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(72) Inventor: **Liet, Cornelis Hendricus**
NL-7581 PJ Losser (NL)

(74) Representative:
de Vries, Johannes Hendrik Fokke
De Vries & Metman
Overschiestraat 180
1062 XK Amsterdam (NL)

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(71) Applicant: **Liet, Cornelis Hendricus**
NL-7581 PJ Losser (NL)

(54) **Apparatus and method for bending and punching a metal sheet**

(57) An apparatus for bending a metal sheet (1) comprises a supporting table (25) for supporting the metal sheet, a holding unit (9) for clamping down and moving the metal sheet and at least one stop unit (18) provided with a stop for positioning the metal sheet. The apparatus furthermore comprises a working unit (18) for

removing material from the metal sheet, which working unit (18) is movable with respect to the supporting table (25) between an operative position, in which a material removing operation can be carried out on the metal sheet, and a rest position, in which the metal sheet can be moved by the holding unit (9).

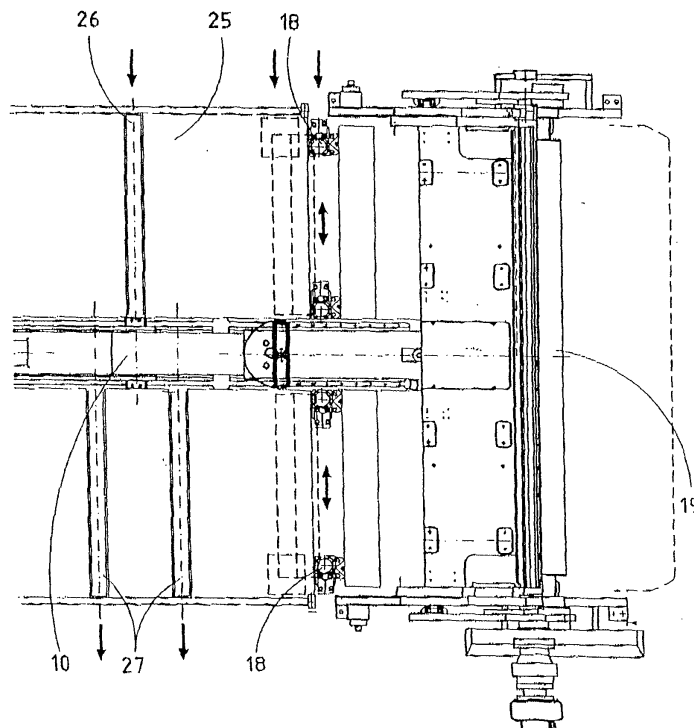


Fig. 2

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Description

[0001] The invention relates to an apparatus for bending a metal sheet, which apparatus comprises a supporting table for supporting the metal sheet, a holding unit for clamping down and moving the metal sheet and at least one stop unit provided with a stop for positioning the metal sheet, and to a method for bending a metal sheet.

[0002] Such an apparatus and method are known from WO 97/32677 of the same applicant. In the manufacture of box-shaped products, such as cabinets, drawers, doors and the like, corners must be removed from the usually rectangular metal sheet by means of a material removing operation, such as punching or laser or plasma cutting, prior to the bending operation. When use is made of known bending apparatuses, such as the apparatus disclosed in WO 97/32677, the metal sheet is placed in a separate metal working apparatus for this purpose, in which working apparatus the metal sheet must first be positioned before the punching operation or the like can be carried out. Then the metal sheet is removed from the working apparatus and transferred to the bending apparatus, in which the sheet must be positioned anew. This leads to a relatively long cycle time and to higher manufacturing costs.

[0003] The object of the invention is to provide an improved apparatus and method of the kind referred to in the introduction.

[0004] In order to accomplish that objective, the apparatus according to the invention comprises a working unit for removing material from the metal sheet, which working unit is movable with respect to the supporting table between an operative position, in which a material removing operation can be carried out on the metal sheet, and a rest position, in which the metal sheet can be moved by the holding unit.

[0005] According to the invention, the method for bending a metal sheet, in which the metal sheet is placed in an apparatus for bending the metal sheet, the metal sheet is positioned by pressing the metal sheet against the stop of at least one stop unit, after which the metal sheet is clamped down by a holding unit and can be moved to a position intended for carrying out the bending operation, after which bending of the metal sheet takes place, is characterized in that the metal sheet is subjected to a material removing operation after being positioned in the bending apparatus.

[0006] The effect achieved by using the apparatus or the method according to the invention is that positioning of the metal sheet is necessary only once, after which both the material removing operation and the bending operation can be carried out in a continuous process. This leads to lower manufacturing costs and a reduced cycle time.

[0007] The invention will be explained in more detail hereinafter with reference to the drawing, which shows an embodiment of the apparatus according to the inven-

tion.

[0008] Fig. 1 is a very schematic side elevation of an embodiment of the apparatus according to the invention for bending a metal sheet.

[0009] Fig. 2 is a very schematic top plan view of the apparatus of Fig. 1.

[0010] Figs. 3, 4 and 5 are views of a part of the apparatus of Fig. 1, showing the stop/working unit in three different positions thereof.

[0011] Fig. 6 is a larger-scale side elevation of a stop/working unit of the apparatus of Fig. 1.

[0012] Fig. 7 is a front view, partially in section, of the stop/working unit of Fig. 6.

[0013] The invention will be described hereinafter in an application for manufacturing box-shaped products, such as cabinets, drawers and doors. With such products, corners must be removed from a rectangular metal sheet prior to the bending operation. The invention is not limited to apparatuses and methods for manufacturing such products, however, it can be used in any metal sheet working operation in which parts of the sheet must be removed prior to an/or possibly after the bending operation.

[0014] Fig. 1 shows a very schematic side elevation of an apparatus for bending a metal sheet 1, which apparatus comprises a frame 2, a stationary lower beam 3 fitted with a lower clamp 4 and a movable upper beam 5 fitted with an upper clamp 6. The apparatus furthermore comprises a lower bending beam 7 and an upper bending beam 8 for bending the clamped-down metal sheet 1 in upward and downward direction, respectively.

[0015] The apparatus also comprises a holding unit 9 for clamping down and moving the metal sheet 1. The holding unit 9 comprises a substantially C-shaped frame 10, which is mounted on a slide 11 which can be moved reciprocatingly on a slide bed 12. The slide 11 can be moved reciprocatingly between a front position as shown in Fig. 1 and a rear position as indicated by a dashed line 13. The legs 14, 15 of the C-shaped frame 10 are fitted with a lower dish 16 and an upper dish 17 respectively at their free ends, which dishes clamp down the metal sheet 1 in the operative position as shown in Fig. 1. Said dishes 16, 17 are rotatably connected to the legs 14, 15, so that the metal sheet 1 can be rotated in the apparatus described herein. For a further description of the bending apparatus comprising a holding unit 9, reference is made to the applicant's patent WO 97/93677.

[0016] The bending apparatus comprises two stop/working units 18 disposed on either side of the central axis 19 of the bending apparatus. In the top plan view of Fig. 2, a double arrow indicates that the stop/working units 18 are capable of reciprocating movement with respect to a supporting table 25 for supporting the metal sheet; the stop/working units are shown in their end positions therein. The movement of the units 18 can be effected by means of any suitable driving elements. Said driving elements are not shown in the drawing.

[0017] The stop/working units 18 can also be moved in vertical direction between the three different positions that are shown in Figs. 3-5. In Fig. 3 the unit 18 is shown to occupy a stop position, in which positioning of a metal sheet 1 can take place. In Fig. 4 the stop/working unit 18 is shown to occupy an operative position, in which the material removing operation can be carried out. In Fig. 5 the unit is shown to occupy a rest position, in which a metal sheet 1 can pass the stop/working unit without impediment.

[0018] Figs. 6 and 7 are larger-scale views of one stop/working unit 18 in side elevation and front elevation respectively, with part of said unit being shown in sectional view. As appears from Figs. 6 and 7, the unit comprises a stop or switching cam 20, which delivers a signal to a control unit (not shown) of the bending apparatus when a metal sheet 1 makes contact with the stop 20. In the illustrated embodiment the working portion of the stop/working unit 18 is a punching unit comprising an upper die 21 and a lower die 22, which can be moved up and down by means of a hydraulic cylinder-piston assembly 23. The lower die 22 is provided with a channel 24 for discharging a part that has been punched out of the metal sheet 1. It is noted that also material removing units other than a punching unit, such as a laser or plasma cutting unit, may be used as the working unit. Furthermore it will be apparent that also a different type of punching unit may be used. The working unit may be fitted with a tool changing system, for example, so that different operations can be carried out on the metal sheet.

[0019] The apparatus as shown operates as follows. The supporting table 25 is fitted with suitable conveyor belts 26, 27 for, respectively, introducing and discharging a metal sheet 1. When a metal sheet 1 is being introduced, the holding unit 9 occupies its rear position. The stop/working units 18 are positioned the correct mutual distance apart with respect to the central axis 19, such that a metal sheet 1 to be worked readily fits between the facing stop surfaces 28 of the units 18. The stop/working units 18 occupy the stop position as shown in Fig. 3. A moving element (not shown) supported by the C-frame 10, such as an air cylinder, presses the metal sheet 1 in the direction of the bending beams 7, 8, until the metal sheet makes contact with the stops or switching cams 20, as a result of which a signal is delivered to the control unit indicating that the metal sheet is in the correct position. Then the stop/working units 18 are moved towards each other, so that the metal sheet 1 is centred between the units 18 with respect to the central axis 19 as well. Once the metal sheet 1 has been moved to a precisely defined position in the bending apparatus, the metal sheet 1 is clamped down by the holding unit 9, i.e. between the dishes 16, 17, after which the metal sheet 1 is moved away from the units 18 by the holding unit 9.

[0020] The stop/working units 18 are subsequently moved to the operative position as shown in Fig. 4, in

which the metal sheet can be introduced into the unit 18. The holding unit 9 then moves the metal sheet 1 to the desired position in the working units 18, after which the punching operation can be carried out. Then the holding unit 9 moves the metal sheet 1 away from the units 18 again. The stop/working units 18 are then moved down to the rest position as shown in Fig. 5, in which the metal sheet can pass the units 18. The metal sheet 1 may be rotated through 180° by the holding unit 9, after which the corners on the other side of the metal sheet can be punched out. As soon as the corners have been punched out in all the desired places, the bending operation can be started.

[0021] From the foregoing it will be understood that it is possible to achieve a considerable reduction of the cycle time in the manufacture of products, in which a material removing operation is required in addition to a bending operation, by arranging working units for removing material in the bending apparatus. In addition to that, the metal sheet only needs to be positioned once for both operations, so that a high degree of precision can be realised.

[0022] Although it is preferred to use the stop/working unit as described above, in which the stop unit and the working unit are combined into one unit, it is also possible to use separate stop units and working units. The holding unit 9 is capable of placing the metal sheet in any desired position with respect to the working unit for carrying out a removing operation.

[0023] In the illustrated embodiment, the stop/working units are disposed between the supporting table 25 and the frame 2 of the bending apparatus. It is also possible, if desired, to dispose the stop/working units on the side of the supporting table remote from the frame 2. Furthermore it is possible to dispose stop/working units 18 on the longitudinal sides of the supporting table.

[0024] It is further noted that the bending apparatus has been described merely by way of example herein. Also bending apparatuses of different design comprising different holding units can be advantageously combined with the stop/working units 18 as described herein.

[0025] The invention is not limited to the embodiments as described above, which can be varied in several ways without departing from the scope of the invention as defined in the claims.

Claims

1. An apparatus for bending a metal sheet, which apparatus comprises a supporting table for supporting the metal sheet, a holding unit for clamping down and moving the metal sheet and at least one stop unit provided with a stop for positioning the metal sheet, **characterized by** a working unit for removing material from the metal sheet, which working unit is movable with respect to the supporting table

between an operative position, in which a material removing operation can be carried out on the metal sheet, and a rest position, in which the metal sheet can be moved by the holding unit.

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2. An apparatus according to claim 1, wherein the working unit can be moved up and down with respect to the supporting table.

3. An apparatus according to claim 1 or 2, wherein the working unit can be moved reciprocatingly in a direction substantially transversely to the central axis of the supporting table. 10

4. An apparatus according to any one of the preceding claims, wherein the stop unit and the working unit are integrated into one unit. 15

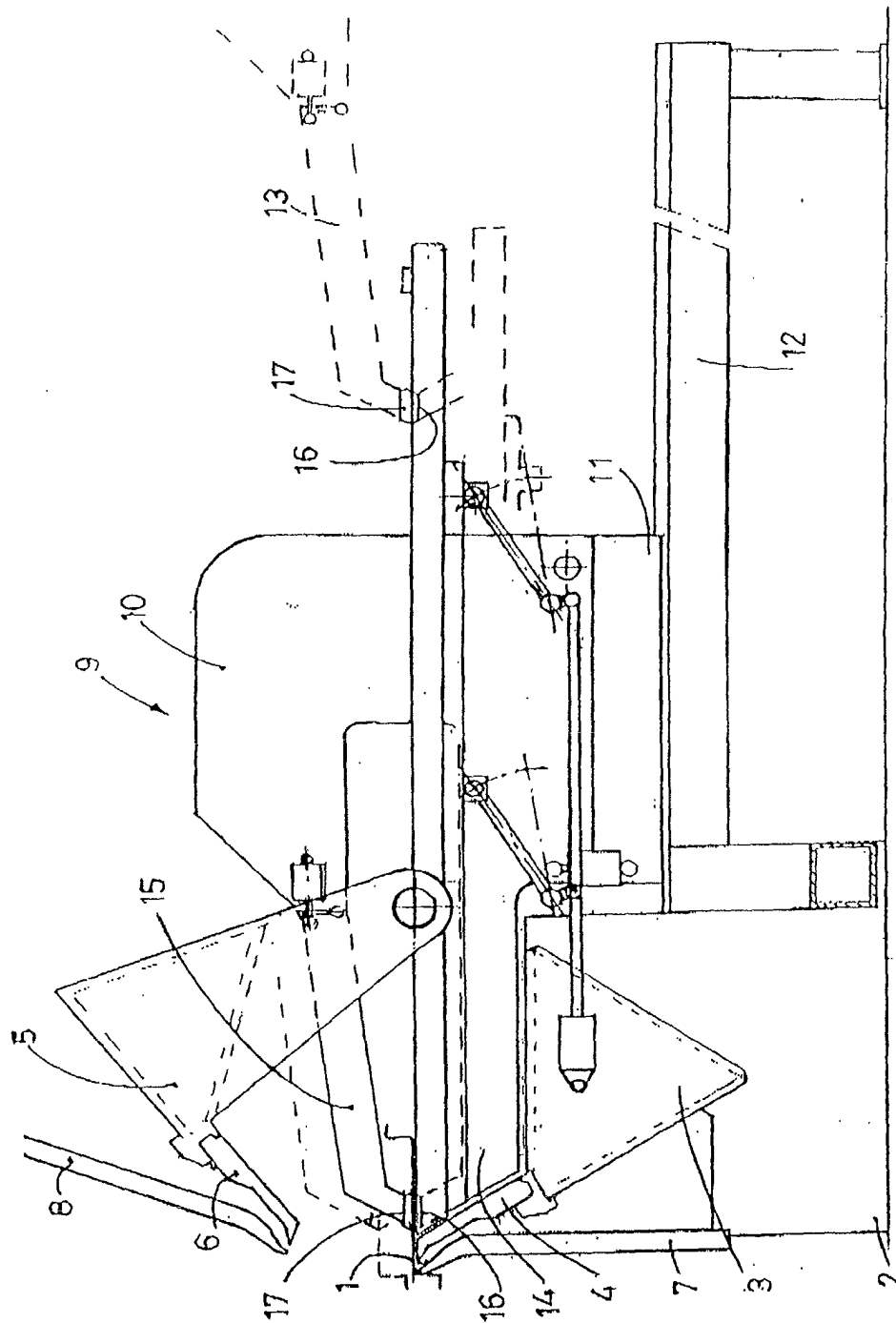
5. An apparatus according to claim 5, wherein the stop/working unit can be moved in vertical direction between a stop position, in which the stop is operative, the operative position and the rest position of the working unit. 20

6. A method for bending a metal sheet, in which the metal sheet is placed in an apparatus for bending the metal sheet, the metal sheet is positioned by pressing the metal sheet against the stop of at least one stop unit, after which the metal sheet is clamped down by a holding unit and can be moved to a position intended for carrying out the bending operation, after which bending of the metal sheet takes place, **characterized in that** the metal sheet is subjected to a material removing operation after being positioned in the bending apparatus. 25
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7. A method according to claim 6, wherein at least two stop/working units are used, wherein the stop/working units are positioned a mutual distance apart and the stop of each unit is moved to an operative stop position and the metal sheet is pressed into abutment with the stops, wherein the metal sheet is clamped down by the holding unit and moved away from the stop and at least one stop/working unit is moved to an operative position for removing material, wherein the metal sheet is introduced into the stop/working unit by the holding unit and material is removed from the metal sheet, wherein the metal sheet is moved to a position intended for carrying out the bending operation by the holding unit after one or more removing steps have been carried out. 40
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8. A method according to claim 7, wherein the stop/working units are moved towards each other once the metal sheet abuts against the stops, such that the metal sheet is centred with respect to the central axis of the bending apparatus. 55

9. A method according to claim 6, 7 or 8, wherein the metal sheet can be moved by the holding unit and/or be rotated to any desired position for carrying out a removing operation.



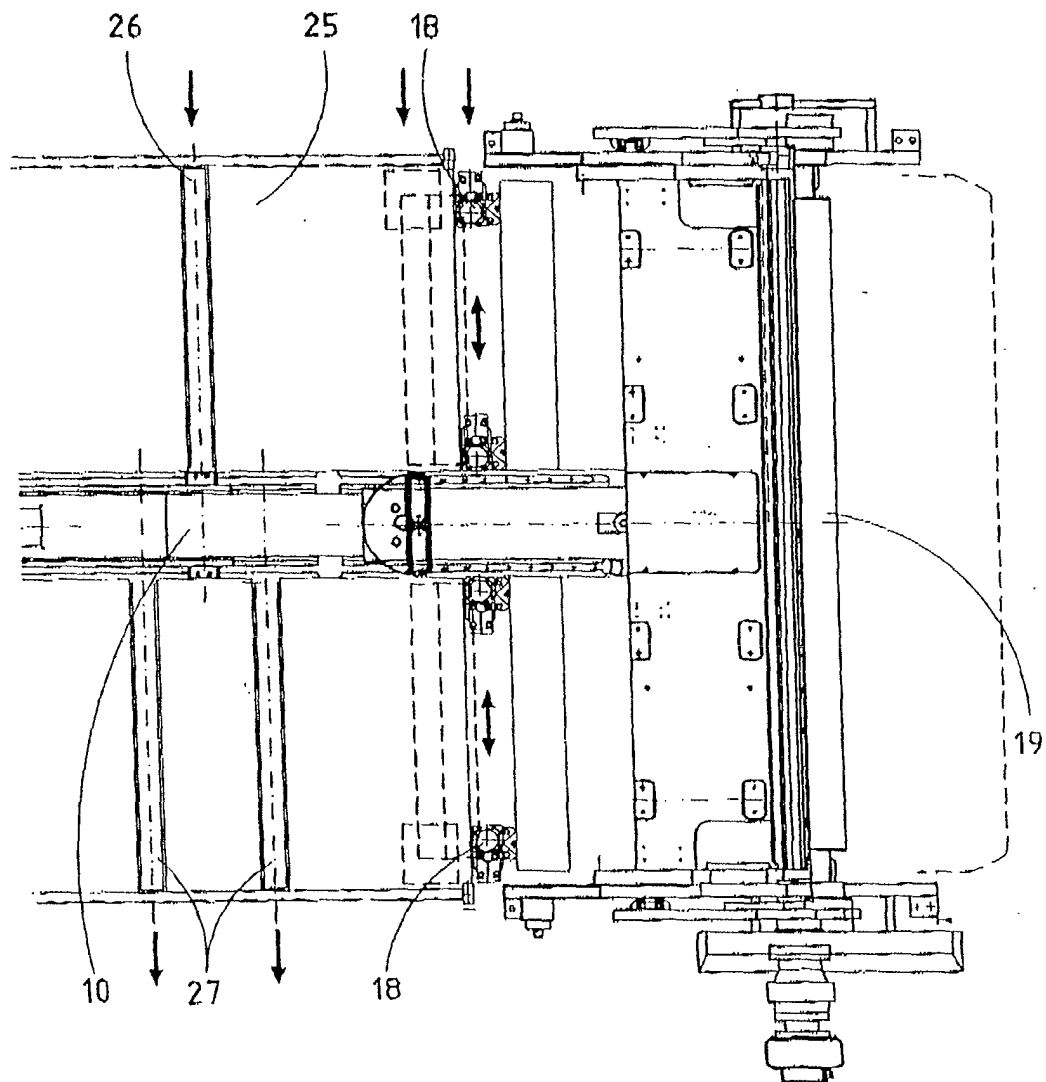


Fig. 2

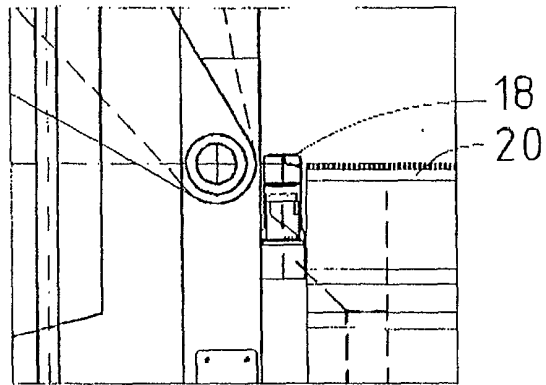


Fig. 3

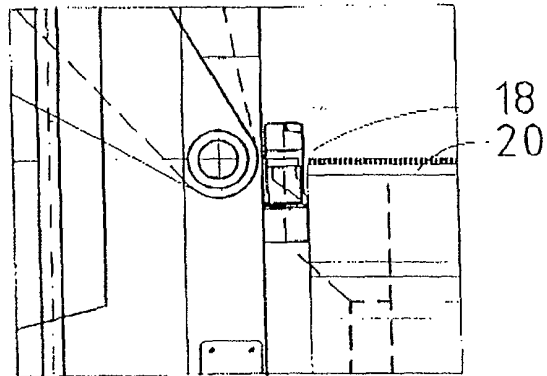


Fig. 4

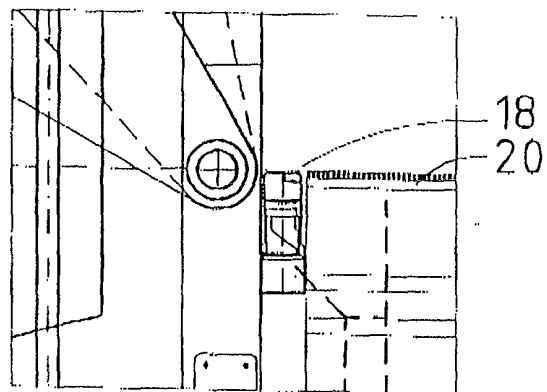


Fig. 5

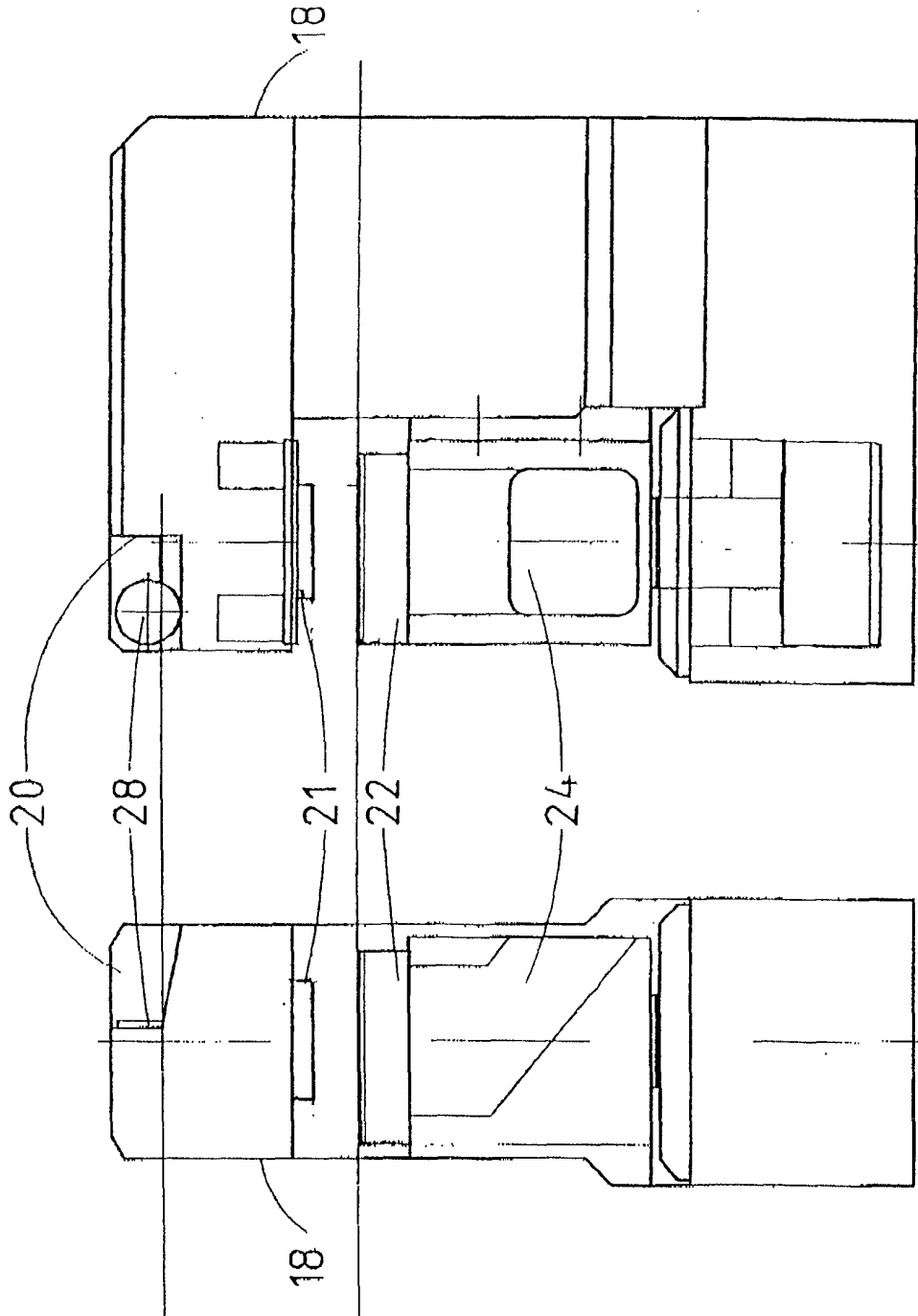


Fig. 7

Fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 8790

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	US 6 185 974 B1 (VENTURINI GIANFRANCO) 13 February 2001 (2001-02-13) * column 1, line 64 - column 4, line 27; figures 1,2 *	1-9	B21D5/04 B21D35/00 B21D28/26
A,D	WO 97 32677 A (LIET CORNELIS HENDRICUS) 12 September 1997 (1997-09-12) * page 3, line 3 - page 6, line 37; figures 1,2 *	1-9	
A	US 5 528 818 A (WARNEKE HORST) 25 June 1996 (1996-06-25) * figure 1 *	1,6	
A	US 4 242 898 A (SALVAGNINI TRANSFERICA S.P.A.) 6 January 1981 (1981-01-06) * figures 1,2 *	1,6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21D
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 29 October 2002	Examiner Vinci, V
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 02 07 8790

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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29-10-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6185974 B1	13-02-2001	IT MI981668 A1	21-01-2000
		AT 213975 T	15-03-2002
		BR 9902976 A	08-03-2000
		DE 69900959 D1	11-04-2002
		DE 69900959 T2	04-07-2002
		DK 976470 T3	24-06-2002
		EP 0976470 A2	02-02-2000
		ES 2172284 T3	16-09-2002
		JP 2000042662 A	15-02-2000
		KR 2000011868 A	25-02-2000
WO 9732677 A	12-09-1997	NL 1002552 C1	09-09-1997
		DE 69707894 D1	06-12-2001
		DE 69707894 T2	04-04-2002
		EP 0958071 A1	24-11-1999
		EP 0920931 A2	09-06-1999
		WO 9732677 A1	12-09-1997
US 5528818 A	25-06-1996	DE 4222741 A1	01-04-1993
		AT 174824 T	15-01-1999
		AU 4501093 A	31-01-1994
		DE 59309246 D1	04-02-1999
		WO 9401234 A2	20-01-1994
		EP 0603366 A1	29-06-1994
		ES 2126650 T3	01-04-1999
		JP 6510487 T	24-11-1994
		RU 2110349 C1	10-05-1998
US 4242898 A	06-01-1981	IT 1086365 B	28-05-1985
		DE 2839978 A1	29-03-1979
		ES 473454 A1	01-05-1979
		FR 2403126 A1	13-04-1979
		GB 2004216 A ,B	28-03-1979
		JP 54090063 A	17-07-1979
		JP 58041132 B	09-09-1983

EPO FORM P0459

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