(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 458 531 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
24.01.2007 Bulletin 2007/04

(21) Application number: **02789121.7**

(22) Date of filing: **28.11.2002**

(51) Int Cl.:
B27B 33/20 *(2006.01)*

(86) International application number:
PCT/SE2002/002199

(87) International publication number:
WO 2003/064126 (07.08.2003 Gazette 2003/32)

(54) **METHOD FOR PLAN PROCESSING OF A ROUND LOG**

VERFAHREN ZUR PLANBEARBEITUNG VON RUNDHOLZ

PROCEDE DE TRAITEMENT PLAN D'UNE BILLE DE BOIS RONDE

(84) Designated Contracting States:
AT DE FI FR

(30) Priority: **28.11.2001 SE 0103967**

(43) Date of publication of application:
22.09.2004 Bulletin 2004/39

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EP 1 458 531 B1

Description

[0001] The present invention relates to a method for forming a round log into a block with two or more flat lateral surfaces, comprising the steps of directly cutting into chips the material which is to be removed, by means of a block-forming assembly of the type having two or more working tools which each have the form of a rotatable drum or frustoconical body which on its circumferential surface carries a plurality of chipper knives; after the block-forming assembly, feeding the block to a sawing assembly for resawing the block to produce boards and planks, and, when sawing thick logs, reducing the feed rate of the sawing assembly and, thus, also of the block-forming assembly.

Background Art

[0002] Block-forming assemblies of the type mentioned by way of introduction are often included in a production line of a sawmill. As an example of such a block-forming assembly, reference is made to US-A-4456045 in which is disclosed a chipping machine having a frustoconical chipping head with circumferentially spaced chipping knives.

[0003] As a rule, a sawing assembly is placed immediately after the block-forming assembly and the logs and blocks are fed at the same rate through the block-forming assembly and through the sawing assembly. For instance, it is not unusual for the block-forming assembly and the sawing assembly to be positioned so close to each other that the front end of a log enters the sawing assembly before its rear end has left the block-forming assembly. As a result, also the feed rate of the block-forming assembly will be reduced when cutting thick logs, since the feed rate of the sawing assembly must be reduced owing to limitations in capacity. To maintain the size of the chips that are cut, also the rotary speed of the working tools of the block-forming assembly must therefore be reduced. The ratio of the rotary speed to the feed rate is in fact crucial for the length of the cut chips, i.e. how closely the chipper knives hit the log along a given length of the log. The thickness of the chips on the other hand is in the first place dependent on their length in such a manner that the chips will be thinner when chopping short lengths and vice versa. In general, when chopping short chip lengths, a larger amount of undesirable short fractions such as shavings and splits is formed. Maintaining a uniform chip size, and above all reducing the amount of shavings and splits, is of great economical importance when using chips as raw material in pulp making owing to the fact that the quality of the pulp increases and the consumption of chemicals decreases in the pulp process the more uniform the size of chips used.

[0004] However, it is disadvantageous to reduce the rotary speed of the working tools. Among other things, the peripheral speed of the chipper knives will decrease, which also applies to a possible saw blade or finishing disc that is usually placed in the upper part of conical working tools to improve the quality of the flat processed surfaces. The peripheral speed of chipper knives should normally be between 20 and 30 m/s for the cutting properties of the chipper knives to be optimal. Below the optimal speed, the risk of pick-ups and reduced surface smoothness increases. The speed also has a certain effect on the thickness of the chips in such a manner that a reduced speed gives thicker chips and vice versa. The optimal peripheral speed of a saw blade is usually between 40 and 60 m/s below which the quality of the surfaces is deteriorated.

[0005] Furthermore a reduced rotary speed results in a reduction of the kinetic energy of the working tools, and it is also common to control the rotary speed by controlling the speed of an electric motor, which in most cases causes a reduction of the motor output as the speed decreases. Consequently, both the kinetic energy and the output will be lower when there is a maximum need for high kinetic energy and output, i.e. when sawing thick logs, and therefore the risk of jamming and standstill increases in these cases.

[0006] One way of obviating these drawbacks and keeping an unchanged rotary speed of the working tools would be to operate at different feed rates of the sawing assembly and the block-forming assembly and arrange some kind of buffer zone between them, which delays the feeding into the sawing assembly if the sawing of the preceding block is not yet completed. However, such a solution would be costly and take up a great deal of space.

Summary of the Invention

[0007] The present invention aims at obviating problems and drawbacks that are associated with a reduction of the feed rate of a block-forming assembly in the processing of thick logs. More specifically, the invention relates to a new method in which the rotary speed of the working tools can be kept or the otherwise necessary reduction of the rotary speed can at least be limited at a reduced feed rate but with a maintained chip size. At least this object is achieved by a method according to claim 1.

[0008] The invention is thus based on the knowledge that the above objects can be achieved by removing, from a block-forming assembly which is included in a sawing line, one or more chipper knives from each of the working tools to compensate for the reduced feed rate of the sawing assembly and, thus, of the block-forming assembly which is necessary when cutting thick logs, and thus preventing or at least limiting the reduction of the rotary speed which otherwise is necessary to maintain the desired chip size.

[0009] Several advantages are achieved in such a method. For example, it is possible to keep the rotary speed at a level enabling that the chipper knives can be driven at an optimal peripheral speed at which their cutting properties are best utilised. When operating below this optimal peripheral speed, the cutting properties are

deteriorated. In cutting tools in the form of frustoconical discs it is possible to provide finishing of the lateral surfaces of the block either by means of a cutting blade located at the top surface of the cone or by means of finishing knives arranged in the same area. By keeping the rotary speed at a high level it is ensured that also the saw blade or finishing knives can be driven at a speed which is favourable as regards their capability of cutting flat and smooth block surfaces. As mentioned above, a high rotary speed further implies that also the kinetic energy and the output will be high, which decreases the risk of jamming.

[0010] The invention is generally applicable in so far as one or more chipper knives can be removed from an arbitrary block-forming assembly, both those with frustoconical working tools and those with cylindrical working tools, for the purpose of keeping a high rotary speed. To produce chips of a uniform size, the chipper knives are distributed symmetrically round the circumferential surface of the working tool. When removing chipper knives, it is therefore important to maintain a symmetrical distribution of the remaining chipper knives so that the log is hit by the chipper knives at regular intervals for uniform chips to be formed. The expression symmetrical distribution thus comprises also a single chipper knife in a rotary plane of the working tool since this will hit the log at the same intervals. A symmetrical distribution is most easily obtained by removing exactly half of the chipper knives, i.e. by removing every second chipper knife, but can also be achieved in other ways.

[0011] In the following preferred embodiment, a working tool is shown in the form of a frustoconical disc with the chipper knives arranged in two separate circumferential rings or rotary planes, an inner and an outer. Each of the rings has four chipper knives. In the shown embodiment, two opposite chipper knives are removed from the inner ring while two opposite chipper knives are kept. In such a case, the feed rate of the logs can thus be reduced by half while keeping the same rotary speed and the same size of chips. However, it would be possible to remove three of the chipper knives in each ring and only keep one if measures are taken to balance the working tool so that no unbalance occurs during rotation. This can be achieved, for instance, by arranging, in the positions of the removed chipper knives, blind knives having the same mass as a chipper knife but no processing cutting edge that protrudes from the circumferential surface of the tool. Besides such a blind knife has the further advantage of protecting the seats of the removed chipper knives from wear caused by logs and chips. When removing three chipper knives and keeping only one, it is thus possible to reduce the feed rate of the logs to one fourth of the original but yet keep the rotary speed of the working tools and the size of the chips. A third possibility in the shown embodiment would be removing only one chipper knife and keeping three. In such cases, however, alternative seat positions must be arranged for two of the three chipper knives that are kept in order to obtain a symmetrical distribution of the chipper knives and, thus, a uniform length of chips.

[0012] In the preferred embodiment, the working tool is provided with a feed limiter which limits the maximum feed rate of the block between the chipper knives by preventing what is called power feed. The feed limiter has the form of a ring which along its outer circumference has stepped cam curves and is arranged between the top surface of the cone and a saw blade which performs finishing of the lateral surfaces of the block. However, the feed limiter need not have the form of a ring but could consist of short arcuate sections to facilitate an exchange of the feed limiter, for instance by allowing an exchange without first having to remove an exteriorly positioned saw blade or finishing disc. When the number of chipper knives is changed, also this feed limiter must be replaced with one having a corresponding number of cam curves. Such a feed limiter is advantageous by limiting the maximum feeding of logs so that the chips will have a uniform size. In practice, it is therefore preferred to use such a feed limiter on the working tools, but it would also be possible to ensure the correct feed rate in other ways, for instance by accurate control by means of feeding rolls.

[0013] In the preferred embodiment of the invention that will be described in the following, the working tools have the form of frustoconical discs or bodies which each have chipper knives arranged in two rings or rotary planes along the circumference of the circumferential surface. More specifically, one ring with four symmetrically distributed chipper knives at the top surface of the truncated cone and one ring with four symmetrically distributed chipper knives at a longer distance from the top surface of the truncated cone. In the shown embodiment, two opposite chipper knives are removed from the inner ring located closest to the top surface when reducing the feed rate, while all chipper knives in the outer ring spaced from the top surface are kept. This is done to allow the outer ring of chipper knives which processes the logs only in case of very large timber dimensions, such as in connection with root swellings and the like, to give a more power-saving processing of the timber by the chips that are cut by the outer ring being shorter and thus also thinner. This reduces the risk of pick-ups of larger pieces of wood, especially in the rear end faces of the logs, which happens quite frequently and may reduce the timber yield. This certainly means that the chips that are cut by the outer ring will not have the same form as the chips that are cut by the inner ring, but in practice this is not very important since the chipper knives of the outer ring process the logs only in connection with extremely large dimensions, which means that the amount of chips from the chipper knives of the outer ring will be small. However, the invention is not restricted to this and could be varied in many ways within the scope of the claims. For example, half of the chipper knives could be removed also from the outer ring. Moreover many different types of working tools are available on the market, for instance those with more than two rings of chipper knives or those with only

one ring of chipper knives, which then usually have a greater length than those shown in this embodiment. The basic principle of the invention, however, is applicable to all these types of working tool and, as mentioned above, also to working tools that are not frustoconical but cylindrical.

Brief Description of the accompanying Drawings

[0014] In the drawings

Fig. 1 is a top plan view of a round log which is formed into a block with two flat lateral surfaces in a prior-art block-forming assembly and which is then resawn in a sawing assembly,
Fig. 2 is a perspective view of a working tool in the block-forming assembly according to Fig. 1,
Fig. 3 is a side view of the working tool in Fig. 2,
Fig. 4 is a top plan view of a round log which is formed into a block with two flat lateral surfaces in a block-forming assembly, which is modified according to the present invention, and then resawn in a sawing assembly,
Fig. 5 is a perspective view of a working tool in the block-forming assembly according to Fig. 4,
Fig. 6 is a side view of the working tool in Fig. 5,
Fig. 7 illustrates a feed limiter for the working tool according to Figs 2 and 3, and
Fig. 8 illustrates a feed limiter for the working tool according to Figs 5 and 6.

Detailed Description of a Preferred Embodiment of the Invention

[0015] Reference is first made to Figs 1-3 which describe a conventional prior-art method for forming a round log into a block with two flat lateral surfaces and subsequent resawing to produce boards and planks. Fig. 1 is a schematic top plan view of the procedure of block-forming and sawing of a round log. The round log 1 is fed longitudinally first through a block-forming assembly which is generally designated 2 and which in the shown embodiment consists of two opposing frustoconical working tools or chipper discs 3, 3'. On the circumferential surfaces of the working tools, a plurality of chipper knives 4 are arranged, which during rotation of the working tool and simultaneous longitudinal feeding of the round log cut the material to be removed from the round log into chips so that the round log is formed into a block with two flat lateral surfaces 5, 5'. Immediately after the block-forming assembly, a sawing assembly is arranged, which is schematically shown in the Figure in the form of two circular saw blades 6. As is evident, the distance between the block forming assembly and the sawing assembly is so small that the front end of the block enters the sawing assembly before its rear end has left its block-forming assembly.

[0016] Figs 2 and 3 illustrate the more precise construction of a working tool 3. The working tool has a frustoconical form with chipper knives 4 mounted on its circumferential surface. The chipper knives are arranged in two separate circumferential rings with four chipper knives in each ring. Moreover the chipper knives are symmetrical arranged, equidistantly spaced from each other along the circumference of the working tool as is best seen in Fig. 3. Moreover each chipper knife has a processing cutting edge and is screwed into a recessed seat in the working tool. In the area in front of each chipper knife, through holes 7 are formed in the working tool through which the chips leave the block-forming assembly. In the upper part of the frustoconical working tool a saw blade 8 is arranged, which performs finishing of the lateral surfaces of the block. Moreover there is in the area between the saw blade 2 and the upper surface of the cone a feed limiter 9, whose outer circumferential edge forms a stepped cam curve with a height decreasing from one chipper knife to the next. The feed limiter is shown and described in more detail in connection with Figs 7 and 8.

[0017] As described above, the size of the chips, above all the length but indirectly also the thickness, is dependent on the rotary speed of the working tools in relation to the feed rate of the log. When sawing thick logs, the feed rate of the logs must be reduced owing to limitations in capacity of the sawing assembly, and consequently then also the rotary speed of the working tool of the block-forming assembly must, as stated above, be reduced, with the ensuing problems.

[0018] Figs 4-6 illustrate a preferred embodiment of a method according to the present invention, which obviates the problems and drawbacks that are associated with the reduction of the feed rate of the logs when sawing thick logs. In this embodiment, two opposite chipper knives are removed from the working tool from the inner circumferential ring of chipper knives and are replaced with blind knives 10 which are screwed into the ordinary chipper knife seats 11. The blind knives protect the chipper knife seats from wear and can be arbitrarily designed, provided that they can be mounted in the chipper knife seats and have no cutting edge or other protruding parts that can interfere with the feeding of logs. According to a preferred embodiment, the blind knives have the same mass as the ordinary chipper knives so as not to change the balancing of the working tool independently of how many chipper knives are removed and replaced with blind knives. Optionally, the blind knives could have such a form as to cover also the openings 7 of the working tool.

[0019] As is evident from Figs 7 and 8, the feed limiter has a number of cam curves 12 along the outer periphery of the feed limiter. More specifically, the feed limiter has in Fig. 7 four cam curves while the feed limiter in Fig. 8 has only two cam curves. Each cam curve has a gradually decreasing radial distance between the axis of rotation and its outer peripheral edge from the area immediately behind a chipper knife to the area immediately in front of the next chipper knife.

[0020] The feed limiter depicted in Fig. 7 is intended for use in a working tool which has four cutting knives in the inner circumferential ring, i.e. one chipper knife in each recess along the periphery of the feed limiter as shown in the Figures. If, according to the invention, two of the chipper knives are then removed to be able to reduce the feed rate of the logs but keep a high rotary speed of the working tool, the feed limiter in Fig. 7 must be replaced with a feed limiter according to Fig. 8 which has two cam curves 12 and two recesses for the chipper knives along its periphery. If the same length of chips is to be obtained with two chipper knives as in the case involving four chipper knives, the radial distance between the centre of rotation and the periphery of the feed limiter is to decrease to the same extent from the front end to the rear end of each cam curve both in the embodiment according to Fig. 7 and in the embodiment according to Fig. 8. The difference is that in Fig. 8 the change of the radial distance between the centre of rotation and the outer periphery of the feed limiter is to occur along about twice the distance in Fig. 7.

[0021] The function of the feed limiter will be most easily understood from Fig. 4. As is evident, the outer peripheral edge of the cam curve of the feed limiter abuts against the surface last cut by the chipper knives. As a result, the feed limiter will limit the maximum feeding of the log to be processed by the feeding being limited to the reduction of the radial distance between the centre of rotation and the outer peripheral surface of the cam curve that occurs from one chipper knife to the next chipper knife.

[0022] By removing, as in the shown embodiment, half of the chipper knives in the inner circumferential ring of chipper knives, the feed rate of the logs can thus be reduced to half, without the rotary speed of the working tools needing to be reduced or the size of the chips being changed. In the embodiment shown, certainly the number of chipper knives is maintained in the outer circumferential ring but this is not very important since, as illustrated in Fig. 4, it is usually only the inner circumferential ring of chipper knives that processes the round log while the outer circumferential ring of chipper knives will process the logs only in case of unusually large dimensions, such as in connection with root swellings and the like. The amount of chips that is cut by the outer circumferential ring of chipper knives and that will be smaller than the chips that is cut by the inner circumferential ring of chipper knives will thus be small.

Claims

1. A method for forming a round log (1) into a block with two or more flat lateral surfaces (5, 5'), comprising the steps of directly cutting into chips the material which is to be removed, by means of a block-forming assembly (2) of the type having two or more working tools (3, 3') which each have the form of a rotatable drum or frustoconical body which on its circumferential surface carries a plurality of chipper knives (4); after the block-forming assembly, feeding the block to a sawing assembly (6) for resawing the block to produce boards and planks, and, when sawing thick logs, reducing the feed rate of the sawing assembly and, thus, also of the block-forming assembly, **characterised by** the further step of removing, when processing thick logs, one or more chipper knives (4) from each of the working tools (3, 3') while taking a symmetric distribution of the remaining chipper knives into consideration, with a view to obtaining uniform chips, so as to compensate for the reduced feed rate and, thus, preventing or at least limiting the reduction of the rotary speed of the working tools which otherwise is necessary to maintain the desired chip size.

2. A method as claimed in claim 1, **charac- terised by** replacing, in connection with removal of chipper knives (4), a feed limiter (9), which has cam curves (12) arranged on an outer edge surface, with a feed limiter with the same number of cam curves as the number of remaining chipper knives in a circumferential ring adjacent to the feed limiter.

3. A method as claimed in claim 1 or 2, **char- acterised by** removing, in a working tool (3, 3') of frustoconical form having chipper knives (4) which are arranged in two or more circumferential rings round the circumferential surface, chipper knives not from all circumferential rings but at least from the inner circumferential ring closest to the frustoconical top.

4. A method as claimed in any one of the preceding claims, **characterised by** mounting, in the respective positions of removed chipper knives (4), blind knives (10) which fit into the seats (11) of the chipper knives but have no processing cutting edge.

Patentansprüche

1. Verfahren zum Formen von Rundholz (1) zu einem Block mit zwei oder mehr flachen Seitenflächen (5, 5'), das die Schritte eines direkten Schneidens des Materials, das entfernt werden soll, zu Spänen mittels einer Blockbildungsanordnung (2) des Typs, der zwei oder mehr Bearbeitungswerkzeuge (3, 3') besitzt, von denen jedes die Form einer drehbaren Trommel oder eines kegelstumpfförmigen Körpers besitzt, der auf seiner Umfangsfläche eine Vielzahl Zerspanungsmesser (4) trägt; nach der Blockbildungsanordnung eines Zuführens des Blocks zu einer Sägeanordnung (6), um den Block so aufzutrennen, um Bretter und Bohlen zu fertigen, und, wenn dicke Hölzer gesägt werden, eines Verringern der Zuführrate der Sägeanordnung und demzufolge

auch der Blockbildungsanordnung; aufweist, **gekennzeichnet durch** den weiteren Schritt eines Entfernens eines Zerspanungsmessers (4) oder mehrerer davon von jedem Bearbeitungswerkzeug (3, 3'), wenn dicke Hölzer bearbeitet werden, wobei eine symmetrische Verteilung der verbleibenden Zerspanungsmesser, die herangezogen werden, im Hinblick darauf vorgenommen wird, gleichförmige Späne zu erhalten, um so die verringerte Zuführrate zu kompensieren und demzufolge die Verringerung der Drehgeschwindigkeit der Bearbeitungswerkzeuge zu verhindern oder zumindest zu begrenzen, die ansonsten notwendig ist, um die gewünschte Spangröße beizubehalten.

2. Verfahren nach Anspruch 1, **gekennzeichnet durch** Ersetzen, in Verbindung mit einem Entfernen der Zerspanungsmesser (4), einer Zuführbegrenzungseinrichtung (9), die Nockenkurven (12) besitzt, die auf einer äußeren Kantenfläche angeordnet sind, gegen eine Zuführbegrenzungseinrichtung mit derselben Anzahl von Nockenkurven wie die Anzahl der verbleibenden Zerspanungsmesser in einem Umfangsring angrenzend an die Zuführbegrenzungseinrichtung.

3. Verfahren nach Anspruch 1 oder 2, **gekennzeichnet durch** Entfernen von Zerspanungsmessern in einem Bearbeitungswerkzeug (3, 3') einer Kegelstumpfform, das Zerspanungsmesser (4) besitzt, die in zwei oder mehr Umfangsringen um die Umfangsfläche herum angeordnet sind, nicht von allen Umfangsringen, sondern zumindest von dem inneren Umfangsring, der sich am nächsten zu der Kegelstumpfspitze befindet.

4. Verfahren nach einem der vorhergehenden Ansprüche, **gekennzeichnet durch** Montieren von Blindmessern (10) in den jeweiligen Positionen der entfernten Zerspanungsmesser (4), die in die Sitze (11) der Zerspanungsmesser passen, allerdings keine Bearbeitungsschneidkante haben.

Revendications

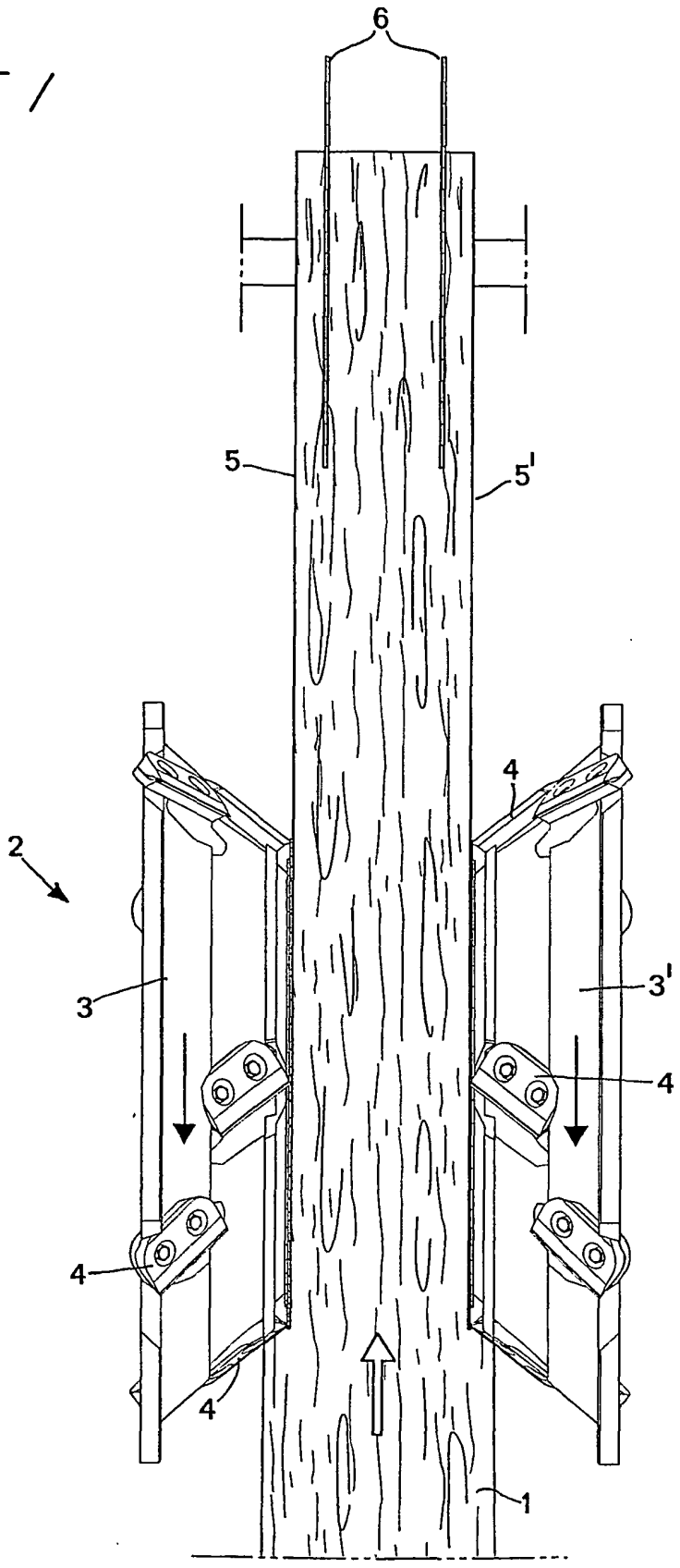
1. Procédé pour former une bille de bois ronde (1) dans un bloc avec deux ou plusieurs surfaces latérales plates (5, 5') comprenant les étapes consistant à couper directement en copeaux le matériau qui doit être retiré, au moyen d'un ensemble de formation de bloc (2) du type ayant deux ou plusieurs outils de travail (3, 3') qui ont chacun la forme d'un tambour rotatif ou d'un corps tronconique qui, sur sa surface circonférentielle, supporte une pluralité de couteaux de déchiquetage (4) ; après l'ensemble de formation de bloc, alimenter le bloc à un ensemble de sciage (6) pour rescier le bloc afin de produire des planches et des plateaux, et lors du sciage des billes de bois épaisses, réduire la vitesse d'alimentation de l'ensemble de sciage et, ainsi également de l'ensemble de formation de bloc, **caractérisé par** l'étape supplémentaire consistant à retirer, lors du traitement des billes de bois épaisses, un ou plusieurs couteaux de déchiquetage (4) de chacun des outils de travail (3, 3') tout en prenant en considération une répartition symétrique des couteaux de déchiquetage restants, en vue d'obtenir des copeaux uniformes, afin de compenser la vitesse d'alimentation réduite, et ainsi d'empêcher ou au moins de limiter la réduction de la vitesse de rotation des outils de travail qui est sinon nécessaire pour maintenir la taille de copeau souhaitée.

2. Procédé selon la revendication 1, **caractérisé par** l'étape consistant à remplacer, conjointement au retrait des couteaux de déchiquetage (4), un limiteur d'alimentation (9), qui a des courbes de came (12) agencées sur une surface de bord externe avec un limiteur d'alimentation avec le même nombre de courbes de came que le nombre de couteaux de déchiquetage restants dans un anneau circonférentiel adjacent au limiteur d'alimentation.

3. Procédé selon la revendication 1 ou 2, **caractérisé par** l'étape consistant à retirer, dans un outil de travail (3, 3') de forme tronconique ayant des couteaux de déchiquetage (4) qui sont agencés sur deux ou plusieurs anneaux circonférentiels autour de la surface circonférentielle, les couteaux de déchiquetage ne provenant pas de tous les anneaux circonférentiels mais au moins de l'anneau circonférentiel interne le plus près de la partie supérieure tronconique.

4. Procédé selon l'une quelconque des revendications précédentes, **caractérisé par** l'étape consistant à monter, dans les positions respectives des couteaux de déchiquetage (4) retirés, des couteaux aveugles (10) qui se montent dans les sièges (11) des couteaux de déchiquetage mais n'ont pas de bord de coupe de traitement.

Fig 1



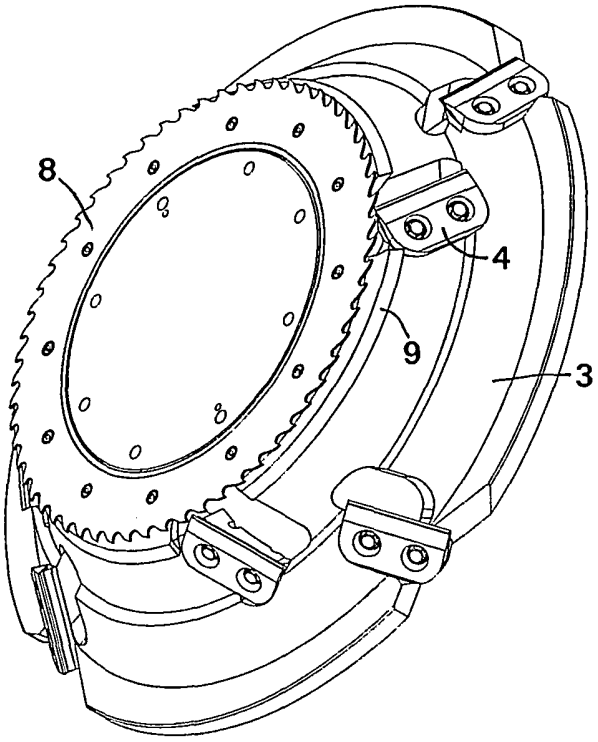


Fig 2

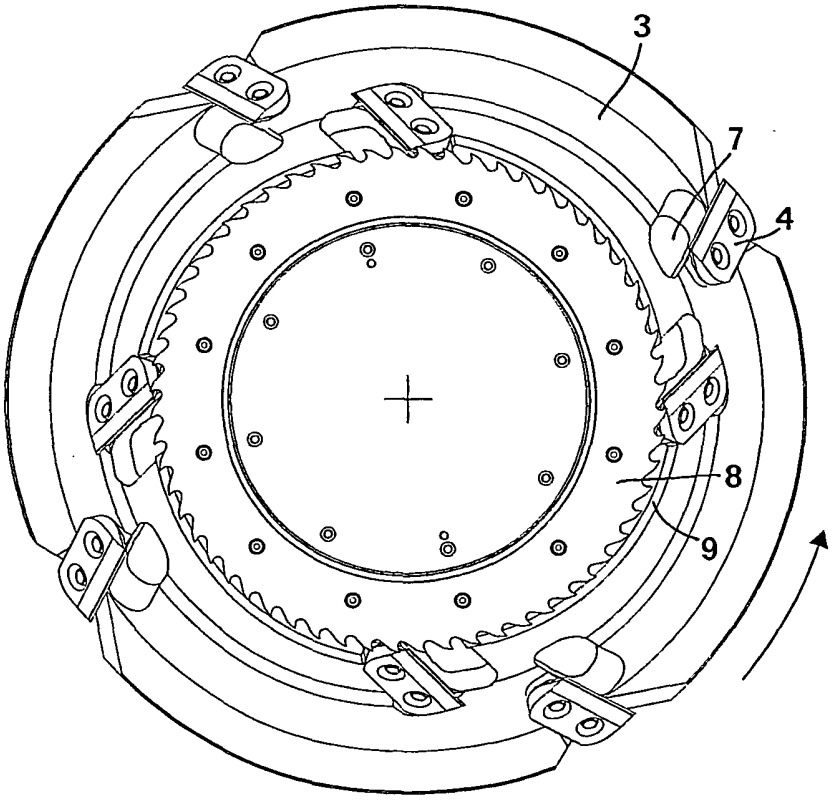
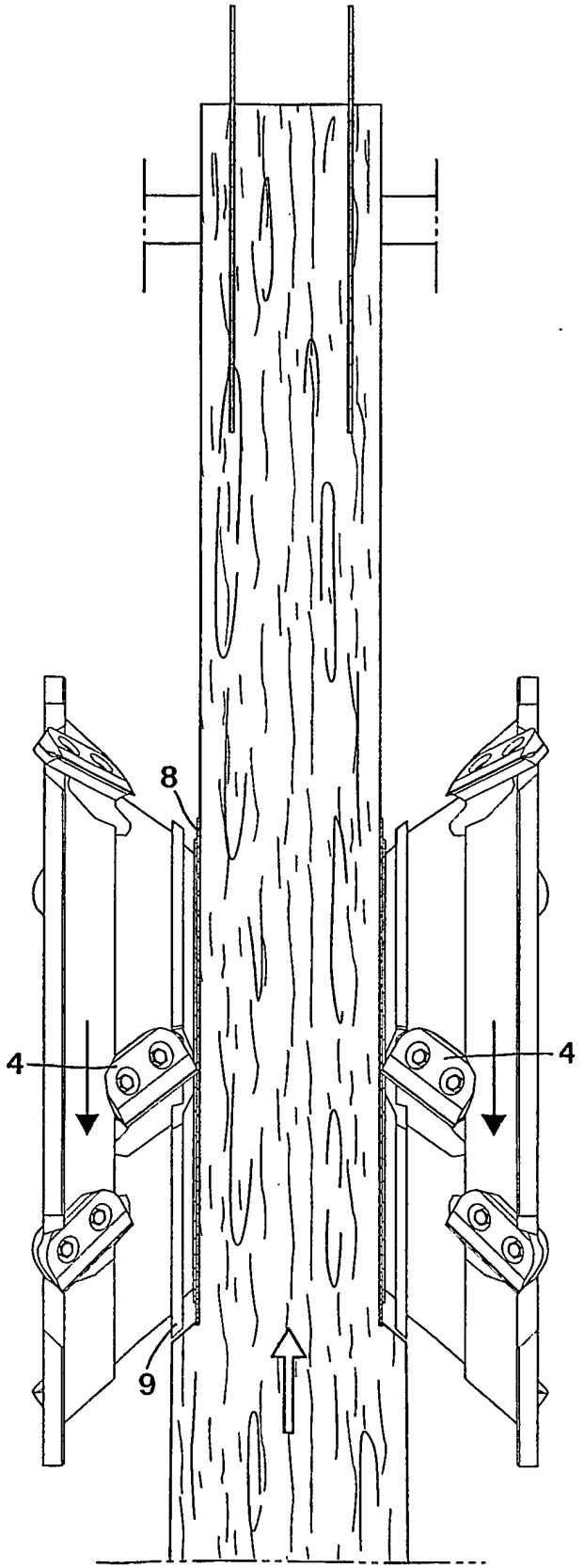


Fig 3

Fig 4



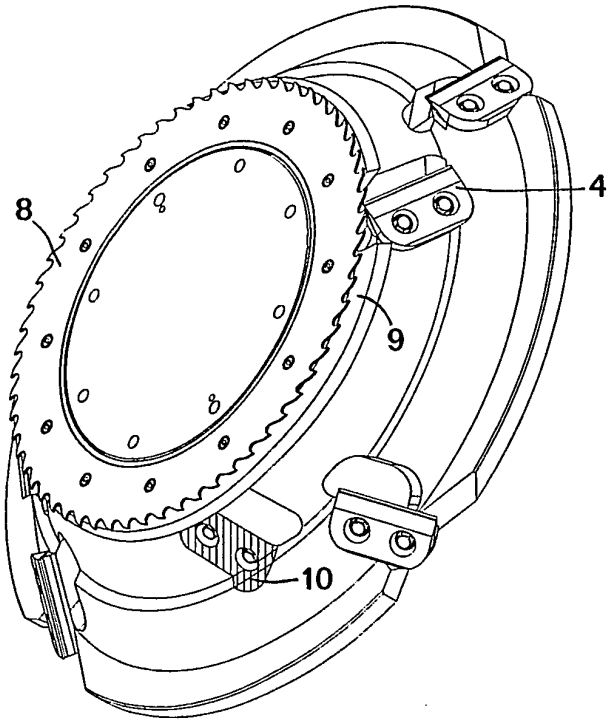


Fig 5

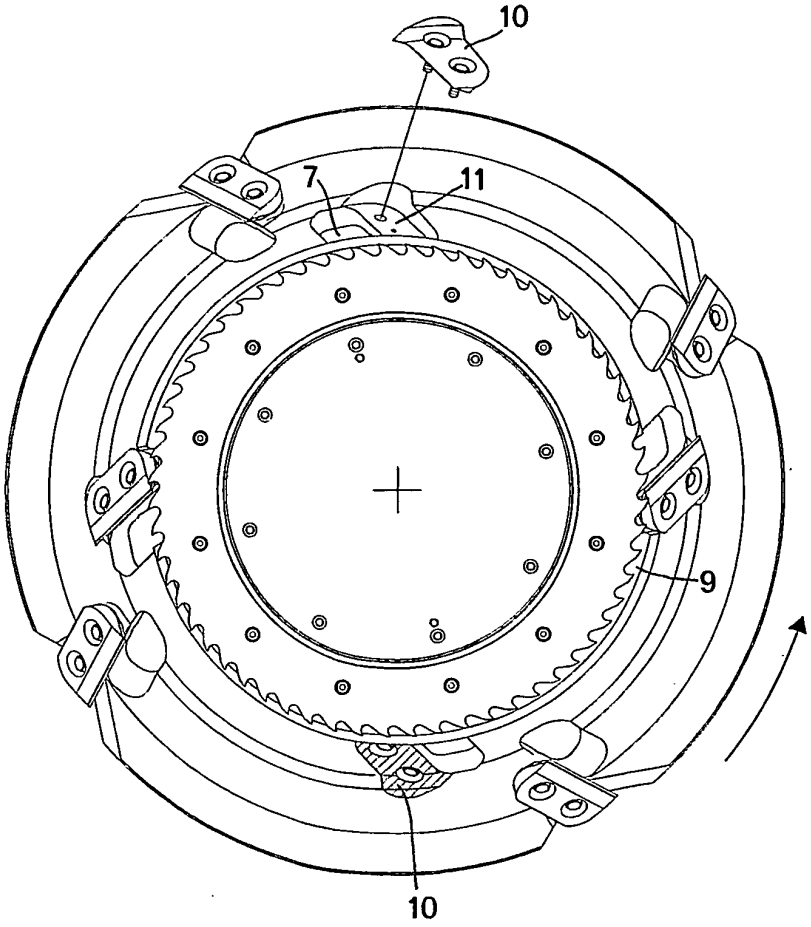


Fig 6

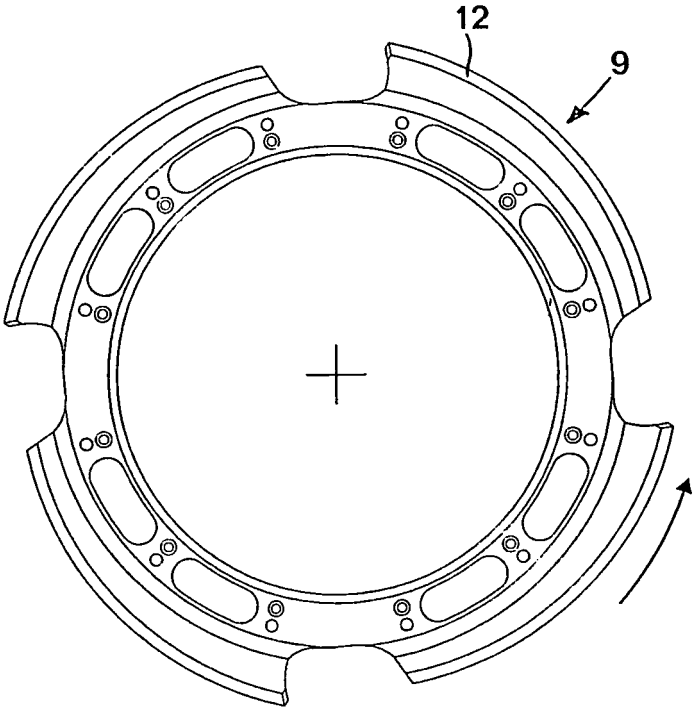


Fig 7

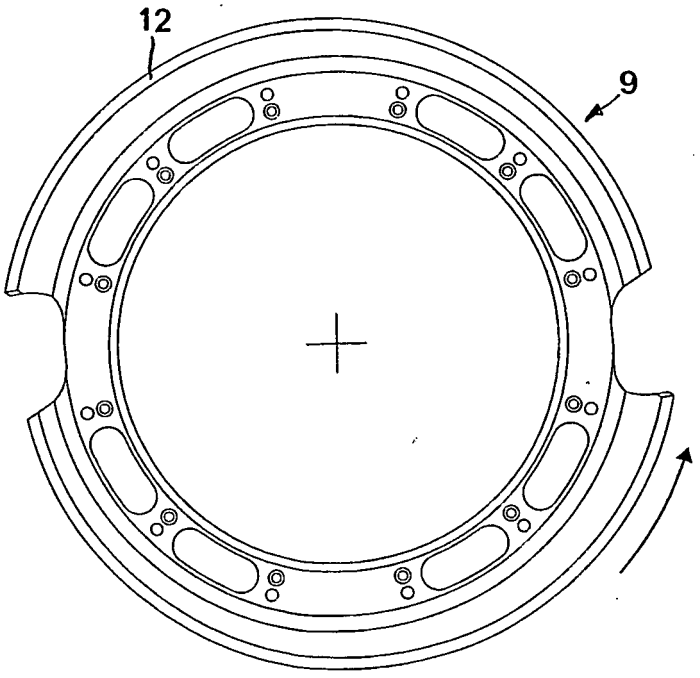


Fig 8