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(54) METHOD AND TOOL FOR BENDING BAR MATERIAL

VERFAHREN UND WERKZEUG ZUM BIEGEN VON STANGENMATERIAL

PROCEDE ET OUTIL POUR LE CINTRAGE DE MATERIAU EN BARRE

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Description

[0001] The invention concerns a method for bending bar material, where bar material is fed to a bending tool by means of feeding means, is fixed by a clamping means during a bending operation and is bent to elements by means of a bending tool consisting of a bending core with a central bar channel and a bolt mounted on a bending disc and spaced apart from the centre thereof, where a bending roller is rotatably journalled on the bolt. The bar material may e.g. be rods for reinforcing concrete. The invention furthermore concerns a bending tool for performing the method, the tool including a rotatable bending disc and a bending core provided at the centre thereof and mounted with a central bar channel, where the bending core can be held non-rotatable at a given position, where at the bending disc a bending roller, which is rotatably journalled on a bolt, may rotate.

[0002] It is known, e.g. from FR-A1-2 715 334, EP-A1-1 199 115 or EP-A2-1 002 592, a bending tool with a rotatable bending disc that has non-rotatable bending core at its centre. Spaced apart from the centre of the bending core, the bending disc carries a bolt with a bending roller rotatably journalled thereon and which may be pivoted by the rotatable bending disc about its centre for performing a predefined bending operation for bending elements in the form of one or more rods. The rods may be held fixed during the bending operation by clamping jaws provided outside the bending disc.

[0003] A drawback of the said prior art is that after the last of a number of bending operations where a rod or a bundle of rods have been bent, the bent elements will still be fixed between the clamping jaws via rod material situated in the clamping jaws and between the bending core and the clamping jaws. This rod material is to be cut off after finishing the bending operation and thereby represents a considerable waste of material of 2.5 - 5% of the source material.

[0004] It is the purpose of the invention to reduce the amount of this waste material.

[0005] This purpose is achieved by the said method which is characterised in that the clamping means is mounted in the bending core for clamping the bar material during the bending operation, preferably in immediate vicinity of the centre of the bending disc. The bending tool according to the invention is characterised in that at least one clamping means is mounted in the bending core for clamping the bar material to be bent in the bending tool.

[0006] Thereby is achieved a minimum of waste material after the last bending operation to which a bar is subjected, because the fixation of the bar during the bending operations now occurs in the core of the bending tool instead of at a place situated entirely outside the bending disc.

[0007] The method according to the invention may in a preferred embodiment be peculiar in that the clamping operation occurs by means of one or more clamping means.

[0008] After a number of bending operations with the prior art bending tool, the part of the bar situated behind the feeding clamping jaw holding the bar for bending, is too short to form yet a bent element. The part of the bar situated before the clamping jaw as well as the part of the bar located in the clamping jaw and between the clamping jaw and the bending core where the bar is to be cut off are wasted.

[0009] After the same number of bendings with the bending tool according to the invention, where the bar is fixed during bending of one or two clamping or pressing jaws incorporated in the bending core, the length of the bar available for bending an element is increased with the length of the part of the rod which by the prior art bending apparatus was situated between the clamping jaw and the bending core. In a certain number of cases, this increased length of the remaining part of the rod will be sufficient for bending yet an element. A corresponding saving of material is hereby attained.

[0010] The bending tool according to the invention may in a preferred embodiment be peculiar in that at one side of the bar channel and upstream of the clamping means there is disposed a sharp edge part extending perpendicularly to the bottom of the bar channel, preferably of hardened steel, for interacting with the clamping means located at the opposite side of the channel.

[0011] The bending tool according to the invention may in a further embodiment be peculiar in that at least one clamping means is constituted by a central pivot bolt that has a groove or slot which may be aligned with the bar channel of the bending core. Hereby is achieved a particularly simple embodiment where the rotation of the pivot bolt in one direction or the other produces a squeezing/fixation of the rod against bearing surfaces in the bending core. These bearing faces may be made sharp-edged in order to achieve a more secure clamping of the bar.

[0012] The invention will now in the following be explained with reference to the drawing, where:

- Fig. 1 shows a prior art bending tool with bending core;
- Fig. 2 the tool of Fig. 1 with a supplied bar;
- Fig. 3 first bending operation is initiated;
- Fig. 4 second bending operation is finished;
- Fig. 5 a first embodiment of a bending tool according to the invention;
- Fig. 6 the bar shown in Fig. 5 with a added bar;
- Fig. 7 first bending operation is initiated with the tool shown in Fig. 5 and with the bar fixed in the bending core of the bending tool;
- Fig. 8 a bar feeding tongs with gripper and two clamping members for advancing the bar end quite close to the bending core;
- Fig. 9 a further embodiment of a bending tool according to the invention;
- Fig. 10 first bending operation for bending to the left is initiated with the tool shown in Fig. 9 and

with the bar clamped in the bending core of the tool; and

Fig. 11 first bending operation for bending to the right is initiated with tool shown in Fig. 9 and with the rod clamped in the bending core of the tool itself.

[0013] In Fig. 1 appears an example of a prior art design of a bending tool. It consists of a bending disc 1 which is rotatable about its centre and in the open centre of which a non-rotatable bending core 2 is provided, consisting of two opposed halves with an intermediate bar channel. The bending core 2 may be elevated and lowered between a position over and a position below the bending disc 1. A bolt is fastened to the bending disc 1 and is carrying a bending roller 3 which is rotatable about the bolt.

[0014] In Fig. 2 appears a bending tool with a bar channel in which is laid a rod 4 which by means of the bending roller 3 on the bolt is bent about the contour 5 of the bending core. Due to the turning movement of the bending disc 1, the rod 4 will tend to be pulled out from the core in the direction of arrow 6.

[0015] In order to avoid this pulling out, according to prior art clamping jaws 7 are disposed in front of and after the bending disc 1, and Fig. 3 shows such a disposition. The clamping jaws 7 are actuated while the bending takes place and holds the rod under this operation. The rod is advanced by means of drive roller mechanisms 8 or 9. The clamping jaws 7 and the drive roller mechanisms 8 and 9 may be depressed for avoiding collision with the bent ends of the rod. Some of the geometric conditions for the rods to be bent are given by the distances between respective drive roller mechanisms 8 and 9 and clamping jaws 7. The drive roller mechanism 9 and the clamping jaw 7 at the right side may be countersunk for avoiding collision with the bent part of the rod.

[0016] As shown on Fig. 4, the bending core may be turned 180°, and the drive roller mechanism in the left side may be countersunk. Besides, it appears that the section 10, which is situated between the bending core and the clamping jaw and in the clamping jaw itself, is to present a certain minimum length in order that the clamping jaw is to hold the rod during the bending operation. Systems in which the clamping jaw function is provided by the drive roller mechanism 8 and 9 are also known. The geometric limitation is the same.

[0017] As it is the object of the invention to reduce waste of material, it is thus also the object to limit the geometrical boundaries to a minimum with a method of clamping and method of feeding suited therefor. With this intention there appears in Fig. 5 a clamping jaw in the form of a squeezing piston 14 in the bending core 11 as an example of a tool according to the invention. In order to optimise the geometrical boundary conditions, as described above, the bar material to be bent is to be clamped after feeding in the bar channel 18 for receiving the rod 4 in the bending core 11. The bending core 11 is secured against turning and is provided at the centre of a bending disc 12. The bending disc 12 may rotate about the bending core 11. The clamping is effected by means of a steel hardened pressure member 13 which is pressed against the rod by a clamping piston 14 or 15. The bending disc 12 can turn about the bending core 11. Operation of the clamping piston 14 may occur hydraulically, pneumatically or mechanically or in combination thereof.

[0018] These clamping elements 13, 14 and 13, 15 may, due to the present limited space in the bending core itself, only exert a limited squeezing force.

[0019] A second embodiment of the invention provides a special procedure for the clamping function and a special shape of the bending core. Fig. 6 shows this situation. During the bending operation, one pressing member is pressed by its clamping piston 15 against the side of the rod 4 opposite the bolt with its bending roller 6 rotatably journalled there about. Under this unilateral pressing, the rod bears against a sharp edge 17 on the bending core. This edge and the clamping piston prevent an immediate longitudinal displacement of the rod in the bar channel 18 at the beginning of the bending operation. The two halves of the bending core are each equipped with at least one sharp edge 17 as shown. During a bending operation, the bolt provided at one side of the rod with the bending roller 3 rotatably joumalled thereon is to be brought in operation by turning the bending disc. During this operation, the clamping piston 15 incorporated at the opposite side of the rod is brought into function and thereby presses the rod against the sharp edge 17 at the opposite half of the bending core. The rod is thus fixed during the bending operation itself between a sharp edge and one clamping piston.

[0020] In Fig. 7 is seen a continued procedure of the bending operation which is arranged as shown in Fig. 6. By turning the bending disc, the bolt with the bending roller has bent the rod in an angle. The rod 4 is thereby pressed against a sharp edge 17 on one half of the bending core and a contact surface 19 on the opposite core half, contributing to secure the rod in its position between the two halves of the bending core during the bending. Besides that the rod is clamped by a clamping piston, the rod thus contributes to it own clamping.

[0021] In Fig. 8 appears a gripper 20 with two clamping elements 21 and 22 which are passed in over the bending disc and which clamps the outer end of a rod which has been bent. The part of the rod remaining after the previous bending operation has had a length which was just sufficient for bending yet an element. In this case, waste of material is entirely avoided.

[0022] The rods clamped in the bar channel 18 of the bending core may, as mentioned, be fixed in the core by a single clamping piston pressing the rod, or the bundle of rods, in the channel against a sharp edge in the channel wall during bending, but the clamping may also be effected by two clamping pistons, possibly each with a sharp edge extending perpendicularly to the bottom of the bar

channel on the piston end to engage the rod/rods for their fixation.

[0023] For increasing the force against the rod/rods in the bar channel 18 of the bending core, hydraulic liquid under high pressure may be conducted to the clamping pistons in the tool, and this high pressure may be attained from one or more pressure booster units that e.g. elevates the pressure in the bending core to 500-5000 bar.

[0024] The invention is not at all limited to the embodiments indicated in the present application, as other embodiments may be provided within the scope of the invention.

[0025] In Figs. 9-12 appears a further embodiment for the bending tool according to the invention. This embodiment is designed technically simple, as a central pivot bolt 23 is provided in a non-rotatable bending core 11.

[0026] The pivot bolt 23 is provided at the centre of the bending core 11 and has a groove or slot 24 which can be aligned with the bar channel 18. The pivot bolt 23 may turn in both directions, whereby a rod 4 is brought in contact with opposed contact surfaces 25 and interacting contact surfaces 19 on the bending core. The contact surfaces 25 in the pivot bolt can be made sharp-edged in order to get a function corresponding to the sharp edge 17 which is mentioned above.

[0027] Fig. 9 illustrates the bending tool with the slot 24 aligned with the bar channel 18 and without any rod in the tool.

[0028] Fig. 10 shows a situation where the rod 4 is provided in clamped position by bending to the left as seen against the plane of the paper, and as indicated by arrow in the left side of the drawing. In this situation, the rod 4 is clamped by the marked sharp-edged contact surfaces 25 in the bolt and the marked contact surfaces 19 in the bending core.

[0029] In Fig. 11 appears a corresponding clamping by bending to the right, as seen against the plane of the paper and as indicated by the arrow in the left side of the Figure. In this situation, the rod 4 will be clamped between the marked shaip-edged contact surfaces 25 in the pivot bolt and the marked contact surfaces 19 in the bending core.

[0030] With the embodiment of the bending tool shown in Figs. 9-11, there is no need for separate pistons for clamping the rod 4 during the bending movement. In this embodiment, the rotation itself is applied during bending, as the rotation of the pivot bolt 23 is used at the same time for clamping the rod.

List of reference numbers

[0031]

1	Bending disc
2	Bending core
3	Bending roller (on bolt)
4	Rod
5	Contour of bending core
6	Arrow
7	Clamping jaws
8	Drive roller mechanism
9	Drive roller mechanism
10	Rod section
11	Bending core
12	Bending disc
13	Pressing member
13,14	Clamping means/clamping member
13,15	Clamping means/clamping member
14	Clamping piston
15	Clamping piston
16	Bending roller which is rotatably journalled on a bolt
17	Sharp edge
18	Rod channel
19	Contact surface
20	Gripper
21	Clamping element
22	Clamping element
23	Central pivot bolt
24	Groove or slot
25	Contact surface

Claims

1. A method for bending bar material, where bar material is fed to a bending tool by means of feeding means, is fixed by a clamping means during a bending operation and is bent to elements by means of a bending tool consisting of a bending core (11) with a central bar channel and a bolt mounted on a bending disc (12) and spaced apart from the centre thereof, where a bending roller (3) is rotatably journalled on the bolt, **characterised in that** the clamping means (13, 14; 13,15) is mounted in the bending core (2) for clamping the bar material during the bending operation, preferably in immediate vicinity of the centre of the bending disc (12).

2. A method according to claim 1, **characterised in that** the clamping operation occurs by means of one or more clamping means.

3. A bending tool for performing the method according to claim 1 or 2, the bending tool including a rotatable bending disc (12) and a bending core (11) provided at the centre thereof and mounted with a central bar channel (18), where the bending core (11) can be held non-rotatable at a given position, where at the bending disc (12) a bending roller (3), which is rotatably joumalled on a bolt, may rotate, **characterised in that** at least one clamping means (13,14; 13,15) is mounted in the bending core (11) for clamping the bar material to be bent in the bending tool.

4. A bending tool according to claim 3, **characterised**

in that at one side of the bar channel and upstream of the clamping means (13,14; 13,15) there is disposed a sharp edge part (17) extending perpendicularly to the bottom of the bar channel, preferably of hardened steel, for interacting with the clamping means located at the opposite side of the channel.

5. A bending tool according to claim 3, **characterised in that** the at least one clamping means is constituted by a central pivot bolt (23) having a slot or groove (24) which can be aligned with the bar channel (18) of the bending core.

Patentansprüche

1. Verfahren zum Biegen von Stangenmaterial, wobei Stangenmaterial einem Biegewerkzeug mittels Zufuhrmitteln zugeführt wird, durch Klemmmittel während eines Biegevorgangs befestigt wird und in Elemente mittels eines Biegewerkzeugs gebogen wird, das aus einem Biegekern (11) mit einem mittigen Stangenkanal und einem an einer Biegescheibe (12) montierten Bolzen, der von ihrem Zentrum beabstandet ist, besteht, wobei am Bolzen eine Biegewalze (3) drehbar gelagert ist, **dadurch gekennzeichnet, dass** die Klemmmittel (13, 14; 13, 15) in dem Biegekern (2) montiert sind, um das Stangenmaterial während des Biegevorgangs, vorzugsweise in unmittelbarer Umgebung des Zentrums der Biegescheibe (12), festzuklemmen.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Klemmvorgang mittels eines oder mehrerer Klemmmittel erfolgt.

3. Biegewerkzeug zum Ausführen des Verfahrens nach Anspruch 1 oder 2, wobei das Biegewerkzeug eine drehbare Biegescheibe (12) und einen in ihrem Zentrum vorgesehenen Biegekern (11), an dem ein mittiger Stangenkanal (18) montiert ist, enthält, wobei der Biegekern (11) an einer gegebenen Position drehfest gehalten werden kann, wo sich an der Biegescheibe (12) eine Biegewalze (3), die drehbar an einem Bolzen gelagert ist, drehen kann, **dadurch gekennzeichnet, dass** im Biegekern (11) wenigstens ein Klemmmittel (13, 14; 13, 15) montiert ist, um das im Biegewerkzeug zu biegende Stangenmaterial festzuklemmen.

4. Biegewerkzeug nach Anspruch 3, **dadurch gekennzeichnet, dass** auf einer Seite des Stangenkanals und stromaufseitig des Klemmmittels (13, 14; 13, 15) ein scharfer Kantenabschnitt (17) angeordnet ist, der sich senkrecht zum Boden des Stangenkanals erstreckt und vorzugsweise aus gehärtetem Stahl besteht, um mit dem Klemmmittel, das sich auf der gegenüberliegenden Seite des Kanals befindet, in Wechselwirkung zu treten.

5. Biegewerkzeug nach Anspruch 3, **dadurch gekennzeichnet, dass** das wenigstens eine Klemmmittel durch einen mittigen Drehbolzen (23) gebildet ist, der einen Schlitz oder eine Nut (24) besitzt, der bzw. die auf den Stangenkanal (18) des Biegekerns ausgerichtet werden kann.

Revendications

1. Procédé pour le cintrage de matériau en barre, où le matériau en barre est alimenté à un outil de cintrage au moyen d'organes d'avancement, est fixé par un organe de serrage lors d'une opèration de cintrage et est cintré à des éléments au moyen d'un outil de cintrage comportant un noyau de cintrage (11) avec un canal de barre central et un boulon monté sur un disque de cintrage (12) et éloigné de son centre, où un rouleau de cintrage (3) est monté de manière rotative sur le boulon, **caractérisé en ce que** l'organe de serrage (13, 14; 13, 15) est monté dans le noyau de cintrage (2) pour serrer le matériau en barre lors de l'opération de cintrage, de préférence dans la proximité immédiate du centre du disque de cintrage (12).

2. Procédé selon la revendication 1, **caractérisé en ce que** l'opération de cintrage s'effectue au moyen d'un ou plusieurs organes de cintrage.

3. Outil de cintrage pour exécuter le procédé selon la revendication 1 ou 2, l'outil de cintrage comportant un disque de cintrage rotatif (12) et un noyau de cintrage (11) prévu à son centre et monté avec un canal de barre central (18), où le noyau de cintrage (11) peut être maintenu d'une manière non-rotative dans une position donnée, où auprès du disque de cintrage (12) un rouleau de cintrage (3) monté sur un boulon de manière rotative peut pivoter, **caractérisé en ce qu'**au moins un organe de cintrage (13, 14; 13, 15) est monté dans le noyau de cintrage (11) pour serrer le matériau en barre à être cintré dans l'outil de cintrage.

4. Outil de cintrage selon la revendication 3, **caractérisé en ce que** sur un côté du canal de barre et en amont de l'organe de cintrage (13, 14; 13, 15) une partie à vive arête (17) s'étendant perpendiculairement à la partie inférieure du canal de barre est prévue, de préférence en acier trempé, pour coopérer avec l'organe de cintrage situé du côté opposé du canal.

5. Outil de cintrage selon la revendication 3, **caractérisé en ce qu'**au moins un organe de cintrage est constitué par un boulon à pivot central (23) compre-

nant une encoche ou rainure (24) qui peut être alignée avec le canal de barre (18) du noyau de cintrage.

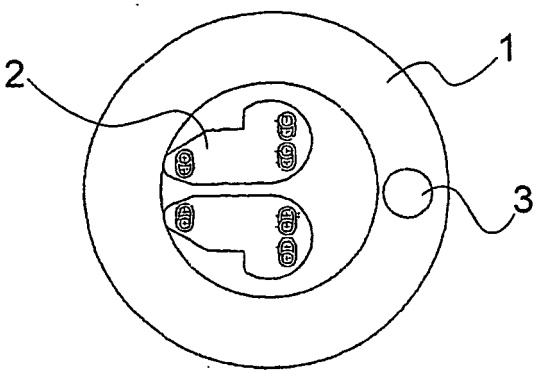

Fig. 1

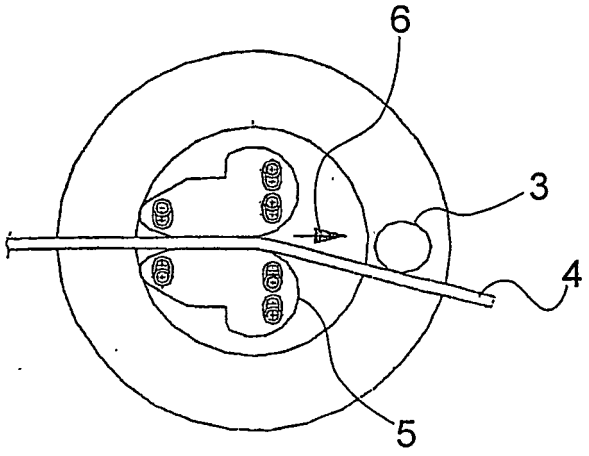

Fig. 2

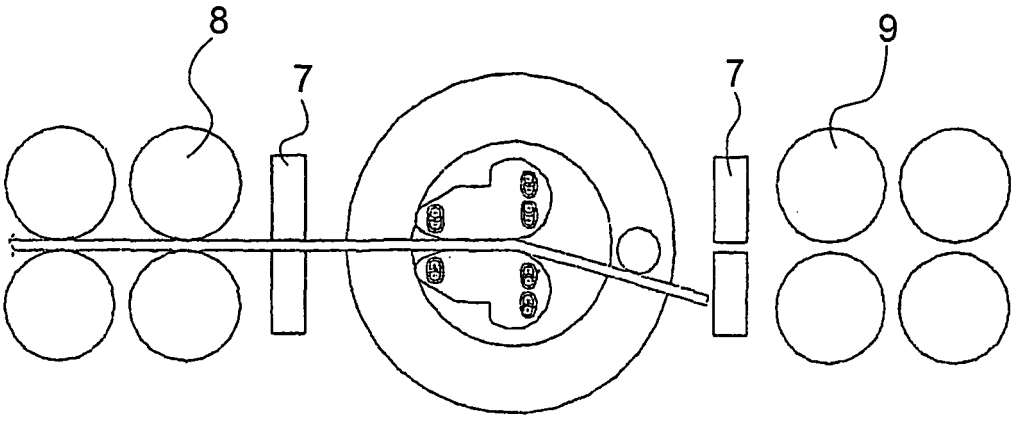

Fig. 3

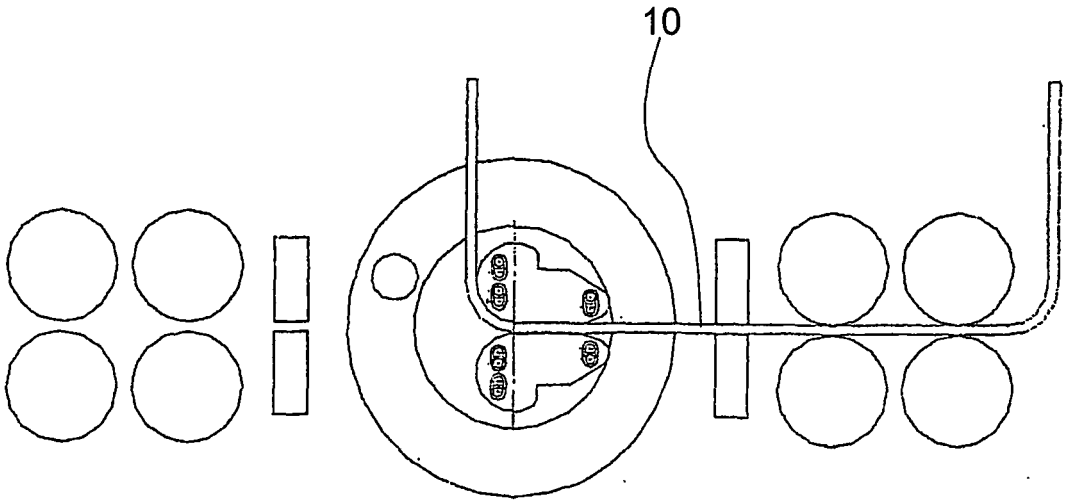

Fig. 4

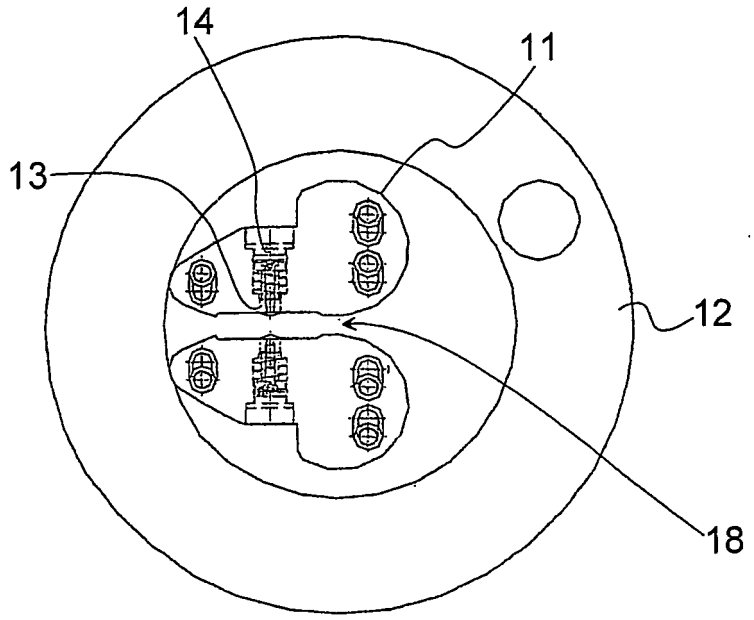

Fig. 5

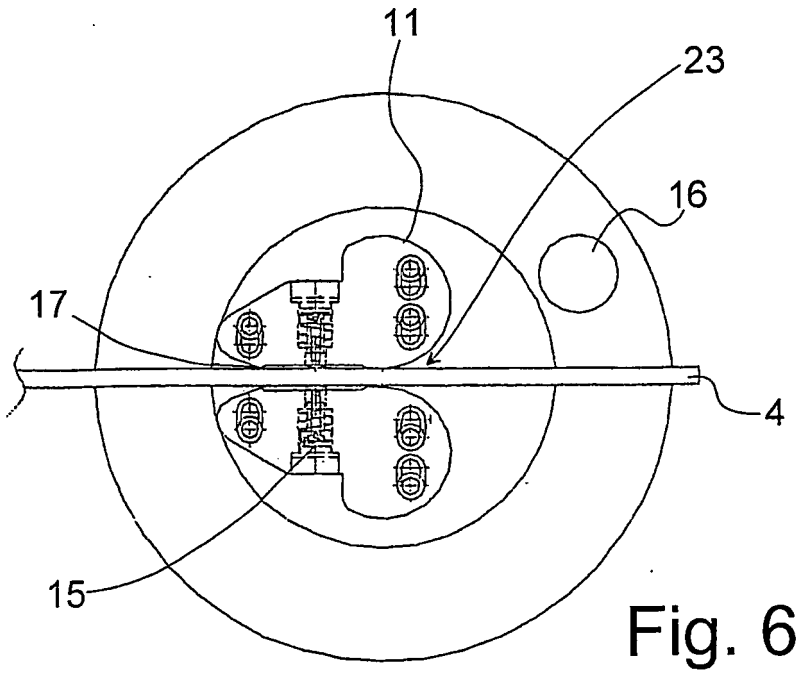

Fig. 6

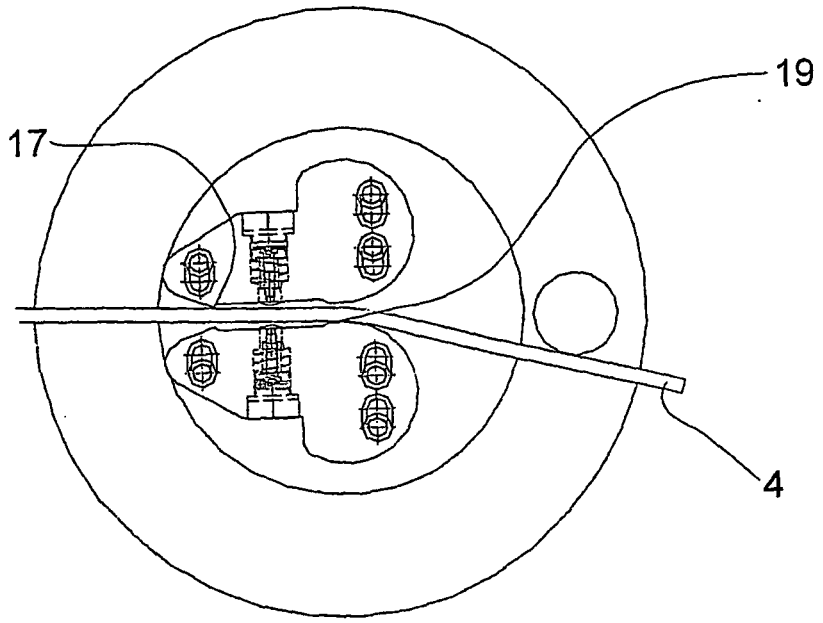

Fig. 7

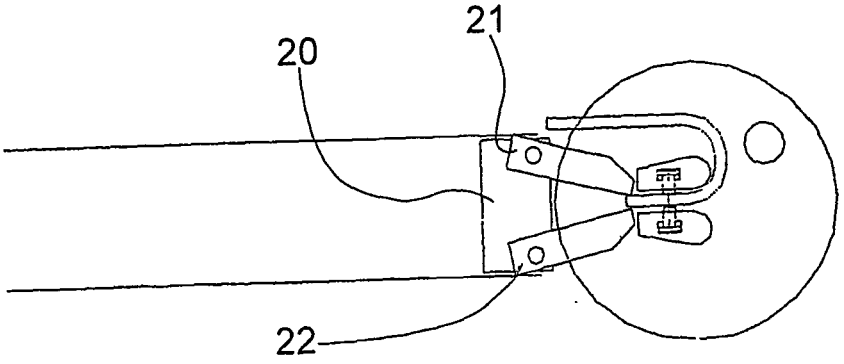

Fig. 8

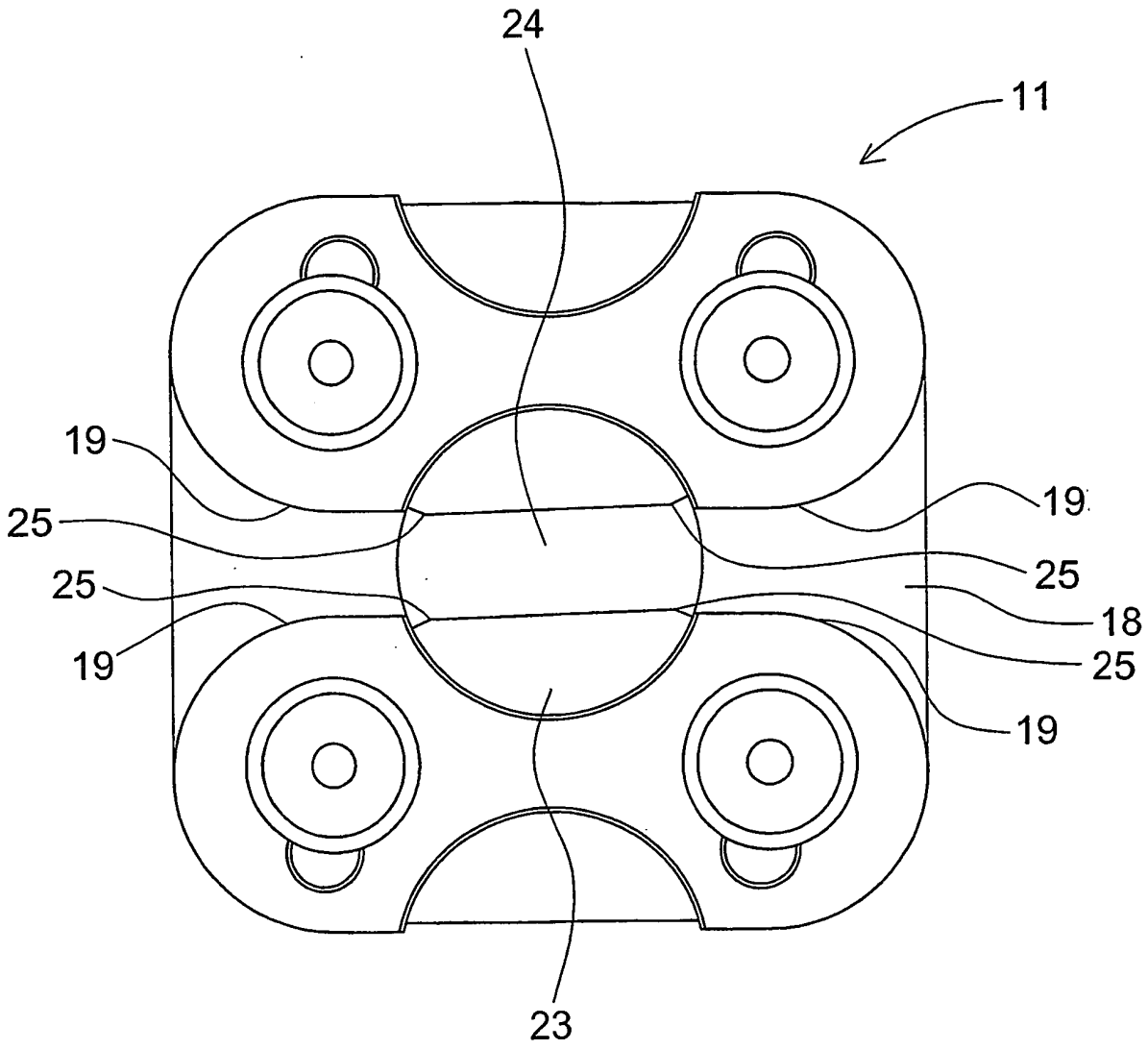

Fig. 9

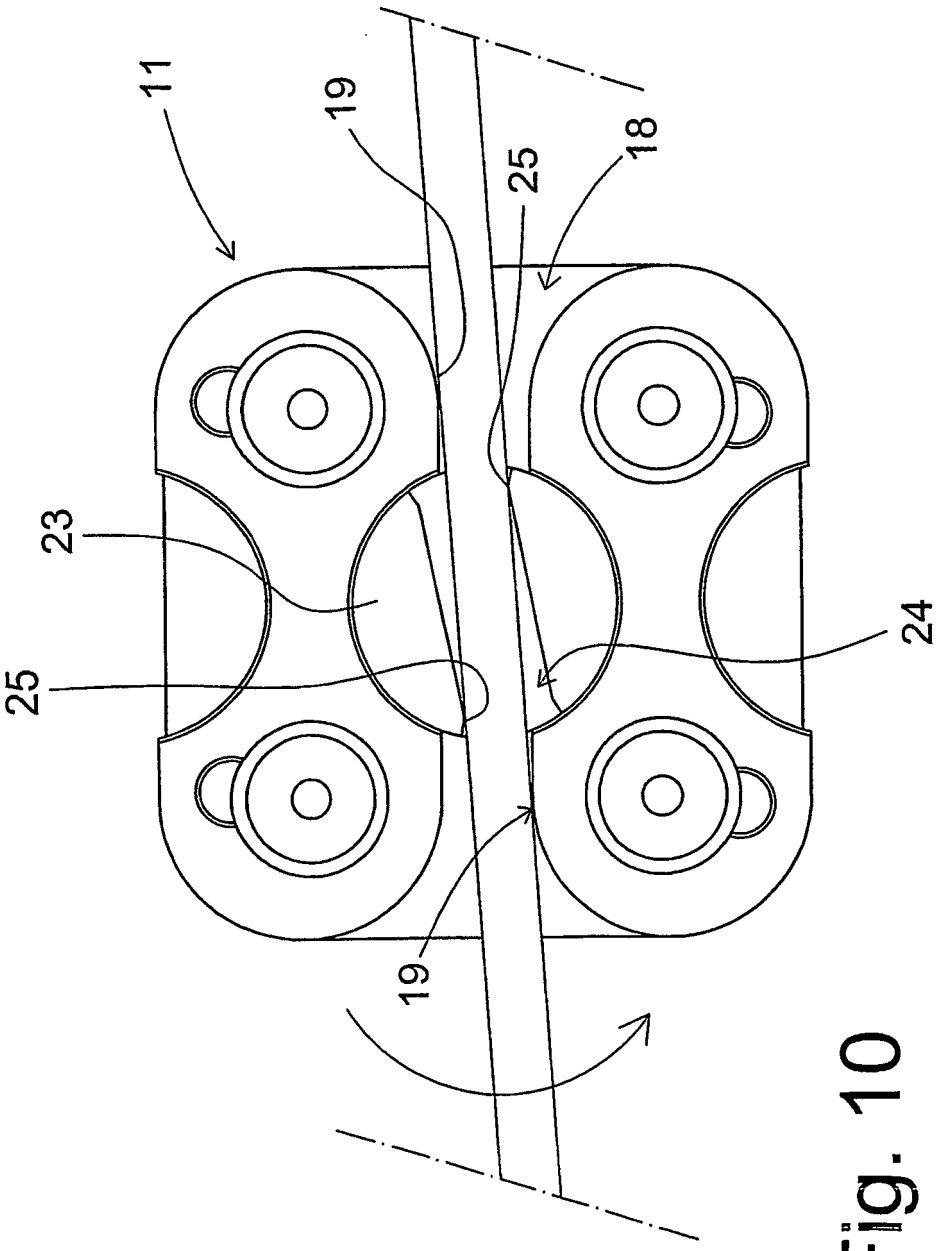

Fig. 10

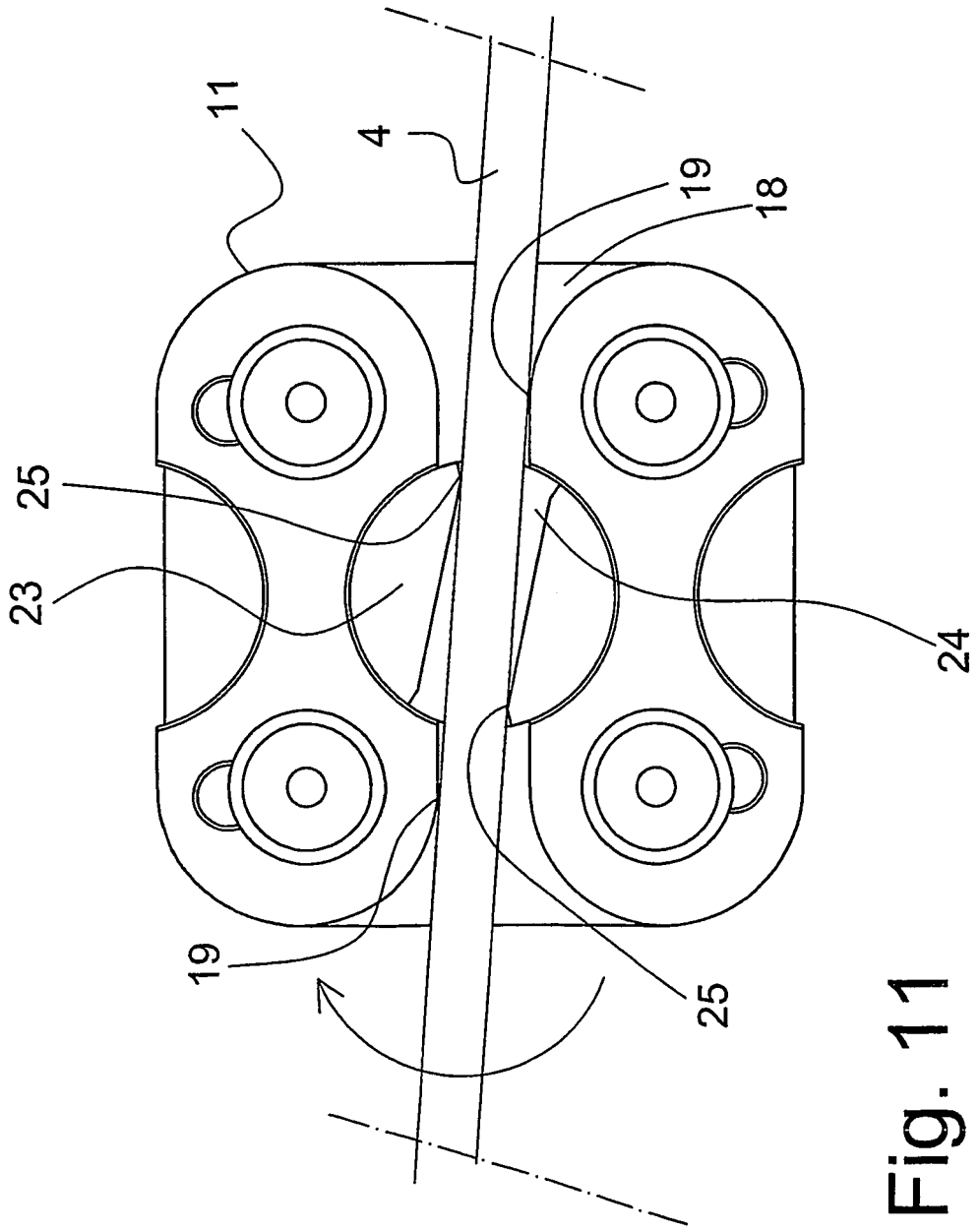

Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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