mounted on its mounting ring 22 in a manner such that during high speed rotation of the shaft 14 the blade members 20 are pivoted outwardly by centrifugal force against suitable stop members whereby portions of the cutting edges 26 of the blade members 20 rotate in close proximity to the inner surface of the cylindrical housing 12. Actually, each blade mounting ring 22 carries a series of blade members 20 on opposite sides thereof as illustrated in FIG. 2 with alternate series of blade members 20 being circumferentially staggered. The spacers 24 are suitably designed to provide for adequate spacing between the blade mounting rings 22 and the blade members 20 carried thereby with pin receiving apertures therein (not shown) to interlock the assembly and prevent relative movement therebetween.

Each blade mounting ring 22 and spacer 24 is centrally webbed as defined by inwardly projecting flange-like portions 34 which hug the sleeve 16 and are circumferentially spaced thereabout to establish intermediate the same a plurality of axially directed air evacuation or gas input passages or ports 36 extending the full axial length of the sleeve 16. During operation of the chopper as-

sembly 10, the passages 36 may be connected to a vacuum device whereby oxygen-bearing air is removed from the material being comminuted for preservation thereof as well as color maintenance in connection with meat.

In the operation of the chopper assembly 10, feed material, such as relatively small chunks of meat which, if desired, may be mixed with sausage batter ingredients, is delivered into the housing 12 through an inlet (not shown). The blade members 20 are rotated at relatively high speeds as, for example, within the range of 3,000 to 4,500 r.p.m., operation at these speeds providing adequate centrifugal force to provide for an accumulation of meat along the inner surface of the housing 12 to define a continuously moving meat sleeve. The meat is thus placed in contact with the cutting edges 26 of the blade members 20, these cutting edges being rotatable, as previously mentioned herein, in close proximity to the inner surface of the housing 12. The thickness of the sleeve-like accumulation of meat may vary from approximately one-eighth to five-eighths of an inch with the cutting edge 26 of each blade member 20 continuously moving through the accumulation for relatively fine comminution thereof. The substantial centrifugal force developed by the high speed rotation of the blade members 20 will maintain the meat particles against the inner surface of the housing 12 and the bevels 28 formed on the bottom edges of the blade members 20 will provide for continuous movement of the accumulated meat particles downwardly along the inner surface of the housing 12 toward the discharge end of the chopper assembly 10.

After long and continuous operation of the chopper assembly 10, the cutting edges 26 of the blade members 20 tend to become dulled. The novel form of the blade members 20 and the mounting thereof, as best illustrated in FIGS. 1 and 3, permits sharpening of the dulled cutting edges 26 without affecting or increasing the close spacing or clearance between the cutting edges 26 and the inner surface of the cylindrical housing 12, which clearance should be retained to provide the desired fineness of comminution of the product passed through the housing 12.

In addition to the leading cutting edge 26, each of the generally sector-shaped blade members 20 is provided with a trailing edge 40 which extends generally radially toward the axis of the shaft 14, and an edge 42 which extends between the inner end of the cutting edge 26 and the inner end of the trailing edge 40 and is disposed generally tangentially of the shaft 14. For mounting on the ring 22, each blade member 20 is provided with an open-sided recess 44 formed in the trailing edge 40 thereof for receiving the pin 30 therein and an opening 46 in the corner of the blade 20 determined by the cutting edge 26 and the edge 42 in which opening the pin 32 is received. Each open-sided recess 44 is provided with a side 48 which tapers gradually in a direction toward the trailing end of the cutting edge 26 and a ledge or inner side 50 which extends parallel to the edge 42 and is spaced therefrom. The ledge portion 50 of the recess 44 may be defined as an integral projection or shoulder on the corner of the blade 20 opposite the cutting edge 26.

As each blade member 20 is pivotably mounted on the pin 32, the centrifugal force imparted to each blade member 20 during high speed rotation of the shaft 14 serves to retain the ledge or integral projection 50 of each blade member 20 against its associated pin or stop member 30. The dimensions of each new blade member 20 are such that during high speed rotation of the shaft 14 a portion of the cutting edge 26 forward of the trailing end thereof rotates in close proximity to the inner surface of the cylindrical housing 12 to provide effective comminution of the product passed through the housing 12. The combination of the pivotal mounting of the blade 20 and the open-sided recess 44 in the trailing edge 40 thereof permits each blade to give or swing counterclockwise (as

viewed in FIG. 1) if the cutting edge 26 encounters fibrous material which is somewhat resistant to comminution, whereby to reduce the tendency of such material building up on the cutting edge 26.

When it becomes necessary to resharpen the cutting edge 26 of one of the blade members 20, an amount of material, corresponding to that removed from the cutting edge 26 upon sharpening thereof, is removed from the ledge 50, as by grinding or milling, whereby during high speed rotation of the shaft 14, the resharpened blade member 20, identified in FIG. 1 by the addition of the suffix "a," is permitted to swing, due to centrifugal force, a further distance toward the inner surface of the cylindrical housing 12 about the pin 32 in a clockwise direction (as viewed in FIG. 1) whereby the previous small spacing or clearance between the cutting edge 26 and the inner surface of the cylindrical housing 12 is retained. As each cutting edge 26 is repeatedly sharpened, the portion thereof which rotates in close proximity to the inner surface of the housing 12 shifts progressively toward the trailing end of the cutting edge 26.

In FIG. 1, the three blades identified by the reference numerals 20 represent new knife blades with the three alternately positioned blade members identified by the reference numerals 20a representing knife blades which have been repeatedly sharpened. The dimensional differences between the blade member 20 before and after sharpening thereof are best illustrated in FIG. 3 wherein a new unsharpened blade is illustrated in full lines and the same blade after being repeatedly sharpened is illustrated in broken lines. Although an exaggerated amount of material has been removed from the cutting edge 26 of the new blade member of FIG. 3 to illustrate sharpening thereof, the distances x and y between the ledge 50 and the cutting edge 26 measured generally on a radial line passing through the axis of the shaft 14 and the axis of the pin 30 before and after sharpening of the blade, are substantially equal due to the corresponding amount of material removed from the ledge 50 of the new blade member 20. As further illustrated in FIG. 1, wherein three of the blade members 20 are new blades and the other three blade members 20a are blades which have been sharpened, it is evident that the clearances between the cutting edges 26 of all of the blade members and the inner surface of the cylindrical housing 12 are substantially identical whereby to produce the desired fineness of comminution of the product passed through the housing 12.

It will be understood that certain changes may be made in the knife blade and mounting assembly disclosed herein without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. In combination, a generally sector-shaped knife blade with the arcuate edge thereof constituting the cutting edge, a shaft rotatable in a concentric housing, a mounting ring carried on said shaft for rotation therewith, means within the confines of said sector-shaped blade and adjacent one cutting-edge-corner thereof for pivotably mounting said blade on said mounting ring whereby said blade is rotatable with said shaft, an open recess formed in the non-arcuate edge of said sector-shaped blade opposite said one cutting-edge-corner thereof with the end of said recess furthest from the other cutting-edge-corner defining a bearing surface within the general confines of said sector-shaped blade, which bearing surface is spaced from and extends parallel to the other non-arcuate edge of said sector blade, and a stop member secured on the mounting ring and adapted to be engaged by said bearing surface during rotation of said shaft, said blade being pivoted outwardly by centrifugal force during rotation of said shaft whereby said bearing surface engages said stop member to determine the desired clearance between said arcuate cutting edge and the inner surface of said housing, said bearing surface being selectively shiftable to-

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ward said other non-arcuate edge of said blade by removal of an amount of material corresponding to the amount of material removed from said arcuate cutting edge during sharpening thereof whereby to retain said desired clearance between said arcuate cutting edge and the inner surface of said housing.

2. In a chopper assembly having a cylindrical housing and a co-axial shaft rotatable therein at relatively high rates of speed, a blade mounting ring keyed to said shaft, a generally sector-shaped knife blade having an arcuate cutting edge and two non-arcuate edges intersecting each other and opposite ends of the arcuate cutting edge, means within the confines of the sector-shaped blade for pivotably mounting said blade at one cutting-edge-corner thereof on said mounting ring so that upon rotation of said shaft said arcuate cutting edge defines the leading edge of the blade, an open recess formed in the non-arcuate edge of said sector-shaped blade opposite said one cutting-edge-corner thereof with the end of said recess furthest from the other cutting-edge-corner defining a bearing surface within the general confines of said sector-shaped blade, which bearing surface is spaced from and extends parallel to the other non-arcuate edge of said sector-shaped blade, and a stop member secured to said mounting ring and adapted to be engaged at its side nearest said shaft by said bearing surface during rotation of said shaft, said blade being pivoted outwardly by centrifugal force during rotation of said shaft whereby said bearing surface engages said stop member so that a portion of said arcuate cutting edge forward of the trailing end thereof rotates in close proximity to the inner surface of said cylindrical housing, said bearing surface being selectively shiftable toward said other non-arcuate edge of said blade by removal of an amount of material corresponding to the amount of material removed from said cutting edge during sharpening thereof whereby to permit the blade to pivot outwardly a further distance so that a portion of said sharpened cutting edge nearer the trailing end thereof rotates in close proximity to the inner surface of said cylindrical housing, said arrangement permitting the clearance between the cutting edge of the blade and the inner surface of said cylindrical housing to be retained substantially constant despite repeated sharpening of said cutting edge.

3. In a chopper apparatus having a cylindrical housing, a high speed shaft extending axially therethrough, at least one blade mounting ring secured to the shaft, and a pair of circumferentially spaced blade mounting pins carried on said mounting ring, a generally sector-shaped cutting blade mounted on said pins and being characterized by an arcuate cutting edge constituting the leading edge of the blade relative to the direction of rotation thereof, by two non-arcuate edges which intersect each other and opposite ends of the arcuate cutting edge, by a hole within the confines of the sector-shaped blade at one cutting-edge-corner thereof for receiving one of said pins, and by an elongated open-sided recess formed in

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the non-arcuate edge of the blade opposite said one cutting-edge-corner with said recess terminating in a bearing surface adjacent the corner of said blade opposite said arcuate cutting edge, which bearing surface is spaced from and extends parallel to the other non-arcuate edge of the blade, the other one of said pins being received in said recess whereby the centrifugal force acting on said blade as a result of high speed rotation of said shaft retains said bearing surface against said other pin so that a portion of said cutting edge is rotated in close proximity to the inner surface of said cylindrical housing, said bearing surface being selectively removable to shift the same toward said other non-arcuate edge of the blade in response to sharpening of said cutting edge whereby to retain the clearance between said cutting edge and the inner surface of said cylindrical housing substantially constant.

4. In a chopper apparatus of the type having a cylindrical housing, an axially disposed shaft rotatable therein at a high rate of speed, a plurality of axially spaced blade mounting rings keyed to the shaft, and a plurality of circumferentially spaced pairs of circumferentially spaced blade mounting pins on each mounting ring, a plurality of generally sector-shaped cutting blades each of which is adapted to be mounted on a pair of said mounting pins so that portions of arcuate leading cutting edges of said blades rotate in close association with the inner surface of said housing to finely comminute material therebetween, each of said blades being characterized by two non-arcuate edges which intersect each other and opposite ends of said arcuate cutting edge, by a hole formed in one cutting-edge-corner wholly within the confines of the sector-shaped blade for receiving one pin of said pair of mounting pins, and by an open-sided recess formed in the non-arcuate edge of the blade opposite said one cutting-edge-corner for receiving the other mounting pin, said recess terminating at a bearing shoulder adjacent the inner corner of the blade opposite the arcuate cutting edge, which shoulder is spaced from and extends parallel to the other non-arcuate edge of the blade, said blades being urged outwardly toward the inner surface of the cylindrical housing by centrifugal force during rotation of the shaft whereby said bearing shoulders are urged against said other mounting pins, said arrangement permitting said cutting edges to be sharpened when dull without increasing the spacing between the cutting edges and the inner surface of the cylindrical housing inasmuch as said bearing shoulders are selectively shiftable toward said other non-arcuate edges by removal of a corresponding amount of material therefrom.

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