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(54) **Apparatus for bending a metal sheet**

(57) There is illustrated an apparatus for bending a metal sheet, comprising an upper bending beam (1) supporting an upper die (2) and a lower bending beam (3) supporting a complementary lower die (4), said bending beams (1,3) being movable towards each other for engaging the metal sheet between the upper and lower dies, (2,4) and wherein at least one of the dies

(2,4) is detachably housed in a longitudinally extending channel (6) formed in the respective bending beam (3). At least one side wall of the channel (6) is defined by a pressure piece (8) movable normally to the channel (6), which pressure piece is biased by bias means (19) in one direction and is engaged by a fluid-inflatable means (20) for a movement in the opposite direction.

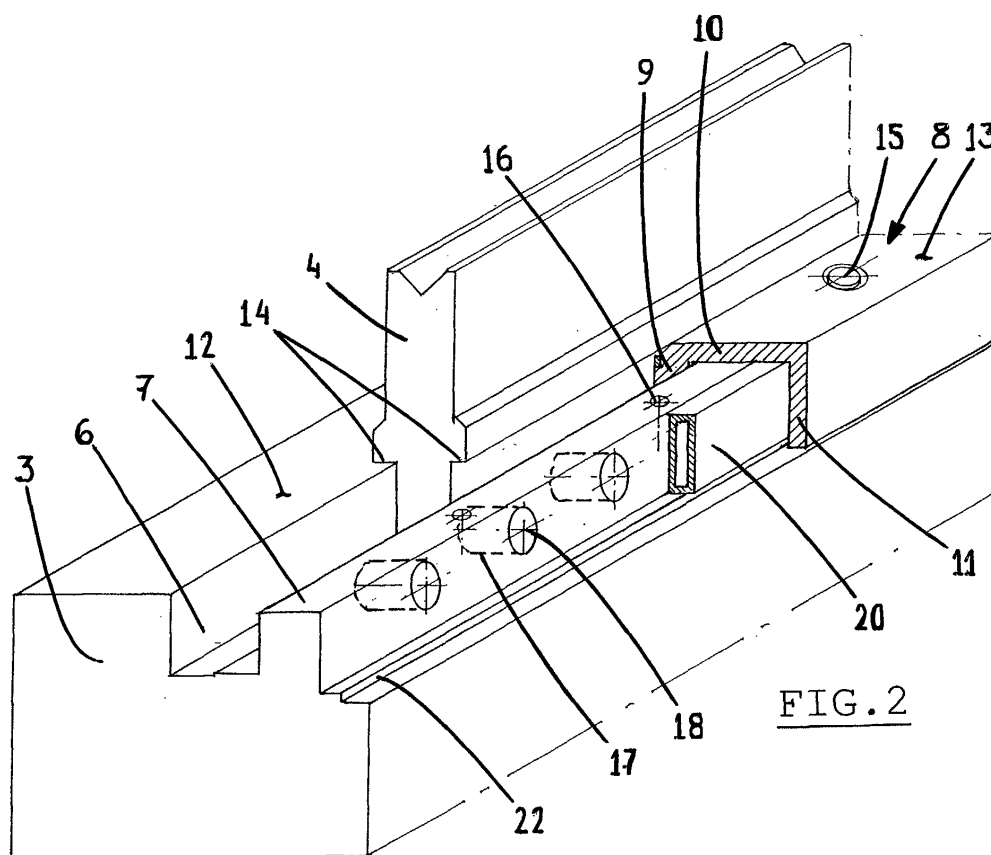


FIG. 2

Description

[0001] The invention relates to an apparatus for bending a metal sheet comprising an upper bending beam supporting an upper die and a lower bending beam supporting a complementary lower die, said bending beams being movable towards each other for engaging the metal sheet between the upper and lower dies, and wherein at least one of the dies is detachably housed in a longitudinally extending channel formed in the respective bending beam.

[0002] When using such an apparatus for bending a metal sheet, often a number of different dies are used. Therefore, for an economic use of the apparatus, it is essential that dies can be exchanged in a rapid manner.

[0003] It is an object of the invention to provide an improved apparatus of the type referred to above allowing a swift exchange of dies.

[0004] Therefore, the apparatus according to the invention is characterized in that at least one side wall of the channel is defined by a pressure piece movable normally to the channel, which pressure piece is biased by bias means in one direction and is engaged by a fluid-inflatable means for a movement in the opposite direction.

[0005] Activating or deactivating the fluid-inflatable means in a quick and reliable way leads to a movement of the pressure piece normally to the channel between a position in which the respective die is securely held between the side walls of the channel and a position in which said die can be removed or (if needed) moved. The fluid-inflatable means defines a simple, but nevertheless reliable means for engaging and moving the pressure piece.

[0006] Preferably, the fluid-inflatable means is a flexible compressed air hose. However, it is to be noted that also other fluids may be applied for inflating the fluid-inflatable means.

[0007] While, in a preferred embodiment of the apparatus according to the invention, the bias means are rubber blocks, also other bias means may be used, such as spring members or alike.

[0008] In an other preferred embodiment of the apparatus, the respective beam comprises a ridge extending longitudinally alongside the channel, wherein the pressure piece is shaped as an inverted channel beam positioned over the ridge in such a manner that one leg thereof is positioned at one side of the ridge and defines the said one side wall of the channel, the web surpasses the ridge, and the other leg is positioned at the opposite side of the ridge, and wherein the bias means are positioned between the ridge and one of the legs, whereas the fluid-inflatable means are positioned between the ridge and the other of the legs.

[0009] In this embodiment the ridge, which is a stationary part of the respective beam, acts as a support for the bias means as well as the fluid-inflatable means.

[0010] When applying the above embodiment, the bi-

as means may be positioned at the side of the ridge facing the channel. Then the bias means bias the pressure piece in a direction for clamping the die in the channel. For exchanging the die it then is necessary to inflate the fluid-inflatable means. In such an embodiment the apparatus in its inoperative position (fluid-inflatable means not inflated) securely holds the die in the respective bending beam.

[0011] However, also the opposite is possible. In such an opposite case, the bias means are positioned at the side facing away from the channel, whereas the fluid-inflatable means are positioned at the side of the ridge facing the channel. In this embodiment the die is not clamped when the fluid-inflatable means is inactive (not inflated), and securely holding the die is only realised when the fluid-inflatable means is inflated.

[0012] When the bias means are housed in recesses provided in the ridge, the dimensions of the inverted channel beam, and thus the respective bending beam, can be limited.

[0013] In a further embodiment of the apparatus according to the invention the pressure piece and the respective beam are provided with co-operating abutment means for limiting the relative movement therebetween. Such co-operating abutment means can prevent a damaging of the pressure piece due to a too large a movement thereof at longitudinal positions along the bending beam where no die is provided.

[0014] For preventing an unwanted movement (tilting) of the respective die, it further is preferred that the respective beam and the pressure piece have top surfaces extending in the same plane. Shoulders of the die extending in the same plane will engage these top surfaces for a correct positioning of the die relative to the bending beam.

[0015] Sometimes the die to be received in the channel has a reduced length. In such a case it may be of advantage when the pressure piece at its side facing the channel is provided with flexible members, such as for example flexible strips or alike, for engaging the die.

[0016] Finally, in another embodiment of the apparatus according to the invention, the pressure means is secured to the respective beam by means of securing means allowing only the movement of the pressure means normally to the channel. These securing means prevent the loss of the pressure means, for example during the exchange of dies.

[0017] Hereinafter the invention will be elucidated referring to the drawings, in which an embodiment of the apparatus according to the invention is illustrated.

Fig. 1 shows, in a perspective view, part of an embodiment of the apparatus according to the invention;

Fig. 2 shows, on a larger scale, a perspective view of the lower part of the apparatus of Fig. 1;

Fig. 3 shows a first sectional view of the embodiment illustrated in Fig. 2;

Fig. 4 shows a second sectional view of the embodiment illustrated in Fig. 2, and

Fig. 5 shows a sectional view of an alternative embodiment of the apparatus according to the invention.

[0018] In Fig. 1 an apparatus for bending a metal sheet is partly illustrated. This apparatus comprises an upper bending beam 1 supporting an upper die 2 and a lower bending beam 3 supporting a complementary lower die 4. The bending beams 1 and 3 are movable towards each other by operating means not illustrated here and known per se. A metal sheet to be bend is inserted between the upper die 2 and lower die 4, whereupon the upper bending beam 1 and lower bending beam 3 are moved towards each other. After the bending operation has been completed, the upper and lower bending beams 1 and 3, respectively, are moved apart.

[0019] The upper die 2, in the illustrated embodiment, is attached to the upper bending beam 1 by conventional means 5 which will not be explained in detail here. It should be noted, however, that the following could also apply for the upper die 2.

[0020] The lower bending beam 3 is provided with a longitudinally extending channel 6 in which the lower die 4 is detachably housed. The manner in which the lower die 4 is detachably housed in the longitudinally extending channel 6 formed in the respective lower bending beam 3 will be explained referring to the following drawings.

[0021] Fig. 2 shows, in a perspective view and on a larger scale, part of the lower bending beam 3 with longitudinally extending channel 6 formed therein. The lower die 4 is housed in the channel 6. Alongside the channel 6 a ridge 7 extends longitudinally. A pressure piece 8 shaped as an inverted channel beam is positioned over the ridge 7 in such a manner, that one leg 9 thereof is positioned at the side of the ridge 7 facing the channel 6, the web 10 thereof surpasses the ridge 7, and the other leg 11 thereof is positioned at the side of the ridge 7 facing away from the channel 6.

[0022] In the assembled position as illustrated in Fig. 2 the top surface 12 of the lower bending beam 3 and the top surface 13 of the pressure piece 8 extend in the same plane. These top surfaces 12 and 13 engage downwardly facing shoulders 14 of the lower die 4, in such a manner that the lower die 4 is in a stable manner positioned in the lower bending beam 3 (e.g. preventing tilting thereof when loaded).

[0023] Referring to Fig. 3, securing means shaped as a pin 15 are attached in mounting holes 16 in the ridge 7. These securing means 15 extend through openings in the web 10 of the pressure piece 8, wherein the dimensions of the openings are larger than the dimensions of the pin 15. In such a manner, the pressure piece 8 can move perpendicularly (normally) to the channel 6, but not in another direction.

[0024] The ridge 7 further is provided with transverse-

ly extending recesses 17. As shown in Fig. 2 and 4, these recesses 17 are at the right-handed side closed by covers 18. In each recess 17 a flexible means, in this embodiment a rubber block 19, is housed. This rubber block 19 engages and biases leg 9 of the pressure piece 8.

[0025] Between the ridge 7 and the other leg 11 (see Fig. 2 and 3) a fluid-inflatable means 20 is positioned. In the illustrated embodiment, this fluid-inflatable means may comprise a flexible compressed air hose.

[0026] The apparatus according to the invention operates as follows. In a non-operative position (Fig. 3) the fluid-inflatable means 20 is not inflated. The rubber blocks 19 are biased and engage leg 9 of the pressure piece 8, moving it towards the channel 6 and thus towards the die 4 housed in the channel 6. Thus, when the fluid-inflatable means 20 is not inflated, the bias of the rubber blocks 19 securely holds the lower die 4 in the lower bending beam 3.

[0027] The movement of the pressure piece 8 under influence of the bias of the rubber blocks 19 is limited by co-operating abutment means 21 and 22 of the pressure piece 8 and lower beam 3, respectively (see Fig. 4). Thus it can be prevented, that (at longitudinal positions where no lower die 4 is housed in the channel 6) the pressure piece 8 would be deformed and be damaged.

[0028] When the lower die 4 has to be exchanged and thus should be removed from the channel 6 (or, alternatively, only should be moved longitudinally in the channel 6), the fluid-inflatable means 20 is inflated. When this means 20 expands, it engages the leg 11 of the pressure piece 8 and thus the pressure piece 8 is moved to the right opposing the bias of the rubber blocks 19. This position is shown in Fig. 4. This movement is limited by a contact between the opposing faces of the leg 9 of the pressure piece 8 and ridge 7.

[0029] In the position illustrated in Fig. 4 the lower die 4 is no longer engaged by the pressure piece 8 and can be removed (or moved).

[0030] At its side facing the channel 6 the pressure piece 8 is provided with flexible members 23 (indicated in Fig. 3), such as for example flexible strips or alike, for securely engaging the lower die 4.

[0031] Fig. 5 shows an alternative embodiment, in which the rubber blocks 19 and fluid-inflatable means 20 have changed positions. In this embodiment, the lower die 4 is held securely in the lower beam 3 when the fluid-inflatable means 20 is inflated. Deflating the fluid-inflatable means 20 leads to disengaging the lower die 4.

[0032] The invention is not limited to the embodiments illustrated here, but can be varied widely within the scope of the invention as defined by the claims. The fluid-inflatable means do not necessarily have to be inflated by compressed air. Instead of rubber blocks the bias means also may be shaped as any type of spring members.

[0033] Whereas in the illustrated embodiment only one side wall of the channel 6 is movable and the other side wall is stationary, one should realise that also both side walls can be movable, and in such a case two pressure pieces are provided.

[0034] Further it should be noted, that the apparatus as illustrated in Fig. 1 also could be provided with an upper die 2 which is housed in the upper beam 1 in a corresponding manner as the lower die 4 in the lower bending beam 3.

Claims

1. Apparatus for bending a metal sheet, comprising an upper bending beam supporting an upper die and a lower bending beam supporting a complementary lower die, said bending beams being movable towards each other for engaging the metal sheet between the upper and lower dies, and wherein at least one of the dies is detachably housed in a longitudinally extending channel formed in the respective bending beam, **characterized in that** at least one side wall of the channel is defined by a pressure piece movable normally to the channel, which pressure piece is biased by bias means in one direction and is engaged by a fluid-inflatable means for a movement in the opposite direction. 15
2. Apparatus according to claim 1, wherein the fluid-inflatable means is a flexible compressed air hose. 20
3. Apparatus according to claim 1 or 2, wherein the bias means are rubber blocks. 25
4. Apparatus according to any of the previous claims, wherein the respective beam comprises a ridge extending longitudinally alongside the channel and wherein the pressure piece is shaped as an inverted channel beam positioned over the ridge in such a manner that one leg thereof is positioned at one side of the ridge and defines the said one side wall of the channel, the web surpasses the ridge, and the other leg is positioned at the opposite side of the ridge, and wherein the bias means are positioned between the ridge and one of the legs, whereas the fluid-inflatable means are positioned between the ridge and the other of the legs. 30 35 40 45
5. Apparatus according to claim 4, wherein the bias means are positioned at the side of the ridge facing the channel. 50
6. Apparatus according to claim 4 or 5, wherein the bias means are housed in recesses provided in the ridge. 55
7. Apparatus according to any of the previous claims,

wherein the pressure piece and the respective beam are provided with co-operating abutment means for limiting the relative movement therebetween.

8. Apparatus according to any of the previous claims, wherein the respective beam and the pressure piece have top surfaces extending in the same plane. 5
9. Apparatus according to any of the previous claims, wherein the pressure piece at its side facing the channel is provided with flexible members, such as for example flexible strips or alike, for engaging the die. 10
10. Apparatus according to any of the previous claims, wherein the pressure means is secured to the respective beam by means of securing means allowing only the movement of the pressure means normally to the channel. 15

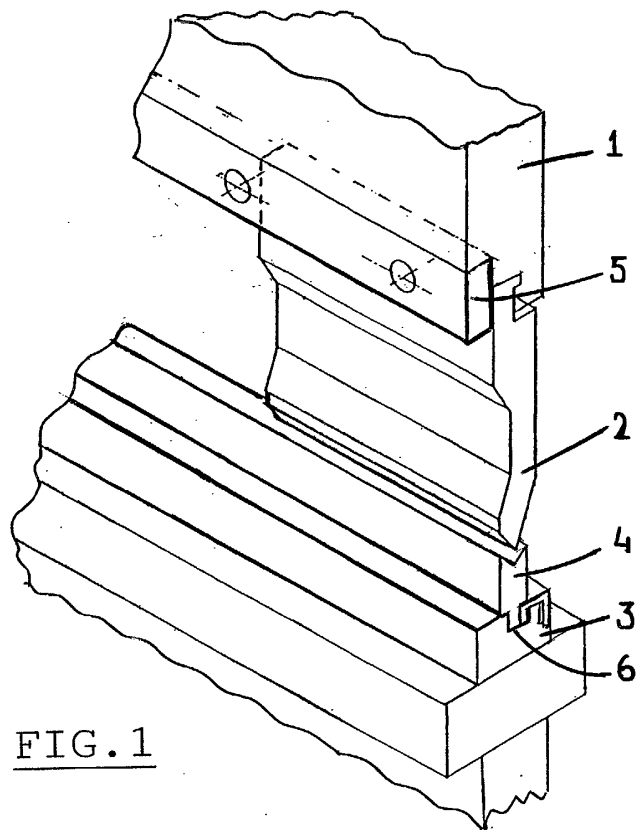


FIG. 1

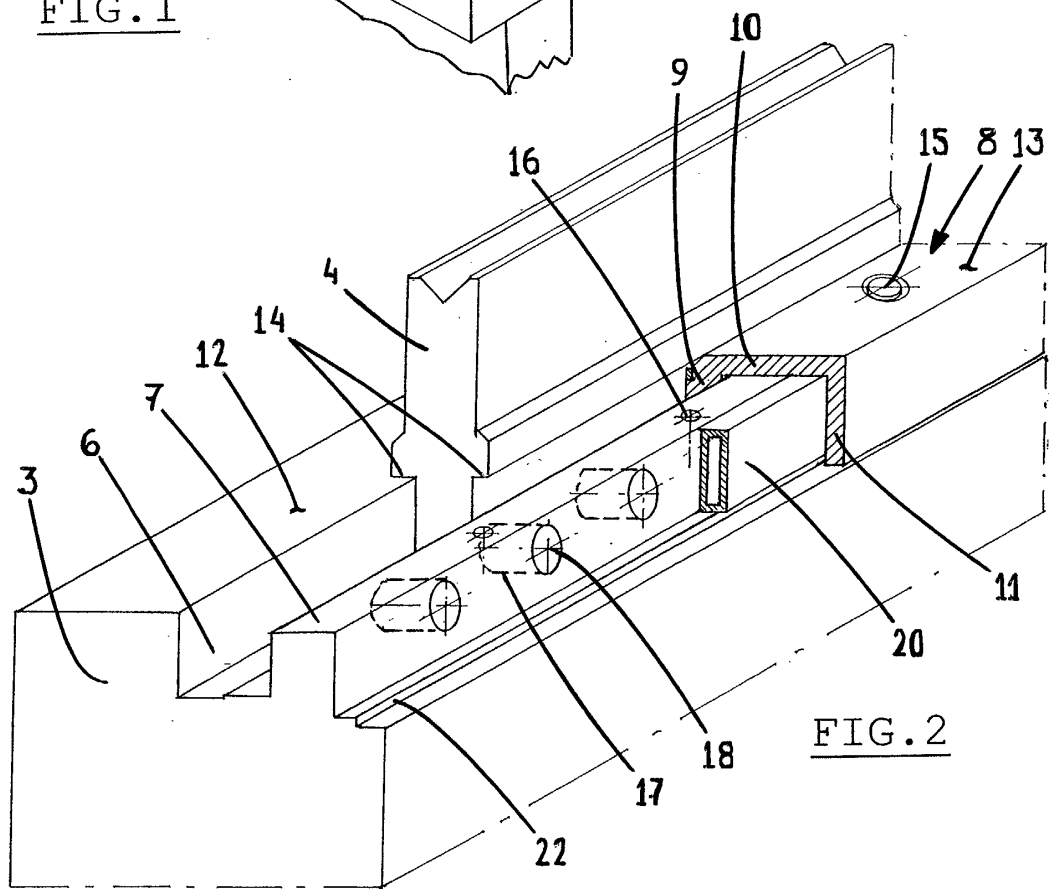


FIG. 2

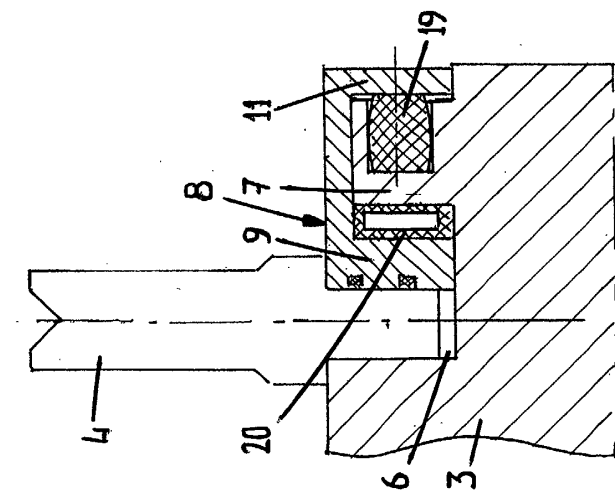


FIG. 5

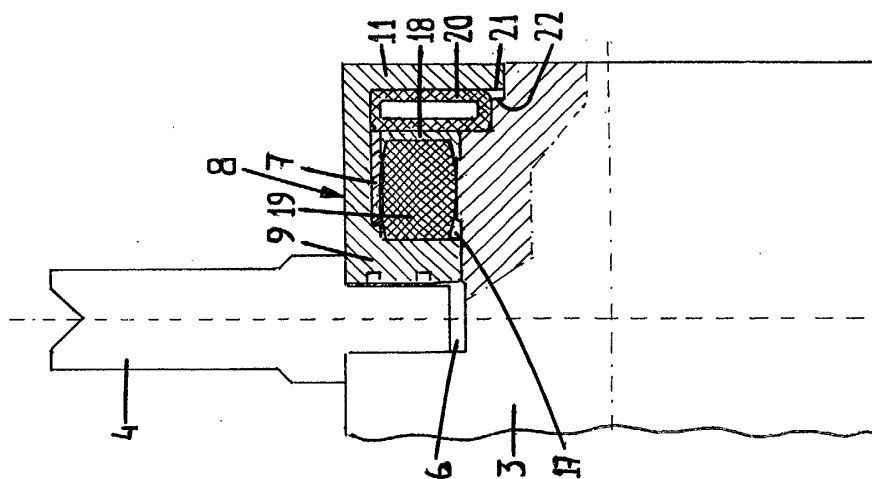


FIG. 4

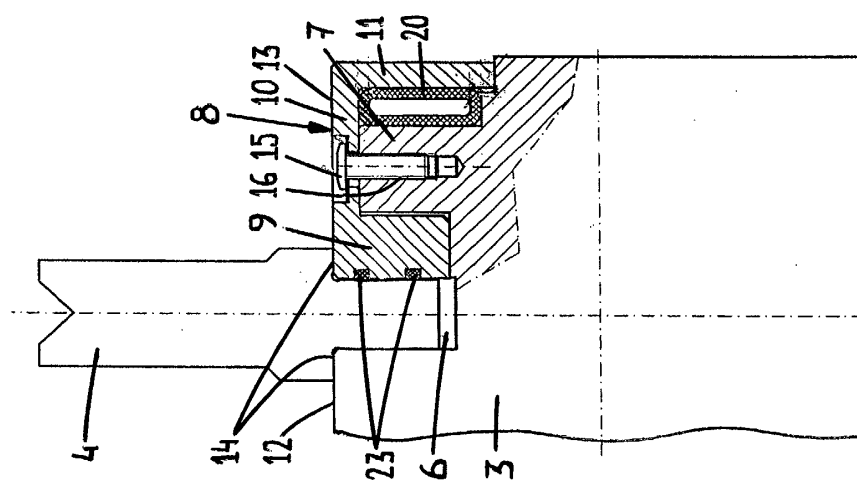


FIG. 3



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 6234

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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 24 July 2002	Examiner Vinci, V
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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