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(54) Method and apparatus for dividing a log into pieces of lumber

(57) The invention relates to a method for working a log and dividing the same into pieces of lumber. The method comprises feeding (101) a log onto a processing line (201) and advancing it through the following process steps of: (a) measuring (102) a log three-dimensionally, thereby finding out its geometrical shape; (b) storing (103) the log measurement data, the log treatment being conducted on the basis of said measurement data; (c) checking the position of a log (T) and rotating (104) the log, such that a possible skewness points upwards; (d) trimming (105) first two vertical sides on the log at its opposite sides and the log is thereby turned into a first balk having first and second vertical sides. According to the invention, the method further comprises: (e) milling (106) first and second grooves in top and bottom parts of each vertical side of the first balk, each of said grooves having one of its groove flanks adjacent to a vertical side of the balk, said grooves being used for defining at least first and second side slabs on the balk's trimmed sides; (f) removing (107) the side slabs, most preferably by sawing, from the first balk's vertical sides; followed by (g) separating (108) a remaining segment of the first balk, i.e. a second balk, and the removed side slabs from each other and advancing the second balk to a further treatment (109). The invention relates also to an apparatus applying the method.

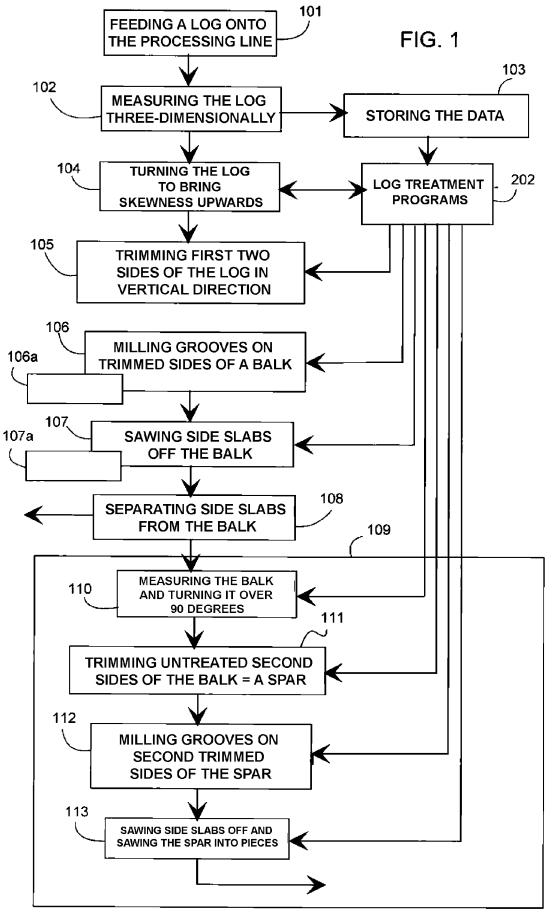

FIG. 1

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Description

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

[0002] The invention relates also to an apparatus as set forth in the preamble of claim 5 for working a log and dividing the same into pieces of lumber.

[0003] The conventional sawmill line used for working a log and dividing the same into pieces of lumber operates as follows. The first step comprises measuring a debarked log three-dimensionally, e.g. with an optical 3D measuring instrument, to find out precisely its geometrical shape. At this point, data is collected regarding e.g. the diameter, conicity, ellipticity, and skewness of the log. The log measurement data is stored in a control unit or the like and utilized in working the log and dividing it into pieces of lumber. If necessary, this is followed by rolling the log 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 generally 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. In the next step, the balk is turned over such that its trimmed flat surface faces downward against a conveyor. This is followed by centering the balk to a second chipping canter, in which its two opposite untreated surfaces are trimmed basically the same way as in the treatment of the preceding first chipping canter. Thus, the balk becomes a spar with four trimmed sides. The spar is at least partly wane-edged, meaning that at least some of its lengthwise corners are constituted by a curving surface of the original log.

[0004] The spar is measured, after which the trimming of spar side slabs and the slicing of side slabs are optimized with a control unit. The optimization comprises determining the dimensions of side slabs obtained from a spar, particularly the width of the slabs, the required elevation and direction for profiling work. In the next step, the spar is worked with an appropriate profiling machine, whereby the wane edges are dressed in an optimized manner off the side of the spar. This is followed by using a suitable saw machine, preferably a circular saw, for sawing first side slabs off the profiled spar. In the spar advancing direction, the saw machine is preceded by a first pair of servo controlled side rolls for directing the spar in a correct position to the saw machine. In the next step, the remaining segment of the spar is turned over through 90 degrees by means of a rotating device and the spar is fed again to the profiling machine, which dresses the spar edges in an optimized manner for second side slabs. After this, the rest of the spar is chopped with an appropriate saw, such as a board saw, into pieces of lumber. The board saw is preceded by a second pair of servo controlled side rolls for directing the spar in a correct position to the saw machine.

[0005] A problem with sawmill lines as described above is being structurally long lines. In a sawmill line, various operations require a specified unit whose length is basically equal to the maximum length of a log being processed. A drawback here is that such a long sawmill line occupies plenty of space which is expensive to build.

[0006] Finnish patent FI-73905 discloses a method and apparatus for shaving tree trunks or logs into a wood product processed from all sides, such as boards and beams. The wane edges of four-way trimmed tree trunks are milled in a rectangular manner, followed by removing at least two side slabs by sawing. In order to improve the surface quality of wood products, the milling heads for wane edges are fitted not only with a chopping blade but also with a circular saw blade, the latter providing a smooth sawn surface on the narrow sides of the side slabs and providing dimensionally precise side slabs. The four-side trimming of a tree trunk is imple-mentable e.g. as described in Patent specification US-3742993.

[0007] Finnish patent FI-104316 discloses a method and apparatus for processing a tree trunk or log by shaving, which comprises measuring the tree trunk with a log measuring instrument three-dimensionally, transferring data to a control unit, and determining a processing center line for the tree trunk and processing center lines as well as widths for side slabs, after which the work on the tree trunk begins. First, the tree trunk has its sides trimmed with a chipping canter so as to have four trimmed sides, i.e. it has been worked into a quadrangular spar. After this, the spar has side cuts milled on its opposite sides by specifically operating milling tool heads, thus also removing possible wane edges of the spar and side slabs being sawn off the spar. Alternatively, the sawing-off of side slabs is performed prior to the edging of side cuts, the latter being implemented with milling tool heads.

[0008] One of the problems encountered in solutions set forth in the foregoing patents is that, in particular, the four-side trimming of a warped tree trunk is pursued by means of chipping heads placed close to each other. Trimming the surface of a curving tree trunk is awkward and useful wood material is also lost in the process. An objective of the method and apparatus according to the invention is to eliminate problems relating to prior known sawmill lines and/or chipping canter lines. Another objective is to provide a new method and apparatus, which enable reducing physically the length of a sawmill line or the like log processing line and improving the yield of sawn timber or 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 5.

[0010] The dependent claims disclose preferred embodiments for a method and apparatus of the invention.

[0011] The method according to the invention for working a log and dividing the same into pieces of lumber comprises feeding the log onto a processing line and advancing the same through process steps as follows:

a) the log is measured three-dimensionally, thereby finding out its geometrical shape;

b) the log measurement data is stored, the log treatment being conducted on the basis of said measurement data:

c) the log position is checked and the log is rolled over for bringing a possible skewness to face upward;

d) the first two vertical sides are trimmed on the log at its opposite sides, thus turning the log into a first balk with first and second vertical sides (s1, s2);

[0012] According to the invention, the method further comprises

e) milling first and second grooves in top and bottom parts of each vertical side of the first balk, each of said grooves having one of its groove flanks adjacent to a vertical side of the balk, said grooves being used for defining at least first and second side slabs on the trimmed sides of the balk;

f) removing the side slabs, most preferably by sawing, from the vertical sides of the first balk; followed by

g) separating a remaining segment of the first balk, i.e. a second balk, and the removed side slabs from each other and conveying the second balk to further processing.

[0013] In a preferred embodiment of the invention, the foregoing step e is followed by

e1) milling third and fourth grooves in top and bottom parts of each vertical side of the first balk alongside the first and second grooves, one of the groove flanks of said third and fourth grooves being adjacent to the first and second grooves, respectively, said grooves being used for defining third and fourth side slabs on the trimmed sides of the balk; and wherein said steps f and g are supplemented by

f1) removing all side slabs, most preferably by sawing, from the vertical sides of the first balk; followed by

g1) separating a remaining segment of the first balk, i.e. a second balk, and all the removed side slabs from each other, followed by conveying the second balk to a further treatment.

[0014] In the most preferred embodiment of the invention, the above-mentioned sequential process steps, particularly the trimming of vertical sides on a log, the milling of grooves on a first balk, and the removal of side slabs by sawing from the first balk, are conducted along the processing line in such a way that a part of the log is in one process step while another part thereof is in the immediately preceding process step. Hence, at least two successive process steps are provided within a range whose length does not exceed that of the log, the maximum length being preferably 6 m.

[0015] Referring to an apparatus of the invention for working a log and dividing the same into pieces of lumber, said apparatus comprises a processing line, along which the log is advanced forward on one or more conveyors and treated in treatment units included in the processing line principally by means of treatment programs stored in an appropriate data processing unit, said treatment units including:

a) a log measuring instrument, which is to be used for measuring the log three-dimensionally and which measuring results are to be stored in a memory unit for optimizing the log treatment in the data processing unit;

b) a log rotating device, by means of which the log is to be rolled over for bringing a possible skewness to face upward;

c) a first chipping canter provided with two chipping discs and/or the like chipping elements, which chipping canter is to be used for trimming first two vertical sides on the log at its opposite sides, thus turning the log into a first balk;

[0016] According to the invention, the apparatus further comprises:

d) a first profiling machine, which is to be used for milling first and second grooves in top and bottom parts of each vertical side of the first balk in such a way that each groove has one of its groove flanks adjacent to a vertical side of the balk, said grooves being used for defining at least first and second side slabs on the trimmed sides of the balk;

e) a first saw assembly, which is to be used for cutting the side slabs off the vertical sides of the first balk by sawing; and

f) a separating unit, which is to be used for separating a remaining segment of the first balk, i.e. a second balk, and the side slabs from each other, followed by advancing the balk to a further treatment.

[0017] In a preferred embodiment of the invention, the apparatus further comprises:

e1) a second profiling machine, which is disposed downstream of the first profiling machine in the log

advancing direction and which is to be used for milling third and fourth grooves in top and bottom parts of each vertical side of the first balk alongside the first and second grooves, one of the groove flanks of said third and fourth grooves being adjacent to the first and second grooves, respectively, said grooves being used for defining third and fourth side slabs on the trimmed sides of the balk; and

f1) a second saw assembly, which is to be used for cutting the third and fourth side slabs off the vertical sides of the first balk by sawing.

[0018] In the most preferred embodiment of the invention, the apparatus has at least some of its sequential treatment units, particularly the first chipping canter, the first profiling machine, and the first saw machine, or, alternatively, said treatment units and the second profiling machine and the saw machine assembly relevant thereto, disposed on the processing line close to each other in such a way that at least two successive log treatment units are provided within a range whose length does not exceed that of the log.

[0019] An advantage of the invention is its capability of implementing the processing line in the configuration of a short and efficient line. This provides savings in manufacturing and installation costs and, moreover, it is economically more favorable to cover a short line than a long line.

[0020] Another specific advantage of the invention is that some of the essential and important process steps and treatment units are most preferably disposed close to each other, especially the successive process steps/ treatment units, within a range whose length does not surpass that of the log, being 6 m at a maximum.

[0021] The invention and further benefits thereof will be described in more detail with reference to the accompanying drawing, in which

fig. 1 shows in a flow chart a method of the invention for working and sawing a log;

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

figs. 3a - 3k show cross-sections for a log and balk in various process steps thereof.

[0022] In the figures, like reference numerals are used for like elements.

[0023] The method according to the invention for working a log and dividing the same into pieces of lumber is illustrated sequentially in a flow chart in fig. 1. The method comprises feeding 101 a log onto a processing line 201 and advancing the same through process steps to follow. A first step a comprises measuring 102 a log T three-dimensionally with a log measuring instrument, such as a 3D scanner (cf. fig. 3a). Hence, 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. A second step b comprises storing 103 measurement data relevant to the log T. The treatment of a log in various process steps is optimized by means of an appropriate data processing unit 202, which has suitable programs previously stored therein for executing the optimization. As a ground rule, the term optimization refers to the yield of useful pieces of lumber in a volume and/or value as large as possible from the log. A third step c comprises checking the position of a log on a conveyor and rolling 104 the log over with a rotating device, such that a possible skewness L (i.e. a curved section) faces upward (fig. 3b). It should be noted that the logs may contain sections warped in various directions in a plane perpendicular to the longitudinal direction, whereby, as a ground rule, what is turned upwards is the section whose curvature is the most prominent and most dominating. A fourth step d comprises feeding a log to an appropriate first working machine, wherein the first two vertical and most preferably substantially flat sides, i.e. a first side and a second side s1, s2, are trimmed 105 on the log at its opposite sides and thereby the log is turned into a first balk P1 (fig. 3c).

[0024] According to the invention, the method further comprises at least a fifth e, a sixth f, and a seventh g step as follows. The fifth step e comprises milling first and second grooves u11, u21; u12, u22 in top and bottom parts of each vertical side s1, s2 of the first balk P1 (fig. 3d). Each groove u11, u21; u12, u22 has one of its groove flanks us1, us2; us3, us4 adjacent to the vertical side s1, s2 of the balk P1. Most preferably, the groove u11, u21; u12, u22 has its groove flank us1, us2; us3, us4 at a right angle relative to the side s1, s2 of the balk P1. The grooves u11, u21; u12, u22 serve to define on the trimmed side s1, s2 of the balk P1 in an appropriate direction at least first and second straight side slabs L1, L2. This is performed in an optimized manner according to the log measurement data and the data processing unit's program. The sixth step f comprises removing the side slabs L1, L2, most preferably by sawing 107, from the vertical sides s1, s2 of the first balk P1 (fig. 3e). After this, in the seventh step g, a remaining segment of the first balk P1, i.e. a second balk P2, and the removed side slabs L1, L2 are separated 108 from each other. The side slabs L1, L2 are dropped onto a suitable crosswise conveyor and carried to a further treatment of side slabs. The second balk P2 is conveyed to a further treatment 109 along the processing line 201.

[0025] In a preferred embodiment of the invention, the fifth step e is followed by an additional step e1, wherein third and fourth grooves u31, u41; u32, u42 are milled 106a in top and bottom parts of each vertical side s1, s2 of the first balk P1 alongside the first and second grooves u11, u21; u12, u22 (fig. 3f). The third and fourth grooves u31, u41; u32, u42 are milled with appropriate milling heads most preferably on the side of the balk P1 which is till untreated. The third and fourth grooves u31, u41;

u32, u42 have one of their groove flanks us5, us6, us7, us8 adjacent to the first and second grooves u11, u21; u12, u22, respectively, and have it preferably at a right angle relative to the vertical side s1, s2 of the balk. The third and fourth grooves u31, u41; u32, u42 serve to define third and fourth substantially straight side slabs L3, L4 on the trimmed sides s1, s2 of the balk P1. This is conducted in an optimized manner according to the log measurement data and the data processing unit's program.

[0026] The sixth and seventh steps f and g, which are to be performed subsequent to the additional step e1, are supplemented with additional steps f1 and g1. The sixth step f has its additional step f1 adapted to removing all side slabs L1, L2, L3, L4 by sawing 107a from the vertical sides of the first balk P1 with an appropriate saw machine (fig. 3g). The seventh step g has its additional step g1 adapted to separating 108 a remaining segment of the first balk P1, i.e. a second balk P2, and all the removed side slabs L1, L2, L3, L4 from each other and particularly to advancing the second balk P2 to a further treatment 109.

[0027] In a preferred embodiment of the invention, the successive process steps, particularly the fourth process step d, fifth step e, sixth step f, and seventh step g, or, alternatively, said process steps and the fifth step's additional step e1, sixth step's additional step f1, and seventh step's additional step g1 relevant thereto, are conducted along the processing line 201 in such a way that a part of the log T is in one process step while at the same time another part thereof is in the preceding process step. Hence, the log T has its leading end in one process step, such as in the fifth step e, in which the grooves u11, u21; u12, u22 are being milled on the balk P1, while the log T has its middle section (or at least its trailing end) in the preceding process step, such as in the fourth step d, in which the log is being trimmed along its vertical sides. Alternatively, the log lies simultaneously in three successive process steps. In this case, the log T has its leading end for example in the sixth step f, in which the side slabs L1, L2 (L3, L4) are being removed by sawing from the vertical sides s1, s2 of the first balk P1, the log T has its middle section in the fifth step e, in which the grooves u11, u21; u12, u22 (u31, u41; u32, u42) are being milled on the balk P1, and the log T has its trailing end in the fourth step d, in which the log's vertical sides are being trimmed. What is essential in this embodiment of the invention is that at least two successive log processing steps are fitted within a range A, the length of which does not exceed that of the log, being preferably between 5 and 7 m, most preferably 6 m.

[0028] In a preferred embodiment of the invention, the further treatment 109 of the second balk P2 comprises at least four successive steps as follows: steps from eighth to eleventh. An eighth step h comprises measuring and overturning 110 the second balk P2 on one of its trimmed sides s10 (or s20), i.e. the second balk P2 is rotated over 90 degrees (fig. 3h). Measurements of the second balk P2 serve to check the balk dimensions, and particularly with regard to the trimmed sides s1, s2. A ninth step i comprises feeding the second balk P2 to an appropriate second working machine and trimming 111 the untreated opposite sides of the second balk P2 for substantially vertical third and fourth sides s3, s4 (fig. 3i). Thus, the second balk P2 is turned into a substantially quadrangular spar P3, the edges of which are generally at least partially wane. In a tenth step j, the spar P3 has the marginal areas of its four sides, i.e. the edges thereof, milled 112 with suitable profiling machines for grooves u8, u9, u10, u11, which are used for defining side slabs on the vertical trimmed third and fourth sides (fig. 3j). An eleventh step comprises removing side slabs L5, L6 from the spar's vertical side by sawing and, most preferably, the remaining spar is sawn 113 at the same time into appropriate pieces of lumber with a suitable saw machine (fig. 3k).

[0029] An apparatus of the invention for working and sawing a log is specifically illustrated in fig. 2. The cross-section of the log T, the balk P1, P2, and the spar P3, after the procedures conducted with various treatment units, is also apparent from figs. 3a-3k.

[0030] The apparatus according to the invention for working a log and dividing the same into pieces of lumber comprises a processing line 201, wherein a log is advanced (in the direction indicated by an arrow B) on one or more conveyors 2011. A log T is treated at 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 target of optimizing the log treatment in order to maximize the yield of pieces of lumber obtained from the log. The treatment units of this apparatus comprise at least units as follows: a log measuring instrument 203, a log rotating device 204, and a first chipping canter 205. According to the invention, the apparatus further comprises at least treatment units as follows: a first profiling machine 206, a first saw machine assembly 207, and a separating unit 208. The treatment units are arranged along the processing line successively, most preferably in the presented sequence.

[0031] The log measuring instrument 203, such as an optical 3D scanner, is a device conducting a measurement of the log T three-dimensionally (cf. fig. 3a). The log measuring instrument is used e.g. for measuring cross-sections of the log in a lengthwise direction of the log at conveniently small intervals. This enables finding out the geometrical shape of a log, such as conicity, ellipticity, and skewness. Revealed at the same time are location and position of the log T on top of the conveyor 2011. Measurement data of the log T is stored in a suitable memory unit 2021, which is most preferably associated with the data processing unit 202.

[0032] 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 to point upward (fig. 3b). This is the position, in which the log T will be treated in the next

treatment unit.

[0033] The first chipping canter 205 comprises preferably two chipping discs 205a, 205b and/or the like chipping tools. The first chipping canter 205 is used for making first two vertical, substantially straight sides, i.e. a first side and a second side s1, s2, on the log T at its opposite sides, thus turning the log into a first balk P1 (fig. 3c).

[0034] The first profiling machine 206 comprises most preferably four milling heads. The profiling machine's 206 milling heads are used for milling first and second grooves u11, u21; u12, u22 lengthwise of the first balk P1 in top and bottom parts of each vertical side s1, s2 of the balk (fig. 3d). Each groove u11, u21; u12, u22 has one of its groove flanks us1, us2, us3, us4 arranged to lie adjacent to a vertical side of the balk P1 and in such a way that said flank is at a right angle relative to this side. The first and second grooves are used for defining at least first and second substantially straight side slab L1, L2 on the trimmed sides s1, s2 of the balk P1. The location and dimensions of the side slab L1, L2 are determined most preferably in an optimized manner in accordance with data obtained from the log measuring instrument 203 and a treatment program stored in the data processing unit 202.

[0035] The first saw machine 207 comprises suitable blade units 207a, 207b, by means of which the side slabs L1, L2 are cut off the vertical sides s1, s2 of the first balk P1 by sawing (fig. 3e).

[0036] The separating unit 208 comprises e.g. an open-side conveyor 208a, such as a conveyor chain, which is co-directional with the processing line 201. Hence, the side slabs L1, L2 are adapted to fall by gravity on top of a crosswise conveyor 208b set for side slabs underneath the conveyor 208a while at the same time advancing the second balk P2 to a further treatment on the conveyor 208a and the processing line 201.

[0037] In a preferred embodiment of the invention, the apparatus further comprises a second profiling machine 2061 and a second saw assembly 2071.

[0038] The second profiling machine 2061 comprises most preferably four milling heads. The second profiling machine 2061 is positioned downstream of the first profiling machine 206 in the log T conveying direction B. The second profiling machine 2061 has its four milling heads adapted to mill third and fourth grooves u31, u41; u32, u42 in top and bottom parts of each vertical side s1, s2 of the first balk P2 alongside the first and second grooves u11, u21; u12, u22, particularly on the untreated surface side of the balk P1 (fig. 3f). The third and fourth grooves u31, u41; u32, u42 have one of their groove flanks us5, us6, us7, us8 to lie adjacent to the first and second grooves u11, u21; u12, u22, respectively, and to lie preferably at a right angle relative to the vertical side s1, s2 of the balk. The third and fourth grooves u31, u41; u32, u42 are used for defining third and fourth straight side slabs L3, L4 on the trimmed sides s1, s2 of the balk. In this case as well, the location and dimensions of the side slab L1, L2 are determined most preferably in an optimized manner in accordance with data obtained from the log measuring instrument 203 and a treatment program stored in the data processing unit 202.

[0039] The second saw assembly 2071 comprises appropriate blade units 2071 a, 2071 b. It is positioned downstream of the first saw machine assembly 207 in the log T conveying direction B. Alternatively, the first and second saw assemblies 207, 2071 are integrated for a single saw machine assembly, comprising blade units 207a, 2071 a, 207b, 2071 b. The blade units 2071 a, 2071 b of the second saw assembly 2071 are used for cutting the third and fourth side slabs L3, L4 by sawing off the first balk's P1 vertical sides, most preferably immediately after cutting off the first and second side slabs L1, L2 (fig. 3g).

[0040] In this embodiment of the invention, the saw assembly 207, 2071 is followed by the separating unit 208, 208a in the log T conveying direction B. This treatment unit enables separating a remaining segment of the first balk, i.e. a second balk P2, and the removed side slabs L1, L2, L3, L4 from each other, and particularly advancing the second balk P2 to a further treatment along the processing line 201.

[0041] In the most preferred embodiment of the invention, at least some of the successive treatment units of the apparatus, particularly the first chipping canter 205, the first profiling machine 206, and the first saw assembly 207, or, alternatively, said treatment units and the second profiling machine 2061 and the second saw assembly 2071 relevant thereto, are arranged on the processing line 201 close to each other in such a way that at least two successive log treatment units are positioned within a range which is not more than equal to the log in length, at a maximum 6 m. Thus, a part of the log T is on the processing line 201 subjected to a treatment by one treatment unit while a part of it is subjected to a treatment by the preceding treatment unit. In this case, the log T has its leading end in one treatment unit, such as subjected to a treatment by the first profiling machine 206 with the grooves u11, u21; u21, u22 being milled on the balk P1, while the log T has its middle section (or at least its trailing end) in the preceding treatment unit, such as subjected to a treatment by the first chipping canter 205 with the log's T vertical sides s1, s2 being trimmed. Alternatively, the log T lies simultaneously in three successive treatment units. Hence, the log T has its leading end for example in the first saw assembly 207, in which the side slabs L1, L2 are being removed by sawing from the first balk's P1 vertical sides, the log T has its middle section in the first profiling machine 206, in which the grooves u11, u21; u21, u22 are being milled on the balk P1, and the log T has its trailing end in the first chipping canter 205, in which the log's vertical sides are being trimmed.

[0042] In a preferred embodiment of the invention, the apparatus comprises treatment units on the processing line 201 which are suitable for a further treatment of the second balk P2. The further treatment of the second balk P2 is conducted with at least treatment units as follows:

a measuring device 209a, a rotating device 209b, a second chipping canter 210, a spar profiling machine 211, and a spar saw machine assembly 212. The second balk P2 comprises two opposite trimmed sides s10, s20, which remain along the balk's sides after the side slabs L1, L2; L3, L4 have been removed. The measuring device 209a is used for checking dimensions of the second balk P2 after the removal and separation of the side slabs L1, L2 (and possibly L3, L4), and the measurement data is (most preferably stored and) handed over to the data processing unit 202 for checking the optimization relevant to dividing the balk P2 into pieces of lumber. When delivered to a further treatment, the second balk P2 is turned over by the rotating device 209 first through 90 degrees, i.e. sideways to lie on its trimmed side s10 (or s20) and on a conveyor 2011 (fig. 3h). This is followed by feeding the second balk P2 to the second chipping canter 210, which is provided with two chipping discs 210a, 210b and/or the like chipping elements. The second chipping canter 210 is used for trimming and dressing the untreated opposite sides of the turned-over second balk P2 for substantially vertical third and fourth sides s3, s4, and thereby the second balk P2 is turned into a basically four-edged spar P3 (fig. 3i). From the second chipping canter 210, the spar P3 is delivered to the spar profiling machine 211, which most preferably comprises four milling heads. The fringe area or edges of the spar's four sides are milled for appropriate grooves u8, u9, u10, u11, which are used for defining fifth and sixth side slabs L5, L6 on the vertical third and fourth sides, respectively (fig. 3j). Thereby is obtained a profiled spar P3. Preferably, the location and dimensions of the side slab L5, L6 are determined (like most preferably also the entire division of the spar P3 into pieces of lumber) most preferably in an optimized manner on the basis of data obtained from the log measuring instrument 203 and a treatment program stored in the data processing unit 202. The profiled spar is fed to the spar saw machine assembly 212 used for sawing the side slabs L5, L6 off the spar's vertical sides and, preferably, the remaining spar is also cut with the same saw machine assembly into suitable pieces of lumber (fig. 3k). The spar saw machine assembly 212 comprises e.g. a ring saw, a bandsaw or the like.

[0043] It should be noted that the above-described apparatus of the invention is presented schematically and just those process steps and treatment units which are essential from the standpoint of the invention have been described in a more detailed manner. Equipment such as deflection roll assemblies, needed for passing and possibly aligning a log, a balk and/or a spar to and for various treatment units, has not been illustrated in this context.

[0044] The invention is not limited to concern just the above-described exemplary embodiment, but a multitude of modifications are possible within the framework of an inventive concept as defined in the claims.

Claims

1. A method for working a log and dividing the same into pieces of lumber, wherein a log is fed (101) onto a processing line (201) and advanced forward through process steps as follows:

   a) a log (T) is measured (102) three-dimensionally, thereby finding out its geometrical shape;
   b) measurement data of the log (T) is stored (103), the log treatment being conducted on the basis of said measurement data;
   c) the log's (T) position is checked and the log is rolled over (104) such that a possible skewness (L) faces upwards;
   d) first two vertical sides are trimmed (105) on the log (T) at its opposite sides and thereby the log is turned into a first balk (P1) provided with first and second vertical sides (s1, s2);
   characterized in that the method further comprises
   e) milling (106) first and second grooves (u11, u21; u12, u22) in top and bottom parts of each vertical side (s1, s2) of the first balk (P1), each of said grooves having one of its groove flanks (us1, us2, us3, us4) adjacent to a vertical side of the balk, said grooves being used for defining at least first and second side slabs (L1, L2) on the trimmed sides of the balk;
   f) removing (107) the side slabs (L1, L2), most preferably by sawing, from the vertical sides of the first balk; followed by
   g) separating (108) a remaining segment of the first balk, i.e. a second balk (P2), and the removed side slabs (L1, L2) from each other and conveying the second balk to a further treatment (109).

2. A method as set forth in claim 1 or 2, **characterized in that** the step e is followed by

   e1) milling (106a) third and fourth grooves (u31, u41; u32, u42) in top and bottom parts of each vertical side (s1, s2) of the first balk (P1) alongside the first and second grooves (u11, u21; u12, u22), one of the groove flanks (us5, us6, us7, us8) of said third and fourth grooves (u31, u41; u32, u42) being adjacent to the first and second grooves, respectively, said grooves being used for defining third and fourth side slabs (L3, L4) on the trimmed sides of the balk; and wherein the steps f and g are supplemented by
   f1) removing (107a) all side slabs (L1, L2, L3, L4), most preferably by sawing, from the vertical sides of the first balk; followed by
   g1) separating (108) a remaining segment of the first balk, i.e. a second balk (P2), and all the removed side slabs (L1, L2, L3, L4) from each oth-

er, followed by conveying the second balk to a further treatment (109).

3. A method as set forth in claim 1 or 2, **characterized in that** the sequential process steps, particularly the trimming (d) of vertical sides on a log, the milling (e; e1) of grooves on a first balk, and the removal (f; f1) of side slabs by sawing from the first balk, are conducted along the processing line in such a way that a part of the log (T) is in one process step while another part thereof is in the immediately preceding process step.

4. A method as set forth in claim 1, 2 or 3, **characterized in that** the further treatment (109) for the second balk (P2) comprises at least the following steps of:

h) measuring and turning (110) the second balk (P2) over 90 degrees to lie on its trimmed side;
i) trimming (111) the untreated opposite sides of the turned-over second balk (P2) for substantially vertical third and fourth sides (s3, s4), thereby turning the second balk (P2) into a spar (P3);
j) milling (112) the marginal areas of four sides of the spar (P3) for grooves used for defining side slabs on the vertical trimmed third and fourth sides; and
k) removing the side slabs from the spar's vertical sides most preferably by sawing and, preferably in the same step, sawing (113) the remaining spar into suitable pieces of lumber.

5. An apparatus for working a log and dividing the same into pieces of lumber, said apparatus comprising a processing line (201), along which a log (T) is advanced forward on one or more conveyors (2011) and treated in treatment units included in the processing line principally by means of treatment programs stored in an appropriate data processing unit (202), said treatment units including:

a) a log measuring instrument (203, which is to be used for measuring the log (T) three-dimensionally and which measuring results are to be stored in a memory unit (2021) for optimizing the log treatment in the data processing unit (202;
b) a log rotating device (204), by means of which the log is to be rolled over for bringing a possible skewness (L) to face upward;
c) a first chipping canter (205) provided with two chipping discs (205a, 205b) and/or the like chipping elements, which chipping canter is to be used for trimming first two vertical sides, a first side and a second side (s1, s2), on the log at its opposite sides, thus turning the log into a first balk (1);
characterized in that the apparatus further comprises:
d) a first profiling machine (206), which is to be used for milling first and second grooves (u11, u21; u12, u22) in top and bottom parts of each vertical side (s1, s2) of the first balk (P1) in such a way that each groove (u11, u21; u12, u22) has one of its groove flanks (us1, us2, us3, us4) adjacent to a vertical side of the balk, said grooves being used for defining at least first and second side slabs (L1, L2) on the trimmed sides of the balk;
e) a first saw assembly (207), which is to be used for cutting the side slabs (L1, L2) off the vertical sides (s1, s2) of the first balk (P1) by sawing; and
f) a separating unit (208), which is to be used for separating a remaining segment of the first balk, i.e. a second balk (P2), and the removed side slabs (L1, L2) from each other, followed by advancing the balk to a further treatment.

6. An apparatus as set forth in claim 5, **characterized in that** the apparatus further comprises:

e1) a second profiling machine (2061), which is to be used for milling third and fourth grooves (u31, u41; u32, u42) in top and bottom parts of each vertical side (s1, s2) of the first balk (P1) alongside the first and second grooves (u11, u21; u21, u22), one of the groove flanks (us5, us6, us7, us8) of said third and fourth grooves (u31, u41; u32, u42) being adjacent to the first and second grooves (u11, u21; u12, u22), respectively, said grooves (u31, u41; u32, u42) being used for defining third and fourth side slabs (L3, L4) on the trimmed sides of the balk; and
f1) a second saw assembly (2071), which is used for cutting the third and fourth side slabs (L3, L4) off the vertical sides of the first balk by sawing.

7. An apparatus as set forth in claim 5 or 6, **characterized in that** the apparatus has at least some of its sequential treatment units, particularly the first chipping canter (205), the first profiling machine (206), and the first saw machine (207), or, alternatively, said treatment units and the second profiling machine (2061) and the saw machine assembly (2071) relevant thereto, disposed on the processing line (201) close to each other in such a way that at least two successive log treatment units are provided within a range (A) whose length does not exceed that of the log (T).

8. An apparatus as set forth in any of the preceding claims 5-7, **characterized in that** the further treat-

ment of the second balk (P2) is conducted at least with treatment units as follows:

h) a measuring device (209a), by which the second balk (P2) is measured;
i) a rotating device (209b), by which the second balk (P2) is turned over 90 degrees to lie on its trimmed side;
j) a second chipping canter (210) provided with two chipping discs (210a, 210b) and/or the like chipping elements, said chipping canter being used for trimming the untreated opposite sides of the turned-over second balk (P2) for substantially vertical third and fourth sides (s3, s4), thereby turning the second balk (P2) into a spar (P3);
k) a spar profiling machine (211) used for milling (111) appropriate grooves (u5, u6, u7, u8) in the marginal areas of four sides of the spar (P3), said grooves being used for defining side slabs (L5, L6) on the vertical third and fourth sides; and
l) a spar saw machine assembly (212) used for sawing the side slabs (L5, L6) off the spar's vertical sides (s3, s4), and preferably also for cutting (112) the remaining spar into suitable pieces (P) of lumber.

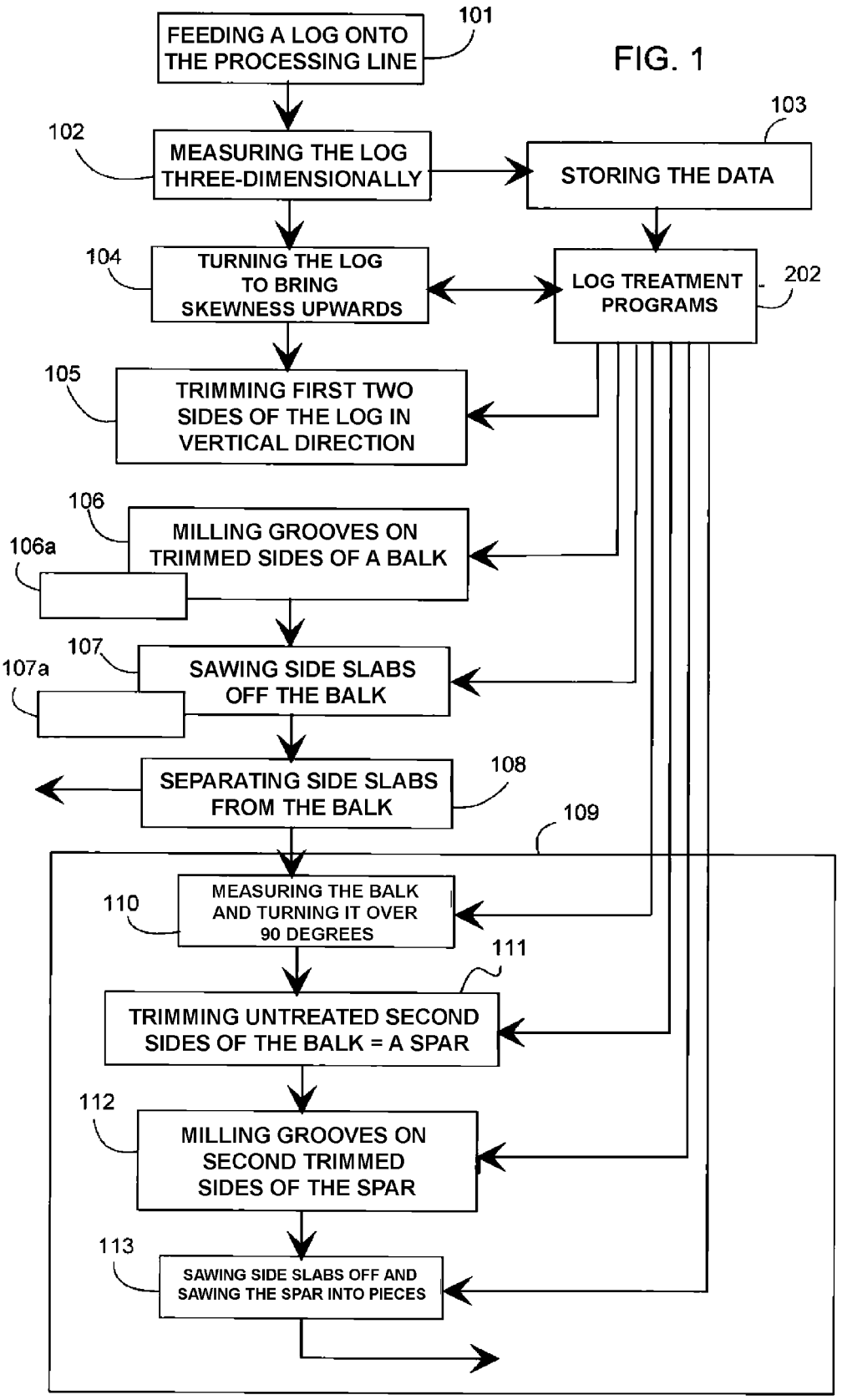
FEEDING A LOG ONTO THE PROCESSING LINE
101
MEASURING THE LOG THREE-DIMENSIONALLY
102
STORING THE DATA
103
TURNING THE LOG TO BRING SKEWNESS UPWARDS
104
LOG TREATMENT PROGRAMS
202
TRIMMING FIRST TWO SIDES OF THE LOG IN VERTICAL DIRECTION
105
MILLING GROOVES ON TRIMMED SIDES OF A BALK
106
106a
SAWING SIDE SLABS OFF THE BALK
107
107a
SEPARATING SIDE SLABS FROM THE BALK
108
109
MEASURING THE BALK AND TURNING IT OVER 90 DEGREES
110
TRIMMING UNTREATED SECOND SIDES OF THE BALK = A SPAR
111
MILLING GROOVES ON SECOND TRIMMED SIDES OF THE SPAR
112
SAWING SIDE SLABS OFF AND SAWING THE SPAR INTO PIECES
113

FIG. 1

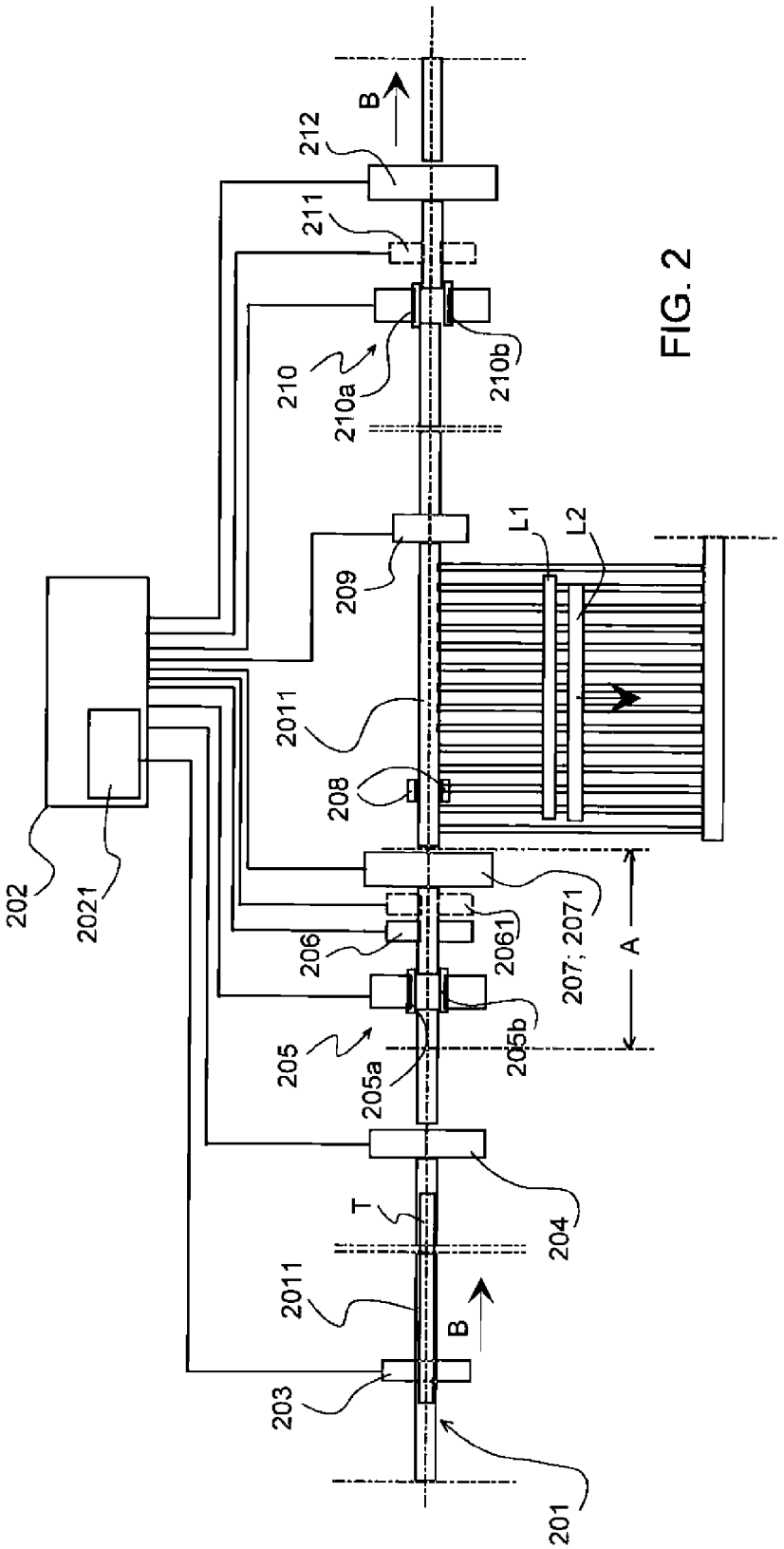
B
212
211
210
210a
210b
209
L1
L2
2011
208
202
2021
206
2061
207; 2071
A
205
205a
205b
T
204
2011
B
203
201

FIG. 2

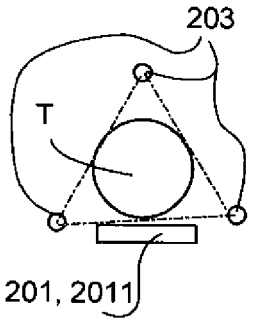

FIG. 3a

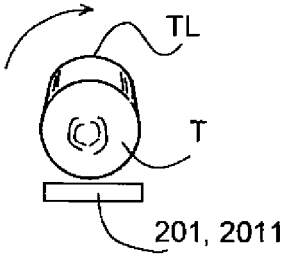

FIG. 3b

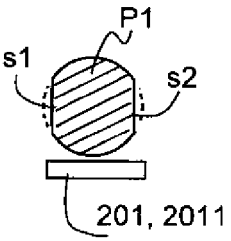

FIG. 3c

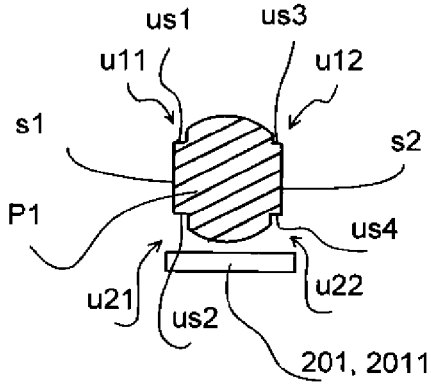

FIG. 3d

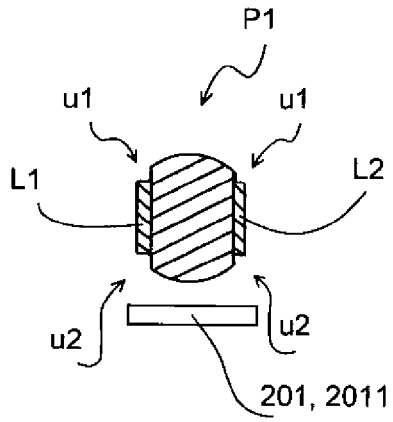

FIG. 3e

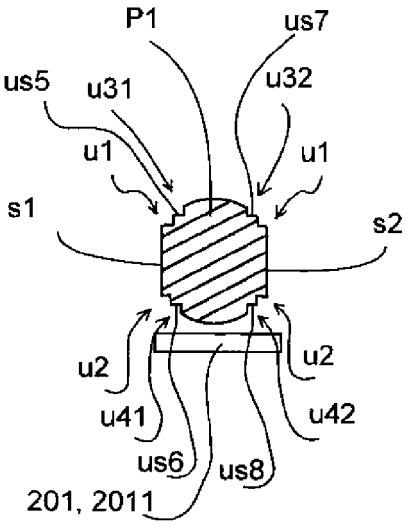

FIG. 3f

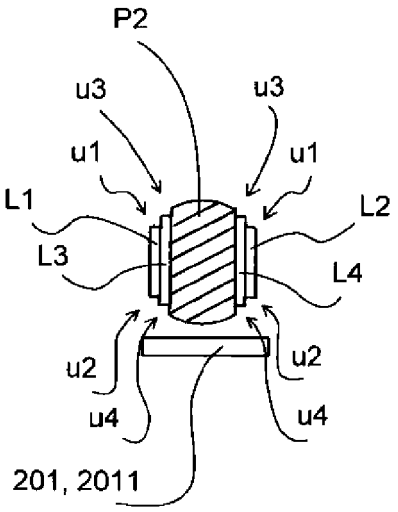

FIG. 3g

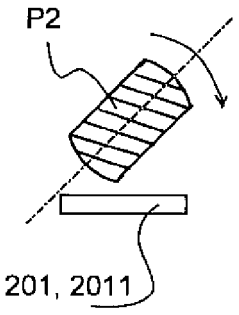

FIG. 3h

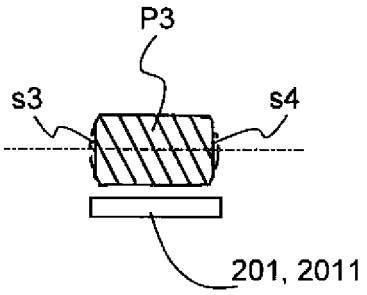

FIG. 3i

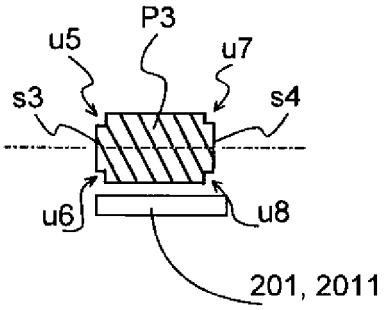

FIG. 3j

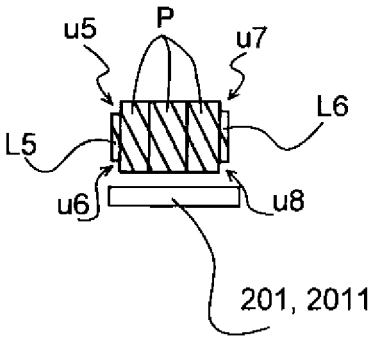

FIG. 3k

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 2961

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	26 May 2011	Rijks, Mark

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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26-05-2011

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