US 20080066520A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2008/0066520 A1**

Sperrer (43) **Pub. Date: Mar. 20, 2008**

(54) **METHOD FOR PRODUCING A WORKPIECE BY FORMING UNDER BENDING CONDITIONS**

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(21) Appl. No.: **11/662,420**

(22) PCT Filed: **Aug. 30, 2005**

(86) PCT No.: **PCT/AT05/00346**

§ 371(c)(1),
(2), (4) Date: **Jul. 27, 2007**

(30) **Foreign Application Priority Data**

Sep. 10, 2004 (AT) .... A 1512/2004

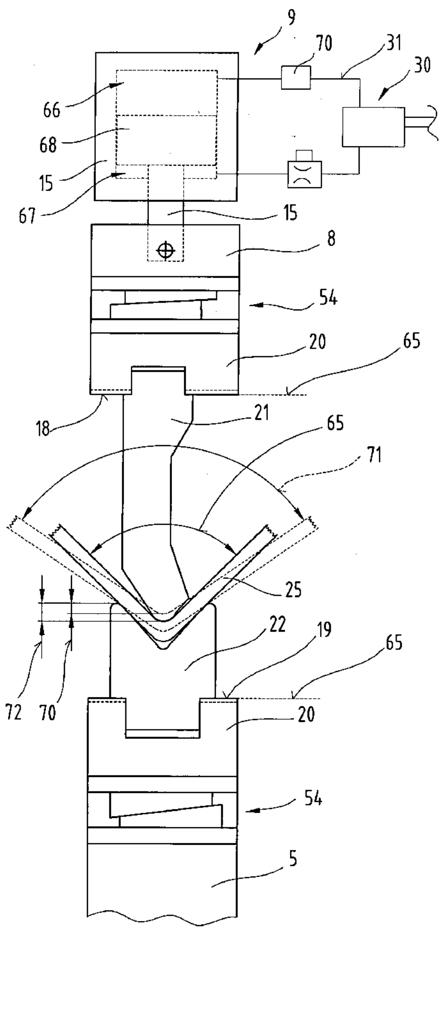
Publication Classification

(51) **Int. Cl.**
B21D 5/02 (2006.01)

(52) **U.S. Cl.** **72/389.5**

(57) **ABSTRACT**

A method of producing a workpiece by bending a panel in a bending press, in particular an edge bending press, with measures for compensating deformations of the edge bending press due to load. The measures involve detecting the displacement forces of drive means whilst the panel is being bent at a bending depth of the bending tools that is slightly shorter than a bending depth needed to produce a predefined bending angle. From the detected displacement forces, the bending deformation of the press beams corresponding to them are determined and the displacement force of the drive means is reduced, after which a compensating device is displaced in order to set a complementary camber in support surfaces for the bending tools or tool holders, and the panel is finally bent by displacing the press beam to the bending depth corresponding to the predefined bending angle.



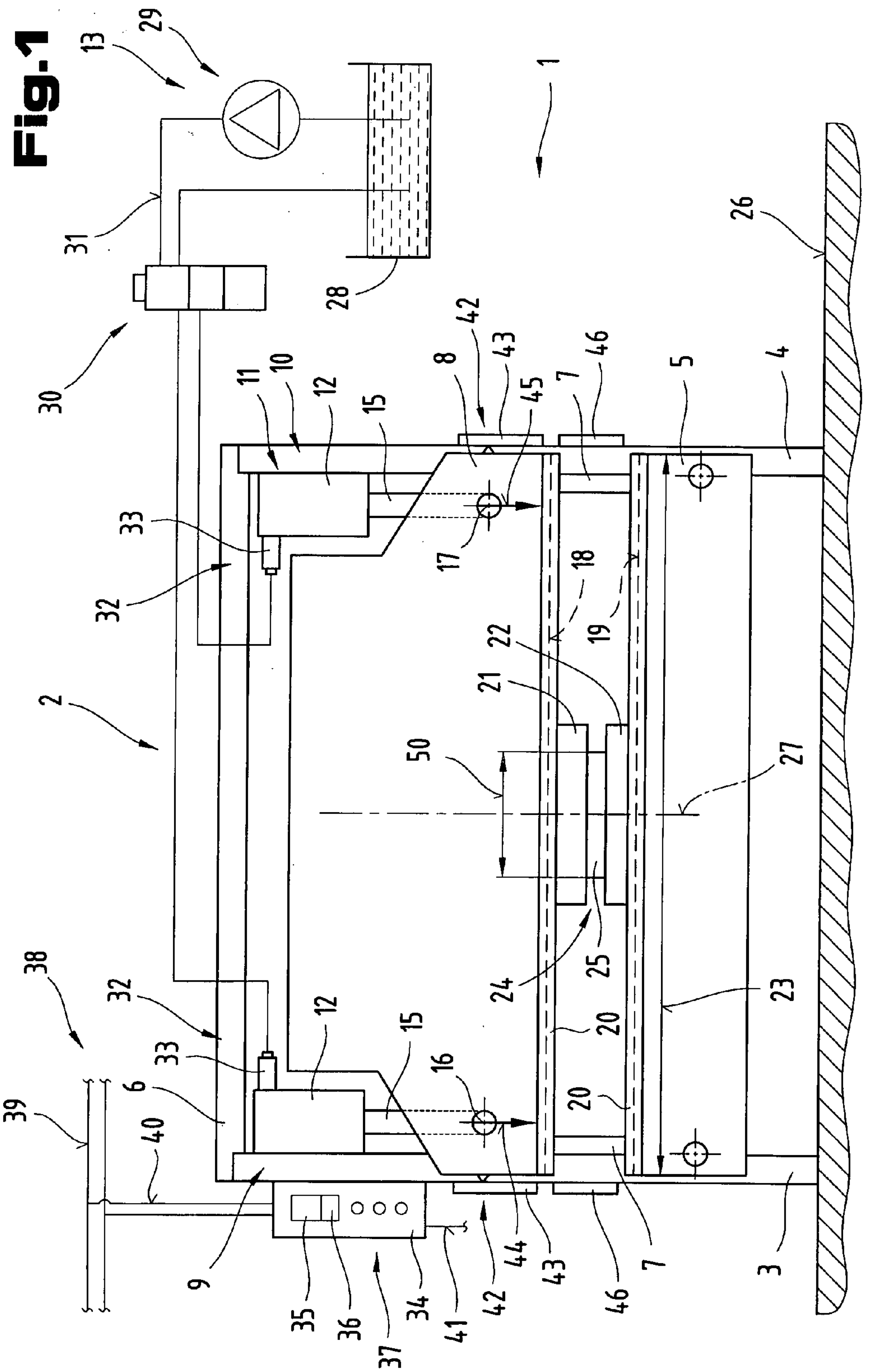

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Fig.1

Fig.2

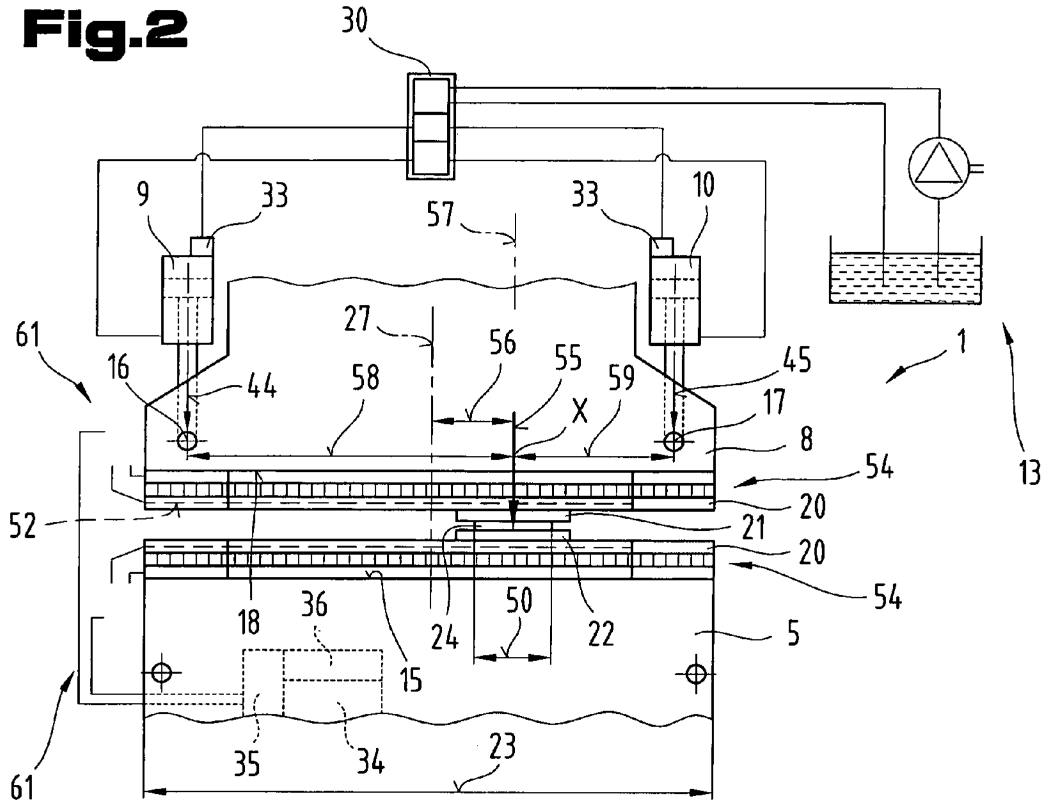
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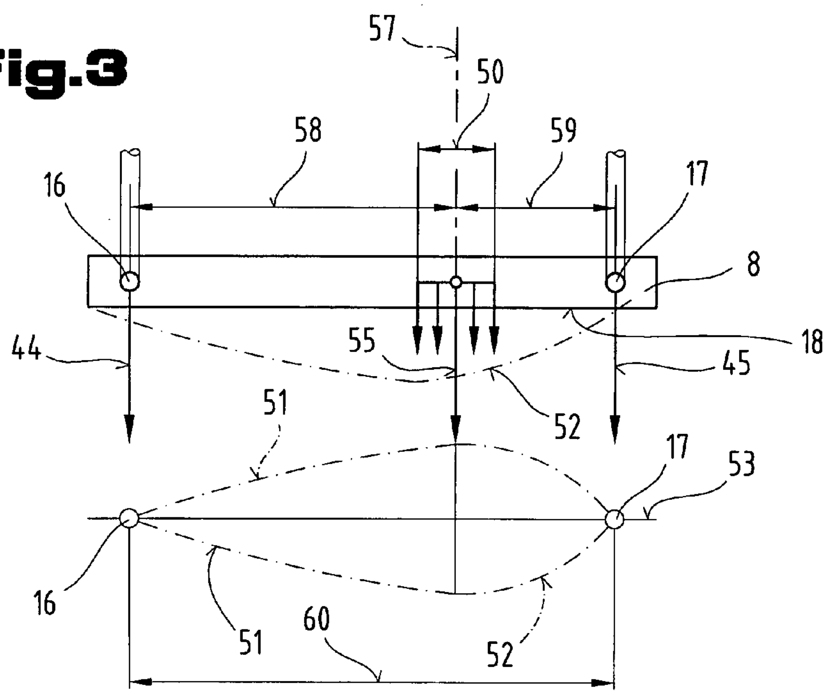
Fig.3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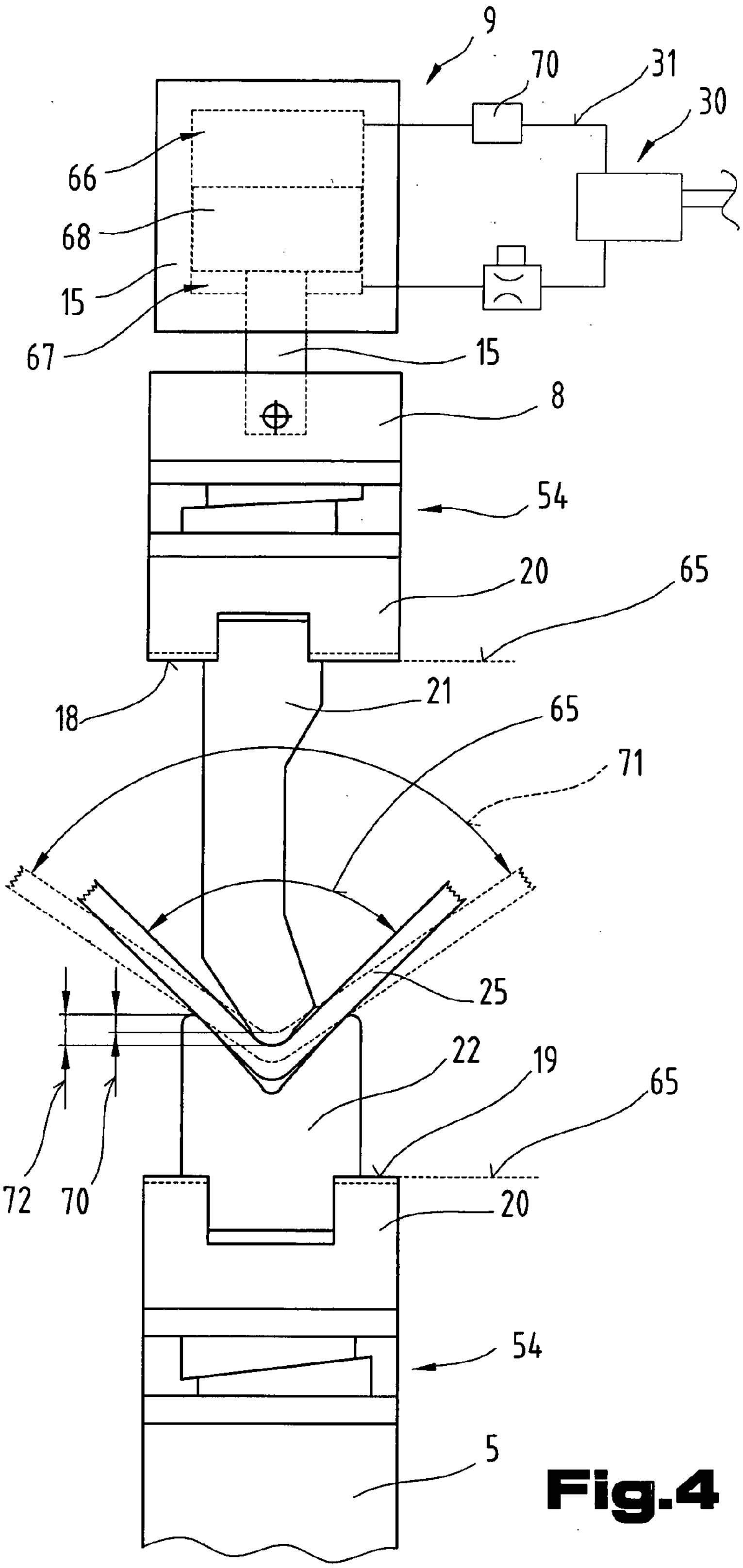

Fig.4

METHOD FOR PRODUCING A WORKPIECE BY FORMING UNDER BENDING CONDITIONS

[0001] The invention relates to a method of operating a bending press, in particular an edge bending press, of the type outlined in the introductory part of claim **1**.

[0002] Numerous devices are already known as a means of counteracting mechanical deformations which occur when a bending press is placed under load when shaping workpieces by bending, in particular flexing of a table beam and/or a pressing beam, by means of which bending tools or tool holder devices for the bending tools are pre-cambered in the direction opposite anticipated bending. These devices and hence the camber are set on the basis of values known from experience or computed models for a number of load situations derived from the position of the tools, tool length and shaping force needed for the respective workpiece.

[0003] Patent specification DE 37 09 555 A1 discloses a device of this type, in which several pairs of top and bottom wedges are provided at intervals along the longitudinal direction of the edge bending press in order to fit a pressing tool in a convex state between the bottom pressing tool and the pressing table. A mutually adapted sliding movement of the wedges is generated by means of an elastic spring element extending across the entire length of the edge bending press, which can be activated by a control drive, as a result of which a support surface for the tools or a holder device for the tools assumes a camber specifically adapted to requirements, thereby compensating for any bending of the table beam and/or press beam across a full bending length so that the depth to which the bending tools are lowered is more or less identical across the entire bending length.

[0004] Patent specification DE 32 45 755 A1 also discloses a method of correcting the bending line of the bending tool of a bending press, in particular an edge bending press, whereby the bottom tool is split in the direction of the bending line and the tool halves sub-divided into tool segments fan be displaced transversely to the bending line. The bending line of the top tool is measured in the vertical plane by means of several measuring sensors. The tool segments of the bottom tool are moved, partially by motor, in the horizontal plane in conformity with the detected measurement values in order to form a bending gap taper or narrower region corresponding to the bending line, thereby ensuring that the bending line can be automatically determined and corrected as a result.

[0005] Patent specification CH 508 426 A discloses an edge bending press, in which the table beam and/or press beam has a slit running virtually across the entire length and extending across its entire thickness. Due to the design of this slit and by means of positioning means bridging the slit, it is possible to impart a camber to a region of the table beam or press beam forming the tool support as a function of the respective position of the positioning means, making allowance for the anticipated bending line.

[0006] Patent specification WO 00/13813 A1, finally, discloses an edge bending press, in which the table beam is provided with slits extending from the two end regions in the direction towards the middle, which separate the table beam across its entire thickness, as a result of which projecting supports form the regions of the table bench constituting the support surface for the bending tools, which are deformed by means of positioning mechanisms by varying the slit width in order to create a camber in the support surface.

[0007] The objective of the invention is to propose measures whereby allowance can be made for a plurality of load situations to which edge bending presses can be subjected and a camber can be exactly adapted to load-induced bending deformations of a table beam and/or press beam.

[0008] This objective is achieved by the invention on the basis of the features defined in the characterising part of claim **1**. The surprising advantage of this approach is that a compensation corresponding to the real load and hence deformation values can be achieved in order to guarantee a high-quality bending process and, for this purpose, an essential aspect of the invention is that the bending operation is split into a pre-bending and actual bending operation with the bending press relieved of adjustment forces between the operations so that a compensating device can be moved in order to create a complementary camber counteracting the deformations on the bending press in at least one support surface for the bending tools or for tool holders in a load-free state, thereby permitting significantly reduced positioning forces and a high setting accuracy.

[0009] Other possible features defined in claims **2** to **4** are also of advantage because a less complex detection system with a rapid response time is needed.

[0010] The advantageous feature defined in claim **5** ensures that the effects of asymmetrical loads on the bending behaviour of the table beam and the press beam are compensated.

[0011] The features described in claims **6** and **7** ensure that, because the displacement forces of the drive means are detected directly during a forming operation of a workpiece, deformation data stored in a data memory and containing a number of different load situations in a data matrix can be retrieved, thereby enabling a required camber of a support surface for the bending tools to be set on a compensating device, manually or by machine, in order to compensate for the current bending deformation of the table beam or press beam.

[0012] Also of advantage are the features defined in claims **8** to **10**, which enable rapid preparation for mass production or alternatively for individual production runs, thereby disrupting the production sequence to only a slight degree.

[0013] The advantage of the features defined in claim **11** is that the deformation data of a bending deformation is determined directly from the detected displacement forces of the drive means and thus by means of a computing operation based directly on the actual load situation.

[0014] However, another approach defined in claim **12** is possible, whereby faulty settings are prevented, thereby ruling out any associated faulty production.

[0015] The features defined in claim **13** permit largely automated operation.

[0016] Finally, the features defined in claims **14** and **15** define variants permitting adaptation to meet economic requirements.

[0017] In order to provide a clearer understanding, the invention will be described in more detail with reference to examples of embodiments illustrated in the appended drawings. Of these:

[0018] FIG. 1 shows a view in elevation of an edge bending press proposed by the invention;

[0019] FIG. 2 shows a detail of the edge bending press;

[0020] FIG. 3 is a schematic diagram of a load situation when bending a workpiece;

[0021] FIG. 4 is a schematic diagram showing a detail of a forming operation, in elevation.

[0022] Firstly, it should be pointed out that the same parts described in the different embodiments are denoted by the same reference numbers and the same component names and the disclosures made throughout the description can be transposed in terms of meaning to same parts bearing the same reference numbers or same component names. Furthermore, the positions chosen for the purposes of the description, such as top, bottom, side, etc., relate to the drawing specifically being described and can be transposed in terms of meaning to a new position when another position is being described. Individual features or combinations of features from the different embodiments illustrated and described may be construed as independent inventive solutions or solutions proposed by the invention in their own right.

[0023] FIG. 1 is a simplified, schematic diagram illustrating an edge bending press 1, with a machine frame 2 comprising side walls 3, 4, a stationary press beam 5 and a transverse connection 6. Mounted in guide arrangements 7 of the side walls 3, 4 and the transverse connection 6 is another press beam 8 in a plane formed by the press beam 5 and which is displaceable relative to the latter, which, in the embodiment illustrated as an example, can be operated by drive means 9, 10 of a drive system 11 fixedly mounted on the side walls 3, 4, e.g. hydraulic cylinders 12 of a hydraulic system 13, and at least one hydraulic cylinder 12 with a piston rod 15 is active at oppositely lying end regions 14 of the displaceable press beam 8 in each case, thereby resulting in two axial positions 16, 17 for transmitting the displacement forces of the drive means 9, 10 to the press beam 8.

[0024] Disposed on oppositely lying support surfaces 18, 19 of the stationary press beam 5 and the displaceable press beam 8 are tool holders 20 in which oppositely lying bending tools 21, 22 are detachably secured and can be displaced.

[0025] In the embodiment illustrated as an example, the bending tools 21, 22, which do not extend across an entire length 23 of the table beam 5 and the press beam 8, are positioned centrally by reference to the length 23 of the press beam 5, 8 for producing a workpiece 24, e.g. by bending a panel 25, for example a sheet metal blank, which will require identical displacement forces of the drive means 9, 10 and result in symmetrical bending lines on the press beams 5, 8.

[0026] In practice, however, off-centre dispositions—such as illustrated in the subsequent drawings—are very common. If shorter bending tools 21, 22 that are not of the length 23 are used, they are often positioned off-centre by reference to a mid-plane 27 extending perpendicular to a standing surface 26 and parallel with the side walls 3, 4 for example, in order to form two or more tool sets comprising the bending tools 21, 22 for alternate use when retooling the edge bending press 1 or in order to gain better access to the bending tools 20, 21 when working with bent workpieces 4 that have already been partially shaped.

[0027] However, an off-centre disposition of the bending tools 20, 21 causes a non-symmetrical load on the edge bending press 1 because it results in differing degrees of displacement forces and the natural result is also a non-symmetrical bending deformation of the table beam 5 and the press beam 8.

[0028] In the embodiment illustrated as an example, the drive system 11 comprises the hydraulic system 13 and the latter essentially comprises a container 28 for a pressurising medium, e.g. hydraulic oil, a pump unit 29, a control unit 30 and appropriate connecting lines 31 for pressurising the hydraulic cylinder 12.

[0029] Various detection means 32 are also provided for controlling the hydraulic system 13, and, in a manner known from the prior art, pressure sensors 33 are provided in the connecting lines 31 which are preferably mounted directly on the hydraulic cylinders 12 at the intake end to detect the pressure during a working stroke of the press beam 8 during the operation of bending the workpiece 4.

[0030] Operation of the edge bending press 1 is controlled and regulated by means of a control and/or regulating unit 34 essentially comprising a computer 35 with a data memory 36, as well as the requisite switching and control elements 37. The control and/or regulating unit 34 is supplied with power from a power source 38, for example a mains network 39, via cables 40 and is connected via cables 41 to control, regulating, detection and safety means which have to be activated and supplied with power in a manner known from the prior art and provided as standard with bending machines of this type. A distance measuring system 42 is often connected to the control and/or regulating unit 34, by means of which the respective position of the displaceable press beam 8 is measured and monitored relative to a reference position—selected zero position—during a displacement operation and used as a variable control parameter in a control programme of a distance measuring system for controlling displacements.

[0031] The distance measuring system 42 preferably comprises opto-electronic linear measuring bars 43 and an electronic optical measurement evaluation system of a type known from the prior art disposed at the two opposite end regions 14 of the displaceable press beam 8, between it and the stationary side walls 3, 4. The disposition of this distance measuring system 42 at the opposite end regions 14 of the press beam 8 therefore also enables the parallel positioning of the press beam 8 to be detected when it is being displaced and hence also the oppositely lying bending tools 21, 22, thereby enabling an angular position to be detected and monitored, such as occurs on different displacement paths of the drive means 9, 10, and also for different flexing behaviour of the side walls 3, 4 caused by asymmetrical loads induced by the off-centre position of the bending tools 21, 22 at differing displacement forces—indicated by arrows 44, 45- to be compensated, so that the displacement paths can be adapted to these deformations.

[0032] Naturally, the distance measuring system 42 may also be some other system known from the prior art, such as distance lasers, etc.

[0033] A variety of different methods and devices may also be used to determine flexing of the side walls **3**, **4**, for example strain gauge sensors **46** disposed on the side walls **3**, **4** or in the side walls **3**,**4** or press beams **5**, **8**, or piezoelectric elements or distance lasers integrated in the piston rod **15**.

[0034] The essential process of detecting the displacement forces needed for applying measures to compensate for the deformation which occurs in the edge bending press **1** under load is based directly on a detection of the working pressure of the pressurising medium in the hydraulic cylinders **12** by means of the pressure sensors **33**—as indicated by arrows **44**, **45**.

[0035] At this point, however, another option should be mentioned, namely that of computing the displacement forces—indicated by arrows **44**, **45**—from the measured flexing of the side walls **3**, **4** and applying the known machine data, such as the cross-sectional dimensions of the side walls **3**, **4** and strength values relating to the material.

[0036] Turning to FIGS. **2** and **3**, the measures used to compensate for deformations of the edge bending press will be described in more detail, together with the effects of load based on the example of the displaceable press beam **8** and, in approximately the same way, also the stationary press beam **5**, but in the reverse direction.

[0037] From the measured or computed displacement forces—indicated by arrows **44**, **45**—a computing operation run in the computer **35** determines the position of the bending tools **21**, **22** by reference to the length **23** and, by applying the bending length **50** pre-defined in the operating programme for controlling the work process, which is dependent on the workpiece **24**, a series of load situations incorporating the associated deformation values is retrieved from the data memory **36**. A specific bending line **51** and hence a specific complementary camber **52** for applying a correction to the press beams **5**, **8** and thus a directly measured deviation from the angular position at the bending tools **21**, **22**, which is set under load with respect to a neutral line **53** in the non-loaded state, correspond to each of the load situations stored in the data memory. Settings values are derived from this measured deviation in the computer **35** and used as measures for correcting the setting of the complementary camber **52** of the support surfaces **18**, **19** at the compensating devices **54**.

[0038] FIG. **3** illustrates the conditions at the displaceable press beam **8**. The press beam **5** must be evaluated on the basis of the complementary effect. Instead of using this method based on the load situations stored in the data memory **36** and the deformation values derived from them, it would naturally also be possible in another embodiment to determine the deformation values by a computer operation run in the computer **35** by applying the detected displacement forces—indicated by arrows **44**, **45**- and the machine data by detecting the displacement forces directly.

[0039] The press beams **5**, **8** are equipped with the adjustable compensating devices **54** and constitute the support surfaces **18**, **19** for the tool holders **20**. Compensating devices **54** of this type may be displaceable devices which can be set manually or by means of drives in order to obtain the complementary camber **52** of the support surfaces **18**, **19** for the tool holders **20**.

[0040] In the embodiment illustrated as an example, the bending tools **21**, **22** are disposed in a position off-centre with respect to the mid-plane **27**. A resultant force—indicated by arrow **55**—based on a load to be applied across a distance in order to bend the workpiece **24** corresponding to the bending length **50** is offset from the mid-plane **27** by a distance **56** in the direction of one of the drive means **9**, **10** in this example.

[0041] In order to determine the displacement forces needed to produce the bending required in the workpiece **24**—indicated by arrow **44**, **45**—an operation is run by activating the drive means **9**, **10** during which a lowering depth of the tools **21**, **22**—which will be described in detail below—is selected so that it is shorter than that needed to produce the ultimate specified bending angle on the workpiece **24** by controlling the displacement path of the displaceable press beam **8**.

[0042] This operation is used to determine the actual displacement forces—indicated by arrows **44**, **45**. The displacement forces which are applied in the axial positions **16**, **17** are determined on the basis of the medium pressure and the pressure surface of the hydraulic cylinders **12** measured by the pressure sensors **33**. From the sum of the different displacement forces—indicated by arrows **44**, **45**—the resultant total force—indicated by arrow **55**—needed to bend the workpiece **24** is calculated and the set of torques is used to determine the position "X" for an active line **57** of the resultant total force—indicated by arrow **55**—extending parallel with the displacement forces—indicated by arrows **44**, **45**. Accordingly, the position of the tools **21**, **22** is determined with the distances **58**, **59** measured perpendicular to the displacement forces—indicated by arrows **44**, **45**- and the resultant bending force—indicated by arrow **53**—as may be seen from the detail illustrated in FIG. **3**.

[0043] The position of the bending tools **20**, **21** and the resultant total force—indicated by arrow **55**—and bending length **50** define the specific load situation.

[0044] In order to compensate for the deviation from the neutral line **53** which occurs under load due to bending in this specific load situation, a load situation that is approximately the same is selected from a number of load situations stored in the data matrix in the data memory **36**.

[0045] The load situations and the resultant degrees of deformation are set for different displacement forces—indicated by arrows **44**, **45**- and predefined machine data, for example support length **60** between the axial positions **16**, **17** as well as the dimension data of the table beam **5**, press beam **8**, side walls **3**,**4** and the material-related strength values, using model computations, and these are stored in a data matrix in the data memory **36**.

[0046] Corresponding to each of these load situations is a characteristic value, e.g. K**1** to K**10**, representing ten stored load situations, for example, which are used as predefined setting values for the compensating device **54**.

[0047] Once a test bending operation has been undertaken on the workpiece **4** and the resultant displacement forces—indicated by arrows **44**, **45**—determined, a characteristic value K**1** to K**10** is displayed directly on the control and/or regulating unit **34** which is then used as the setting for the compensating device **54**.

[0048] It is of advantage to use displacement drives **61** which can be activated by machine, for example by means of the control and regulating unit **34**, to displace the compensating device **54** in steps on the basis of the characteristic values K1 to K**10**, for example.

[0049] Instead of using the deformation data stored in the data memory for a specific number of load situations relating to the bending deformation of the table beam **5**, press beam **8** and/or flexing of the side walls **3**,**4**, it would naturally also be possible to determine this data on the basis of computing operations run in real time using a computer programme stored in the computer **35** directly from the detected displacement forces—indicated by arrows **44**, **45**- and by applying the fixed machine data, and then applying to the result a characteristic value associated with the load situation, thereby generating setting data for the compensating device **54** in order to set a complementary camber at the support surface **18**, **19**.

[0050] FIG. **4** is a schematic diagram illustrating the bending and setting process run in order to achieve high-quality bending of a panel **25**, which will be described with reference to this drawing. The operation of bending the panel **25** to achieve a predefined bending angle **65** is broken down into a pre-bending operation and actual bending operation. In the drawing, the broken lines represent the pre-bending operation and the solid lines represent the actual bending situation of the panel **25**.

[0051] The drawing illustrates the stationary press beam **5** and the compensating device **54** forming the support surface **19** to which the tool holder **20** with the bending tool **22** is attached. Lying opposite this arrangement is the displaceable press beam **8**, likewise with the compensating device **54** and the tool holder **20** and bending tool **21**. In the example of the hydraulic cylinders **12** illustrated here, the drive means **9** has a cylinder chamber split by a piston **68** into a pressure chamber **66** and an annular chamber **67**. Pressurising medium is supplied from the hydraulic system via the hydraulic control unit **30** and connecting lines **31**. Connected upstream of the pressure chamber **66** is a pressure sensor **69** serving as the detection means **32** for a displacement force during the bending operation.

[0052] As mentioned above, the bending operation is broken down into two stages, although another option is to select a single-stage bending operation.

[0053] During a pre-bending operation, the press beam **8** is displaced to a bending depth **70** of the bending tools **21**, **22** at which a bending angle **71** is slightly bigger than or identical to the predefined bending angle **65**. On this basis, the displacement force and hence the load situation and deformation values as well as the derived correction values for setting the compensating device **54** are determined, as described above.

[0054] Once this operation is complete, the pressure is released on a controlled basis until the pressure in the pressure chamber **66** of the hydraulic cylinder **12** has been more or less completely released. In the annular chamber **67**, it is preferable to maintain a pressure level resulting from the natural weight of the press beam **8**, thereby avoiding applying additional load to the panel due to the natural weight of the press beam **8**.

[0055] As a result, the no-load state of the press beam **5**, **8** but also the compensating device **54** is achieved and the compensating device **54** can be displaced in order to produce the requisite complementary camber of the support surfaces **18**, **19** essentially without any force-induced resistance, e.g. due to high friction values at the actuator of the compensating device.

[0056] Once the compensating device **54** has been set accordingly, the pressure chamber **66** is activated with pressurising medium and the press beam **8** is then displaced in order to run the actual bending operation. On a distance-controlled basis, a bending angle **72** of the bending tools **21**, **22** in the end position is reached which is bigger than the bending depth **70** and which is necessary, taking account of the rebound behaviour of a material, to achieve the predefined bending angle **65** on the panel **25**. It is of the highest accuracy across a total bending length, due to the measures undertaken to define and produce the complementary camber.

[0057] Finally, it should be pointed out that in the case of mass production, the described measures involved in setting up the compensating device **54** are run only at the beginning of each production cycle, in other words using the first workpiece, and the rest of the production cycle can be run on the basis of the existing settings and the described measures.

[0058] If, on the other hand, a high production quality is necessary or there are likely to be load fluctuations because of the material due to differences in the thickness of the panels **25**, it is naturally also possible to operate the two-stage bending operation for each workpiece in a series of workpieces.

[0059] The embodiments illustrated as examples are possible embodiments of the edge bending press and it should be pointed out that this stage that the invention is not restricted to the embodiments specifically illustrated, and instead the individual design variants may be used in different combinations with one another and these possible variations lie within the reach of the person skilled in this technical field given the disclosed technical teaching. Accordingly, all conceivable design variants which can be obtained by combining individual details of the design variants described and illustrated are possible and fall within the scope of the invention. In particular, the drive system is not restricted to an operating system based on a pressurising medium. It would also be conceivable to use electromechanical drives, for example spindle drives driven by electric motors at which the displacement forces—indicated by arrows **44**, **45**—are measured or by means of which the output power of the motors is determined. Details of the characteristic values K1 to K**10** for setting up the compensating device **54** should also be construed as an example and if necessary, it would also be conceivable to operate on the basis of a stepless control.

[0060] For the sake of good order, finally, it should be pointed out that, in order to provide a clearer understanding of the structure of the edge bending press, it and its constituent parts are illustrated to a certain extent out of scale and/or on an enlarged scale and/or on a reduced scale.

[0061] The objectives underlying the independent inventive solutions may be found in the description.

LIST OF REFERENCE NUMBERS

[0062]

1	Edge bending press
2	Machine frame
3	Side wall
4	Side wall
5	Press beam
6	Transverse connection
7	Guide arrangement
8	Press beam
9	Drive means
10	Drive means
11	Drive system
12	Hydraulic cylinder
13	Hydraulic system
14	End region
15	Piston rod
16	Axial position
17	Axial position
18	Support surface
19	Support surface
20	Tool holder
21	Bending tool
22	Bending tool
23	Length
24	Workpiece
25	Panel
26	Standing surface
27	Mid-plane
28	Container
29	Pump unit
30	Control unit
31	Connecting line
32	Detection means
33	Pressure sensor
34	Control and/or regulating unit
35	Computer
36	Data memory
37	Switching and control elements
38	Power source
39	Mains network
40	Cable
41	Cable
42	Distance measuring device
43	Linear measuring bar
44	Arrow
45	Arrow
46	Strain gauge sensor
50	Bending length
51	Bending line
52	Complementary camber
53	Neutral line
54	Compensating device
55	Arrow
56	Distance
57	Active line
58	Distance
59	Distance
60	Support length
61	Displacement drive
65	Bending angle
66	Pressure chamber
67	Annular chamber
68	Piston
69	Pressure sensor
70	Bending depth
71	Bending angle
72	Bending angle

1. Method of producing a workpiece by bending a panel in a bending press, with a machine frame comprising two side walls spaced at a distance apart from one another and connected to a table beam equipped with a first bending tool and a press beam equipped with another bending tool which can be displaced in guides relative to the table beam, and having drive means of a drive system for the press beam and a control and/or regulating unit with a computer and data memory, and detection means hardwired to the control and/or regulating unit, and a compensating device for creating a complementary camber in oppositely lying support surfaces of the table and press beams for the bending tools or tool holders to counter a bending deformation of the table and press beams which occurs under load due to displacement forces of the drive means, wherein once the panel has been positioned between the mutually spaced first and second bending tools, the bending tools are positioned by displacing the press beam at a bending depth slightly shorter than a bending depth needed to produce a predefined bending angle and to this end the displacement force of each drive means is derived from a measurement value of the detection means in the computer, after which the bending deformation of the table and press beams, corresponding to the displacement forces is determined as a function of machine data stored in the computer or from data stored in the data memory and the displacement force of the drive means is reduced, after which the complementary camber of the support surfaces is set by displacing the compensating device and then the panel is actually bent by displacing the press beam by the bending depth corresponding to the predefined bending angle.

2. Method as claimed in claim 1, wherein the bending deformation of the table beam and/or the press beam is derived from the detected displacement forces and the production data for bending the panel and the machine data.

3. Method as claimed in claim 1, wherein the displacement forces for each drive means are determined whilst the panel is being bent on the basis of the pressure level in a pressurising medium applied to the drive means.

4. Method as claimed in claim 1, wherein the displacement forces for each drive means are determined whilst the panel is being bent on the basis of the output power of a drive of the drive means.

5. Method as claimed in claim 1, wherein a position of the bending tools by reference to a length of the table beam and/or the press beams is determined on the basis of the displacement force of each drive means.

6. Method as claimed in claim 1, wherein the bending deformation of at least one of the table beam and press beam and/or the flexing of the side walls is stored in a data matrix in the data memory for a predefined number of load situations.

7. Method as claimed in claim 6, wherein once the displacement forces have been determined on the basis of a stored load situation approximately corresponding to the current one, associated setting values for the compensating device are retrieved and the compensating device is adjusted in accordance with the setting values.

8. Method as claimed in claim 1, wherein a characteristic value in the data matrix is assigned to each load situation for setting up the compensating device.

9. Method as claimed in claim 8, wherein the characteristic value is displayed at the control and/or regulating unit.

10. Method as claimed in claim 8, wherein a specific setting is assigned to the characteristic value at the compensating device.

11. Method as claimed in claim 1, wherein the bending deformation of at least one of the table beam and press beam

is derived by a computing operation of the computer from the detected displacement forces of the drive means as well as the position of the bending tools and the bending length and the machine data.

12. Method as claimed in claim 1, wherein a characteristic value is assigned to respective predefined ranges of the bending deformation.

13. Method as claimed in claim 12, wherein control signals are generated from the characteristic value in the control and regulating unit, and displacement drives of the compensating device are activated in order to set up the compensating device on the basis of the characteristic values.

14. Method as claimed in claim 12, wherein the compensating device is set in stages predefined by the characteristic values.

15. Method as claimed in claim 1, wherein the compensating device is set steplessly.

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