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(54) **PANEL BENDER FOR BENDING SHEET METAL**

PLATTENBIEGEVORRICHTUNG ZUM BIEGEN VON BLECH

CINTREUSE DE PANNEAUX POUR LE PLIAGE DE TÔLES

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Description

[0001] The invention relates to a panel bender for bending sheet metal. In particular, the invention relates to a panel bender for bending sheet metal according to claim 1.

[0002] With panel benders, the bending beam is moved using a wide variety of complicated mechanisms. The bending beam must be movable in the vertical and horizontal direction and generate the required force. The vertical, long-stroke movement is usually carried out using cylinders or screw drives. The horizontal direction requires a relatively short stroke with great force for application and is implemented using various transmissions, such as wedge systems, eccentrics or superimposed rotary connections. Such implementations are difficult to scale.

[0003] The technology of panel bending requires a superposition of vertical and horizontal movement, or an overdetermination of the construction and the movement of the bending beam. The accuracy requirements and the construction of the machine are therefore disproportionately high, very expensive and require a high level of control engineering effort.

[0004] Bending reaction forces that occur, especially in the horizontal direction, cannot be prevented or compensated, or only with great difficulty, by means of control technology due to the structural drive structure. As a result, material deformations on the bending beam have a negative impact on the bending result.

[0005] AT 372883 B discloses a device for folding a sheet metal panel, wherein the drive of the bending tool acts approximately parallel to the clamping plane being supported on the carrier of the holding punch serving as a counter tool.

[0006] Document EP 2 691 190 A1 discloses a panel bender having a C-shaped blade holder structure. The blade holder structure is slidably arranged on upper and lower wedge-shaped slides which can be moved along vertical guides by associated actuators.

[0007] The object of the invention is to avoid the disadvantages of the prior art and to provide an improved panel bender.

[0008] This object is achieved by a panel bender for bending sheet metal according to claim 1.

[0009] The panel bender according to the invention for bending sheet metal by means of at least one bending tool arranged on a bending beam, the bending beam extending along a direction, comprises

a machine body,
at least two guide receptacles, which run in a first direction on the machine body, wherein the first direction is perpendicular to the direction along which the bending beam extends, at least two drive guide units, which are movably arranged in the at least one guide receptacle, and
wherein the bending beam is movably arranged in the drive guide units in a second direction running perpendicular to the first direction and perpendicular to the direction along which the bending beam extends.

[0010] In the panel bender according to the invention, at least one second drive is arranged in each drive guide unit, wherein the at least one second drive engages the bending beam to move the same in the second direction. Suitable guides on the second drives of the vertical adjustment enable the angle of the bending beam to be adjusted. To implement the horizontal movement, small short-stroke cylinders (also electromechanical or similar) can be embedded in the drive guide unit. These units are connected horizontally to the bending beam and allow both an almost flat introduction of force and a particularly advantageous use of the rigidity of the unit. Any deformations that occur can be minimised by using the available space inside the machine body with the appropriate use of material. The entire construction optimises the resulting stresses through reaction forces. The short-stroke cylinders do not affect the vertical movement/guidance in any way and allow the technologically required circular movement of the bending beam to be implemented on the control side.

[0011] The panel bender according to the invention or the swivel bending machine has the advantage that vertical and horizontal movements are mechanically separated and overlapping is excluded. Both the vertical and the horizontal guidance of the bending beam is close to the force flow due to the structure described and enables the machine to be designed in accordance with the rigidity. The entire construction optimises the resulting stresses through reaction forces. Furthermore, a significantly simplified and also more precise production of the machine body is possible; only the front side is machined after clamping.

[0012] The invention simplifies the entire structure of a panel bender since additional drives and guides are saved and there are still possibilities for adjustment and dynamic control. Installation and service times are significantly reduced in comparison, and simple interchangeability is guaranteed in terms of design.

[0013] Scaling the machines is significantly simplified according to the invention. If more bending force is required, for example with longer machine lengths or when bending thicker sheets, the number of drives, for example in the form of short-stroke cylinders, can be increased.

[0014] According to the invention, a two-fold increase in accuracy can be achieved. On the one hand, increased accuracy is already achieved in the manufacture of the machine body since no re-clamping or retooling is required since only a front side of the machine body has to be processed. On the other hand, by decoupling the two movements or axes of movement, increased accuracy is achieved during operation of the panel bender.

[0015] It can be provided that the first direction runs vertically and that the second direction runs horizontally.

This arrangement allows an advantageous introduction and absorption of forces and torques.

[0016] It can be provided that the drive guide unit has a substantially C-shaped base body, wherein an inner contour of the drive guide unit at least partially corresponds to an outer contour of the bending beam. In this way, the bending beam can be fitted precisely into the drive guide unit, also in a form-fitting or force-fitting manner.

[0017] It can also be provided that an infeed element is provided as a support bearing for the bending beam in the drive guide unit, wherein the infeed element can be attached to one end of a lower leg of the C-shaped base body. In the upper area (also possible in the lower area), the drive guide unit can be attached in a floating manner. In the lower area of the drive guide unit or the guide unit, a further support bearing such as an infeed element can be attached, which optimally dissipates moments when bending sheet metal. This guide can advantageously be advanced by means of a wedge adjustment and reached from the front.

[0018] It can be provided that at least one first drive is provided on the machine body, wherein the at least one first drive engages at least one drive guide unit to move the same. The bending beam can be suspended from two or more optimally rigid drive guide units. The guide can be in the horizontal direction directly below and exactly in the power flow of this receptacle. The vertical bending beam guide of the now technically separate movements can be attached directly to the machine body with sliding or rolling element guides (or similar). The drive guide unit with the embedded bending beam is guided directly. The simultaneous entrainment of the bending beam and the horizontally applied bending force in the vertical direction is also advantageous. The control effort is significantly reduced if the same parameters can be used for the horizontal movement-regardless of the vertical position.

[0019] It can further be provided that the second drives can be operated independently of one another.

[0020] It can be provided that the at least one second drive is arranged along the first direction in an axis of the at least one first drive. The second drive can thus be located directly above or below the first drive, for example as an extension of a movement axis of the first drive. As a result of this measure, the two drives are decoupled from one another in terms of force so that both axes of movement are independent of one another.

[0021] It can be provided that multiple second drives are arranged along the first direction. In this way, the bending beam can be tilted.

[0022] It can further be provided that multiple drive guide units are arranged along the direction along which the bending beam extends and that the bending beam is arranged in the several drive guide units. The bending beam can be positioned horizontally or tilted.

[0023] It can be provided that a first drive is assigned to each of the multiple drive guide units. This enables a more precise control and a more uniform introduction of force.

[0024] It can further be provided that an extension of the bending beam in the direction of the second direction is smaller than an extension of the bending beam in the direction of the first direction. In this way, the bending line is arranged close to the introduction of force so that torques can be better absorbed. In addition, warpage is reduced when heated.

[0025] It can be provided that a controller is provided for controlling the at least one first drive and the at least one second drive and in that the controller is arranged to align the at least one bending tool arranged on the bending beam in the first and second directions along a bending line. This can be a parallel orientation. A rotary movement of the bending beam can be achieved by individual activation of the drives, which allows bends that were previously impossible to carry out.

[0026] A machine body structure of this type enables, among other things, a horizontal adjustment of the parallelism of the entire bending beam to the bending line. For this purpose, the drives are operated, for example in the form of a short-stroke cylinder per unit, in parallel and independently of one another on the outside of the machine. Deviations in parallelism can thus be compensated for and avoided in a position-controlled manner, for example with measuring systems and corresponding controls. For example, one side can be positioned a little further forward than the other side. The same principle applies to the vertical parallelism setting, here the suspension of the bending beam on two or more externally attached and separately controllable drives such as cylinders enables parallelism to be set in the event of deviations.

[0027] Further preferred embodiments of the invention will become apparent from the remaining features mentioned in the dependent claims.

[0028] The various embodiments of the invention mentioned in this application can, unless otherwise stated in individual cases, be advantageously combined with one another.

[0029] The invention will be explained below in exemplary embodiments with reference to the accompanying drawings. In the figures:

Figure 1	shows a perspective view of a panel bender;
Figure 2	shows a perspective view of a machine body with a guide frame;
Figure 3	shows a perspective partial sectional representation of the panel bender with a bending beam; and
Figure 4	shows a schematic view of a panel bender with a crowning unit.

[0030] Figure 1 shows a perspective view of a panel bender 10 with a machine body 12 which can be attached to a floor by means of feet 14.

[0031] The machine body 12 extends in a first direction z, which runs vertically, a second direction y, which runs horizontally, and a third direction x, which runs horizontally and perpendicular to the other two directions z and y. A bending line, along which sheet metal parts are bent by the panel bender 10, runs in the x direction.

[0032] Bending is carried out by means of a bending beam 16, which is mounted on the machine body 12 so as to be movable in the z and y directions. For this purpose, the bending beam 16 is supported here on at least two drive guide units 18, which can be moved in the z direction on the machine body 12 and are each driven by a first drive 20. The drive guide units 18, of which more than two can be provided, are arranged along the x direction. The bending beam 16 is movably supported in the drive guide units 18, specifically in the y direction.

[0033] The two movement axes in the z and y directions are technically separate movements and thus decoupled from one another, which simplifies both the construction and the control and also increases the accuracy.

[0034] A hold-down device for a workpiece is movably held on a front side of the machine body and can be moved in the z direction on the machine body by two drives. For the sake of clarity, the hold-down device is not shown here.

[0035] Figure 2 shows a perspective view of the machine body 12 with a front side 22 which lies in the x-z plane. In the front side 22, three guide receptacles 24 are provided here, which extend in the z direction. The guide receptacles 24 are recesses in the machine body 12 and here have guide means 26 which are attached to the front side 22 of the machine body 12. The guide means 26 can be designed as slide rails, for example.

[0036] In each of the guide receptacles 24 there is a drive guide unit 18 which is driven by a first drive 20. The drive guide unit 18 has a substantially C-shaped base body 28 with an upper leg 30 and a base part 32. Only the two outermost drive guide units 18 are driven while the one or more inner drive guide units, i.e., arranged between the two outermost drive guide units 18, are not driven. Alternatively, it is possible that the inner drive guide units are also driven.

[0037] For this purpose, a piston or cylinder of the first drive 20 engages an upper leg 30 of the drive guide unit 18. The guide means 26 can secure the drive guide unit 18 in the recess of the guide receptacles 24 against removal. On the upper leg 30, further guide means 34, for example in the form of slide rails, are provided, which interact with the guide means 26.

[0038] In the base part 32, three second drives 36 in the form of short-stroke cylinders are arranged here. The three second drives 36 are arranged along the z direction and can be arranged in an axis or an extension of the axis of the first drive 20. The second drives 36 exert an actuating force in the y direction. The second drives 36 engage the bending beam in order to move the same and allow an almost flat introduction of force.

[0039] Scaling the machines is significantly simplified according to the invention. If more bending force is required, for example in the case of larger machine lengths or the bending of thicker sheets, the number of second drives 36 or the short-stroke cylinders can be increased. Each of the three short-stroke cylinders shown here can be referred to as a second drive 36. Alternatively, the three short-stroke cylinders shown here can be referred to collectively as a second drive 36.

[0040] The first drive(s) 20 move the drive guide units 18 in the vertical direction z. The second drives 36 are thus moved along with the drive guide units 18. The second drives 36 can be moved independently and decoupled from the first drives 20.

[0041] Figure 3 shows a perspective partial sectional representation of the panel bender 10 with a bending beam 16. The bending beam 16 is received and held in the drive guide units 18. The substantially C-shaped base body 28 of the drive guide unit 18 has an inner contour which at least partially corresponds to an outer contour of the bending beam 16. For example, the bending beam 16 rests against the upper leg 30 of the base body 28 or the drive guide unit 18. Furthermore, a back or rear side 33 of the bending beam 16 runs parallel to the base part 32 in which the second drives 36 are received in recesses. Finally, an underside of the bending beam 16 runs parallel to a lower leg 38 of the drive guide unit 18.

[0042] The upper leg 30 and the lower leg 38 extend from the base part 32. A receiving space for the bending beam 16 is formed between the two legs 30, 38.

[0043] An infeed element 40 is provided as a support bearing for the bending beam 16 in the drive guide unit 18, wherein the infeed element 40 is attached to one end of the lower leg 38 of the C-shaped base body 28. The infeed element 40 optimally dissipates torques when bending sheet metal, in particular with negative bending. The infeed element 40 can easily be reached from the front and fastened, for example, by means of a screw connection.

[0044] An extension of the bending beam 16 in the direction of the second direction is smaller here than an extension of the bending beam 16 in the direction of the first direction. In this way, torques can be reduced by the second direction.

[0045] A plurality of drive guide units 18 can be arranged along the third direction, wherein the bending beam 16 is arranged in the multiple drive guide units 18. Station operation can be enabled between two drive guide units 18, so that, for example, multiple work steps can be carried out along the bending line or in the third direction.

[0046] A controller 42 of the panel bender 10 is used to control the at least one first drive 20 and the at least one second drive 36 and is only shown schematically here. The controller 42 is connected to the drives 20, 36 and possibly sensors and further controllers.

[0047] The controller 42 is configured to align a bending tool 44 arranged on the bending beam 16 in the first and second directions along a bending line. Sensors for measuring a deformation of the bending beam during a bending process can provide measured values. Based on the measured values, manipulated variables for the first and/or the second drive to compensate for the deformation can be derived. The controller 42 can then control the drive(s) in accordance with the manipulated variables.

[0048] Due to the decoupling of the drives, the manipulated variables for the first drive 20 and the second drive 36 are also independent of one another.

[0049] The simple and modular construction allows a simple production and a simple construction of the panel bender 10. Thus, the machine body 12 only has to be clamped once, since it only has to be machined from the front. The assembly of the drive guide units 18, the bending beam 16 and the first drives 20 is only necessary from the front. The components can easily be scaled for larger or smaller variants of the panel bender 10 or larger or smaller forces, so that a modular system is possible. This is made possible by the decoupling of the two axes of movement, i.e., of the at least one first drive 20 and the at least one second drive 36.

[0050] The panel bender presented here enables the two movement axes in the z and y directions to be technically separate movements and thus decoupled from each other, which simplifies both the construction and the control and also increases the accuracy.

[0051] Another exemplary embodiment of a panel bender with optimised crowning is described below. Both exemplary embodiments or embodiments of the invention can be combined with one another.

[0052] With panel benders, the bending beam is moved using a wide variety of complicated mechanisms. The bending beam must be movable in the vertical and horizontal direction and generate the required force. Bending reaction forces that occur, especially in the horizontal direction, cannot be prevented or compensated, or only with great difficulty, by means of control technology due to the structural drive structure. As a result, material deformations on the bending beam have a negative impact on the bending result.

[0053] The object of the invention is now to avoid the disadvantages of the prior art and to provide an improved panel bender or an improved method for crowning a bending beam.

[0054] This object is achieved by a panel bender or a method for crowning a bending beam.

[0055] The panel bender according to the invention with dynamic crowning for bending sheet metal by means of at least one bending tool arranged on a bending beam, wherein the bending beam extends along one direction, comprises a machine body,

at least two guide receptacles, which run in a vertical direction on the machine body,
at least two drive guide units, which are movably arranged in the at least two guide receptacles by at least one first drive,
a bending beam which is movably arranged in a horizontal direction in the at least two drive guide units, wherein a second drive for the bending beam is arranged in each drive guide unit,
wherein the second drive has at least two drive elements arranged in a vertical direction, at least one sensor for measuring a deformation of the bending beam during a bending process,
a controller for determining manipulated variables based on measured values of the at least one sensor for the first and/or the second drive to compensate for the deformation.

[0056] At least the second drives, optionally also the drive guide units, can form a crowning unit to compensate for a deformation of the bending beam. The crowning unit is connected to the bending beam in the vertical direction and thus moves with it. Positive and negative bends are thus crowned in the same way and allow a simplified control.

[0057] The design allows the two axes of movement, i.e., of the at least one first drive and the second drives, to be decoupled. The second drives compensate for the deformation, i.e., the crowning. In addition, the second drives take over the infeed of the bending beam in the horizontal direction. The crowning component can be superimposed on the infeed component of the second drive. The crowning component is completely independent of the at least one first drive.

[0058] In order to avoid or compensate for deformations of the bending beam caused by horizontally occurring forces, at least one second drive, optionally floating in this direction, is connected to the bending beam. Force generation and position control of the horizontal direction of movement of the bending beam can be implemented via externally connected crowning units and guided accordingly. A centrally connected crowning unit can act in addition to the positioning described and can generate additional bending force under pressure, but also position-controlled. This minimises the general deformation of the bending beam due to the reduced support width and reaction-related deviations in the horizontal direction are reduced. The introduction of a higher force corresponding to the deformation in the middle of the bending beam even compensates for the deviations and allows an optimal bending result.

[0059] The use of such a device further improves the overall machine frame construction since a flat introduction of force is made possible and comparatively wide sheets can be processed in accordance with the force. This unit can be driven hydraulically, electromechanically or similarly.

[0060] It can be provided that the second drive has three to five drive elements arranged in a vertical direction. This enables an almost flat introduction of force and can also increase the spatial resolution of the crown.

[0061] It can be provided that the at least one sensor measures path, position, force and/or pressure. By separating or decoupling the two axes of movement, i.e., of the at least one first drive and the second drives, the measurement and evaluation of the deformation can be easily implemented.

[0062] It can be provided that at least four drive guide units are arranged along a bending line of the panel bender which runs perpendicular to the vertical direction and the horizontal direction. The use of multiple drive guide units or crowning units, distributed over the width of the machine, enables station operation on the panel bender. The resulting bending forces are then introduced at the respective station.

[0063] It can be provided that the drive elements are short-stroke cylinders and are subjected to the same pressure. This variant allows simple control or regulation.

[0064] It can be provided that the drive elements are short-stroke cylinders and are subjected to different pressures. This variant allows the bending beam to be inclined and a comprehensive crowning of the rear of the bending beam and thus the bending beam itself.

[0065] The method according to the invention for crowning a bending beam of a panel bender according to one of the preceding claims comprises the steps:

- Measuring a deformation of the bending beam during a bending process by means of at least one sensor;
- Determining a manipulated variable for the first and the second drive; and
- Separately controlling the first and the second drive.

[0066] The same advantages and modifications apply as described above.

[0067] It can be provided that the bending beam is moved in the horizontal direction by moving at least two external drive guide units. Inner drive guide units arranged between the two outer drive guide units can be used for crowning, as can the two outer drive guide units.

[0068] Figure 4 shows a schematic view of a panel bender 10 with a crowning. The structure of the panel bender 10 shown in Figure 4 corresponds to the panel bender 10 shown in Figures 1 and 2. To avoid repetition, not all details of Figures 1 and 2 are described in the following description of Figure 4; reference is made to these two figures.

[0069] The machine body 12 of the panel bender 10 extends in a first direction z, which runs vertically, a second direction y, which runs horizontally, and a third direction x, which runs horizontally and perpendicular to the other two directions z and y. A bending line, along which sheet metal parts are bent by the panel bender 10, runs in the x direction.

[0070] Bending is carried out by means of a bending beam 16, which is mounted on the machine body 12 so as to be movable in the z and y directions. For this purpose, the bending beam 16 is supported here on at least two drive guide units 18, which can be moved in the z direction on the machine body 12 and are each driven by a first drive 20. The drive guide units 18, of which more than two can be provided, are arranged along the x direction. The bending beam 16 is movably supported in the drive guide units 18, specifically in the y direction.

[0071] The two movement axes in the z and y directions are technically separate movements and thus decoupled from one another, which simplifies both the construction and the control and also increases the accuracy.

[0072] A second drive 36 with three drive elements 46, for example in the form of short-stroke cylinders, is arranged in the drive guide unit 18. The three drive elements 46 are arranged along the z direction and can be arranged in an axis or an extension of the axis of the first drive 20. The second drive 36 exerts an actuating force in the y direction. The drive elements 46 engage the bending beam in order to move the same and allow an almost flat introduction of force.

[0073] Scaling the machines is significantly simplified according to the invention. If more bending force is required, for example in the case of larger machine lengths or the bending of thicker sheets, the number of second drives 36 or the short-stroke cylinders can be increased. Each of the three short-stroke cylinders shown here can be referred to as a second drive 36. Alternatively, the three short-stroke cylinders shown here can be referred to collectively as a second drive 36.

[0074] The first drive(s) 20 move the drive guide units 18 in the vertical direction z. The second drives 36 are thus moved along with the drive guide units 18. The second drives 36 can be moved independently and decoupled from the first drives 20.

[0075] The bending beam 16 is received and held in the drive guide units 18. An extension of the bending beam 16 in the direction of the y direction is smaller here than an extension of the bending beam 16 in the direction of the z direction. In this way, torques can be reduced by the x direction.

[0076] Multiple drive guide units 18 are arranged along the x direction, wherein the bending beam 16 is arranged in the multiple drive guide units 18. Station operation can be enabled between two drive guide units 18, so that, for example, multiple work steps can be carried out along the bending line or in the x direction.

[0077] At least one second drive 36, optionally also the associated drive guide unit 18, can form a crowning unit 48 to compensate for a deformation of the bending beam 16. The crowning unit 48 is connected to the bending beam 16 in the vertical y direction and thus moves with it. Positive and negative bends are thus crowned in the same way and allow a simplified control.

[0078] A controller 42 of the panel bender 10 is used to control the at least one first drive 20 and the at least one second drive 36 and is only shown schematically here. The controller 42 is connected to the drives 20, 36, at least one sensor 46 and, if necessary, further controllers.

[0079] The controller 42 is configured to align a bending tool 44 arranged on the bending beam 16 in the first and second directions along a bending line. Sensors 46 for measuring a deformation of the bending beam 16 during a bending process can provide measured values. Based on the measured values, manipulated variables for the first and/or the second drive 20, 36 to compensate for the deformation can be derived. The controller 42 can then control the drive(s) 20, 36 in accordance with the manipulated variables. The crowning takes place here by compensating for the deformation of the bending beam 16 during a bending process.

[0080] The drive or the control for the crowning can be superimposed on a drive or a control for the movement of the bending beam 16.

[0081] Depending on the measured values or the manipulated variables, the drive elements 46 of a second drive 36 can be controlled in parallel or differently. If the drive elements 46 are, for example, short-stroke cylinders, the same or different pressures can be applied to them.

[0082] The method for crowning a bending beam of a panel bender can run in the controller 42.

[0083] First, a deformation of the bending beam 16 is measured during a bending process by means of at least one sensor 50. Deformations in all directions, preferably the y direction, can be recorded.

[0084] A manipulated variable for the first and the second drive 20, 36 is then determined. Here, separate manipulated variables can be determined for the second drive 36 for each drive element 46 of the second drive 36. Alternatively, a single manipulated variable can be determined for a second drive 36. It is possible, for example, that a single manipulated variable is determined for a second drive 36 for a movement of the bending beam 16 and that separate manipulated variables are determined for each drive element 46 of the second drive 36 for crowning.

[0085] Finally, the first and second drives are controlled separately. This separate activation can take place at the same time; the separation of activation relates to the functionality. Thus, a crowning only requires the control of the drive elements 46 or the second drives 36.

[0086] The crowning or the crowning unit presented here is connected to the bending beam in the vertical direction and moves with the bending beam. Positive and negative bends are thus crowned in the same way and allow a simplified control.

Claims

1. A panel bender (10) for bending sheet metal by means of at least one bending tool (44) arranged on a bending beam (16), wherein the bending beam (16) extends along a direction (x),

    having a machine body (12),
    having at least two guide receptacles (24) which run in a first direction (z) on the machine body (12), wherein the first direction (z) is perpendicular to the direction (x) along which the bending beam (16) extends,
    having at least two drive guide units (18) which are movably arranged in the at least two guide receptacles (24), and
    wherein the bending beam (16) is movably arranged in the drive guide units (18) in a second direction (y) running perpendicular to the first direction (z) and perpendicular to the direction (x) along which the bending beam (16) extends,
    characterized in that
    at least one second drive (36) is arranged in each drive guide unit (18), wherein the at least one second drive (36) engages the bending beam (16) to move the same in the second direction (y).

2. The panel bender (10) according to claim 1, **characterised in that** the first direction (z) runs vertically and that the second direction (y) runs horizontally.

3. The panel bender (10) according to any one of the preceding claims, **characterised in that** the drive guide unit (18) has a substantially C-shaped base body (28), wherein an inner contour of the drive guide unit (18) at least partially corresponds to an outer contour of the bending beam (16).

4. The panel bender (10) according to claim 3, **characterised in that** an infeed element (40) is provided as a support bearing for the bending beam (16) in the drive guide unit (18), wherein the infeed element (40) can be fastened at one end of a lower leg (38) of the C-shaped base body (28).

5. The panel bender (10) according to any one of the preceding claims, **characterised in that** at least one first drive (20, 36) is provided on the machine body (12), wherein the at least one first drive (20) engages at least one drive guide unit (18) to move the same.

6. The panel bender (10) according to any one of the preceding claims, **characterised in that** the second drives (36) can be operated independently of one another.

7. The panel bender (10) according to claim 5 and 6, **characterised in that** the at least one second drive (36) is arranged along the first direction (z) in an axis of the at least one first drive (20).

8. The panel bender (10) according to claim 6 or 7, **characterised in that** multiple second drives (36) are arranged along the first direction (z).

9. The panel bender (10) according to one of the pre-

ceding claims, **characterised in that** multiple drive guide units (18) are arranged along the direction (x) along which the bending beam extends and that the bending beam (16) is arranged in the multiple drive guide units (18).

10. The panel bender (10) according to claim 9, **characterised in that** a first drive (20) is assigned to each of the multiple drive guide units (18).

11. The panel bender (10) according to one of the preceding claims, **characterised in that** an extension of the bending beam (16) in the direction of the second direction (y) is smaller than an extension of the bending beam (16) in the direction of the first direction (z).

12. The panel bender (10) according to claim 5, **characterised in that** a controller (42) is provided for controlling the at least one first drive (20) and the at least one second drive (36) and **in that** the controller (42) is arranged to align the at least one bending tool (44) arranged on the bending beam (16) in the first (z) and second (y) directions along a bending line.

Patentansprüche

1. Panelbender (10) zum Biegen von Blech mittels mindestens eines an einer Biegewange (16) angeordneten Biegewerkzeugs (44), wobei sich die Biegewange (16) entlang einer Richtung (x) erstreckt,

aufweisend einen Maschinenkörper (12),
aufweisend mindestens zwei Führungsaufnahmen (24), die in einer ersten Richtung (z) an dem Maschinenkörper (12) verlaufen, wobei die erste Richtung (z) senkrecht zu der Richtung (x) verläuft, entlang derer sich die Biegewange (16) erstreckt,
aufweisend mindestens zwei Antriebsführungseinheiten (18), die in den mindestens zwei Führungsaufnahmen (24) beweglich angeordnet sind, und
wobei die Biegewange (16) in den Antriebsführungseinheiten (18) in einer zweiten Richtung (y) beweglich angeordnet ist, die senkrecht zu der ersten Richtung (z) und senkrecht zu der Richtung (x) verläuft, entlang derer sich die Biegewange (16) erstreckt, **dadurch gekennzeichnet, dass**
mindestens ein zweiter Antrieb (36) in jeder Antriebsführungseinheit (18) angeordnet ist, wobei der mindestens eine zweite Antrieb (36) in die Biegewange (16) eingreift, um diesen in der zweiten Richtung (y) zu bewegen.

2. Panelbender (10) nach Anspruch 1, **dadurch gekennzeichnet, dass** die erste Richtung (z) vertikal verläuft und dass die zweite Richtung (y) horizontal verläuft.

3. Panelbender (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Antriebsführungseinheit (18) einen im Wesentlichen C-förmigen Grundkörper (28) aufweist, wobei eine Innenkontur der Antriebsführungseinheit (18) mindestens teilweise einer Außenkontur der Biegewange (16) entspricht.

4. Panelbender (10) nach Anspruch 3, **dadurch gekennzeichnet, dass** ein Einzugselement (40) als Stützlager für die Biegewange (16) in der Antriebsführungseinheit (18) bereitgestellt ist, wobei das Einzugselement (40) an einem Ende eines unteren Schenkels (38) des C-förmigen Grundkörpers (28) befestigt sein kann.

5. Panelbender (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** an dem Maschinenkörper (12) mindestens ein erster Antrieb (20, 36) bereitgestellt ist, wobei der mindestens eine erste Antrieb (20) in mindestens eine Antriebsführungseinheit (18) eingreift, um diese zu bewegen.

6. Panelbender (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Antriebe (36) unabhängig voneinander betrieben werden können.

7. Panelbender (10) nach Anspruch 5 und 6, **dadurch gekennzeichnet, dass** der mindestens eine zweite Antrieb (36) entlang der ersten Richtung (z) in einer Achse des mindestens einen ersten Antriebs (20) angeordnet ist.

8. Panelbender (10) nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** mehrere zweite Antriebe (36) entlang der ersten Richtung (z) angeordnet sind.

9. Panelbender (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** mehrere Antriebsführungseinheiten (18) entlang der Richtung (x) angeordnet sind, entlang derer sich die Biegewange erstreckt, und dass die Biegewange (16) in den mehreren Antriebsführungseinheiten (18) angeordnet ist.

10. Panelbender (10) nach Anspruch 9, **dadurch gekennzeichnet, dass** jeder der mehreren Antriebsführungseinheiten (18) ein erster Antrieb (20) zugeordnet ist.

11. Panelbender (10) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** eine

Erstreckung der Biegewange (16) in Richtung der zweiten Richtung (y) kleiner als eine Erstreckung der Biegewange (16) in der Richtung der ersten Richtung (z) ist.

12. Panelbender (10) nach Anspruch 5, **dadurch gekennzeichnet, dass** eine Steuereinheit (42) zum Steuern des mindestens einen ersten Antriebs (20) und des mindestens einen zweiten Antriebs (36) bereitgestellt ist und dass die Steuereinheit (42) angeordnet ist, um das mindestens eine an der Biegewange (16) angeordnete Biegewerkzeug (44) in der ersten (z) und in der zweiten (y) Richtung entlang einer Biegelinie auszurichten.

Revendications

1. Cintreuse de panneaux (10) pour le pliage de tôles au moyen d'au moins un outil de cintrage (44) agencé sur une poutre de cintrage (16), dans laquelle la poutre de cintrage (16) s'étend le long d'une direction (x),

   comportant un corps de machine (12),
   comportant au moins deux réceptacles de guidage (24) qui s'étendent dans une première direction (z) sur le corps de machine (12), dans laquelle la première direction (z) est perpendiculaire à la direction (x) le long de laquelle s'étend la poutre de cintrage (16), comportant au moins deux unités de guidage d'entraînement (18) qui sont agencées de manière mobile dans les au moins deux réceptacles de guidage (24) et
   dans laquelle la poutre de cintrage (16) est agencée de manière mobile dans les unités de guidage d'entraînement (18) dans une seconde direction (y) s'étendant perpendiculairement à la première direction (z) et perpendiculairement à la direction (x) le long de laquelle s'étend la poutre de cintrage (16),
   caractérisée en ce que
   au moins un second entraînement (36) est agencé dans chaque unité de guidage d'entraînement (18), dans laquelle le au moins un second entraînement (36) vient en prise avec la poutre de cintrage (16) pour déplacer celle-ci dans la seconde direction (y).

2. Cintreuse de panneaux (10) selon la revendication 1, **caractérisée en ce que** la première direction (z) s'étend verticalement et **en ce que** la seconde direction (y) s'étend horizontalement.

3. Cintreuse de panneaux (10) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'unité de guidage d'entraînement (18) comporte un corps de base sensiblement en forme de C (28), dans laquelle un contour interne de l'unité de guidage d'entraînement (18) correspond au moins partiellement à un contour externe de la poutre de cintrage (16).

4. Cintreuse de panneaux (10) selon la revendication 3, **caractérisée en ce qu'**un élément d'alimentation (40) est prévu en tant que palier de support pour la poutre de cintrage (16) dans l'unité de guidage d'entraînement (18), dans laquelle l'élément d'alimentation (40) peut être fixé au niveau d'une extrémité d'une branche inférieure (38) du corps de base en forme de C (28).

5. Cintreuse de panneaux (10) selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**au moins un premier entraînement (20, 36) est prévu sur le corps de machine (12), dans laquelle l'au moins un premier entraînement (20) vient en prise avec au moins une unité de guidage d'entraînement (18) pour déplacer celle-ci.

6. Cintreuse de panneaux (10) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** les seconds entraînements (36) peuvent être actionnés indépendamment l'un de l'autre.

7. Cintreuse de panneaux (10) selon les revendications 5 et 6, **caractérisée en ce que** le au moins un second entraînement (36) est agencé le long de la première direction (z) dans un axe du au moins un premier entraînement (20).

8. Cintreuse de panneaux (10) selon la revendication 6 ou 7, **caractérisée en ce que** de multiples seconds entraînements (36) sont agencés le long de la première direction (z).

9. Cintreuse de panneaux (10) selon l'une des revendications précédentes, **caractérisée en ce que** de multiples unités de guidage d'entraînement (18) sont agencées le long de la direction (x) le long de laquelle s'étend la poutre de cintrage et **en ce que** la poutre de cintrage (16) est agencée dans les multiples unités de guidage d'entraînement (18).

10. Cintreuse de panneaux (10) selon la revendication 9, **caractérisée en ce qu'**un premier entraînement (20) est associé à chacune des multiples unités de guidage d'entraînement (18).

11. Cintreuse de panneaux (10) selon l'une des revendications précédentes, **caractérisée en ce qu'**une extension de la poutre de cintrage (16) dans la direction de la seconde direction (y) est plus petite qu'une extension de la poutre de cintrage (16) dans la direction de la première direction (z).

12. Cintreuse de panneaux (10) selon la revendication 5, **caractérisée en ce qu'**un dispositif de commande (42) est prévu pour commander le au moins un premier entraînement (20) et le au moins un second entraînement (36) et **en ce que** le dispositif de commande (42) est agencé pour aligner le au moins un outil de cintrage (44) agencé sur la poutre de cintrage (16) dans les première (z) et seconde (y) directions le long d'une ligne de cintrage.

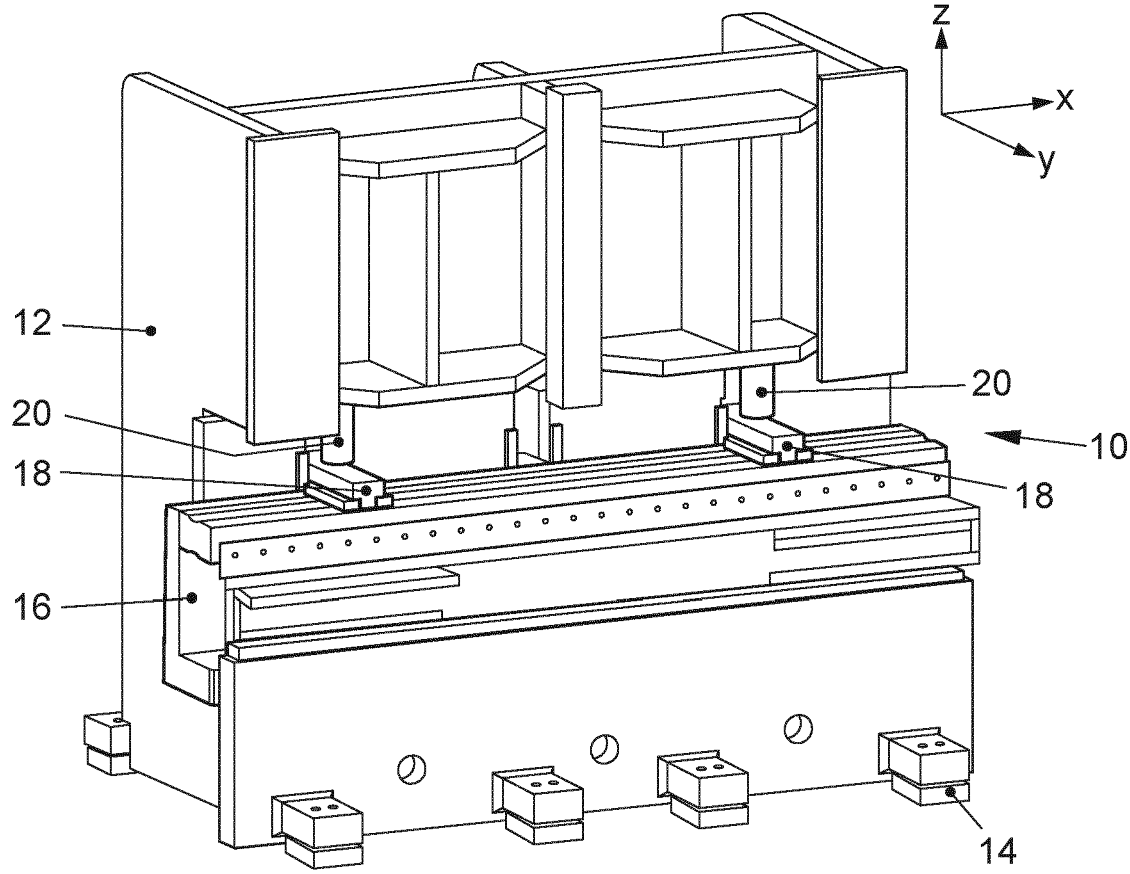

FIG. 1

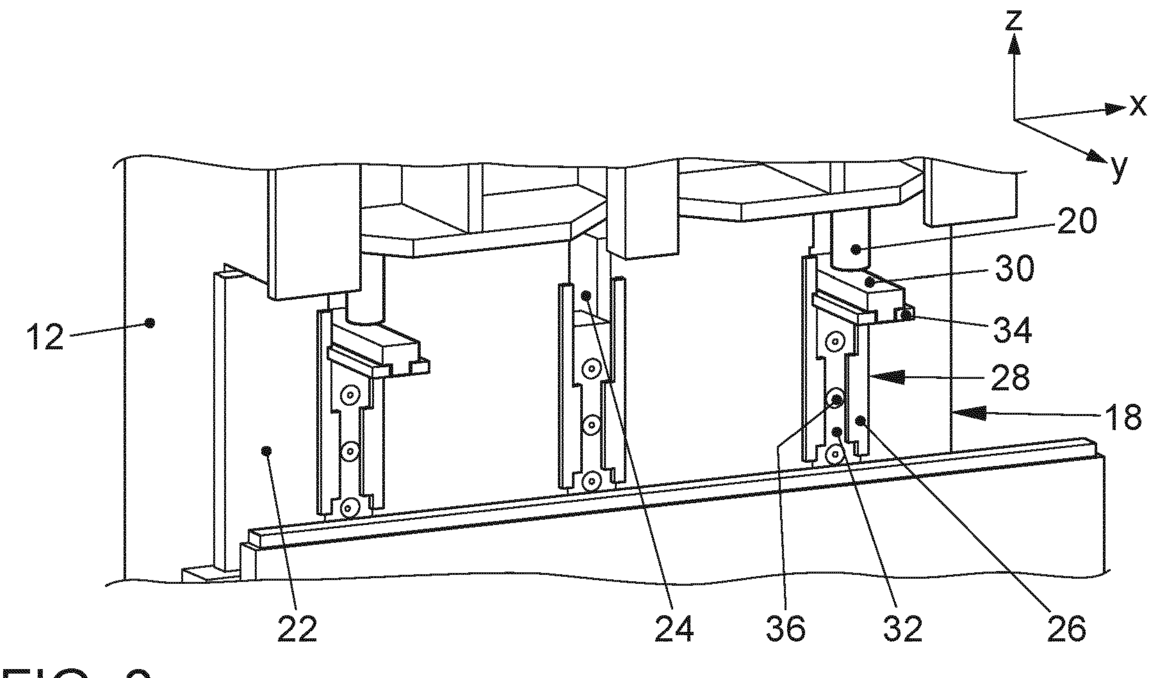

FIG. 2

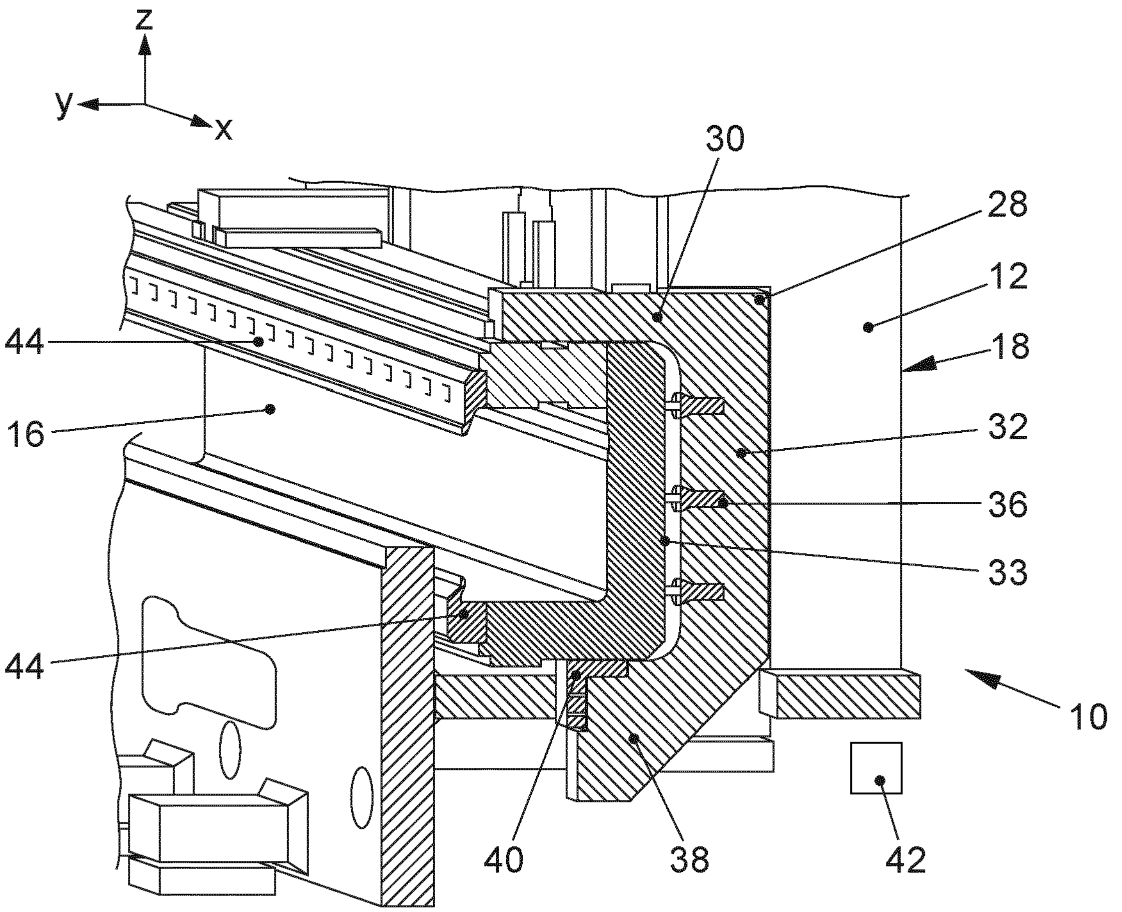

FIG. 3

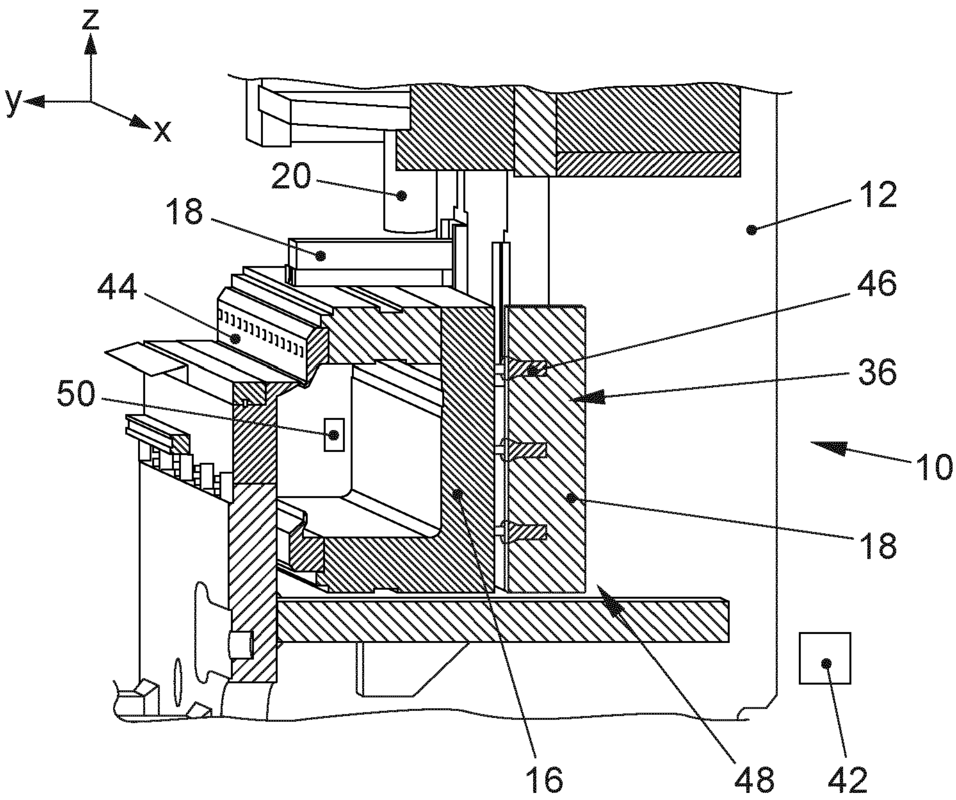

FIG. 4

REFERENCES CITED IN THE DESCRIPTION

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- EP 2691190 A1 **[0006]**