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Maier

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[54] **APPARATUS FOR CUTTING PRE-COMMINUTED MATERIAL INTO CHIPS**

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[52] **U.S. Cl.** ..... **241/244,** 241/259.1, 241/285 A, 241/299

[51] **Int. Cl.** **B02c 13/06**

[58] **Field of Search** ..... 241/228, 244, 255, 241/285 R, 285 A, 285 B, 286, 299

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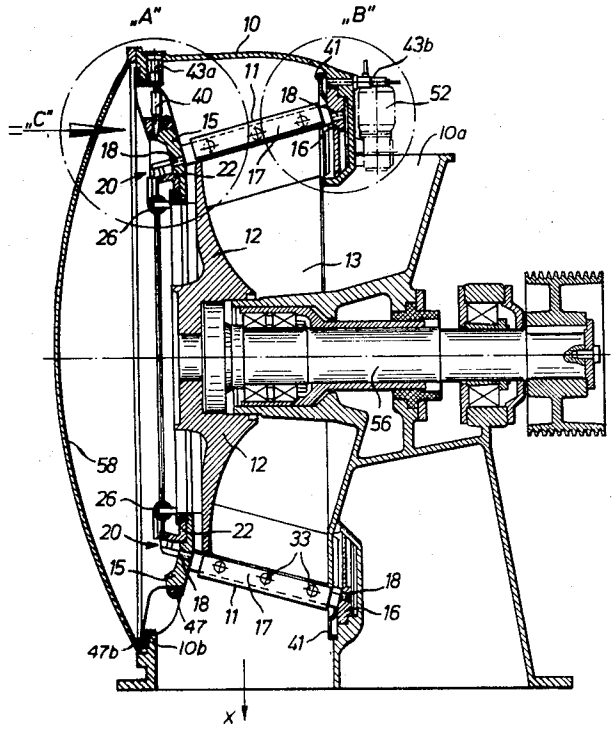
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[57] **ABSTRACT**

Apparatus for cutting pre-comminuted material into chips. The apparatus includes an outer normally stationary cage which carries a plurality of normally stationary blade assemblies which circumferentially surround a rotor which carries rotary blades to coact with normally stationary blades of the cage. The several normally stationary blade assemblies which are carried by the cage can all be simultaneously locked or unlocked. When unlocked they can be individually removed in order to be selectively replaced. However, it is also possible to remove all of the normally stationary blade assemblies simultaneously when a ring of the cage is unlocked from a housing of the apparatus.

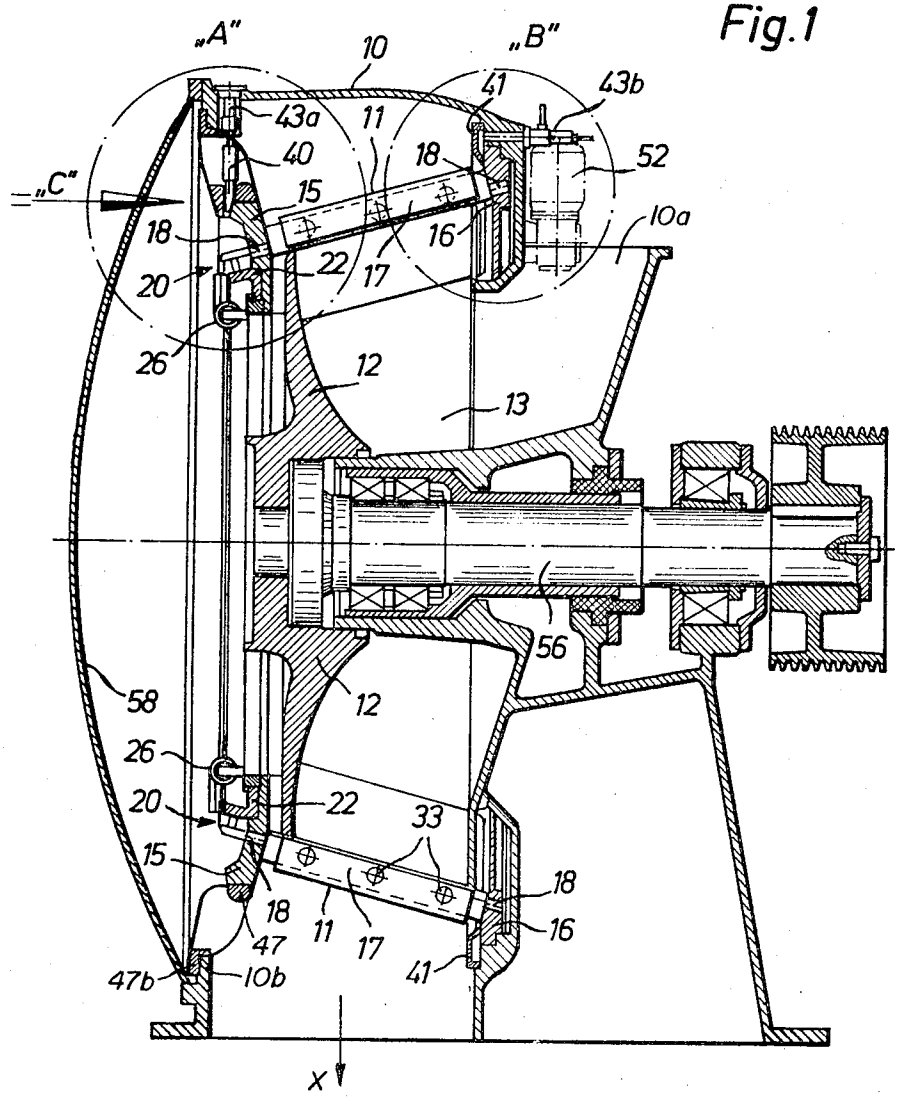
9 Claims, 9 Drawing Figures



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7 Sheets-Sheet 1

Fig.1



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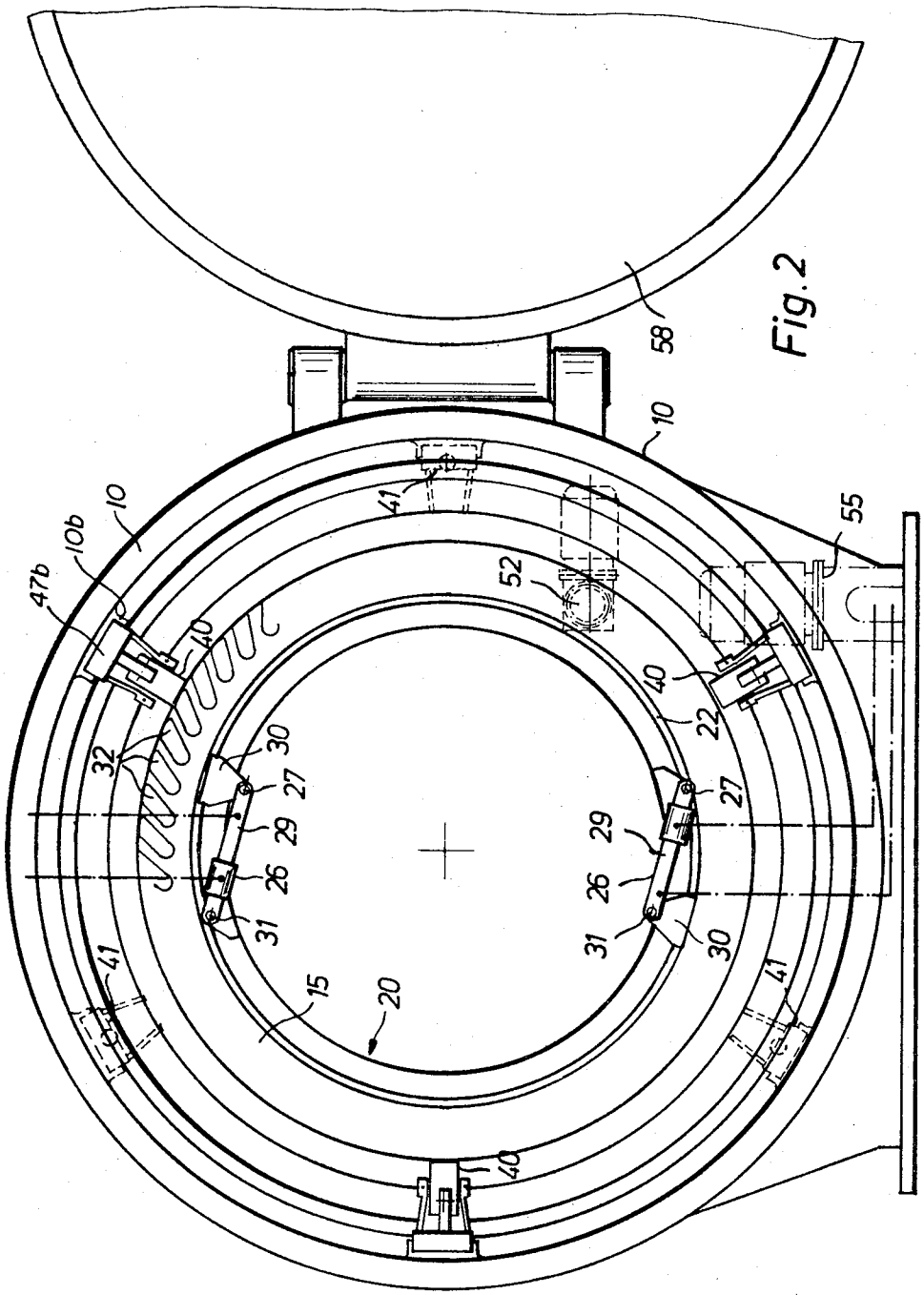
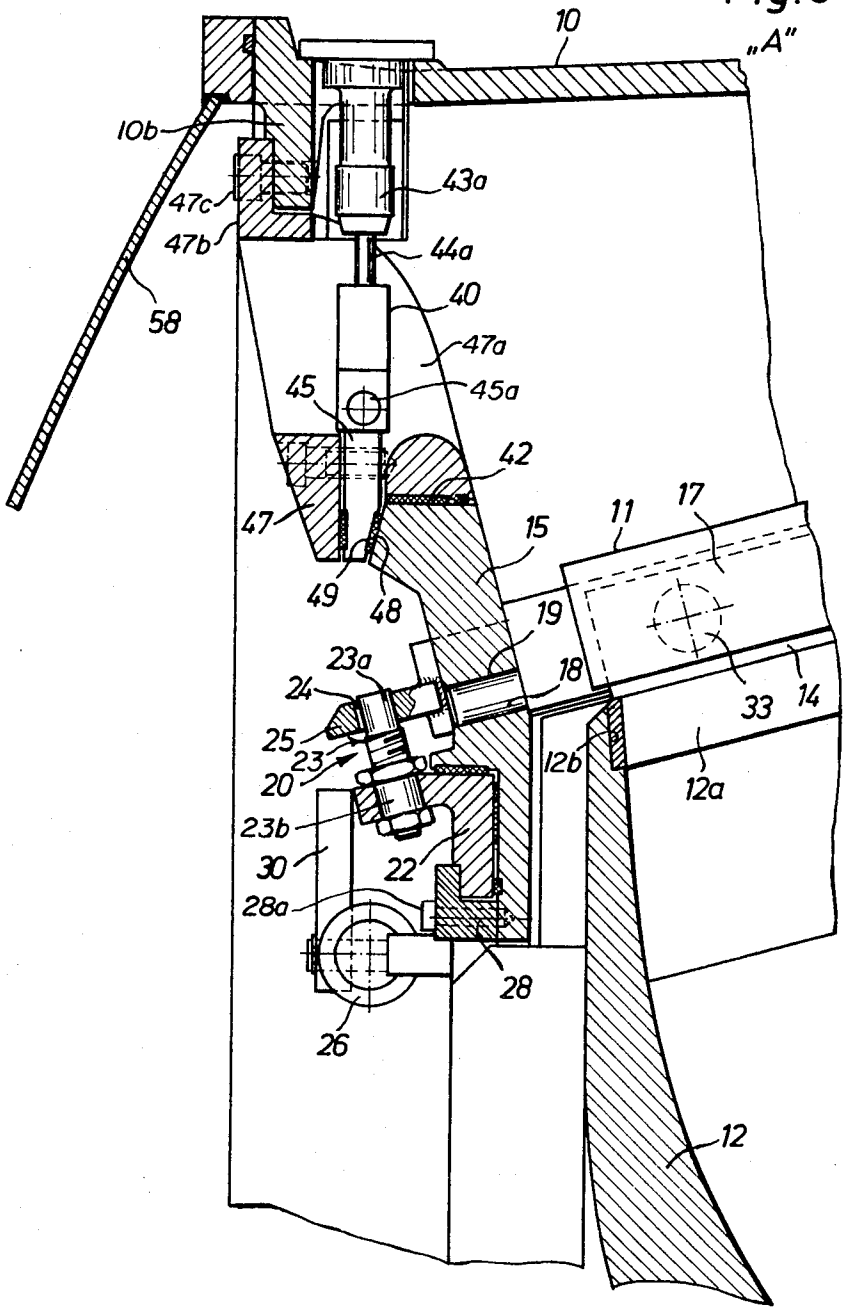


Fig. 2

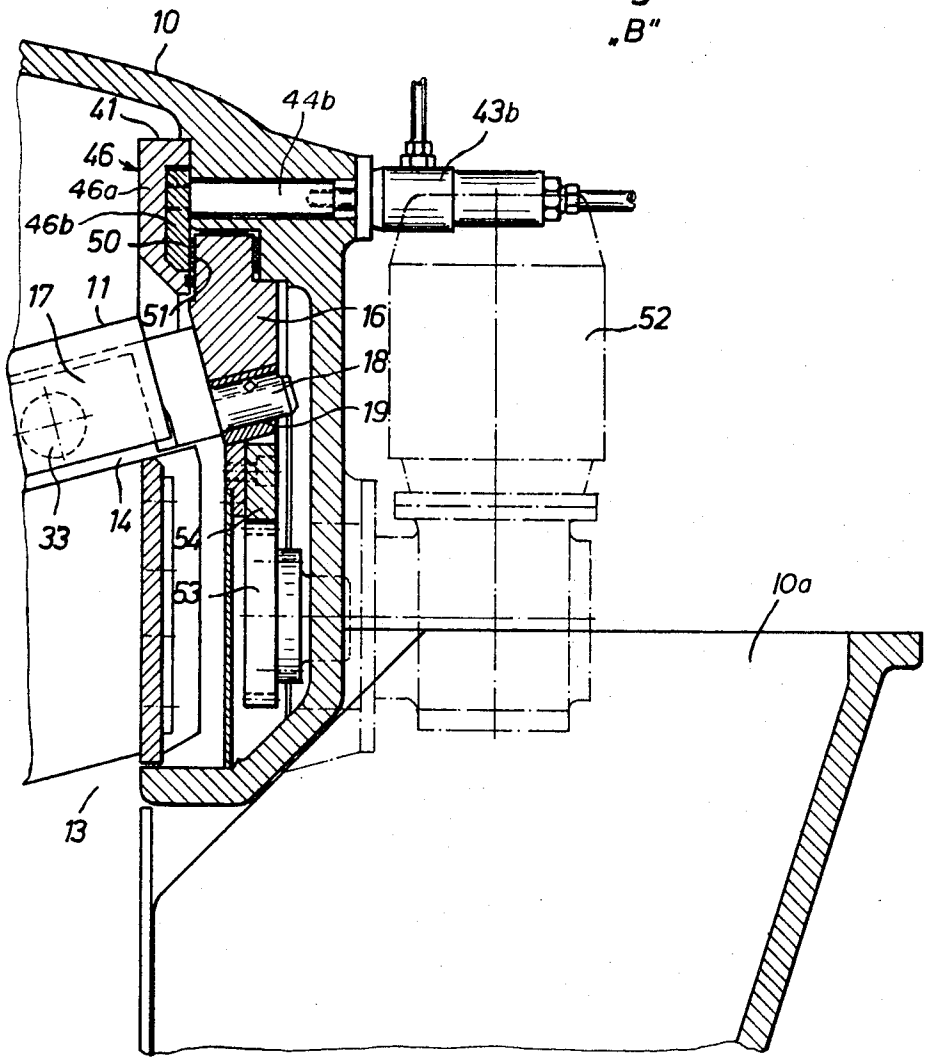
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Fig. 3



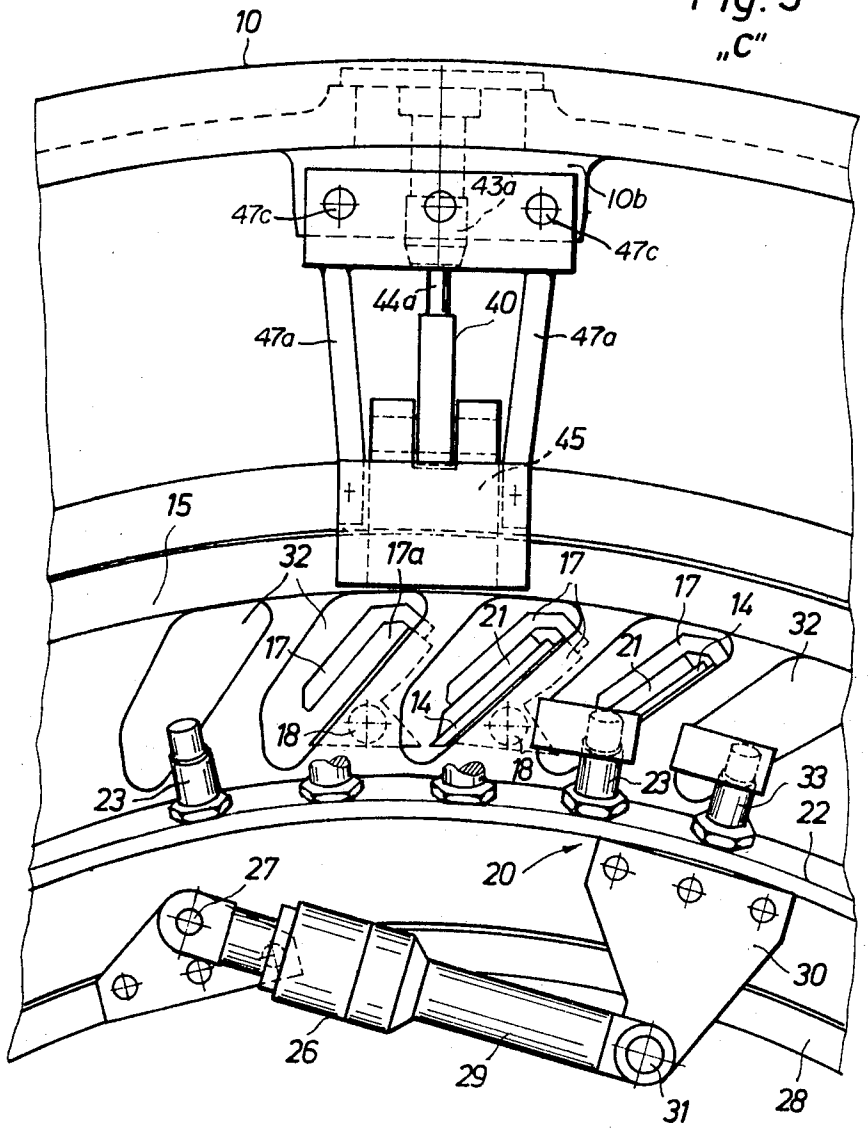
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Fig.4
„B"



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Fig. 5
„C"



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Fig. 6

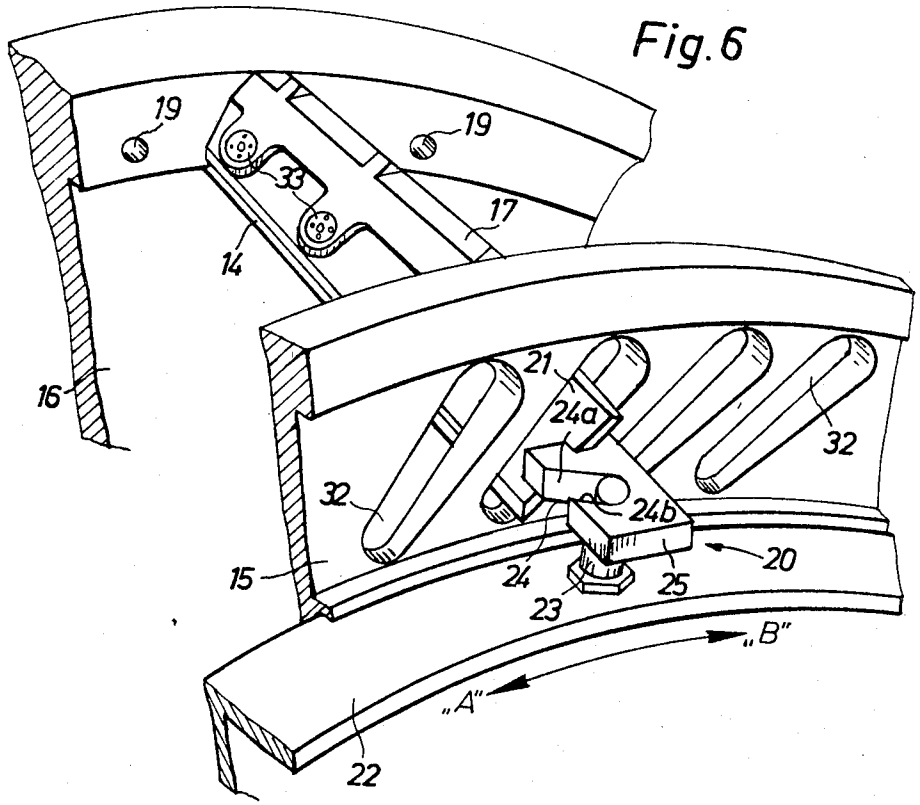


Fig. 8

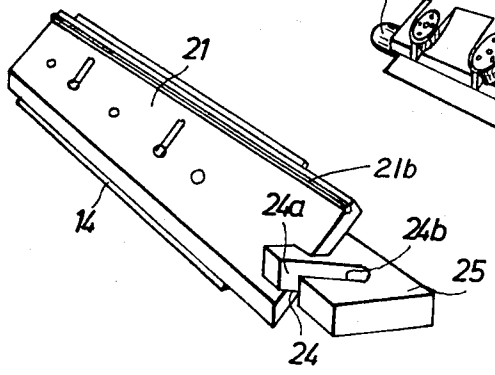
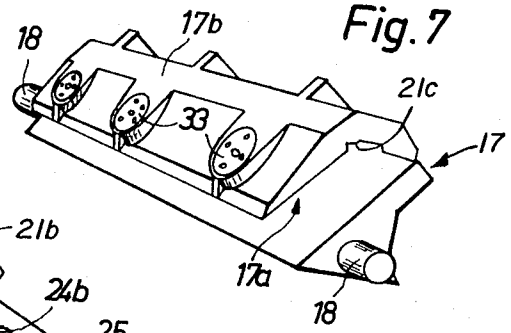


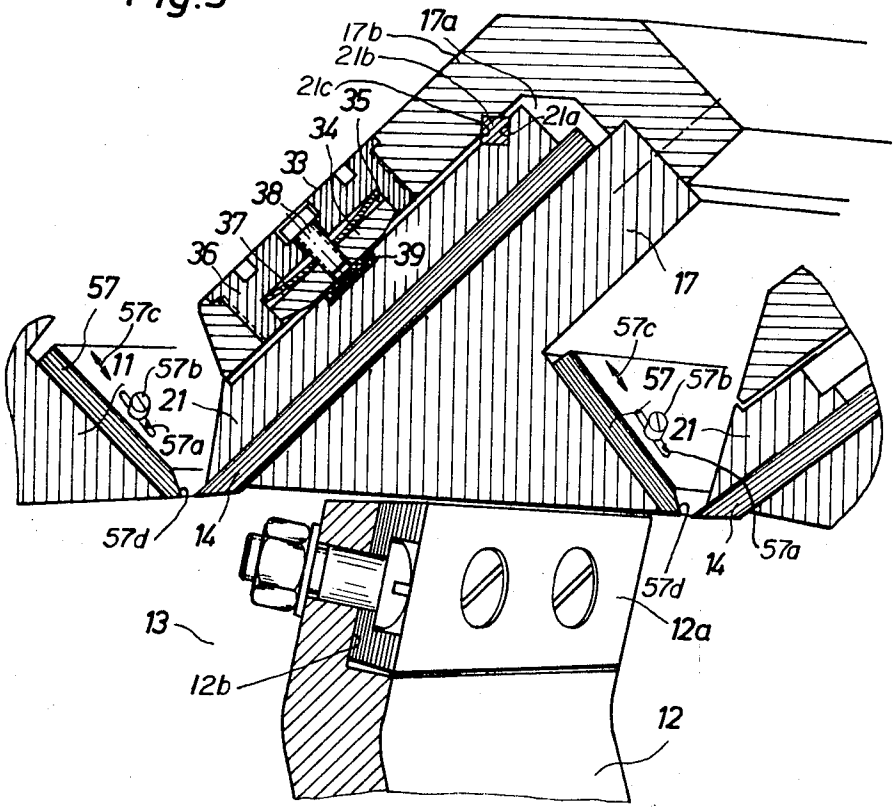
Fig. 7



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Fig.9



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APPARATUS FOR CUTTING PRE-COMMINUTED MATERIAL INTO CHIPS

BACKGROUND OF THE INVENTION

The present invention concerns a device for cutting up fragmented material such as pre-comminuted wood into chips. The device includes a comminuting chamber with a fixed knife cage having a plurality of knives, and splitting knives rotating within the knife cage and co-operating with the fixed knives thereof.

In some known devices for cutting wood into chips, difficult and time consuming dismantling of the entire knife cage is necessary when exchanging the knives. The dismantled knife cage is fitted with new or sharpened knives and installed again. Such exchange or replacement of the knives means that the device is out of action for a considerable time and involves accessories and labour

It is also known to make individual knives of the cage such that they can be replaced within said cage; each knife is secured in position in the cage by its own locking device. When releasing the knives, several knives, combined in a group, are gradually removed from their holders by an extractor. Machine construction is complicated, and dismantling and reassembling of individual knives are difficult due to the many operations involved. Another disadvantage of known devices resides in the wedging of the knives in the cage as a result of expansion due to heat, which makes it extremely difficult to dismantle the knives immediately after use.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improved comminuting device in which the blades are individually replaceable in a simple manner, and readily secured in the knife cage.

A further object is to provide the comminuting device with an unlocking and locking mechanism acting simultaneously on all the blades. At the same time, this mechanism prevents unintentional release of the individual blades and forms a means of assembly for securing said blade.

Moreover, the blades may be easily interchanged without the use of great force directly after use, when the machine is stationary.

In accordance with the invention an outer normally stationary cage means surrounds an inner rotor which carries a plurality of rotatable blade means. The cage means carries a plurality of normally stationary blade means with which the rotary blade means coact to cut pre-comminuted material into chips. The cage means is located within a housing and includes a pair of coaxial rings normally maintained stationary by a plurality of lock means which are carried by the housing and which coact with the rings for releasably locking them in stationary positions. The rings are supported for rotary movement so that when they are unlocked from the housing they can be rotated. The plurality of normally stationary blade means extend between the rings of the cage means and each normally stationary blade means includes a blade carrier extending between and directly connected to the rings and an assembly of a blade and blade-holding member carried by the blade carrier and removable therefrom. The assembly formed by the blade and blade-holding member can be releasably locked with respect to each blade carrier and one of the rings is formed with openings through which the

assemblies of blades and blade-holding members can be removed after they are unlocked. However, the entire set of normally stationary blade means together with one of the rings of the cage means can be removed while the other of the rings remains in the housing by removing from the housing a supporting ring with respect to which the one ring of the cage means is rotatable after unlocking this latter one ring from the support ring. The other ring of the cage means is also capable of being locked and unlocked so that when both rings are unlocked the entire cage means can be turned for situating the several blade means at suitable locations for individual removal and replacement.

BRIEF DESCRIPTION OF DRAWINGS

An embodiment of the present invention is illustrated in the accompanying drawings in which:

FIG. **1** is a longitudinal section through a device for the splitting up of pre-comminuted wood into chips, comprising a conical knife cage secured against rotation by means of locking devices with individually extractable blade assemblies which are detachable and lockable by means of a common unlocking and locking mechanism.

FIG. **2** is a front view of the same device with the cover hood raised.

FIG. **3** is a longitudinal section through a portion of the same device at the area A of FIG. **1**, showing the locking device stopping the knife cage, and the device for unlocking and locking the knife assembly.

FIG. **4** is a longitudinal section through a portion of the same device at the area B of FIG. **1** showing the locking device stopping the knife cage.

FIG. **5** is a front view of several blade assemblies inserted in the cage and secured by the unlocking and locking device, and also the locking device preventing the cage from turning, viewed in the direction of the arrow C in FIG. **1**.

FIG. **6** is a perspective view of a portion of the cage, with a blade assembly formed of two rings, with blade supports holding the rings spaced from each other.

FIG. **7** is a perspective view of a blade support.

FIG. **8** is a perspective view of a blade assembly consisting of a holding plate and a cutting knife.

FIG. **9** is a cross section through a portion of the knife cage and through the rotor, with a splitting knife co-operating with the knife cage.

DESCRIPTION OF PREFERRED EMBODIMENTS

A device according to the present invention for splitting up small pieces of material such as pre-comminuted wood, is provided with a stationary knife cage **11** in a housing **10** with a filling aperture **10***a*, and a rotor **12** extending into the knife cage **11** and rotating about a horizontal axis.

The knife cage **11** is provided with a plurality of knives or cutting blades **14** distributed over its circumference and extending into the comminuting chamber **13** which is enclosed by the knife cage **11**. The knives **14** co-operate with splitting knives **12***a* provided on the rotor **12**.

The normally stationary cage means **11** is composed of two coaxial rings **15, 16**, mounted in the housing **10**, and knife supports **17** equal to the number of knives and extending between the rings **15, 16**. The knife supports **17** engage detachably in openings **19** of the two

knife cage rings **15, 16,** by means of bearing pins **18** provided at both ends of each support.

The knives **14** are mounted in the knife cage **11,** and secured in position by means of a common locking device or means **20** so that they can be removed individually; at the same time all knife assemblies, each formed of a holding member (holding plate **21**) and a cutting knife **14,** are clamped in recesses **17***a* (see FIGS. 7–9) of the cage **11** and are releasable jointly, so that they can be removed individually, by means of unlocking and locking device **20.**

The unlocking and locking device **20** is provided with a pressing ring **22** which is rotatable for unlocking and locking said knife assemblies, the ring **22** being provided on its circumference with an unlocking and locking bolt **23** for each knife assembly **14, 21;** each bolt **23** of the pressing ring **22** engages in a slot **24** of a respective knife assembly **14, 21,** which defines two parallel pressure surfaces **24***a*, **24***b*, of a slot **24** provided at an acute angle to the longitudinal direction of the knives (knife insertion direction).

All the unlocking and locking bolts **23** are detachably secured to the pressure ring **22** from which they extend radially outwardly, and the slots **24** open towards one side portion of the knife assemblies **14, 21.** Each slot is formed in a pressure plate **25** connected as by bolts **28***a* (FIG. 3) to the holding plate **21.**

The pressure ring **22** is acted upon by a thrustor **26** which can rotate the ring through a limited angle; the thrustor **26** is mounted at one end on an annular member **28** detachably connected to the knife cage ring **15,** at the connecting point **27,** and engages a bracket **30** secured to ring **22,** by means of a pressure and draw bar **29.** The thrustor **26** has an articulated connection at the linking point **31** between its rod **29** and the bracket **30** (see FIG. 5).

The knife cage ring **15** is provided with insertion openings **32** adjacent to the pressure ring **22** of a number equal to the number of knife assemblies **14, 21,** through which openings the individual knife assemblies (holding plate **21** with cutting knife **14**) are insertable in the recesses **17***a* of the knife support **17** and removable therefrom.

The recess **17***a* of each knife support **17** is a slot extending in the longitudinal direction of the knife supports, and each knife support **17** is provided with several, preferably **3,** resilient pad means **33** located spaced apart in the longitudinal direction of the knife supports and pressing against the knife assembly **14, 21.** Thus, the cage means **11** includes a plurality of normally stationary blade each composed of a carrier **17** and a blade assembly **14, 21** composed of the blade **14** and the blade-holding member **21.** The holding plate **21** of each knife assembly is formed as shown in FIGS. **7–9,** with a V-groove **21***a* receiving a key **21***b* of square cross section which is also received in a V-groove **21***c* formed in the inner surface of each wall **17***b* of each carrier **17.**

The pad means **33** are provided with pressure discs **34** the pressure of which is adjustable and bear against the holding member **21.** Each pressure disc **34** is mounted in a recess **35** of a plug **36** threaded into an opening in wall **17***b* of the carrier **17;** it is loaded by at least one cup spring **37** and held by a screw **38** for adjusting the pressure of the spring; the screw **38** passes freely through a hole in plug **36** and is screwed into the pressure disc **34** so that when the screw is turned, the position of the pressure disc **34** in recess **35** of plug **36** is changed and the cup spring **37** is compressed more or less.

In order to increase the clamping connection between the holding plate **21** and pad means **33,** the holding plate **21** is provided in the region of each disc **34** with an elastic contact surface **39** against which the resiliently secured pressure disc **34** is supported.

The knife cage **11** is of conical section and is prevented from rotating by means of locking devices **40, 41,** pressing against the knife cage rings **15, 16.**

The knife cage **11** and its two rings **15, 16** can rotate on bearing surface **42** (FIG. 3) of ring **47** having pairs of arms **47***a* interconnected by crosspieces **47***b* detachably connected by bolts **47***c* to inwardly extending portions **10***b* of the housing **10,** so that it rings **15, 16** can be turned for interchanging the individual knife assemblies **14, 21.**

The said assemblies may be brought sequentially to a convenient position. During operation the knife cage **11** is secured against rotation by the locking devices **40, 41.** Several locking devices are spaced uniformly over the circumference of the cage **11.**

Each locking device **40,** (FIGS. **3** and **5**) includes a cylinder and piston assembly **43***a* **44***a*, the cylinder being fixed to the housing **10,** with a holding member **45** pivotally secured to the piston **44***a* by a pin **45***a* and displaceable in an opening of ring **47** at a right angle, to the axis of rotation of the knife cage, in contact with the knife cage ring **15,** to effect a clamping action. Thus holding members **45** of the locking devices **40** are displaceable at a right angle to the axis of rotation of the knife cage, and engage with a clamping effect between the knife cage ring **15** and external ring **47.**

The surface of the ring **15** facing the housing ring **47** has an outwardly directed bevel surface **48** and the member **45** is provided with a wedge surface **49** co-operating with this bevel surface **48;** other two surfaces of the holding member **45** and the ring **47** are formed so as to extend vertically parallel, so that the holding members **45** act as wedges between the two rings **15, 47,** for securing the knife cage.

Releasable holding means **41** includes a number of cylinders **43***b* operatively connected with pistons **44***b* which are connected to the annular; holding member **46.** The annular member **46** of the releasable holding means **41** which coacts with the ring **16** includes an outer ring **46***a* fixed to an inner **46***b* which is fixedly carried by the outer ring and which in turn is connected with the several pistons **44***b* which are displaceable parallel to the axis of rotation of the knife cage in response to movement of pressure fluid into and out of the cylinders **43***b*, and holding member **46** has a contact surface **50** co-operating with opposing surface **51** of the knife cage ring **16.** These two co-operating surfaces **50, 51,** are parallel, and perpendicular to the axis of rotation of the knife cage. The releasable holding means **46** engages the ring **16** and draws it with a clamping effect against the housing **10** so that the knife cage is secured here also (FIG. **4**).

As is apparent from the above description in connection with FIGS. **1, 3,** and **4,** the ring **16** may be considered as permanently supported for rotary movement by the housing **10.** While the ring **15** is supported for rotary movement by the ring **47,** this latter ring is detachably connected to the housing **10** by way of the screws **47c.** The several fluid-pressure releasable lock means

40 serve to urge the ring 15 toward the right, as viewed in FIGS. 1 and 3, and the ring 15 thus urges all of the normally stationary blade means, each composed of the carrier 17 and the blade assemblies 14, 21 carried thereby, longitudinally toward the ring 16 so that in this way in response to the action of the of the releasable lock means 40 the several stationary blade means are maintained stationary and fixed between the rings 15 and 16.

For rotating the knife cage to exchange the individual knife assemblies 14, 21, a motor 52 is provided which is mounted on the housing 10 and engages by means of a driving pinion 53 in a toothed crown wheel 54 connected to the knife cage ring 16.

The actuators 26, 43, may be hydraulic motors which receive their fluid from a common unit 55 (FIG. 2) by way of connecting lines.

The rotor 12, which is motor driven by its shaft 56, is provided with several recesses 12*b* in to which splitting knives 12*a* are detachably connected (FIG. 9); these knives 12*a* co-operate with the cutting knives 14 of the cage 11. Associated with each cutting knife 14 is an adjustable backing strip 57 determining with the cutting knife 14 the width of passage openings 57*d* and thus the thickness of the resultant chips. For example, as shown schematically in FIG. 9, the backing strips 57 may each be formed with a plurality of slots 57a, through which extend screws 57b which are threaded into the carriers 17 so that by loosening the screws 57b it is possible to shift the strips 57 in the direction indicated by the double-headed arrows 57c, and thus it is possible to adjust the width of the gaps 57d through which the chips fall in the direction indicated by the arrow X in FIG. 1 into a suitable receptacle situated beneath the structure of the invention which is illustrated in FIG. 1.

The knife assemblies 14, 21, provided in the knife cage 11 are secured by the bolts 23 of the unlocking and locking device 20; these bolts 23 press against the surface 24*a* of each slot 24 of the knife assemblies 14, 21, and thus keep the knife assemblies in the recesses 17*a* of the knife supports 17.

In order to interchange the knife assemblies 14, 21, the pressure ring 22 is turned in the direction of the arrow A (see FIG. 6) by its thrustor motor 26; its bolt 23 now presses against the other pressure surfaces 24*b* of the slots 24 and at the same time draw all the knife assemblies 14, 21 simultaneously by a certain longitudinal amount out of the knife support recesses 17*a*. The pressure ring 22 is turned until its bolts 23 move out of the slots 24.

In this position the individual knife assemblies 14, 21, are loosely disposed in the recesses 17*a* and can then be easily removed manually from the knife cage 11 through the openings 32.

In order to be able to turn the knife cage 11 to a convenient place for removing the knife assemblies 14, 21, the locking devices 40, 41, are released after rotation of the pressure ring 22. Their holding members 45, 46 are displaced radially outwardly and axially, respectively, and their pressure surfaces 49, 50 unclamp from the annular surfaces 48, 51, so that the knife cage 11 can be brought manually or by the motor 52 to the desired location.

The extracted knife assemblies 14, 21, are replaced by fresh knife assemblies with re-sharpened knives 14, and are inserted individually by hand through the openings 32 in the individual recesses 17*a* in the knife supports. After all the knife assemblies are replaced, the knife cage 11 is stopped. By the pressure of elements 44*a*, 44*b* of the actuators 43*a*, 43*b*, its two rings 15, 16 are re-clamped by the holding members 45, 46, again, and the knife cage 11 is secured so that it is unable to turn.

The clamping of the knife assemblies is now effected. The pressure ring 22 is turned by the thrustors 26 in the direction of the arrow B (see FIG. 6) so that its bolts 23 are introduced into the slots 24, and all the knife assemblies are simultaneously displaced longitudinally in the recesses 17*a* of the blade carriers 17.

The rib-like knife supports 17 forming the knife cage frame with the rings 15, 16, can be rapidly and simply changed without a screw connection when required. The individual knife supports 17 held in the two rings 15, 16 by bearing pins 18 can be easily extracted when the pressure ring 22 is opened, by removing the front ring 47 (after removing bolts 47*c*) and knife cage ring 15 with the several normally stationary blade means carried thereby from the other knife cage ring 16. At this time the releasable lock means formed by the pressure ring 22 and the pins 23 can remain engaged with the several blade means carried by the ring 15 so as to compel the several normally stationary blade means of the cage means 11 to be removed together with the ring 15 while the pins 18 at the right ends of the normally stationary blade means, as viewed in FIGS. 1 and 4, slip out of the openings 19 of the ring 16.

The assembly and dismantling of the knife supports 17 is facilitated by the rotor 12, since the latter rotates with a very small clearance in the knife cage 11 and thus provides a guide surface for the assembling and dismantling process of the knife supports 17.

In order to increase the clamping connection between the knife cage 11 and locking devices 40, 41, in the fixed position, the co-operating holding members 45, 46 and the surfaces of the rings 15, 16, and of the housing 10, 47 may be provided with resilient linings.

The housing 10 is provided with a pivotable cover hood 58 which can be locked manually or mechanically.

The locking and unlocking bolts 23 are made adjustable so that the pressure of the bolts 23 on the slots 24 can be adjusted and compensation of tolerances within the slots 24 can be equalised.

Each locking bolt part 23*a* (FIG. 3) engaging in the slot 24 is eccentric with respect to its part 23*b* secured in the pressing ring 22; thus adjustment is possible by the rotation of the bolt 23.

I claim:

1. In an apparatus for cutting pre-communited material into chips, housing means, rotary cutting means carried by said housing means for rotation about a predetermined axis and including a plurality of rotary blade means distributed about said axis, normally stationary cage means surrounding said rotary cutting means and carried by said housing, said cage means carrying a plurality of normally stationary blade means which coact with said plurality of rotary blade means to cut pre-comminuted material into chips, said cage means including a pair of rings supported for rotation by said housing, a plurality of blade carriers extending between and carried by said rings, and a plurality of blade assemblies respectively carried by said carriers and forming said normally stationary blade means

therewith, one of said rings of said cage means carrying a releasable locking means which coacts with all of said blade asemblies for releasably locking the latter in operative positions carried by said plurality of carriers, respectively, and at least a pair of releasable holding means carried by said housing and coacting respectively with said rings for releasably holding the latter against rotation.

2. The combination of claim 1 and wherein said one ring is formed with openings through which said blade assemblies are respectively insertable into and removable from said carriers.

3. The combination of claim 2 and wherein each of said blade assemblies includes a blade member and a holding member for holding said blade member on said carrier, each holding member being formed at one end which projects through and beyond one of said openings of said one ring with an inclined slot, and said releasable locking means including a rotary pressure ring supported for rotation by said one ring and a plurality of lock pins extending radially from said pressure ring respectively into said slots of said holding members, and fluid-pressure means connected between said one ring and said pressure ring for rotating the latter in one direction to move said pins with respect to said slots for locking said blade assemblies in said operative positions carried by said carriers and in an opposite direction for moving said pins with respect to said slots for retracting said blade assemblies away from said operative positions partly out of said carriers, respectively.

4. The combination of claim 1 and wherein a turning means is operatively connected with the other of said rings of said cage means for turning the latter and the entire cage means therewith when said releasable holding means is actuated to release said cage means for rotary movement, so that the several normally stationary blade means can be located at a convenient location for removal and replacement.

5. The combination of claim 1 and wherein said releasable holding means includes fluid-pressure units and clamping components actuated thereby for clamping said rings to said housing.

6. The combination of claim 5 and wherein said normally stationary blade means are removably connected with the other of said rings, a support ring detachably connected with said housing and supporting said one of said rings for rotary movement so that when the releasable holding means which coacts with said one ring is released for releasing the latter ring, said support ring and said one ring can be removed with all of said normally stationary blade means carried thereby and separated from the other ring while the latter remains connected with said housing.

7. The combination of claim 1 and wherein each of said blade assemblies includes a blade member and a holding member for holding said blade member on said carrier and each of said normally stationary blade means including at its carrier a plurality of resilient units pressing against said holding member to press the latter against said blade member of each blade assembly.

8. The combination of claim 7 and wherein each of said resilient units includes a plug threaded into a wall of each carrier and having a hollow interior, a pressure disc situated in said hollow interior, and adjustable spring means pressing said disc against said holding member.

9. The combination of claim 1 and wherein elastic linings are carried by said rings at the regions where the latter are engaged by said holding means.

* * * * *