May 26, 1970

B. MAIER

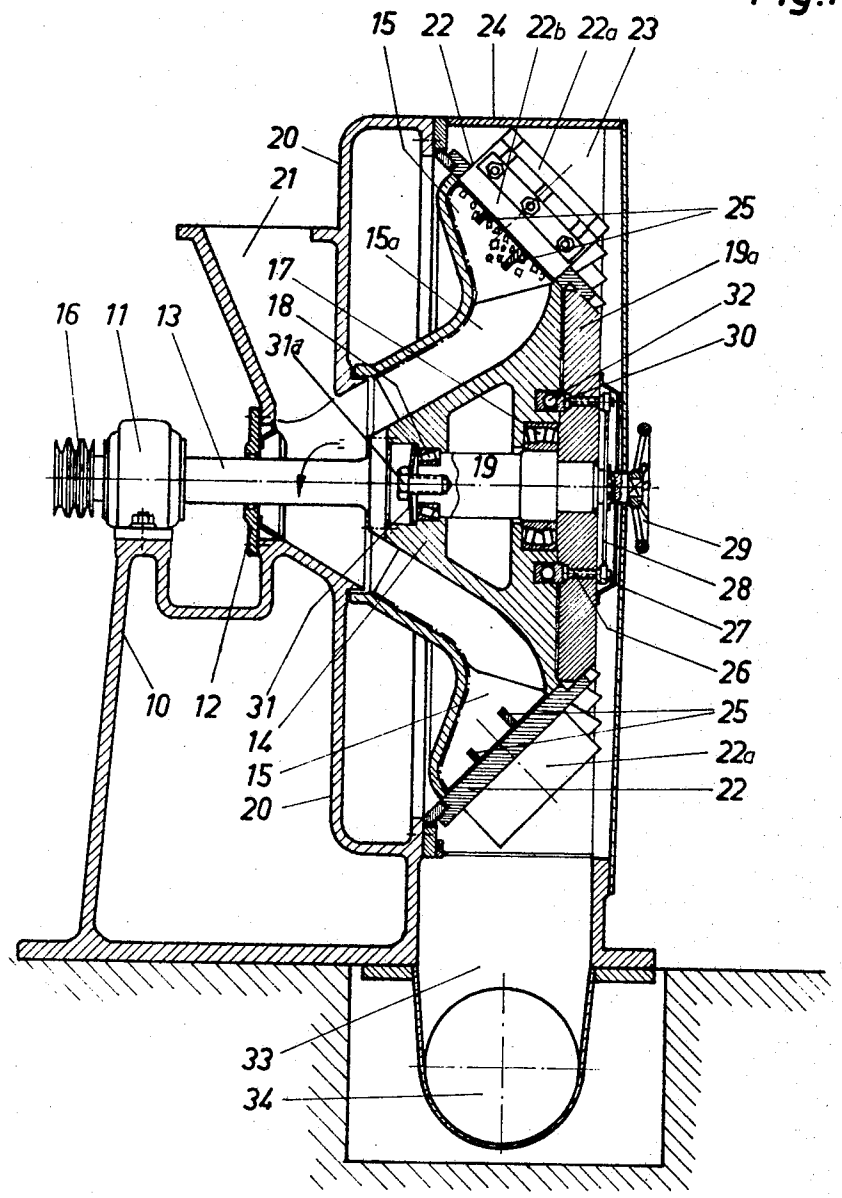
WOOD COMMINUTOR

3,514,044

Filed June 26, 1967

5 Sheets-Sheet 1

Fig.1



Inventor:
BALTHAS MAIER
by Stephen A. Frishauf
AHG

May 26, 1970 B. MAIER 3,514,044

WOOD COMMINUTOR

Filed June 26, 1967 5 Sheets-Sheet 2

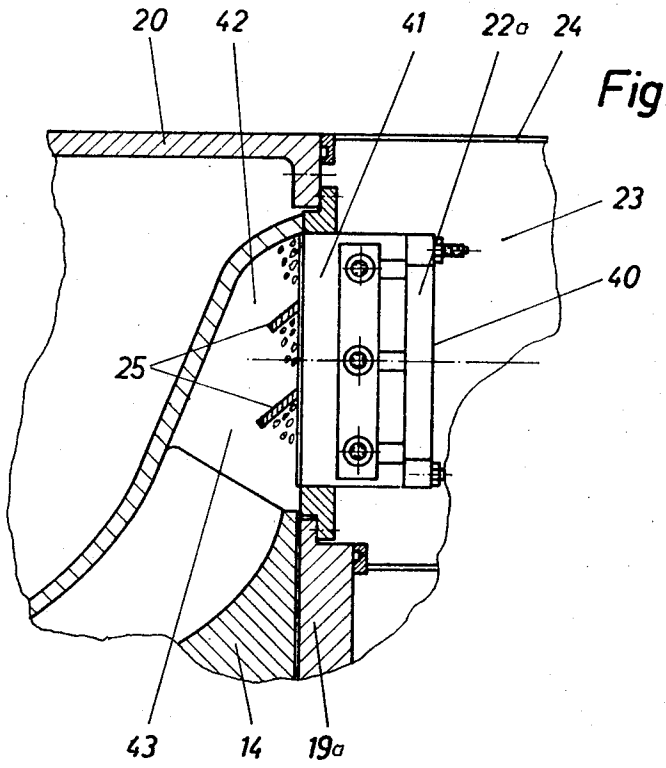


Fig. 2

May 26, 1970 B. MAIER 3,514,044

WOOD COMMINUTOR

Filed June 26, 1967 5 Sheets-Sheet 3

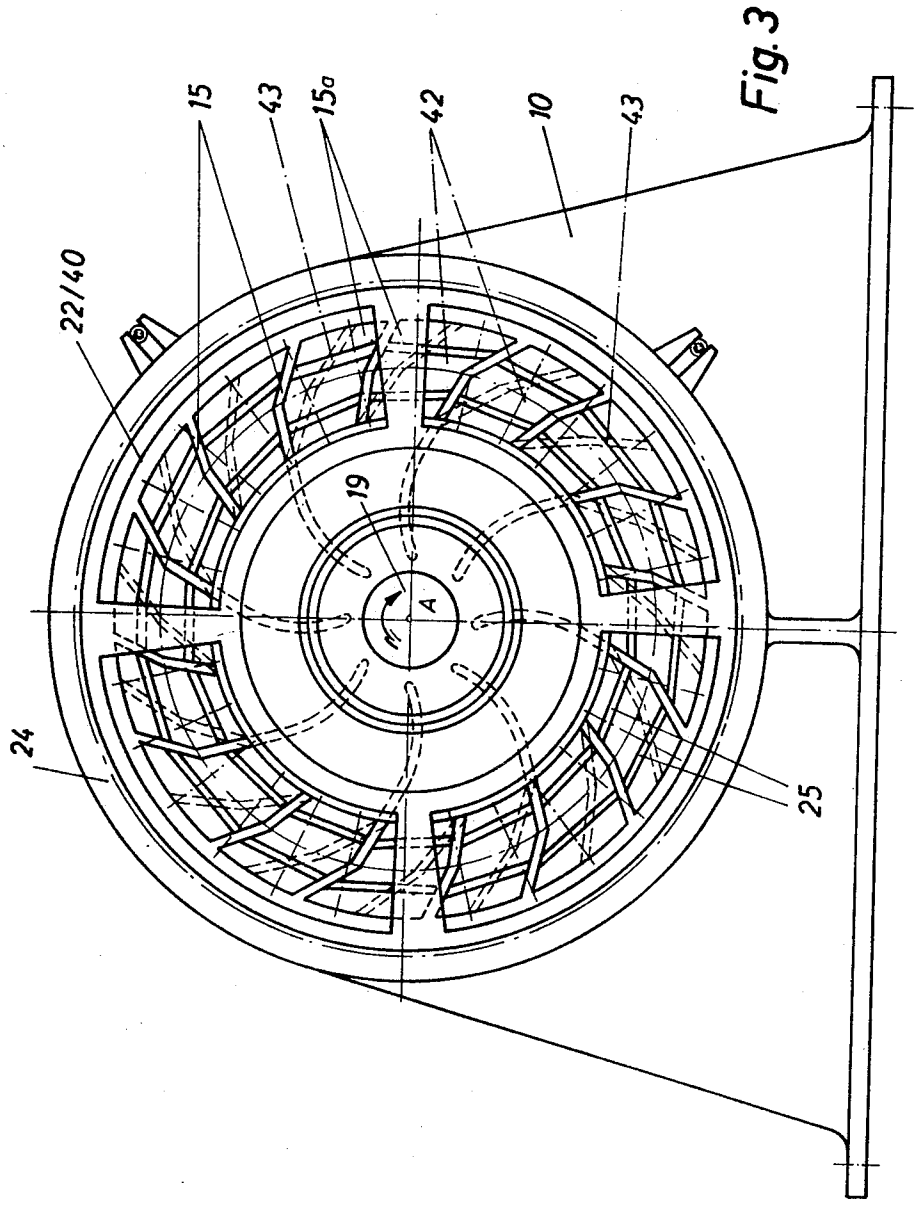


Fig. 3

May 26, 1970 B. MAIER 3,514,044

WOOD COMMINUTOR

Filed June 26, 1967 5 Sheets-Sheet 4

Fig. 4

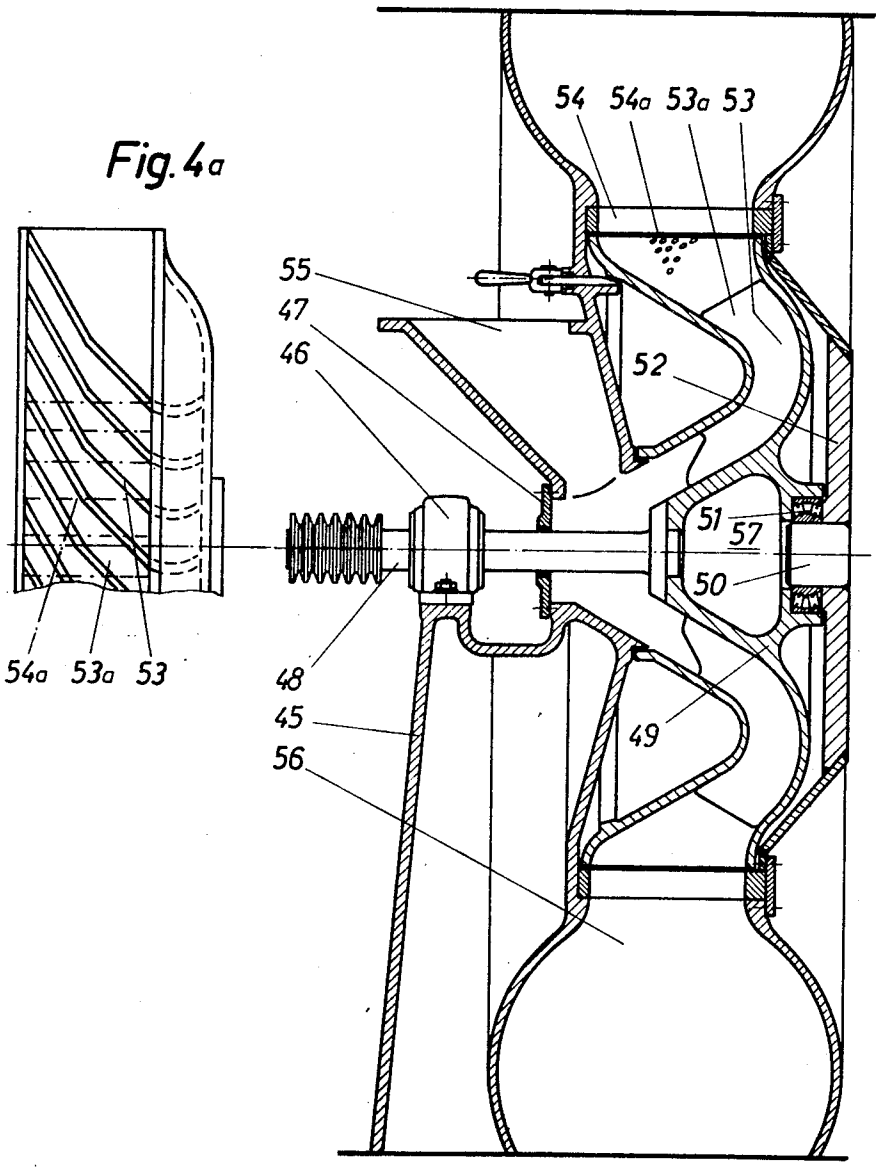


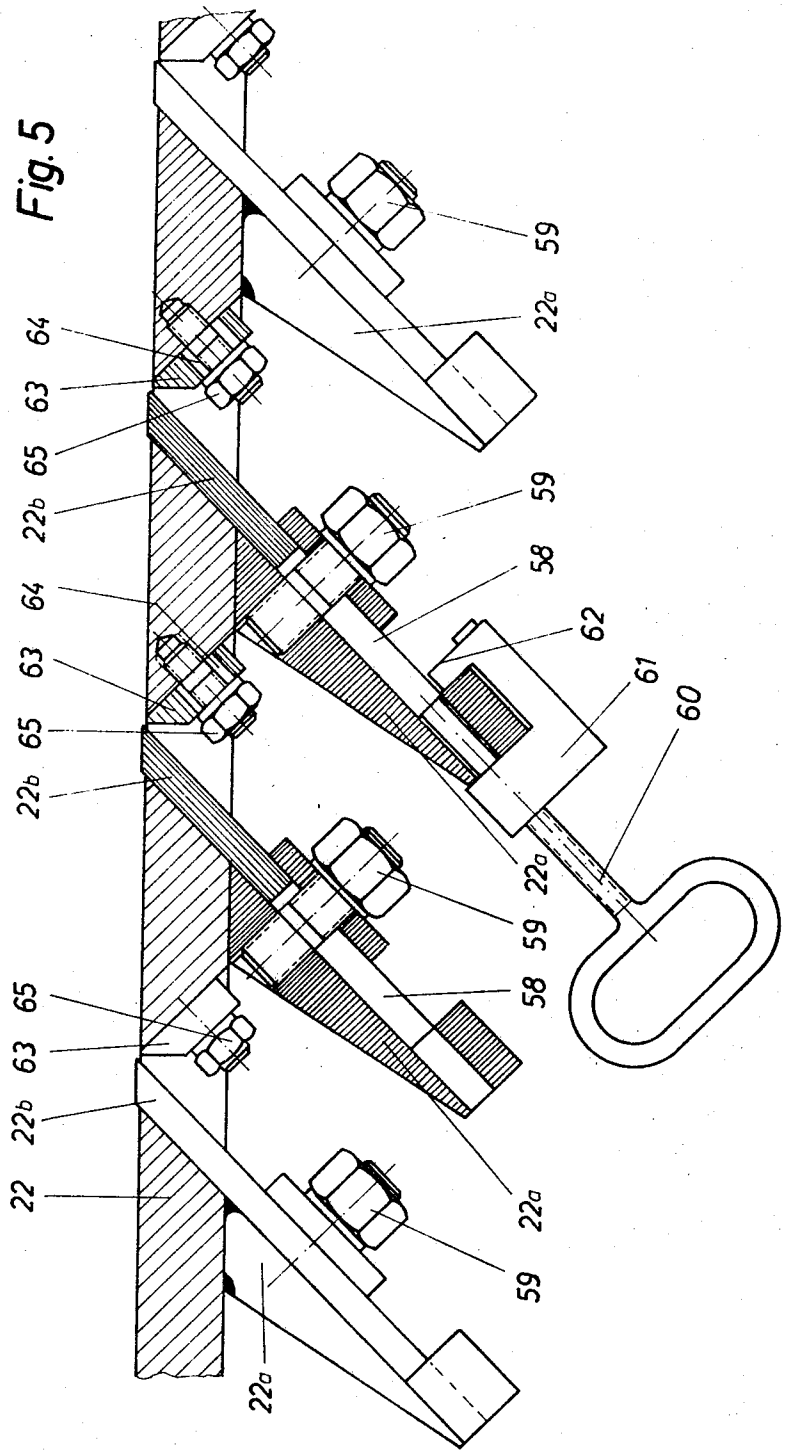
Fig. 4a

May 26, 1970 B. MAIER 3,514,044

WOOD COMMINUTOR

Filed June 26, 1967 5 Sheets-Sheet 5

Fig. 5



United States Patent Office 3,514,044 Patented May 26, 1970

3,514,044

WOOD COMMINUTOR

Balthas Maier, Brackwede, Westphalia, Germany, assignor to Dr.-Ing. Gerhard Maier, Brackwede, Westphalia, Germany

Filed June 26, 1967, Ser. No. 648,671
Int. Cl. B02c *18/00, 19/00;* B07b *7/06*
U.S. Cl. 241—51 7 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for finely and uniformly cutting up wood chunks or chips. The comminuted wood is fed to a hopper which discharges it to a rotary impeller having outwardly-directed flared channels. The ends of the channels run inside a stationary ring of adjustable cutters against which the chips are pressed by centrifugal action, and the reduced material is sucked away from the backs of the cutters. The cutter faces may lie on a flat surface, a cylindrical surface, or a frusto-conical surface.

The present invention concerns an apparatus for cutting material, especially wood, by means of a revolving device which feeds the material to surrounding cutters by centrifugal action.

Devices are known in the form of cutter shafts or disc cutters which cut round timber. Although these cutters produce a good flat shaving of uniform thickness, they are unsuitable for cutting up odd wood shapes, such as chips, off-cuts or the like.

Cutting machines are known which are fed with wood waste, such as chips, and which further cut up these chips.

Such cutting machines operate with stationary or rotatable cylindrical cutter cages, in which the wood chips are thrown against the cutter cage by means of a centrifugal wheel acting due to centrifugal force.

In this case the wood chips are only partially cut since a proportion of the chips is crushed between the centrifuge wheel and the cutter cage. Here the cut material discharged from the cutter cage contains a large porportion of undesired crushed material, which in the chipboard industry does not conform to their requirements of narrow, elongated chips of constant thickness.

Further known embodiments of cutters operate with beaters swinging pendulum-fashion instead of the centrifuging wheel, or with a revolving cutter cage and fixed feed device. Such hitherto known devices for cutting material, especially wood, have considerable disadvantages, since the supply of the material to be cut results in a vortex formation in the region of the cutters, so that the material is cut irregularly which has an adverse effect on the quality of chip and increases the proportion of dust in the final material.

It is an object of the present invention to provide an apparatus for cutting material, especially wood chips or the like, the feed device of which is so formed that by using centrifugal force the material is fed uniformly and without vortex formation to the cutters with a simple operating procedure which produces small flat chips of uniform and adjustable thickness.

In accordance with the present invention an apparatus for cutting material such as precomminuted wood or the like, having a centrifugal device feeding the material to a plurality of cutters, in which the centrifugal device comprises feed passages of turbine form between a plurality of blades located at spaced intervals, which discharge the material against the cutters of a fixed cutter cage enclosing the centrifugal device.

In a preferred embodiment the passages are hydrodynamically shaped and flared in the direction of their ends; the input ends of the passages may be located on a conical generating line, and towards the output ends may be bent over at right angles. The ends of the passages are enlarged until their orifice is flush with the cutting blades. The blades of the centrifugal device may be secured to a rotary cage.

According to a feature of our invention the cutting blades may be detachably mounted on a cutter cage adapted to be interchangeable as a whole, and are arranged on a plane; alternatively the cutters may be arranged on a frusto-conical surface to one another, or may be mounted along the surface of a cylinder. The rotary cage may be mounted for cut adjustment so as to be axially displaceable relative to the cutter cage, and the cutters pitch blades may be individually adjustable for chip thickness in the cutter cage, though the cylindrical cutter arrangement is not so adjustable.

The outer surfaces of the cutter cage in the region of the cutting blades may be case hardened, the hardening being provided by hard metal applied or sprayed thereon, or by nitriding the surface.

This apparatus in accordance with the persent invention feeds the material to be cut to the cutters by centrifugal action whilst minimizing vortex formation and has a uniform feed action with low friction. The feed device has the form of a pump impeller which is constructed hydrodynamically for coarse-grained material, and the impeller-type blades have an excellent conveying action.

The construction of the feed device used provides a constant rate of cutting the material charged, since even with a partial charge the material remains pressed against the cutter cage without vortex formation until cut up completely, since the guidance of the spatially curved blades acts like a pump for the pieces of wood.

Furthermore the cutting effect takes place over the whole width of the cutters, and the cut material is discharged over the whole outlet cross-section without any tendency to vortex formation.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a vertical section through a pair of disc cutters having a frusto-conical cutter arrangement and feed blades;

FIG. 2 is a partial section through a modified pair of disc cutters with a flat cutter arrangement and feed blades;

FIG. 3 is a view of the cutter arrangement as shown in FIGS. 1 and 2; without the cutter cage;

FIG. 4 is a vertical section through a modified pair of disc cutters having a cylindrical cutter arrangement;

FIG. 4*a* is a partial view of the same cutter as shown in FIG. 4, and

FIG. 5 is a cross-section through a cutter cage with adjusting means for the cutters.

In FIG. 1, a machine frame supports a pedestal bearing **11** and a sealing cover **12**, with a horizontal driving shaft **13** which rotates a cage **14** with external guide blades **15** for the material to be cut. On this driving shaft **13** a V-pulley **16** is splined, which is rotated by means of a driving belt, not shown. The cage **14** is supported by a plurality of roller or ball bearings **11, 17, 18** which are mounted on a shaft **19** which is rigidly connected with a face plate **19***a* in turn secured to the machine frame **10.**

The machine frame **10** has a dished housing **20,** and between this and the sealing cover **12** there is a charging hopper **21** which discharges into the passages **15***a* of the guide blades **15.**

These passages **15***a* are flow-curved like the blade passages in pumps towards a cutter cage **22,** which is clamped between the housing **20** and the face plate **19***a.* The

cage carries separate cutter head supports **22***a* for the cutting blades **22***b* and the stump cutters **63** (FIG. 5). The passages **15***a* are flared, with their orifices flush with the cutting edges of the cutting blades **22***b*.

The rotary cage **14** with the blades **15** is designed along the lines of a pump impeller, so that the surfaces of the blades **15** form an acute angle at the cage outlet with the conical surface of the cutter cage **22**, whereby during rotation, the material to be cut is then firmly pressed against the cutting blades **22***b*, even when the machine is only partially loaded.

With such partial loading, i.e. in which the material supply does not completely fill the blade passages, and to ensure even distribution over the whole length of the cutters, rib plates **25** may be provided on the wheel outlet in the peripheral direction of the rotary cage **14**, arranged in the direction of feed, the plates being secured alternately on the rear side of one blade **15** and the front surface of the adjacent blade **15**; these rib plates **25** divide the outlet cross-section of each passage **15***a* into two or more rectangles seen along the conical generating line. In this way, when the passages are not filled completely, pieces of material which strike against the inner part of the cutter cage **14** are prevented from slipping outwards due to the centrifugal force along the cone generating line on the cutter cage **14**, thus ensuring a substantially uniform distribution of material to the cutting blades **22***b*.

To vary the thickness of chip cut, the distance of the inner rotary cage **14** from the cutters may be varied in the direction of its pivotal axis. For this purpose, adjusting screws **26** engage the face plate **19***a* and carry gear wheels **27** on their outwardly projecting ends which are rotated by means of a large gear wheel **28**, rotated by a hand wheel **29**. The screws **26** press against a displaceable thrust ring **30** on the face plate **19***a* and thereby displace thrust bearings **32** between the face plate **19***a* and the rotary cage **14** and hence move this rotary cage **14** in the direction of the pedestal bearing **11**, so that the gap between the orifices of the passages **15***a* of the blades **15** and the cutting edge of the cutting blades **22***b* is increased. This displacement takes place against a disc spring **31** which is supported at the end of the journal **19** against a screw **31***a* and which, when the screws **26** are slackened, urged the rotary cage **14** into the opposite direction, thus causing the said gap to be reduced.

It is also possible to effect the adjustment of the rotary cage **14** in an axial direction by means of a spindle structure, in which by turning a screwed spindle to the right or left, the rotary cage **14** is forwardly or rearwardly displaced, and remains so positioned.

Owing to the feed action of the rotary cage **14** acting as pump impeller, the flat chips hurled through between the cutting blades **22***b* are discharged into a ring chamber **23** which is covered by an external removable cylinder housing **24** adjacent to the dishlike housing **20**. Due to the feed pressure produced by the rotary cage **14**, the cut material is progressively conducted away from this cylinder housing **24** via a pipe socket **33**, and the feed action may be assisted by an extractor fan (not shown) into which a delivery pipe **34** leads.

In the modified embodiment of a disc cutter shown in FIG. 2, the cutting edges of the cutters **41** are located on a plane so that the orifices of the passages **42** of the guide blades **43** sweep over an annular ring surface. This is the limiting case of a conical cutter cage **40** with 90° taper; a flat surface studded with cutting blades **14** is thus obtained.

This embodiment uses the remainder of the features of the embodiment described with reference to FIG. 1; it differs only in that in the cutting operation, perfect chips are formed as in conventional flat disc cutters; in this case also the feed action is used for the shredding movement. The chips to be shredded are supported substantially flat on the cutter surface. This embodiment is particularly economical in cost.

FIG. 3 shows the shapes of the blades **15**, with the blades **15** in full lines and with passages **15***a* according to the embodiment of FIG. 1, the broken lines showing the blades **43** with passages **42** of the embodiment of FIG. 2. The blades **15**, **43** are either curved in a peripheral direction (arrow A) or bent sharply as with turbine-blades; they are flared outward to avoid jamming.

In the modified embodiment shown in FIG. 4 a frame **45** supports a pedestal bearing **46** and a closure cover **47** in which shaft **48** is rotatably mounted. This shaft **48** is rigidly connected with a rotary cage **49** which is mounted on a steel-shaft **50** by means of bearings **51**, the shaft being carried in a face plate **52**. In this embodiment the passages **53***a* facing radially outwards of the pump-like curved blades **53** are enclosed by a cylindrical cutter cage **54**, the cutters **54***a* of which are hence parallel to the horizontal shaft **48**. In this case the limit of the cone angle is 0°, i.e. the cutters **54***a* extend parallel to the longitudinal axis of the shaft. The chips arriving from the charging hopper **55** are subject to considerable deflection in the passages **53***a* and are thereby aligned and then urged at an acute angle against the cutters **54***a*, the feed action of the pump-like rotary cage **49** being particularly advantageous.

The chips produced in the cutting guides described above with reference to FIG. 4, are collected in an outer ring chamber **56** from whence they are extracted by suction.

A further feature of the invention consists in that in all embodiments the cutting blades with their cutter head supports are assembled into a cutter cage, which may be removed from the cutting device for regrinding the cutters, or may be changed for a cutter cage having sharpened cutters. Such a change is simple and take little time, so that the idling time during changing the blades is minimal.

FIG. 5 shows how the cutting blades **22***b* are adjustably mounted in the cutter cage **22**.

Thus, for each cutter **22***b* a flat cutter head carrier **22***a* is secured on the cutter cage **22** on which the cutting blade **22***b* is supported; each carrier has a plurality of longitudinal slots **58** parallel to one another, through each of which a bolt **59** is inserted.

An adjusting screw **60** engages the rear of the cutter **22***b* the screw being mounted on the cutter head carrier **22***a* by means of a clamp **61** in which it is threaded. This clamp is a detachable device for cutter adjustment, which is removed after the cutter **22***b* has been adjusted. For this purpose the clamp **61** is provided with a rotatable locking closure **62** which temporarily fastens the clamp **61** on the cutter head carrier **22***a*.

If the screw **59** is slackened, then by turning the adjusting screw **60** to the cutter **22***b* is shifted forwardly to take up wear.

The pitch blade **63** used for the setting gap for the chip thickness may be adjusted in the same way. For this purpose this pitch blade **63** has a slot **64** through which an adjusting bolt **65** passes to engage in the cutter cage. By slackening this screw **65** the pitch blade may be adjusted. The cutting blades **22***b* and the pitch blades **63** permit production of a very flat chip of, for example, 0.2 mm. to 0.3 mm. thickness. The readjustments prevent pieces of wood not fully shredded from being prematurely extracted by suction.

It is advantageous for the surfaces of the cutter cage to be case hardened by nitriding, or covered with hard metal, which may be sprayed on. This prevents these running surfaces from being scored on both sides of the cutting blades by wood friction. These surfaces must remain flat in order to produce perfectly uniform chips. All machine parts are readily assessible; the thickness of all chips produced may be adjusted in a simple manner as already described by displacing the rotary cage carrying the guide blades.

The formation of the rotary cage as a pump impeller,

the adjustability of the spacing between the end of the rotary cage and the cutting edges of the cutters, the individual adjustability of the cutting blades and the pitch blades, interact to cause the material to cut uniformly conveyed to the cutters without vortex formation, to remain there until completely cut up without small uncut pieces being extracted by suction; in addition, all size reduction is effected by a cutting process and not by crushing.

I claim:

1. Apparatus for producing shavings comprising:

a fixed ring having a plurality of cutters mounted thereon;

a frusto-conical body rotatably monuted within said ring;

means for rotatably driving said frusto-conical body;

a hopper for receiving precommuted material; and

means forming in a plurality of juxtaposed, curved, and outwardly directed guiding passages on said frusto-conical body between said hopper and said cutters, said passages being enlarged towards their outlet end to the width of said cutters and the curvature of said passages being such that suction is produced during rotation of said frusto-conical body to cause said pre-comminuted material to be pressed against said cutters.

2. Apparatus according to claim 1 wherein said means forming said plurality of guiding passages includes a plurality of blades forming the walls of said passages, said blades being arcuately curved in the same direction as the direction of rotation of said frusto-conical body.

3. Apparatus according to claim 1 wherein said means

forming said plurality of passages includes a plurality of blades forming the walls of said guide passages, said blades being monuted at an angle in the same direction as the direction of rotation of said frusto-conical body.

4. Apparatus according to claim 1 wherein said cutter ring is a frusto-conical body.

5. Apparatus according to claim 1 further comprising a plurality of ribs arranged at the outlet end of said guiding passages to evenly spread the pre-comminuated material over the width of said cutters.

6. Apparatus according to claim 1 wherein said frusto-conical body is rotatably mounted on a shaft within said ring.

7. Apparatus according to claim 6 wherein said frusto-conical body is further slidably mounted on said shaft, the position of said frusto-conical body along the length of said shaft determining the thickness of said shavings.

References Cited

UNITED STATES PATENTS

2,369,312	2/1945	Porteous	241—90
2,874,909	2/1959	Pallmann	241—93 X
2,917,248	12/1959	Krug	241—299 X
3,219,076	11/1965	Logan	241—93 X
3,371,693	3/1968	Voelskow	241—91 X

ROBERT C. RIORDON, Primary Examiner

D. G. KELLY, Assistant Examiner.

U.S. Cl. X.R.

241—275