



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 415 734 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.05.2004 Bulletin 2004/19

(51) Int Cl.7: **B21D 11/12**

(21) Application number: **03103942.3**

(22) Date of filing: **24.10.2003**

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

(72) Inventors:
• **Del Fabro, Giorgio**
33019, TRICESIMO (UD) (IT)
• **Del Fabro, Marcello**
33010, TAVAGNACCO (UD) (IT)

(30) Priority: **28.10.2002 IT UD20020226**

(74) Representative: **Petraz, Gilberto Luigi**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(71) Applicant: **M.E.P. Macchine Elettroniche**
Piegatrici S.p.A.
33010 Reana del Rojale (UD) (IT)

(54) **Bending machine for bars and relative bending method**

(57) Bending machine (12) for bars (18) comprising at least a bending assembly (11) and at least a drawing assembly (15) located upstream of the bending assembly (11) and defining an axis of feed (21) and a plane of feed (19) on which the bars (18) are fed. Associated with

the bending assembly (11) there is at least an auxiliary element (10) able to be selectively activated to temporarily arrange itself in a position cooperating with the axis of feed (21) and to perform at least temporarily the function of auxiliary drawing element in or close to the area of the bending assembly (11).

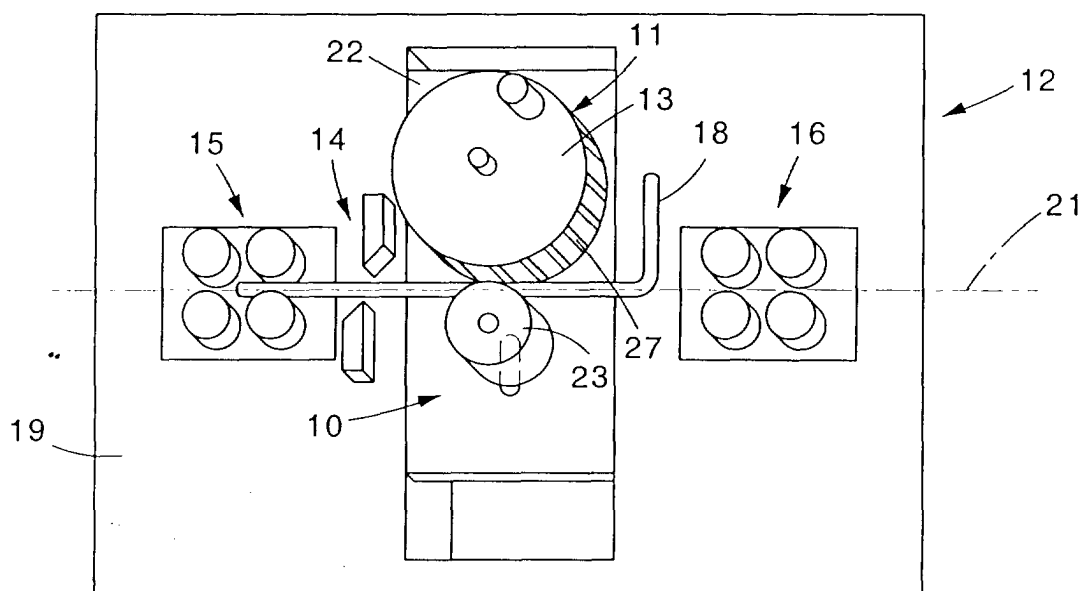


fig. 6

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a bending machine for bars and a relative bending method.

[0002] The bending machine according to the invention has at least an element associated or cooperating with the bending assembly and suitable to be selectively activated to function as an auxiliary drawing element, in or close to the area of the bending assembly, in order to axially move segments of bar that are not bent, or are partly bent.

[0003] The auxiliary drawing element can be used to discharge segments or off-cuts gripped on a drawing assembly, to transfer a bar from one to the other of the drawing assemblies arranged upstream and downstream of the bending assembly, or for every other operating step typical of such bending machines wherein the intervention of an auxiliary drawing element is required.

BACKGROUND OF THE INVENTION

[0004] Bending machines for bars are known, suitable to produce shaped reinforcement elements, essentially consisting of at least a drawing assembly, at least a shears and at least a bending assembly. There may also be present a second drawing assembly, downstream of the bending assembly, used to move the bar linearly with respect to the bending assembly and make trailing end bends in order to make the shaped element.

[0005] The drawing assemblies may be of the type having a first working position, above the plane where the bars advance, and at least a second retracted position under this advancing plane. Examples of these bending machines are disclosed in EP-A-0.379.043, FR-A-2.553.314 and EP-A-0.538.595, all in the name of the present Applicant.

[0006] Depending on the type of bending machine, the second drawing assembly can be found on the same axis or off-axis with respect to the first drawing assembly. In this second case, there are transfer means to move the bar from one to the other working axis.

[0007] The drawing assemblies can be of the type with rollers, grippers, or combined rollers and grippers. The machine can have a single shears or several shears, for example one upstream and one downstream of the first drawing assembly, and/or another shears arranged between the bending assembly and the second drawing assembly.

[0008] A first problem of bending machines of this type is how to discharge the off-cuts or surplus workings of the machine.

[0009] Another problem is that it is substantially impossible to make small-size shaped elements, for example with a linear development of less than 100 cm. This is caused by the fact that the distance between the

two drawing assemblies, upstream and downstream of the bending assembly, cannot be reduced beyond a minimum value, given the intermediate presence of at least a shears and the bending assembly itself.

[0010] If the bar to be worked has a length of less than the distance between the two drawing assemblies, when it leaves the upstream drawing assembly it is not yet gripped on the downstream drawing assembly and therefore it can no longer be moved. This constitutes a considerable limit to the versatility of such machines.

[0011] Applicant has devised and embodied the present invention to overcome these shortcomings and to obtain other advantages as shown hereafter.

SUMMARY OF THE INVENTION

[0012] The present invention is set forth and characterized in the main claims, while the dependent claims describe other characteristics of the main embodiment.

[0013] The purpose of the invention is to achieve a bending machine for bars, and a connected bending method, suitable to work every length of bar, even small size ones, to obtain shaped elements starting from segments of a length less than 100 cm, as little as 60-70 cm and less. A further purpose is to allow off-cuts, remaining gripped on the drawing assembly, to be discharged.

[0014] According to the invention, associated with the bending assembly, and substantially laterally positioned with respect to said bending assembly, there is at least an auxiliary element that can be selectively activated to arrange itself temporarily in a position cooperating with the axis of feed of the bar, in or close to the area of the bending assembly, and to perform at least temporarily the function of an auxiliary drawing element, for example to transfer the bar from one to the other of the drawing assemblies, or to discharge an off-cut from the drawing assembly.

[0015] To be more exact, said auxiliary element has a first inactive position arranged at the side of the axis of feed of the bar, and a second active position, translated laterally with respect to the first position, wherein it is taken to cooperate with the axis of feed of the bar substantially in the area of the bending assembly, or in close proximity with this area.

[0016] In one embodiment of the invention, the bending assembly is movable laterally with respect to the axis of feed of the bar and the auxiliary element is mounted on the same supporting element on which the bending assembly is mounted, and moves with said assembly.

[0017] In a preferential embodiment, in a machine where the bending assembly comprises a disk element supporting at least a bending pin and a contrasting pin, said auxiliary element comprises at least a roller able to selectively perform, in cooperation with the outer perimeter of the disk element, the function of an auxiliary drawing element.

[0018] One and/or the other of the disk-type bending

element and the auxiliary element are also equipped with an independent movement of lateral translation to close on the bar. When this positioning step is finished, the two elements are driven in rotation on their axis so as to perform a temporary drawing function.

[0019] According to a variant, the disk-type bending element is associated with a position transducer, such as for example an encoder, and functions as a drawing element, while the roller functions as a contrasting element.

[0020] According to another variant, the outer perimeter of the disk-type bending element includes means to accentuate the grip, in order to increase the gripping action on the segment of bar during drawing.

[0021] In another embodiment, the auxiliary element comprises at least a pair of rollers mounted on the supporting element of the bending assembly and able to be selectively arranged, by means of lateral translation, astride the axis of feed of the bar in order to function as an auxiliary drawing element by rotating on its own axis.

[0022] According to another variant, the auxiliary element comprises at least a gripper element, mounted on the supporting element of the bending assembly and able to be selectively arranged in cooperation with the axis of feed of the bar by means of lateral translation. Once in position, the gripper element moves linearly with an alternating movement in order to move the segment of bar, moving along eyelets made on the supporting element of the bending assembly.

[0023] According to another variant, the auxiliary element comprises a gripper element, or a pair of rollers, having a first inactive position arranged laterally to the bending assembly and an active position cooperating with the axis of feed of the bar in order to grip the bar and move it linearly. In this case, before the auxiliary element is positioned in the active position, the bending assembly moves to a position of non-interference with the plane of feed of the bar and allows said auxiliary element to be positioned and driven.

[0024] The bending machine illustrated above, by obtaining an auxiliary drawing function in or strictly close to the area of the bending assembly, allows both to discharge any type of off-cut gripped on the drawing assembly, and also to achieve shaped elements of a minimum size, less than the distance between the two drawing assemblies located upstream and downstream of the bending assembly. Moreover, the bulk in length of the machine is not increased, and the structure and functioning of the components normally used are not modified.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

- figs. 1-4 show a view from above of a first embodiment of a bending machine according to the invention in four operating steps;
- figs. 5-6 show, in two distinct steps and in a three-dimensional view, the bending machine in figs. 1-4;
- figs. 7-8 show, in two steps, a second embodiment of a bending machine according to the invention;
- figs. 9-10 show, in the steps of figs. 1-4, a third embodiment of a bending machine according to the invention;
- fig. 11 shows another variant of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0026] With reference to the figures, a bending machine 12 for bars 18 essentially comprises a bending assembly 11, a shears 14 located upstream of the bending assembly 11, a first drawing assembly 15 with pairs of rollers located upstream of the shears 14 and, in this case, a second drawing assembly 16 with pairs of rollers located downstream of the bending assembly 11. It comes within the field of the invention that the second drawing assembly 16 is located on another axis with respect to the first drawing assembly 15, or that it is not present.

[0027] The bending assembly 11 consists of a rotary bending disk 13 on which a contrasting pin 20 is mounted, arranged axially, and a peripheral bending pin 28.

[0028] The bending machine 12 also comprises, in this case, a guard 17 which limits any lifting of the partly bent portion of bar 18 with respect to a plane of feed 19. The bar 18 advances with respect to the machine 12 on an axis of feed 21. It comes within the field of the invention that the bending machine 12 can have a different configuration, for example with two or more shears 14, one or both the drawing assemblies of the gripper type instead of with rollers, or other configuration.

[0029] The bending machine 12 also comprises, in this case, an auxiliary element 10 temporarily arranged in an inactive position at the side of the bending disk 13 and mounted on the same movable supporting plate 22 on which the disk 13 itself is mounted. In the case of figs. 1-4, the auxiliary element 10 consists of a roller 23 associated with an axial rotation pin 24.

[0030] To be able to achieve shaped elements of limited size, such as small stirrups or similar, starting from segments of bar 18 with a length of less than the distance between the first 15 and the second 16 drawing assembly, the supporting plate 22 can be moved transversely with respect to the axis of feed 21 of the bar 18, in the direction 25 (fig. 2). To be more exact, the supporting plate 22 is selectively driven to perform a first movement of retraction inside the plane of feed 19, in order to free the bending disk 13 from interference with the bar 18, then a second movement of lateral translation until it positions the outer perimeter of the bending disk 13 at the side of the bar 18, and then another movement to exit onto the plane of feed 19. Finally, the roller

23 moves laterally, in the direction 26, to close on grip on the bar 18 (figs. 2 and 3).

[0031] When these positioning operations are finished, the bending disk 13 and the roller 23 are made to rotate on their own axis to function as an auxiliary drawing element and transfer segments of bar 18 of limited length from the first 15 to the second 16 drawing assembly. When the bar 18 is gripped on the second drawing assembly 16, the inverse operations are started to move the supporting plate 22 in order to again position the bending disk 13 in its normal position with respect to the axis of feed 21 and perform the trailing end bends so as to complete the formation of the shaped element (fig. 4).

[0032] In its function as an auxiliary drawing element, the bending disk 13 advantageously uses the encoder with which it is normally equipped in order to displace the bar 18 linearly according to defined lengths functional to obtain the subsequent desired bends.

[0033] In the preferential embodiment shown in figs. 5 and 6, on its outer perimeter the bending disk 13 has means 27 to accentuate grip, such as teeth, knurling, ridges or suchlike, in order to increase its ability to grip the segment of bar 18 when it performs its function as an auxiliary drawing element.

[0034] Even if, in the case shown here, the roller 23 is arranged below the bending disk 13, it obviously comes within the field of the invention that it can be located above the disk 13, and also not exactly in axis with it, at least in the inactive position.

[0035] According to the variant shown in figs. 7 and 8, wherein the same numbers identify components identical or equivalent to those in figs. 1-6, the auxiliary element 10 consists of two pairs of rollers 31 mounted on the supporting plate 22.

[0036] In the same way we saw for the previous solution, when it is necessary to transfer a short segment of bar 18 from the first 15 to the second 16 drawing assembly, the plate 22 is moved and translated transversely with respect to the axis 21 in order to position the rollers 31 astride said axis 21. After a further closing movement of one pair of rollers 31 with respect to the other, the rollers 31 are driven in rotation to make the bar 18 advance linearly and transfer it to the second drawing assembly 16. Finally, the plate 22 is again moved to return the bending disk 13 into position.

[0037] In the further variant shown in figs. 9 and 10, the auxiliary element 10 consists of a gripper element 29 mounted on the supporting plate 22 and movable with an alternating motion, autonomous with respect to the bending disk 13, along eyelets 30. As in the previous cases, in order to move a short segment of bar 18, the supporting plate 22 is moved transversely to the axis 21 and upwards to position the gripper element 29 in cooperation with the axis 21 and gripping on the bar 18.

[0038] The gripper element 29, moving linearly in the eyelets 30, makes the segment of bar 18 advance until it is gripped on the rollers, or other similar or comparable

elements, of the drawing assembly 16. Then, in the same way as we saw before, the plate 22 repositions the bending disk 13 in axis with the axis of feed 21 of the bar 18 in order to make further bends.

[0039] According to the other variant shown in fig. 11, the auxiliary element 10 consists of a gripper element 129, movable autonomously with respect to the bending assembly 11 transversely to the axis of feed 21 in the direction 125. The gripper element 129, by means of an arm 34, is mounted on a slider 32 with respect to which it can slide axially in the direction 125.

[0040] When it is necessary to move an off-cut or a short bar 18, the bending disk 13 moves to a position of non-interference below the plane of feed 19, the gripper element 129 translates laterally to move into cooperation with the axis of feed 21, the gripper closes on the bar 18, and the slider 33 is moved forwards, along eyelets 30 in the direction 126, to displace the bar 18 linearly, for example to transfer it to the second drawing assembly 16. Then, the inverse movements are made to return the gripper element 129 to the position of non-interference and the bending disk 13 to the working position.

[0041] On the plane of feed 19 there may be a retracted positioning compartment where the gripper element 129 is located during the normal functioning of the bending machine 12.

[0042] It comes within the field of the invention that any similar or equivalent drawing element can function as an auxiliary element 10, both in combination with the bending disk 13, as in the case of figs. 1-6, and also autonomously, as in figs. 7-11.

Claims

1. Bending machine for bars (18) comprising at least a bending assembly (11) and at least a drawing assembly (15) located upstream of said bending assembly (11) and defining an axis of feed (21) and a plane of feed (19) on which the bars (18) are fed, **characterized in that** associated with said bending assembly (11) there is at least an auxiliary element (10) laterally positioned with respect to said bending assembly (11) and able to be selectively activated to temporarily arrange itself in a position cooperating with said axis of feed (21) and to perform at least temporarily the function of auxiliary drawing element in or close to the area of said bending assembly (11).
2. Bending machine as in claim 1, **characterized in that** said auxiliary element (10) has a first inactive position arranged at the side of said axis of feed (21) and a second active position, laterally translated with respect to the first position, wherein it is taken to cooperate with said axis of feed (21).

3. Bending machine as in claim 1 or 2, **characterized in that** said bending assembly (11) is movable at least laterally with respect to said axis of feed (21) and **in that** said auxiliary element (10) is mounted on the same supporting element (22) on which said bending assembly (11) is mounted and moves with said bending assembly (11) in order to position itself selectively in cooperation with said axis of feed (21).
4. Bending machine as in claim 1 or 2, wherein said bending assembly (11) is movable orthogonally with respect to said plane of feed (19) on which the bar (18) is fed in order to free itself from interference therewith, **characterized in that** said auxiliary element (10) is movable autonomously with respect to said bending assembly (11) in order to position itself selectively in cooperation with said axis of feed (21) when said bending assembly (11) is in the position of non-interference.
5. Bending machine as in any claim hereinbefore, wherein said bending assembly (11) comprises a disk element (13) supporting at least a bending pin (28) and a contrasting pin (20), **characterized in that** said auxiliary element (10) comprises at least a roller (23) able to function selectively, in cooperation with the outer perimeter of the disk element (13), as an auxiliary drawing element.
6. Bending machine as in claim 5, **characterized in that** one and/or the other of said disk-type bending element (13) and said roller (23) are equipped with an independent movement of lateral translation to close on grip on the segment of bar (18).
7. Bending machine as in claim 5 or 6, **characterized in that** said bending disk (13) is associated with a position transducer such as an encoder.
8. Bending machine as in claim 5, **characterized in that**, on its lateral perimeter, said bending disk (13) has means (27) to accentuate the grip.
9. Bending machine as in claim 1 or 2, **characterized in that** said auxiliary element (10) comprises at least a gripper element (29, 129) able to be arranged selectively in cooperation with said axis of feed (21) by means of lateral translation.
10. Bending machine as in claim 9, **characterized in that** said gripper element (29, 129) is able to move linearly along eyelets (30) with an alternating movement in order to move the bar (18) linearly.
11. Bending machine as in claim 1 or 2, **characterized in that** said auxiliary element (10) comprises at least a pair of rollers (31) able to be arranged selectively, by means of lateral translation, astride the axis of feed (21) in order to function as an auxiliary drawing element by means of rotation on its own axis.
12. Bending machine as in any claim hereinbefore, **characterized in that** said auxiliary element (10) is arranged above or below, right or left of said bending assembly (11).
13. Method for bending bars (18) in a bending machine (12) comprising at least a bending assembly (11) and a first drawing assembly (15) located upstream of said bending assembly (11) and defining an axis of feed (21) on which the bar (18) is fed, **characterized in that**, when a bar (18) is gripped on said drawing assembly (15), an auxiliary drawing element (10), having a first inactive position arranged at the side of said axis of feed (21) and adjacent to said bending assembly (11), is translated laterally to move to a second active position cooperating with said axis of feed (21) to perform an auxiliary drawing function in or close to the area of said bending assembly (11).
14. Method as in claim 13, **characterized in that** said auxiliary drawing element (10) is mounted on the same supporting element (22) on which said bending assembly (11) is mounted, and **in that**, during the passage between said inactive and active positions, said supporting element (22) is translated laterally until it positions said auxiliary element (10) in cooperation with said axis of feed (21).
15. Method as in claim 13 or 14, wherein the bending assembly (11) is of the type comprising at least a disk-type bending element (13), **characterized in that** as an auxiliary element (10) a roller (23) is used, rotating on its own axis together with said disk-type bending element (13), the method providing at least a step wherein, after said auxiliary element (10) has been positioned in cooperation with said axis of feed (21), the roller element (23) and/or the disk-type bending element (13) are displaced laterally one with respect to the other in order to close on grip on the bar (18).
16. Method as in claim 13 or 14, **characterized in that** as an auxiliary element (10) a gripper element (29) is used, movable linearly with an alternating movement, or a pair of rotary rollers (31), wherein said lateral translation is performed in order to take said gripper element (29) or said rollers (31) onto the axis of feed (21) and to grip on the bar (18) in order to allow the linear movement thereof.

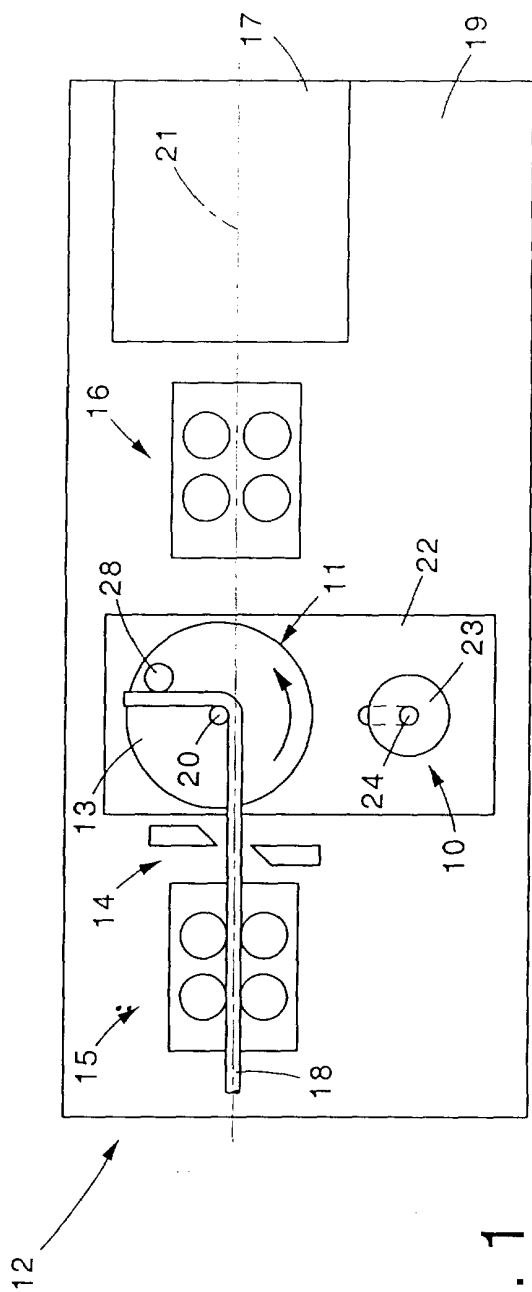


fig. 1

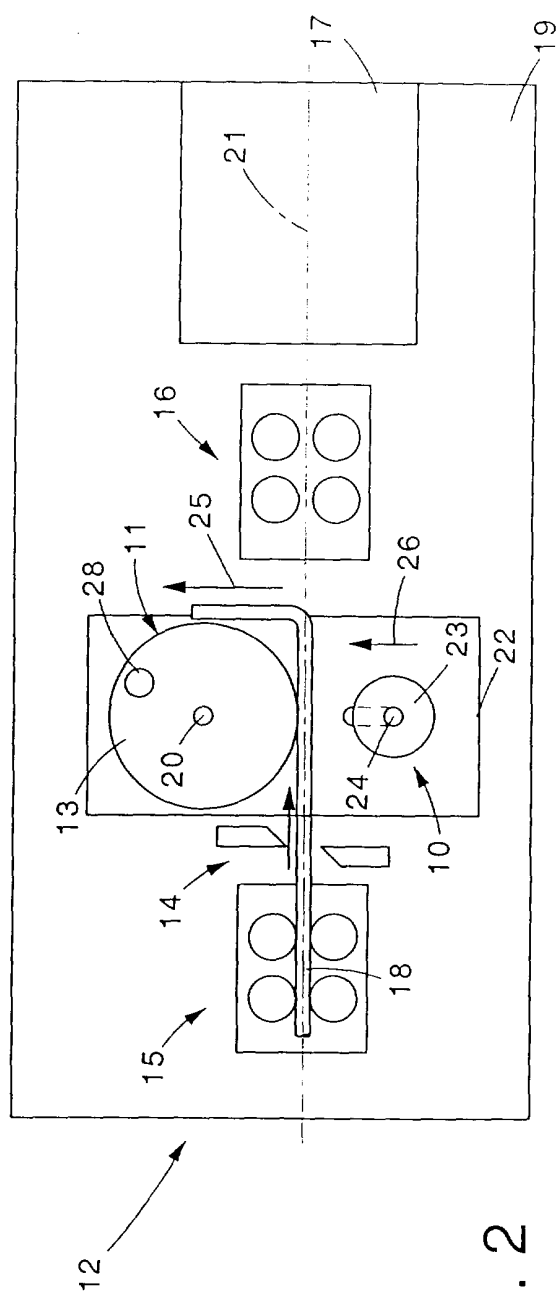


fig. 2

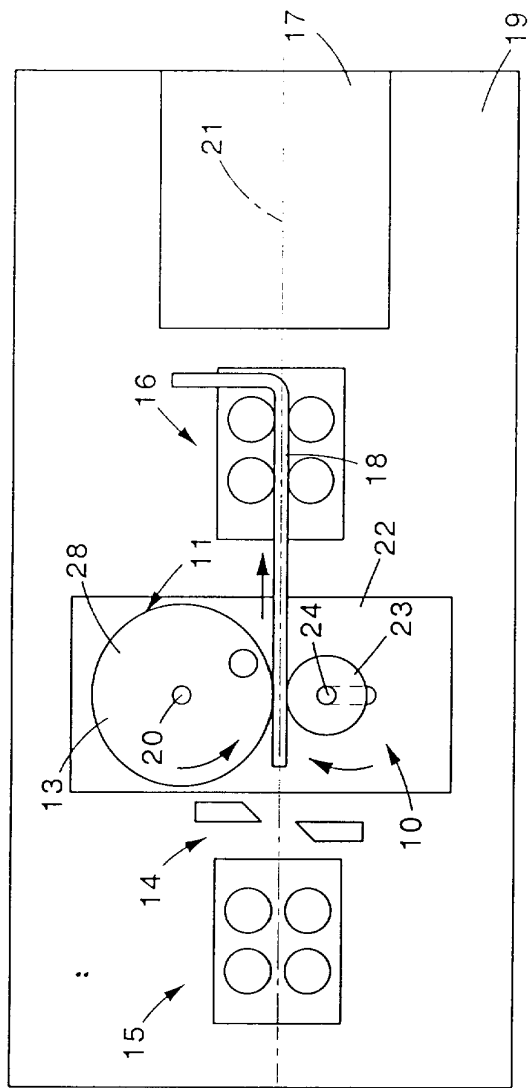


fig. 3

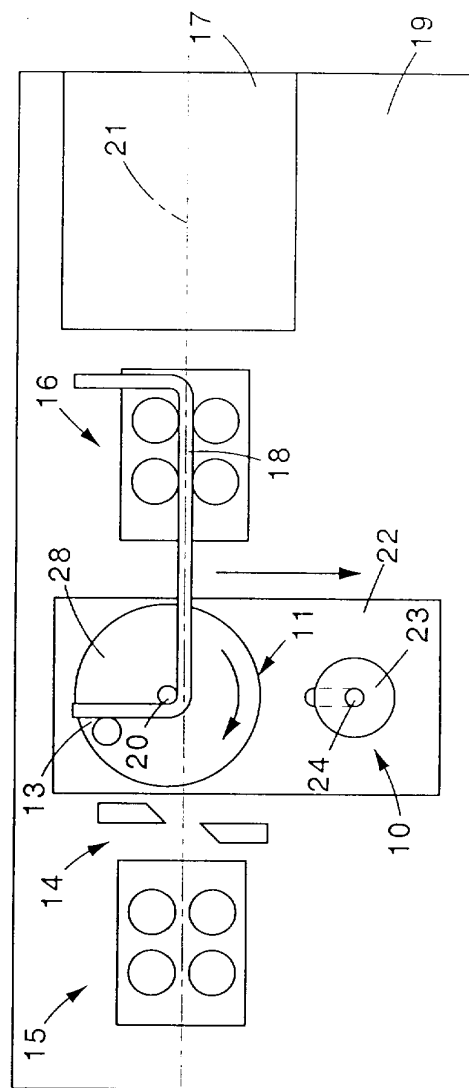


fig. 4

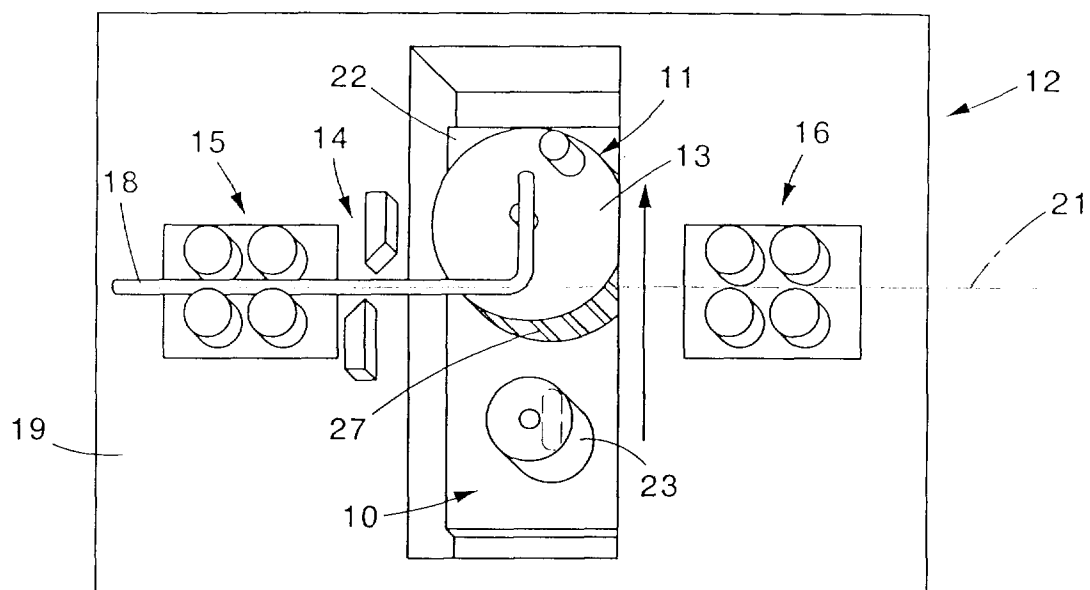


fig. 5

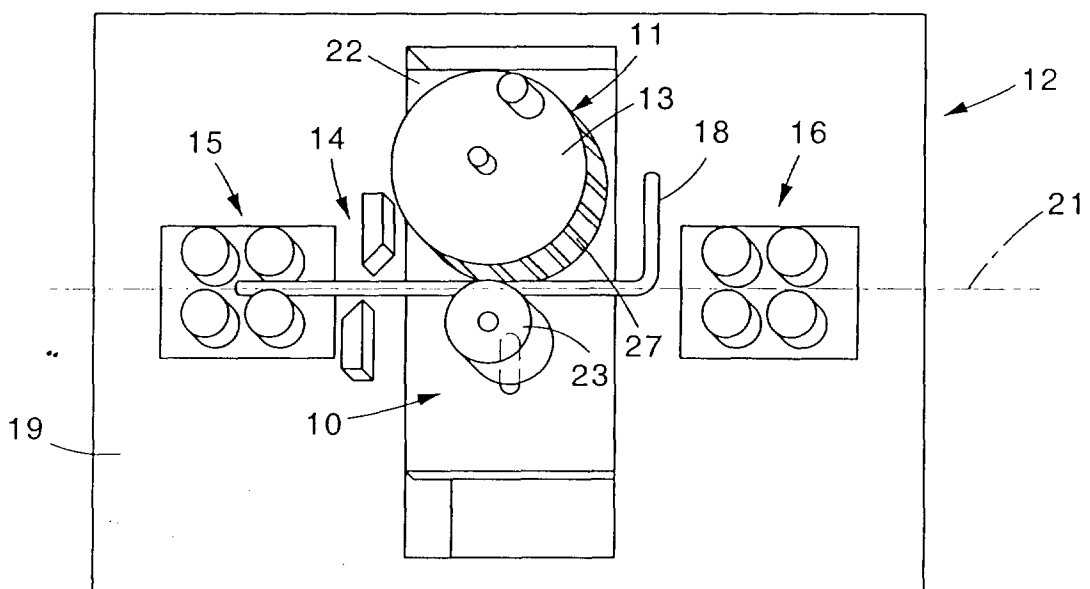


fig. 6

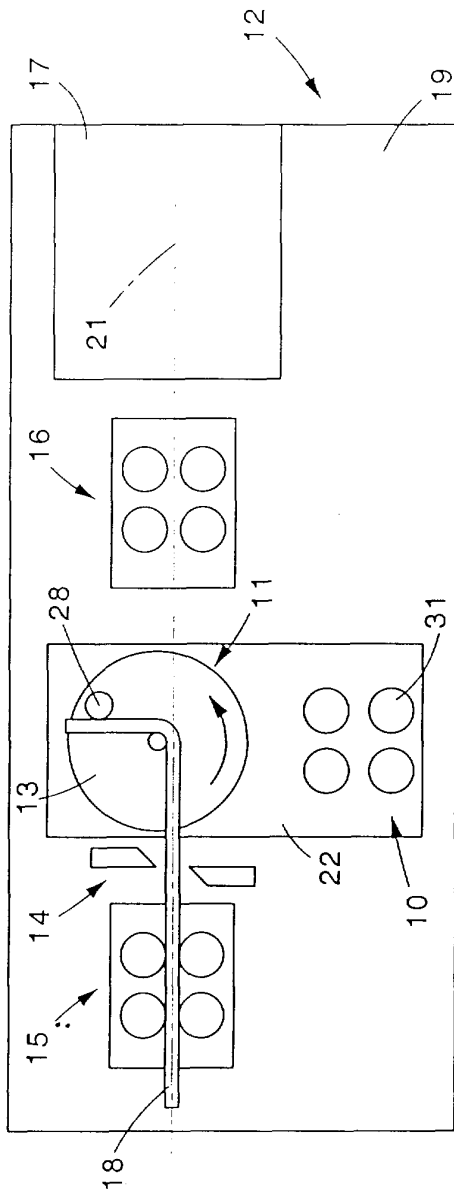


fig. 7

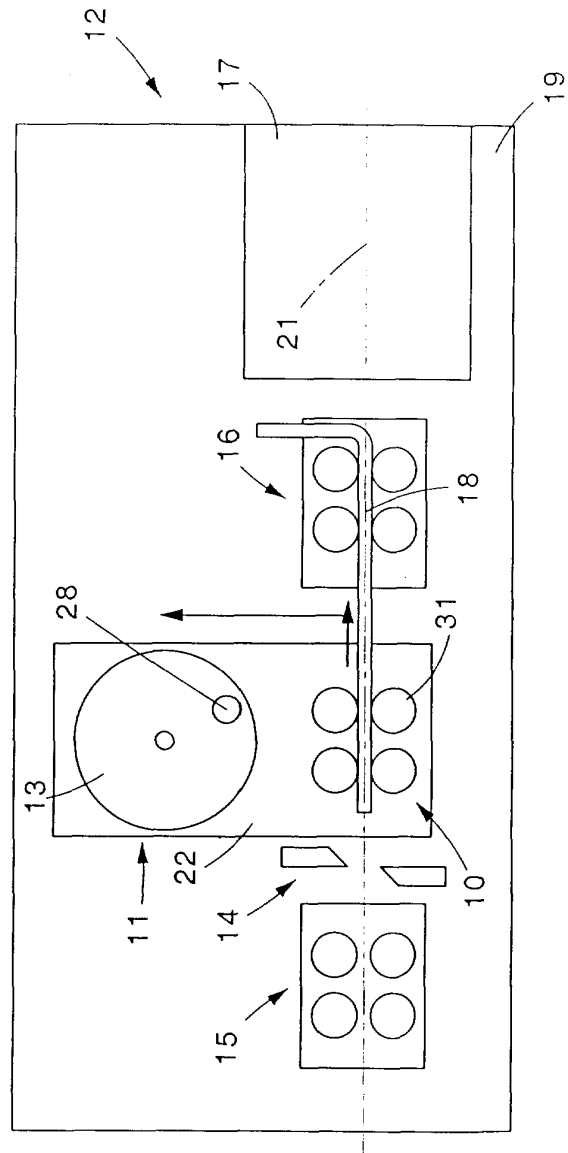


fig. 8

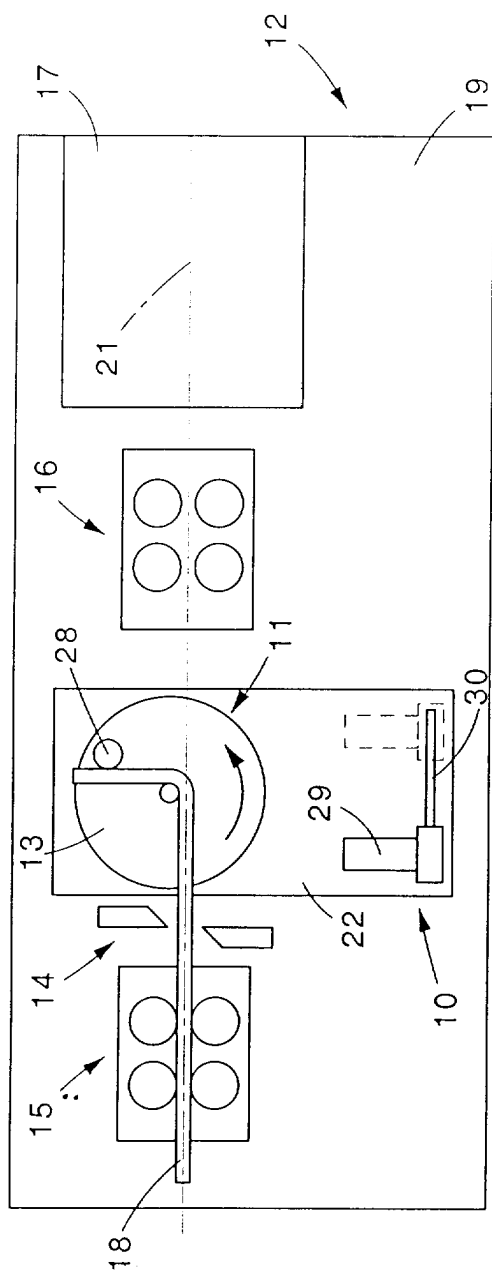


fig. 9

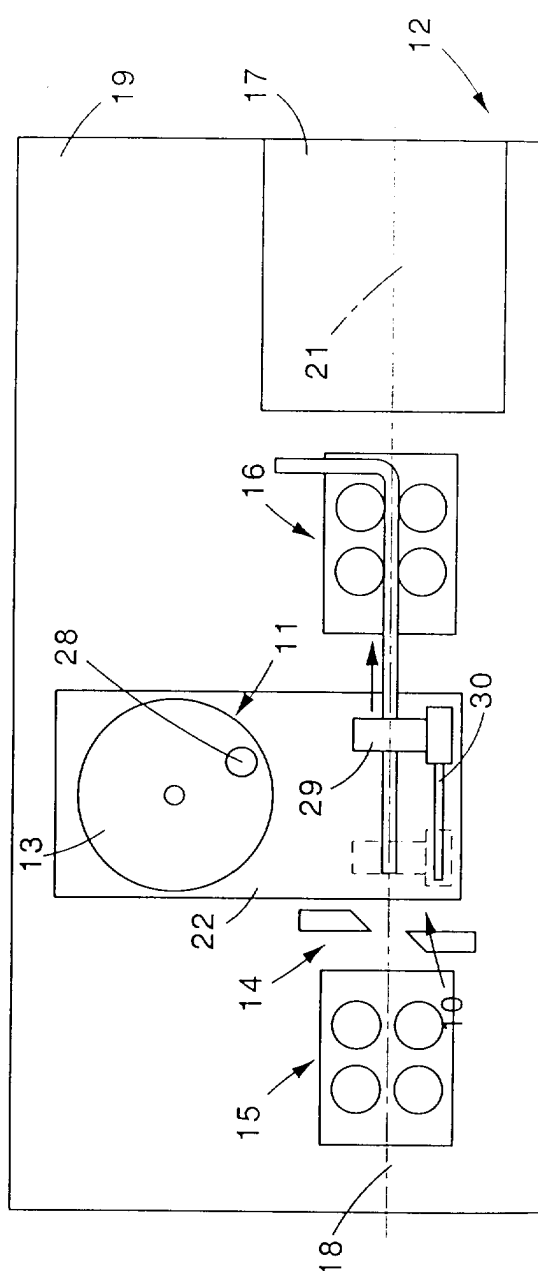


fig. 10

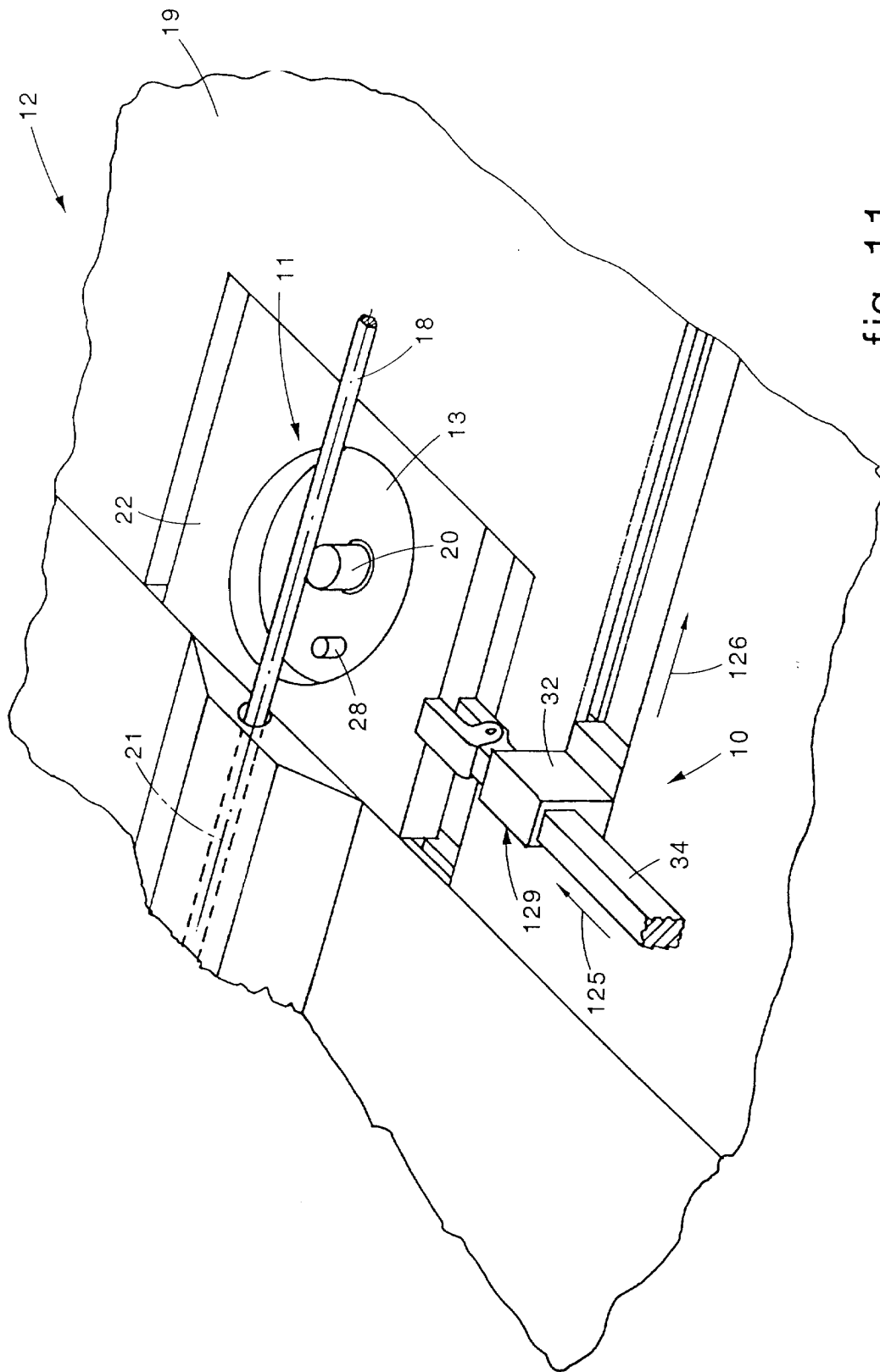


fig. 11



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 10 3942

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.C1.7)
X	EP 0 538 595 A (PIEGATRICI MACCH ELETTR) 28 April 1993 (1993-04-28) * the whole document *	1,13	B21D11/12
X	EP 0 379 043 A (PIEGATRICI MACCH ELETTR) 25 July 1990 (1990-07-25) * the whole document *	1,13	
X	FR 2 553 314 A (PIEGATRICI MACCH ELETTR) 19 April 1985 (1985-04-19) * the whole document *	1,13	
			TECHNICAL FIELDS SEARCHED (Int.C1.7)
			B21D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		28 January 2004	Peeters, L
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 03/02 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 10 3942

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.

28-01-2004

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0538595 A	28-04-1993	IT 1252984 B	10-07-1995
		AT 122940 T	15-06-1995
		CA 2080881 A1	22-04-1993
		DE 69202679 D1	29-06-1995
		DE 69202679 T2	25-01-1996
		DK 538595 T3	24-07-1995
		EP 0538595 A1	28-04-1993
		ES 2072674 T3	16-07-1995
		JP 3263149 B2	04-03-2002
		JP 5208220 A	20-08-1993
		US 5285671 A	15-02-1994
EP 0379043 A	25-07-1990	IT 1235177 B	23-06-1992
		AT 91652 T	15-08-1993
		CA 2007984 A1	18-07-1990
		DE 69002243 D1	26-08-1993
		DE 69002243 T2	23-12-1993
		DK 379043 T3	23-08-1993
		EP 0379043 A1	25-07-1990
		ES 2043119 T3	16-12-1993
		JP 2229623 A	12-09-1990
		JP 2801332 B2	21-09-1998
		US 4993253 A	19-02-1991
FR 2553314 A	19-04-1985	IT 1175134 B	01-07-1987
		DE 3436285 A1	25-04-1985
		FR 2553314 A1	19-04-1985