

[54] **CUTTING HEAD FOR COMMINUTING MACHINES**

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[58] **Field of Search**.....146/67, 106; 241/282.1

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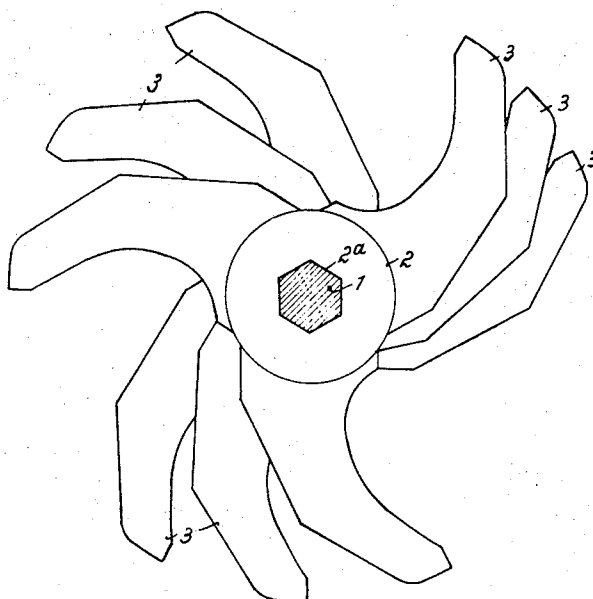
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[57] **ABSTRACT**

A cutting head for comminuting machines, particularly meat cutting machines, includes rotatable angularly displaced knives which are secured to a knife support or driving disk by means of cooperating, or engaging, sets of teeth precluding displacement of the knife in a direction longitudinally thereof relative to their support.

12 Claims, 11 Drawing Figures



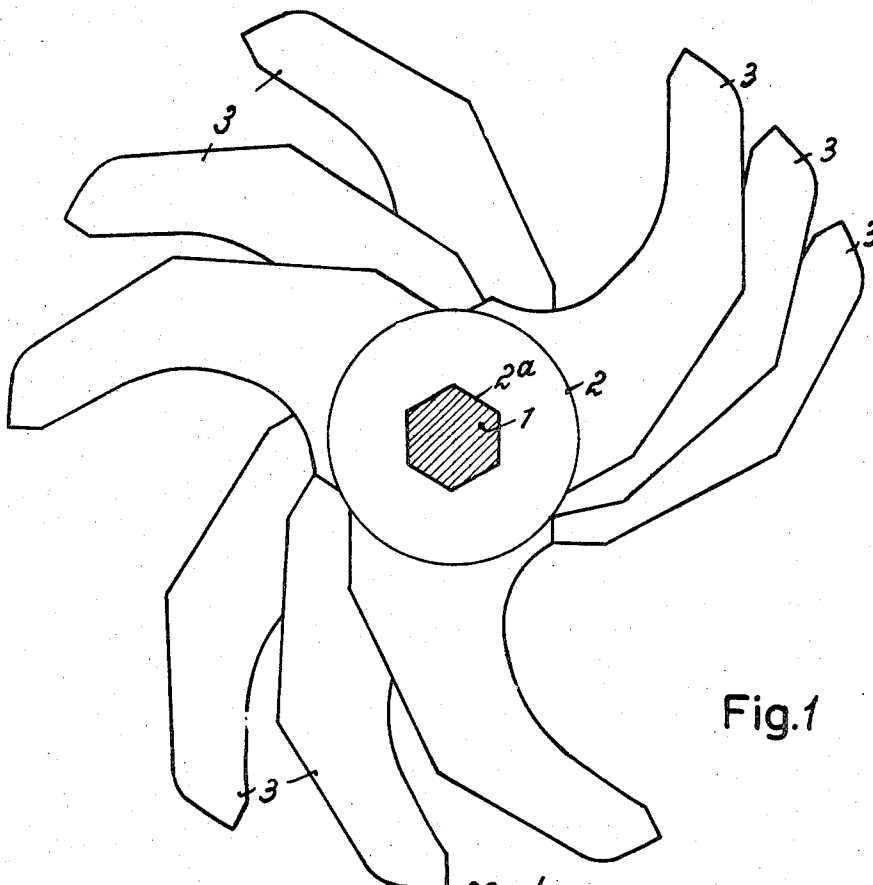


Fig. 1

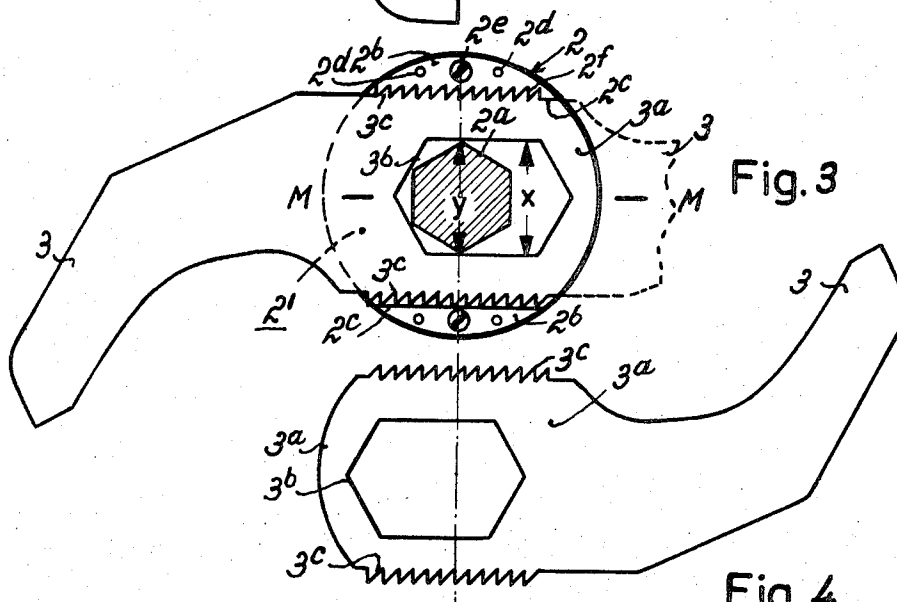


Fig. 3

Fig. 4

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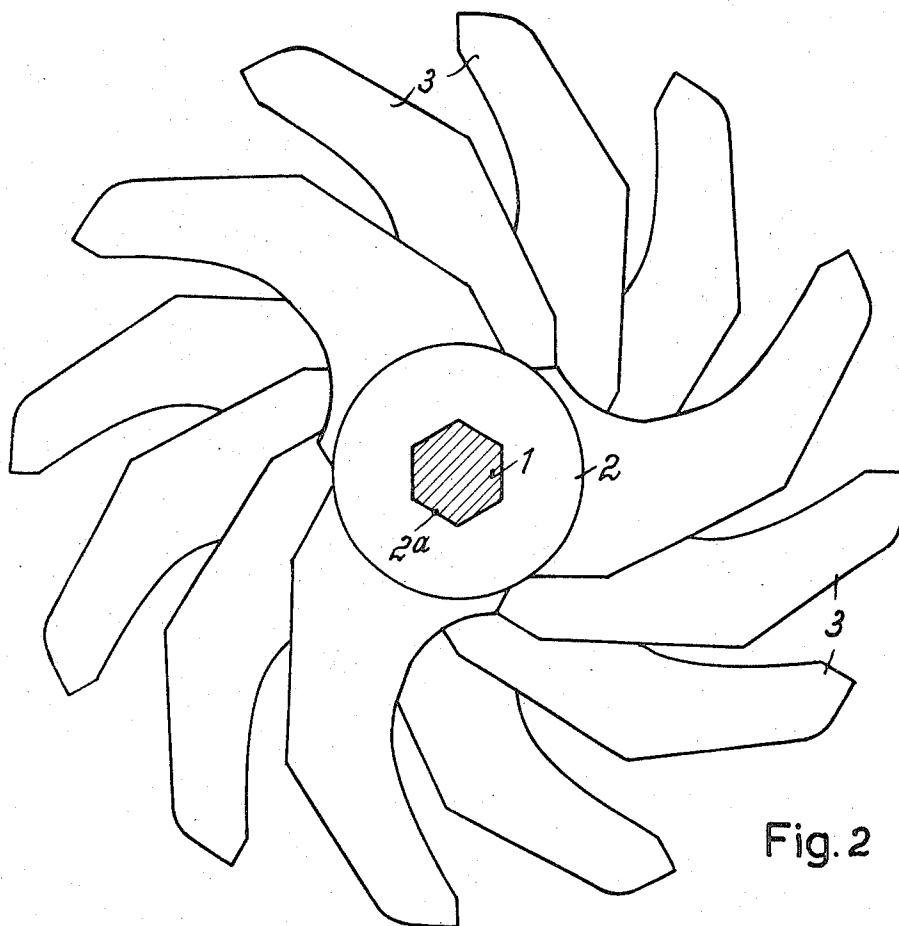


Fig. 2

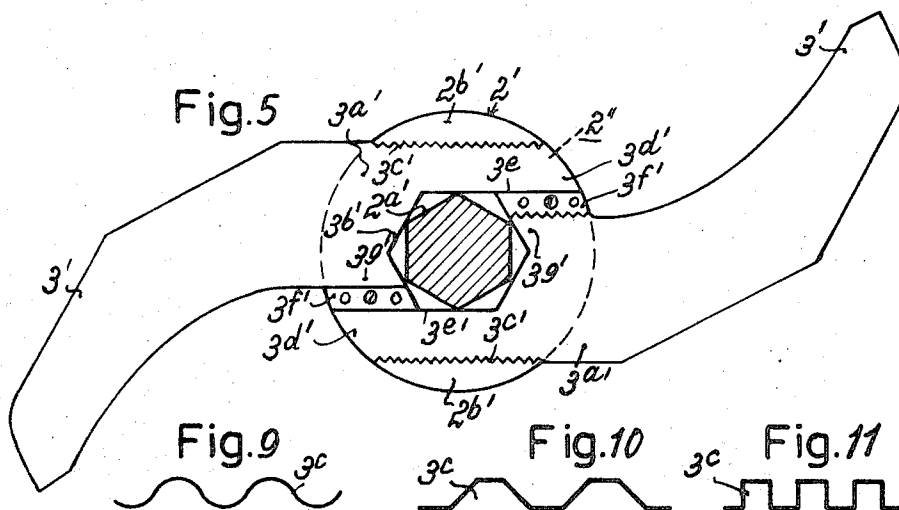


Fig. 5

Fig. 9

Fig. 10

Fig. 11

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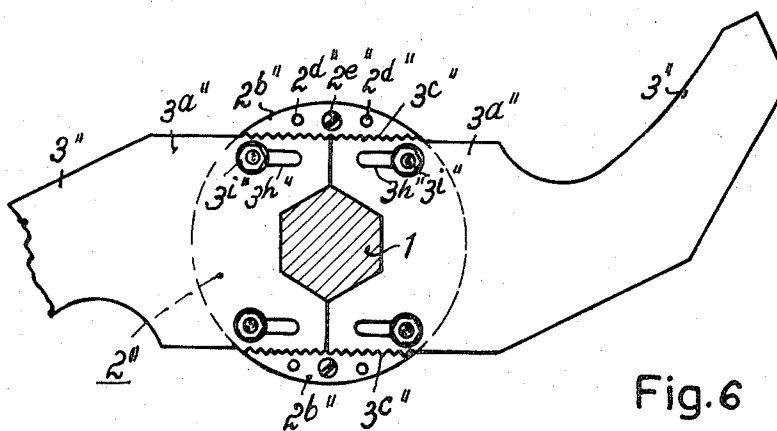


Fig. 6

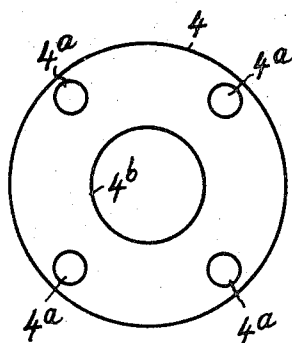


Fig. 7

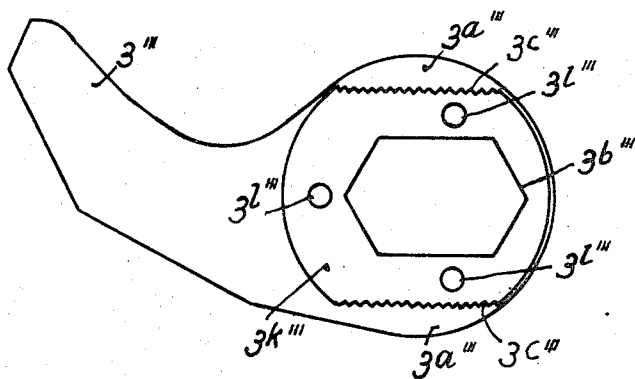


Fig. 8

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Handwritten signature of Josef Karp

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CUTTING HEAD FOR COMMINUTING MACHINES

BACKGROUND OF THE INVENTION

State of the art comminuting, and particularly meat cutting, machines include rotatable cutting heads provided with cutting knives which are generally angularly displaced and form sets of rotating knives. The cutting knives are supported by rotatable knife supports, or driving disks, each supporting one of the rotatable knives. To this end each driving disk defines a knife-receiving groove extending substantially in the direction of a diameter of a knife support, or driving disk. The aforementioned groove receives the radially inner portion of a cutting knife, and its cutting portion or blade portion projects radially outwardly from its radially inner portion and its knife support, or driving disk. A plurality of such knife supports, or driving disks, may be stacked and clamped together by appropriate clamping means. The axial spacing between contiguous knife supports, or clamping disks, may be controlled by the insertion of spacers between said supports or disks.

Cutting heads of the aforementioned type project into a bowl containing meat, or other matter intended to be cut. The capacity of such bowls has been on the increase during recent times, and at the present bowls adapted to contain as much as 1,300 lbs of meat are not uncommon. Large machines of this type may have sets of knives having an outer diameter of about 30 inches, and peripheral velocities in the order of, or in excess of, 300 feet per second. As a result the knives of such machines are subjected to large forces, in particular large centrifugal forces. It has occurred that cutting knives, even though carefully clamped in position, have moved radially outwardly under the action of centrifugal forces, and have engaged and damaged the surrounding meat or other matter containing bowl. In such instances there is a likelihood that the cutter knives break. Then the contents of the bowl cannot be used for its intended purpose since the possible presence of particles of cutting knives in food involves an intolerable danger. The broken end of a knife may also be ejected and result in injury to personnel operating, or supervising the operation of, the machine.

In state of the art machines of the kind under consideration it is difficult to control the angle of displacement of the various cutting knives. As a general rule, the cutting knives are arranged in groups which are angularly displaced, but the constituent knives of each such group are not angularly displaced. This limits the cutting efficiency of their cutting heads. It is desirable in the interest of increased cutting efficiency and in order to obtain comminuted substances which are as homogenous as possible to angularly displace each cutting knife relative to any contiguous cutting knife of a cutting head.

Generally the cross-section of the drive shaft for the cutting head is in the shape of a polygon, e.g. that of a hexagon. It is desirable to form stacks of cutting knives along a drive shaft in the shape of a polygon the position of the constituent knives of which does not depend upon the geometry of the cross-section of the drive shaft, and which allow to select an angular displacement of each cutting knife relative to an adjacent or contiguous cutting knife irrespective of the shape of the cross-section of the drive shaft.

The invention relates to cutting heads which are not subject to the above referred-to limitations of comparable prior art cutting heads, and include the above referred-to desirable features.

SUMMARY OF THE INVENTION

A cutting head for comminuting machines embodying this invention includes a drive shaft, a driving disk and a cutting knife. The driving disk is mounted on, and jointly rotatable with, the drive shaft. It has a knife-receiving groove in one of the end surfaces thereof. The knife-receiving groove has a first system of teeth in one of the lateral surfaces thereof. The cutting knife has a radially outer portion and a radially inner portion. The latter defines an aperture for the passage of the aforementioned drive shaft, and is inserted into the knife-receiving groove of the driving disk. An edge of the radially inner portion of the cutting knife has a second system of teeth having substantially the same shape as said first system of teeth and engaging said first system of teeth and thereby precluding displacement of said cutting knife relative to said driving disk in a direction substantially longitudinally of said groove of said driving disk.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top-plan view of a cutting head including a plurality of knives arranged in a predetermined angular relation;

FIG. 2 is a view of the same kind as FIG. 1 showing a cutting head including a plurality of knives arranged in a predetermined angular relation differing from that shown in FIG. 1;

FIG. 3 is a top-plan view of a cutting knife support exposing to view the means for precluding radial movement of a cutting knife;

FIG. 4 is a top-plan view of the cutting knife of the structure of FIG. 3 per se turned around 180 deg.;

FIG. 5 shows another embodiment of the invention in the same fashion as FIG. 3;

FIG. 6 shows still another embodiment of the invention in the same fashion as FIGS. 3 and 5;

FIG. 7 shows a spacing disk intended for the structure of FIG. 6;

FIG. 8 is a top-plan view of a modified cutting knife embodying this invention; and

FIGS. 9-11, inclusive, are diagrammatic illustrations of various profiles of teeth which may be used to carry this invention into effect.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2, numeral 1 has been applied to indicate a drive shaft for operating a plurality of rotatable knives 3. The cross-section of drive shaft 1 is in the shape of a hexagon. A plurality of driving disks 2 are mounted upon shaft 1, forming a stack of disks. Each driving disk 2 is provided with a central aperture or perforation 2a in the shape of a hexagon engaged by shaft 1. The aperture 2a and the cross-section of shaft 1 are virtually congruent. Driving disks 2 support cutting knives 3 and transmit the rotation of shaft 1 to the latter.

The shape of knives 3 and their relative arrangement may vary. As shown in FIG. 1, knives 3 form three

separate and distinct groups. The knives forming an upper right group have a smaller angular displacement than the knives forming an upper left group and the knives forming a lower center group. According to FIG. 2 the angular displacement of all knives 3 is equal and 30°.

In the embodiment of the invention shown in FIGS. 3 and 4 driving disk 2 supports a pair of radially spaced fastener segments 2b. The radially inner surfaces 2c of fastener segments 2b define a groove 2' for receiving the radially inner portions or shafts 3a of knives 3. The fastener segments 2b are positioned relative to, and secured to, driving disks 2 by pins 2d and screws 2e. This makes it possible to readily remove and replace fastener segments 2b. This mode of affixing fastener segments 2b to driving disks 2 is, however, optional. Fastener segments 2b may be permanently affixed to driving disks 2, as by welding or rivetting. As shown in FIG. 3 the radially inner surface 2c of the upper fastener segment 2b is sawtooth-shaped, as indicated at 2f, but the radially inner surface 2c of the lower fastener segment 2b is planar.

Knife 3 is provided at the radially inner portion 3a thereof with an elongated hole or aperture 3b having a width x. The width x exceeds the largest diameter y of drive shaft 1. The parallel edges of the radially inner portion 3a of knives 3 are provided with systems of teeth 3c which have the same shape as the teeth 2f on fastener segment 2b. As shown in FIG. 3, the upper system of teeth 3c of knife 3 engages the system of teeth 2f of the upper fastener segment 2b, and thus firmly positions knife 3, while the lower system of teeth 3c of knife 3 engages the planar surface 2c of the lower fastener segment 2b. The upper system of teeth 3c and the lower system of teeth 3c of knife 3 are displaced in longitudinal direction half the length of one tooth.

FIG. 3 shows a position of knife 3 in solid lines and a position of knife 3 in dotted lines. Assuming the length of a tooth to be in the order of one-tenth of an inch, and assuming that a knife that has originally been positioned as shown in solid lines in FIG. 3 is placed upon having been sharpened by grinding in the position shown in dotted lines in FIG. 3, this would amount to a shortening of the effective length of the knife of but one half the length of a tooth, or about one-twentieth of an inch.

In addition to the two fastener segments 2f provided on the front surface of driving disk 2 the same may be provided with a pair of fastener segments 2f on the rear side thereof, thus forming a knife-receiving groove 2' both on the front and on the rear side thereof. A knife is then arranged in each of the knife-receiving grooves 2' of which one has the position indicated in solid lines of FIG. 3, and the other the position indicated in dotted lines in FIG. 3. Both knives rotate in parallel planes which are spaced in a direction longitudinally of drive shaft 1. A cross-section through this arrangement would be substantially in the shape of an I.

Referring now to FIG. 5 showing another embodiment of the invention, the driving disk 2' of the cutting head defines a groove 2'' receiving two knives 3'. The radially inner fork-shaped portion 3a' of each knife 3' has a projection 3d' whose radially outer edge forms a system of teeth 3c'. Each of the teeth 3c' has the shape of an equilateral triangle. The radially inner edges 3e'

of each projection 3d' is straight and planar, i.e., does not have a toothed surface. The bottom of groove 2'' is provided with a pair of fastener blocks 3f' which may be pinned to, and screwed against, driving disk 2' in the same fashion as the fastener segments 2b of FIG. 3.

The left side and the right side of FIG. 5 illustrate two slightly different modifications of the same structure, as will be explained below more in detail. As shown to the left of FIG. 5, the portion 3g' of knife 3' has a planar surface arranged in abutting relation to a planar surface of fastener block 3f'. As shown to the right of FIG. 5, the portion 3g' of knife 3' has a toothed surface engaging a similar toothed surface of fastener block 3f'. The arrangement shown to the left of FIG. 5 is satisfactory, but that shown to the right of FIG. 5 provides an even more effective mode of positioning knife 3'.

Referring now to FIG. 6, drive shaft 1'' supports the driving disk 2''. The cross-section of shaft 1'' is hexagonal and driving disk 2'' has a corresponding centrally located hole or aperture. Each of a pair of knives 3'' is provided with a radially inner or shaft portion 3a''. The fastener segments 2b'' and one end surface of driving disk 2'' form a groove or recess 2''' for receiving the radially inner ends of knives 3''. Each knife is provided with a pair of oblong holes 3h'' at the radially inner end thereof. Screws 3i'' projecting through the oblong holes 3h'' firmly secure the knives 3'' to driving disk 2''. The radially inner portions 3a'' of knives 3'' are provided with systems of teeth 3c'' engaging corresponding systems of teeth 2f'' provided in the lateral surfaces 2c'' of fastener segments 2b''.

Upon securing the knives 3'' to driving disk 2'' a spacer disk 4 shown in FIG. 7 is superimposed upon parts 3'' and 2''. The spacer disk 4 is provided with four apertures or holes 4a in registry with screws 3i'' for receiving the heads of the aforementioned screws or for receiving nuts mounted upon the aforementioned screws. The spacer disk 4 is further provided with a central bore or aperture 4b having a larger diameter than the largest diameter of shaft 1''.

Referring now to FIG. 8, this figure shows a cutting knife 3''' having a radially inner portion 3a''', having about the same dimensions, or the same diameter, as the diameter of a shaft-driven driving disk (not shown in FIG. 8). The radially inner portion of knife 3''' supports a plate member 3k which may be affixed to knife 3''' by means of rivets 3i'''. The plate member 3k is provided with an oblong aperture 3b''' which may be in the shape of a hexagon, as shown in FIG. 8. The width of oblong aperture 3b''' exceeds the largest diameter of the driving shaft (not shown in FIG. 8) intended to rotate knife 3'''. Knife 3''' is provided with a hole or aperture which is substantially congruent, and arranged in registry with, the hole or aperture 3b''' in plate member 3k, and which, therefore, does not appear in FIG. 8. The plate member 3k is provided with a pair of parallel edges each having a system of teeth 3c'''. These teeth 3c''' are intended to be engaged by a pair of fastener segments of the kind shown and described in connection with FIG. 3 of which one or both have a system of teeth on juxtaposed surfaces thereof.

The system of teeth shown in FIG. 9 is substantially sinusoidal, that shown in FIG. 10 has teeth which have the shape of trapezoids, and that shown in FIG. 11 has teeth which are rectangular.

As shown in FIGS. 1 and 2 it may be necessary or desirable to arrange the constituent knives of the cutting head in different configurations, in particular to vary the angular displacement thereof as required for any particular application. This makes it necessary to vary the angular relation between the median line of the knife-receiving groove in the driving disks (the line M—M of FIG. 3) and the holes or apertures in the driving disks (marked 2a in FIG. 3) for mounting the latter on the drive shaft. There are two ways of achieving the desired end. All of a plurality of driving disks may be provided with pairs of fastener segments of which each is arranged in the same position. Thereupon drive-shaft-receiving holes are punched out of the driving disks in any particular angular relation which may be desired. As an alternative, all of a plurality of driving disks may be provided with driving-shaft-receiving holes, or apertures, which have the same position, and thereafter fastener segments may be mounted on the driving disks which are angularly displaced as deemed necessary, or desirable.

It will be apparent from the above that in all embodiments of the invention the cutting knives are positively blocked against movement in any radial direction under the action of centrifugal forces by virtue of pairs of co-engaging sets of teeth. The shape of the co-engaging teeth is optional, as suggested by FIGS. 9 to 11, i.e. the desired result may be achieved with teeth of various shapes. The shape of the teeth shown in FIGS. 3 and 4 is substantially the shape of the teeth of a saw made up of triangles whose sides are of unequal length enclosing an acute angle at the point farthest remote from the center line, or median line, of the knife blade. The length of each tooth is preferably in the order of one-tenth of an inch, or slightly more than that. It has been found desirable to minimize the spacing of the radially outer ends of the cutting knives from the wall of the container or bowl receiving the cutting head. This can be achieved readily with the structures illustrated and described. It will be apparent from the above that the drive shaft does not engage the sidewalls of the oblong apertures in the radially inner portions of the cutting knives, and does not directly transmit its torque to the cutting knives. The drive shaft engages a substantially congruent aperture in the driving disks and drives the latter, and the driving disks transmit a torque to the cutting knives which they support. The oblong aperture for the passage of the drive shaft may be a hole, as shown in FIGS. 1 to 4, or the radially inner end of the cutting knives may be forked-shaped, in which case the oblong aperture in the radially inner ends of the cutting knives is in the form of a slot which is open on one side thereof as shown in FIG. 5. The structure of FIG. 8 makes it possible to impart to the radially inner portion of the cutting knives a particularly large diameter which may be desirable in the interest of increased mechanical strength.

As explained above it is desirable to displace the two lines of teeth of a cutting knife slightly in a direction longitudinally thereof. As an alternative which is equivalent, a blade-receiving groove in driving disks may be provided on opposite lateral surfaces with rows of teeth which are displaced relative to each other in a direction longitudinally of the cutting knife, the displacement being preferably half the length of a single tooth.

I claim as my invention:

1. A cutting head for comminuting machines including
 - a. a drive shaft;
 - b. a driving disk mounted on and jointly rotatable with said drive shaft and having a knife-receiving groove in one of the end surfaces thereof, said knife-receiving groove having a first system of teeth in one of the lateral surfaces thereof; and
 - c. a cutting knife having a radially outer portion and a radially inner portion, said radially inner portion defining an aperture for the passage of said drive shaft and being inserted into said knife-receiving groove of said driving disk, an edge of said radially inner portion of said cutting knife having a second system of teeth having substantially the same shape as said first system of teeth and engaging said first system of teeth and thereby precluding displacement of said cutting knife relative to said driving disk in a direction substantially longitudinally of said groove of said driving disk.
2. A cutting head as specified in claim 1 wherein said driving disk is provided with a pair of groove-forming fastener segments, one of said pair of fastener segments having said first system of teeth on the radially inner edge thereof engaging said second system of teeth on an edge of said cutting knife.
3. A cutting head as specified in claim 1 including
 - a. a driving disk having a pair of knife-receiving grooves each on one of the end surfaces thereof, each of said pair of knife-receiving grooves having a first system of teeth in one of the lateral surfaces thereof; and
 - b. a pair of cutting knives each inserted into one of said pair of knife-receiving grooves and each having a second system of teeth engaging said first system of teeth in one of the lateral surfaces in one of said pair of knife-receiving grooves.
4. A cutting head as specified in claim 1 wherein said knife-receiving groove is provided with teeth in both lateral surfaces thereof, the teeth in one of said surfaces being displaced relative to the teeth in the other of said surfaces in a direction longitudinally of said cutting knife.
5. A cutting head as specified in claim 1 wherein opposite edges of said radially inner portion of said cutting knife each have a second system of teeth, the teeth on one of said opposite edges being displaced relative to the teeth on the other of said opposite edges in a direction longitudinally of said cutting knife.
6. A cutting head as specified in claim 4 wherein the teeth on one side of said opposite edges are displaced relative to the teeth on the other of said opposite edges about one half the length of one of said teeth.
7. A cutting head as specified in claim 1 wherein said drive shaft has a cross-section in the shape of a polygon, and wherein the said aperture of said cutting knife is oblong and has a width in excess of the largest diameter of said polygon.
8. A cutting head as specified in claim 1 including
 - a. a plurality of stacked driving disks each having a central aperture in the shape of a regular polygon angularly displaced relative to an aperture in a contiguous of said plurality of stacked driving disks; and

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b. a plurality of angularly displaced cutting knives each supported by one of said plurality of driving disks.

9. A cutting head as specified in claim 1 wherein said radially inner portion of said cutting knife is substantially fork-shaped and has a relatively long radially outer prong and a relatively short radially inner prong, a radially outer edge of said relatively long prong having said second system of teeth and an edge of said relatively short prong being engaged by a clamping block solid with said driving disk.

10. A cutting head as specified in claim 8 wherein juxtaposed edges of said relatively short prong and of

said clamping block are provided with cooperating auxiliary teeth.

11. A cutting head as specified in claim 1 wherein said second system of teeth is provided on an edge portion of a plate member abutting against said radially inner portion of said cutting knife, being solid with said cutting knife and having an aperture for the passage of said drive shaft.

12. A cutting head as specified in claim 11 wherein said plate member has a pair of parallel edges each provided with teeth arranged to engage cooperating teeth solid with said driving disk.

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