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(54) **Method and apparatus for machining and dividing a cant into pieces of timber**

(57) The invention relates to a method for processing a balk and dividing the same into pieces of lumber. A balk (P1) has been made from a log (T) by trimming (105) it for two vertical sides (s1, 2). The method comprises advancing a balk on a processing line (201) through subsequent treatment steps, comprising a) milling (106) a side slab groove (u11, u21; u12, u22) near top and bottom edges of the balk's (P1) each vertical side (s1, s2), said groove having its first groove flank (uh1, uh2, uh3, uh4) set in substantially perpendicularly to the balk's vertical side and its second groove flank (uv1, uv2, uv3, uv4) substantially co-directionally with the balk's vertical side, and said side slab grooves serving to define side slabs (L1, L2) on the balk's trimmed sides; and b) sawing (108) each side slab (L1, L2) off of the balk's (P1) vertical side (s1, s2) by means of a saw machine (208). According to the invention, after step a, wood material is removed from the second groove flank (uv1, uv2, uv3, uv4) of each side slab groove (u11, u21; u12, u22) by milling, and a third groove flank (uv1 a, uv2a, uv3a, uv4a) is produced which is parallel to the balk's vertical side (s1, s2), and during the course of step b, one or more saw blades of the saw machine (208) are adapted to trace the third groove flank in its immediate proximity. The invention relates also to an apparatus applying the method.

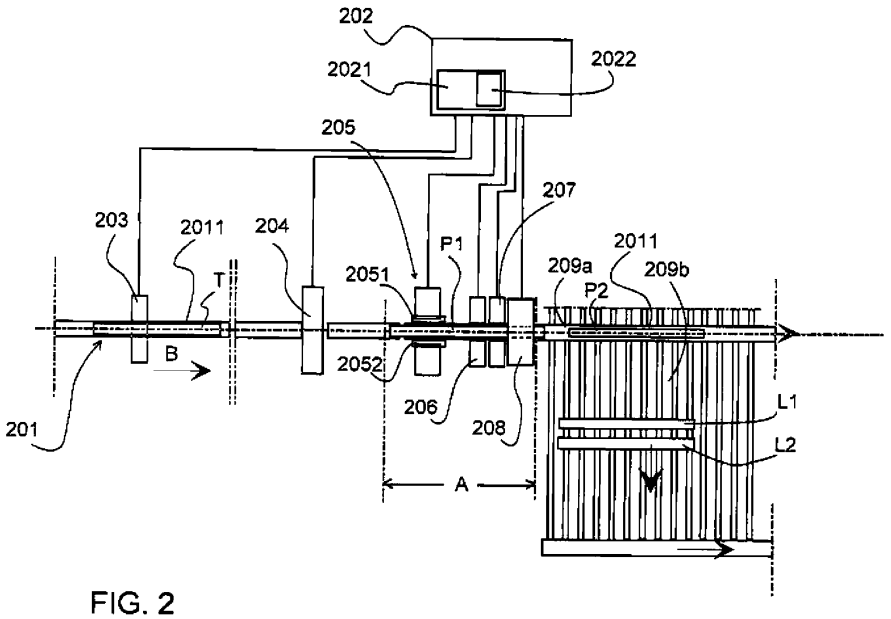

FIG. 2

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Description

[0001] The invention relates to a method as set forth in the preamble of claim 1 for processing a balk and dividing the same into pieces of lumber.

[0002] The invention relates also to an apparatus as set forth in the preamble of claim 3 for processing a balk and dividing the same into pieces of lumber.

[0003] A prior known sawmill line, especially a chipping canter line, used for processing a log and dividing it into pieces of lumber, operates as follows. A first step comprises measuring a debarked log three-dimensionally, e.g. with an optical 3D measuring instrument, to find out precisely its geometrical shape. Thus, data is collected regarding e.g. the log's diameter, conicity, ellipticity and skewness. The log measurement data is stored in a control unit or the like and utilized in processing the log and dividing it into pieces of lumber. This is followed, if necessary, by rolling the log over with an appropriate rotating device to an optimal position for a saw machine or the like woodworking tool of a sawmill line. The first woodworking tool is usually a chipping canter, to which the log is delivered in a centered manner and by which two opposite sides of the log are trimmed, and at the same time the removed side surface material of the log is chipped. Hence, the log becomes a balk.

[0004] The same Applicant's earlier Finnish patent application FI-20105090 discloses making a balk by checking the position of a log and rolling the log over to bring a possible skewness upward. This is followed by trimming the log for two first vertical sides on its opposite flanks and thereby turning the log into a balk with two vertical sides. A first and a second groove are milled near upper and lower edges of the first balk's each vertical side, one groove flank of each groove adjoining the balk's vertical side, said grooves serving to define at least a first and a second side slab on the balk's trimmed sides. This is followed by removing the side slabs by sawing from the first balk's vertical sides, and the remaining segment of the balk, i.e. a second balk, and the removed side slabs are separated from each other and the second balk is conveyed to further treatment.

[0005] The sawing of each slide slab is preferably conducted by means of a circular saw, having at least two sets of circular blades in a vertical plane of sawing. The first circular saw blade in a set of circular blades lies partly above a balk conveying line in the plane of sawing, the second one lying respectively below the balk. This type of circular saw machine is an economically efficient saw machine for removing side slabs from a balk.

[0006] There are two prior known ways of removing side slabs from a balk. The first circular blades are fairly large and the sawing is conducted in such a way that the circular blades sweep the balk along the flank of the first and the second groove and remove part of it, while a side slab is being sawn off the balk. A problem with the above type of balk processing is that the circular saw blades of a circular saw machine are large blades in terms of diameter, such as 600-800 mm, as well as in terms of thickness. Such circular saw blades present a major sawing height, and their rotating speeds, and thereby also sawing speeds, are comparatively low. Consequently, the sawing of side slabs off the vertical sides of a balk is a relatively slow process. This slows down the operation of a log and balk sawmill line. In addition, the resulting abundant sawdust represents a waste of wood material.

[0007] Optionally, side slabs can be removed from a balk in another way. In this case, the circular blades are fairly small and the sawing is conducted in such a way that the circular blades are adapted to hit the bottom of the first and the second groove, i.e. the intersection of groove flanks, while the side slab is being sawn off the balk. A problem is simply the difficulty of aligning the saw blades so as to hit the intersection of groove flanks. The principal reason for this is the fact that the milling of grooves and the sawing are conducted with different machine units, which are independent of each other. Errors in alignment are immediately reflected in the dimensional accuracy of side slabs, i.e. in the form of varying thicknesses.

[0008] A method and apparatus of the invention have an objective of eliminating the problem related to prior known sawmill lines, particularly chipping canter lines. Another object of the invention is to provide a new method and apparatus, which enable a physical compaction of the sawmill line and speeding up the processing of a balk, and at the same time even improving the yield of sawn pieces of lumber.

[0009] A method of the invention is characterized by what is presented in claim 1. -An apparatus of the invention is characterized by what is presented in claim 3.

[0010] Preferred embodiments for a method and apparatus of the invention are presented in the dependent claims.

[0011] In a method of the invention for processing a balk and dividing the same into pieces of lumber, the balk has been made from a log by trimming the latter for two vertical sides on opposite flanks thereof, and in which method the balk is advanced on a processing line through the following treatment steps, comprising

a) milling a side slab groove near top and bottom edges of the balk's each vertical side, said groove having its first groove flank set in substantially perpendicularly to the balk's vertical side and its second groove flank substantially co-directionally with the balk's vertical side, and said side slab grooves serving to define side slabs on the balk's trimmed sides; and

b) sawing each side slab off of the balk's vertical side by means of a saw machine.

[0012] According to the invention, after step a, wood material is removed from the second groove flank of each side slab groove by milling, and by a third groove flank is produced which is parallel to the balk's vertical side,

and during the course of step b, one or more saw blades of the saw machine are adapted to trace the third groove flank in its immediate proximity.

[0013] A preferred embodiment for a method of the invention comprises adapting a distance of the third groove flank from the balk's vertical side to match a thickness of the side slab plus a cross-dimension of the cut made by a saw blade.

[0014] In an apparatus of the invention for processing a balk and dividing the same into pieces of lumber, said balk has been made from a log with a chipping canter or the like working machine by trimming it for two vertical sides on opposite flanks thereof, in which apparatus the balk is to be advanced on a processing line with one or more conveyors and to be treated in treatment units included in the processing line by means of treatment programs stored substantially in an appropriate data processing unit on the basis of log measurement data for an optimized treatment of the log and hence the balk, said apparatus further comprising:

a) a first profiling machine, which comprises first cutter heads for milling a side slab groove near the top and bottom edges of the balk's each vertical side in such a way that the groove has its first groove flank substantially perpendicular to the balk's vertical side and its second groove flank substantially co-directional with the balk's vertical side, and said side slab grooves serving to define side slabs on the balk's trimmed sides;

b) a saw machine, or a band saw machine, which comprises appropriate saw blades, by which the side slabs are sawn off of the balk's vertical sides.

[0015] According to the invention, the apparatus further comprises:

c) a second profiling machine, which comprises second cutter heads, such as routers, which are adapted to work in pairs in two parallel cutting planes of the saw machine for removing wood material from the second groove flank of each side slab groove and for producing a third groove flank, which is parallel to the balk's vertical groove flank; and

said saw blades of the saw machine being adapted to trace the third groove flank in its immediate proximity as the side slab is being sawn off of the balk's vertical sides.

[0016] In a preferred embodiment of the invention, the apparatus comprises tools for defining a distance of the third groove flank from the balk's vertical side in such a way that it matches a thickness of the side slab plus a cross-dimension of the cut made by the saw machine's saw blade.

[0017] In one preferred embodiment of the invention, the saw machine is a circular saw machine, which comprises two side-by-side sets of circular blades working in a common cutting plane, by which the side slabs are sawn off of the balk's vertical sides, the circular blades of said side-by-side sets of circular blades having a radius whose size is most preferably within the range of 100-150 mm.

[0018] In a second preferred embodiment of the invention, the saw machine is a band saw machine by which the side slabs are sawn off of the balk's vertical sides.

[0019] In a preferred embodiment of the invention, the second cutter heads of the second profiling machine are routers, comprising a circular saw blade and a chipping blade, said routers having a diameter which is most preferably 100-150 mm.

[0020] In a preferred embodiment of the invention, the saw machine and the second profiling machine, particularly its second cutter heads, such as routers, are combined for a single processing machine, wherein the saw blades and the second cutter heads, preferably sets of cutter heads, have their working line in a common cutting plane.

[0021] In a preferred embodiment of the invention, at least some of the successive treatment units of the apparatus, particularly the chipping canter, the profiling machines, and the saw machine are disposed on the processing line close to each other, such that at least two successive treatment units are arranged within an area whose length does not exceed that of the balk, 6 m in maximum.

[0022] A benefit of the invention is its capability of conducting the removal of side slabs from a balk quickly, precisely and effectively.

[0023] A benefit of the invention is that positioning of the saw machine's saw blades and the second profiling machine's cutter heads is adapted to be inter-dependent and is therefore precise and simple. When the saw machine is a circular saw machine, it is possible to use circular blades small in diameter, thus resulting in a relatively modest sawing height and a high sawing speed. Consequently, the production of sawdust is also modest.

[0024] When the saw machine is a band saw machine, it is a narrowness of the saw blade which provides a benefit over the circular saw blade. When the saw blade is narrow, i.e. it has a small cross-dimension, such as 2 mm, the sawing operation does not produce as much sawdust as in a circular blade sawing operation. At the same, the log yields more sawn lumber than what is obtained in a circular saw operation. The band saw machine is also a faster saw machine than the circular saw machine.

[0025] A benefit of the invention is a capability of implementing the saw machine and particularly the second profiling machine in a compact, tight unit taking up a small space. This represents savings in the manufacturing and installation costs of a sawmill line, especially a chipping canter line, and furthermore, the log and especially the balk processing line can be generally made shorter than those of the prior art.

[0026] The invention and its other benefits will now be described in more detail with reference to the accompa-

nying drawing, in which

fig. 1 shows a block diagram for a method of the invention for processing and sawing a log;

fig. 2 shows schematically an apparatus of the invention for processing and sawing a log;

figs. 3a-3f show cross-sections of a log and a balk in their various treatment steps;

fig. 4 is a schematic plan view of an apparatus for processing a balk and dividing it into pieces of lumber, and a balk being processed thereby; and

fig. 5 is a schematic side view and partly a longitudinal section of an apparatus for processing a balk and dividing it into pieces of lumber, and a balk being processed thereby.

[0027] In the figures, like elements are designated with like reference numerals.

[0028] Processing a log into a balk, as well as processing a balk and dividing it into pieces of lumber, are illustrated stepwise in the form of a block diagram in fig. 1. A first step 101 comprises feeding a log onto a processing line 201 and advancing it through subsequent treatment steps.

[0029] A second step 102 comprises measuring a log T three-dimensionally with a log measuring instrument, such as a 3D scanner (cf. fig. 3a). The log's geometrical shape, such as conicity, ellipticity and skewness, and at the same time - if necessary - its position on a conveyor is thereby found out.

[0030] A third step 103 comprises storing measurement data of the log T. Processing of the log is optimized in various treatment steps with an appropriate data processing unit 202 with previously stored appropriate programs for conducting the log treatment and optimization. As a general rule, optimization refers to obtaining as high a volumetric yield of useful pieces of lumber as possible and/or obtaining as high a value as possible from the log.

[0031] A fourth step 104 comprises checking a position of the log on a conveyor and rolling (104) the log with a rotating device for bringing a possible skewness L (i.e. a curved section) to face upward (fig. 3b). It should be noted that, in a plane perpendicular to the longitudinal direction, the logs may include segments curving in various directions, whereby, as a general rule, what is turned upwards is a segment with the most severe and dominating curvature between the log ends.

[0032] A fifth step 105 comprises feeding the log T to an appropriate first working machine, in this case to a chipping canter. Two first vertical, and most preferably substantially straight sides, i.e. a first side and a second side s1, s2, are trimmed on the log on its opposite flanks, and hence the log is turned into a balk P1 (fig. 3c).

[0033] A sixth step 106 comprises milling side slab grooves, such as first and second side slab grooves u11, u21; u12, u22, near the upper and lower edges of the balk's P1 each vertical side s1, s2 (fig. 3d). Each groove u11, u21; u12, u22 has its first groove flank uh1, uh2; uh3, uh4 adjoining the balk's P1 vertical side s1, s2 and disposed substantially perpendicularly to the side. A second groove flank uv1, uv2; uv3, uv4 of each groove u11, u21; u12, u22 is disposed to be substantially co-directional with the balk's P1 vertical side s1, s2. In addition, the second groove flank uv1, uv2; uv3, uv4 is disposed at a distance defined by the thickness of a side slab L1, L2 apart from the vertical side s1, s2. The grooves u11, u21; u12, u22 serve to define on the balk's P1 trimmed sides s1, s2 at least a first and a second straight side slab L1, L2. This is conducted in an optimized manner according to the log measurement data and the data processing unit's program.

[0034] A seventh step 107 comprises removing wood material by milling from the second groove flank uv1, uv2, uv3, uv4 of the balk's P1 each side slab groove u11, u21; u12, u22. Most preferably, all wood material being removed is just a thin, such as 0.5-1,0 mm thick slice from the second groove flank. The result is a third groove flank uv1 a, uv2a, uv3a, uv4a, which is parallel to the balk's vertical side s1, s2.

[0035] An eighth step 108 comprises separating the side slabs L1, L2 from the balk by sawing with a saw machine. One or more saw blades 2081 of a saw machine 208 are adapted to sweep along the third groove flank uv1 a, uv2a, uv3a, uv4a. What is meant by this is that the saw blade traces the third groove flank in its immediate proximity.

[0036] The third groove flank uv1 a, uv2a, uv3a, uv4a has its distance a from the balk's vertical side s1, s2 adapted to match a thickness b of the side slab s1, s2 plus a cross-dimension c of the cut made by a saw blade 2081 used for separating the side slab from the balk. The cutting width of a saw blade matches substantially the cross-dimension of the cut.

[0037] In a preferred embodiment of the invention, the saw machine is a circular saw machine. As the balk P1 has a cross-dimension in vertical direction, which is relatively large with respect to the diameter of the employed circular blade 2081 (= 2 x h), it is advisable that the third groove flank uv1a, uv2a, uv3a, uv4a be milled on the balk. While the sawing is being performed with the circular saw machine 208, the circular blade 2081 works its way deep into the balk P, whereby each circular blade 2081 sweeps along and traces the third groove flank without any significant clearance therebetween. The location of each third groove flank uv1 a, uv2a, uv3a, uv4a, especially the distance a, is calculated with an appropriate means 2022, e.g. with a data processing program stored in a memory unit 2021, on the basis of measurements and lumber yield calculations conducted on the log T and/or the balk P1.

[0038] In a preferred embodiment of the invention, the eighth step 108 comprises sawing the side slabs L1, L2 with the circular saw machine 208 off of the first balk's

P1 vertical sides s1, s2 (fig. 3c). The circular saw machine 208 comprises preferably at least two sets of circular blades 2081; 2081 a, 2081 b; 2081 c, 2081 d, said circular blade sets being disposed in a vertical plane, i.e. in a sawing plane, partly above and below the balk conveying line. The circular blade sets do not have their hubs on a common imaginary perpendicular vertical axis, but at a small distance d from each other and in such a way that the cutting ranges of circular blades partially overlap each other in order to ensure that the sawing cuts completely through the balk (cf. fig. 4).

[0039] In a preferred embodiment of the invention, the eighth step 108 comprises sawing the side slabs L1, L2 with a band saw machine off of the first balk's P1 vertical sides s1, s2. The band saw machine comprises a thin saw blade in the form of an endless band, which is adapted to extend over two wheels. The band saw machine features at least one jig, which holds the blade at a desired point of sawing during a sawing operation. A thin blade makes a narrow cut, whereby less wood is wasted than in the circular saw operation.

[0040] It should be noted that positioning of the saw machine's 208 saw blades, such as the circular blade sets 2081; 2081 a, 2081 b; 2081 c, 2081 d, and the second profiling machine's 207 cutter heads 2071, 2072, 2073, 2074, sets of cutter heads 2071, 2072; 2073, 2074, is adapted to be interdependent. This enables calibrating the same to work together and in a common cutting plane A-A, B-B.

[0041] After this, a ninth step 109 comprises separating from each other the remaining segment of the balk P1, i.e. a second balk P2, and the removed side slabs L1, L2. The side slabs L1, L2 are dropped on a suitable lateral conveyor and carried to further treatment of side slabs. The second balk 201 is conveyed on a processing line 201 to further treatment, in which it is e.g. further divided into appropriate pieces of lumber.

[0042] What has been described above is an embodiment of the invention, wherein the balk P1 had just one side slab L1, L2 defined, sawn and separated from each vertical side s1, s2 thereof. In some cases, it is nevertheless possible to subject the balk P1 to defining, sawing and separating two side slabs from one side or both vertical sides s1, s2 thereof. Even in this case, the side slabs are also defined on the sides s1, s2 of a balk with side slab grooves, in this case with two parallel grooves, by which each side slab is defined in an optimized manner according to the log's measurement data and the data processing unit's program. A third groove flank, if needed, is milled from the second groove flanks of the parallel side slab grooves on the same principle and on the same terms as described above in connection with a single side slab groove. The sawing step 108 of side slabs, their separation from the balk and transfer to further treatment 109 are conducted basically as described above.

[0043] An apparatus for processing a balk and dividing into pieces of lumber for the balk is illustrated specifically in fig. 2. In the same context, there are also illustrated treatment units related to processing the log T. The cross-sections of a log T and a balk P1, after operations performed with various treatment units, are presented in figs. 3a-3f. Fig. 4 shows in a longitudinal direction the sawing of side slabs off the balk P1 in a circular saw machine.

[0044] The log T is carried forward on a processing line 201 in the direction indicated by an arrow B with one or more conveyors 2011. The log T is treated in treatment units included in the processing line 201 principally in accordance with treatment programs stored in an appropriate data processing unit 202, such as a computer, with a primary objective of optimizing the treatment of a log and maximizing the yield of pieces of lumber obtained from a resulting balk. The treatment units for a log and further also a balk comprise at least the following units: a log scanner 203, a log rotating device 204, a log working device 205, i.e. a chipping canter, first and second profiling machines 206, 207, a saw machine 208, and a separating unit 209 for side slabs. The treatment units are accommodated in the processing line sequentially, most preferably in the presented order.

[0045] The log scanner 203, such as an optical 3D scanner, is a device capable of measuring the log T three-dimensionally (cf. fig. 3a). The log scanner is used e.g. for measuring the cross-sections of a log lengthwise along the log at suitable small distances. This enables finding out the log's geometrical shape, such as conicity, ellipticity, and skewness. At the same time, the location and position of the log T on the conveyor 2011 are also revealed. Measurement data for the log T is stored in an appropriate memory unit 2021, which is most preferably integral with the data processing unit 202.

[0046] The log rotating device 204 is a device, by means of which a log is to be rolled over for bringing a possible skewness L upward (fig. 3b). It is in this position that the log T is treated in the next treatment unit.

[0047] The log working device or chipping canter 205 comprises preferably two chipping disks 205a, 205b and/or the like chipping tools. The first chipping canter 205 is used for machining two first vertical substantially straight sides, i.e. a first side and a second side s1, s2, on the log T along opposite flanks thereof, and thereby the log is turned into the balk P1 (fig. 3c).

[0048] The first profiling machine 206 comprises most preferably four positionally adjustable and most preferably rotatable cutter heads 2061, 2062, 2063, 2064. The profiling machine's 206 cutter heads are used for machining a side slab groove u11, u21; u12, u22 lengthwise of the balk P1 near the top and bottom edges of the balk's each vertical side s1, s2 (fig. 3d). A first groove flank uh1, uh2; uh3, uh4 for each side slab groove u11, u21; u12, u22 is machined on the balk P1 most preferably in such a way that it substantially adjoins the balk's P1 vertical side s1, s2 and in such a way that it is substantially perpendicular to the side. A second groove flank uv1, uv2; uv3, uv4 for each groove u11, u21; u12, u22 is machined on the balk P1 in such a way that it is substantially co-directional with the balk's P1 vertical side s1, s2. In ad-

dition, the second groove flank uv1, uv2; uv3, uv4 is to be arranged apart from the vertical side s1, s2 at a distance determined by the thickness of a side slab L1, L2. Hence, the side slab grooves u11, u21; u12, u22 serve to define on each trimmed side s1, s2 of the balk P1 at least one substantially straight side slab L1, L2. The side slab L1, L2 has its location and measurements determined most preferably in an optimized manner according to data obtained from the log scanner 203 and a treatment program stored in the data processing unit 202.

[0049] The second profiling machine 207 comprises also four positionally adjustable and most preferably rotatable cutter heads 2071, 2072, 2073, 2074, such as routers. These are adapted to work in pairs in two side-by-side cutting planes A-A; B-B of the saw machine 208. The second profiling machine 207 has its cutter heads adapted to remove wood material in the form of a narrow slice from the second groove flank uv1, uv2, uv3, uv4 of each side slab groove u11, u21; u12, u22, and at the same time to produce a third groove flank uv1 a, uv2a, uv3a, uv4a. The third groove flank is preferably parallel to the balk's P1 vertical side s1, s2. (fig. 3e).

[0050] A distance a of the third groove flank uv1 a, uv2a, uv3a, uv4a is determined by means of the data processing unit 202 with appropriate calculation tools, which are implemented in the data processing unit most preferably by means of a computer program and according to those terms that were presented above in the context of describing the method. The apparatus comprises most preferably tools 2022 for determining the distance a of the third groove flank in such a way that it matches a thickness b of the side slab s1, s2 plus a cross-dimension c of the cut made by a saw blade 2081 used for separating the side slab from the balk. The tools 2022 are employed when working the log T and the balk P1 on the processing line 201. The tools 2022 are most preferably stored in the memory unit 2021.

[0051] The saw machine 208 is in one preferred embodiment a circular saw machine. The circular saw machine 208 comprises appropriate circular blades 2081, which are arranged in sets 2081 a, 2081 b; 2081 c, 2081 d on a vertical sawing plane and which are provided with one or more suitable drive motors 2083. The circular blades 2081 of a circular blade set 2081 a, 2081 b; 2081 c, 2081 d have partially overlapping mutual cutting ranges for ensuring a sawing operation that extends through the balk P1. The side slabs L1, L2, which are defined with the side slab grooves u11, u21; u12, u22 on the balk P1, are cut by sawing off of the first balk's P1 vertical sides s1, s2 (fig. 3e, fig. 4). The saw machine 208 has its saw blades 2081, such as a set of circular blades, adapted to trace the third groove flank in its immediate proximity as the side slab s1, s2 is being sawn off of the balk's vertical side s1, s2.

[0052] In a preferred embodiment of the invention, the circular blade 2081; 2081 a, 2081 b; 2081 c, 2081 d has the size of its radius h most preferably within the range of 150-200 mm. Thus, the circular blade's radius h is not more than half of the maximum vertical thickness of a heavy-duty balk P1.

[0053] In a preferred embodiment of the invention, the second profiling machine's 207 second cutter heads 2071, 2072, 2073, 2074 are routers, comprising a circular saw blade 2070a and a chipping blade 2070b. The circular saw blade 2070a has most preferably a diameter of 50-100 mm. The chipping blade 2070b has preferably a diameter of the same size.

[0054] In a preferred embodiment of the invention, the saw machine, such as the circular saw machine 208, and the second profiling machine 207, particularly the second cutter heads 2071, 2072, 2073, 2074, such as routers, are combined for a single processing machine. In this case, the saw blades 2081, such as the sets of circular blades 2081 a, 2081 b, 2081 c, 2081 d, and the second cutter heads 2071, 2072, 2073, 2074, preferably sets of cutter heads, have their working line arranged precisely in the same cutting plane A-A, B-B and it is jointly adjustable precisely to a desired cutting plane position in a plane perpendicular to the cutting plane.

[0055] The separating unit 209 for side slabs comprises e.g. an open-sided longitudinal conveyor 209a, such as a transport chain, which is co-directional with the processing line 201. Thus, the side slabs L1, L2 are adapted to fall by gravity onto a lateral conveyor 209b for side slabs present underneath the conveyor 209a, while the second balk P2 is advanced to further treatment on the conveyor 209a and the processing line 201.

[0056] What has been described above is an embodiment of the invention, wherein the balk P1 had just one side slab L1, L2 defined, sawn and separated from each vertical side s1, s2 thereof. In some cases, it is nevertheless possible to subject the balk P1 to defining, sawing and separating two side slabs either from one or both vertical sides s1, s2. Even in this case, the side slabs are also defined on the sides s1, s2 of a balk with a profiling machine, which is similar to the first profiling machine 206 and comprises a necessary number of cutter heads. The side-by-side side slabs to be separated from one side s1, s2, and the parallel side slab grooves thereof, are determined in an optimized manner according to the log's measurement data and the data processing unit's program. Third groove flanks are milled as necessary from the second groove flanks of the side-by-side side slab grooves on the same principle and on the same terms as described above in connection with the first profiling machine 206 and in connection with defining a single side slab. The sawing step of side slabs, their separation from the balk and transfer to further treatment 109 are conducted basically as described above.

[0057] In a preferred embodiment of the invention, at least some of the sequential treatment units of the apparatus, especially the first chipping canter 205, the first profiling machine 206 and the second profiling machine 207, along with the saw machine 208, are disposed on the processing line 201 close to each other, such that at least two successive treatment units are arranged within

an area A whose length does not exceed that of the log T, and therefore that the balk P1, 6 m in maximum. Consequently, a part of the log T/balk P1 on the processing line 201 is worked on by one treatment unit while another part of it is worked on by the preceding treatment unit. Hence, the leading end of a balk lies in one treatment unit, such as being treated by the first profiling machine 206 with the side slab grooves u11, u21; u21, u22 being machined on the balk P1, while at the same time the middle portion (or at least the trailing end) of the balk P1 lies in the preceding treatment unit, such as being treated by the chipping canter 205 with the balk P1 being shaped and the vertical sides s1, s2 being trimmed on the log T. Alternatively, the log T lies simultaneously in three successive treatment units. In this case, the balk P1 has its leading end in the saw machine 208 and in the second profiling machine 207, the balk P1 has its middle portion in the first profiling machine 206, and the balk p1 has its trailing end in the first chipping canter 205.

[0058] It should be appreciated that the above-described apparatus of the invention is presented schematically and describes specifically only those treatment steps and treatment units that are essential from the standpoint of the invention. Equipment, such as guide roll units, necessary in various treatment units for the transfer, possible alignment and support of a log, as well as a balk produced therefrom, has not been described at this time.

[0059] The invention is not limited to concern just the foregoing exemplary embodiment, but a plurality of modifications are possible while remaining within the inventive concept defined in the claims.

Claims

1. A method for processing a balk and dividing the same into pieces of lumber, said balk (P1) having been made from a log (T) by trimming (105) the latter for two vertical sides (s1, s2) on opposite flanks thereof, and in which method the balk is advanced on a processing line (201) through subsequent treatment steps, comprising

   a) milling (106) a side slab groove (u11, u21; u12, u22) near top and bottom edges of the balk's (P1) each vertical side (s1, s2), said groove having its first groove flank (uh1, uh2, uh3, uh4) set in substantially perpendicularly to the balk's vertical side and its second groove flank (uv1, uv2, uv3, uv4) substantially co-directionally with the balk's vertical side, and said side slab grooves serving to define side slabs (L1, L2) on the balk's trimmed sides; and
   b) sawing (108) each side slab (L1, L2) off of the balk's (P1) vertical side (s1, s2) by means of a saw machine (208);
   characterized in that, after step a, wood material is removed from the second groove flank (uv1, uv2, uv3, uv4) of each side slab groove (u11, u21; u12, u22) by milling, and a third groove flank (uv1 a, uv2a, uv3a, uv4a) is produced which is parallel to the balk's vertical side (s1, s2), and during the course of step b, one or more saw blades of the saw machine (208) are adapted to trace the third groove flank in its immediate proximity.

2. A method according to claim 1 for processing a balk and dividing the same into pieces of lumber, **characterized in that** a distance (a) of the third groove flank (uv1 a, uv2a, uv3a, uv4a) from the balk's vertical side (s1, s2) is adapted to match a thickness (b) of the side slab (s1, s2) plus a cross-dimension (c) of the cut made by a saw blade (2081).

3. An apparatus for processing a balk and dividing the same into pieces of lumber, said balk (P1) having been made from a log (T) with a chipping canter (205) or the like working machine by trimming it for two vertical sides (s1, s2) on opposite flanks thereof, in which apparatus the balk (P1) is to be advanced on a processing line (201) with one or more conveyors (2011) and to be treated in treatment units included in the processing line by means of treatment programs stored substantially in an appropriate data processing unit (202; 2021) on the basis of log measurement data for an optimized treatment of the log and hence the balk, said apparatus further comprising:

   a) a first profiling machine (206), which comprises first cutter heads (2061, 2062, 2063, 2064) for milling a side slab groove (u11, u21; u12, u22) near the top and bottom edges of the balk's (P1) each vertical side (s1, s2) in such a way that the groove has its first groove flank (uh1, uh2, uh3, uh4) substantially perpendicular to the balk's vertical side and its second groove flank (uv1, uv2, uv3, uv4) substantially co-directional with the balk's vertical side, and said side slab grooves serving to define side slabs (L1, L2) on the balk's trimmed sides;
   b) a saw machine (208), which comprises appropriate saw blades, by which the side slabs (L1, L2) are sawn (108) off of the balk's (P1) vertical sides (s1, s2);

   characterized in that the apparatus further comprises:

   c) a second profiling machine (207), which comprises second cutter heads (2071, 2072, 2073, 2074), such as routers, which are adapted to work in pairs in two parallel cutting planes (A-A; B-B) of the saw machine for removing wood ma-

terial from the second groove flank (uv1, uv2, uv3, uv4) of each side slab groove and for producing a third groove flank, which is parallel to the balk's vertical groove flank; and

said saw blades of the saw machine being adapted to trace the third groove flank in its immediate proximity as the side slab (s1, s2) is being sawn off of the balk's vertical side (s1, s2).

4. An apparatus according to claim 3 for processing a balk and dividing the same into pieces of lumber, **characterized in that** the apparatus comprises tools (2022) for determining a distance (a) of the third groove flank (u11a, u21a, u12a, u22a) from the balk's vertical side (s1, s2) in such a way that it matches a thickness (b) of the side slab (s1, s2) plus a cross-dimension (c) of the cut made by the saw machine's saw blade (2081).

5. An apparatus according to claim 3 or 4 for processing a balk and dividing the same into pieces of lumber, **characterized in that** the saw machine is a circular saw machine (208), which comprises two side-by-side sets of circular blades (2081; 2081 a, 2081 b; 2081 c, 2081 d) working in a common cutting plane (A-A; B-B), by which the side slabs (L1, L2) are sawn (108) off of the balk's (P1) vertical sides (s1, s2), the circular blades (2081; 2081 a, 2081 b; 2081 c, 2081 d) of said side-by-side sets of circular blades (2081; 2081 a, 2081 b; 2081 c, 2081 d) having a radius (h) whose size is most preferably within the range of 100-150 mm.

6. An apparatus according to claim 3 or 4 for processing a balk and dividing the same into pieces of lumber, **characterized in that** the saw machine is a band saw machine, by which the side slabs (L1, L2) are sawn off of the balk's (P1) vertical sides (s1, s2).

7. An apparatus according to claim 3, 4, 5 or 6 for processing a balk and dividing the same into pieces of lumber, **characterized in that** the second cutter heads (2071, 2072, 2073, 2074) of the second profiling machine (207) are routers, comprising a circular saw blade (2070a) and a chipping blade (2070b), said routers having a diameter which is most preferably 100-150 mm.

8. An apparatus according to any of the preceding claims for processing a balk and dividing the same into pieces of lumber, **characterized in that** the saw machine (208) and the second profiling machine (207), particularly the second cutter heads (2071, 2072, 2073, 2074), such as routers, are combined for a single processing machine, wherein the saw blades, preferably sets of circular blades, and the second cutter heads, preferably sets of cutter heads, have their working line in the common cutting plane (A-A; B-B).

9. An apparatus according to any of preceding claims 3-8 for processing a balk and dividing the same into pieces of lumber, **characterized in that** at least some of the successive treatment units of the apparatus, particularly the chipping canter (205), the profiling machines (206. 207), and the saw machine (208) are disposed on the processing line (201) close to each other, such that at least two successive treatment units are arranged within an area (A) whose length does not exceed that of the balk (P1), 6 m in maximum.

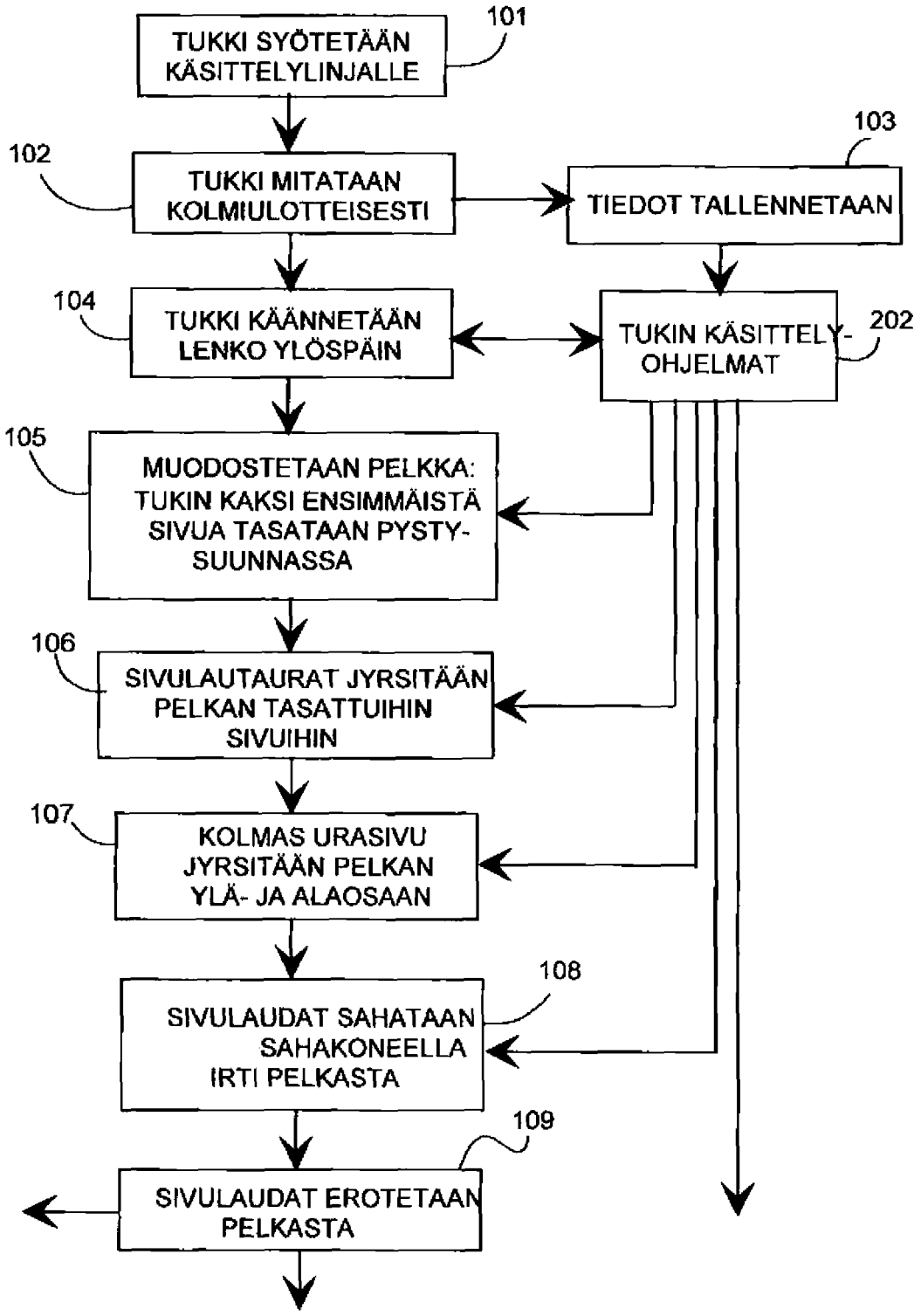

TUKKI SYÖTETÄÄN KÄSITTELYLINJALLE
101
TUKKI MITATAAN KOLMIULOTTEISESTI
102
TIEDOT TALLENNETAAN
103
TUKKI KÄÄNNETÄÄN LENKO YLÖSPÄIN
104
TUKIN KÄSITTELY-OHJELMAT
202
MUODOSTETAAN PELKKA: TUKIN KAKSI ENSIMMÄISTÄ SIVUA TASATAAN PYSTY-SUUNNASSA
105
SIVULAUTAURAT JYRSITÄÄN PELKAN TASATTUIHIN SIVUIHIN
106
KOLMAS URASIVU JYRSITÄÄN PELKAN YLÄ- JA ALAOSAAN
107
SIVULAUDAT SAHATAAN SAHAKONEELLA IRTI PELKASTA
108
SIVULAUDAT EROTETAAN PELKASTA
109

FIG. 1

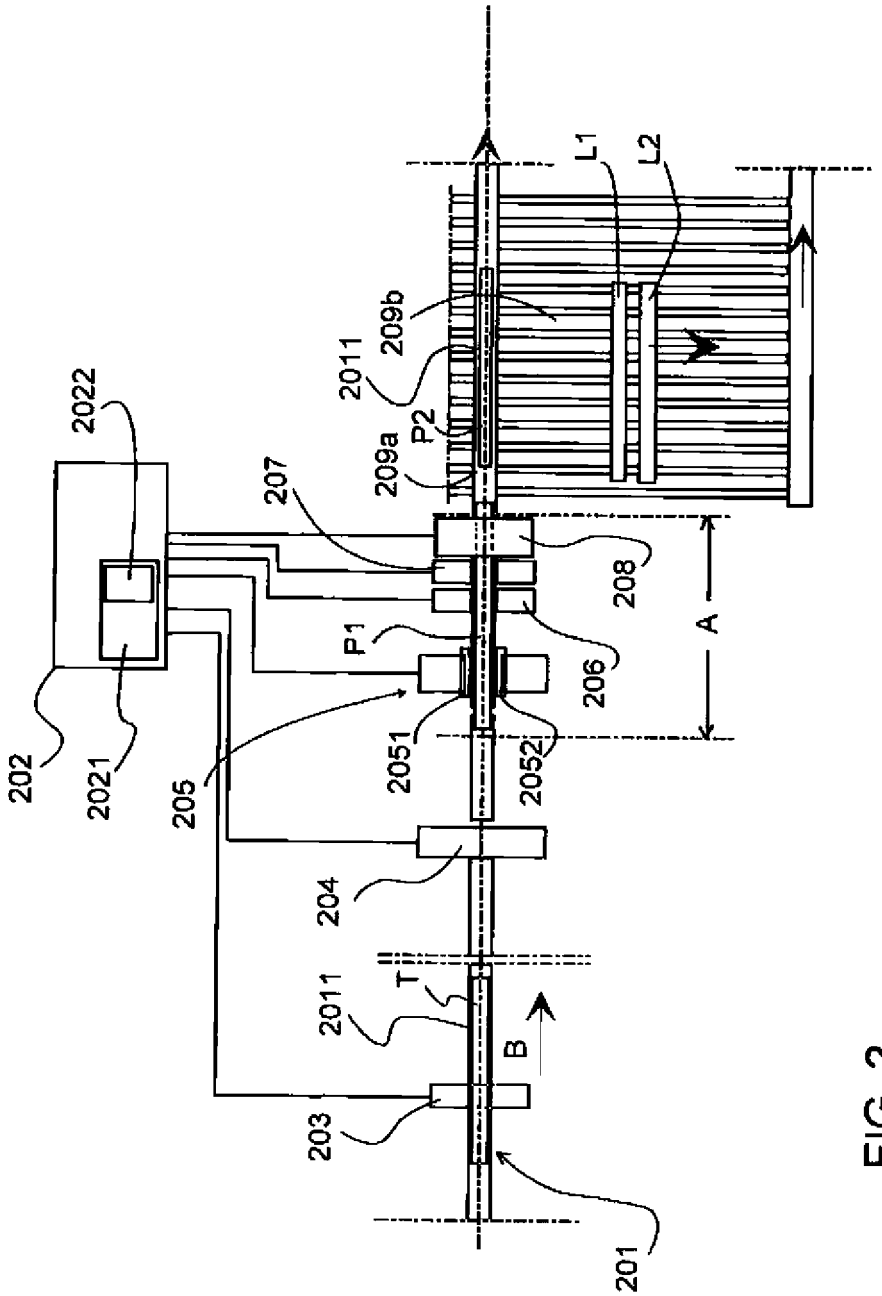

L1
L2
209b
2011
P2
209a
2022
207
208
A
P1
206
2051
2052
202
2021
205
204
T
2011
B
203
201

FIG. 2

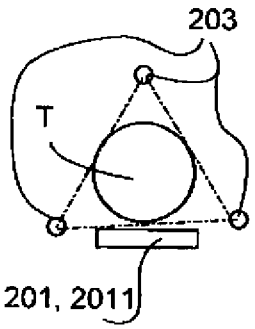


FIG. 3a

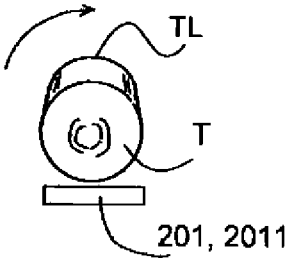


FIG. 3b

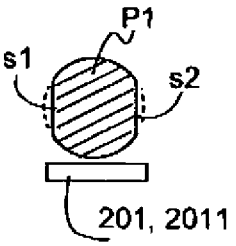


FIG. 3c

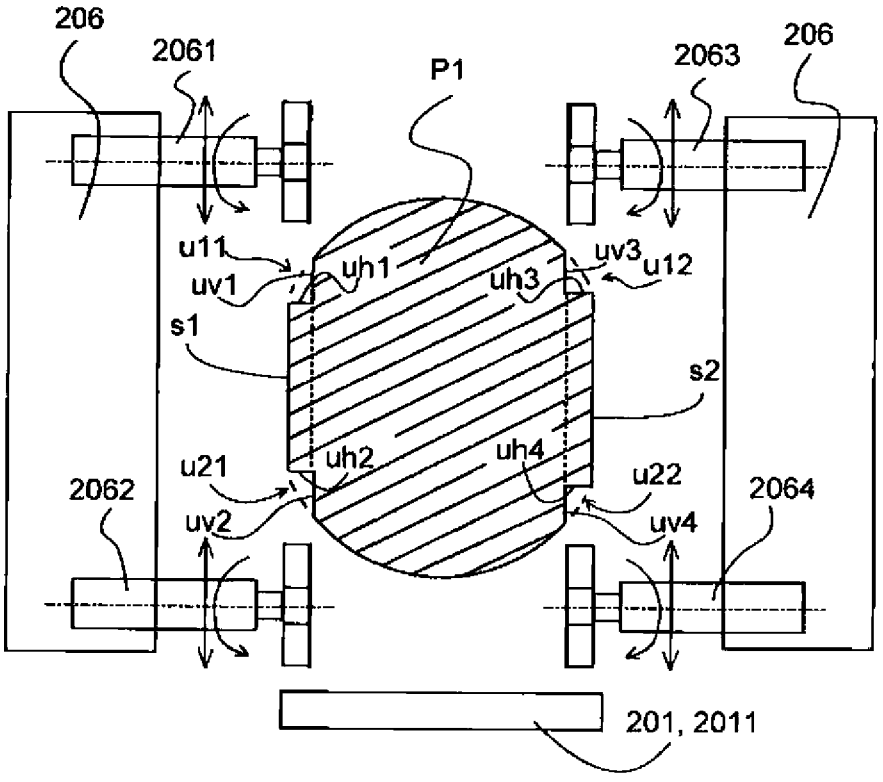
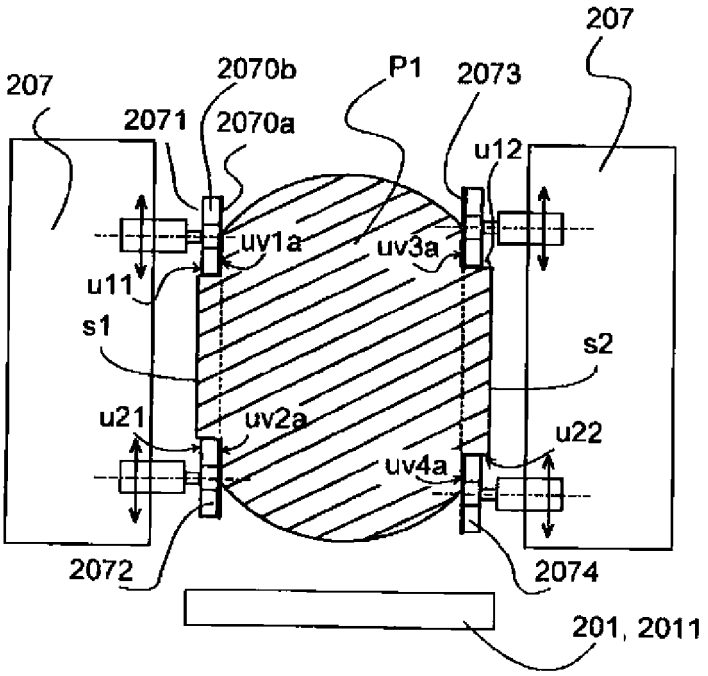


FIG. 3d



a

FIG. 3e

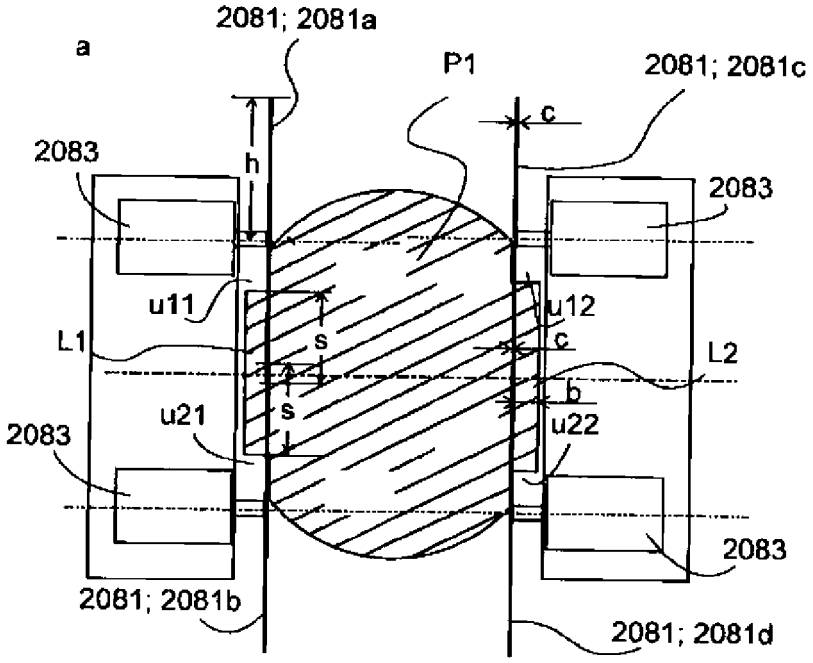


FIG. 3f

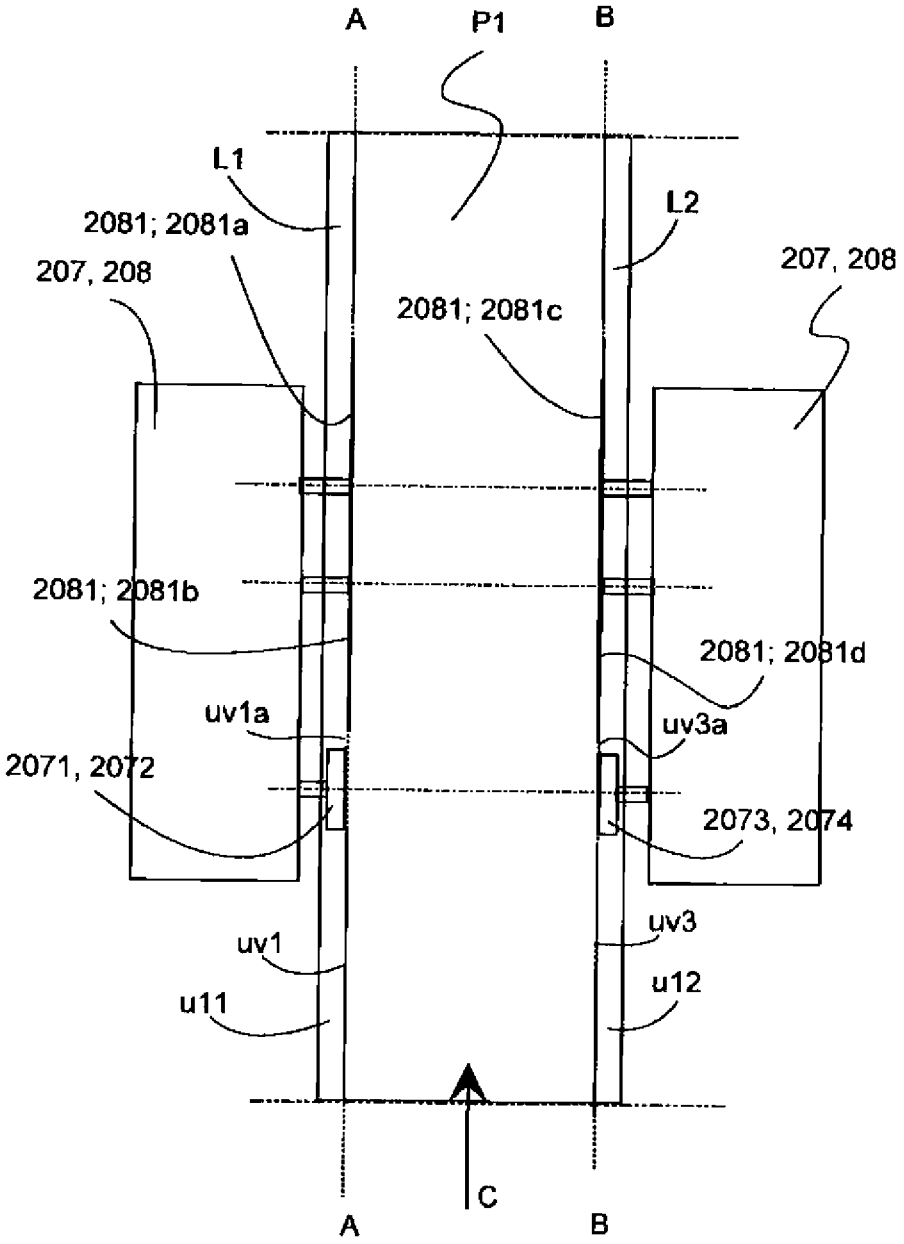

A
P1
B
L1
L2
2081; 2081a
207, 208
207, 208
2081; 2081c
2081; 2081b
2081; 2081d
uv1a
uv3a
2071, 2072
2073, 2074
uv1
uv3
u11
u12
C
A
B

FIG. 4

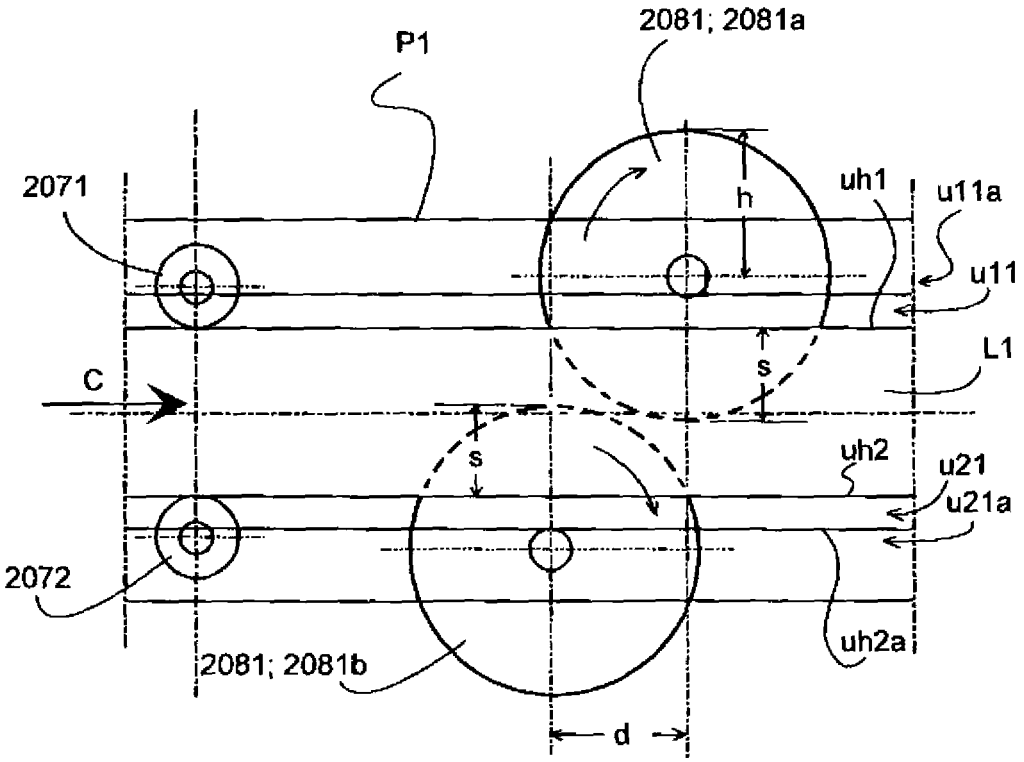

2081; 2081a
P1
2071
h
uh1
u11a
u11
L1
C
s
s
uh2
u21
u21a
2072
uh2a
2081; 2081b
d

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
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B27B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 January 2012	Chariot, David

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