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(54) **Press brake**

(57) A press brake is described comprising folding tools (3) that can be fitted in a movable beam (1) by means of a receiving and clamping arrangement, which receiving and clamping arrangement consists at least of recesses (2) formed in said beam for accommodating the folding tools, a clamping plate (6) being pivotable about a pivot axis (15), which clamping plate has an end (9) 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. In order to prevent excessive torsion of the clamping plate at the engaging end thereof, 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. In this press brake, from the centre of the clamping plate outwardly successive cuts (16) enclose an ever increasing angle with the perpendicular to the edge (18) of the clamping plate in such a manner, that the cuts mutually converge in a direction from said edge towards said pivot axis.

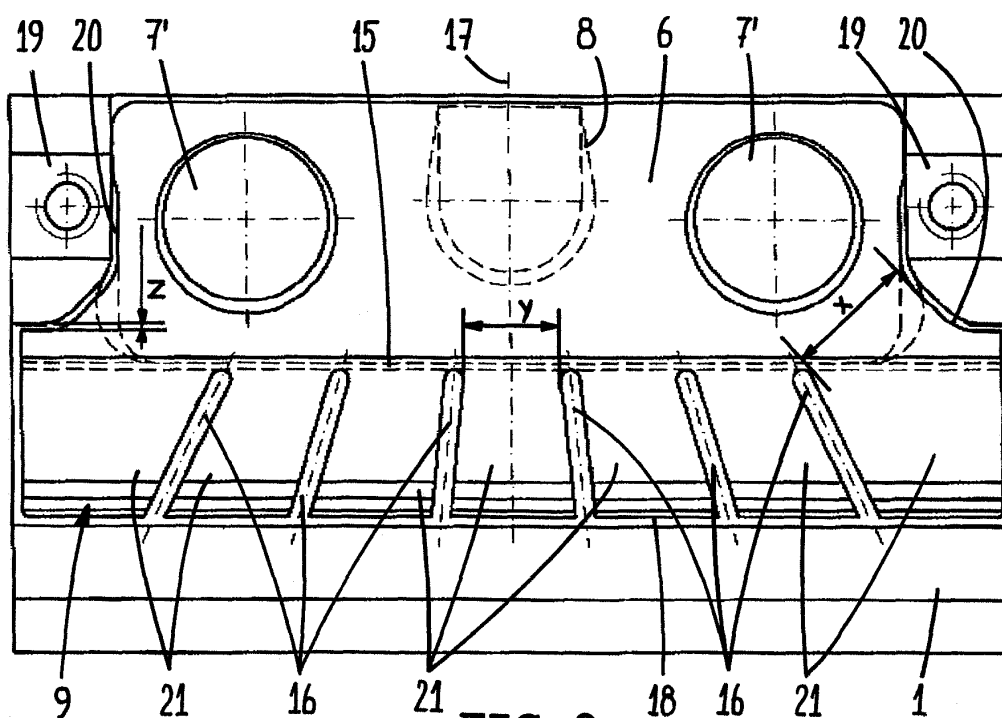


FIG. 2

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 which comprises a number of resilient lips arranged side by side and separated from each other by cuts extending from the edge of the end of the clamping plate, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, wherein 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.

[0002] Because in a press brake of this type 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, it is possible to keep the distance between said end of the clamping plate and the pivot axis very small. Like this it is possible to minimise the distortion (torsion) of the clamping plate when the clamping plate is asymmetrically loaded (for example when folding tools are not provided along the entire length of the beam in the recesses thereof). This is of importance, because otherwise the end of the clamping plate would engage the folding tools in an irregular way, or even part of the folding tools would not be engaged at all by the clamping plate.

[0003] It is an object of the present invention to improve a press brake of the type referred to in the introduction.

[0004] In view of the above 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 which comprises a number of resilient lips arranged side by side and separated from each other by cuts extending from the edge of the end of the clamping plate, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, wherein 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, characterised in that from the centre of the clamping plate outwardly successive cuts enclose an ever increasing angle with the perpendicular to said edge of the clamping plate in such a manner, that the cuts mutually converge in a direction from said edge towards said pivot axis.

[0005] Whereas all cuts of a known press brake of the present type extend in parallel to the said perpendicular of the clamping plate (thus perpendicularly to said edge), such that it cannot be avoided completely that lips present between successive cuts experience different deformations and an optimal clamping of the folding tools cannot be guaranteed, the positioning of the cuts according to the present invention results in such a shape of the resilient lips, that these all engage the folding tools at their ends with a substantially equal clamping force.

[0006] In a preferred embodiment the distance between adjacent cuts at said edge remains substantially unchanged.

[0007] Due to this measure the operation of the press brake can be optimised further.

[0008] Moreover it is suggested, that the cuts extend substantially up to the pivot axis. As a result the lips obtain an optimal resilience.

[0009] In correspondence with another preferred embodiment of the press brake according to the invention, the pivot axis is defined by a shoulder of a housing mounted on the beam for accommodating at least part of the driving arrangement and a counter shoulder on the clamping plate, whereas the shoulder and counter shoulder are shaped in such a manner that in the clamping position of the clamping plate a surface contact occurs there between for receiving reaction forces caused by the clamping force and driving force. The said surface contact prevents that damage occurs at the cooperating parts of the shoulder and counter shoulder as a result of the high reaction forces which may be generated during the operation of the press brake.

[0010] When, in accordance with another embodiment of the press brake according to the invention, in the clamping position of the clamping plate the play between the side ends of the clamping plate and the housing is at most 0,5 mm, and preferably is in the magnitude of 0,1 mm, it can be prevented that the clamping plate will assume an inclined position (that means that one of its ends lies at a higher level than its other end). Such an inclined position of the clamping plate would lead to irregularly clamping the folding tools. By now minimising the play between the side ends of the clamping plate and the housing such an undesired effect can be avoided.

[0011] 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.

Figure 1 is a schematic cross-sectional view of a part of the press brake according to the invention; and

figure 2 is a schematic front view of a clamping plate used in the press brake according to the invention.

[0012] 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.

[0013] 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 the illustrated embodiment the folding tools comprise a transverse pin 4 which engages in a corresponding recess 5 of the beam 1. When the receiving and clamping arrangement to be described hereinafter has released the folding tools, these folding tools 3 can be shifted with their transverse pin 4 in the recess 5 of the beam 1 in a direction perpendicular to the plane of the drawing, until the folding tools 3 can be taken away sideways from the beam 1.

[0014] In order to effect the mentioned 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, apart from the recesses 2 and the combination of transverse pin 4 and recess 5, also a pivotable clamping plate 6 and a driving arrangement engaging the clamping plate 6, which driving arrangement in this case consists of compression springs 7 and a driving unit 8.

[0015] The clamping plate 6 has an end 9 intended for engaging the folding tools 3 that are accommodated in the recesses 2. Said end 9 is thereto provided with a nose 10, which can mate with a corresponding cut out 11 in the folding tools 3.

[0016] The clamping plate 6 has a shoulder 12 at a point some distance away from the aforesaid end 9, which shoulder rests on a counter shoulder 13 of a housing 14 mounted to the beam 1. As a result of the mating interaction of the shoulders 12 and 13, a pivot axis for the clamping plate 6 is formed at that location, which pivot axis extends over the entire width of the clamping plate 6, perpendicularly to the plane of drawing in figure 1.

[0017] The compression springs 7, a number of which are arranged side by side perpendicularly to the plane of drawing, load the clamping plate to a pivoted position (as shown) in which the nose 10 engages the cut-out 11 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 8 (e.g. a cylinder-piston assembly) is activated, the clamping plate 6 can be pivoted against the force exerted by the compression springs 7 to a position (not shown) in which the clamping nose 10 releases the recesses 11, and the folding tools 3 can be removed in downward direction, as seen in figure 1, from the beam 1. In the illustrated embodiment the point of engagement of the compression springs 7 with the clamping plate 6 is located below the point of engage-

ment of the driving unit 8 (thus closer to the pivot axis). As a result, when activating the driving unit 10 a moment is created which promotes the movement of the clamping plate 6 towards its release position.

[0018] By only activating the driving unit 8 to a small extend the folding tools 3 are not fully released, however a shift thereof relative to the beam 1 perpendicular to the plane of drawing is possible.

[0019] Because the driving arrangement 7, 8 is positioned at the side of the pivot axis facing away the end 9, as appears clearly from figure 1, the distance between this pivot axis (as defined by the shoulders 12 and 13) and the end 9 can be minimised. Thus possible torsions (for example when the clamping plate 4 is asymmetrically loaded) are limited.

[0020] Now referring to figure 2, the clamping plate 6 as applied in the press brake illustrated in figure 1 is again visible. The location of the pivot axis has been indicated by a twin dotted line 15. The circles 7' schematically indicate the location where in this case two compression springs 7 engage the clamping plate 6. At a central position the driving unit 8 has been indicated in dotted lines.

[0021] As appears clearly from figure 2, the end 9 of the clamping plate 6 engaging the folding tools is provided with cuts 16. One can see directly, that from the centre of the clamping plate (dotted line 17) outwardly successive cuts 16 enclose an ever increasing angle with the perpendicular to the edge 18 of the clamping plate 4 (this perpendicular runs in parallel to the indicated dotted line 17). The cuts 16 converge in a direction from the edge 18 towards the pivot axis 15.

[0022] The positioning of the cuts is such, that the distance between adjacent cuts 16 at the edge 18 of the clamping plate 4 remains substantially unchanged. Further it appears clearly from figure 2 that the cuts extend substantially up to the pivot axis 15.

[0023] Figure 2 further partially shows the beam 1, which beam 1 comprises mounting arrangements 19 for the housing 14. For giving room to said mounting arrangements 19 the clamping plate 4 comprises corresponding cut-outs 20 at its side ends. In this particular case the distance x between the inner end of each outer cut 16 and the corresponding cut 20 is larger than the distance y between the inner ends of the two innermost cuts 16. This ensures, that at the edges 18 of the lips 21 defined between the cuts 16 substantially equal clamping forces are generated.

[0024] At the left in figure 2 the play z between the clamping plate 6 and the housing 14 (or its mounting arrangement 19) has been indicated (the same applies at the right side). For avoiding an inclined position of the clamping plate 6 this play should be kept as small as possible, for example 0,5 mm (or even in the magnitude of 0,1 mm).

[0025] Finally, again referring to figure 1, it is visible that in the represented clamping position of the clamping plate 6 (in which the compression springs 7 have

moved the upper end of the clamping plate 6 to the right, while the driving unit 8 is not activated) a surface contact exists between the clamping plate 6 and the housing 14 in the areas immediately adjacent (partly below and partly aside) the location of engagement between the shoulder 12 and counter shoulder 13. As a result of such a surface contact (in contrast to a line contact) the reaction forces as a result of the forces generated by the compression springs and the clamping force at the nose 10 can be accommodated without the risk of damaging the clamping plate 6 or the housing 14.

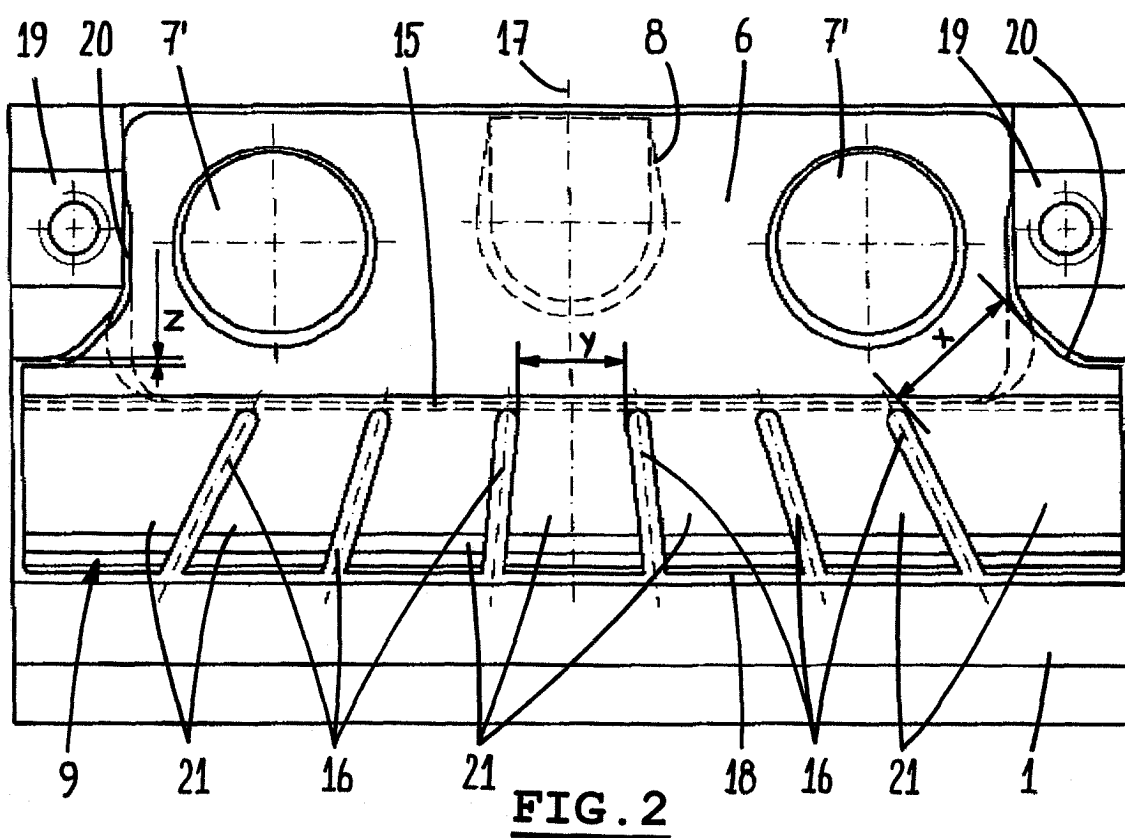
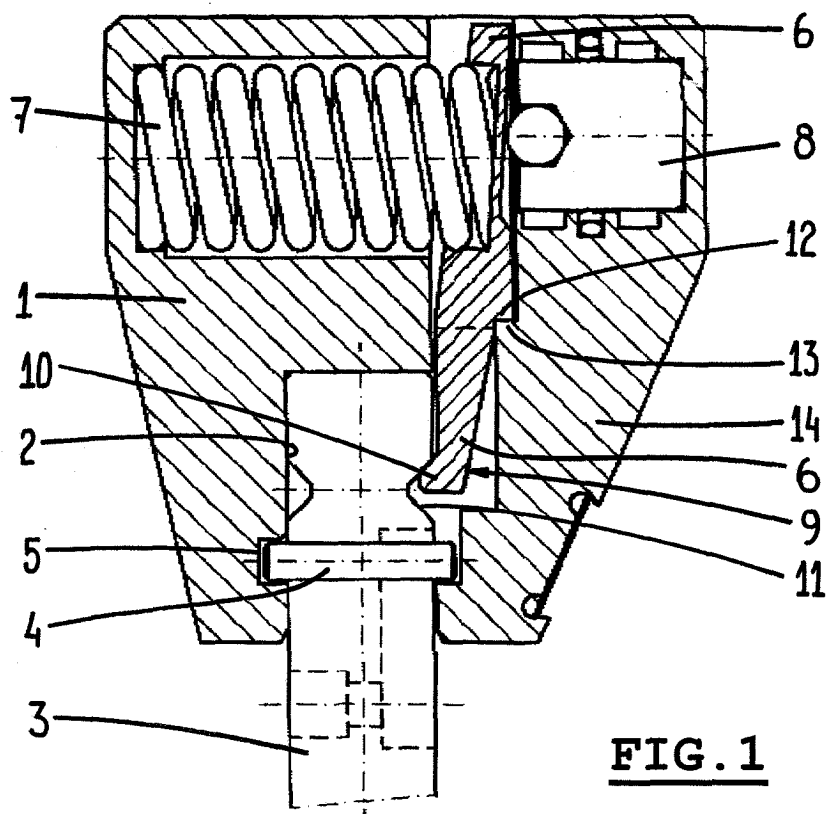
[0026] The invention is not limited to the embodiment as described above, which can be varied widely within the scope of the invention as defined in the claims.

Claims

1. 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 which comprises a number of resilient lips arranged side by side and separated from each other by cuts extending from the edge of the end of the clamping plate, and a driving arrangement engaging said clamping plate, which functions to cause the clamping plate to pivot about its pivot axis, wherein 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, **characterised in that** from the centre of the clamping plate outwardly successive cuts enclose an ever increasing angle with the perpendicular to said edge of the clamping plate in such a manner, that the cuts mutually converge in a direction from said edge towards said pivot axis.
2. Press brake according to claim 1, wherein the distance between adjacent cuts at said edge remains substantially unchanged.
3. Press brake according to claim 1 or 2, wherein the cuts extend substantially up to the pivot axis.
4. Press brake according to one of the previous claims, in which the pivot axis is defined by a shoulder of a housing mounted on the beam for accommodating at least part of the driving arrangement and a counter shoulder on the clamping plate, whereas the shoulder and counter shoulder are shaped in such a manner that in the clamping position of the clamping plate a surface contact occurs therebetween for receiving reaction forces caused

by the clamping force and driving force.

5. Press brake according to claim 4, wherein in the clamping position of the clamping plate the play between the side ends of the clamping plate and the housing is at most 0,5 mm.
6. Press brake according to claim 5, wherein in the clamping position of the clamping plate the play between the side ends of the clamping plate and the housing is in the magnitude of 0,1 mm.
7. Press brake according to one of the previous claims, wherein the driving arrangement of the clamping plate comprises at least a compression spring and an activatable driving means, such as for example a cylinder-piston assembly, engaging the clamping plate at opposite sides and mutually staggered.
8. Press brake according to claim 7, wherein the compression spring engages the clamping plate closer to the pivot axis than the driving means.





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 10 4105

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 6 003 360 A (DOOLITTLE JASON A ET AL) 21 December 1999 (1999-12-21) * column 6, line 27 - line 41; figures * -----	1	B21D5/02
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B21D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 March 2004	Examiner Ris, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 03 10 4105

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The members are as contained in the European Patent Office EDP file on
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18-03-2004

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