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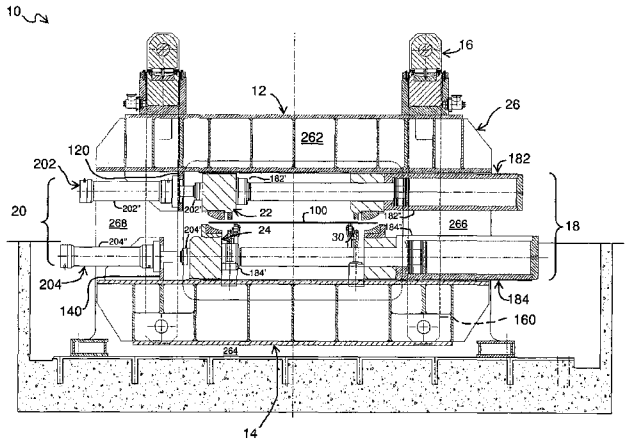

Fig. 4

(57) Abstract: The present invention relates to an edge-bending press (10) which comprises an upper platen (12), a lower platen (14) and operating actuators (16). The operating actuators (16) are designed to cause a relative movement of the upper platen and lower platen towards and/or away from each other. The press also comprises an upper die- holder assembly (22) which is connected to the upper platen and a lower die-holder assembly (24) which is connected to the lower platen. Each die-holder assembly comprises a right-hand die-holder and a left-hand die- holder; thus there is an upper right-hand die-holder (222), an upper left-hand die-holder (224), a lower right- hand die-holder (242) and a lower left-hand die-holder (244). The press also comprises adjustment actuators (18) designed to cause a relative movement of the right-hand die-holders and left-hand die-holders towards and/or away from each other. The press also comprises centring actuators (20) designed to impart a movement involving displacement of the die-holder assemblies along the platens.

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TITLE: "EDGE-BENDING PRESS"

DESCRIPTION

The present invention relates to an edge-bending press and in particular relates to an edge-bending press suitable for processing metal sheets for the production of longitudinally welded pipes.

It is known to use flat metal sheets for the production of longitudinally welded pipes. The sheets undergo successive processing operations in order to form the pipe. During a first step the longitudinal edges of the sheets are chamfered. During a second step, using an edge-bending press (or crimping press), the longitudinal edges are deformed with a radius of curvature equivalent to that of the finished pipe. During the third step the sheet is deformed until it assumes a U-shaped cross-section. During the fourth step the sheet is deformed until it assumes a cross-section in the form of an open "O". During the fifth and final step the sheet is welded longitudinally so as to close the O-shaped cross-section and obtain the finished pipe.

The present invention relates to an edge-bending press for imparting a curvature to the edges of the sheets. This operation is illustrated generally in Figures 1 to 3.

Usually this operation is completed by means of two presses with an open C-shaped frame. The two presses are situated opposite each other and positioned at a suitable distance so that each one operates on one of the two longitudinal edges of the sheet. This solution is described for example in the patent US 3,911,709.

With this known solution it is possible to obtain, by displacing one press with respect to the other one, configurations suitable for the different widths of the sheets to be processed. The width of the sheet is in fact variable from a minimum of about 2 m to a maximum of about 4.5 m, depending on the different diameters of the pipe which is to be obtained.

In order to help one understand better the technical subject it should be mentioned here that the edge-bending presses designed for the described function are able to generate a force in the direction of operation (referred to as "separation force" and regarded below as vertical) which is of the order of thousands of tonnes. This force is necessary in order to be able to bend sheets of considerable thickness, for example thicknesses which are of the order of some centimetres. During each of the bending operations, the sheet reacts to the separation force applied by the press, with a complex system of reaction forces. With respect to external effects, these reaction forces may be regarded

as a vertical resultant, a horizontal resultant and a moment.

This solution of oppositely arranged C-shaped presses, although widely used, is not defect-free.

The most evident defect relates to the structure of the two presses. In fact each of the two presses must oppose reaction forces of the sheet, which have a markedly asymmetrical structure. Even if the reaction forces generated by an edge of the sheet are a perfect mirror-image of the forces generated by the other edge, the fact that the two C-shaped presses are separate from each other does not allow the two systems of forces to be closed in such a way as to cancel out each other. Finally, the open configuration of the two C-shaped presses does not allow the structure of the said presses to be exploited in the best possible manner.

Owing to the abovementioned factors, each of the two C-shaped presses is subject to a notable overturning moment. The overall system must take account of this moment, allowing each of the two presses to perform a limited rotational movement in order to comply partially with this moment.

This type of response involves the use of particularly complex constraining devices for each of the two presses.

A further known solution is described for example in

the patent application EP 1 958 712. This solution envisages the use of an edge-bending press with a closed frame in which double rams for positioning the die-holders are fixed to the centre of each of the platens or platens.

This solution, although it solves partly some of the problems associated with the open structure of the C-shaped presses, continues to have a number of drawbacks.

Serious problems may arise, for example, should the system of reaction forces generated during operation of the press be asymmetrical, for example owing to incorrect positioning of the sheet. In this case, the system of reaction forces is not symmetrical: a lateral thrust is in fact generated on one of the two edges and is not compensated by any equal and opposite thrust generated on the other edge of the sheet. This lateral thrust, which may reach values of the order of some thousand tonnes, is transmitted to the central support of the die-holder positioning double ram. Obviously this support may be suitably designed so as to withstand such lateral forces, but only by providing the structure with excessively large dimensions.

The object of the present invention is therefore to overcome at least partly the drawbacks mentioned above with reference to the prior art.

In particular, one task of the present invention is to provide an edge-bending press such that a closed system of reaction forces is obtained on the two edges of the sheet, resulting in a system of forces which is symmetrical and zero with respect to external effects.

The abovementioned object and tasks are achieved by an edge-bending press in accordance with that claimed in Claim 1.

The characteristic features and further advantages of the invention will emerge from the description provided hereinbelow, of a number of examples of embodiments, provided by way of a non-limiting example, with reference to the accompanying drawings in which:

- Figure 1 shows a schematic cross-sectional view of a generic edge-bending press during a first working step;
- Figure 2 shows a view of the press according to Figure 1 during a second working step;
- Figure 3 shows a view of the press according to Figure 1 during a third working step;
- Figure 4 shows a partially cross-sectioned front view of an edge-bending press according to the invention;
- Figures 5.a to 5.d show successive configurations of a press according to the invention;
- Figure 6 shows a cross-sectional view along the line VI-VI in Figure 5.c;
- Figure 7 shows a view, similar to that of Figure 4,

of another edge-bending press according to the invention;

- Figure 8 shows a partial view of the cross-section along the line VIII-VIII in Figure 7, where some parts have been removed for greater clarity.

With reference to the accompanying Figure 4, 10 denotes in its entirety an edge-bending press according to the invention, while 100 denotes the sheet being processed. The edge-bending press 10 according to the invention comprises an upper platen 12, a lower platen 14 and operating actuators 16. The operating actuators 16 are designed to cause a relative movement of the upper platen 12 and lower platen 14 towards and/or away from each other. The press 10 also comprises an upper die-holder assembly 22 which is connected to the upper platen 12 and a lower die-holder assembly 24 which is connected to the lower platen 14. Each die-holder assembly 22, 24 comprises a right-hand die-holder and a left-hand die-holder; thus there is an upper right-hand die-holder 222, an upper left-hand die-holder 224, a lower right-hand die-holder 242 and a lower left-hand die-holder 244. The press 10 according to the invention also comprises adjustment actuators 18 designed to cause a relative movement of the right-hand die-holders 222, 242 and the left-hand die-holders 224, 244 towards and/or away from each other. The press 10 according to

the invention also comprises centring actuators 20 designed to impart a movement involving displacement of the die-holder assemblies 22, 24 along the platens 12, 14.

Here and below the vertical and horizontal directions refer to the condition where the press 10 is correctly installed and in working order. Furthermore, the longitudinal direction is understood as being the horizontal direction for feeding the sheet 100 to the press 10; the transverse direction is understood as being the horizontal direction perpendicular to the longitudinal direction.

Here and below the terms, top, upper, up, overlying and the like and the terms bottom, lower, low, underlying and the like refer to the press 10 correctly installed and in working order. Similarly, the reference to right-hand and left-hand is based on a view of the press 10 which is similar to that in Figure 4. Obviously the right-hand and left-hand positions could be equally well reversed.

In accordance with one embodiment, the press 10 according to the invention also comprises a frame 26 on which the platens and the actuators are mounted. The frame 26 rests on a base and comprises preferably an upper horizontal member 262 and a lower horizontal member 264. The two horizontal members are connected by

a right-hand vertical member 266 and a left-hand vertical member 268.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the upper platen 12 is fixed on the frame 26, while the lower platen 14 is movable as a result of the action of the operating actuators 16. In accordance with other possible embodiments, on the other hand, the upper platen 12 is movable and the lower platen 14 is fixed.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the operating actuators 16 comprise hydraulic actuators of the cylinder and piston type. The operating actuators 16 act in the vertical direction.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the operating actuators 16 are positioned at the top of the upper platen 12 and act on the lower platen 14 by means of tie-rods 160.

In accordance with one embodiment of the press 10, the operating actuators 16 comprise an auxiliary cylinder and piston unit (not shown in the Figures) and a main cylinder and piston unit 164. The two auxiliary and main units 164 are preferably arranged in a parallel configuration. The function and the interaction between the two cylinder and piston units, i.e. auxiliary unit and main unit 164, is explained in detail below.

In accordance with the embodiment of the press 10 shown in the accompanying figures, convex dies 226 are mounted on the upper die-holder assembly 22, while concave dies 246 are mounted on the lower die-holder assembly 24. In accordance with other embodiments and without any differences in terms of operation, concave dies are mounted on the upper die-holder assembly, while convex dies are mounted on the lower die-holder assembly.

The dies 226, 246 are interchangeable so as to allow replacement of the worn dies, but in particular so as make it possible to achieve different radii of curvature for the edges of the sheets. The curvature to be imparted to the edges of the sheet 100 in fact depends on the diameter of the finished pipe to be obtained.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the adjustment actuators 18 comprise hydraulic actuators of the cylinder and piston type. In particular, the adjustment actuators 18 comprise an upper adjustment actuator 182 and a lower adjustment actuator 184. The adjustment actuators 18 act in the transverse direction.

In accordance with other possible embodiments, the adjustment actuators 18 may be mechanical instead of hydraulic in nature. Mechanical actuators which are

suitable for this purpose may be threaded-bar actuators or rack-and-pinion actuators.

The upper adjustment actuator 182 is mounted on the upper platen 12, while the lower adjustment actuator 184 is mounted on the lower platen 14. The adjustment actuators 18 are mounted on the respective platens so as to be able to slide in the transverse direction relative thereto. The adjustment actuators 18 may, for example, be mounted by means of tracks, rails or the like.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the upper right-hand die-holders 222 and the upper left-hand die-holders 224 are fixed to the upper adjustment actuator 182. Similarly, the lower right-hand die-holder 242 and the lower left-hand die-holder 244 are fixed to the lower adjustment actuator 184. In particular, the upper right-hand die-holder 222 is rigidly fixed to the outer casing 182" of the cylinder, while the upper left-hand die-holder 224 is rigidly fixed to the end 182' of the piston rod. Similarly, the lower right-hand die-holder 242 is rigidly fixed to the outer casing 184" of the cylinder, while the lower left-hand die-holder 244 is rigidly fixed to the end 184' of the piston rod.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the centring actuators 20

comprise hydraulic actuators of the cylinder and piston type. In particular, the centring actuators 20 comprise an upper centring actuator 202 and a lower centring actuator 204. The centring actuators 20 act in the transverse direction.

In accordance with other possible embodiments, the centring actuators 20 may be mechanical instead of hydraulic in nature. Mechanical actuators which are suitable for this purpose are threaded-bar actuators or rack-and-pinion actuators.

The upper centring actuator 202 is mounted on the upper platen 12, while the lower centring actuator 204 is mounted on the lower platen 14. In particular, the outer casing 202" of the cylinder of the upper centring actuator 202 is rigidly connected to the upper platen 12. The end 202' of the piston rod of the upper centring actuator 202 is connected to the upper adjustment actuator 182. The outer casing 204" of the cylinder of the lower centring actuator 204 is rigidly connected to the lower platen 14. The end 204' of the piston rod of the lower centring actuator 204 is connected to the lower adjustment actuator 184.

As can be clearly seen in Figure 4, the end 202' of the piston rod of the upper centring actuator 202 is connected to the upper adjustment actuator 182 by means of the upper left-hand die-holder 224. Respectively,

the end 204′ of the piston rod of the lower centring actuator 204 is connected to the lower adjustment actuator 184 by means of the lower left-hand die-holder 224. Obviously, other configurations may be adopted, provided that operation of the centring actuators is able to move the adjustment actuators and the die-holders fixed thereto.

In accordance with the embodiment of the press 10 shown in the accompanying figures, the upper platen 12 comprises a fixing plate 120 to which the outer casing 202″ of the cylinder of the upper centring actuator 202 is rigidly fixed. Similarly, the lower platen 14 comprises a fixing plate 140 to which the outer casing 204″ of the cylinder of the lower centring actuator 204 is rigidly fixed.

In accordance with one embodiment of the invention, the centring actuators 20 comprise adjustable safety valves (not shown in the figures).

In accordance with the embodiment shown in the accompanying figures, the press 10 also comprises means 28 for moving the sheet 100 and/or means 30 for clamping the sheet.

In a manner known per se, the means 30 comprise (hydraulic or mechanical) actuators with respective abutments. The means 30 are able to exert on the sheet 100 a clamping force such as to keep the sheet itself

in the correct position also in response to disturbances in the system of forces generated during operation of the press 10. This clamping force may be quantified as being a good 20% of the force which the press 10 requires in order to perform bending of the edges (or crimping).

The clamping means 30 are mounted in a manner known per se on straight guides so as to be able to slide in the transverse direction together with the die-holders. The clamping means 30 must in fact be able to act in the vicinity of the edges of sheets of various widths.

In accordance with the embodiment shown in Figures 4 and 5, the clamping means 30 are mounted, in a manner known per se, between the lower platen 14 and the upper platen 12 of the press 100. In this configuration, during the crimping action, the operating actuators 16 must also overcome the force exerted by the clamping means 30.

In accordance with the embodiment shown in Figures 7 and 8, the clamping means 30 are instead mounted on the frame 26. In particular, the clamping means 30 are mounted on the lower horizontal member 264 by means of straight guides so as to be able to slide in the transverse direction together with the die-holders. The clamping means 30 must in fact be able to act in the vicinity of the edges of sheets of various widths.

In this configuration, during the crimping action, the force exerted by the clamping means 30 does not influence the force of the operating actuators 16. As a result of this solution, therefore, the operating actuators 16 may be designed so as to develop a force about 20% less than that of the preceding solution. All other factors being equal, it can be noted how this solution achieves a significant reduction in the dimensions and operation of the operating actuators 16 and the associated power supply plant.

In accordance with a number of embodiments, the press 10 according to the invention also comprises means for controlling the operating movements, for example for controlling the hydraulic and/or mechanical operating, adjustment and/or centring actuators. The control means may advantageously comprise some of the following components: a user interface designed to receive commands from a user; pressure sensors able to detect the internal pressure of the hydraulic actuators; load cells able to detect the force exerted at a given point; displacement sensors able to detect the relative position of given components; safety sensors; actuating devices able to cause the displacement of the various hydraulic actuators; a processing unit designed to collect the signals received from the user interface and from the various sensors and operate the actuating

devices depending on a predefined logic.

In accordance with the embodiment shown in Figure 6, the press 10 comprises a plurality of stations which are arranged next to each other in the longitudinal direction. Each station corresponds to the description given above and comprises an upper platen 12, a lower platen 14, operating actuators 16, die-holder assemblies 22 and 24, adjustment actuators 18 and centring actuators 20.

In accordance with one embodiment (not shown) of the invention, the movable platens of the plurality of stations are connected together in the longitudinal direction by a middle member mounted between the said platens and the die-holders. This middle member, where present, may help improve mechanical synchronization of the various stations.

In the light of the structural description given above, operation of the press 10, in particular the operations necessary for reconfiguring and using a press 10 according to the invention, will now be described briefly.

Figure 5.a shows a press 10 according to the invention in a configuration similar to that of Figure 4. In this configuration, considered by way of example, the press 10 is able to operate on sheets of maximum width (in the specific example about 4.5 m). It is assumed below,

again by way of example, that it is required to reconfigure the press 10 so as to be able to operate on sheets of different width, for example minimum width (in the specific example about 1.9 m). In order to reconfigure the press 10 it is necessary first of all to mount the upper (e.g. convex) dies 226 and the lower (e.g. concave) dies 246 suitable for the minimum width of the sheet, i.e. dies which are designed to impart to the edges of the sheet 100 the curvature of a circumference having an extension of 1.9 m.

It is then required to move the right-hand and left-hand die-holders with the associated dies towards each other. Figure 5.b shows a first temporary configuration of the press 10 where the adjustment actuators 182 and 184 caused a relative movement of the right-hand die-holders and left-hand die-holders towards each other.

As can be noted by comparing Figure 5.a with Figure 5.b, this temporary configuration is obtained by keeping immobile the ends 182' and 184' of the piston rods of the upper adjustment actuator 182 and lower adjustment actuator 184, and therefore by keeping immobile the left-hand die-holders 224 and 244. The relative approach movement is obtained by means of the movement of the outer casings 182" and 184" of the upper adjustment actuator 182 and lower adjustment actuator 184. This movement therefore involves the

movement of the right-hand die-holders 222 and 242. Asymmetrical positioning of the die-holders relative to the centre of the press 10 is thus produced.

The asymmetrical configuration obtained would result in an asymmetrical load on the platens and therefore on the operating actuators 16 during crimping. It is therefore required firstly to displace rigidly the upper die-holder assembly 22 and lower die-holder assembly 24 so as to reposition them in a symmetrical configuration relative to the centre of the press 10. This rigid displacement of the die-holder assemblies 22 and 24 is obtained by means of the upper centring actuator 202 and lower centring actuator 204, respectively.

The symmetrical configuration thus obtained is shown in Figure 5.c, in which the sheet 100 correctly positioned between the dies is also shown. The sheet 100 is preferably brought into the position shown in Figure 5.c via the movement means 28. The press 10 in the configuration shown in Figure 5.c is therefore ready for performing crimping of the sheet 100.

The succession of movements of the dies described above is merely exemplary and is intended to describe from a logical point of view the steps required for configuration. It is obviously equally possible, in other embodiments, for the centring actuators 20 to be

operated first, followed by the adjustment actuators 18, or also for the centring actuators 20 and the adjustment actuators 18 to be operated simultaneously. At this point, it is preferable to operate the clamping means 30, if present, in a manner known per se and as schematically illustrated in Figure 2. The use of the clamping means 30 allows the sheet to be kept in position also in the case of small disturbances in the system of forces.

The next operation is that of activating the operating actuators 16. In accordance with some embodiments and as described above, the operating actuators 16 comprise an auxiliary cylinder and piston unit (not shown) and a main cylinder and piston unit 164. The auxiliary piston has a working area which is decidedly smaller than that of the main piston. Since the two units, i.e. auxiliary unit and main unit 164, are supplied by the same hydraulic plant, the auxiliary unit is able to provide a smaller force (the oil pressure acts on a smaller surface area), while ensuring a faster movement (the oil flow must supply a smaller volume). On the other hand, the main unit 164 is able to provide a greater force (the oil pressure acts on a larger surface area), but with a slower movement (the oil flow must supply a larger volume).

The auxiliary unit is therefore useful during the

stroke performed by the lower platen 14 from the position shown in Figure 5.c into the position where the dies start to come into contact with the sheet 100. This stroke in fact requires a minimum force since it must overcome only the weight force of the lower platen 14 and the internal resistance of the press 10, while there is no reaction to be overcome on the part of the sheet 100. The main unit 164 instead intervenes when the reaction forces of the sheet 100 start to be generated. By means of the operating actuators 16 it is therefore possible to obtain crimping of the sheet 100, as shown in Figure 3 and Figure 5.d.

As mentioned above, during crimping, a complex system of reaction forces arises on the part of the sheet 100. This system of forces is, limited to each of the two edges of the sheet, highly asymmetrical. Each edge of the sheet therefore introduces an overturning moment acting on the press 10 and a lateral force which tends to displace the dies in the transverse direction. The reaction forces produced by the right-hand edge and left-hand edge are, in ideal conditions, identical. As a result, when the structure of the press 10 is closed, the right-hand reaction forces are cancelled out by the left-hand reaction forces so as to produce a zero force system with respect to external effects.

Obviously, inside the press 10 the reaction forces

produced by the sheet 100 must be effectively opposed. In particular, the adjustment actuators 18 must be able to maintain the predefined distance between the dies also during crimping, i.e. in response to transverse forces equivalent to thousands of tonnes. This control over the relative position of the dies is achieved in a known manner by means of the hydraulic system of the adjustment actuators 18. In ideal conditions, therefore, the force which is transmitted onto the fixing plates 120 and 140 during crimping has a zero value.

It is possible, however, to obtain an asymmetrical reaction, for example because the two edges of the sheet 100 do not react in a symmetrical manner or because the sheet 100 is incorrectly positioned. In such a case the transverse reaction of one of the two edges is not offset nor compensated by the reaction of the other edge. This therefore produces a transverse force on the centring actuators 20 and, in turn, on the fixing plates 120 and 140. In such a situation the safety valves of the centring actuators 20 described above become useful. These safety valves allow a threshold value for the pressure inside the actuator to be predefined. When the threshold value is reached, the safety valve is designed to open a vent so as to limit the pressure inside the actuator. In other words, when

the threshold value is reached, the safety valve is designed to allow oil to flow out from inside the actuator towards the storage tank. It should be noted that the safety valves may be constructed with an extremely simple and therefore reliable design. In order to limit the pressure to a predefined value it is in fact sufficient to use a mechanical valve which can preferably be pre-loaded in a variable manner depending on the specific requirements. It is thus possible to limit in a very simple manner to a predefined value the forces which may be transmitted by the centring actuators 202 and 204 onto the respective fixing plates 120 and 140, for example in the case of a non-symmetrical system of reaction forces on the part of the sheet 100.

This operating logic may also be adopted in the case of an edge-bending press of the known type in which die-holder positioning double rams are fixed to the centre of the platens. In this case, the safety device must comprise a sensor for detecting the pressure inside each of the two chambers of the said double ram and a circuit which limits the difference between the two pressures to a predetermined value. When the threshold value is reached, the safety device is designed to block operation of the press. It should be noted therefore how this safety device required by the

configuration of the prior art is in fact more complex and therefore necessarily less reliable and robust than the simple safety valve of the press according to the invention.

In accordance with one embodiment, the press 10 according to the invention comprises means for operating simultaneously, during the crimping step, the centring actuators 20 and the adjustment actuators 18. In this way it is possible to impart to the dies a movement away from each other in the transverse direction during the approach movement in the vertical direction. This function of the edge-bending press is useful for limiting or preventing slipping of the sheet on the dies.

With regard to the embodiments of the edge-bending press 10 described above, the person skilled in the art may, in order to satisfy specific requirements, make modifications to and/or replace parts described with equivalent parts, without thereby departing from the scope of the accompanying claims.

CLAIMS

1. Edge-bending press (10) for the production of longitudinally welded pipes, comprising:
an upper platen (12), a lower platen (14) and operating actuators (160) designed to cause a relative movement of the upper platen (12) and lower platen (14) towards and/or away from each other;
an upper die-holder assembly (22) comprising an upper right-hand die-holder (222) and an upper left-hand die-holder (224), said upper die-holder assembly (22) being connected to the upper platen (12); and
a lower die-holder assembly (24) comprising a lower right-hand die-holder (242) and a lower left-hand die-holder (244), said lower die-holder assembly (24) being connected to the lower platen (14);
characterized in that it also comprises:
adjustment actuators (18) designed to cause a relative movement of said right-hand die-holders (222, 242) and said left-hand die-holders (244, 244) towards and/or away from each other, and
centring actuators (20) designed to impart a movement involving displacement of said die-holder assemblies (22, 24) along said platens (12, 14).

2. Press (10) according to Claim 1, wherein the centring actuators (20) are hydraulic actuators and comprise adjustable safety valves able to predefine a

threshold value for the pressure inside the centring actuators (20) whereby, upon reaching a threshold value, the safety valve opens a vent so as to limit the pressure inside the centring actuators (20).

3. Press (10) according to Claim 2, wherein the safety valve is a mechanical valve which can be variably preloaded.

4. Press (10) according to any one of the preceding claims, also comprising a frame (26).

5. Press (10) according to the preceding claim, also comprising clamping means (30) able to keep a sheet (100) in the correct position also in response to disturbances in the system of forces generated during operation of the press (10), the clamping means (30) being mounted on the frame (26).

6. Press (10) according to any one of the preceding claims, wherein the operating actuators (16) are hydraulic actuators.

7. Press (10) according to the preceding claim, wherein the operating actuators (16) comprise a main cylinder and piston unit (164) and an auxiliary cylinder and piston unit which has a working area smaller than that of the main cylinder and piston unit (164), the two units, i.e. main unit (164) and auxiliary unit, being arranged in parallel.

8. Press (10) according to any one of the preceding

claims, wherein the adjustment actuators (18) comprise an upper adjustment actuator (182) mounted on the upper platen (12) and a lower adjustment actuator (184) mounted on the lower platen (14), the adjustment actuators (182, 184) being mounted on the respective platens (12, 14) so as to be able to slide in a transverse direction relative thereto.

9. Press (10) according to the preceding claim, wherein the centring actuators (20) are hydraulic actuators of the type comprising a cylinder and piston unit and comprise an upper centring actuator (202) and a lower centring actuator (204), whereby:

the outer casing (202') of the cylinder of the upper centring actuator (202) is rigidly connected to the upper platen (12);

the end (202") of the piston rod of the upper centring actuator (202) is connected to the upper adjustment actuator (182);

the outer casing (204') of the cylinder of the lower centring actuator (204) is rigidly connected to the lower platen (14); and

the end (204") of the piston rod of the lower centring actuator (204) is connected to the lower adjustment actuator (184).

10. Edge-bending press (10) according to any one of the preceding claims, also comprising means for

operating simultaneously, during the crimping step, the centring actuators (20) and the adjustment actuators (18) so as to impart to the dies a movement away from each other in the transverse direction during the approach movement in the vertical direction.

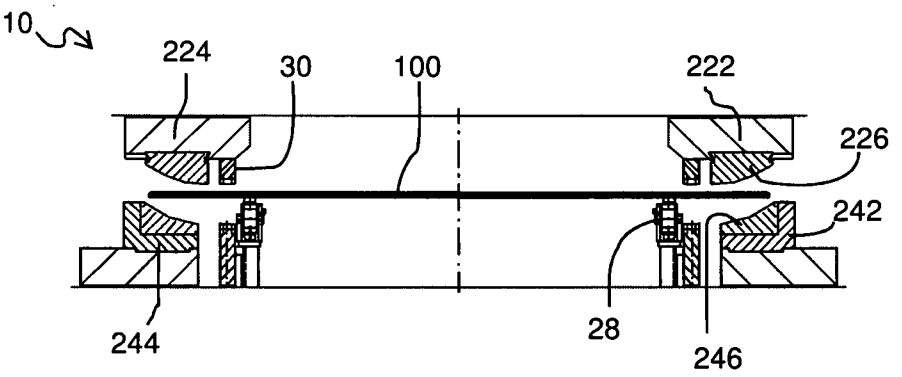

Fig. 1

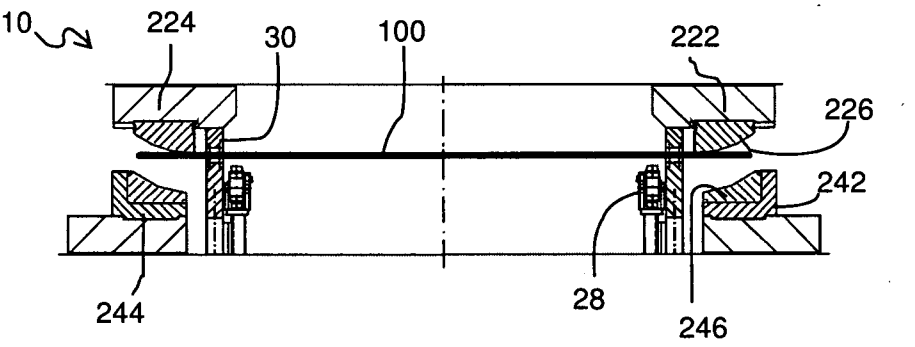

Fig. 2

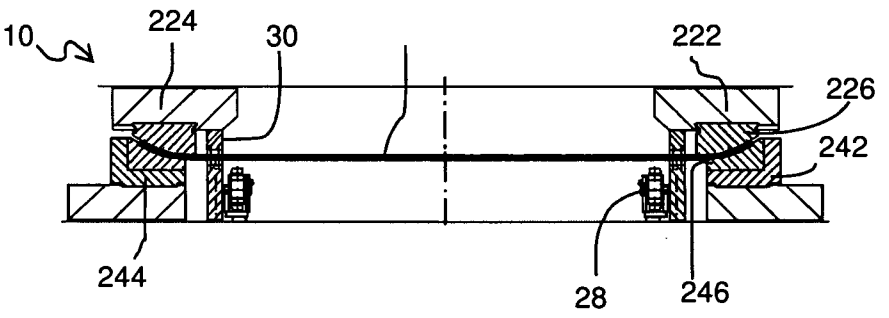

Fig. 3

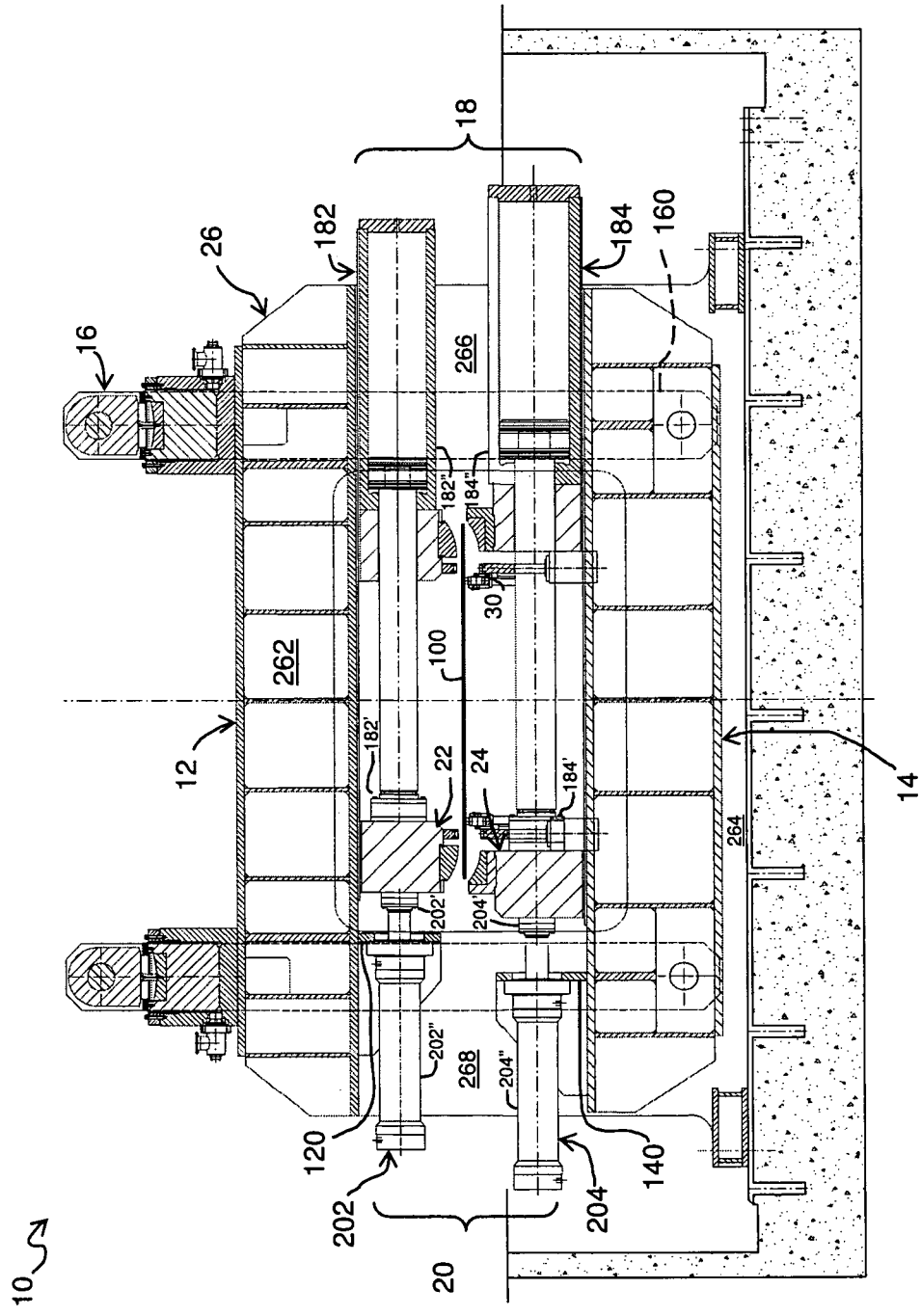
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Fig. 4

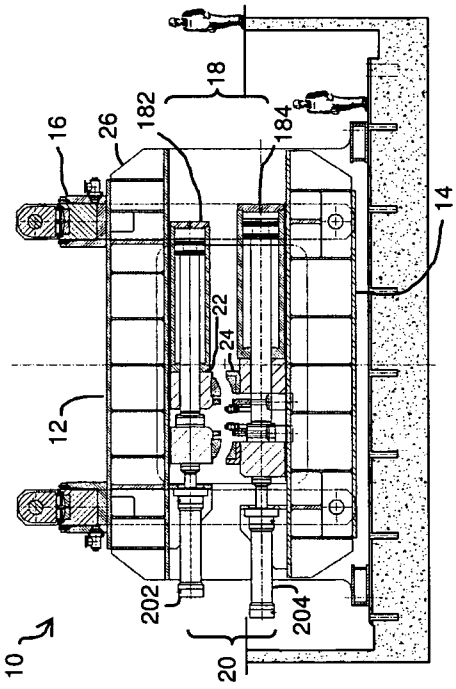


Fig. 5.b

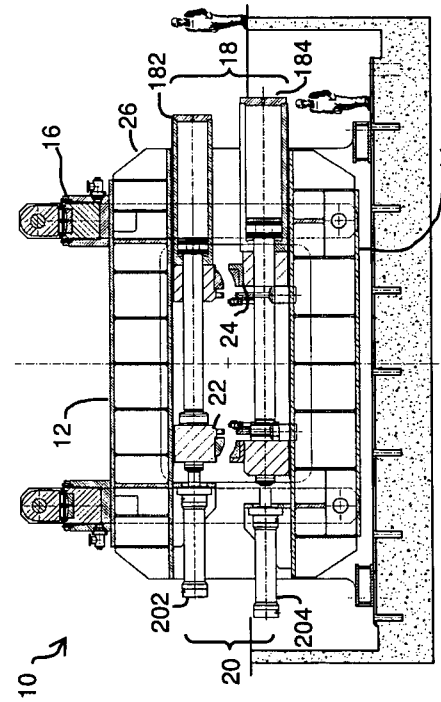


Fig. 5.a

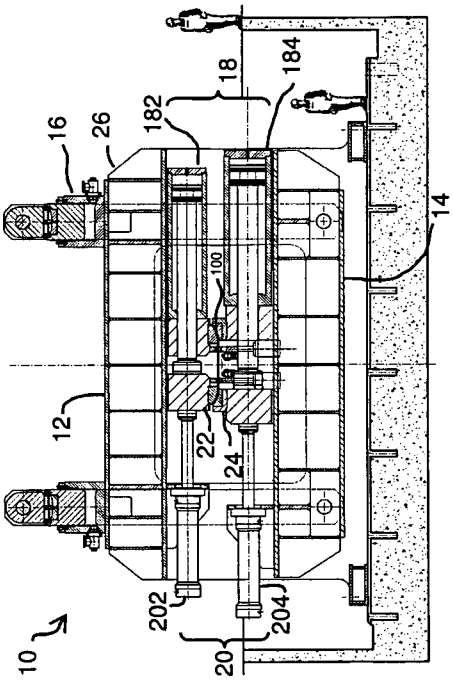


Fig. 5.d

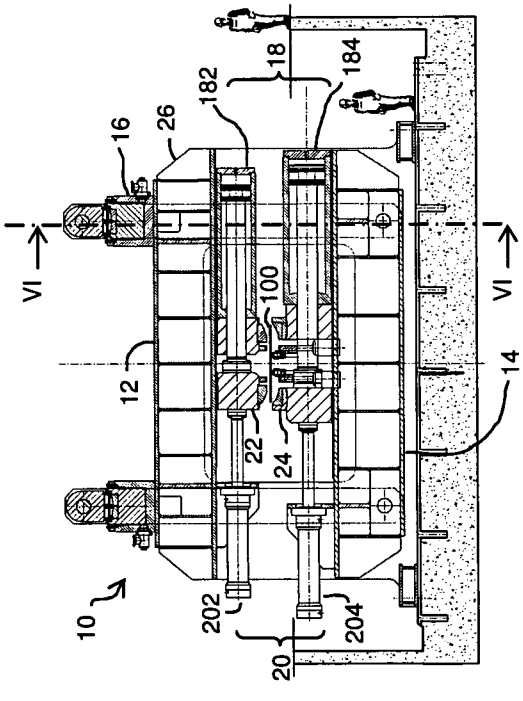


Fig. 5.c

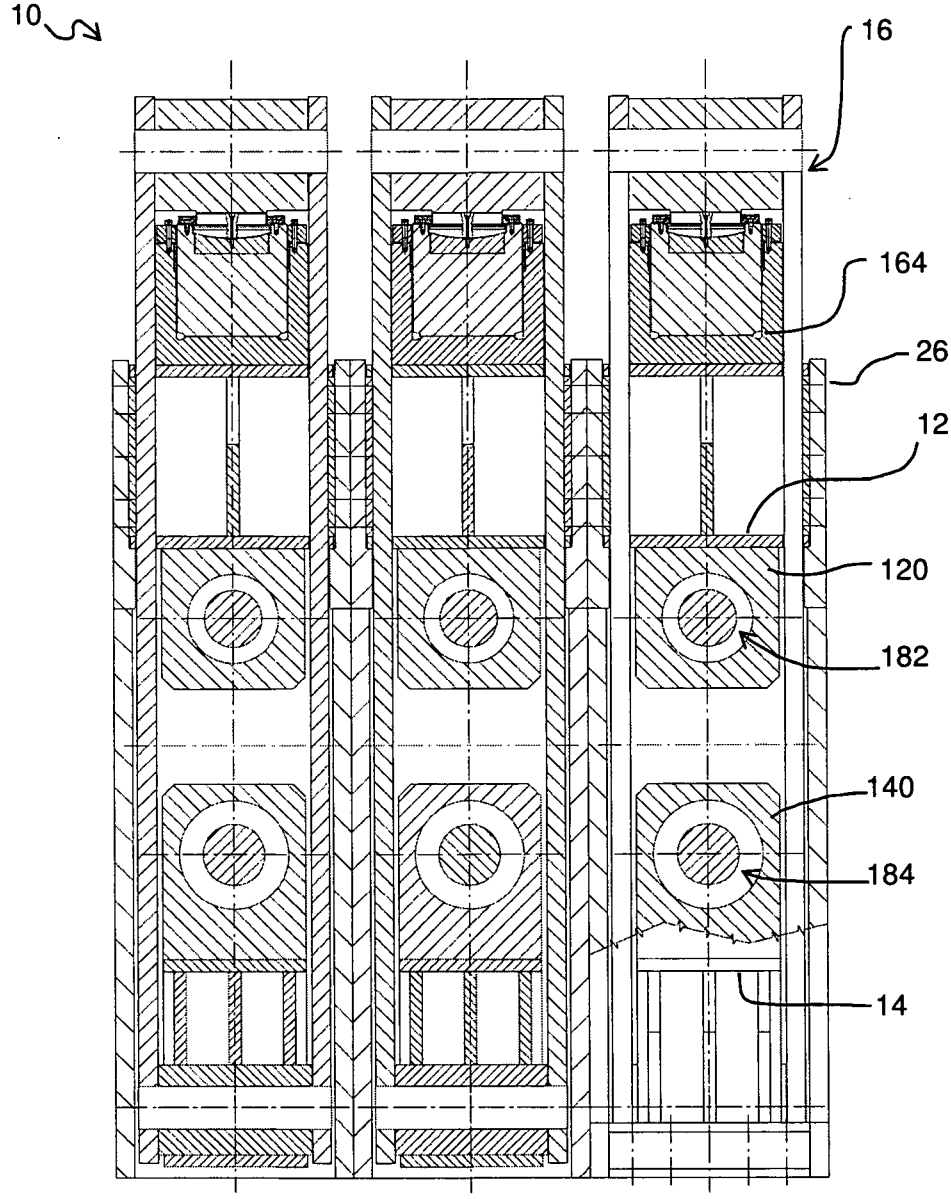
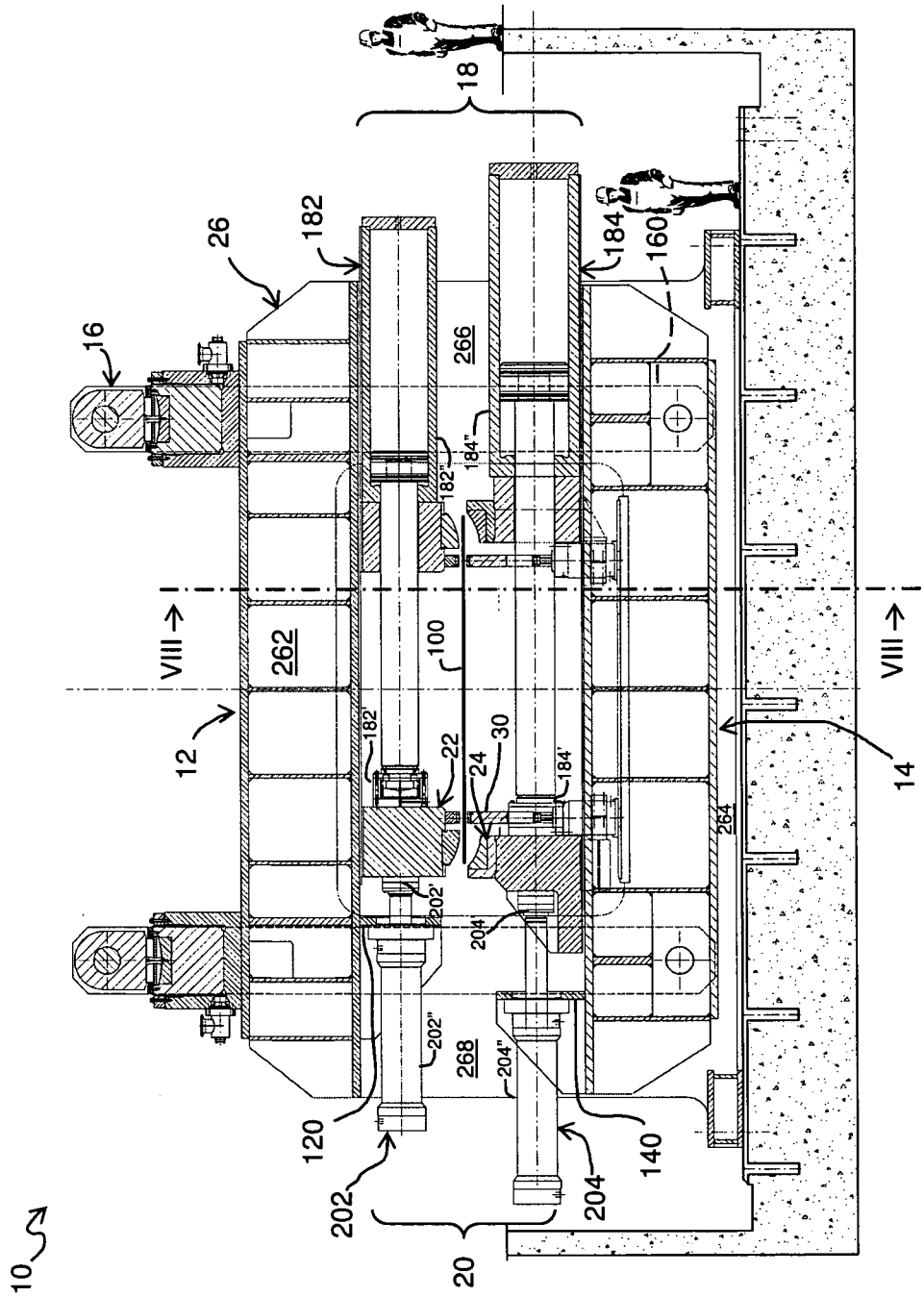


Fig. 6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VIII

Fig. 7

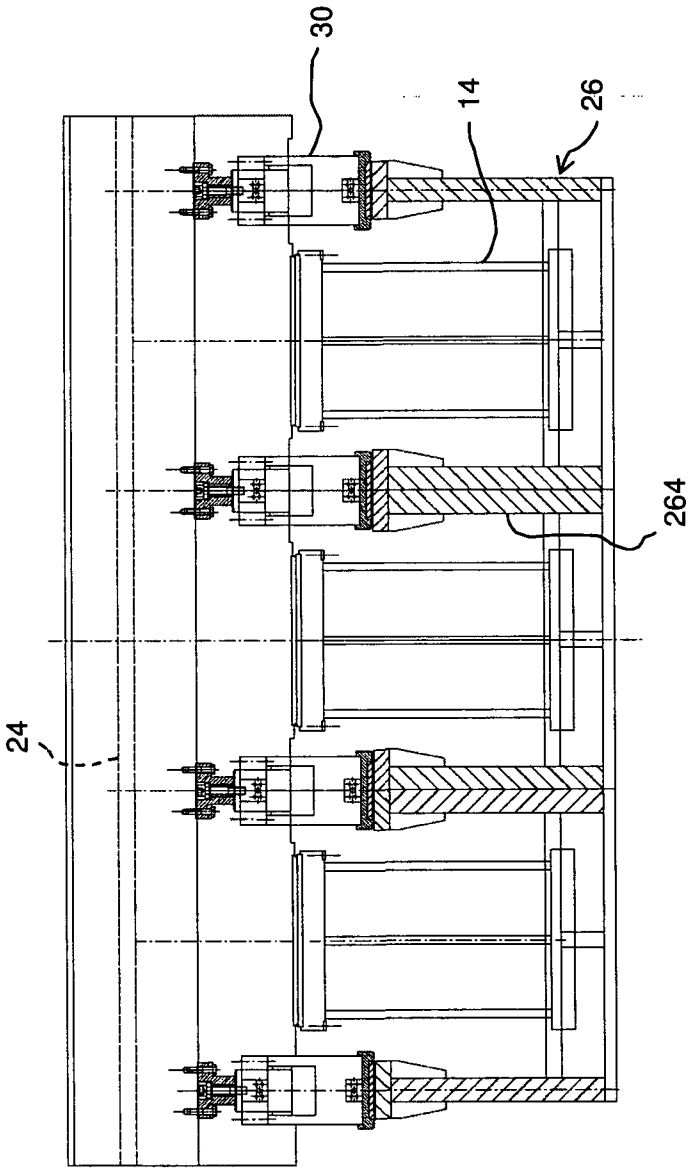

Fig. 8