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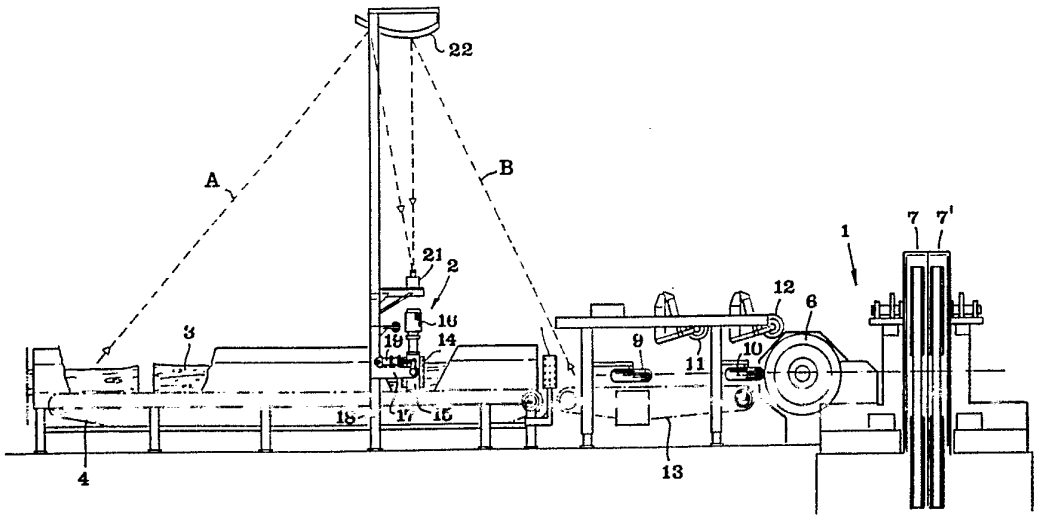

(57) Abstract

In a method for positioning logs in connection with the shaping of cants in a cant-shaping device (1), the individual log (3) is fed in its longitudinal direction through a turning device (2) serving to rotate the log, when continuously fed, to a rotational position which later gives an optimum yield of wood. The curved shape of the log is optically read by reading equipment (21, 22), and data on the log shape recorded by this equipment is processed in a picture-processing device or computer. The latter is made to transmit control pulses to the turning device (2) so that this device, after receiving the front end of the log, is capable of rotating the log not only through the angle of rotation required to enable a complete reading of the log shape, but also through the angle of rotation required to rotate the log to the optimum rotational position before the rear end of the log leaves the turning device.

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+ DESIGNATIONS OF "SU"

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METHOD AND PLANT FOR POSITIONING LOGS IN CONNECTION WITH THE SHAPING OF CANTS

Field of the Invention

This invention concerns a method for positioning logs in connection with the shaping of cants in a cant-shaping device, comprising the steps of feeding the individual log in its longitudinal direction through a turning device serving to rotate the log, when continuously fed towards said cant-shaping device, to a rotational position which later gives an essentially optimum yield of wood pieces from the future cant, and retaining the log in this optimum position while fed from said turning device to said cant-shaping device.

Description of the Prior Art

Logs which are to be split into boards or planks in a saw mill cannot normally be fed directly into the splitting device proper, such as a frame saw or a circular saw, but must first be shaped into so-called cants which have two opposite and flat surfaces. This is done in a cant-shaping device which is arranged in the saw line ahead of the splitting device and which, in actual practice, may consist of an edge frame saw which comprises two vertical bands or blades between which the log is passed, while so-called slabs are cut off on both sides of the log, or a reducer which comprises two rotatable and vertically positioned cutter discs removing wood material on both sides of the log by a sort of milling operation resulting in the formation of two flat surfaces. Occasionally, one may also use a combination of an edge frame saw and a canter.

Nature-grown trees are almost never absolutely straight, but are instead more or less curved, which is due to e.g. the wind conditions in their habitat or other such circumstances. Thus, saw logs from such trees are practically always inherently curved to some extent. If a curved log were to be put directly on a conveyor to be fed

through the cant-shaping device, the yield of wood from the future cant would be poor, especially for logs of a markedly curved shape, since one edge-frame-saw blade or reducer would then cut away too much wood material at the top and root ends, but only a little or none at all at the middle of one side of the log, whereas the opposite blade or reducer would remove a lot of material at the middle of the log, but only a little or none at all at the ends. Therefore, it is necessary to accurately position the log in a rotational position in which the log curve is facing substantially upwards when the cant-shaping device is passed. There are various prior-art methods for positioning the log in this manner, and these methods can be divided into two categories, namely manually controlled methods and automated methods.

In a much-used prior-art method of the first category, the logs are fed one by one towards the cant-shaping device lying on a conveying path along which is arranged a turning device, a distance ahead of the cant-shaping device. The turning device consists of two spaced-apart, rotatable and substantially vertical spike rollers which, via universal joints, are connected to pivotable arms in such a manner that the longitudinal axes of the spike rollers can be individually inclined to impart to the log a rotational movement, at the same time as the log is moved in the longitudinal direction by the rotation of the rollers. The turning device is controlled by an operator from a cabin above the conveying path, more precisely at a certain distance from the turning device so that the operator has an open view of the conveying path and the logs fed therealong. By ocular inspection of each log, the operator determines its curved shape, and operates the two spike rollers of the turning device in such a manner that the log is rotated to an optimum rotational position before the rear end thereof leaves the spike rollers. When leaving the turning device, the log is maintained in place by special means, e.g. rubber wheels and/or toothed wheels

applying a lateral pressure against the upper side of the log. Such work is, however, mentally extremely tiring, especially in modern high-capacity saw mills. Today's saw-mill techniques aim at achieving a feeding rate of 10-20 logs per min, which means that the individual log must pass the cant-shaping device at a speed of about 1.5 m/sec, there being maximally about 0.5 m between successive logs. Thus, the operator has no more than a second or two for determining the curved shape of a log having a length of 3 m. It is, of course, extremely difficult to maintain the precision when positioning the logs under such circumstances, and as a result the logs are often incorrectly positioned. One alternative is to lower the feeding rate, but this would drastically reduce the total capacity of the saw mill.

In order to obviate the drawbacks of the manually-operated positioning method, an automated method and a plant which in the field is known as Ari KSI-6 have been devised. In this prior-art plant, the log is placed sideways in a special bench above which is arranged reading equipment in the form of a video camera and a mirror recording a great number of silhouette pictures of the log which is being rotated in the bench, and these pictures are then analysed by a computer. To rotate the log while the pictures are recorded, there is provided a rotatable gripping jaw engaging one end of the log, more precisely the root end of the log resting on the bench or support structure. This gripping device first rotates the log for recording the pictures, and then rotates the log further to position it in the optimum rotational position, whereupon the log is seized by gripping arms mounted on trolleys conveying the log from the bench to the cant-shaping device.

It is true that this prior-art plant gives a good precision when positioning the logs, which thus are always fed into the cant-shaping device in optimum rotational positions. However, the taking of pictures is a drastic

interruption in the log flow into the cant-shaping device, the log being held by the gripping device in an axially immobile position during this entire operation, i.e. there is no longitudinal feed. This means that the successive logs arriving at the cant-shaping device are spaced apart a considerable distance. In other words, the feeding capacity at the cant-shaping device, and consequently in the entire saw line, will be extremely low. Another drawback of this plant is that the logs have to be trimmed at the ends before they are placed in the bench.

Objects of the Invention

The present invention aims at obviating the drawbacks of the prior-art methods mentioned above, while maintaining the advantages thereof. One basic object of the invention is, therefore, to provide a method for positioning logs, in which the log shape can be read or measured while the log is simultaneously rotated and continuously fed in its longitudinal direction through the turning device, towards the cant-shaping device, a considerable feeding capacity of the cant-shaping device being maintained. Another object of the invention is to provide a method in which the logs are positioned with high precision, despite being at the same time fed in their longitudinal direction at considerable speed.

Summary of the Invention

These objects are achieved by the method defined in the characterising clause of appended claim 1.

In addition, the invention concerns a plant for implementing the method. The features of this plant are recited in appended claims 2-7.

Brief Description of the Drawings

In the drawings,

FIG. 1 is a top plan view of a plant according to the invention,

FIG. 2 is a side view of the plant of Fig. 1, and

FIG. 3 is an enlarged cross-sectional view of the plant.

Description of the Preferred Embodiment

The plant illustrated in the drawings comprises a cant-shaping device or station 1 and a turning device 2. A conveyor 4 is arranged to feed individual logs 3 in their longitudinal direction towards the cant-shaping device 1, and advantageously is of the type having two endless chains between which extend transverse drivers 5. In the embodiment shown, the cant-shaping device 1 comprises a canter 6 consisting of two rotatable discs 6', 6" which are movable towards and away from one another and which further are equipped with cutters serving to process opposite sides of the incoming log by a sort of milling operation. The cant-shaping device or station 1 further comprises a pair of band saws 7, 7' intended to separate one or two side boards on both sides of the log when need be, thereby forming a cant with two opposite and flat sides. In the area between the turning device 2 and the cant-shaping device 1 are arranged a number of means for retaining the logs positioned in the turning device. In the embodiment shown, these means consist of a pair of spike rollers 8, 8' which are mounted on pivotable arms so that they can be approached to and removed from one another to be applied against the two opposite sides of the log. Two pairs of rubber wheels 9, 10 arranged after the spike rollers 8, 8' operate in analogous manner. In the area above the conveying path, there are further arranged two pressure wheels 11, 12 serving to press down the logs against a conveyor 13 below. In actual practice, the pressure wheels mostly consist of discs equipped with a toothed rim that can be distinctly pressed into the upper side of the log.

In the range of logs taken through a saw line, the shortest log is normally 3 m long, while the longest one is 6 m. To enable the pair of spike rollers 8, 8', i.e. the retaining means closest to the turning device, to seize the shortest logs while these are still held by the turning device 2, the distance between the turning device

and the pair of spike rollers 8, 8' is less than 3 m. In actual practice, this distance is usually about 2.5 m.

In per se known manner, the turning device 2 comprises two rotatable spike rollers 14, 14', each of which is mounted in a holder 15 which supports a motor 16 for rotating the individual roller and is hingedly suspended from a bracket 17 or the like. The bracket is in turn supported by a leg-shaped stand 18 which advantageously contributes to supporting the conveyor 4. Each holder 15 with its associated spike roller 14 can be pivoted by means of a piston-cylinder mechanism 19. More precisely, the spike rollers 14, 14' can be pivoted separately in vertical planes on both sides of the log in such a manner that one spike roller is swung obliquely forwards, while the other is swung obliquely rearwards. Thus, transverse power components can be applied to the log, ensuring that the log is rotated while fed in its longitudinal direction by the rotation of the spike rollers. At 20 is illustrated a piston-cylinder mechanism serving to bring the two spike rollers 14, 14' towards one another, as well as remove them from one another. Naturally, the log 3 is not seized by the spike rollers 14, 14' until it has been fed by the conveyor 4 into a position in which the rollers may seize its front end.

It should here be pointed out that the piston-cylinder mechanisms 19 for inclining the spike rollers 14, 14' consist, in prior-art plants, of air cylinders by means of which it is possible to adjust the spike rollers from a vertical starting position to one of two end or extreme positions, but not to any positions therebetween.

Thus far, the plant described above is previously known.

According to the invention, reading equipment is arranged adjacent to the turning device 2 and comprises, in the preferred embodiment shown, a pair of cameras 21, 21' and a pair of mirrors 22, 22' cooperating therewith. The mirrors 22, 22', which reflect pictures of the log 3

passing the turning device to the optics of the cameras, are located rather high above the conveying path, while the cameras are situated at a much lower level. The cameras and the mirrors are arranged in a common vertical plane perpendicular to the log-feeding direction. The vertical plane may advantageously coincide with, or be located near to, the vertical plane in which the feeding spike rollers 14, 14' are situated, as is shown most clearly in Fig. 2. In actual practice, the reading equipment thus made up of cameras and mirrors may conveniently be mounted in the stand 18 supporting the turning device 2 formed by the feeding spike rollers 14, 14'. As shown in SE Patent 8500204-6, the mirrors 22, 22' may have a curved reflecting surface ensuring that the pictures of the log that are reflected to the optics of the cameras are diminished in the longitudinal direction relative to the transverse direction in order to make it possible to attain just as good relative accuracy of measurement in the longitudinal direction as in the transverse direction. As shown in Fig. 2, the mirrors 22, 22' will, owing to their comparatively high position as well as their curved reflecting surfaces, cover a picture area extending substantially along the entire length of the conveyor 4. It is further apparent from Fig. 2 that the distance between the reading equipment and the log-receiving end of the conveyor 4 is about twice as long as that between the reading equipment and the log-discharging end of the conveyor. In practice, the first distance may be about 6 m or more, i.e. corresponding to the length of the longest logs in the range. Thus, the cameras are able to "see" an entire log of maximum length already before the front end of the log reaches the turning device. In the area after the turning device, the requirements on picture-coverage are less severe, in so far as the reproduction process has to be completed before a log of minimum length leaves the turning device, for which reason the rear part of the picture area may be

shorter than the front part, as illustrated by the broken lines A and B, respectively, in Fig. 2.

In the embodiment of Fig. 3, the cameras 21, 21' and the mirrors 22, 22' cooperate in a "crosswise" manner in that a connecting line between the camera 21 and the mirror 22 crosses a connecting line between the camera 21' and the mirror 22' at an acute angle. In this case, the angle is about 30°.

A picture-processing device 23, in this case a computer, is connected to the cameras 21, 21' and serves to record and process data on the log shape, as well as to convert this data to control pulses which automatically control the piston-cylinder mechanisms which turn or tilt the spike rollers 14, 14'. The computer 23 may also control the motors 16 for adjustment of the rotational speed of the spike rollers.

According to a distinctive feature of the invention, banks of light 24, 24' are arranged along opposite long side edges of the conveyor 4 to illuminate the logs that are being fed. Thus, the silhouettes or profiles of the logs will be sharply outlined in front of the cameras.

According to another distinctive feature of the invention, the two piston-cylinder mechanisms 19 are not the air cylinders known from the prior art, but double-acting hydraulic cylinders by means of which the spike rollers can be continuously adjusted in optional tilting positions between two extreme or end positions. Above all, the tilting movements of the spike rollers can be gradually and smoothly retarded when the log has been turned to the area of its optimum rotational position.

The plant described operates as follows. When the front end of a usually more or less curved log 3 lying on the conveyor 4 reaches the turning device 2, it is nipped between the spike rollers 14, 14' forming part of the turning device and, at least partly, taking over the feeding function of the conveyor (the spike rollers are advantageously driven so as to give essentially the same feed-

ing rate as the conveyor). When the front end of the log is nipped by the rollers 14, 14', the latter are tilted in accordance with a predetermined program in the computer 23, such that the log is rotated about its own longitudinal axis. Already before the log reaches the turning device, the cameras 21, 21' begin to photograph the silhouette of the log, the exposure time conveniently being 1-10 ms. Each camera will photograph the silhouette or profile on opposite sides of the log. Owing to the provision of two camera-and-mirror sets operating in oblique relationship to one another, pictures will not be taken of the same profile lines on the two opposite sides of the log, but of profile lines which are offset at an acute angle, e.g. about 30°, to one another along the periphery of the log. Thus, one may obtain the requisite data on the log shape already after turning the log through an extremely small angle (much less than 180°). In other words, complete information on the log shape is obtained in a very short time. As soon as the log shape has been established, the computer 23 transmits control pulses to the turning device which, depending on the log shape and its original position on the conveyor, rotates the log until the latter has reached an optimum rotational position in which the curve of the log is facing upwards. Since photographing of the log begins already before it has reached the turning device, the computer is at an early stage given an approximate picture of the log shape, which can be used for presetting the two spike rollers 14, 14' of the turning device to turn either anti-clockwise or clockwise when nipping the front end of the log, there being a minimum turning movement from the starting position to the optimum position. In the optimum rotational position, the spike rollers 14, 14' are set in vertical positions in which they maintain the log in the optimum position until the log is taken over by the following holding devices 8, 9, 10, 11, 12 which then transfer the

log in the optimum rotational position to the cant-shaping device 1.

The advantages of the invention are manifest. By reading the log shape with the aid of the reading equipment and the associated picture-processing device while the log is fed in its longitudinal direction and rotated about its longitudinal axis, the log can be automatically, i.e. without any manual action, positioned in an exact rotational position which later gives an optimum yield from the cant, there being no interruption in the rapid log flow through the cant-shaping device. Both the photographing of the log shape and the positioning of the log are carried out without any reduction of the inherent motion energy of the log being conveyed. Thus, the logs can be positioned as above while maintaining therebetween a distance shorter than 0.5 m, as well as maintaining a flow rate or feeding rate exceeding 90 m/min. Further, there will be no need of an operator or a special and bulky inspection cabin, which reduces the costs quite considerably.

It should here be pointed out that the invention is not based on the idea of recording the log shape in a first step, and then rotating the log in a separate second step to the optimum rotational position. The invention is instead based on the idea of reading the log shape while the log is rotated and fed in its longitudinal direction. Thus, the reading process and the turning process will require a minimum amount of time, so that also logs of minimum length can be turned to the optimum rotational position, also at high flow rates.

Conceivable Modifications of the Invention

It goes without saying that the invention is not restricted to the embodiment described above and shown in the drawings. Thus, it is conceivable to use other holding means than the means 8-12 shown, and the number thereof may also be varied. Further, the cant-shaping device 1 may be designed in a different manner, i.e. comprise other

shaping means than a canter and two band saws. Moreover, it should be emphasised that the curve of the log 3 is not necessarily facing upwards when the log is in its optimum rotational position. Thus, the log may be oriented with the curve facing downwards. Furthermore, only one camera and one mirror may be used, albeit two of each kind are preferred in actual practice. The cameras and mirrors may also be arranged otherwise than in the "crosswise" manner shown in Fig. 3. Thus, the single camera can be placed within the beam angle or sector starting from the mirror cooperating with the camera and extending to the log. It is also possible to space the mirrors farther apart, resulting in a much greater offset than 30° between the profile lines on the log photographed by the respective camera. In practice, this offset may amount to 50-70°, conveniently about 60°. It should here be pointed out that it is not necessary that the camera is arranged below and faces the associated mirror. Thus, the camera may be positioned in or close to the horizontal plane of the mirror. This option does, however, unnecessarily restrict the picture area.

CLAIMS

1. Method for positioning logs in connection with the shaping of cants in a cant-shaping device (1), comprising the steps of feeding the individual log (3) in its longitudinal direction through a turning device (2) serving to rotate the log, when continuously fed towards said cant-shaping device, to a rotational position which later gives an essentially optimum yield of wood pieces from the future cant, and retaining the log in this optimum position while fed from said turning device (2) to said cant-shaping device (1), c h a r a c t e r i s e d in that the shape, especially the curved shape, of the log (3) continuously fed towards the cant-shaping device (1) is optically read by reading equipment arranged adjacent to said turning device (2) and comprising at least one camera (21), that data on the log shape recorded by said reading equipment is transmitted to and processed by a picture-processing device (23), and that said picture-processing device is made to transmit control pulses to said turning device (2) so that the latter, after receiving the front end of the log in an optional non-predetermined rotational position, is capable of rotating the log not only through the angle of rotation required to enable a complete reading of the log, but also through the angle of rotation required to rotate the log to the optimum rotational position before the rear end of the log leaves said turning device.

2. Plant for positioning logs in connection with the shaping of cants in a cant-shaping device (1), comprising a turning device (2) through which the individual log (3) can be continuously fed in its longitudinal direction towards said cant-shaping device (1) while being simultaneously rotated to a rotational position which later gives an essentially optimum yield of wood pieces from the future cant, and at least one means (8, 9, 10, 11, 12)

arranged between the turning device (2) and the cant-shaping device (1) to retain the log in the optimum rotational position while fed from said turning device to said cant-shaping device, c h a r a c t e r i s e d in that reading equipment arranged adjacent to the turning device (2) comprises at least one camera (21) for optically reading the shape, especially the curved shape, of the log (3) continuously fed towards the cant-shaping device (1), and that a picture-processing device, e.g. a computer (23), is adapted to process the data on the log shape recorded by said reading equipment and to transmit control pulses to said turning device (2) so that the latter, after receiving the front end of the log in an optional non-predetermined rotational position, is capable of rotating the log not only through the angle of rotation required to enable a complete reading of the log shape, but also through the angle of rotation required to rotate the log to the optimum rotational position before the rear end of the log leaves said turning device.

3. The plant of claim 2, c h a r a c t e r i s e d in that the reading equipment comprises, in addition to the camera (21), a mirror (22) for reflecting the pictures of the log to the optics of the camera, and that the camera and the mirror are so arranged in a common vertical plane perpendicular to the log-feeding direction that the mirror is situated above the camera and the camera faces upwards towards the mirror, the latter having a curved reflecting surface covering a picture area which extends along a conveyor (4) adjacent to said turning device.

4. The plant of claim 3, c h a r a c t e r i s e d in that the reading equipment comprises two cameras (21, 21') and two mirrors (22, 22') cooperating therewith and so arranged that connecting lines between said cameras and the associated mirrors are inclined in relation to one another at an acute angle.

5. The plant of any one of claims 2-4, c h a r a c - t e r i s e d in that the reading equipment is arranged substantially in the same transverse vertical plane as the turning device (2), e.g. by being mounted in the same stand (18) as said device.

6. The plant of any one of claims 2-5, a conveyor for feeding the logs to the turning device being arranged at least in the area ahead of said device, c h a r a c - t e r i s e d in that banks of light (24, 24') are arranged along opposite long sides of the conveyor (4) to illuminate the logs while their shape is being read.

7. The plant of any one of claims 2-6, the turning device (2) comprising two spike rollers (14, 14') which are arranged on both sides of the log-feeding path so as to be movable towards and from one another and which are rotatable to ensure that the logs are fed in their longitudinal direction and which, by means of piston-cylinder mechanisms (19), are inclinable in order to apply a transverse power component to the log, thereby rotating the log while fed in its longitudinal direction, c h a r a c - t e r i s e d in that the piston-cylinder mechanisms consist of double-acting hydraulic cylinders serving to continuously adjust the spike rollers (14, 14') in optional inclined positions between two extreme or end positions.

AMENDED CLAIMS
[received by the International Bureau
on 27 October 1991 (27.10.91);
original claims 1-7 replaced by amended claims 1-6 (3 pages)]

1. Method for positioning logs in connection with the shaping of cants in a cant-shaping device (1), comprising the steps of feeding the individual log (3) in its longitudinal direction through a turning device (2) serving to rotate the log, when continuously fed towards said cant-shaping device, to a rotational position which later gives an essentially optimum yield of wood pieces from the future cant, and retaining the log in this optimum position while fed from said turning device (2) to said cant-shaping device (1), wherein the shape, especially the curved shape, of the log (3) continuously fed towards the cant-shaping device (1) is optically read by reading equipment and comprising at least one camera (21), and data on the log shape recorded by said reading equipment is transmitted to and processed by a picture-processing device (23), said picture-processing device being made to transmit control pulses to said turning device (2) so that the latter, after receiving the front end of the log in an optional non-predetermined rotational position, is capable of rotating the log not only through the angle of rotation required to enable a complete reading of the log, but also through the angle of rotation required to rotate the log to the optimum rotational position before the rear end of the log leaves said turning device, c h a r a c t e r i c e d in that as reading equipment an equipment is used which is arranged adjacent to said turning device (2) and which comprises, in addition to said camera (21), a mirror (22) for reflecting the pictures of the log to the optics of the camera, and that the camera and the mirror are so arranged in a common vertical plane perpendicular to the log-feeding direction that the mirror is situated above the camera and the camera faces upwards towards the mirror, the latter having a curved reflecting surface covering a picture area which extends along a conveyor (4)

adjacent to said turning device.

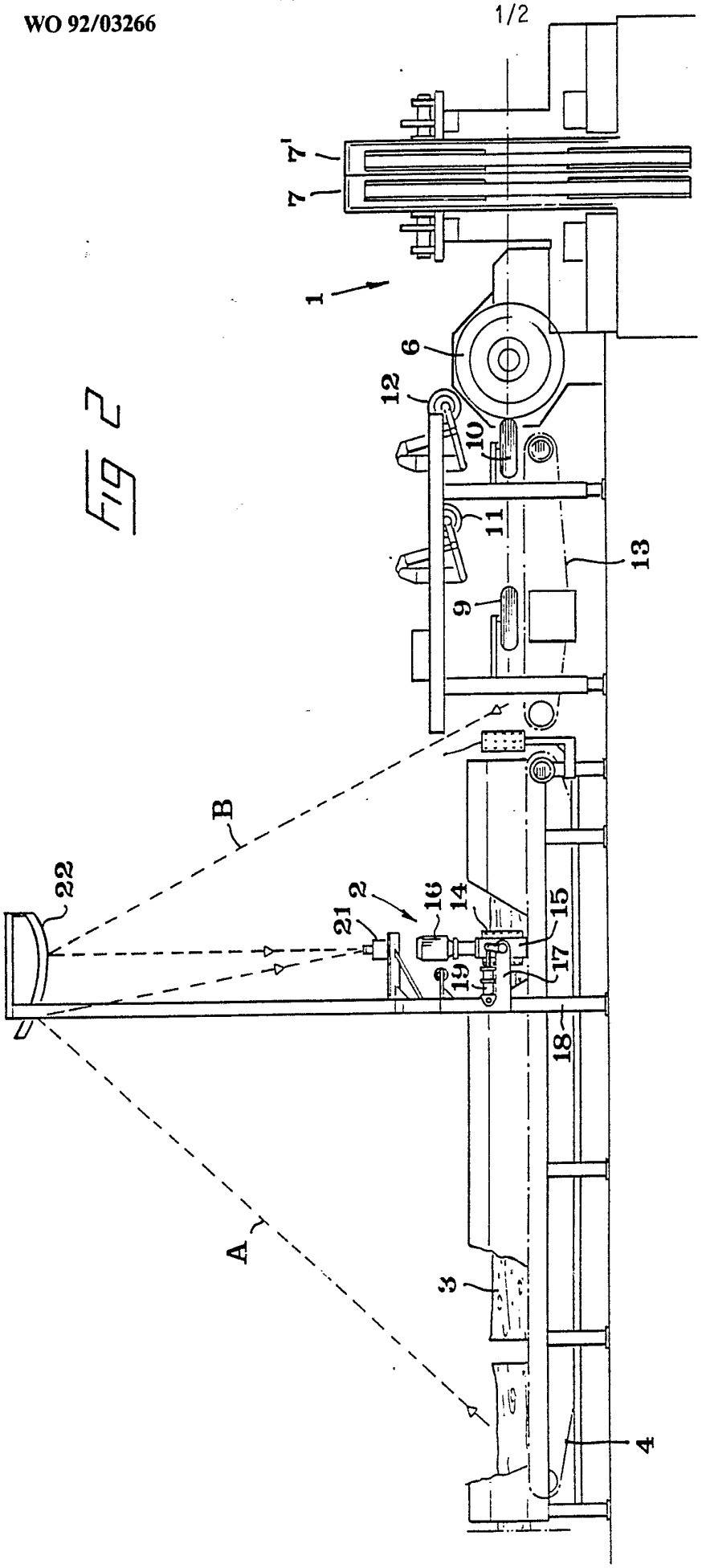
2. Plant for positioning logs in connection with the shaping of cants in a cant-shaping device (1), comprising a turning device (2) through which the individual log (3) can be continuously fed in its longitudinal direction towards said cant-shaping device (1) while being simultaneously rotated to a rotational position which later gives an essentially optimum yield of wood pieces from the future cant; at least one means (8, 9, 10, 11, 12) arranged between the turning device (2) and the cant-shaping device (1) to retain the log in the optimum rotational position while fed from said turning device to said cant-shaping device, reading equipment having at least one camera (21) for optically reading the shape, especially the curved shape, of the log (3) continuously fed towards the cant-shaping device (1); and a picture-processing device, e.g. a computer (23), being adapted to process the data on the log shape recorded by said reading equipment and to transmit control pulses to said turning device (2) so that the latter, after receiving the front end of the log in an optional non-predetermined rotational position, is capable of rotating the log not only through the angle of rotation required to enable a complete reading of the log shape, but also through the angle of rotation required to rotate the log to the optimum rotational position before the rear end of the log leaves said turning device, c h a r a c t e r i s e d in that the reading equipment is arranged adjacent to the turning device (2) and comprises, in addition to the camera (21), a mirror (22) for reflecting the pictures of the log to the optics of the camera, and that the camera and the mirror are so arranged in a common vertical plane perpendicular to the log-feeding direction that the mirror is situated above the camera and the camera faces upwards towards the mirror, the latter having a curved reflecting surface covering a picture area which extends along a conveyor (4) adjacent to said turning device.

3. The plant of claim 2, c h a r a c t e r i s e d in that the reading equipment comprises two cameras (21, 21') and two mirrors (22, 22') cooperating therewith and so arranged that connecting lines between said cameras and the associated mirrors are inclined in relation to one another at an acute angle.

4. The plant of any one of claims 2 or 3, c h a r - a c t e r i s e d in that the reading equipment is arranged substantially in the same transverse vertical plane as the turning device (2), e.g. by being mounted in the same stand (18) as said device.

5. The plant of any one of claims 2-4, a conveyor for feeding the logs to the turning device being arranged at least in the area ahead of said device, c h a r a c - t e r i s e d in that banks of light (24, 24') are arranged along opposite long sides of the conveyor (4) to illuminate the logs while their shape is being read.

6. The plant of any one of claims 2-5, the turning device (2) comprising two spike rollers (14, 14') which are arranged on both sides of the log-feeding path so as to be movable towards and from one another and which are rotatable to ensure that the logs are fed in their longitudinal direction and which, by means of piston-cylinder mechanisms (19), are inclinable in order to apply a transverse power component to the log, thereby rotating the log while fed in its longitudinal direction, c h a r a c - t e r i s e d in that the piston-cylinder mechanisms consist of double-acting hydraulic cylinders serving to continuously adjust the spike rollers (14, 14') in optional inclined positions between two extreme or end positions.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15
21
19
17
18
A
3
4

Fig 2

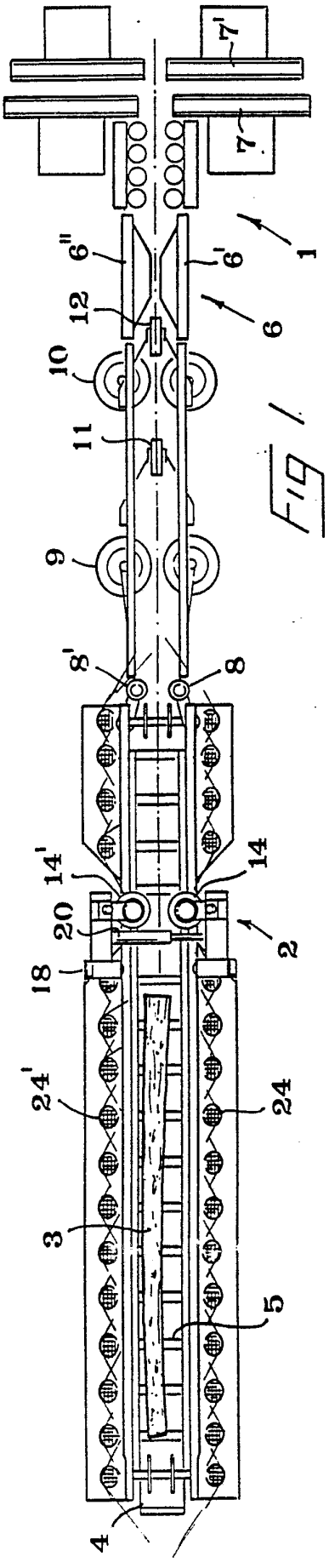
1
7'
7
6"
6'
6
12
10
11
9
8'
8
14'
14
20
2
18
24'
24
3
5
4

Fig 1

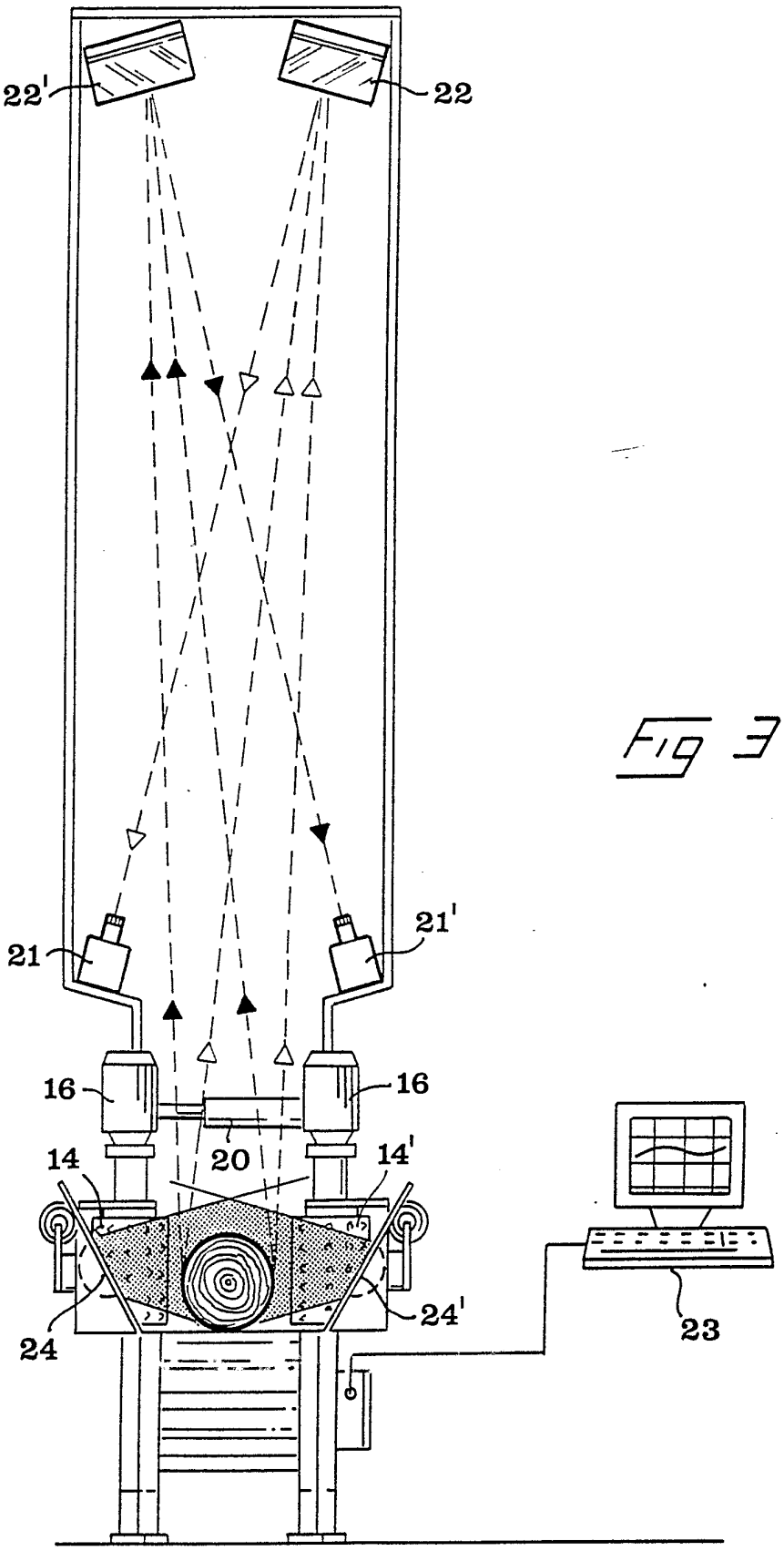

Fig 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 91/00456

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 27 B 31/06

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 27 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	SE, B, 414543 (KOCKUMS AUTOMATION AB) 4 August 1980, see the whole document	1,2
A	--	3-7
X	SE, B, 424833 (T WADELL) 16 August 1982, see the whole document	1,2
A	--	3,7
X	SE, B, 449712 (A AHLSTRÖM OY) 18 May 1987, see the whole document	1,2
A	--	3-7
X	US, A, 3724958 (CALLAN) 3 April 1973, see the whole document	1,2
A	--	3-7

* Special categories of cited documents:[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
15th October 1990	1991 -10- 22
International Searching Authority	Signature of Authorized Officer
SWEDISH PATENT OFFICE	Eddy Leopold

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
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A	--	3-7
X	US, A, 4139035 (BYSTEDT ET AL) 13 February 1979, see the whole document	1,2
A-7	--	3-7
X	US, A, 4471823 (WADELL) 18 September 1984, see the whole document	1,2
A	--	3-7
A	SE, B, 436711 (SAAB-SCANIA AB) 21 January 1985, see the whole document	1-7
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/SE 91/00456

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 91-08-30
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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		DE-A-C-	2945456	80-05-22
		FR-A-B-	2441148	80-06-06
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		SE-A-	7812273	79-06-02
		US-A-	4294149	81-10-13