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

(11) EP 0 900 602 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
10.03.1999 Bulletin 1999/10

(51) Int Cl.[6]: **B21D 11/12**

(21) Application number: **98830414.3**

(22) Date of filing: **09.07.1998**

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

(30) Priority: **08.09.1997 IT TO970792**

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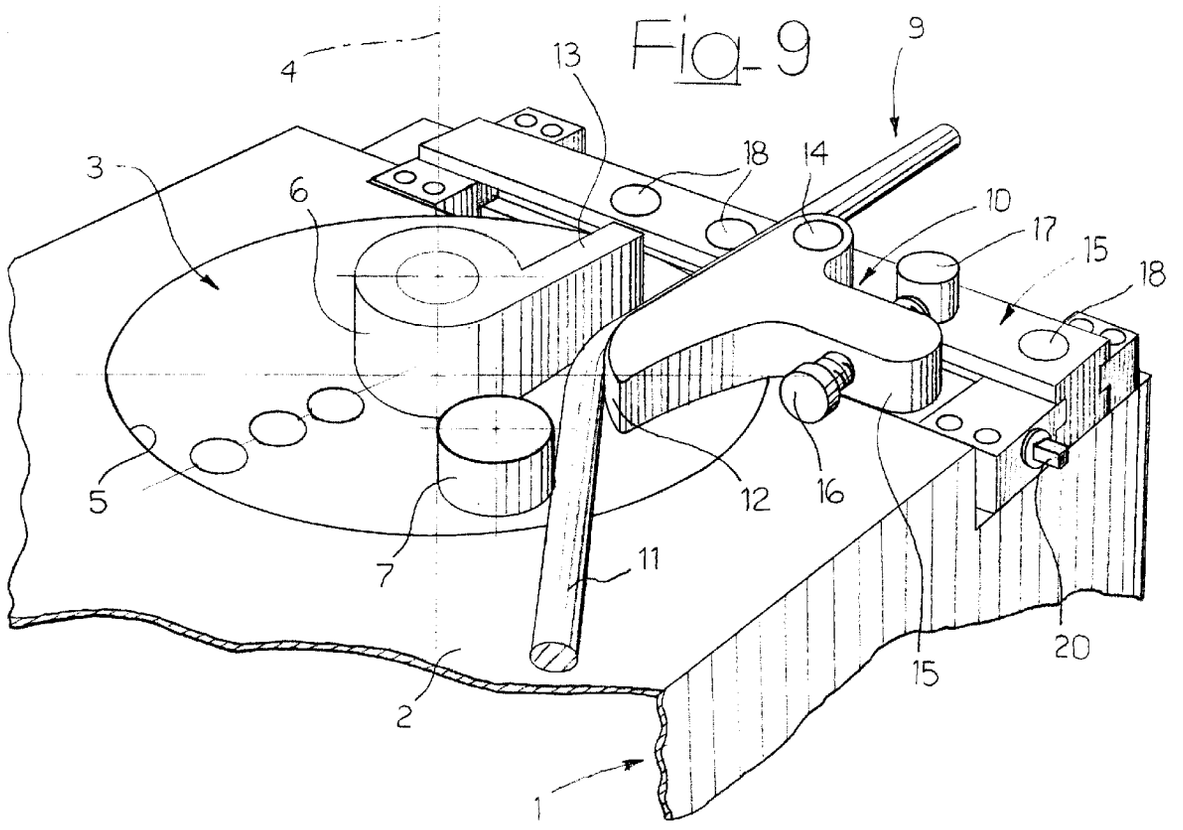
(54) Apparatus for bending steel bars, particularly concrete reinforcing bars

(57) An apparatus for bending steel bars (9) comprises a base (1) and a bending disk (3) having a central shaft (6) and an eccentric pin (7) and further cooperating with an abutment element (10) while the bending operation is carried out. The central shaft (6) and the abutment element (10) are shaped in such a way that they are able to exchange their functions with each other when it is necessary to carry out a bending operation in a direction opposite with respect to a previous bending operation.

Fig. 9



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Description

[0001] The present invention relates to apparatus for bending steel bars, particularly concrete reinforcing bars, of the known type comprising:

- a base,
- a bending disk rotatably mounted around a vertical axis on the base, and having a central support shaft and an eccentric bending pin, between which the bar portion to be bent has to be arranged,
- an abutment element supported in a fixed position by the base, on the same side of the bar as the eccentric pin, for constituting an abutment during the bending operation for the bar portion adjacent to the bar portion which is bent.

[0002] Apparatus of the above indicated type have been known and used for a long time in automatic bending plants. Once bending of an end portion of the bar is carried out, it may be necessary to carry out an opposite bending on an adjacent portion of the same bar, i.e. the bar may be bent in the opposite direction with respect to the previous operation. In this case, various solutions are adopted: in a first solution, the bar is raised from the rotatable disk and then positioned again on the other side of the central shaft, while the eccentric pin of the disk is further arranged on the opposite side of the bar. It is further necessary in this case to arrange the abutment element on the opposite side of the bar, with respect to its previous location. In this manner, the opposite bending of the bar can be carried out by rotating the rotatable disk in the opposite direction with respect to that which has caused the previous bending. This solution implies a long time to provide the sequence of movements required and also involves complications due to the great number of driven components.

[0003] A second solution provides for the use of a central fork-shaped block, and a rotatable disk having two bending pins, which are selectively used to carry out bendings in the two opposite directions. This solution cannot be used to carry out bending operations by over 90°, due to the presence of the bending pin which is inactive.

[0004] The object of the present invention is that of providing a bending apparatus which is able to carry out two bending operations in sequence in opposite directions on the same bar, in a simple and rapid manner, with no need of raising the bar or modifying the location of the abutment element between one bending operation and the other.

[0005] In view of achieving this object, the invention provides a bending apparatus of the type indicated at the beginning, characterized in that the above mentioned abutment element has a portion having a rounded profile, adapted to fulfil the function of said central shaft when opposite bending of the bar is carried out, in that said central shaft is shaped so as to be able to fulfil the function of said abutment element when opposite bending of the bar is carried out, and further in that there are provided means for moving temporarily the bar away from the disk in the vertical direction, so as to enable the eccentric pin to be brought from one side to the other of the bar when a bending operation must be carried out in the opposite direction with respect to a previous bending operation.

[0006] In the apparatus according to the present invention, when the operator must carry out an opposite bending, i.e. a bending operation in a direction opposite to that of a previous bending operation, he has not to exercise any effort for raising the bar in order to move the eccentric pin of the rotatable disk on the other side of the bar, nor he has to provide a new positioning for the abutment element. Thus, a reduction of dead periods is obtained along with a resulting increase in productivity which further renders the operation for the user simpler and easier.

[0007] Further features and advantages of the invention will become apparent from the following description with reference to the annexed drawings, given purely by way of non limiting example, in which:

figure **1** is a diagrammatic plan view of an apparatus according to the invention,
figure **2** is an elevational cross-sectional view of the apparatus of figure 1 in a first condition of operation,
figures **3, 4** are cross-sectional views corresponding to that of figure 2 which show two different conditions of operation of the apparatus,
figure **5** is a plan view which shows a different condition of operation of the apparatus,
figure **6** is a plan view at an enlarged scale and in greater detail of the apparatus according to the invention,
figure **7** is a cross-sectional elevational view, at an enlarged scale and in greater detail, of the apparatus according to the invention,
figure **8** is a further cross-sectional elevational view of the apparatus according to the invention, and
figure **9** is a perspective view at an enlarged scale of the upper part of the apparatus according to the invention.

[0008] With reference to the drawings, and particularly to figure 9, the bending apparatus according to the invention comprises, in a way known per se, a base 1 having an upper wall 2 and a bending disk 3 rotatably mounted on the base 1 around a vertical axis 4. In the operative condition, the upper surface of disk 3 is arranged flush with the upper wall 2 within a circular aperture 5 formed therein.

[0009] According to a technique conventional per se, the rotatable disk 3 has a central shaft 6 acting as a support for a steel bar to be bent around shaft 6 in the clockwise direction (with reference to figure 9), and an eccentric cylindrical pin 7 serving for causing bending of the

bar.

[0010] According to the conventional art (see figure 1) the end portion 8 of a bar 9 is bent, for instance by 90°, in a clockwise direction (with reference to figure 1) by imparting a rotation in the same direction (see arrow A in figure 1) to disk 3, which causes the eccentric pin 7 to push against the end portion 8 of bar 9. While bending is carried out, the bar 8 is wound around the central shaft 6. Also according to the conventional art, an abutment element 10 is provided in a fixed position on the base 1, on the same side as eccentric pin 7 of bar 9, so as to be a support for portion 11 of bar 9 adjacent to the portion 8 which is being bent, while bending is carried out.

[0011] In figure 1, by dotted lines there is shown the position reached by the eccentric pin 7 and the portion 8 after the bending operation.

[0012] In the conventional apparatus, if, after bending of portion 8 of bar 9, a bending is desired of the adjacent portion 11 in a direction opposite to the direction of the previous bending operation, first of all it is necessary to raise the bar 9 from the bending disk and positioning again the bar on the other side of the central shaft 6, while taking care that in this case the eccentric pin is on the opposite side of the bar (i.e. above the bar, with reference to figure 1) with respect to the previous location. By doing this, it will be possible to carry out an opposite bending, i.e. a bending in an opposite direction with reference to figure 1, of portion 11 of bar 9, by driving a rotation in the same direction, i.e. in an anti-clockwise direction, of the rotatable disk 3. Also to this end, it is however necessary to arrange the abutment element 10 at a new location, so that it is positioned on the same side of the bar as the eccentric pin 7.

[0013] In the case of the present invention, the operator has not to carry out any raising operation of the bar between two subsequent bending operations carried out in opposite directions, since the whole rotatable disk 3, along with central shaft 6 and eccentric pin 7 can be lowered vertically with respect to the upper wall 2 of base 1, above which the bar 9 always rests. In this manner, it is possible to raise the rotatable disk 3 again after that it has been rotated so that the eccentric pin 7 is brought to the opposite side of bar 9 with respect to its previous location, i.e. it is brought to the position which is shown in figure 9. At this time, the apparatus according to the invention is already able to carry out the opposite bending, even if the bar is always on the same side with respect to the central shaft. Indeed, in the apparatus according to the invention, the abutment element 10 has a portion having a rounded profile 12 adapted to fulfil the function of the central shaft 6 when an opposite bending is carried out. At the same time, the central shaft 6 is provided with an appendage 13 adapted to fulfil the function of abutment element when opposite bending is carried out.

[0014] Therefore, in the apparatus according to the invention, it is not necessary to change the location of the abutment element 10 between two subsequent bending operations carried out in opposite directions.

[0015] Figure 5 diagrammatically shows in plan view the arrangement of the apparatus before an opposite bending is carried out. In this condition, the disk 3 has been already lowered and then raised again in a rotated position, so as to have its eccentric pin 7 on the opposite side of bar 9 with respect to its previous location shown in figure 1. In this manner, by driving an anti-clockwise rotation of the rotatable disk 3 (see arrow B in figure 5) the eccentric pin 7 pushes portion 11 of bar 9 so as to cause bending of this bar around the rounded surface 12 of the abutment element 10, which in this condition fulfils the function which was fulfilled by the central shaft 6 during the previous bending operation shown in figure 1. At the same time, appendage 13 of central shaft 6 fulfils the function of abutment element.

[0016] Figures 2, 4 are elevational views corresponding to the conditions of the apparatus shown in figures 1, 5. Figure 3 shows the intermediate condition with the rotatable disk 3 lowered.

[0017] Also with reference to figures 6, 9, in the preferred embodiment of the invention which is shown in the drawings, the abutment element 13 has a substantially T-shaped body having a wing which is freely rotatably mounted around a vertical pin 14 secured on an element 15 carried by the base 1. The T-shaped body of the abutment element 10 further has a wing 15 through which a threaded hole is foamed in which a screw 16 is screwed whose tip is in contact with a pin 17 which is also secured to element 15. The body of the abutment element 10 is freely rotatable around pin 14. Therefore, while the bending operations (in either direction) are carried out, the abutment element 10 is subjected to a force applied by bar 9 which causes a rotation around pin 14 tending to push the tip of screw 16 against the stop pin 17. The screw 16 can be adjusted in order to adjust the work angular position of the abutment element 10 around the axis of pin 14 accordingly. Viceversa, if for any reason (for example due to a collision with foreign moving parts) the abutment element 10 is subjected to a clockwise rotation (with reference to figure 9) it is free to perform this rotation, with a resulting movement of the tip of screw 16 away from the stop pin 17. If the diameter of the bars to be bent is varied, it is necessary to provide accordingly a central shaft 6 and an eccentric pin 7 of the required dimensions and at the required distance from each other. For the same reason, it is necessary to provide the abutment element 10 at the required distance from the central shaft 6. This can be made easily because each of pins 14, 17 can be inserted in any of a number of seats 18 arranged in element 15, and also because the element 15 on its turn is a sliding member, slidably guided on base 1 and provided with a micrometric adjustment device. To this end, the sliding member 15 has an appendage 15a (see figure 6) which can be adjusted by means of a screw-and-nut system 19 provided with an actuating end 20 which

can be engaged by an operating tool.

[0018] Figure 8 shows the inner structure of base 1, with the rotatable disk 3 in the lowered position to which it is temporarily brought in order to enable the eccentric pin 7 to move to the opposite side of bar 9 between two subsequent bending operations in opposite directions. As shown in figure 8, the rotatable disk 3 is rotatably supported by a supporting structure 21 which is slidably guided on two vertical cylindrical columns 22 which are secured to the upper wall 2 of the base 1 and projects downwardly inside the base. Reference numeral 23 designates the outer housing of a gear box which drives rotation of the rotatable disk 3 and which is driven by a radial horizontal shaft 24 which is driven through a belt transmission 25 by a motor and reducing unit 26 which is also secured inside base 1.

[0019] The vertical displacement of the unit carrying the rotatable disk 3 is driven by a fluid cylinder 27 which is shown in figure 7 in its extended condition, corresponding to the raised operative condition of the rotatable disk 3.

[0020] As it will be clearly apparent from the foregoing description, by the apparatus according to the invention two bending operations of adjacent portions of a steel bar can be carried out in sequence in directions opposite to each other, with no need to perform troublesome adjusting operation on the apparatus between one bending operation and the other, in particular with no need to change the arrangement of the abutment element and with no need to raise the bar in order to bring it to the opposite side of the central shaft of the bending disk.

[0021] Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention.

Claims

1. Apparatus for bending steel bars, particularly concrete reinforcing bars, comprising:

   - a base (1),
   - a bending disk (3) rotatably mounted around a vertical axis (4) on the base (1), and having a central supporting shaft (6) and an eccentric bending pin (7) between which the portion of the bar to be bent has to be arranged,
   - an abutment element (10) supported at a fixed location by the base on the same side of the bar (9) as the eccentric pin (7), to constitute an abutment for the bar portion adjacent to the bar portion which is being bent while the bending operation is carried out,

   characterized in that said abutment element (10) has a portion having a rounded profile (12), adapted to fulfil the function of said central shaft (6) when opposite bending of the bar is carried out, in that said central shaft (7) is shaped in such a way as to be adapted to fulfil the function of said abutment element (10) when opposite bending of the bar is carried out, and in that there are provided means (27) for moving the bar (9) temporarily in the vertical direction away from the rotatable disk (3), so that the eccentric pin (7) can be brought from one side to the other of the bar in order to carry out a bending operation in a direction opposite to that of the previous bending operation.

2. Apparatus according to claim 1, characterized in that the central shaft (6) is provided with an appendage (13) adapted to act as abutment element during the opposite bending operation.

3. Apparatus according to claim 1, characterized in that said means for moving the bar (9) temporarily in the vertical direction away from the rotatable disk (3) comprises means for lowering the rotatable disk (3) with respect to an upper plane (2) of the base (1) on which the bar (9) is supported.

4. Apparatus according to claim 1, characterized in that said abutment element is secured to the base (1) so as to be adjustable in position in a horizontal direction orthogonal to the longitudinal direction of the bar when the latter is positioned to carry out the bending operation.

5. Apparatus according to claim 4, characterized in that said abutment element (10) is freely rotatably mounted around a vertical pin (14) secured selectively within one of a number of seats (18) formed in the base (1).

6. Apparatus according to claim 5, characterized in that said seats (18) are formed in a sliding member (15) slidably mounted on the base (1) and provided with a micrometric adjustment device (19, 20) for positioning thereof.

7. Apparatus according to claim 6, characterized in that the abutment element (10) is provided with ad adjustable screw (16) acting as engaging element against a fixed stop element (17) provided at one of said seats (18).

8. Apparatus according to claim 7, characterized in that said abutment element (10) has a substantially T-shaped body, having a wing formed with said rounded portion (12), another wing freely rotatably mounted on said pin (14) and another wing provided with said engaging screw (16).

Fig. 1

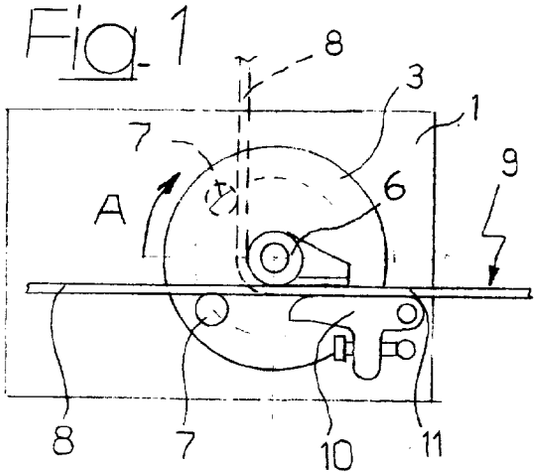


Fig. 2

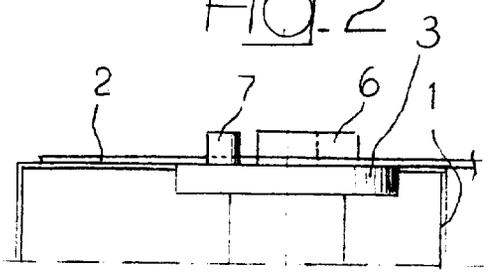


Fig. 3

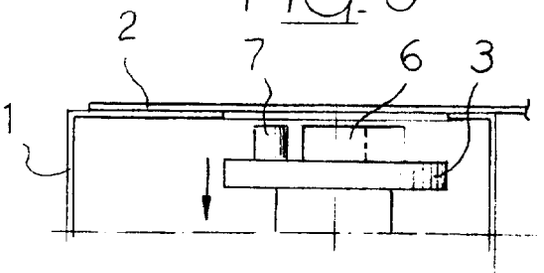


Fig. 4

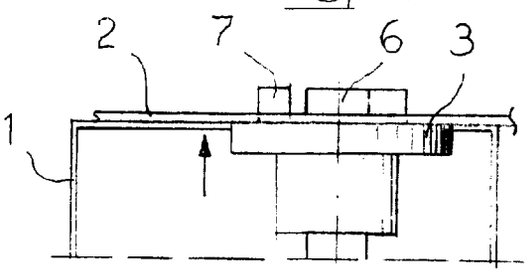
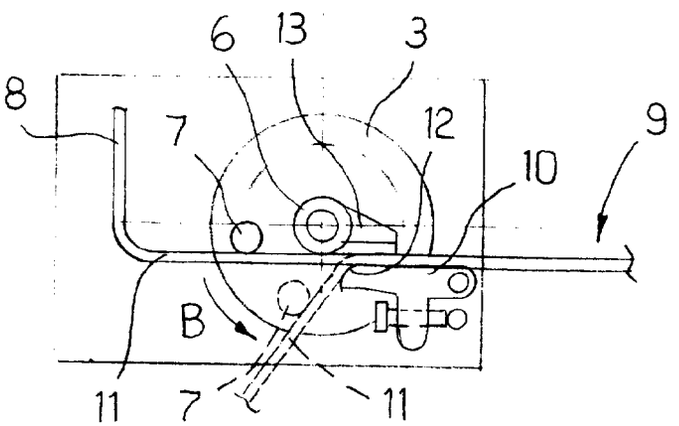


Fig. 5



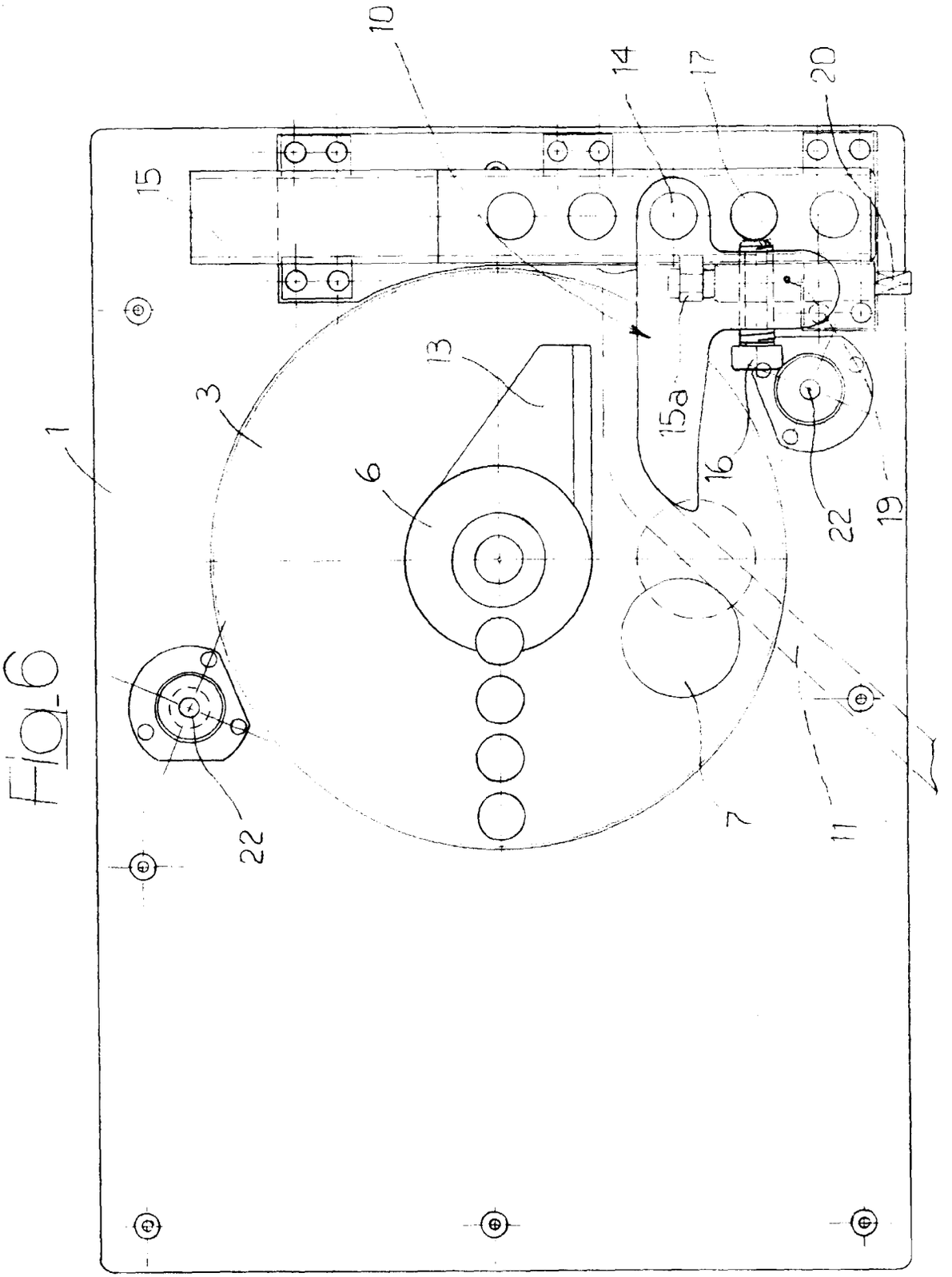


FIG 6

Fig. 7

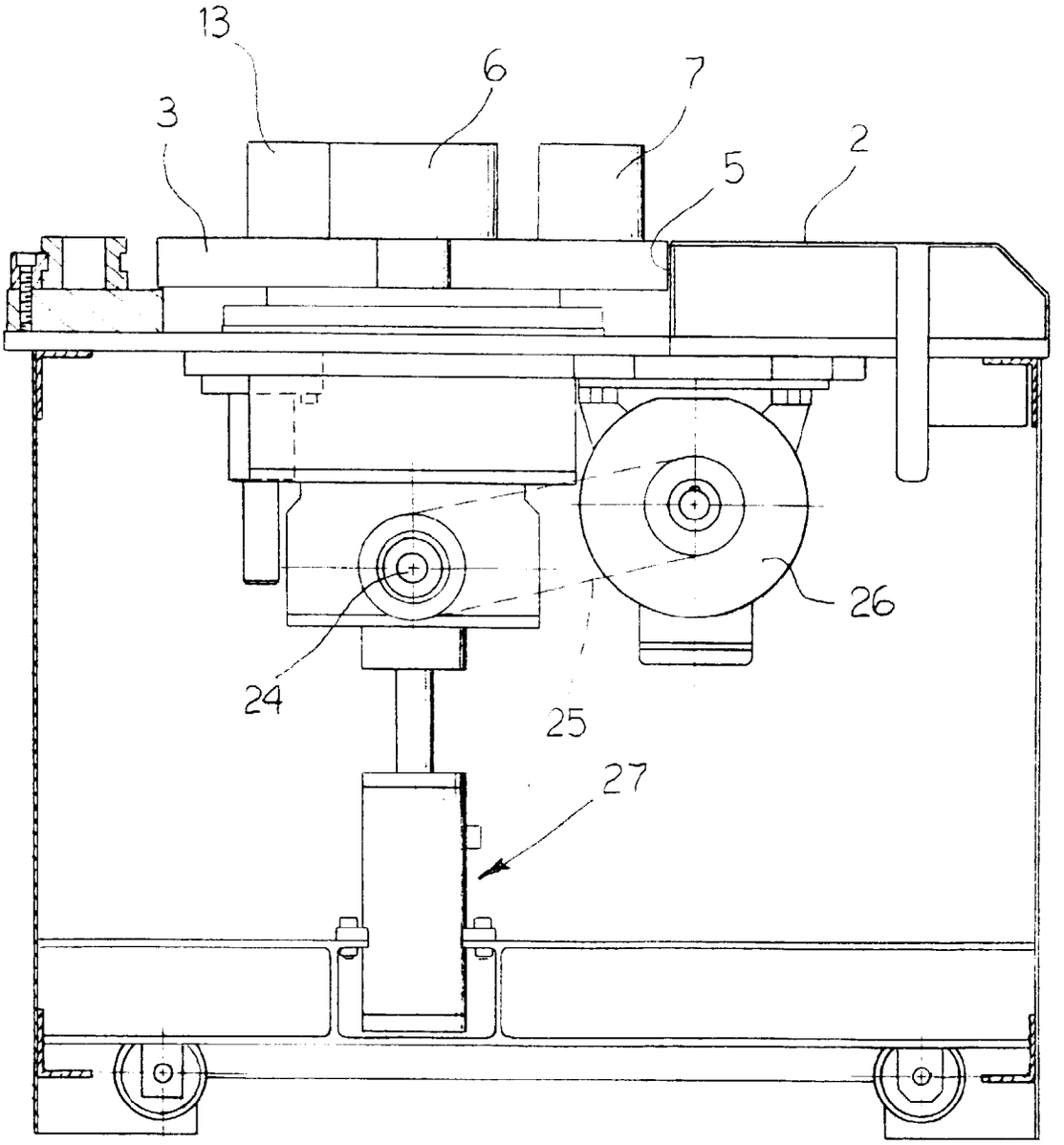
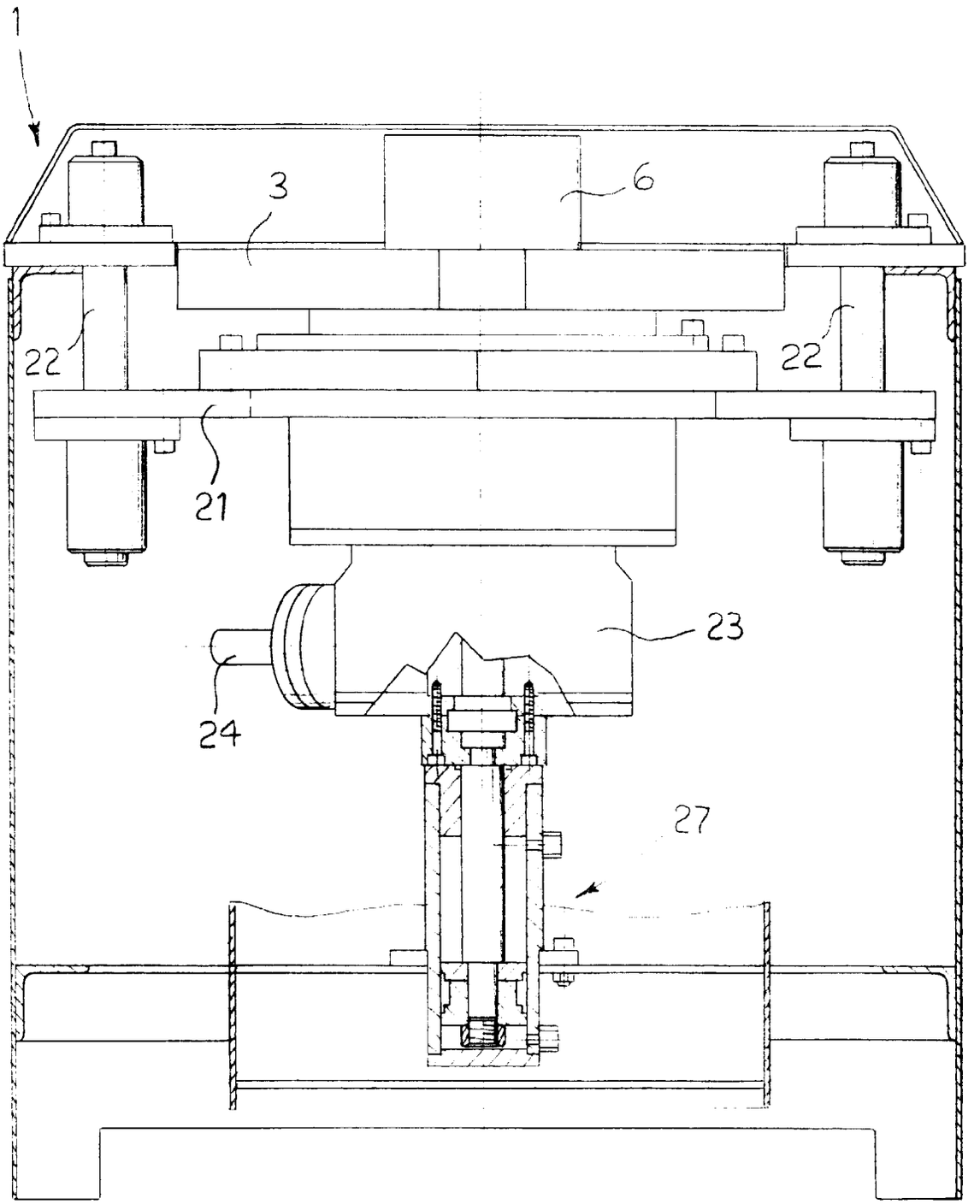


Fig. 8



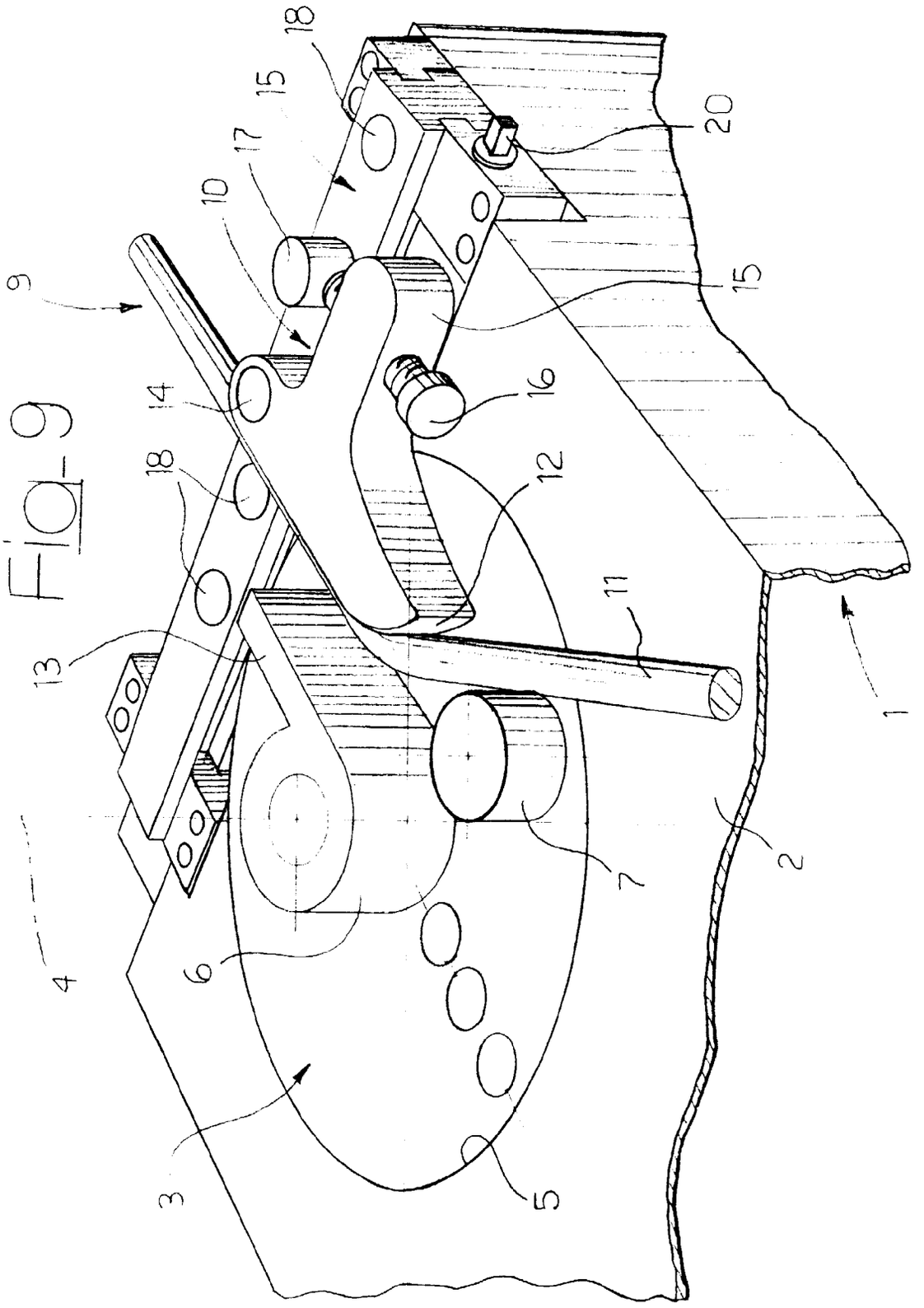


Fig 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0414

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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A	* the whole document *	3	
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TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 December 1998	Ris, M

CATEGORY OF CITED DOCUMENTS

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