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

(11) EP 1 332 833 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.08.2003 Bulletin 2003/32

(51) Int Cl.[7]: **B24B 7/28**, B24B 9/18, B24B 7/06, B24B 7/12

(21) Application number: **02028220.8**

(22) Date of filing: **16.12.2002**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

(30) Priority: **10.01.2002 IT MI20020033**

(71) Applicant: **Angeloni, Marino**
25013 Carpenedolo BS (IT)

(72) Inventor: **Angeloni, Marino**
25013 Carpenedolo BS (IT)

(74) Representative:
Giambrocono, Alfonso, Dr. Ing. et al
Ing. A. Giambrocono & C. S.r.l.
Via Rosolino Pilo 19/B
20129 Milano (IT)

(54) Machine for sanding profiled flat articles

(57) The method enables the various parts of the surface of flat wooden articles presenting recessed or relief shapings to be sanded in successive stages. A machine for implementing the method is also described.

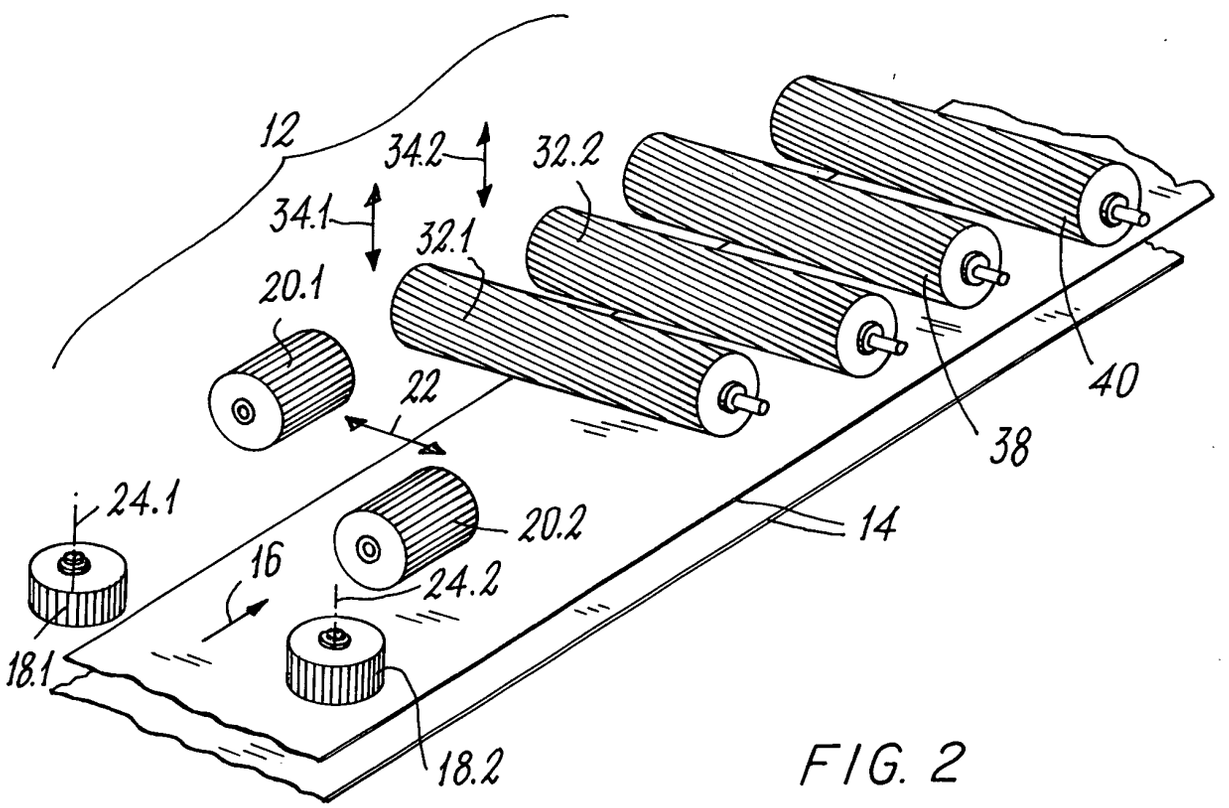

FIG. 2

EP 1 332 833 A1

Description

[0001] The present invention relates to a method for sanding flat wooden articles presenting recessed or relief shapings, including framed articles. The invention also relates to a machine for implementing the method.

[0002] Articles of the aforesaid type include for example the door panels of wooden kitchen furniture units, wooden window frames, and doors themselves in particular.

[0003] Known sanding machines comprise:

- a horizontal conveyor belt on which the articles to be sanded transit in a so-called advancement direction;
- a sanding unit overlying the conveyor belt and comprising at least one cylindrical sanding means of horizontal axis of rotation extending transversely to the advancement direction, each sanding means of said unit being of adjustable elevation; and
- another sanding unit overlying the conveyor belt and comprising at least one cylindrical sanding means of horizontal axis extending substantially in the advancement direction, each sanding means of the second unit having a length at least equal to the width of the article to be sanded, it being of adjustable elevation and being movable horizontally in the two senses in a direction substantially transverse to the advancement direction.

[0004] As is known to the expert of the art, the aforesaid cylindrical sanding means consist essentially of a so-called cylindrical "brush" rotatable about its own axis, in which the filiform elements of the brush extend substantially radially from a coaxial shaft and are grouped into rows normally parallel to the shaft axis and angularly equidistant. Sheets of abrasive cloth are interposed between the rows of filiform elements and have their far edge projecting beyond the free end of the filiform elements, the near edge of these sheets being fixed to the shaft of the cylindrical sanding element. With the exception of their most inner part, which enables them to be fixed to the relative shaft, each sheet of abrasive cloth is cut into strips of equal width (for example 5 mm) extending outwards, this enabling the abrasive cloth, by virtue of the presence of the filiform elements, to follow the shapings of the article to be sanded.

[0005] Improved sanding means of this type are described in Italian patent application MI96A 001313, of which the inventor of the present application is a proprietor and inventor.

[0006] As is well known to the expert of the art, precisely because of the fact that flat articles to be sanded present shapings, the aforedescribed known sanding machines do not give satisfactory results, mainly because the sanding means attack the edging corners present on the article, which can be spoiled by them. Notwithstanding this fairly serious drawback, these machines are widely used, there being nothing better on the market, except obviously hand sanding which however, for cost reasons, could not possibly be used now except for sanding only the edges of the article (as in effect does happen), given that these are not sanded by said machine and in any event constitute a fairly small part of the total surface of the article to be sanded.

[0007] Before proceeding, for reasons of clarity the terminology relative to an article to be sanded will be defined with reference to Figure 1. This shows an isometric view of a generic wooden rectangular article 10 (for example a door panel of a furniture unit or an actual door).

[0008] As can be seen from this figure, the article 10 comprises two parallel lateral uprights 10.1 and 10.2 and two end crosspieces 10.3 and 10.4. It should be noted that if the article is fairly long, one or more intermediate crosspieces can also be present (not provided for simplicity in the example of Figure 1).

[0009] The four elements 10.1, 10.2, 10.3 and 10.4 of the article 10 essentially form a peripheral frame bounding its inner part. This inner part comprises a depressed region 10.5, also in the form of a frame, adjacent to said outer frame, and a rectangular raised central region 10.6 having in this specific example an elevation equal (but could also be different) to that of the outer frame 10.1, 10.2, 10.3 and 10.4. It should be noted that the longitudinal direction of the article 10 (in which the uprights 10.1 and 10.2 extend) coincides with its direction of advancement when carried by the conveyor belt of the sanding machine, so that the crosspieces 10.3 and 10.4 extend in a direction perpendicular to the advancement direction.

[0010] Having said this, the object of the present invention is to obviate the aforesaid drawbacks of known sanding machines, by providing a method for sanding wooden articles of the aforestated type, and a machine for their sanding by such a method.

[0011] The aforesaid object is attained by a sanding method according to the present invention, comprising the following stages:

a) sanding the crosspieces and those inner surfaces of the article having an elevation the same as or only slightly different from that of the crosspieces, by means of a first sanding unit comprising first cylindrical sanding means overlying the article which is to be sanded and which transits in a horizontal advancement direction, the sanding means of the first unit rotating about their horizontal axis which is inclined to the direction of advancement by an angle of 0-30 degrees, the first sanding means moving horizontally in a direction perpendicular to the advancement direction, so as to involve the whole article, within a range less than the width of the article;
b) sanding the recessed inner surfaces of the article and the uprights by a second sanding unit comprising second cylindrical sanding means overlying the

article which is to be sanded and which transits in the advancement direction, the second sanding means having a length at least equal to the width of the article and rotating about their own axis which is horizontal and perpendicular to the advancement direction, the second sanding means moving vertically in the two senses so that they can be raised to prevent their interference with the transverse corners of the article;

c) sanding the remaining surfaces of the article, including any reliefs having an elevation slightly greater than that of the crosspieces and uprights, by means of a third sanding unit comprising third cylindrical sanding means of length at least equal to the width of the article and overlying this latter, to rotate at a selectively variable speed about their own axis which is horizontal and forms an angle of 90-70 degrees to the advancement direction, the rotational speed of these sanding means being reduced in correspondence with the reliefs to prevent their spoiling.

To obtain an even better finish for the article, after stage c) the following further stage is provided, consisting of:

d) finishing sanding effected by a fourth sanding unit comprising fourth sanding means analogous to the third sanding means used in stage c), but softer (i. e. with more flexible filiform elements and with an abrasive cloth of finer grain).

The aforedescribed sanding method enables a sanding quality to be obtained which known sanding machines are totally unable to provide.

It should be noted that it is not indispensable that stage a) precedes stage b), as the temporal order of the two stages is not critical.

To avoid having to manually sand the longitudinal edge of the article, the method of the invention conveniently comprises a further stage consisting of:

e) sanding those edges of the article parallel to the advancement direction by means of a fifth sanding unit comprising at least one pair of fifth cylindrical sanding means, each fifth sanding means of each pair lying to one side of the article which transits in the advancement direction so as to interfere with a longitudinal edge of this latter, the two sanding means of each pair having their axis of rotation contained in a vertical plane perpendicular to the advancement direction and symmetrically forming with the vertical an angle which can be varied between 0 and 30 degrees.

[0012] Preferably, in addition to the rotational speed of the third sanding means, the rotational speed of all the other sanding means can also be varied within determined limits, but (in contrast to said third means) maintained constant during the machining of one and the same article, such as to be able to adjust the rotational speed on the basis of the particular typology and/or type of wood of the article to be sanded.

[0013] The invention also relates to a sanding machine for implementing the aforedescribed method. This machine comprises:

- a conveyor device for causing the articles undergoing sanding to transit horizontally, in succession, in an advancement direction, in correspondence with a series of sanding units;
- a first sanding unit comprising first cylindrical sanding means overlying the article transiting on the conveyor device in a determined advancement direction, the first sanding means being able to rotate about their own axis which is disposed horizontally and forms with the advancement direction an angle of 0-25 degrees, the first sanding means being movable horizontally in a direction perpendicular to the advancement direction, so as to involve the entire article, within a range less than the width of the article;
- a second sanding unit comprising second cylindrical sanding means overlying the article transiting on the conveyor device, the second sanding means having a length at least equal to the width of the article and being able to rotate about their own axis which is horizontal and perpendicular to the advancement direction, and being movable vertically so that they can be raised to prevent their interference with the transverse corners of the article;
- a third sanding unit comprising third cylindrical sanding means of length at least equal to the width of the article and overlying this latter transiting on the conveyor device, the third sanding means being able to rotate about their own axis which is horizontal and forms an angle of 90-70 degrees to the advancement direction, there also being provided means for selectively varying the rotational speed of the third sanding means.

[0014] To obtain an even better finish for the article, the machine described above in terms of its essential characteristics can comprise fourth sanding unit comprising fourth cylindrical sanding means analogous to the third sanding means, but softer.

[0015] The machine can also be provided with a fifth sanding unit comprising at least one pair of fifth cylindrical sanding means, each fifth sanding means of each pair lying to one side of the transiting article so as to interfere with a longitudinal edge of this latter, the two sanding means of each pair having their axis of rotation contained in a vertical plane perpendicular to the advancement direction and symmetrically forming with the vertical an angle which can be varied between 0 and 30 degrees.

[0016] As already stated with reference to the method of the invention, in addition to providing means for varying the rotational speed of the third sanding means of

the machine, means can be conveniently provided for also varying, within determined limits, the rotational speed of all the other sanding means, to enable their rotational speed to be adjusted on the basis of the particular typology and/or type of wood of the article to be sanded.

[0017] The invention will be more apparent from the ensuing description of one embodiment of a sanding machine according to the invention, which implements the method of the invention. In this description reference is made to the accompanying figures from 2 to 6, in which:

Figure 2 is a schematic perspective view of a machine according to the present invention;
Figure 3 is a schematic perspective view showing how the fifth sanding means operate;
Figure 4 is a schematic perspective view showing how the first sanding means operate;
Figure 5 is a schematic perspective view showing how the second sanding means operate;
Figure 6 is a vertical longitudinal section therethrough on the line 6-6 of Figure 5;
Figure 7 is a schematic perspective view showing how the third and fourth sanding means operate.

[0018] As can be seen from Figure 2, the machine for sanding articles of the initially stated type (for example the article 10 of Figure 1) is indicated overall by 12. The machine 12 comprises a conveyor means, consisting in the specific illustrated example of a conveyor belt (but could also be another type of conveyor means, for example a roller table). The two branches 14 of the conveyor means are shown only partially in Figure 2 for simplicity. The articles to be sanded (not shown in Figure 2 for simplicity) are rested on the upper branch in succession and advance together with the upper branch in the direction of the arrow 16, which hence indicates the direction of advancement of the articles 10. Consequently, in the specific example illustrated in Figure 2, the article, which advances in the direction of the arrow 16, firstly encounters that previously defined as the fifth sanding unit, which in this case comprises a single pair of fifth cylindrical sanding means, indicated in Figure 2 by 18.1 and 18.2 (also see Figure 3). As already stated, these latter have their rotational axes 24.1 and 24.2 contained in a vertical plane perpendicular to the advancement direction 16 and inclinable to the vertical in this plane by an angle between 0 and 30 degrees (as indicated by the arrows 26.1 and 26.2 of Figure 3). This can be useful if the longitudinal edges of the article are not vertical or are profiled, so as to obtain the best sanding result. The article passes between the pair of fifth sanding means 18.1 and 18.2, each interfering with one of the two longitudinal sides of the article 10. The distance between the two fifth sanding means 18.1 and 18.2 is previously adjusted such that once put into rotation, they graze the respective longitudinal edges of the article 10. In this respect it can be seen from Figure 3 that the machine 12 comprises reference guides 28.1 and 28.2 which enable the pair of fifth sanding means 18.1 and 18.2 to be exactly positioned on the basis of the width of the article 10. The rotational speed of the fifth sanding means 18.1 and 18.2 can be varied by an inverter and relative potentiometer provided on a control panel (not shown for simplicity) of the machine 12.

[0019] It is however important to note that the fifth sanding means 18.1 and 18.2 could be dispensed with (in which case the longitudinal edges of the article will be sanded manually, as happens for the transverse edges). The fifth means can also be located within the machine 12 in a position different from that shown in Figure 2.

[0020] Proceeding in its advancement along the machine 12, the article 10 encounters that previously defined as the first sanding unit, comprising in this specific example two first cylindrical sanding means, indicated by 20.1 and 20.2 (Figures 2 and 4), the rotational axes of which are horizontal and inclined to the advancement direction 16 by an angle which can vary between 0 and 30 degrees. The purpose of this is to obtain, on the basis of the specific article to be sanded, a softer impact against any reliefs or internal shapings of the article, which however must be of modest projection (not greater than 5 mm). As can be seen, the sanding means 20.1 is disposed more downstream than the sanding means 20.2 so that there is no interference between the two as a result of their reciprocating movement in the horizontal direction, transverse to the advancement direction 16 (as indicated by the double arrow 22). Again in this case the rotational speed of the two first sanding means 20.1 and 20.2 (which rotate in the opposite direction, as indicated by the respective arrows 30.1 and 30.2) can be varied by an inverter with a potentiometer provided on the control panel of the machine 12.

[0021] As already stated, the reciprocating movement of the two first sanding means 20.1 and 20.2 in accordance with the double arrow 22 has an amplitude or working stroke which is determined by the position of said positioning guides 28.1 and 28.2, such that the sanding means 20.1 and 20.2 involve in practice only the crosspieces 10.3 and 10.4 and the inner flat surface 10.6 of the article 10 (Figure 1). The stroke can be further adjusted by regulators (not shown for simplicity) positioned on the fifth sanding means 18.1 and 18.2 such that the first sanding means 20.1 and 20.2 do not even interfere with the inner corners of the uprights 10.1 and 10.2.

[0022] The article 10 then encounters the second sanding unit comprising in the specific illustrated example two second cylindrical sanding means, positioned in succession and indicated by 32.1 and 32.2 (Figures 2, 5 and 6). They rotate about their axis in opposite directions (as indicated by the arrows 36.1 and 36.2) and are movable in the two senses in the vertical direction (as indicated by the double arrows 34.1 and 34.2). This enables the frame-shaped recessed inner surface 10.5

(Figure 1) of the article 10 to be sanded. In this respect, as shown in Figure 6, on the arrival of the article 10, each of the two second sanding means 32.1 and 32.2 is raised in order not to interfere with the front upper corner 10.8 of the article 10, it then being lowered to enable it to sand the recessed surface 10.5.

[0023] The devices (not shown because of conventional type) for raising and lowering the second sanding means 32.1 and 32.2 comprise pneumatic cylinders controlled by solenoid valves operated electronically by a sensor positioned at the entry to the machine 12, to transmit to a central unit (not shown for simplicity, but with which the machine 12 is provided) the distance between the beginning and end of the article and the width of the crosspieces of the article 10. Again in this case, the rotational speed of the second sanding means 32.1 and 32.2 can be varied by an inverter and potentiometer positioned on the control panel of the machine 12.

[0024] The article 10 then encounters said third sanding unit, comprising in the specific example a single third cylindrical sanding means 38 (Figure 7) rotatable about its horizontal axis at a speed which can be varied (as in the preceding cases), this axis being perpendicular to the advancement direction 16. The sanding means 38 enables sanding of those surfaces of the article 10 which have not yet been sanded, namely those of the uprights 10.1 and 10.2 (Figure 1), while at the same time also refining those other surfaces of the article which have substantially the same elevation (10.3, 10.4 and 10.6).

[0025] As these surfaces can present small reliefs (although not shown, for simplicity, in the case of the article 10), they are prevented from being spoiled (in order not to compromise the result of the sanding) by the provision of conventional devices which enable the rotational speed of the sanding means 38 to be reduced (even by 30%) when it interferes with such reliefs.

[0026] In the case of the machine 12, to obtain sanding of superior quality, a fourth sanding unit is provided, comprising in this specific example a single cylindrical sanding means 40. This latter differs from the third sanding means 38 only by being "softer" (in the aforestated sense), but otherwise operating in the same manner.

Claims

1. A method for sanding flat wooden articles presenting recessed or relief shapings, comprising the following stages:

   a) sanding the crosspieces and those inner surfaces of the article having an elevation equal to or only slightly different from that of the crosspieces, by means of a first sanding unit comprising first cylindrical sanding means overlying the article which is to be sanded and which is horizontally transiting in a determined advancement direction, the sanding means of the first unit rotating about their axis which is horizontal and inclined to the direction of advancement by an angle of 0-30 degrees, the first sanding means moving horizontally in a direction perpendicular to the advancement direction, so as to involve the whole surface, within a range less than the width of the article;

   b) sanding the recessed inner surfaces of the article and the uprights by a second sanding unit comprising second cylindrical sanding means overlying the article which is to be sanded and which is transiting in the advancement direction, the second sanding means having a length at least equal to the width of the article and rotating about their own axis which is horizontal and perpendicular to the advancement direction, the second sanding means moving vertically in the two senses so that they can be raised to prevent their interference with the transverse corners of the article;

   c) sanding the remaining surfaces of the article, including any reliefs having an elevation slightly greater than that of the crosspieces and uprights, by means of a third sanding unit comprising third cylindrical sanding means of length at least equal to the width of the article and overlying this latter, to rotate at a selectively variable speed about their own axis which is horizontal and forms an angle of 90-70 degrees to the advancement direction, the rotational speed of these sanding means being reduced in correspondence with the reliefs to prevent their spoiling.

2. A method as claimed in claim 1, wherein after stage c) a further stage is provided, consisting of:

   d) finishing sanding effected by a fourth sanding unit comprising fourth sanding means analogous to the third sanding means used in stage c), but softer.

3. A method as claimed in claim 1, wherein a further stage is provided consisting of:

   e) sanding those edges of the article parallel to the advancement direction by means of a fifth sanding unit comprising at least one pair of fifth cylindrical sanding means, each fifth sanding means of each pair lying to one side of the article which transits in the advancement direction so as to interfere with a longitudinal edge of this latter, the two sanding means of each pair having their axis of rotation contained in a vertical plane perpendicular to the advancement direction and symmetrically forming with the vertical an angle which can be varied between 0 and 30 degrees.

4. A method as claimed in claim 1, wherein the rotational speed of those sanding means other than the third sanding means is varied between determined limits but is maintained constant during the machining of one and the same article.

5. A machine for sanding flat wooden articles presenting recessed or relief shapings, comprising:

- a conveyor device for causing the articles undergoing sanding to transit horizontally, in succession, in an advancement direction, in correspondence with a series of sanding units;
- a first sanding unit comprising first cylindrical sanding means overlying the article transiting on the conveyor device in a determined advancement direction, the first sanding means being able to rotate about their own axis which is disposed horizontally and forms with the advancement direction an angle of 0-25 degrees, the first sanding means being movable horizontally in a direction perpendicular to the advancement direction, so as to involve the entire article, within a range less than the width of the article;
- a second sanding unit comprising second cylindrical sanding means overlying the article transiting on the conveyor device, the second sanding means having a length at least equal to the width of the article and being able to rotate about their own axis which is horizontal and perpendicular to the advancement direction, and being movable vertically so that they can be raised to prevent their interference with the transverse corners of the article;
- a third sanding unit comprising third cylindrical sanding means of length at least equal to the width of the article and overlying this latter transiting on the conveyor device, the third sanding means being able to rotate about their own axis which is horizontal and forms an angle of 90-70 degrees to the advancement direction, there also being provided means for selectively varying the rotational speed of the third sanding means.

6. A machine as claimed in claim 5, wherein a fourth sanding unit is provided comprising fourth cylindrical sanding means analogous to the third sanding means, but softer.

7. A machine as claimed in claim 5, wherein a fifth sanding unit is provided comprising at least one pair of fifth cylindrical sanding means, each fifth sanding means of each pair lying to one side of the transiting article so as to interfere with the longitudinal edge of this latter, the two sanding means of each pair having their axis of rotation contained in a vertical plane perpendicular to the advancement direction and symmetrically forming with the vertical an angle which can be varied between 0 and 30 degrees.

8. A machine as claimed in claim 5, wherein, in addition to comprising means for varying the rotational speed of the third sanding means of the machine, means are provided for also varying within determined limits the rotational speed of all the other sanding means.

9. A machine as claimed in claim 7, wherein the fifth sanding unit is disposed upstream of the other sanding units.

10. A machine as claimed in claim 9, wherein the first sanding unit is disposed upstream of the second sanding unit, this latter being disposed upstream of the third and fourth sanding units.

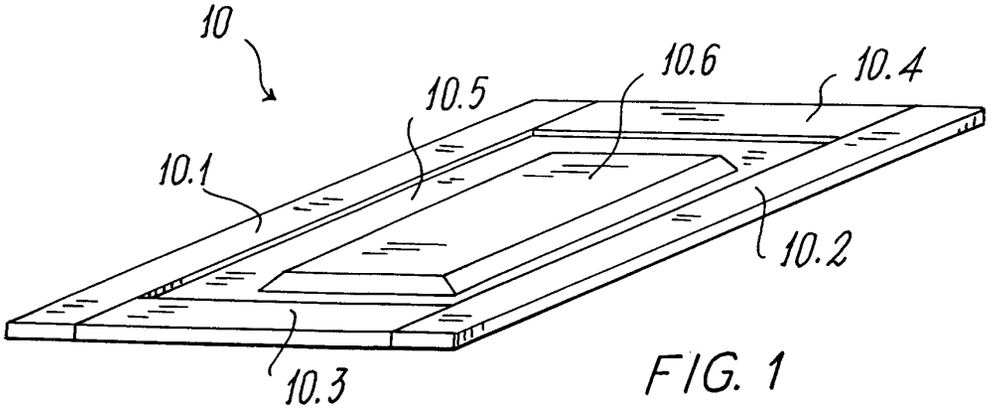
10
10.5
10.6
10.4
10.1
10.2
10.3

FIG. 1

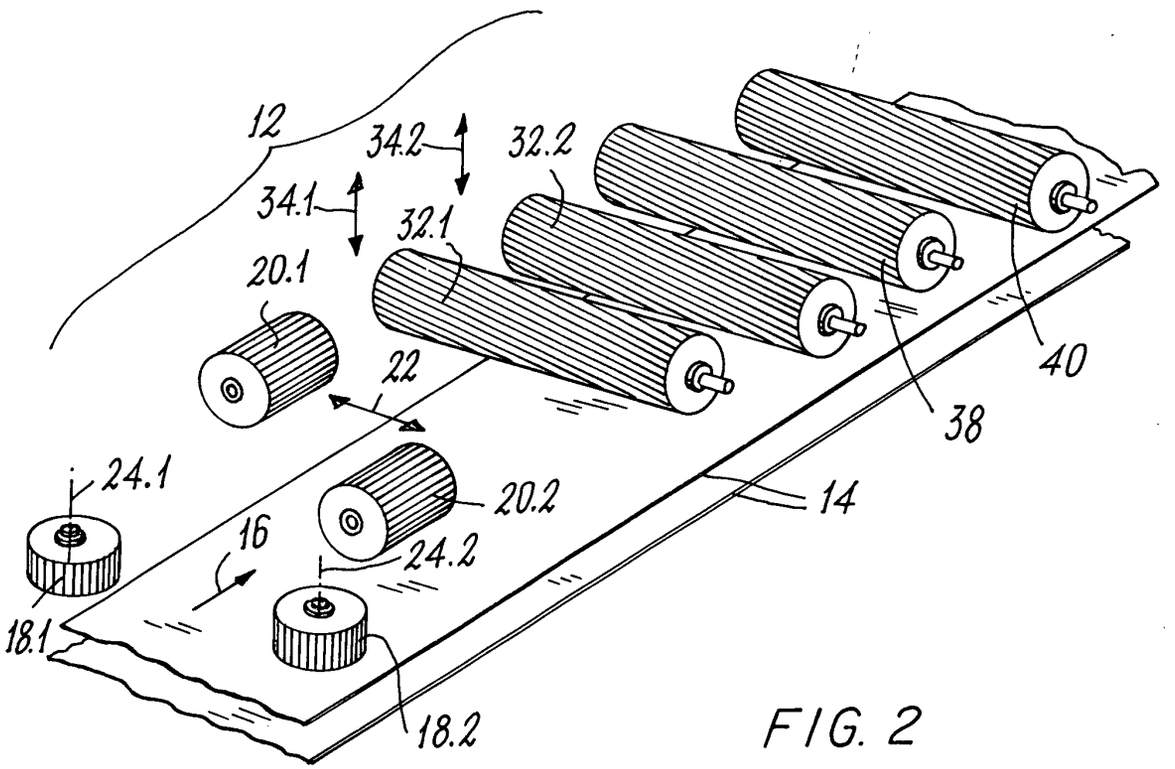
12
34.2
32.2
34.1
32.1
20.1
22
40
38
24.1
20.2
14
16
24.2
18.1
18.2

FIG. 2

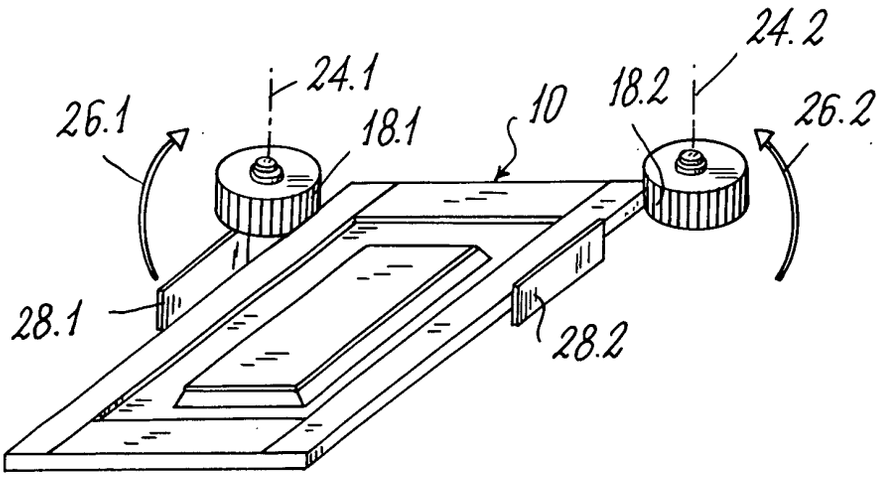

FIG. 3

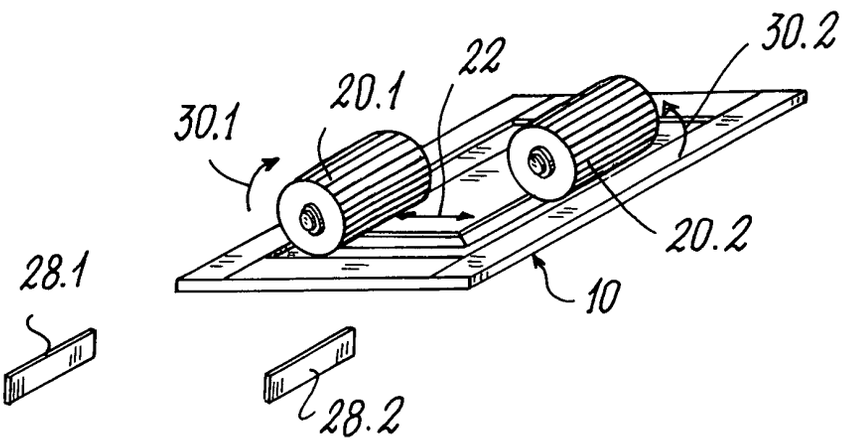

FIG. 4

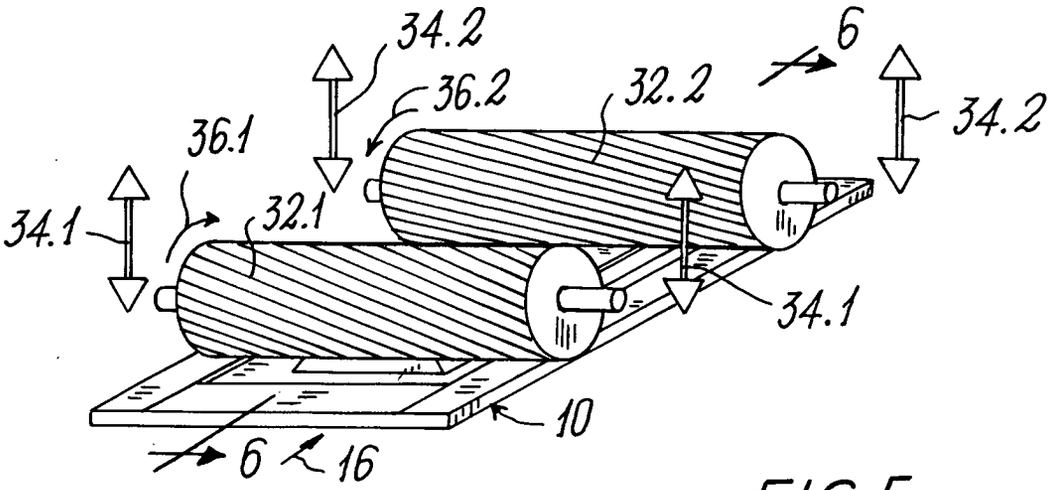

FIG. 5

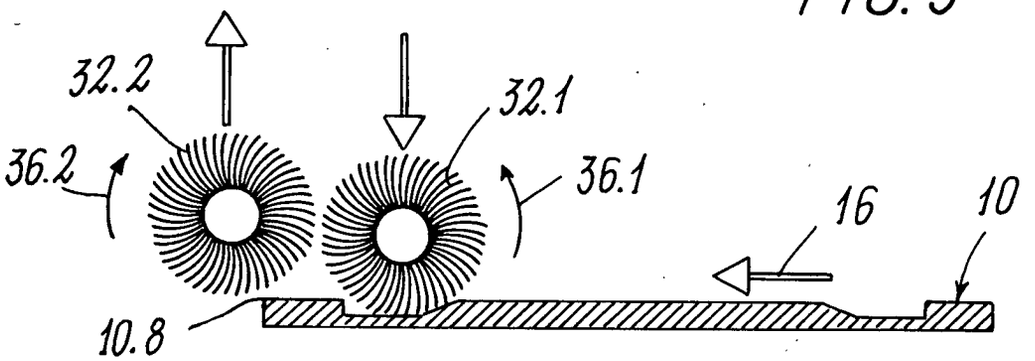

FIG. 6

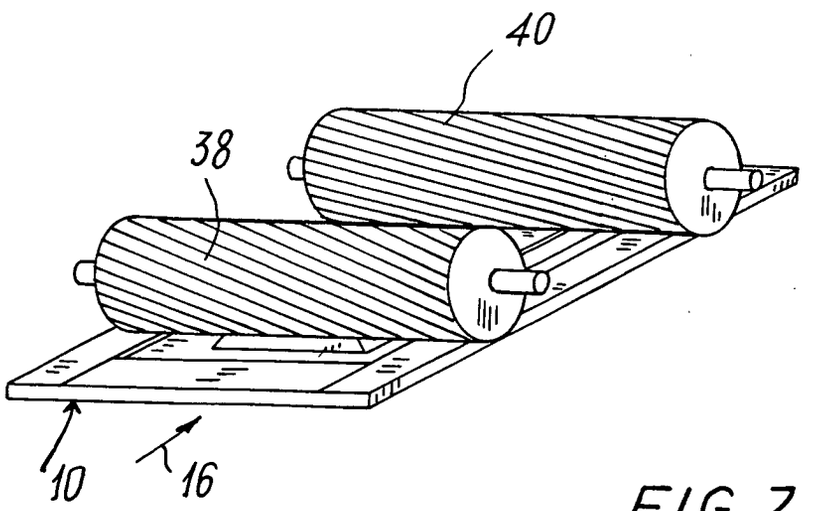

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 02 8220

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X Y	US 5 733 180 A (KILDE BJARNE) 31 March 1998 (1998-03-31) * the whole document *	1,2,4-6, 8 3,7,9,10	B24B7/28 B24B9/18 B24B7/06 B24B7/12
Y	US 4 323 099 A (BOST BENJAMIN S) 6 April 1982 (1982-04-06) * column 2, line 43 - line 49 * * column 3, line 37 - line 42; figures *	3,7,9,10	
A	WO 93 23203 A (KUENDIG AG ;KUENDIG STEPHAN (CH)) 25 November 1993 (1993-11-25)		
A	DATABASE WPI Section PQ, Week 197443 Derwent Publications Ltd., London, GB; Class P61, AN 1974-J8154V XP002238703 & SU 413 030 A (KIEV BOZHENKO FURNITR WK), 4 June 1974 (1974-06-04) * abstract *		

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 April 2003	Eschbach, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 02 8220

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

17-04-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5733180 A	31-03-1998	DK 9300243 Y6	25-06-1993
		AU 6794094 A	20-12-1994
		DE 4493442 T0	27-03-1997
		DK 127295 A	14-11-1995
		WO 9427781 A1	08-12-1994
		FI 955536 A	16-11-1995
		NO 954641 A	17-11-1995
		SE 510937 C2	12-07-1999
		SE 9504000 A	13-11-1995
US 4323099 A	06-04-1982	NONE	
WO 9323203 A	25-11-1993	AT 162448 T	15-02-1998
		CA 2113427 A1	20-11-1993
		WO 9323203 A1	25-11-1993
		DE 59308034 D1	26-02-1998
		EP 0596083 A1	11-05-1994
		JP 6508073 T	14-09-1994
SU 413030 A	30-01-1974	SU 413030 A1	30-01-1974

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82