



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**28.04.2004 Bulletin 2004/18**

(51) Int Cl.7: **B21D 5/02**

(21) Application number: **03103869.8**

(22) Date of filing: **20.10.2003**

(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**

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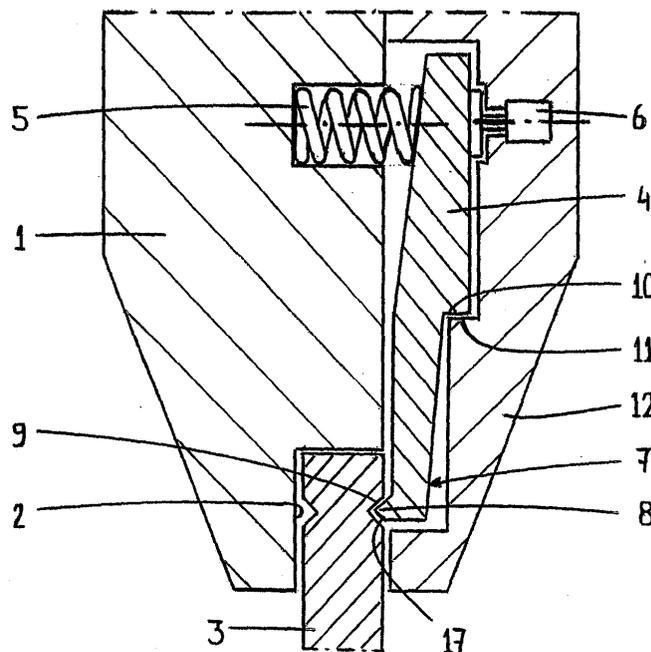
(30) Priority: **21.10.2002 NL 1021707**

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(54) **Press brake**

(57) What is disclosed is a press brake comprising folding tools that can be fitted in a movable beam by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses formed in said beam (1) for accommodating the folding tools (3), a clamping plate being pivotable about a pivot axis, which clamping plate (4) has an end intended to engage the tools (3) present in said recess-

es, and a driving arrangement engaging said clamping plate (4), which functions to cause the clamping plate (4) to pivot about its pivot axis. In order to prevent excessive torsion of the clamping plate (4) at the engaging end thereof, the end of the clamping plate (4) that engages the folding tools (3) and the point of engagement of the driving arrangement are located on opposite sides of the pivot axis.



**FIG. 1**

## Description

**[0001]** The invention relates to a press brake comprising folding tools that can be fitted in a movable beam by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses formed in said beam for accommodating the folding tools, a clamping plate being pivotable about a pivot axis, which clamping plate has an end intended to engage the tools present in said recesses, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis.

**[0002]** With a known press brake of this type, the driving arrangement engages the clamping plate at a point located between the pivot axis and the aforesaid end of the clamping plate engaging the folding tools.

**[0003]** With this known press brake, problems may arise when the beam is not fitted with folding tools in recesses formed therein along the entire length of the beam, so that the clamping plate only needs to engage the folding tools over part of its width. If said partial engagement takes place asymmetrically, the forces exerted on the clamping plate by the driving arrangement will result in a deformation (torsion) of the clamping plate, such that the aforesaid end of the clamping plate will not engage the folding tools with equal force. It is even possible that some of the folding tools will not be engaged at all by the clamping plate. If clamping tools are only present in one half (seen crosswise) of the clamping plate, the folding tools located nearest the centre of the clamping plate will be engaged with the greatest force by the clamping plate, whilst the clamping tools present at locations increasingly further away from said centre of the clamping plate will be engaged with decreasing force (or not at all) by the clamping plate. It stands to reason that such a situation is undesirable, since at least some of the tools may move or even become detached during operation of the press brake in that case, which will have an adverse effect on the accuracy of the folding operation.

**[0004]** It is an object of the present invention to provide a press brake of the type referred to in the introduction, wherein this drawback is eliminated in a simple yet efficient manner.

**[0005]** In order to accomplish that objective, the invention provides a press brake comprising folding tools that can be fitted in a movable beam by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses formed in said beam for accommodating the folding tools, a clamping plate being pivotable about a pivot axis, which clamping plate has an end intended to engage the tools present in said recesses, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, characterized in that the end of the clamping plate that engages the folding tools and the point of engage-

ment of the driving arrangement are located on opposite sides of the pivot axis.

**[0006]** The present invention is based on the perception that the aforesaid undesirable deformation (torsion) of the clamping plate at the location of the end engaging the folding tools can be reduced by decreasing the distance between said end and the pivot axis of the clamping plate. While it is difficult to realise such a decrease when using the press brake that is known from the prior art, as sufficient space must be available in said prior art press brake between said pivot axis and said end in order to enable the driving arrangement to engage the clamping plate, the press brake according to the invention is designed to enable the driving arrangement to engage the clamping plate at a point located on a side of the pivot axis opposite the side where the aforesaid engaging end is located. Since the driving arrangement no longer engages the clamping plate at a position located between said pivot axis and said end, it is possible to minimise the distance between said pivot axis and said end. Thus, the extent of deformation (torsion) will be considerably reduced, whilst the clamping force exerted on the folding tools by the clamping plate remains the same. As a result, the risk that some of the folding tools will not be clamped down at all, or not to a sufficient degree, in the case of an asymmetric placement of folding tools is strongly reduced.

**[0007]** In a preferred embodiment of the press brake according to the invention, said engaging end of the clamping plate comprises a number of resilient lips arranged side by side.

**[0008]** Since the distance between the pivot axis and the end of the clamping plate engaging the folding tools can only be reduced to a minimum but not to zero, it will be necessary at all times to take into account the possibility of a certain degree of deformation of the clamping plate in the situations as described above. If said end comprises resilient lips, said lips can easily compensate for said - already minimised - deformation, by resiliently deforming to a greater or lesser extent. In this way it is ensured at all times that each folding tool is engaged.

**[0009]** A simple way of realising such resilient lips is provided by an embodiment of the press brake in which said end is provided with a number of spaced-apart cuts extending perpendicularly to the relevant edge of the clamping plate. This strip of material defined between two adjacent cuts thus forms a lip. It is possible, of course, to define a desired resilience of the lips by suitably selecting the material at the location of said lips and suitably selecting the shape of said lips.

**[0010]** If, according to another embodiment of the press brake according to the invention, said end of the clamping plate is bevelled on the side that faces towards the folding tools, it will be easier to fit the folding tools in the recesses in the beam, beside the clamping plate, since the bevel forms an entrance guide, as it were, for the ends of the folding tools.

**[0011]** In a preferred embodiment of the press brake

according to the invention, a housing is mounted on the beam for accommodating at least part of the driving arrangement, which housing comprises a shoulder extending parallel to the longitudinal direction of the beam, and thus of the folding tools, which shoulder forms the pivot axis. Such a pivot axis extends over the entire width of the clamping plate, so that, in combination with the minimised distance between said pivot axis and said engaging end of the clamping plate, the extent of deformation of the clamping plate under the influence of an asymmetric load can be minimised. In such cases the clamping plate will generally comprise, in a manner, which is known per se, a (counter) shoulder mating with the aforesaid shoulder. In this way the position of the clamping plate and the housing relative to each other is fixed in a reliable manner, whilst pivoting of the clamping plate and the housing with respect to each other will nevertheless be possible.

**[0012]** Also other constructional solutions may be used for forming such a pivot axis, for example hinge arrangements that are known per se.

**[0013]** In another embodiment of the press brake, the driving arrangement consists of a number of spring members arranged side by side, which spring members load the clamping plate to a pivoted position in which it engages the folding tools, and a driving unit, e.g. a cylinder-piston assembly, for pivoting the clamping plate against the spring force of the spring members to a pivoted position in which the folding tools are released. The spring members may be compression springs accommodated in the beam, for example, whilst the driving unit is accommodated in a housing connected to the beam in that case. The driving unit, e.g. the cylinder-piston assembly, only needs to be activated when the folding tools are to be exchanged, removed or the like. The advantage of this embodiment is the fact that a malfunction of the driving unit will not result in the folding tools unintentionally becoming detached.

**[0014]** In view of the foregoing it is also possible to design a press brake such that the driving arrangement consists of a number of spring members arranged side by side, which spring members load the clamping plate to a pivoted position for releasing the folding tools, and a driving unit, e.g. a cylinder-piston assembly, for pivoting the clamping plate against the spring force of the spring members to a pivoted position in which the clamping plate engages the folding tools. In that case the spring members function to maintain the clamping plate in an inactive pivoted position, so that less powerful spring members may be used. The folding tools are now kept immobile as a result of the driving unit being activated.

**[0015]** The invention will be explained in more detail below with reference to the drawing, which shows an embodiment of the press brake according to the invention.

**[0016]** Fig. 1 is a schematic cross-sectional view of a part of the press brake according to the invention; and

**[0017]** Fig. 2 is a schematic front view of a clamping plate used in the press brake according to the invention.

**[0018]** The press brake according to the invention comprises a movable beam 1, as is already known per se, in which recesses 2 for receiving folding tools 3 are formed. The folding tools 3 can be used for folding sheet material, such as a metal sheet.

**[0019]** Within this framework the following can be noted. Although the movable beam 1 of a press brake of the present type is usually an upper beam of the press brake, said beam 1 may also be a lower beam. Strictly speaking, it is also conceivable for the beam 1 to be stationary rather than movable, and arrangements may be provided for moving the sheet material with respect to the folding tools 3. This does not influence the movement of the folding tools 3 and the sheet material to be worked relative to each other, however.

**[0020]** The folding tools 3 are detachably fitted in the beam 1. After all, it must be possible to adjust the folding tools 3 with respect to the beam 1 (in a direction perpendicular to the plane of the drawing), to move the folding tools 3 at least partially or to exchange at least some of the folding tools for other folding tools. In order to effect this detachability of the folding tools 3 with respect to the beam 1, use is made of a receiving and clamping arrangement, which, as far as the most essential parts thereof are concerned, comprises a pivotable clamping plate 4 and a driving arrangement, which engages the clamping plate 4, in addition to the recesses 2, which driving arrangement in this case consists of compression springs 5 and a driving unit 6.

**[0021]** The clamping plate 4 has an end 7 intended for engaging the folding tools 3 that are accommodated in the recesses 2. Said end 7 is thereto provided with a nose 8, which can mate with a corresponding cutout 9 in the folding tools 3.

**[0022]** The clamping plate 4 has a shoulder 10 at a point some distance away from the aforesaid end 7, which shoulder rests on a shoulder 11 of a housing 12 mounted to the beam 1. As a result of the mating interaction of the shoulders 10 and 11, a pivot axis for the clamping plate 4 is formed at that location, which pivot axis extends over the entire width of the clamping plate 4, perpendicularly to the plane of drawing in Fig. 1.

**[0023]** The compression springs 5, a number of which are arranged side by side perpendicularly to the plane of drawing, load the clamping plate 4 to a pivoted position (as shown), in which the nose 8 engages in the cutout 9 of the folding tools, so that the folding tools 3 are pressed firmly into the recesses 2 and upwards against the beam 1. When the driving unit 6 (e.g. a cylinder-piston assembly) is activated, the clamping plate 4 can be pivoted against the force exerted by the compression springs 5 to a position (not shown) in which the clamping nose 8 releases the recesses 9, and the folding tools 3 can be removed in downward direction, seen in Fig. 1, from the beam 1. It is also possible to activate the driving unit 6 only to a small extent, so that the clamping plate

4 will only pivot about the pivot axis being defined to a limited extent as well, such that it is not possible to remove the folding tools 3 from the recesses 2, whilst on the other hand it is possible to move the folding tools with respect to the beam 1 (in a direction perpendicular to the plane of drawing of Fig. 1).

**[0024]** Placement of the driving unit 5,6 on the side of the pivot axis (defined by the shoulders 10 and 11) remote from the end 7 makes it possible to minimise the distance between said pivot axis and the end 7. Such a minimisation will also lead to a minimisation of the extent of torsion of the clamping plate 4, in particular at the end 7 (e.g. in the case of an asymmetric loading). In this way it is ensured that all folding tools will be effectively engaged, even when the clamping plate 4 is loaded asymmetrically.

**[0025]** Fig. 2 shows a front view of a clamping plate 4 that may be used in the press brake that is shown in Fig. 1. A dotted line 16 indicates the location of the pivot axis (defined by the mating shoulders 10 and 11 of the clamping plate 4 and the housing 12, respectively). The dotted circles 5' schematically represent the location at which two (in this case) compression springs 5 engage the clamping plate 4. The dotted circle 6' similarly indicates the location at which a driving unit 6, such as a cylinder-piston assembly, engages the clamping plate 4 (in a direction opposite to the direction of pressure of the compression springs 5). As Fig. 2 clearly shows, the end 7 of the clamping plate 4 that engages the folding tools is provided with cuts 13, which extend perpendicularly to the respective edge 14 of the clamping plate 4. Said cuts 13 define resilient lips 15 lying side by side, which lips are capable of offsetting possible torsion of the clamping plate 4, so that an effective engagement of all folding tools remains ensured.

**[0026]** While in the embodiment of the press brake according to the invention that is shown in Fig. 1 the compression springs 5 pivot the clamping plate 4 to a rest position, in which the tools 3 are held in position in the recesses 2 (and the driving unit 6 needs to be activated in order for the tools 3 to be released from the beam 1), it is also conceivable to use an arrangement in which the compression springs 5 are present in the housing 12 and the driving unit 6 is present in the beam 1. In this way the compression springs 6 load the clamping plate 4 towards a releasing position (in which the folding tools 3 can be removed from the beam 1), and the driving unit 6 must be activated for retaining the folding tools 3 in their position in the recesses 2.

**[0027]** It is furthermore noted that the press brake may be provided with a safety arrangement to prevent the folding tools 3 from falling out of the beam 1 in the inoperative position of the clamping plate 4 already. Such a safety arrangement may e.g. consist of a projection formed on the folding tools 3, which mates with a movable projection that is connected to the beam 1 or to the housing 12.

**[0028]** Fig. 1 furthermore shows that the clamping

plate 4 is provided with a bevelled portion 17 near the end 7. This provides a smooth entry of the folding tools 3 into the recesses 2 of the beam 1.

**[0029]** The invention is not limited to the embodiments as described above, which can be varied in many ways within the scope of the invention as defined in the claims.

## Claims

1. A press brake comprising folding tools that can be fitted in a movable beam by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses formed in said beam for accommodating the folding tools, a clamping plate being pivotable about a pivot axis, which clamping plate has an end intended to engage the tools present in said recesses, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, **characterized in that** the end of the clamping plate that engages the folding tools and the point of engagement of the driving arrangement are located on opposite sides of the pivot axis.
2. A press brake according to claim 1, wherein said engaging end of the clamping plate comprises a number of resilient lips arranged side by side.
3. A press brake according to claim 2, wherein said end is provided with a number of spaced-apart cuts extending perpendicularly to the relevant edge of the clamping plate.
4. A press brake according to any one of the preceding claims, wherein said end of the clamping plate is bevelled on the side that faces towards the folding tools.
5. A press brake according to any one of the preceding claims, wherein a housing is mounted on the beam for accommodating at least part of the driving arrangement, which housing comprises a shoulder extending parallel to the longitudinal direction of the beam, and thus of the folding tools, which shoulder forms the pivot axis.
6. A press brake according to any one of the preceding claims, wherein the driving arrangement consists of a number of spring members arranged side by side, which spring members load the clamping plate to a pivoted position in which it engages the folding tools, and a driving unit, e.g. a cylinder-piston assembly, for pivoting the clamping plate against the spring force of the spring members to a pivoted position in which the folding tools are released.
7. A press brake according to any one of the claims 1

- 5, wherein the driving arrangement consists of a number of spring members arranged side by side, which spring members load the clamping plate to a pivoted position for releasing the folding tools, and a driving unit, e.g. a cylinder-piston assembly, for pivoting the clamping plate against the spring force of the spring members to a pivoted position in which the clamping plate engages the folding tools.

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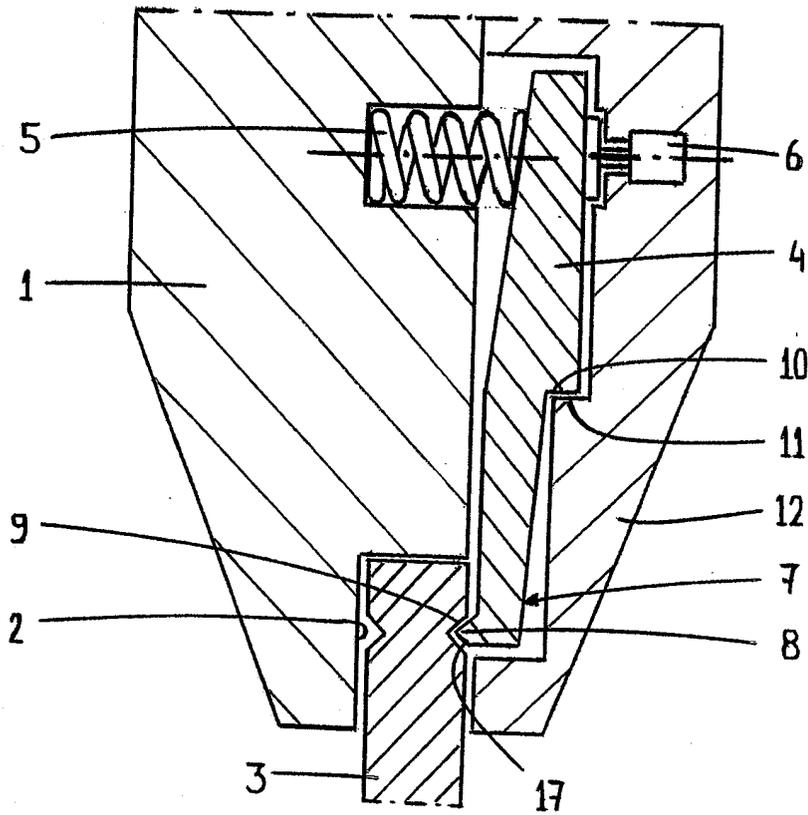


FIG. 1

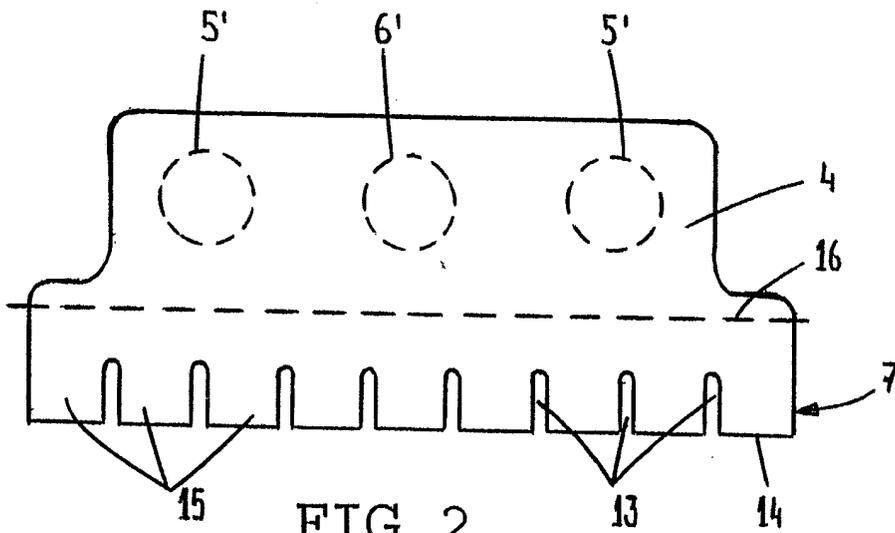


FIG. 2



European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number  
EP 03 10 3869

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |   |  |
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| Place of search<br>THE HAGUE   |   | Date of completion of the search<br>21 January 2004   | Examiner<br>Peeters, L                       |
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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