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(54) Title: METHOD FOR MACHINING A PIECE AND A CHIPPING TOOL

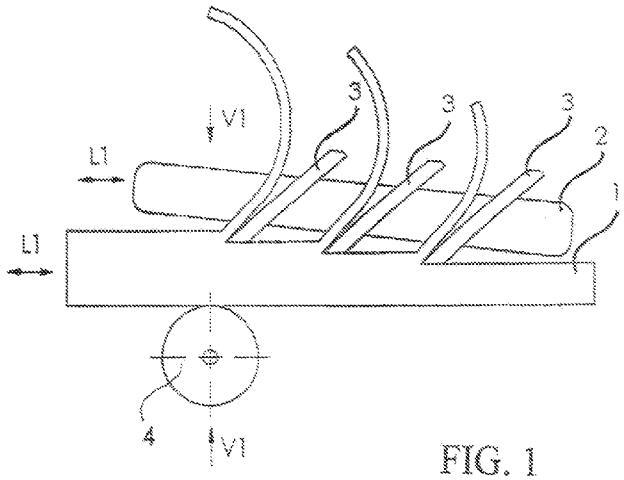


FIG. 1

(57) Abstract: The object of the invention is a method for machining a piece by a multiple blade tool, in which method, the machinable piece (1) and the multiple blade tool (2) are pressed against each other, the machinable piece or the tool or both of them are moved in relation to each other such that they make a linear, rotating or curved mutual feeding motion and several chips are machined from the piece (1) simultaneously. Furthermore the object of the invention is a chipping tool which includes a body (2) and chipping blades (3) fastened to it, of which chipping blades (3) there are several located one after the other in the direction of a feeding motion LI. In the method the length of the mutual feeding motion of the machinable piece (1) and the tool (2) are adjusted such that the machined chips remain fast at their one end on the machinable piece (1). The chipping tool includes control elements for controlling the length of the mutual motion of the machinable piece (1) and the tool (2) in order for the machinable chips to remain fast at their one end on the machinable piece (1).

METHOD FOR MACHINING A PIECE AND A CHIPPING TOOL

The invention relates to a method for machining a piece by a multiple blade tool according to the preamble of claim 1. The invention also relates to a chipping tool according to the first device claim.

In recent years, there has been more and more consideration of flue gas emissions of small fireplaces and the regulations on their use are more restricted. Uncontrolled and high flue gas emissions are harmful to the environment as they deteriorate the quality of breathing air. They also incur financial losses to the users of fireplaces due to their diminished energy efficiency. From the viewpoint of flue gas emissions, the most critical moment is usually the firing phase of a small fireplace.

According to studies, wood to be burned in a small fireplace should be piled in the fire chamber most preferably horizontally and an adequate quantity of suitable kindlings should be set on top of the wood pile. The kindlings should be of good quality, dry and clean. Commonly used kindlings are wooden chips and splinters, birch bark, paper, board and special lighter pieces and fluids. Many fireplace manufacturers do not recommend the burning of coated paper and board packages or some plastic grades in their fireplaces and particularly their use as kindlings. In most cases, it would be the safest to use only clean wood or its bark as the kindlings and fuel in a fireplace. The wooden kindlings should be thin enough splinters or chips and they should be set suitably densely. Wooden chips carved of a piece of wood and left fast at their one end represent such a kindling type.

Most preferably, the wood batch to be burned should be fired from its top part, whereby the wood material gasifiable from the heat of the kindlings can be burned more accurately. If the wood batch to be burned is fired from its bottom part, the flames of the kindlings often heat up too large a quantity of the top wood batch, whereby there is not enough time for most of the gasified wood to burn in the fire chamber. The incombustible gas mixture exits the fire chamber as such to the chimney stack and is usually visible as dark smoke which also smells strongly. This incomplete burning of flue gas mixture causes, inter alia, increased carbon monoxide (CO), hydrocarbon (HC) and fine particle emissions and creates also other compounds detrimental to health.

A disadvantage in the recently known carving methods of wooden kindling chips by a knife, an axe or some other hand tool is the laboriousness and slowness of manual labour particularly when manufacturing larger kindling batches. Usually, the

amount of kindling chips carved or cut by hand is only the quantity required for firing one fireplace. Carving by hand is not an economic way to manufacture kindlings in larger quantities in the scale of serial production. Carving with a knife requires accurateness and good knife handling skills of the knife user. The knife must be suitable for carving and sufficiently sharp. When carving kindling chips by hand, the piece of wood must be of suitable shape and size. Of too thick wood, it is difficult to carve thin and long kindling chips. Too thin a piece of wood again breaks easily when carving with a knife. The wood fibre structure must be sufficiently straight and branchless in order to be able to work long and thin chips by a knife. In carving performed by hand, there is an accident risk of a possible injury to the carver by a slipping knife. The blade of the knife can also easily be damaged if the knife slips away from the wood piece being supported e.g. against a hard floor or a fireplace plane. An uncontrolled slip of the knife can often cause the splitting of the piece of wood particularly when hand-carving the last chips. When carving kindlings from chopped firewood by an axe, the chips being worked are often too thick to act as kindling chips as such. Such carving work also requires good axe handling skills and carefulness of the axe user due to the risk of accidents.

The object of the invention is to introduce a method for machining a piece and a chipping tool by means of which the above disadvantages are eliminated. A particular object of the invention is to disclose a method for machining a piece and a chipping tool which enable the chipping of a machinable piece effectively and the industrial production of a kindling surface of firewood. Furthermore, an object of the invention is to introduce a method and a chipping tool which can treat the surface of firewood such that it intensifies the firing characteristics of firewood. An additional object of the invention is to introduce a method and a chipping tool which can combine chopped firewood used as fuel and kindling chips in the same piece cost-effectively and with quality in the scale of serial production.

The method and the chipping tool according to the invention are characterised by what is presented in the claims.

The inventive idea behind the method and the chipping tool according to the invention is that a piece is machined by a tool which includes several chipping blades one after the other in the direction of the machining motion. Furthermore, the inventive idea is that the machinable piece and the chipping blades are pressed against each other by sufficient pressing force and either the piece or the tool or both are moved in relation to each other to provide a mutual feeding motion. The type of this feeding motion can be linear, rotating, curved or their combination. In

the method, the length of the mutual feeding motion of the machinable piece and the tool is adjusted such that the machined chips remain fast at their one end on the machinable piece.

The feeding motion between the piece and the tool is controllable for a desired length. The number of chipping blades is typically 2–20 pieces. Typically, the thickness of chips is selectable between 0.01–10 mm by adjusting the chipping height of the blades. The width of the chips can vary between 1–100 mm. The mutual distance of the chips from each other is selectable in the range of 1–50 mm by adjusting the mutual position of the blades of the tool. The cross-sectional shape of the chips is selectable between e.g. an even rectangle, a wedge-shaped polygon, a grooved profile etc. by modifying the shape of the blades and by adjusting their position.

The method and the chipping tool according to the invention provide considerable advantages compared with recently known (traditional) manufacturing methods of firewood (kindlings) and chipping tools. The method according to the invention enables the effective serial production of thin material chips e.g. for improving the firing characteristics of firewood. The tool according to the invention enables machining several (2–20 pieces) chips, the common length of which is typically 0.1–10 m, from a piece by one feeding motion.

The firing characteristics of firewood machined by the method and the tool according to the invention are more improved than those of traditionally manufactured firewood. The invented method enables the combining of kindling chips and wood material functioning as fuel into one piece in the scale of serial production. When using firewood machined such, there is always a required amount of kindlings available combined with burnable chopped firewood. It is easier to fire pieces of firewood set in the fire chamber e.g. from the top because these machined pieces of chopped firewood provided with kindlings can be piled up in a suitable arrangement effortlessly. The machined kindling chips can replace traditional kindlings burning with more impurities, such as e.g. birch bark. Particularly cleanly firing firewood is provided by machining kindling chips e.g. to bark-free chopped firewood split from the interior part of the trunk. When wishing to intensify the drying of firewood, the kindling chips can be machined by the invented method also on the barked outer surface of the wood. Then, opening the wood bark and the surfaces of the machined chips increase the water evaporation area inside the wood substantially.

Next, the invention will be described in more detail with reference to the accompanying drawings in which

Fig. 1 shows the operating principle of a chipping method,

Fig. 2 shows the structural principle of a multiple blade chipping tool according to the invention and

Fig. 3 shows the structural principle of a multiple blade chipping tool according to the invention in which the chipping tool is combined with a splitting blade.

In the method according to the invention in accordance with Fig. 1, a machinable piece 1 and chipping blades 3 are pressed in the first work phase against each other by sufficient pressing force V1. The pressing force V1 can be conveyed to the piece 1 e.g. by means of a roll 4, a press, a roller or some other such element. In the next phase, either the machinable piece 1, the chipping blades 3 or both are moved in relation to each other to provide a mutual feeding motion L1. The feeding motion can be one-directional or reciprocating. The shape of the feeding motion can also be linear or rotating or freely curved in their combination. If required, adjusting the length of the feeding motion can force the chips to remain fast at their one end on the machinable piece.

The chipping tool in accordance with Fig. 2 includes a body 2 in which are fastened several chipping blades 3 being at an oblique angle in relation to the body, one after the other at a distance from each other in the direction of the feeding motion L1. Typically, the number of chipping blades 3 can be 2–20 pieces or more. The mutual distance between the blades is typically 1–50 mm. The distance can be changed and it can also vary between different blades 3. The chipping depth of the blades is adjustable by transferring L2 or rotating L3 the position of the blades 3 in relation to the machinable piece. The shape of created chips can be adjusted by rotating L3 the blades 3.

In the work phase in accordance with Fig. 1, the body 2 is set in an oblique position in relation to the machinable piece 1, whereby the blades 3 extend at different points in relation to the machinable piece. In machining, the first blade cuts the first chip, the second blade below it the second chip etc. It is also possible to use a tool in which the blades are fastened to the body of the tool such that they extent at a different distance from the surface of the body obliquely downwards.

In the tool in accordance with Fig. 3, the chipping blades 3 are fastened into connection with a splitting blade 5. The chipping blades 3 are located one after the other after the tip of the splitting blade in the direction of the feeding motion. The body 2 of the chipping blades and the splitting blade 5 can be combined into one piece. There can be one series of chipping blades on one side of the splitting blade or several series on both sides of the splitting blade 5.

The chipping method according to the invention can be also utilised in other applications than in the manufacturing processes of firewood. This machining method enables increasing the area of any quite fixed piece manufactured of chippable material by leaving the machined chips fast at their one end on the machinable piece. Applications which can utilise such increase in the area are e.g. various types of heat exchange elements in heat exchangers, coolers or heaters. Also various types of reactors, catalysts and mixers can utilise the increase in the reaction area of the piece by the here-described chipping method. In addition to different wood species, the material of the chippable piece can be wood, plastic or ceramic composite, plastic, rubber, various metals, plant and foodstuff bulk or other chippable materials. The cross-sectional shape of the machinable piece can be rectangular, quadratic, laminar, tubular, circular, polygonal or free-shaped. The structure of the piece can be closed, hollow or cellular. The length of the piece can be typically at the shortest about 10 mm and at the longest a several hundreds of metres long seamless wire, band or other profile.

The chipping method and the chipping tool according to the invention can be utilised in chipping devices or machines designed and built especially for them. However, they can also be utilised e.g. in existing splitting and manufacturing machines of firewood as a further processing method of chopped firewood and as attachments of splitting blades.

The invention is not limited to the described advantageous embodiments, but it can vary within the scope of the inventive idea presented in the claims.

CLAIMS

1. A method for machining a piece by a multiple blade tool, in which method, the machinable piece (1) and the multiple blade tool (2) are pressed against each other, the machinable piece or the tool or both of them are moved in relation to each other such that they make a linear, rotating or curved mutual feeding motion and several chips are machined from the piece (1) simultaneously, *characterised* by adjusting the length of the mutual feeding motion of the machinable piece (1) and the tool (2) such that the machined chips remain fast at their one end on the machinable piece (1).

2. A method according to claim 1, *characterised* by controlling the mutual position of blades (3) of the tool (2) for adjusting the mutual distance of the chips.

3. A chipping tool which includes a body (2) and chipping blades (3) fastened to it, of which chipping blades (3) there are several located one after the other in the direction of a feeding motion L1, *characterised* in that the device includes control elements for controlling the length of the mutual motion of the machinable piece (1) and the tool (2) in order for the machinable chips to remain fast at their one end on the machinable piece (1).

4. A chipping tool according to claim 3 which is attached into connection with a splitting blade (5), *characterised* in that several chipping blades (3) are fastened one after the other in the direction of the feeding motion to the splitting blade (5) after its splitting tip.

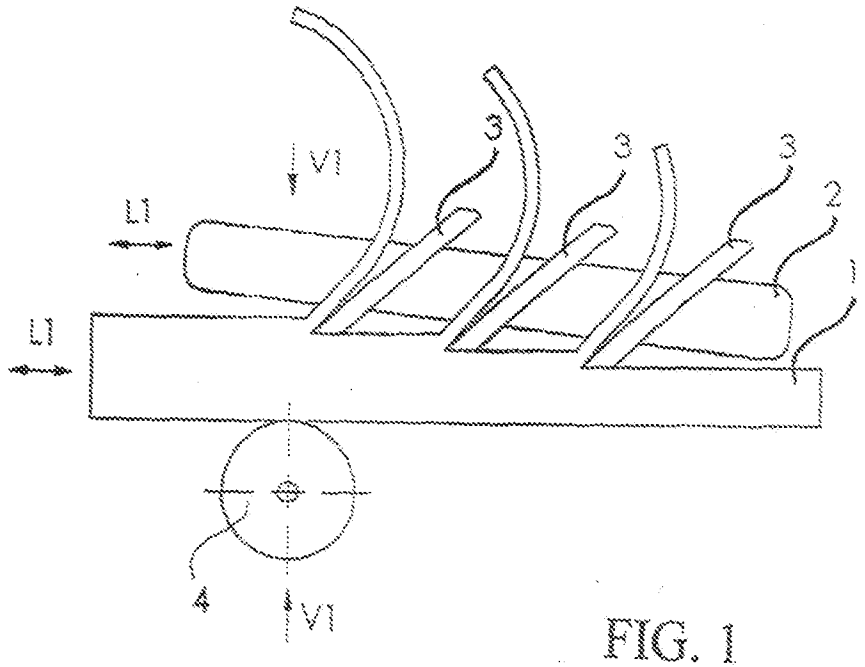
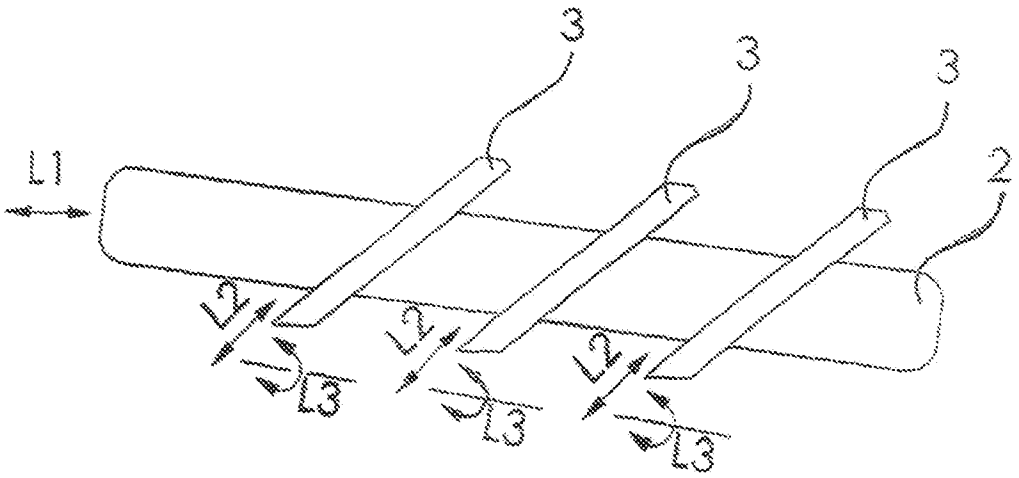


FIG. 1

FIG. 2



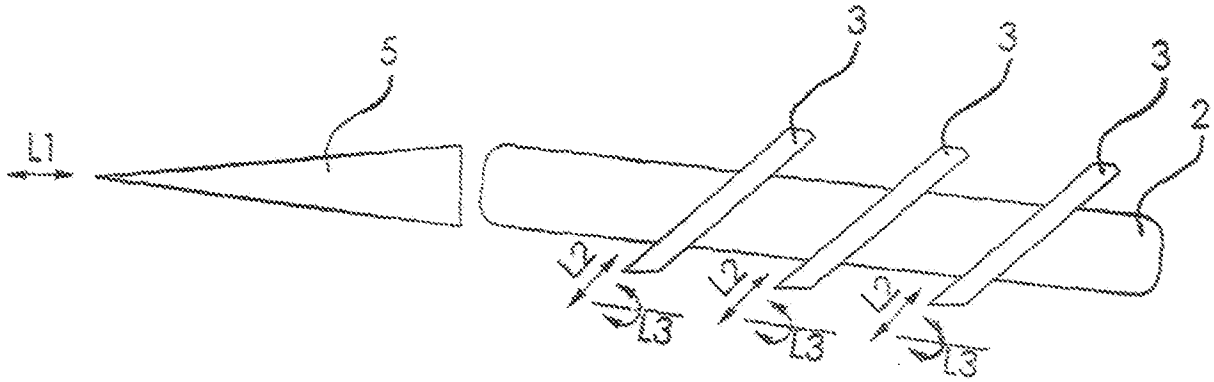


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
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A. **CLASSIFICATION OF SUBJECT MATTER**

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B27L, B26D, G05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)

EPO-Internal, WPIAP

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4220185 A (TRABEN JOSEF [DE]) 02 September 1980 (02.09.1980) column 1, row 54–column 2, row 4; column 2, row 44–column 3, row 14; column 3, rows 30–40; claim 1; figs. 1–6	1–3
Y	WO 2008036028 A1 (OESTLING MIKAEL [SE]) 27 March 2008 (27.03.2008) page 7, rows 14–22; claim 10; figs. 1–4	1–3
A	DE 20302874 U1 (VIVOSET OY JYVAESKYLAE [FI]) 18 June 2003 (18.06.2003) page 7, rows 18–21 and 25–28; fig. 4	1, 3
A	US 5983967 A (GROSS HERMANN [DE] et al.) 16 November 1999 (16.11.1999) whole publication	1–4

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1724075 A2 (GODOY VARO JOSE LUIS [ES]) 22 November 2006 (22.11.2006) whole publication	1–4

INTERNATIONAL SEARCH REPORT
Information on Patent Family Members

International application No.
PCT/FI2016/050382

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 4220185 A	02/09/1980	AR 220136 A1	15/10/1980
		AT A318678 A	15/10/1979
		AT 356878 B	27/05/1980
		AU 521227 B2	25/03/1982
		AU 3612078 A	22/11/1979
		BR 7803288 A	24/07/1979
		CA 1085270 A	09/09/1980
		CS 205120 B2	30/04/1981
		DE 2751238 B1	30/11/1978
		DE 2751238 C2	26/07/1979
		ES 470886 A2	01/02/1979
		FI 781371 A	17/05/1979
		FI 68551 B	28/06/1985
		FI 68551 C	10/10/1985
		FR 2409140 A2	15/06/1979
		FR 2409140 B2	14/01/1983
		GB 1573486 A	28/08/1980
		GR 58236 B	31/08/1977
		GR 64533 B7	10/04/1980
		HU 175782 B	28/10/1980
		IT 7823278 D0	11/05/1978
		IT 1113080 B	20/01/1986
		JP S5473397 A	12/06/1979
		NL 7805425 A	18/05/1979
		NL 169280 B	01/02/1982
		NL 169280 C	01/07/1982
		NO 781558 A	18/05/1979
		NO 143198 B	22/09/1980
		NO 143198 C	02/01/1981
		NZ 187234 A	31/05/1982
		SE 7805111 A	17/05/1979
		SE 435465 B	01/10/1984
		YU 105978 A	30/06/1982
		YU 40516 B	28/02/1986
		ZA 7802749 B	30/05/1979
WO 2008036028 A1	27/03/2008	SE 0601981 A	23/03/2008
		SE 531386 C2	17/03/2009
DE 20302874 U1	18/06/2003	None	
US 5983967 A	16/11/1999	AT 173191 T	15/11/1998
		CA 2218066 A1	17/10/1996

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
		CA 2218066 C	24/07/2001
		DE 19513699 C1	25/04/1996
		DE 59600814 D1	17/12/1998
		DK 0820369 T3	26/07/1999
		EP 0820369 A1	28/01/1998
		EP 0820369 B1	11/11/1998
		NO 974714 D0	10/10/1997
		NO 974714 A	13/10/1997
		WO 9632234 A1	17/10/1996
EP 1724075 A2	22/11/2006	ES 2229953 A1	16/04/2005
		ES 2229953 B1	16/01/2006
		ES 2229954 A1	16/04/2005
		ES 2229954 B1	16/12/2005
		ES 2279659 A1	16/08/2007
		ES 2279659 B1	01/08/2008
		ES 2296433 A1	16/04/2008
		ES 2296433 B1	01/03/2009

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CLASSIFICATION OF SUBJECT MATTER

IPC
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C10L 11/06 (2006.01)
C10L 5/36 (2006.01)