

Description

The present invention relates to apparatus for shaping steel bars, particularly bars for reinforcing concrete, of the type comprising:

- an elongated bed having a supporting structure at the top thereof,
- first and second bending machines both movable independently from each other along the longitudinal direction of said bed adjacent to one side of the latter, each bending machine having a bending device with a motorized rotatable horizontal disc, having a central abutment pin and a bending offset pin, said bending machines further having respective movable clamping devices, having bar receiving channels which can be opened upwardly, for receiving the bars coming from said supporting structure and for keeping these bars superimposed in a vertical plane parallel to the longitudinal direction of the bed, above the discs of the bending machines, as well as for depositing the bars on a storing plane after bending thereof, a third clamping device being provided on the bed at a position intermediate between the two bending machines, and
- means for controlling the movement of the two bending machines along the bed and for activating the respective bending devices according to a predetermined sequence, for shaping the bars as desired.

An apparatus of the above indicated type has been disclosed in European Patent Application EP-A-0 648 577.

The object of the present invention is that of enabling a number of bars to be simultaneously loaded on the bending machines, in a fully automatic manner.

In view of achieving this object, the invention provides an apparatus of the type indicated at the beginning of the present description, characterized in that said supporting structure which receives the bars to be shaped is a substantially channel-shaped structure extending along said bed, having a bottom horizontal wall and two vertical side walls which are movable between a lowered position adjacent to the bottom wall, in which they define along said bar receiving channel with the bottom wall, and a raised position, in that said apparatus comprises pressing horizontal plate elongated along the longitudinal direction of the channel and vertically movable between said two side walls for pressing downwardly the bars supported on the bottom wall so as to keep them all in a same plane, and a pushing horizontal plate, also elongated in the longitudinal direction of the channel, and movable horizontally above said bottom wall in a direction transverse relative to the longitudinal direction of the bars, when the side walls are in their raised condition, for feeding the bars towards a discharging position, in which they can be dis-

charged on said clamping devices for being deposited on the bending machines.

Preferably, means are provided for feeding the bars on the supporting structure of the bed, comprising a cutting head associated with one end of the bed which attends to cutting the bars at the desired length after that they are received within said channel and clamped by means of said pressing plate.

Due to the said features, the bars are received and aligned in a proper position above the supporting structure of the bed and then they are automatically fed towards a position for being discharged on the clamping devices, with no intervention by the operators and in a rapid and precise manner. In a preferred embodiment of the apparatus according to the invention, said side walls are rigidly connected to each other and each have one or more slanted slots each engaged by a respective horizontal pin transverse relative to the longitudinal direction of the channel, each pin being attached to the fixed structure of the bed, so that a horizontal movement of said plates in the longitudinal direction of the channel causes a simultaneous vertical movement thereof.

Yet in the said preferred embodiment, said pressing horizontal plate is rigidly connected to a vertical upper plate, parallel to the longitudinal direction of the channel, having one or more slanted slots each engaged by a respective horizontal pin which is transverse relative to the longitudinal direction of the channel, each pin being attached to the fixed structure of the bed, so that a horizontal movement of said vertical plate in the longitudinal direction of the channel causes a simultaneous vertical movement thereof.

According to a further preferred feature of the invention, the said pushing horizontal plate has one or more slanted slots each engaged by a respective vertical pin which also engages a guiding slot parallel to the longitudinal direction of the channel formed in the fixed structure of the bed, so that a movement of said vertical pin along said longitudinal guiding slot causes a simultaneous horizontal transverse movement of the pushing plate.

Preferably, the horizontal movement of the said vertical walls, the horizontal movement of the vertical plate connected to the pressing plate and the horizontal movement of the vertical pin for driving the pushing plate are all obtained by means of respective fluid cylinders.

Due to the above described further features, the preferred embodiment of the invention ensures a proper and uniform movement of all the above mentioned movable plates throughout the whole length of the bed, while making use of means of simple and inexpensive construction.

A further important feature of the invention lies in that the said third clamping device provided at an intermediate position between the two bending machines is carried by a structure movable along the longitudinal direction of the bed, so that the three clamping devices

are able to move simultaneously in order to deposit the bent bars at different areas of the storing plane. This feature is particularly useful in case the apparatus is used for instance in order to provide bars according to different possible shapes, since it is thus possible to deposit the various types of shaped bars at different areas of the storing plane.

Preferably, said discharging position of the bars, towards which the bars are pushed by said pushing plate is defined by at least one stop lever positioned at the end of an inclined plane on which the bars are fed, said lever being retractable towards a position in which it allows the bars to fall from the inclined plane into the receiving channels of the said clamping devices.

Yet in said preferred embodiment, the bed has an upper plane with conveying chains directed transversally to the longitudinal direction of the channel, for feeding the bars pushed by the pushing plate towards a position for discharging on the clamping devices. A further preferred feature of this embodiment lies in that said bottom wall of the channel structure can be inclined transversally downwardly on the side opposite to that facing forwardly in the direction of thrust of the said pushing plate, for discharging the cut bars which are not to be bent and/or any waste material resulting from the cutting operation.

Preferably, each of the said clamping devices has a pair of jaws which are separately movable on guides directed transversally to the longitudinal direction of the bed, said guides being carried by a slide which is vertically slidably mounted on the structure of the respective bending machine which is movable along the bed or, in the case of said third clamping device, on the respective supporting structure, which is also movable along the bed.

Further features and advantages of the invention will become apparent from the description which follows with reference to the annexed drawings, given purely by way of non limiting example, in which:

figure 1 is a diagrammatic perspective view of a preferred embodiment of the apparatus according to the invention,

figure 2 is a cross-sectional view of the apparatus of figure 1, in a plane perpendicular to the longitudinal direction of the apparatus,

figure 3 is a view at an enlarged scale of the detail indicated by arrow III in figure 2,

figure 4 is a perspective view partially in cross-section of the detail of figure 3,

figure 5 is a perspective view at an enlarged scale and further in cross-section of the detail of figure 4,

figure 6 is a perspective view at different angle of view of the detail of figure 5, and

figure 7 is an elevational side view of the detail shown in figures 3-6.

With reference to figures 1, 2, numeral 1 generally

designates an apparatus for cutting and shaping bars for reinforced concrete, comprising an elongated bed 2 at one end of which there is associated a cutting head 3. The details of the cutting head 3 are not described and shown herein, since they can be made in any known way and since this details, taken alone, do not fall within the scope of the present invention and also because their elimination from the drawings renders the latter simpler and easier to understand. According to a technique known *per se*, the cutting head 3 is provided with means for feeding a plurality of parallel steel bars 4 on the bed 2. The device according to the invention enables a number of cut bars to be loaded simultaneously on the bending machines, in a fully automatic manner, i.e. without requiring any manual intervention and keeping the bars perfectly aligned, so as to enable simultaneous bending thereof at a later stage. The bars 4 advance above the bed 2 within a channel structure 5 (which will be described in detail in the following) by a length corresponding to the desired cutting length, whereupon they are locked and undergo a cutting operation by the cutting head 3. Figures 3-6 show the channel structure 5 which receives the bars to be shaped in detail. With reference in particular to figure 3, bars 4 are received within a channel defined by a bottom wall 6 and two side vertical walls 7. The walls 7 are movable vertically and simultaneously between a lowered position (shown in figure 3) in which they are close to the bottom wall 6 and define therealong the channel 8 for receiving the bars 4, and a raised position. Both the bottom wall 6, and the side walls 7 extend throughout the whole length of bed 2. The walls 7 are guided in their movement between two parallel and spaced apart vertical walls 9 which form part of two longitudinal beams 10 also extending throughout the whole length of bed 2 and rigidly connected to the fixed structure of the bed. As clearly shown in figures 4, 5, the two vertical walls 7 are rigidly connected to each other at each end by a plate 11 (see figure 5) and each have a plurality of slanted slots 12 (only one of which is visible in the drawings) each engaged by a transverse horizontal pin 13 which is fixed in position, since it is rigidly connected to a respective longitudinal beam 10. The structure constituted by the two vertical walls 7 is movable in a horizontal direction parallel to the longitudinal direction of the bed by means of a fluid cylinder 14, pivotally connected at its ends to the head plate 11 connecting the two plates 7 as well as to a support 15 forming part of the fixed structure of bed 2 (see figure 4). By activating the cylinder 14 a longitudinal movement of plates 7 is caused and, as a result of the engagement of slots 12 on the fixed transverse pins 13, also a simultaneous vertical movement of the plates 7 between said lowered position and said raised position is obtained. The above described kinematic linkage ensures a proper and uniform movement of plates 7 throughout the whole length of the bed by simple and inexpensive means.

Yet with reference to figure 3, between the two said

walls 7 there is vertically movable a pressing horizontal plate 16 extending throughout the whole length of the bed which is rigidly connected to an upper vertical plate 17, parallel to the longitudinal direction of the bed and defining along with plate 16 an upturned T-shaped cross-section. With reference also to figures 4, 5, plate 17 has a plurality of slanted slots 18 (only one of which is visible in the drawings), each engaged by a transverse horizontal pin 19 which is fixed in position, since it is rigidly connected to the vertical wall 9 of one of the two longitudinal beams 10. Due to the engagement of each slot 12 on the respective fixed pin 19, a longitudinal movement of plate 17 causes a simultaneous vertical movement thereof. This movement is driven by a fluid cylinder 20 whose ends are respectively articulated to a fixed support 21 and plate 17, as shown in figure 4. Cylinder 20 enables the pressing horizontal plate 16 to be moved downwardly, starting from the raised position, so as to arrange the bars 4 which are fed within channel 8, when the side walls 7 are in their lowered position, in a single plane, clamping the bars while the cutting operation is carried out. Yet with reference to figure 3, between an upper horizontal wall 22 of bed 2 and a horizontal wall 23 forming part of one of the longitudinal beams 10 there is slidably mounted a pushing horizontal plate 24, extending throughout the whole length of the bed. Plate 24 is therefore movable in a transverse horizontal direction relative to the longitudinal direction of the bed. The pushing plate 24 has a plurality of slanted slots 25, only one of which is visible in the drawings, each engaged by a vertical pin 26. This pin is carried at the bottom by a prismatic body 27 attached to a stem 28 of a fluid cylinder 29. The pin 26 is further guided within a slot 30 formed in the fixed wall 23 along a direction parallel to the longitudinal direction of the bed. Activation of cylinder 29 thus causes a movement of pin 26 in the longitudinal direction of the bed, within the guiding slot 30 and a resulting transverse movement of the pushing plate 24 due to the engagement of the slanted slot 25 on pin 26. The pushing plate 24 is used for pushing the bars 4, after that they have been cut, rightwardly, with reference to figure 3, following a raising movement of the pressing plate 16 and side walls 7. After that the side walls have been raised, the pushing plate 24 is free to come in contact at one of its longitudinal edges against the bars 4 feeding them on a chain conveyor bed 31 comprising a plurality of chains 32 directed transversally with respect to the longitudinal direction of the bed and which receive the bars from channel 8 (see figure 2) and feed them towards a discharging post 33 (figure 2) in which they can be discharged on clamping devices provided on the bending machines with which the apparatus is provided and which will be illustrated in detail in the following. With reference in particular to figure 2, at its front edge, the chain bed 31 has an inclined portion 34 along which the bars 4 may slide until they rest against a plurality of levers 35 which normally are in the raised position

shown by dotted lines in figure 2. Each lever 35 can be retracted downwardly by means of a driving cylinder 36 to let the bars free to fall downwardly from the inclined plane 33, to undergo the operations which will be described in detail in the following. According to a technique known for example from the cited European patent application EP-A-0 648 577, the apparatus has two bending machines 36 which are both guided, independently from each other, on longitudinal guides 37 provided alongside the bed 2. The movements of each bending machine 36 along the bed are controlled by electric motors which are on board the machine and which are controlled on their turn by a computer according to a predetermined program in order to move the machines 36 in sequence to the various portions of the bars to be bent, with a technique for example described in the above mentioned European patent application. The details of construction of each bending machine 36 are not illustrated herein since they can be made also in the way known from the said European patent application. It is to be noted that each bending machine comprises an upper motorized rotatable disc 38 having a central pin for abutment of the bars and a bending offset pin. The structure of each machine 36 further supports a clamping device 38 (see figure 2) comprising a pair of jaws 39 movable independently from each other on guides 40 carried by a slide 41 slidably mounted on guides 42 formed on the support structure 36. The movement of the two jaws 34 is obtained for example by engagement of two screws within two nuts carried by said jaws, the rotation of said screws being driven by two electric motors 43 by belt transmissions 44. Due to the above described structure, the jaws 39 are able to move towards and away from each other in order to define an upwardly opened channel for receiving the bars and for clamping the bars within this channel, said jaws being also able to move simultaneously on the respective guides to displace the bars along the transverse direction with respect to the longitudinal direction of the bed. Due to the possibility of moving the slide 41 in a vertical direction and moving the machine 36 in the longitudinal direction, it is thus possible that the bars 4, be displaced in space as desired after that they have been received superimposed on each other, in a vertical plane parallel to the longitudinal direction of the bed, within the receiving channels of the clamping devices 38 of the two bending machines 36. In particular, once the bars have been received by the clamping devices 38, they can be transported by these devices and deposited on the rotating discs 36a of the bending machines 36 and held in this position while the bending operation is carried out. According to a technique known per se from the previous European patent application which has been mentioned above, these bending takes place according to a predetermined program, under the control of a computer which attends to activating the movement of machines 36 along the bed and the rotation of the bending discs in order to provide the var-

ious bends required in the bar. When shaping has been carried out, the same clamping devices 38 may attend to discharging the bar on the storing plane in front of the bed. With reference to figure 1, between the two bending machines 36, there is arranged a further structure 5 45 carrying a clamping device 38 provided exactly as illustrated in figure 2 with reference to a bending machine 36. This clamping device serves for supporting the bars at a position intermediate between their ends. Differently from what has been illustrated in the previous 10 European patent application which has been described above, also structure 45 carrying the central clamping device is movable with respect to the bed 2 in the longitudinal direction of the latter. Therefore, when a group of bars is clamped by the clamping devices 38 of the two 15 bending machines 36 and the central structure 45, it can be translated longitudinally by a simultaneous movement in the longitudinal direction of the two machines 36 and the structure 45. This is useful for example, once shaping has been carried out, for discharging the group 20 of shaped bars at different areas of the discharging plane, for example to group together at different areas bars having different shapes obtained in different working cycles of the apparatus. Yet with reference to figures 2 and 5, 6, the bottom wall 6 of channel 8 is defined by a lever 46 which is pivotally mounted around a longitudinal 25 axis 47 and can be inclined laterally downwardly by means of a cylinder 48 (see figure 3) on the side opposite to that facing the direction of the active stroke of the pushing plate 24, i.e. that facing towards the discharging post 33. In this manner the cut bars which are not to be shaped, or any waste material from the cutting operation, can be discharged on the rear side of bed 2 (figure 2).

From the foregoing description, it is clearly apparent that the apparatus according to the invention enables the operation for transferring the bars from the receiving channel 8 to the discharging post 33 in a particularly efficient and reliable manner, with extremely 35 simple and inexpensive means. The provision of the central clamping device 38 on a structure 45 which is also movable longitudinally gives the possibility of discharging the various type of bars at different areas of the storing plane. 40

Naturally, while the principle of the invention 45 remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention. 50

Claims

1. Apparatus for shaping steel bars (4), particularly bars for reinforcing concrete, comprising:

- an elongated bed (2) having a supporting structure at the top thereof,

- means for feeding a plurality of bars (4) on the supporting structure,
- a first and a second bending machines (36) both movable independently from each other in the longitudinal direction of said bed (2) adjacent to one side thereof, each bending machine having a bending device with a motorized rotatable horizontal disc (36a) having a central abutment pin and a bending offset pin,
- said bending machines further carrying respective movable clamping devices (38) having bar receiving channels (39a) which can be opened upwardly, for receiving the bars (4) coming from said supporting structure and holding them superimposed in a vertical plane parallel to the longitudinal direction of the bed (2), above the discs (36a) of the bending machines (36) as well as for depositing the bars (4) on a storing plane, a third clamping device (38) being provided on the bed (2) at a position intermediate between the two bending machines (36),
- means for controlling movement of the two bending machines (36) along the bed and for activating the respective bending devices according to a predetermined sequence, for shaping the bars (4) as desired,

characterized in that said supporting structure which receives the bars (4) to be shaped is a substantially channel-shaped structure extending along said bed (2), having a horizontal bottom wall (6) and two vertical side walls (7) which are movable between a lowered position adjacent to the bottom wall (6), in which they define said bar receiving channel (8) along with the bottom wall (6) and a raised position, in that said apparatus comprises a pressing horizontal plate (16) elongated in the longitudinal direction of the channel (8) and movable vertically between the two side walls (7), for pressing downwardly the bars (4) resting on the bottom wall (6), so as to hold them all in a same plane, and a pushing horizontal plate (24), also elongated in the longitudinal direction of the channel (8) and movable horizontally above said bottom wall (6) in a transverse direction with respect to the longitudinal direction of the bars (4), in the raised condition of the side walls (7), for feeding the bars (4) towards a discharging position, in which they can be discharged over said clamping devices (38) for being deposited on the bending machines.

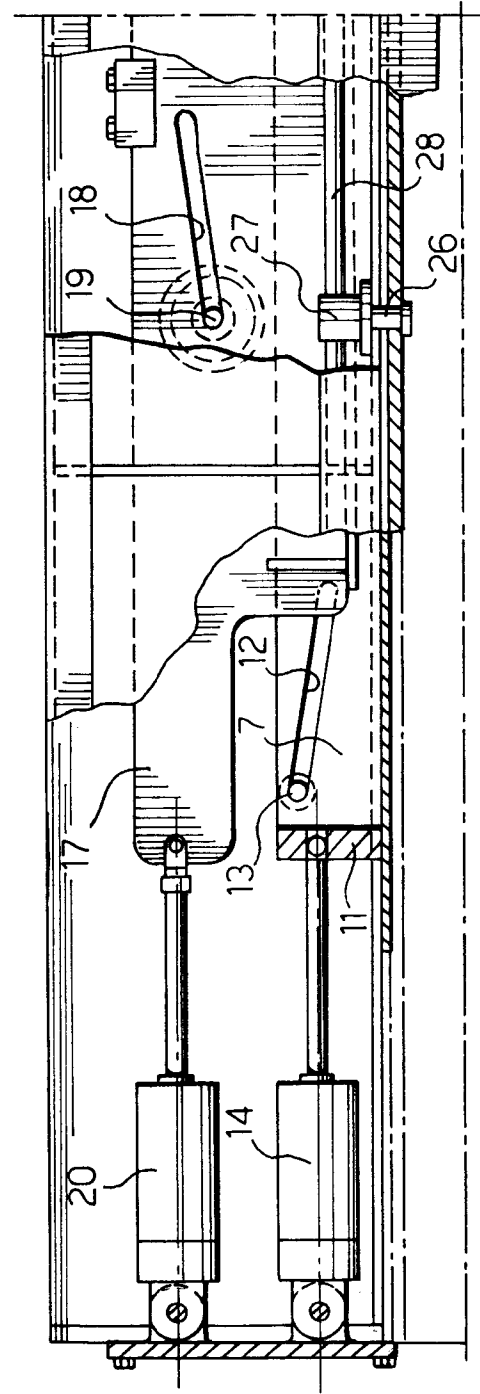
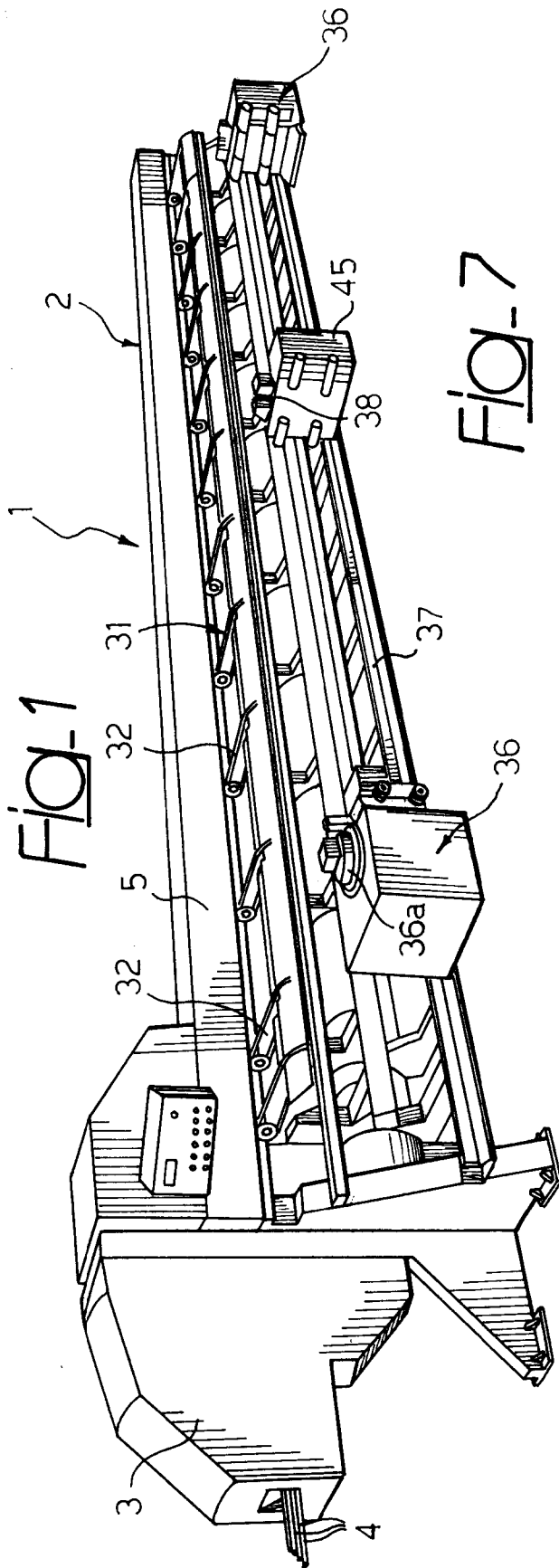
2. Apparatus according to claim 1, characterized in that means are provided for feeding the bars (4) on the supporting structure of the bed (2), comprising a cutting head (3) associated with one end of the

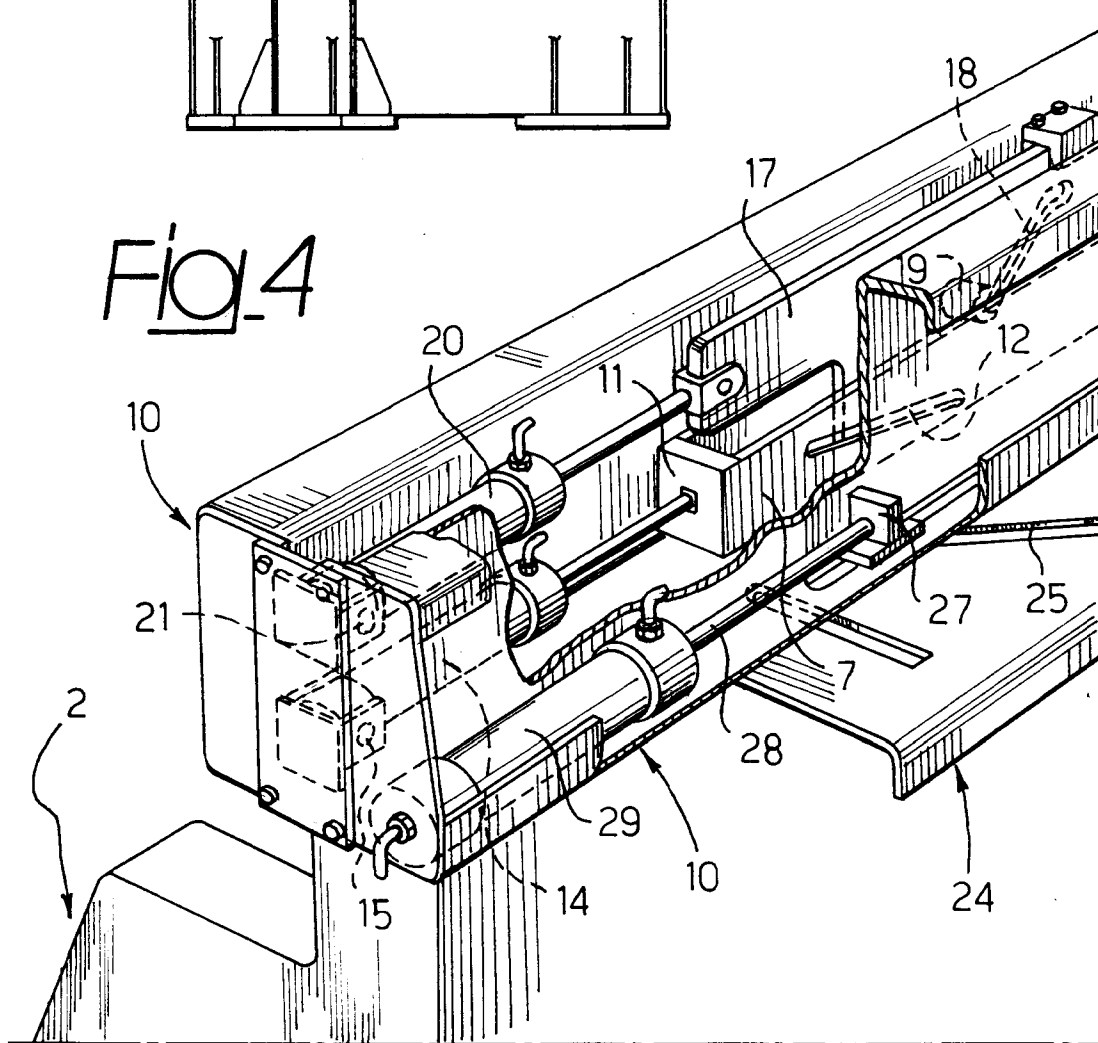
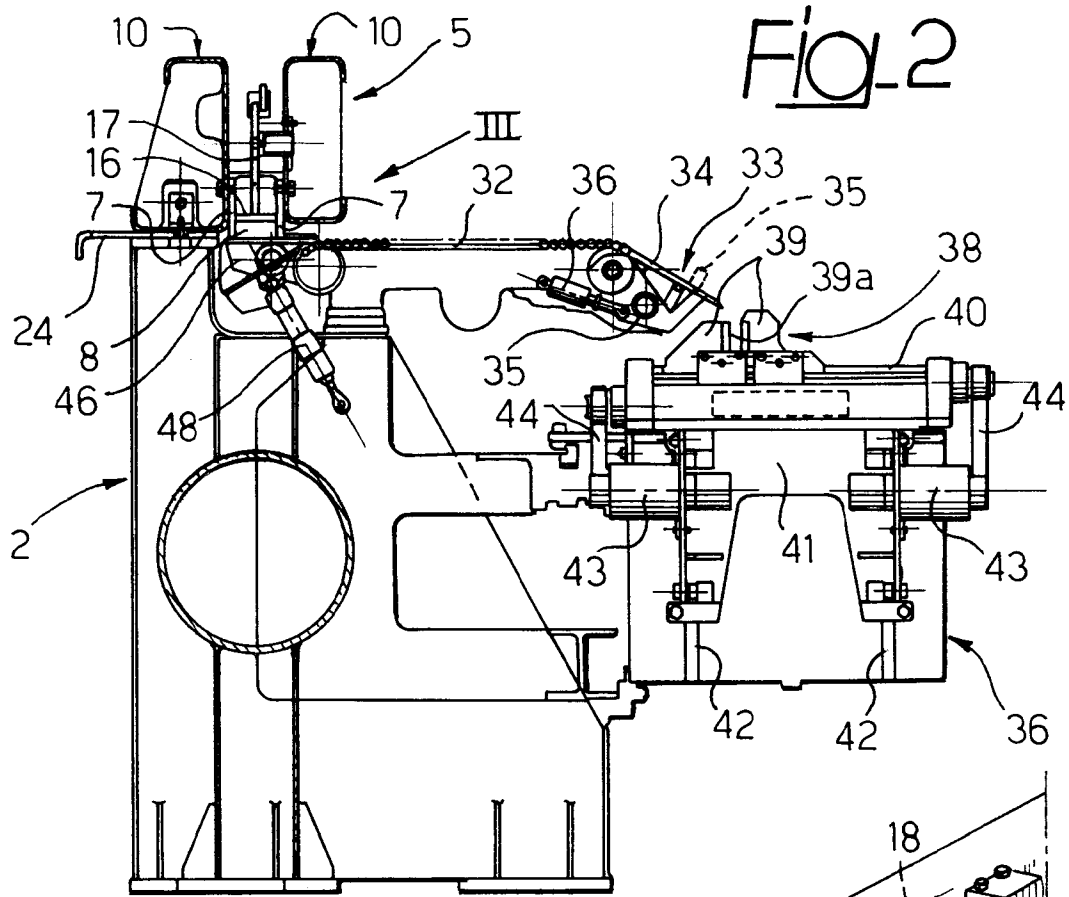
bed (2) and able to cut the bars (4) after that they have been received within said channel (8) and clamped by means of said pressing plate (16).

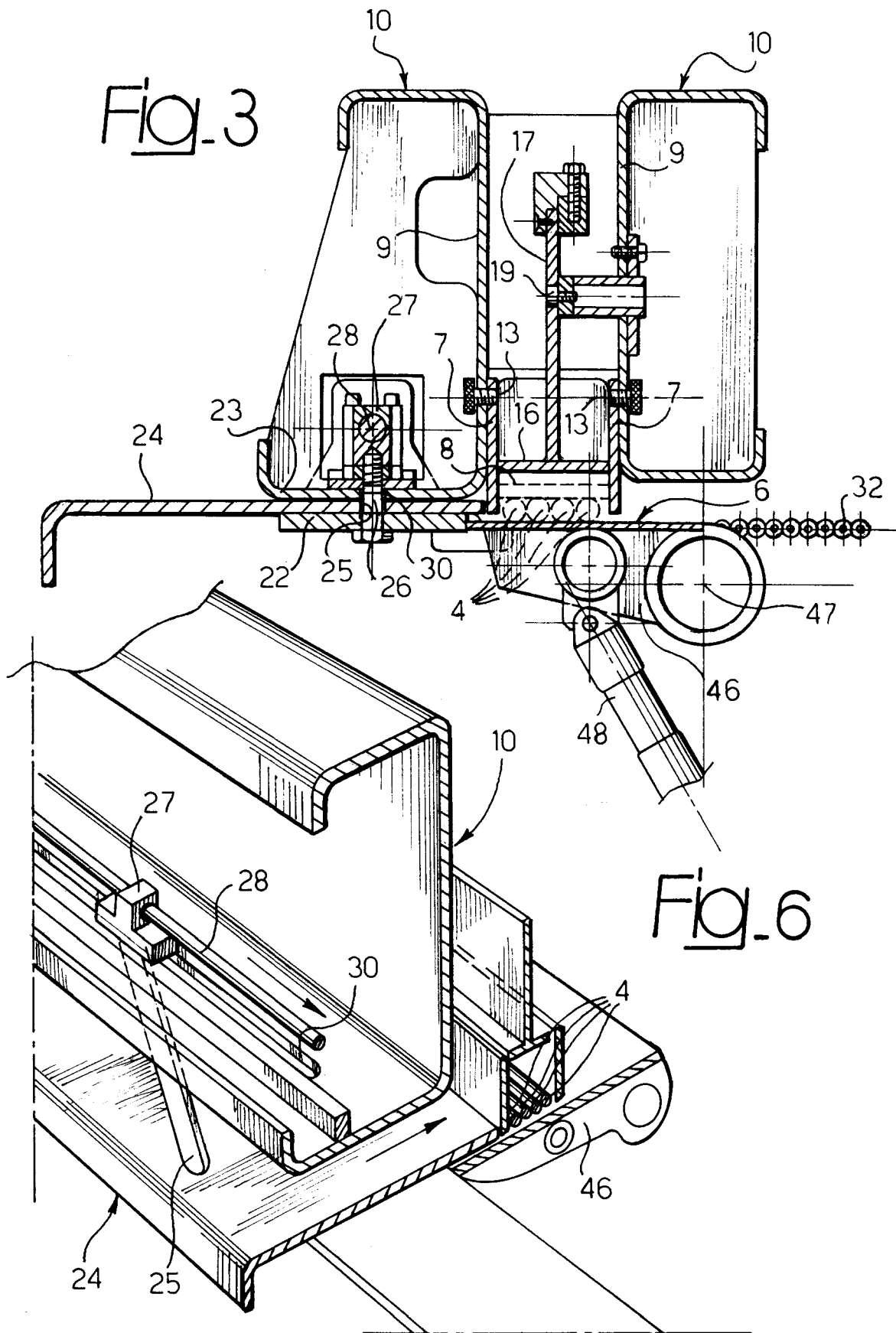
3. Apparatus according to claim 1, characterized in that said side walls (7) are rigidly connected to each other and each have one or more slanted slots (12) each engaged by a respective horizontal pin (13) transverse relative to the longitudinal direction of the channel, each pin (13) being attached to the fixed structure of the bed so that a horizontal movement of said side walls (7) in the longitudinal direction of the channel (8) causes a simultaneous vertical movement thereof. 5
4. Apparatus according to claim 1, characterized in that said pressing horizontal plate (16) is rigidly connected to a vertical upper plate (17) parallel to the longitudinal direction of the channel (8), having one or more slanted slots (18) each engaged by a respective horizontal pin (19) transverse relative to the longitudinal direction of the channel (8) each pin (19) being attached to the fixed structure of the bed (2) so that a horizontal movement of said vertical plate (17) in the longitudinal direction of the channel (8) causes a simultaneous vertical movement thereof. 10
5. Apparatus according to claim 1, characterized in that said pushing horizontal plate (24) has one or more slanted slots (25) each engaged by a respective vertical pin (26) which further engages a guiding slot (30) parallel to the longitudinal direction of the channel (8) formed in the fixed structure of the bed (2), so that a movement of said vertical pin (26) along said guiding longitudinal slot (30) causes a simultaneous transverse horizontal movement of the pushing plate (25). 15
6. Apparatus according to claim 2 or 3 or 4, characterized in that said horizontal movement is driven by means of a fluid cylinder. 20
7. Apparatus according to claim 1, characterized in that said third clamping device (38) provided at an intermediate position between the two bending machines (36) is carried by a structure movable in the longitudinal direction of the bed (2) so that the three clamping devices (38) are able to move simultaneously for depositing the bent bars (4) at different areas of the storing plane. 25
8. Apparatus according to claim 1, characterized in that said bar discharging position towards which the bars (4) are pushed by said pushing plate (24) is defined by at least one stop lever (35) positioned at the end of an inclined plane (33) on which the bars are fed, said lever (35) being retractable to a posi- 30

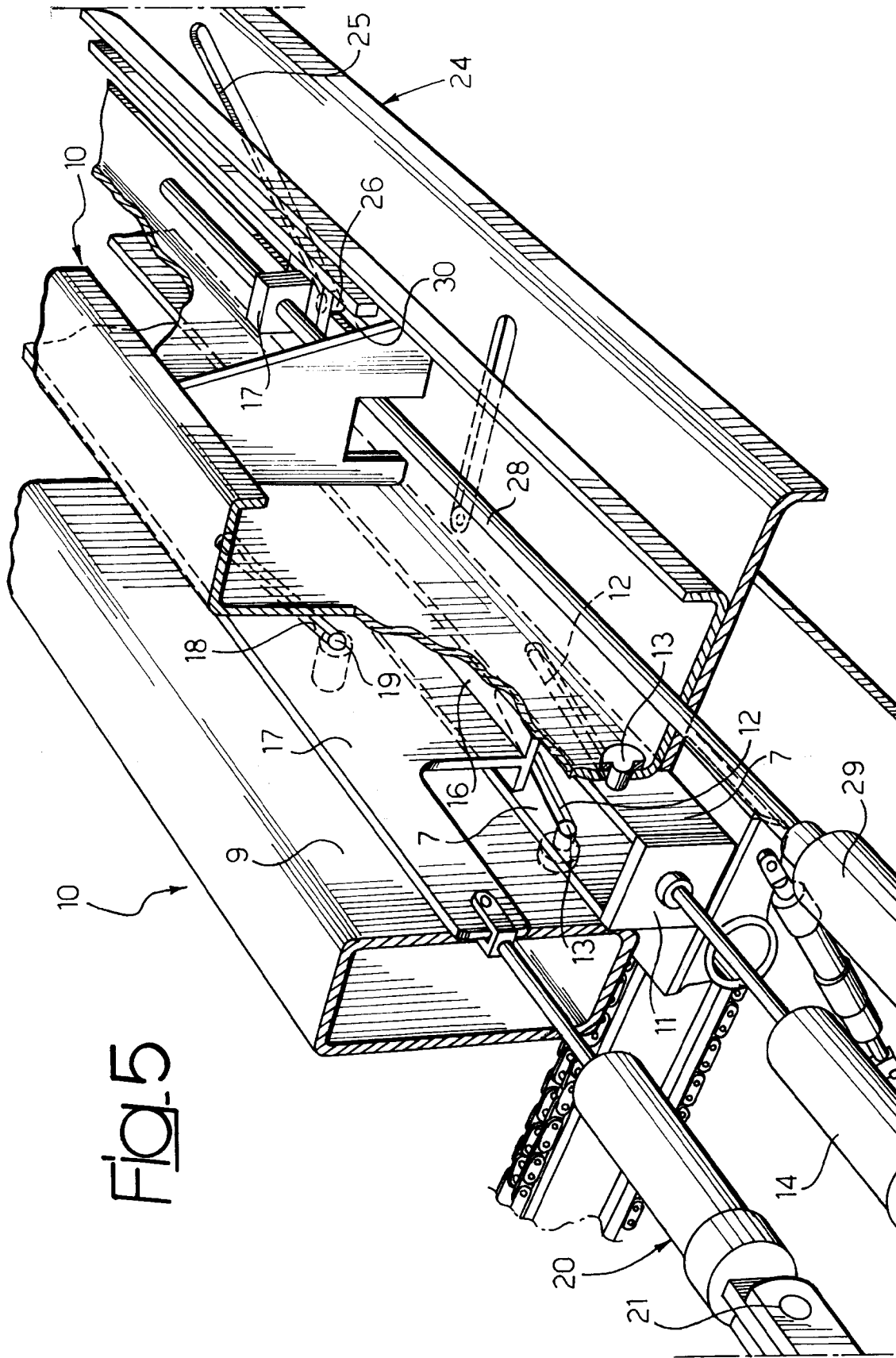
tion in which it enables the bars (4) to fall from the inclined plane within the bar receiving channels of said clamping devices (38).

9. Apparatus according to claim 8, characterized in that the bed (2) has an upper plane (31) with conveyor chains (32) directed transversally to the longitudinal direction of the channel (8), for feeding the bars (4) pushed by said pushing plate (24) towards said position (33) for discharging the bars on the clamping devices (38). 35
10. Apparatus according to claim 1, characterized in that said bottom wall (6) of the channel structure (8) can be inclined transversally downwardly on the side opposite to that facing in the pushing direction of the said pushing plate (24), for discharging the cut bars (4) which are not to be bent and/or any waste material resulted from the cutting operation. 40
11. Apparatus according to claim 7, characterized in that each of said clamping devices (38) has a pair of jaws (39) movable separately on guides directed transversally to the longitudinal direction of the bed (2), said guides being carried by a slide (41) which is vertically slidably mounted on the structure of the respective bending machine (36) which is movable along the bed (2) or, in the case of the third clamping device (38) on the respective supporting structure (45), which is also movable along the bed. 45











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EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0472

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	EP 0 648 577 A (OSCAM S.P.A.) 19 April 1995 * the whole document * ---	1-11	B21D43/00 B21D43/28 B21D11/12
A	US 4 339 861 A (KAJIMA CORPORATION) 20 July 1982 * the whole document * ---	1	
A	US 4 732 066 A (S.A.E. SRL SOCIETA AUTOMATISMI ELETTRONICI) 22 March 1988 * the whole document * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B21D
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 22 January 1998	Examiner Vinci, V
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