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

Vorrichtung zum Biegen von Betonstahl

Dispositif de cintrage des fers à béton

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Description

[0001] The present invention relates to apparatus for bending steel bars, particularly concrete reinforcing bars. Apparatus of this type are known 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] An apparatus having the features indicated in the pre-characterizing portion of claim 1 is also known (see FR-A-2 290 969). However also this known apparatus has a central fork-shaped block, which poses a limit to the maximum diameter of the bar to be bent, since any U-bend of the bar requires a bending radius greater than a minimum admitted value (such as ten times the bar diameter). Therefore, this known device can operate only on bars of relatively small diameter, such as up to 16 mm, since each of the two fork brackets of the fork-shaped block must have a radius not lower than the minimum admitted value. Bars of greater diameter (such as up to 40 mm) would involve providing a disk of excessive dimensions in order to accomodate a fork-shaped block of the necessary size.

[0005] 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.

[0006] In view of achieving this object, the invention provides a bending apparatus as set forth in claim 1.

[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 for bending steel bars,
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,
figure 7 is a cross-sectional elevational view, at an enlarged scale and in greater detail, of the apparatus,
figure 8 is a further cross-sectional elevational view of the apparatus, and
figure 9 is a perspective view at an enlarged scale of the upper part of the apparatus.

[0008] With reference to the drawings, and particularly to figure 9, the bending apparatus 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.

Claims

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

   - a base (1),
   - a bending disk (3) on which the portion of the bar to be bent has to be arranged, said disk being rotatably mounted around a vertical axis (4) on the base (1), and having a central bending support (6) and an eccentric bending pin (7) for bending a bar arranged on said support in a first direction,
   - 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 in said first direction is carried out,
   - 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 said first direction,

   characterized in that:

   - said central bending support is a shaft (6) coaxially arranged on the bending disk (3), adapted to cooperate with the eccentric bending pin of the disk for bending a bar arranged between the shaft (6) and the eccentric pin (7) in said first direction,
   - said abutment element (10) is an element separate from said shaft (6) supported by said base (1) at a location outside of the periphery of said disk (3), said abutment element (10) having a portion with a rounded profile (12), adapted to fulfil the function of said central shaft (6) when the bar is being bent in said opposite direction,
   - said central shaft (6) is provided with an appendage (13) shaped in such a way as to be adapted to fulfil the function of said abutment element (10) when the bar is being bent in said opposite direction,
   - 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.

2. 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.

3. Apparatus according to claim 1, 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), said abutment element having an engaging element (16) cooperating with a fixed stop element (17) provided at another one of said seats (18).

4. Apparatus according to claim 3, 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.

5. Apparatus according to claim 3, characterized in that said engaging element (16) of the abutment element (10) is an adjustable screw (16) carried by the abutment element (10) and acting against said fixed stop element (17).

6. Apparatus according to claim 5, 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 vertical pin (14) and another wing provided with said engaging screw (16).

Patentansprüche

1. Vorrichtung zum Biegen von Rundstahl, insbesondere Betonstabstahl, die umfaßt:
   eine Basis (1); eine Biegescheibe (3) auf welcher der Abschnitt der zu biegenden Stabbewehrung angeordnet werden soll, wobei die Scheibe auf der

Basis (1) um eine vertikale Achse (4) drehbar angebracht ist, und ein mittig angeordnetes Biegelager (6) und einen außermittig angeordneten Biegestift (7) besitzt, um die auf dem Lager angeordnete Stabbewehrung in eine erste Richtung zu biegen; ein Auflageelement (10) getragen an einer fixierten Stelle der Basis auf der gleichen Seite der Stabbewehrung (9) wie der außermittig angeordnete Stift (7), um, während der Biegevorgang in die erste Richtung ausgeführt wird, eine Auflage für den Abschnitt der Stabbewehrung bereitzustellen, der an dem Abschnitt der Stabbewehrung, welcher gebogen wird, vorliegt; Mittel (27), um die Stabbewehrung (9) vorübergehend in die vertikale Richtung von der drehbaren Scheibe (3) weg zu bewegen, derart, daß der außermittig angeordnete Stift (7) von einer Seite der Stabbewehrung zur anderen gebracht werden kann, um einen Biegevorgang in eine der ersten Richtung entgegengesetzten Richtung auszuführen, dadurch gekennzeichnet, daß

das mittig angeordnete Biegelager eine auf der Biegescheibe (3) koaxial angeordnete Welle (6) ist, die angepaßt ist, um mit dem außermittig angeordneten Biegestift der Scheibe zum Biegen einer zwischen der Welle (6) und dem außermittig angeordneten Stift (7) angebrachten Stabbewehrung in eine erste Richtung zusammenzuwirken,
wobei das Auflageelement (10) ein von der Welle (6) getrenntes Element darstellt, getragen von der Basis (1) an einer Stelle außerhalb des Randbereiches der Scheibe (3), wobei das Auflageelement (10) einen Abschnitt mit einem abgerundeten Profil (12) aufweist, angepaßt, um die Funktion der mittig angeordneten Welle (6) zu erfüllen, wenn die Stabbewehrung in die entgegengesetzte Richtung gebogen wird,
wobei die mittig angeordnete Welle (6) mit einer Fortsetzung (13) ausgestattet ist, die derart geformt ist, daß sie die Funktion des Auflageelements (10) erfüllen kann, wenn die Stabbewehrung in die entgegengesetzte Richtung gebogen wird,
wobei das Auflageelement (10) derart an der Basis (1) festgemacht ist, daß dessen Lage in horizontaler Richtung rechtwinkelig zu der Längsrichtung der Stabbewehrung verstellbar ist, wenn die Letztere derart eingestellt wird, um den Biegevorgang auszuführen.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß

die Mittel zum vorübergehenden Bewegen der Stabbewehrung (9) in vertikaler Richtung weg von der drehbaren Scheibe (3) Mittel umfaßt, um die drehbare Scheibe (3) hinsichtlich einer oberen Ebene (2) der Basis (1), von welcher die Stabbewehrung (9) getragen ist, herabzulassen.

3. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß

das Auflageelement (10) um einen vertikalen Stift (14) frei drehbar angebracht ist, festgemacht wahlweise innerhalb einer von mehreren, in der Basis (1) ausgebildeten Vertiefungen (18), wobei das Auflageelement ein Eingriffelement (16) aufweist, das mit einem fixierten Stopelement (17), welches an einer anderen Vertiefung (18) bereitgestellt wird, in Wechselwirkung tritt.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß

die Vertiefungen (18) in einer Schiebekonstruktion (15) ausgebildet sind, die auf der Basis (1) verschiebbar angebracht ist und mit einer mikrometrischen Einstelleinrichtung (19, 20) für deren Einstellung ausgestattet ist.

5. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß

das Eingriffelement (16) des Auflageelements (10) eine verstellbare Schraube (16) ist, die von dem Auflageelement (10) getragen wird und gegen das fixierte Stopelement (17) wirkt.

6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß

das Auflageelement (10) im Wesentlichen eine T-förmige Form aufweist und einen Flügel besitzt, der mit dem abgerundeten Bereich (12) ausgebildet ist und einen weiteren Flügel, der an dem vertikalen Stift (14) frei drehbar angebracht ist und einen weiteren Flügel, der mit der Eingriffschraube (16) ausgestattet ist.

Revendications

1. Appareil de cintrage de barres d'acier, notamment de barres d'armature de béton, comprenant :

une base (1),
un disque de cintrage (3) sur lequel est destinée à être placée la partie de barre à cintrer, le disque étant monté afin qu'il puisse tourner autour d'un axe vertical (4) sur la base (1), et possédant un support central (6) de cintrage et une broche excentrique (7) de cintrage d'une barre placée sur le support dans une première direction,
un élément de butée (10) supporté à un emplacement fixe par la base du même côté de la barre (9) que la broche excentrique (7), afin qu'il constitue une butée pour la partie de barre adjacente à la partie de barre qui est en cours de

cintrage pendant que l'opération de cintrage est réalisée dans la première direction, et
un dispositif (27) de déplacement temporaire de la barre (9) en direction verticale à distance du disque rotatif (3), afin que la broche excentrique (7) puisse passer d'un côté à l'autre de la barre pour permettre l'exécution d'une opération de cintrage dans une direction opposée à la première,

caractérisé en ce que

le support central de cintrage est un arbre (6) placé coaxialement sur le disque de cintrage (3), destiné à coopérer avec la broche excentrique de cintrage du disque pour le cintrage d'une barre placée entre l'arbre (6) et la broche excentrique (7) dans la première direction,
l'élément (10) de butée est un élément séparé de l'arbre (6) supporté par la base (1) à un emplacement qui se trouve vers l'extérieur de la périphérie du disque (3), l'élément de butée (10) ayant une partie de profil arrondi (12) destinée à avoir la fonction de l'arbre central (6) lorsque la barre est cintrée dans la direction opposée,
l'arbre central (6) possède un accessoire (13) dont la forme est telle qu'il peut remplir la fonction de l'élément de butée (10) lorsque la barre est cintrée dans la direction opposée, et
l'élément de butée est fixé à la base (1) afin qu'il soit réglable en position en direction horizontale perpendiculaire à la direction longitudinale de la barre lorsque cette dernière est positionnée pour l'exécution de l'opération de cintrage.

2. Appareil selon la revendication 1, caractérisé en ce que le dispositif de déplacement temporaire de la barre (9) en direction verticale à distance du disque rotatif (3) comporte un dispositif destiné à abaisser le disque rotatif (3) par rapport à un plan supérieur (2) de la base (1) sur laquelle est supportée la barre (9).

3. Appareil selon la revendication 1, caractérisé en ce que l'élément de butée (10) est monté afin qu'il puisse tourner librement autour d'une broche verticale (14) fixée sélectivement dans un siège choisi parmi un certain nombre de sièges (18) formés dans la base (1), l'élément de butée ayant un élément de coopération (16) qui coopère avec un élément fixe d'arrêt (17) placé dans un autre des sièges (18).

4. Appareil selon la revendication 3, caractérisé en ce que les sièges (18) sont formés dans un organe coulissant (15) monté afin qu'il coulisse sur la base (1) et possédant un dispositif d'ajustement micrométrique (19, 20) destiné à son positionnement.

5. Appareil selon la revendication 3, caractérisé en ce que l'élément de coopération (16) de l'élément de butée (10) est une vis réglable (16) portée par l'élément de butée (10) et agissant contre l'élément fixe d'arrêt (17).

6. Appareil selon la revendication 5, caractérisé en ce que l'élément de butée (10) a un corps pratiquement en T, possédant une aile réalisée avec une partie arrondie (12), une autre aile étant montée afin qu'elle puisse tourner librement sur la broche verticale (14) et une autre aile étant munie de la vis de coopération (16).

Fig. 1

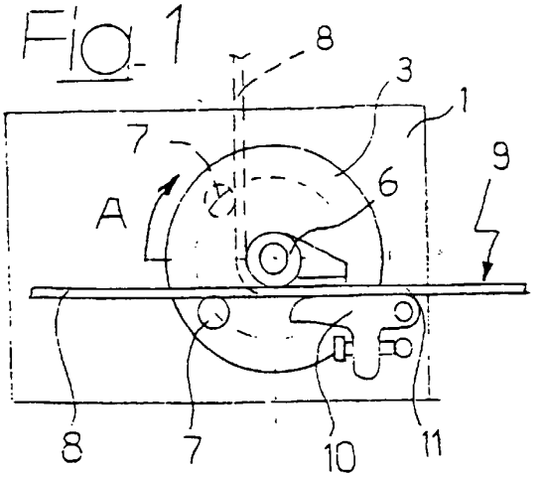


Fig. 2

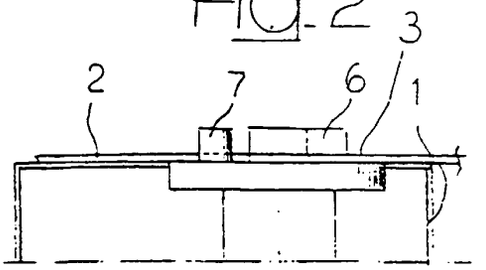


Fig. 3

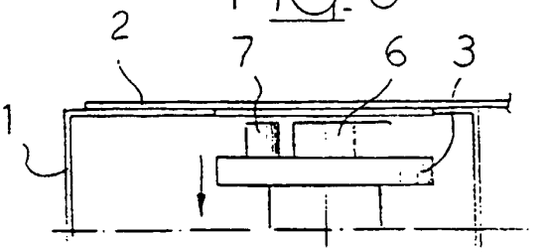


Fig. 4

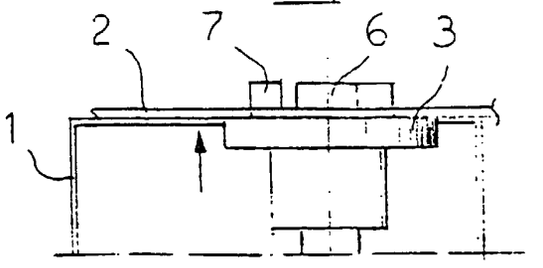
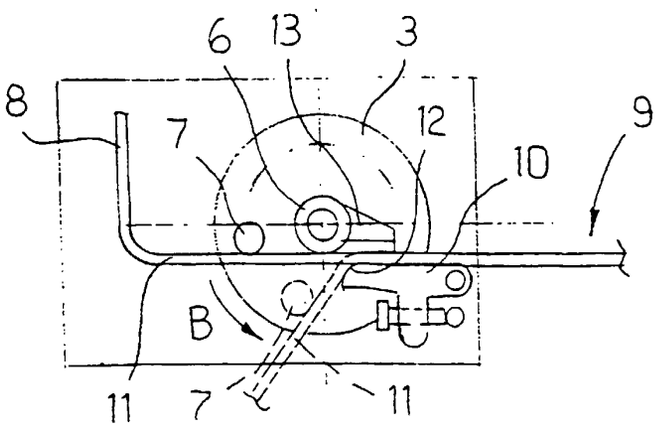


Fig. 5



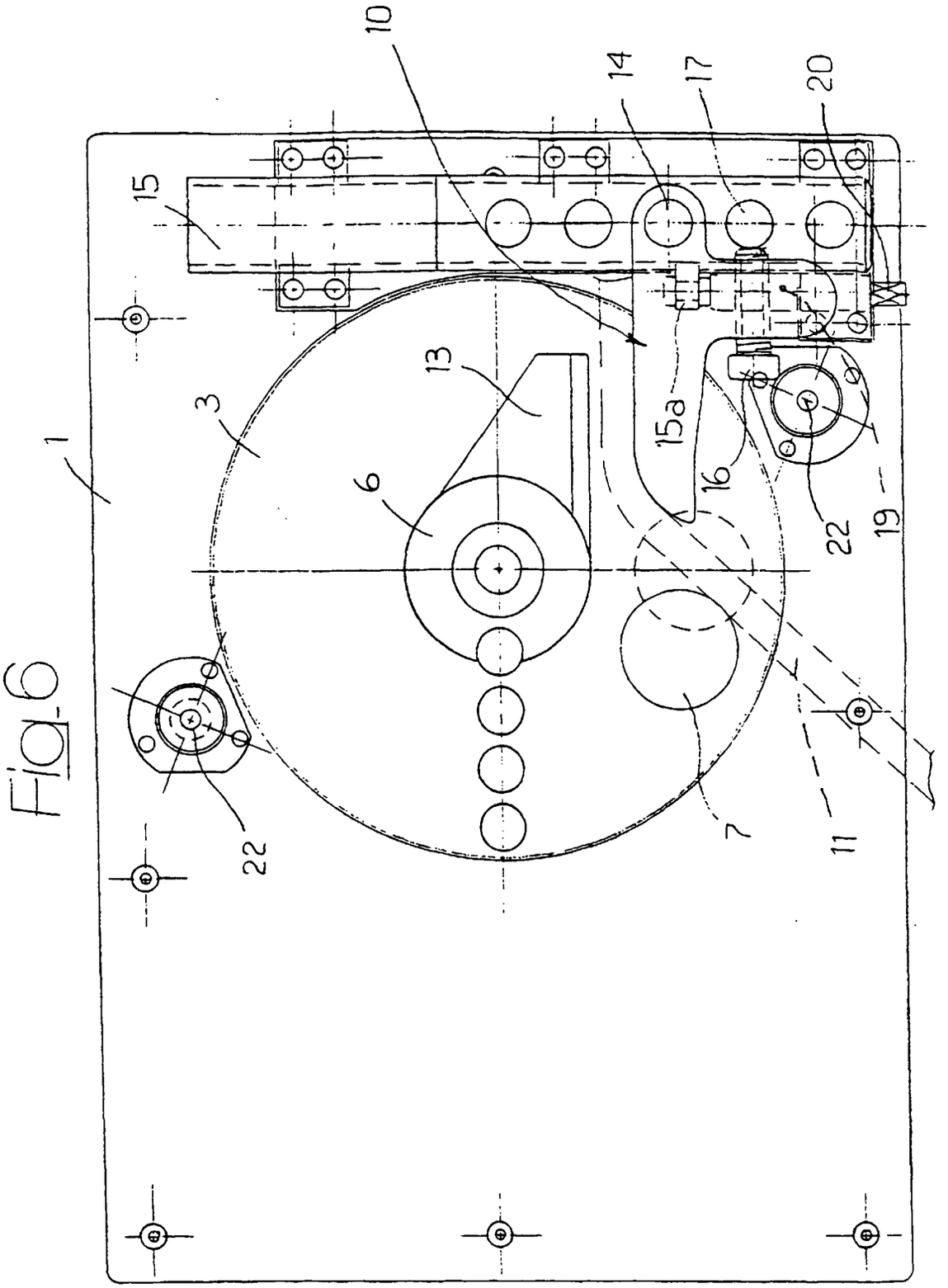


Fig 6

Fig. 7

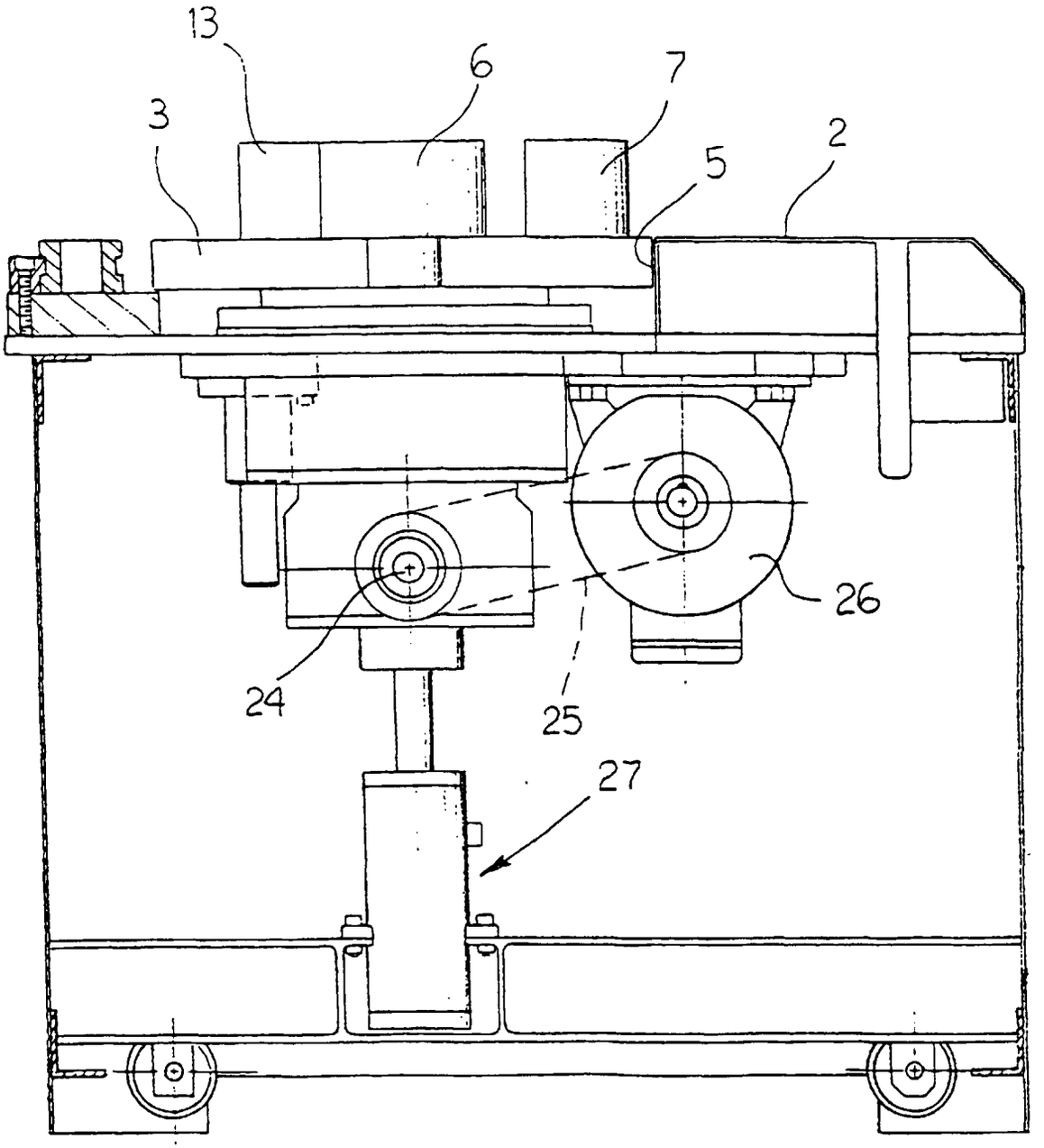
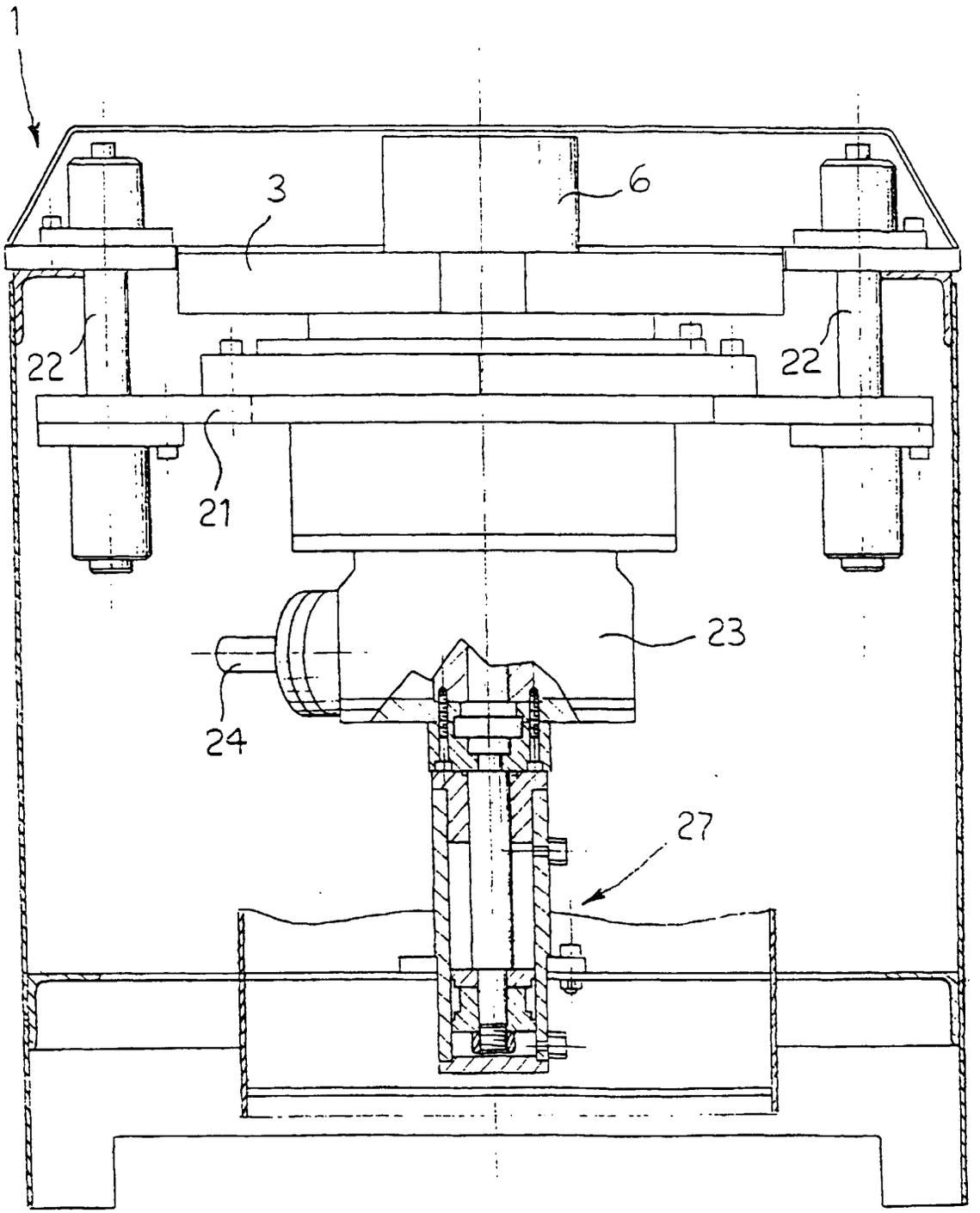


Fig. 8



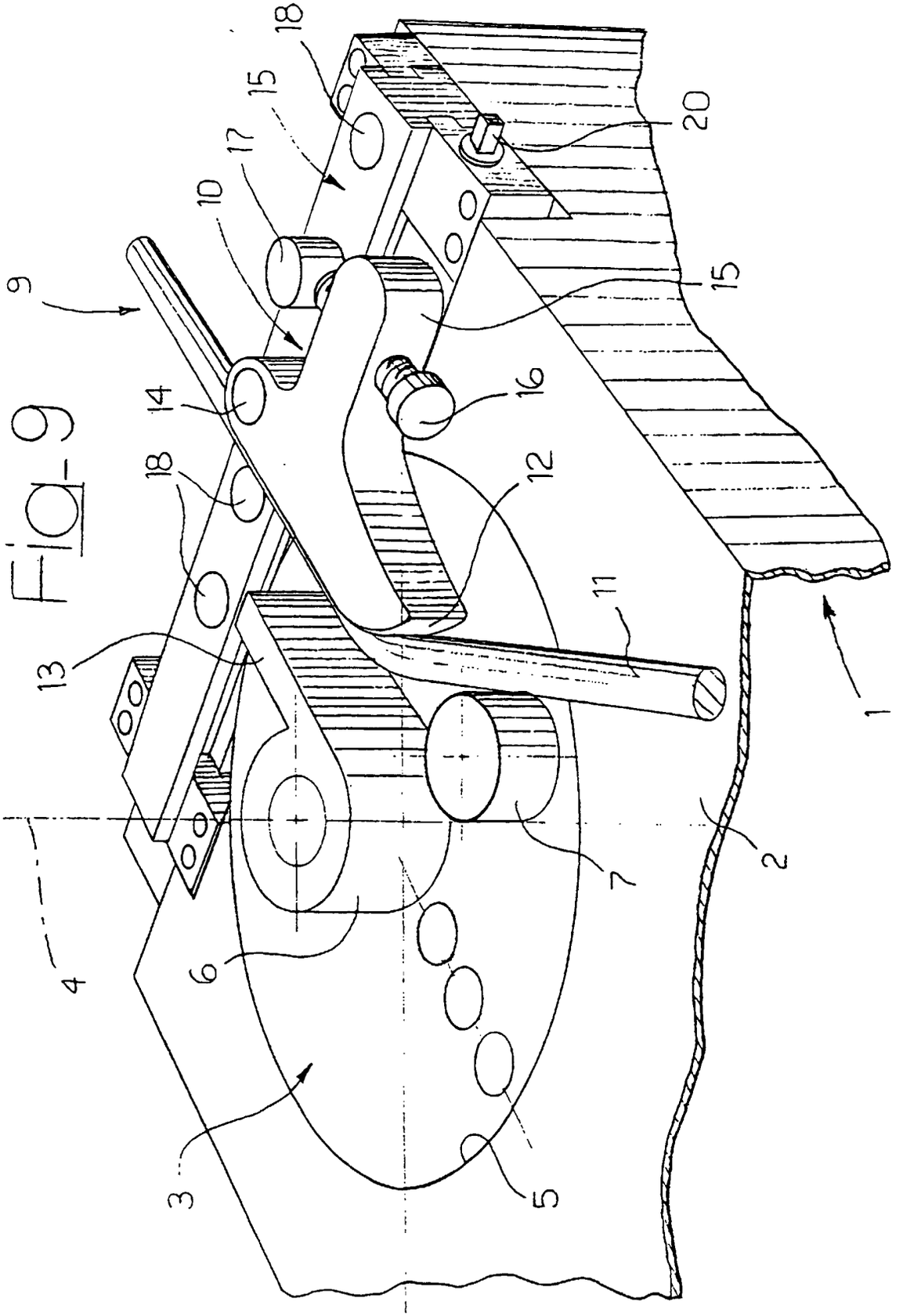


Fig. 9