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(54) BENDING MACHINE FOR BENDING METAL BARS, SUCH AS ROUND PIECES FOR REINFORCEMENT OR SUCHLIKE

BIEGEMASCHINE ZUM BIEGEN VON METALLSTANGEN, WIE RUNDTEILE ZUR VERSTÄRKUNG ODER DERGLEICHEN

MACHINE DE CINTRAGE DESTINÉE À CINTRER DES BARRES MÉTALLIQUES, TELLES QUE DES PIÈCES RONDES DE RENFORT OU SIMILAIRES

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a machine for bending metal bars, such as for example round pieces for reinforcement, structural shapes, tubes or other profiles with any section shape.

[0002] In particular, the machine according to the present invention allows to bend both ends of the metal bar, with bending angles of 180° or more, and can be used both to bend a single bar at a time and two or more overlapping bars and shaped at the same time.

BACKGROUND OF THE INVENTION

[0003] A machine for bending metal bars is known, comprising a first movement device to move the bars, or lead drawing device, a bending device and a second movement device to move the bars, or tail drawing device, disposed downstream of the bending device and suitable to move the bar forward/backward once this is not being gripped by the first movement device.

[0004] A shearing to size device, or shears, is interposed between the first movement device and the bending device to shear the bar to size.

[0005] In particular, when making a shaped profile having a desired shape, the first movement device feeds the bars toward the bending device along a direction of feed and on a determinate feed plane.

[0006] The bending device normally comprises a bending mandrel, with a substantial disc shape and provided, in proximity to its axis of rotation, with a contrast element of a substantially cylindrical shape and around which the bar is bent.

[0007] The mandrel also comprises, in proximity to its periphery, a bending pin, also substantially cylindrical, which, when the mandrel rotates in one direction or the other, bends the bar around the contrast pin.

[0008] One disadvantage of this machine is that, if the bent segment of the bar has a rather large extension, this interferes with the devices disposed nearby, upstream and/or downstream of the bending device, thus deforming the bent bar and often not allowing to obtain particular figures or shapes. Such devices are normally the shears, the first or the second movement device, contrast elements etc.

[0009] However the movement devices are also needed during the execution of the bends to maintain the bar gripped when it is bent, so that it does not slip.

[0010] To partly overcome this drawback, the devices disposed in proximity to the bending device have been provided with protection elements conformed as an inclined plane which, when the bar is bent, divert it to prevent it from jamming against them.

[0011] This solution, although it prevents problems of interference with the devices, generates structural shapes which are not coplanar and therefore of a low quality.

[0012] To overcome these disadvantages it is also known to translate the bending device and the movement device which feeds the bar to the bending device, with respect to the feeding plane in order to prevent the bar from interfering with other devices.

[0013] In this case the disadvantage of interference remains, however, for bars which are bent at an obtuse angle with respect to each other and/or which have very long extensions of the bending sides.

[0014] In particular, for these operations, it is provided to feed the bar completely toward the second movement device and, with the latter, feed the bar to the bending device, making the bar retreat in an inverse direction with respect to the direction of the first feed.

[0015] Subsequently, the rolls of the second movement device are kept gripping on the bar and the bending is carried out. When the bending angle has very high values, near to 180°, the bent segment interferes with the second movement device which keeps the bar gripping, and in particular at least with one of the pairs of rolls disposed on the side where the bending is carried out, not allowing the execution of substantially U-shaped bends, or the execution of shaped profiles which are adequately coplanar.

[0016] Document WO 2005/061144 A1 describes a bending device for metal bars having a first drawing unit upstream of the bending device and a second drawing unit downstream of the bending device, wherein contrast grippers are interposed between each drawing unit and the bending device. Both the drawing units and the contrast grippers can assume a first operating position above the work plane and a second retractable position of non-interference below the work plane. However, WO'144 does not provide that only a part of the contrast grippers, or only a part of the movement device, can move from one or the other of the positions so as to allow the execution of the bends even at 180° and guaranteeing that the bar being worked is supported.

[0017] One purpose of the present invention is to achieve a machine for bending bars which allows to obtain a final product shaped substantially flat whatever its shape or size, starting from bars subjected to bending.

[0018] Another purpose of the present invention is to achieve a bending machine which is simple to make and limited in size.

[0019] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0020] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0021] In accordance with the above purposes, a ma-

chine for bending metal bars, such as round pieces for reinforcement or suchlike, comprises a first movement device and a second movement device suitable to move, along a work plane, at least one bar toward a bending device interposed between the first and the second movement device.

[0022] The bending device comprises a rotating mandrel, provided peripherally with a bending pin and centrally with a contrast member around which a first segment of the bar is suitable to be bent on each occasion so as to obtain the shaped profile having the final desired shape.

[0023] The second movement device can be selectively positioned in a first condition, protruding with respect to the work plane, in which it is suitable to move the bar toward the bending device and to hold at least momentarily a second segment of the bar during bending, and in a second condition in which it is disposed completely under the work plane and not interfering with the movements of the bar.

[0024] According to a first feature of the invention, the machine also comprises at least a mobile pin disposed downstream of the bending device and suitable to selectively assume at least a retracted non-operating position under the work plane and not interfering with the movements of the bar, and an operating position protruding with respect to the work plane in which it is suitable to support and contrast the movement of the second segment of the bar, that is, the one not being bent, when the second movement device is in the second condition, that is, completely retracted under the work plane, and when the first segment of the bar, that is, the one being bent, is bent or at least its bending is completed.

[0025] The second protruding operating position of the pin is in fact temporally and functionally coordinated to the second retracted condition under the work plane of the second movement device.

[0026] The presence of the mobile pin which is selectively activated, located on the opposite side to that of the first segment of the bar which is being bent, allows the second movement device to disappear below the work plane, thus rendering it non-interfering with the execution and/or the completion of the bending of the bar; this allows to execute bends with bending angles having values of about 180°, that is, substantially U-shaped bars and with substantially coplanar bending sides. Moreover, since it supports the second segment of bar which is not being bent, the mobile pin prevents the bar from moving or rotating around the contrast member, altering the position, along the longitudinal extension, in which the bar is bent.

[0027] According to one form of embodiment, the mobile pin is disposed between the bending device and the second movement device, advantageously in a position near that of the bending device, in order to reduce the effects of localized deformation due to the action of contrast which is achieved by the bending pin during bending.

[0028] According to another feature, actuation means are associated to the mobile pin and are suitable to selectively move it into the operating and non-operating condition on the command of a central control unit.

[0029] According to one form of embodiment, the mobile pin is associated to the second movement device, and its movement occurs independently from the movement of the second movement device with respect to the work plane of the machine.

[0030] In a preferential form of embodiment, it is possible to provide that, between the bending device and the second movement device, there are clamping means interposed, which can be selectively positioned between an operating position and a position in which they are retracted under the plane. In the operating condition they are suitable to constrain the sliding of the bar along its longitudinal extension, and therefore allow bends to be made in positions which are very precise along the extension of the bar.

[0031] According to another form of embodiment, alternative to or integrated with the previous one, the action to contrast and support the second segment of the bar, during the completion of bends of up to 180°, is carried out by one or more elements of the second movement device which, during use, are disposed on the side where the bending is carried out.

[0032] In another form of embodiment, the action to contrast and support the second segment of the bar can be carried out, or also carried out, by parts of the clamping means.

[0033] More in particular, the second movement device, and/or the clamping means if present, each comprise at least a first and a second element, opposite each other with respect to the axis of feed of the bar and between which the bar is made to advance, and the second segment of the bar is possibly held during bending.

[0034] From the first operating condition assumed by the second movement device and/or by the clamping means, the first element or elements are selectively movable, transverse to the work plane of the bars, in order to move them under the work plane and in a position of non-interference with the first segment of the bar which is bent, while the second element or elements remain external or protruding from the work plane in order to support and contrast the movement of the second segment of the bar.

[0035] By first and second element we also mean units composed of two or more elements opposite each other with respect to the axis of feed of the bar.

[0036] Therefore it is possible to provide that the contrasting action is carried out in cooperation both by parts of the second movement device and also by parts of the clamping means, or alternatively by only one of these, whereas the other, either the first or the second element, is taken completely under the work plane.

[0037] According to one feature of this form of embodiment, the first element comprises at least a first roll and the second element comprises at least a second roll, which are associated respectively with a first and a sec-

ond frame. When set up, the first and the second frame are associated to respective first and second actuation means which allow the autonomous and reciprocally independent movement thereof with respect to the work plane.

[0038] The present invention also concerns a method for bending metal bars, such as round pieces for reinforcement or suchlike. In particular the method comprises a step of feeding a bar along a work plane and toward a bending device by means of a first movement device or a second movement device, disposed respectively one upstream and the other downstream of the bending device, and a step of bending the bar carried out by the bending device.

[0039] According to one feature of the method, when the first segment of the bar which is being bent begins to interfere with the second movement device, a mobile pin, disposed downstream of the bending device, is moved from its non-operating position, retracted under the work plane, into an operating position, protruding with respect to the work plane, to support and contrast the movement of the second segment of the bar in order to complete the bending of the first segment of the bar, and the second movement device is taken under the work plane and in a position of non-interference with the movements/bending of the bar.

[0040] If the action to support and contrast the bar is carried out by an element of the second movement device and/or possibly by the clamping means, instead of, or together with the mobile pin, when the first segment of the bar begins to interfere with the second movement device, the first element/elements located on the bending side is/are moved transverse to the work plane of the bars and with respect to the second element/elements, in order to take them into a position of non-interference with the first segment of the bar which is being bent, while the second element/elements supports/support and contrasts/contrast the movement of the second segment of the bar during the bending, or the completion of the bending, of the first segment of the bar.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic plan view of a bending machine according to the present invention;
- fig. 2 is a partial view in section of fig. 1;
- fig. 3 is a partial view in section of a variant of fig. 2;
- figs. 4 - 9 are schematic views of the machine in fig. 1 in different operating configurations;
- fig. 10 shows a variant of a detail of fig. 2;
- fig. 11 shows another variant of a detail of fig. 2.

[0042] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one form of embodiment can conveniently be incorporated into other forms of embodiment without further clarifications.

DETAILED DESCRIPTION OF SOME PREFERENTIAL FORMS OF EMBODIMENT

[0043] With reference to the attached drawings, a machine for bending metal bars B is denoted in its entirety by the reference number 10 and comprises a first movement device 11, or lead drawing device, to draw a bar B toward a bending device 12, a second movement device 13, or tail drawing device, substantially aligned with the first, and disposed downstream with respect to the bending device 12, and a shears 15 to shear to size the bar B fed by the first movement device 11 which is disposed downstream with respect to the latter.

[0044] The first movement device 11 (fig. 1), of a substantially known type, comprises motorized rolls 16 which receive the bar B from feed means, not shown in the drawings, which in turn pick up the bars, either from a bundle of bars or directly from a coil.

[0045] The first movement device 11 is suitable to make the bar B advance along a direction of feed D toward the bending device 12, and on a work plane P (fig. 2) for working the bars B.

[0046] The shears 15 (fig. 1) is suitable to shear the bar B to a desired predetermined length and is disposed substantially on a plane coinciding with the work plane P of the bars B.

[0047] The bending device 12 (figs. 1 and 2) comprises a rotating mandrel 20 conformed substantially as a disk and provided on its periphery, solid therewith, a bending pin 21, substantially cylindrical in shape, which extends orthogonal with respect to the rotating mandrel 20.

[0048] The bending device 12 also comprises a contrast pin 22, solidly associated with the rotating mandrel 20, in proximity to its center of rotation and around which the bar B is bent.

[0049] Motor members 23 are also associated with the rotating mandrel 20, in a known manner, and are suitable to rotate the latter around its axis, and first translation means 25, in this case an actuator suitable to translate the rotating mandrel 20 along its axis of rotation and with respect to the work plane P of the bar B, to take the bending device 12 to a first, second and third position, in which the latter is disposed respectively on the same plane, on a lower plane, or on an upper plane with respect to the work plane P of the bars B.

[0050] The rotating mandrel 20 is associated with a support plane 41 which is selectively movable by means of a linear actuator 42 which is suitable to move the rotating mandrel 20 to position the contrast pin 22 substantially tangent to the bar B that is fed. In the case shown in fig. 1 the contrast pin 22 is positioned under the bar B

to execute bending, of both the leading and tail end, downward. In the same way (fig. 7), by positioning the contrast pin 22 above the bar B, it is possible to execute bending, of both the leading and tail end, upward.

[0051] The second movement device 13 in this case comprises a pair of motorized rolls 27, and a pair of contrast rolls 29 selectively translatable toward the pair of motorized rolls 27 by means of actuators 30 which act substantially in a transverse direction with respect to the direction of feed D.

[0052] Both the motorized rolls 27 and the contrast rolls 29 are mounted on respective supports associated with a protective and supporting casing 39.

[0053] The pair of motorized rolls 27is selectively rotatable, in a known manner, by means of motor means 31 to make the bar B advance or retreat from or toward the bending device 12.

[0054] The second movement device 13 is selectively translatable orthogonal to the work plane P by means of second translation means 32, to take respectively the rolls 27 and 29 completely under the work plane P, or to a position where the second device 13 does not interfere with the bar B which is being bent, as shown in fig. 2, or into a position substantially aligned with that of the work plane P of the bar B and where the rolls 27 and 29 are suitable to draw the bar from or toward the bending device 12, or into another, super-elevated position suitable to make the bar B available to the bending device 12 when the latter is in its third position, that is, super-elevated with respect to the work plane P.

[0055] In the form of embodiment shown in fig. 2, an element to support and contrast the bar B is associated with the second movement device 13; in this case, the element is a support pin 33 which is selectively moved by an actuator 35 to take it selectively to a protruding position with respect to the work plane P of the bar B, or to a retracted position where it does not interfere with the movements of the bar B.

[0056] In particular, the protruding position with respect to the work plane of the bar B is also obtained if the second movement device 13 is completely under the work plane P of the bar B.

[0057] More specifically, the function of the support pin 33, during the bending of the bar B, is to support and contrast the bar B.

[0058] In another form of embodiment (fig. 3), instead of being associated with the second movement device 13, and therefore being selectively moved with it, the support pin 33 and the corresponding actuator 35 are attached to a fixed part 40 of the machine, that is, a plane substantially coinciding with the work plane P of the bar B.

[0059] This solution allows to dispose the support pin 33 in a position very close to the bending device 12, allowing to obtain bent bars even with very limited end extensions. Furthermore, disposing the support pin 33 in a position very close to the bending device 12 reduces the bulging effect of the bar that occurs between the contrast pin 22 and support pin 33 during the bending action.

[0060] In both cases, the support pin 33 is disposed laterally to the direction of feed D of the bar B and in such a manner that it is also peripherally aligned with the motorized rolls 27.

[0061] Near the zone where the bar B enters the second movement device 12, clamping means 37 are disposed, in a known manner, which during the bending of the bar B are selectively activated to keep the bar B clamped and to prevent it from sliding, which would modify the position of the bend.

[0062] The work plane P of the bar B, that is, the work plane of the machine 10, is advantageously inclined to allow the bar, once it is bent and no longer supported, to be conveyed to a zone where the bent articles are discharged.

[0063] The machine 10 according to the present invention functions as follows.

[0064] The bar B is fed forward by the first feed device 11 toward the bending device 12 for a length equal to the overall extension of the bent bar to be obtained. In this position, both the bending device 12 and the second movement device 13 are disposed completely under the work plane of the bar B, so as to be disposed in a position that does not interfere with the advancing bar.

[0065] Subsequently, the bar B is sheared to size by the shears 15 (fig. 4) and both the bending device 12 and the second movement device 13 are raised by means of the respective first 25 and second translation means 32, to be disposed on a plane coinciding with the work plane P (fig. 5).

[0066] In this condition the bar B is interposed between the pair of motorized rolls 27 and the pair of contrast rolls 29, which in turn are translated by the actuators 30 against the motorized rolls 27, to keep the bar B clamped between them.

[0067] Subsequently, both the bending device 12 and the second movement device 13 are further translated vertically to be taken, in coordination, to a super-elevated position with respect to the work plane P of the bars B. In this condition, it is possible to bend even very long bars B, preventing problems of interference with the first movement device 11 or with the bending device 12.

[0068] In this condition, by means of the motorized rolls 27, the second movement device 13 again translates the bar B toward the first movement device 11, but still raised with respect to the latter, for a length substantially equal to the position where the bend is to be obtained.

[0069] When the bar B has its portion that is to be bent disposed near the contrast pin 22, the clamping means 37 are activated, which clamp the bar B in such position and allow it to be subsequently bent by rotation of the rotating mandrel 20. In particular, the bending pin 21, going into contact with the bar B, forces the latter to wind around the contrast pin 22 to obtain the desired bending.

[0070] The rotating mandrel 20 is rotated to a position where a first segment of the bar B is in a position near to, or nearly interfering with, the second movement device 13, that is, with the casing 39 that supports the con-

trast rolls 29.

[0071] In this position, the support pin 33 is taken to a protruding position with respect to the plane on which the rolls 27 and 29 lie, the clamping means 37, which had been gripping a second segment of the bar B, release their grip on the latter, the actuators 30 distance the contrast rolls 29 from the motorized rolls 27, and the second translation means 32 translate the second movement device 13 to a retracted position under the work plane P.

[0072] The second segment of the bar B therefore remains constrained in three points of contact, that is, with the contrast pin 22, the bending pin 21, and laterally to the bend, with the support pin 33.

[0073] In this condition the rotating mandrel 20 is driven, rotating it further to bend the first segment of the bar B substantially by an angle of 180° around the contrast pin 22, without any constraints connected to interference with the contrast rolls 29 of the second movement device 13.

[0074] During this step, the support pin 33 contrasts the bending action exerted by the bending pin 21, and allows the correct execution of the bend.

[0075] Subsequently, both the bending device 12 and the support pin 33 are lowered, leaving the bar B free on the work plane of the machine, which, being slightly inclined, discharges the latter toward a collection zone of the bent articles.

[0076] It is clear that modifications and/or additions of parts may be made to the bending machine as described heretofore, without departing from the field and scope of the present invention.

[0077] For example (fig. 10), in another form of embodiment, instead of using a support pin 33, the function of support and contrast during the bending of the bar B may be carried out by the motorized rolls 27, by selective translation of the group of contrast rolls 29 only, which are taken to a condition of non-interference.

[0078] More specifically, the motorized rolls 27 are mounted on a first frame 51, provided with a first guide 52 disposed vertically and facing toward the contrast rolls 29.

[0079] Along the first guide 52 a second frame 53 is slidingly disposed, provided with a second guide 55, disposed horizontal and along which a support element 56 of the contrast rolls 29 is made to slide, in order to take them closer to/away from the motorized rolls 27.

[0080] The second frame 53 is displaced vertically along the first guide 52 by means of a first actuator 57, whereas the horizontal translation of the support element 56 along the second guide 55 is achieved by a second actuator 58.

[0081] Both the first frame 51 and the second frame 53 are moved in a group vertically by means of the second translation means 32.

[0082] More specifically, during the bending step, when the bar B is in a position of interference with the casing 39 supporting the contrast rolls 29 (fig. 7), the latter are translated vertically downward along the first guide 52 to take them completely under the bulk defined by the motorized rolls 27, and hence into a position of non-interference in order to bend the bar B.

[0083] During the step when the bending is being completed, the motorized rolls 27 remain protruding with respect to the work plane of the machine, to define a contrast with the bending action itself.

[0084] In another form of embodiment (fig. 11), the function of supporting and contrasting the bar B during the bending step is carried out by the clamping means 37, which in this particular case are made as a separate element with respect to the second movement device 13.

[0085] In this form of embodiment, the clamping means 37 comprise a first gripping part 65 and a second contrasting part 66 which, in normal use, acts as an abutment element of the bar B when the first part 65 is moved against the second part and thus clamps the translation of the bar B during the bending steps.

[0086] More specifically, the second part 66 is provided with a first guide 69 disposed vertically and facing toward the first part 65 on which a support frame 70 of the first part 65 is slidingly associated. The support frame 70 is provided with a second guide 71, disposed horizontal, along which the first part 65 is made to slide in order to take it closer to/away from the second part 66.

[0087] The support frame 70 is displaced vertically along the first guide 69 by means of a first actuator 72, whereas the horizontal translation of the first part 65 along the second guide 71 is achieved by a second actuator 73.

[0088] Both the first part 66 and the frame 70 are moved in a group vertically by means of translation means 75.

[0089] In particular, during the feed and bending steps of the bar B, both the first part 65 and the second part 66 are disposed substantially facing, coplanar with respect to each other, and protruding from the work plane P, in order to constrain the movement of the bar B during the bending steps.

[0090] When the bar B, in the bending step, begins to interfere with the casing 39 of the second movement device 19, the first part 65 of the clamping means 37 moves under the work plane P, leaving the second part 66 protruding.

[0091] The second movement device 13 is taken under the work plane P and the second part 66 acts as a contrast to the second segment of bar to complete the bending of the first segment.

[0092] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of bending machine, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Machine for bending metal bars, such as round pieces for reinforcement or suchlike, comprising a first movement device (11) and a second movement device (13) both suitable to move, along a work plane (P), at least one bar (B) toward a bending device (12) interposed between said first (11) and second movement device (13), the bending device (12) comprising a rotating mandrel (20) provided peripherally with a bending pin (21) and centrally with a contrast member (22) around which a first segment of said bar (B) is suitable to be bent, clamping means (37) possibly being present, suitable to constrain the sliding of said bar (B) along its longitudinal extension during bending, said second movement device (13) being selectively positionable in a first condition, protruding with respect to the work plane (P), in which it is suitable at least to move said bar (B) toward said bending device (12) and in a second condition in which it is disposed completely under said work plane (P) and not interfering with the movements of said bar (B), **characterized in that** it comprises at least a mobile pin (33) disposed downstream of said bending device (12) and suitable to assume at least a retracted non-operating position under said work plane (P) and not interfering with the movements of the bar (B), and an operating position protruding with respect to said work plane (P) in which it is suitable to support and contrast the movement of a second segment of the bar (B), said second protruding operating position of said pin (33) being temporally and functionally coordinated to the second retracted condition under the work plane (P) of said second movement device (13), so that said second segment of the bar (B) is supported by said pin (33).

2. Machine as in claim 1, **characterized in that** said mobile pin (33) is disposed between said bending device (12) and said second movement device (13);

3. Machine as in claim 2, **characterized in that** actuator means (35) are associated with said mobile pin (33) and are suitable to move it to said operating position and non-operating position.

4. Machine as in any claim hereinbefore, **characterized in that** said mobile pin (33) is associated with said second movement device (13).

5. Machine for bending metal bars, such as round pieces for reinforcement or suchlike, comprising a first movement device (11) and a second movement device (13) both suitable to move, along a work plane (P), at least one bar (B) toward a bending device (12) interposed between said first (11) and second movement device (13) and comprising a rotating mandrel (20) provided peripherally with a bending pin (21) and centrally with a contrast member (22) around which a first segment of said bar (B) is able to be bent, clamping means (37) being possibly present, suitable to constrain the sliding of said bar (B) along its longitudinal extension during bending, said second movement device (13) and/or said clamping means (37), if present, being selectively positionable in a first condition, protruding with respect to the work plane (P), in order to move and/or retain a second segment of said bar (B) at least momentarily during bending, and in a second condition in which they are disposed completely under said work plane (P) and not interfering with the movements of said bar (B) and wherein said second movement device (13) and/or said clamping means (37), if present, comprise at least a first element (29; 65) and a second element (27; 66), opposite each other, and between which said bar (B) is suitable to advance, and said second segment of the bar (B) may possibly be held, **characterized in that** in said first condition of the second movement device (13) and/or the clamping means (37), said first elements (29; 65) are able to assume a position under the work plane (P) of the bars (B), so as to move into a position of non-interference with the first segment of the bar (B) being bent, temporally and functionally coordinated to a second condition of said second elements (27; 66) protruding from the work plane (P) so as to support and contrast the movement of said second segment of the bar (B), so that said second segment of the bar (B) is supported by said second elements (27; 66).

6. Machine as in claim 5, **characterized in that** said first element of the second movement device (13) comprises at least a first roll (29) and said second element of the second movement device (13) comprises at least a second roll (27), said first roll (29) and said second roll (27) being associated respectively with a first (53) and a second frame (51) which, when installed, are associated with respective first actuation means (57) and second actuation means (32) suitable to move said first roll (29) and said second roll (27) in an autonomous and reciprocally independent manner with respect to the work plane (P).

7. Machine as in claim 5 or 6, **characterized in that** said first element of the clamping means (37) comprises a gripping part (65) and said second element of the clamping means (37) comprises a contrast part (66), movement means (72, 73) being associated to said gripping part (65) and said contrast part (66), and being suitable to move said gripping part (65) and said contrast part (66) in an autonomous and reciprocally independent manner.

8. Method for bending metal bars, such as round pieces

for reinforcement or suchlike, comprising a step of feeding a bar (B) along a work plane (P) and toward a bending device (12) by means of a first movement device (11) or a second movement device (13), disposed respectively one upstream and the other downstream of the bending device (12), and a step of bending said bar (B) performed with said bending device (12), wherein said bending device (12) comprises a rotating mandrel (20) provided peripherally with a bending pin (21) and with a contrast member (22) around which a first segment of said bar (B) is bent by means of said bending pin (21), and wherein, during said bending step, the second movement device (13) at least momentarily retains and constrains the rotation of a second segment of the bar (B), **characterized in that** in said bending step, when said first segment of the bar (B) begins to interfere with said second movement device (13), a mobile pin (33), disposed downstream of the bending device (12), is moved from its non-operating position, retracted under the work plane (P), to an operating position protruding with respect to the work plane (P), and supports and contrasts the movement of the second segment of the bar (B) so that the bending of the first segment of the bar (B) is completed, and in direct temporal and functional correlation said second movement device (13) is moved below the work plane (P) and in a position of non-interference with the movements/bending of the bar (B).

9. Method for bending metal bars, such as round pieces for reinforcement or suchlike, comprising a step of feeding a bar (B) along a work plane (P) and toward a bending device (12) by means of a first movement device (11) or a second movement device (13), disposed respectively one upstream and the other downstream of the bending device (12), and a step of bending said bar (B) performed with said bending device (12), wherein said bending device (12) comprises a rotating mandrel (20) provided peripherally with a bending pin (21) and with a contrast member (22) around which a first segment of said bar (B) is bent by means of said bending pin (21), and clamping means (37) possibly being present, suitable to constrain the sliding of the bar (B) along its longitudinal extension during bending, wherein, during said bending step, the second movement device (13) at least momentarily retains and constrains the rotation of a second segment of the bar (B), and wherein said second movement device (13) and/or said clamping means (37), if present, comprise at least a first element (29; 65) and a second element (27; 66), opposite each other, and between which the bar (B) is made to advance and the second segment of the bar (B) may possibly be held, **characterized in that** when said first segment of the bar (B) begins to interfere with said second movement device (13), the first element (29; 65) is translated transverse to the work plane (P) of the bars (B) and with respect to the second element (27; 66), so as to move into a position of non-interference with the first segment of the bar (B) being bent, while the second element (27; 66) remains protruding with respect to the work plane (P) to support and contrast the movement of the second segment of the bar (B) during bending or while the bending of the first segment of the bar (B) is being completed.

Patentansprüche

1. Maschine zum Biegen von Metallstangen, wie runden Stücken zur Verstärkung oder dergleichen, umfassend eine erste Bewegungsvorrichtung (11) und eine zweite Bewegungsvorrichtung (13), die jeweils dafür geeignet sind, wenigstens eine Stange (B) entlang einer Arbeitsebene (P) zu einer Biegevorrichtung (12) zu bewegen, die zwischen der ersten (11) und der zweiten Bewegungsvorrichtung (13) angeordnet ist, wobei die Biegevorrichtung (12) eine Drehspindel (20) umfasst, die am Umfang mit einem Biegestift (21) und mittig mit einem Gegenelement (22) versehen ist, um welches ein erstes Segment der Stange (B) gebogen werden kann, wobei gegebenenfalls eine Klemmeinrichtung (37) vorhanden ist, die dazu geeignet ist, das Gleiten der Stange (B) entlang ihrer Längserstreckung während des Biegens einzuschränken, wobei die zweite Bewegungsvorrichtung (13) selektiv in einen ersten Zustand positionierbar ist, der in Bezug auf die Arbeitsebene (P) vorsteht, in dem sie geeignet ist, die Stange (B) zumindest zur Biegevorrichtung (12) zu bewegen, und in einen zweiten Zustand positionierbar ist, in dem sie vollständig unter der Arbeitsebene (P) angeordnet ist und die Bewegungen der Stange (B) nicht behindert, **dadurch gekennzeichnet, dass** sie wenigstens einen mobilen Stift (33) umfasst, der der Biegevorrichtung (12) nachgelagert angeordnet und dazu geeignet ist, wenigstens eine zurückgezogene, nicht arbeitende Position unter der Arbeitsebene (P), in der er die Bewegungen der Stange (B) nicht behindert, und eine arbeitende Position einzunehmen, die in Bezug auf die Arbeitsebene (P) vorsteht, in der er geeignet ist, die Bewegung eines zweiten Segments der Stange (B) zu stützen und zu kontrastieren, wobei die zweite vorstehende Betriebsposition des Stifts (33) vorübergehend und funktionell dem zweiten zurückgezogenen Zustand unter der Arbeitsebene (P) der zweiten Bewegungsvorrichtung (13) zugeordnet ist, so dass das zweite Segment der Stange (B) von dem Stift (33) gestützt wird.

2. Maschine nach Anspruch 1, **dadurch gekennzeichnet, dass** der mobile Stift (33) zwischen der Biegevorrichtung (12) und der zweiten Bewegungsvorrichtung (13) angeordnet ist.

3. Maschine nach Anspruch 2, **dadurch gekennzeichnet, dass** dem mobilen Stift (33) Betätigungsmittel (35) zugeordnet sind, die dafür geeignet sind, diesen in die arbeitende Position und in die nicht arbeitende Position zu bewegen.

4. Maschine nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der mobile Stift (33) der zweiten Bewegungsvorrichtung (13) zugeordnet ist.

5. Maschine zum Biegen von Metallstangen, wie runden Stücken zur Verstärkung oder dergleichen, umfassend eine erste Bewegungsvorrichtung (11) und eine zweite Bewegungsvorrichtung (13), die jeweils geeignet sind, wenigstens eine Stange (B) entlang einer Arbeitsebene (P) zu einer Biegevorrichtung (12) zu bewegen, die zwischen der ersten (11) und der zweiten Bewegungsvorrichtung (13) angeordnet ist, und umfassend eine Drehspindel (20), die am Umfang mit einem Biegestift (21) und mittig mit einem Gegenelement (22) versehen ist, um welches ein erstes Segment der Stange (B) gebogen werden kann, wobei gegebenenfalls eine Klemmeinrichtung (37) vorhanden ist, die dazu geeignet ist, während des Biegens das Gleiten der Stange (B) entlang ihrer Längserstreckung einzuschränken, wobei die zweite Bewegungsvorrichtung (13) und/oder die Klemmeinrichtung (37), falls vorhanden, selektiv positionierbar sind in einen ersten Zustand, der in Bezug auf die Arbeitsebene (P) vorsteht, um ein zweites Segment der Stange (B) zumindest vorübergehend während des Biegens zu bewegen und/oder zu halten, und in einen zweiten Zustand, in welchem diese vollständig unter der Arbeitsebene (P) angeordnet sind und die Bewegungen der Stange (B) nicht behindern, und wobei die zweite Bewegungsvorrichtung (13) und/oder die Klemmeinrichtung (37), falls vorhanden, wenigstens ein erstes Element (29; 65) und ein zweites Element (27; 66) einander gegenüberliegend umfassen, und zwischen welchen die Stange (B) geeignet ist, sich vorwärts zu bewegen, und das zweite Segment der Stange (B) gegebenenfalls gehalten werden kann, **dadurch gekennzeichnet, dass** in dem ersten Zustand der zweiten Bewegungsvorrichtung (13) und/oder der Klemmeinrichtung (37) die ersten Elemente (29; 65) in der Lage sind, eine Position unter der Arbeitsebene (P) der Stangen (B) einzunehmen, um sich in eine Position zu bewegen, in der das erste Segment der Stange (B), die gebogen wird, nicht behindert wird, die vorübergehend und funktionell mit einem zweiten Zustand der zweiten Elemente (27; 66) koordiniert ist, die von der Arbeitsebene (P) vorstehen, um die Bewegung des zweiten Segments der Stange (B) zu stützen und zu kontrastieren, so dass das zweite Segment der Stange (B) von den zweiten Elementen (27; 66) gestützt wird.

6. Maschine nach Anspruch 5, **dadurch gekennzeichnet, dass** das erste Element der zweiten Bewegungsvorrichtung (13) wenigstens eine erste Walze (29) und das zweite Element der zweiten Bewegungsvorrichtung (13) wenigstens eine zweite Walze (27) umfasst, wobei die erste Walze (29) und die zweite Walze (27) jeweils einem ersten (53) und einem zweiten Rahmen (51) zugeordnet sind, die im eingebauten Zustand jeweiligen ersten Betätigungsmitteln (57) und zweiten Betätigungsmitteln (32) zugeordnet sind, die geeignet sind, die erste Walze (29) und die zweite Walze (27) in autonomer und voneinander unabhängiger Weise in Bezug auf die Arbeitsebene (P) zu bewegen.

7. Maschine nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** das erste Element der Klemmeinrichtung (37) einen Greifteil (65) und das zweite Element der Klemmeinrichtung (37) einen Kontrastteil (66) umfasst, wobei dem Greifteil (65) und dem Kontrastteil (66) Bewegungsmittel (72, 73) zugeordnet sind, die dafür geeignet sind, den Greifteil (65) und den Kontrastteil (66) in autonomer und voneinander unabhängiger Weise zu bewegen.

8. Verfahren zum Biegen von Metallstangen, wie runden Stücken zur Verstärkung oder dergleichen, umfassend einen Schritt des Zuführens einer Stange (B) entlang einer Arbeitsebene (P) und zu einer Biegevorrichtung (12) durch eine erste Bewegungsvorrichtung (11) oder eine zweite Bewegungsvorrichtung (13), wobei jeweils eine der Biegevorrichtung (12) vorgelagert und die andere der Biegevorrichtung (12) nachgelagert angeordnet sind, und einen Schritt des Biegens der Stange (B), der mit der Biegevorrichtung (12) ausgeführt wird, wobei die Biegevorrichtung (12) eine Drehspindel (20) umfasst, die am Umfang mit einem Biegestift (21) und mit einem Gegenelement (22) versehen ist, um welches ein erstes Segment der Stange (B) mittels des Biegestifts (21) gebogen wird, und wobei die zweite Bewegungsvorrichtung (13) während des Biegeschritts zumindest vorübergehend die Drehung eines zweiten Segments der Stange (B) hält und einschränkt, **dadurch gekennzeichnet, dass** in dem Biegeschritt, wenn das erste Segment der Stange (B) beginnt, mit der zweiten Bewegungsvorrichtung (13) in Eingriff zu gelangen, ein mobiler Stift (33), der der Biegevorrichtung (12) nachgelagert angeordnet ist, von seiner nicht arbeitenden Position, die unter der Arbeitsebene (P) eingezogen ist, in eine arbeitende Position bewegt wird, die in Bezug auf die Arbeitsebene (P) vorsteht und die Bewegung des zweiten Segments der Stange (B) stützt und kontrastiert, so dass das Biegen des ersten Segments der Stange (B) vervollständigt wird, und in direkter temporaler und funktioneller Korrelation die zweite Bewegungsvorrichtung (13) unter die Arbeitsebene (P) und in

eine Position, in der sie die Bewegungen / das Biegen der Stange (B) nicht behindert, bewegt wird.

9. Verfahren zum Biegen von Metallstangen, wie runden Stücken zur Verstärkung oder dergleichen, umfassend einen Schritt des Zuführens einer Stange (B) entlang einer Arbeitsebene (P) und zu einer Biegevorrichtung (12) durch eine erste Bewegungsvorrichtung (11) oder eine zweite Bewegungsvorrichtung (13), wobei jeweils eine der Biegevorrichtung (12) vorgelagert und die andere der Biegevorrichtung (12) nachgelagert angeordnet sind, und einen Schritt des Biegens der Stange (B), der mit der Biegevorrichtung (12) ausgeführt wird, wobei die Biegevorrichtung (12) eine Drehspindel (20), die am Umfang mit einem Biegestift (21) und mit einem Gegenelement (22) versehen ist, um welches ein erstes Segment der Stange (B) mittels des Biegestifts (21) gebogen wird, und eine Klemmeinrichtung (37) aufweist, die gegebenenfalls vorhanden und dafür geeignet ist, das Gleiten der Stange (B) entlang ihrer Längserstreckung während des Biegens einzuschränken, wobei während des Biegeschritts die zweite Bewegungsvorrichtung (13) zumindest vorübergehend die Drehung eines zweiten Segments der Stange (B) hält und einschränkt, und wobei die zweite Bewegungsvorrichtung (13) und/oder die Klemmeinrichtung (37), falls vorhanden, wenigstens ein erstes Element (29; 65) und ein zweites Element (27; 66) einander gegenüberliegend umfassen, und zwischen welchen die Stange (B) vorwärts bewegt wird und das zweite Segment der Stange (B) gegebenenfalls gehalten werden kann, **dadurch gekennzeichnet, dass**, wenn das erste Segment der Stange (B) beginnt, mit der zweiten Bewegungsvorrichtung (13) in Eingriff zu gelangen, das erste Element (29; 65) quer zur Arbeitsebene (P) der Stangen (B) und in Bezug auf das zweite Element (27; 66) verschoben wird, um es in eine Position des Nichteingriffs mit dem ersten Segment der Stange (B), die gerade gebogen wird, zu bewegen, während das zweite Element (27; 66) in Bezug auf die Arbeitsebene (P) vorstehend bleibt, um die Bewegung des zweiten Segments der Stange (B), während des Biegens oder während das Biegen des ersten Segments der Stange (B) vollendet wird, zu stützen und zu kontrastieren.

Revendications

1. Machine destinée à cintrer des barres métalliques, telles que des pièces rondes de renfort ou similaires, comprenant un premier dispositif de déplacement (11) et un second dispositif de déplacement (13), les deux dispositifs étant aptes à déplacer le long d'une surface de travail (P) au moins une barre (B) en direction d'un dispositif de cintrage (12) intercalé entre lesdits premier (11) et second (13) dispositifs de déplacement, le dispositif de cintrage (12) comprenant un mandrin rotatif (20) pourvu à sa périphérie d'une goupille de cintrage (21) et au centre d'un élément de contraste (22) autour duquel un premier segment de ladite barre (B) peut être cintré, des moyens de serrage (37) étant éventuellement présents, conçus pour limiter le coulissement de ladite barre (B) le long de son étendue longitudinale pendant le cintrage, ledit second dispositif de déplacement (13) pouvant être sélectivement positionné dans un premier état, faisant saillie par rapport à la surface de travail (P), dans lequel il est apte au moins à déplacer ladite barre (B) en direction dudit dispositif de cintrage (12) et dans un second état dans lequel il est entièrement disposé au-dessous de la surface de travail (P) et ne gêne pas les mouvements de la barre (B), **caractérisée en ce qu'**elle comprend au moins une goupille mobile (33) disposée en aval dudit dispositif de cintrage (12) et apte à assumer au moins une position rétractée de non-fonctionnement au-dessous ladite surface de travail (P) et ne gênant pas les mouvements de la barre (B), et une position de fonctionnement faisant saillie par rapport à ladite surface de travail (P) dans laquelle elle est apte à soutenir et contraster le déplacement d'un second segment de la barre (B), ladite seconde position de fonctionnement en saillie de ladite goupille (33) étant coordonnée temporellement et fonctionnellement avec le second état rétracté au-dessous de la surface de travail (P) dudit second dispositif de déplacement (13), de manière que ledit second segment de la barre (B) soit soutenu par ladite goupille (33).

2. Machine selon la revendication 1, **caractérisée en ce que** ladite goupille mobile (33) est située entre ledit dispositif de cintrage (12) et ledit second dispositif de déplacement (13).

3. Machine selon la revendication 2, **caractérisée en ce que** des moyens actionneurs (35) sont associés à ladite goupille mobile (33) et sont aptes à la déplacer jusqu'à ladite position de fonctionnement et à ladite position de non-fonctionnement.

4. Machine selon n'importe laquelle des revendications précédentes, **caractérisée en ce que** ladite goupille mobile (33) est associée audit second dispositif de déplacement (13).

5. Machine destinée à cintrer des barres métalliques, telles que des pièces rondes de renfort ou similaires, comprenant un premier dispositif de déplacement (11) et un second dispositif de déplacement (13), les deux dispositifs étant aptes à déplacer le long d'une surface de travail (P) au moins une barre (B) en direction d'un dispositif de cintrage (12) intercalé entre lesdits premier (11) et second (13) dispositifs de dé-

placement, et comprenant un mandrin rotatif (20) pourvu à sa périphérie d'une goupille de cintrage (21) et au centre d'un élément de contraste (22) autour duquel un premier segment de ladite barre (B) peut être cintré, des moyens de serrage (37) étant éventuellement présents, conçus pour limiter le coulissement de ladite barre (B) le long de son étendue longitudinale pendant le cintrage, ledit second dispositif de déplacement (13) et/ou lesdits moyens de serrage (37) éventuellement présents pouvant être sélectivement positionnés dans un premier état, faisant saillie par rapport à la surface de travail (P), pour déplacer et/ou retenir un second segment de ladite barre (B) au moins temporairement pendant le cintrage, et dans un second état dans lequel ils en sont entièrement disposés au-dessous de ladite surface de travail (P) et ne gênent pas les mouvements de ladite barre (B), et dans laquelle ledit second dispositif de déplacement (13) et/ou lesdits moyens de serrage (37) éventuellement présents comprennent au moins un premier élément (29 ; 65) et un second élément (27 ; 66) opposés, entre lesquels ladite barre (B) est apte à avancer, et ledit second segment de la barre (B) peut éventuellement être retenu, **caractérisée en ce que** dans ledit premier état du second dispositif de déplacement (13) et/ou des moyens de serrage (37) lesdits premiers éléments (29 ; 65) peuvent assumer une position au-dessous de la surface de travail (P) des barres (B), de manière à parvenir à une position où il ne gênent pas le premier segment de la barre (B) pendant le cintrage de celle-ci, coordonnée temporellement et fonctionnellement avec le second état desdits seconds éléments (27 ; 66) faisant saillie par rapport à la surface de travail (P) de manière a soutenir et contraster le mouvement dudit second segment de la barre (B), pour que ledit second segment de la barre (B) soit soutenu par lesdits seconds éléments (27 ; 66).

6. Machine selon la revendication 5, **caractérisée en ce que** ledit premier élément du second dispositif de déplacement (13) comprend au moins un premier rouleau (29) et ledit second élément du second dispositif de déplacement (13) comprend au moins un second rouleau (27), ledit premier rouleau (29) et ledit second rouleau (27) étant associés respectivement à un premier (53) et à un second (51) châssis associés respectivement, en état de fonctionnement, à de premiers moyens d'actionnement (57) et à de seconds moyens d'actionnement (32) aptes à déplacer ledit premier rouleau (29) et ledit second rouleau (27) d'une façon autonome et indépendante l'un de l'autre, par rapport à la surface de travail (P).

7. Machine selon la revendication 5 ou 6, **caractérisée en ce que** ledit premier élément des moyens de serrage (37) comprend une partie de saisie (65) et ledit second élément des moyens de serrage (37) comprend une partie de contraste (66), des moyens de déplacement (72, 73) étant associés à ladite partie de saisie (65) et à ladite partie de contraste (66), et étant aptes à déplacer ladite partie de saisie (65) et ladite partie de contraste (66) d'une façon autonome et indépendante l'une de l'autre.

8. Procédé de cintrage de barres métalliques, telles que des pièces rondes de renfort ou similaires, comportant une étape d'acheminement d'une barre (B) le long d'une surface de travail (P) et en direction d'un dispositif de cintrage (12) au moyen d'un premier dispositif de déplacement (11) ou d'un second dispositif de déplacement (13), situés respectivement l'un en amont et l'autre en aval du dispositif de cintrage (12), et une étape de cintrage de ladite barre (B), effectuée par ledit dispositif de cintrage (12), dans lequel ledit dispositif de cintrage (12) comprend un mandrin rotatif (20) pourvu à sa périphérie d'une goupille de cintrage (21) et d'un élément de contraste (22) autour duquel un premier segment de ladite barre (B) est cintré au moyen de ladite goupille de cintrage (21), et dans lequel, pendant ladite étape de cintrage, le second dispositif de déplacement (13) retient et contraint au moins temporairement la rotation d'un second segment de la barre (B), **caractérisé en ce que** dans ladite étape de cintrage, quand ledit premier segment de la barre (B) commence à gêner ledit second dispositif de déplacement (13), une goupille mobile (33), située en aval du dispositif de cintrage (12), est déplacée de sa position de non-fonctionnement, rétractée au-dessous de la surface de travail (P), à une positon de fonctionnement faisant saillie par rapport à la surface de travail (P), et soutient et contraste le mouvement du second segment de la barre (B) pour que le cintrage du premier segment de la barre (B) puisse s'achever, et en corrélation temporelle et fonctionnelle directe ledit second dispositif de déplacement (13) est déplacé au-dessus de la surface de travail (P) dans une position où il ne gêne pas les mouvements / le cintrage de la barre (B).

9. Procédé de cintrage de barres métalliques, telles que des pièces rondes de renfort ou similaires, comprenant une étape d'acheminement d'une barre (B) le long d'une surface de travail (P) et en direction d'un dispositif de cintrage (12) au moyen d'un premier dispositif de déplacement (11) ou d'un second dispositif de déplacement (13), situés respectivement l'un en amont et l'autre en aval du dispositif de cintrage (12), et une étape de cintrage de ladite barre (B), effectuée par ledit dispositif de cintrage (12), dans lequel ledit dispositif de cintrage (12) comprend un mandrin rotatif (20) pourvu à sa périphérie d'une goupille de cintrage (21) et d'un élément de contraste (22) autour duquel un premier segment de ladite bar-

re (B) est cintré au moyen de ladite goupille de cintrage (21), des moyens de serrage (37) étant éventuellement présents, conçus pour limiter le coulissement de ladite barre (B) le long de son étendue longitudinale pendant le cintrage, et dans lequel, pendant ladite étape de cintrage, le second dispositif de déplacement (13) retient et contraint au moins temporairement la rotation d'un second segment de la barre (B), et dans lequel ledit second dispositif de déplacement (13) et/ou lesdits moyens de serrage éventuellement présents comprennent au moins un premier élément (29 ; 65) et un second élément (27 ; 66) opposés, entre lesquels ladite barre (B) est apte à avancer, et ledit second segment de la barre (B) peut éventuellement être retenu, **caractérisé en ce que** quand ledit premier segment de la barre (B) commence à gêner ledit second dispositif de déplacement (13), le premier élément (29 ; 65) est translaté transversalement par rapport à la surface de travail (P) des barres (B) et par rapport au second élément (27 ; 66) de manière à parvenir à une position où il ne gêne pas le premier segment de la barre (B) pendant le cintrage de celle-ci, alors que le second élément (27 ; 66) reste en saillie par rapport à la surface de travail (P) pour soutenir et contraster le mouvement du second segment de la barre (B) pendant le cintrage ou pendant l'achèvement du cintrage du premier segment de la barre (B).

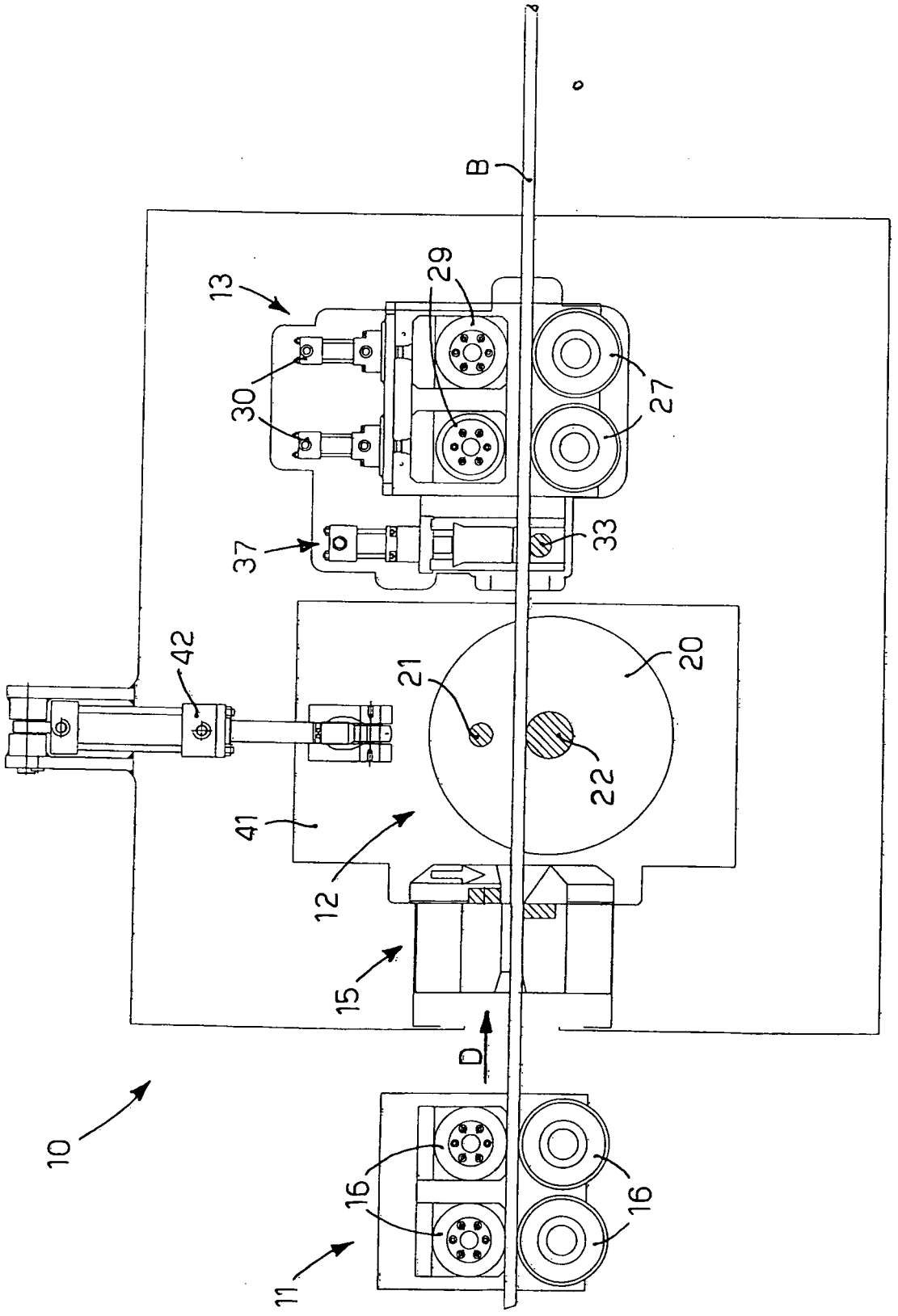

fig. 1

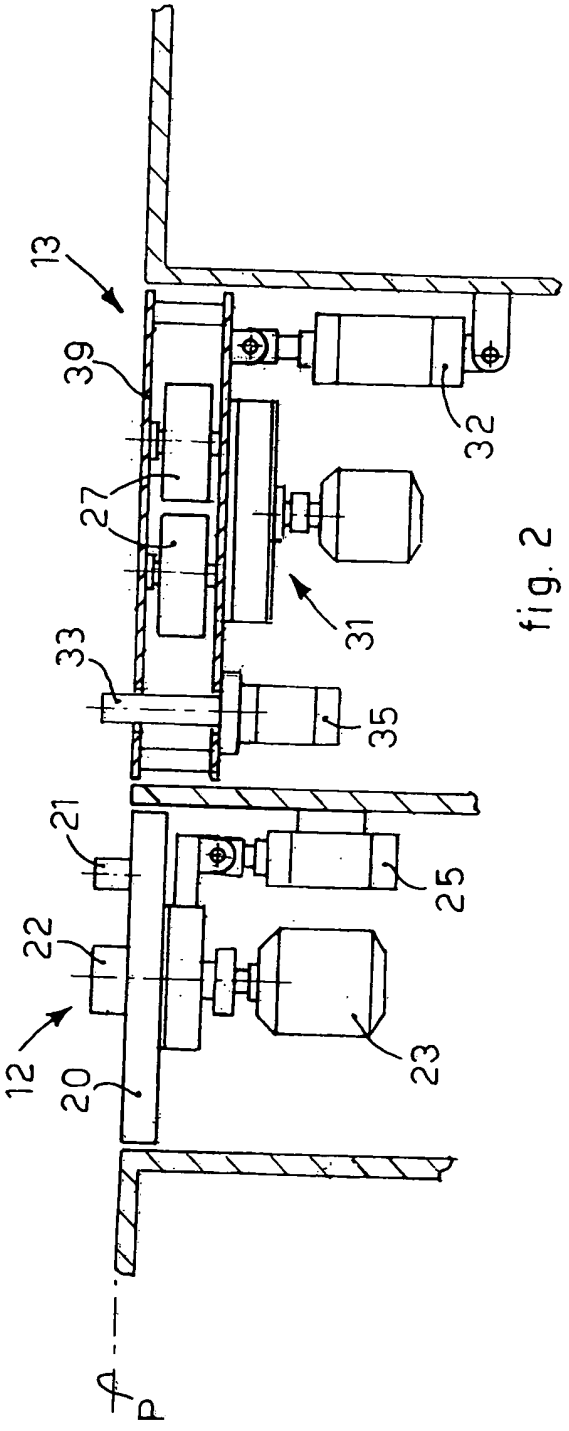
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fig. 2

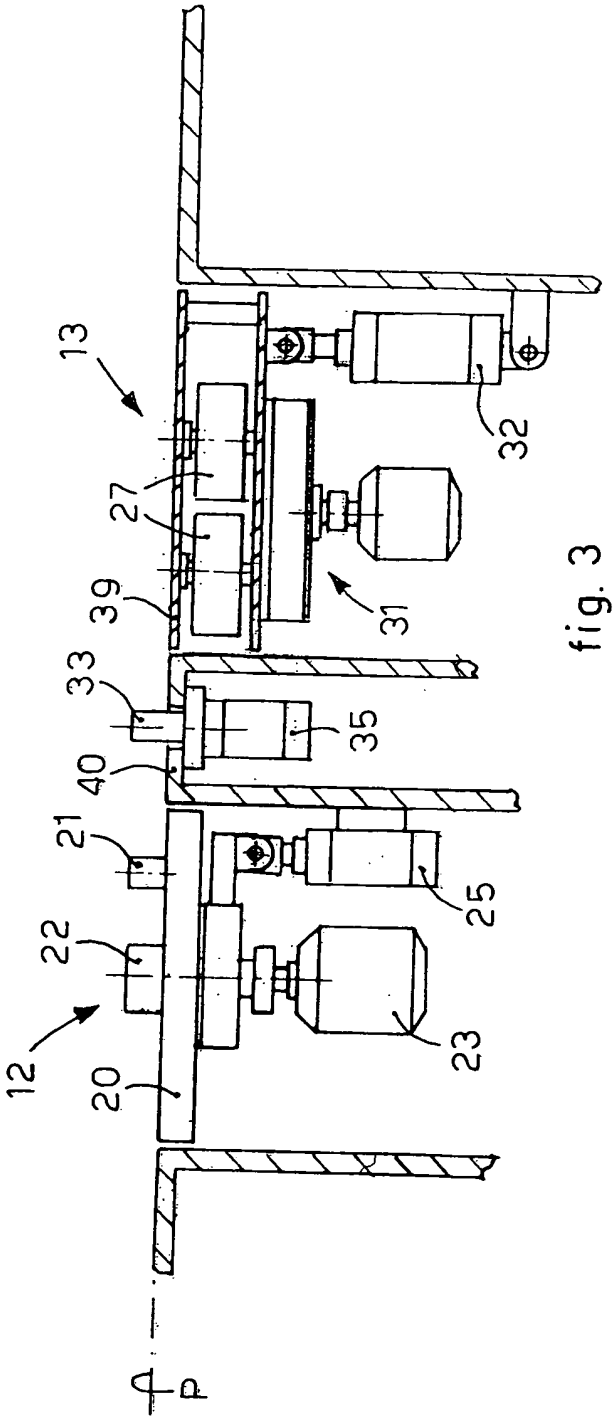
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fig. 3

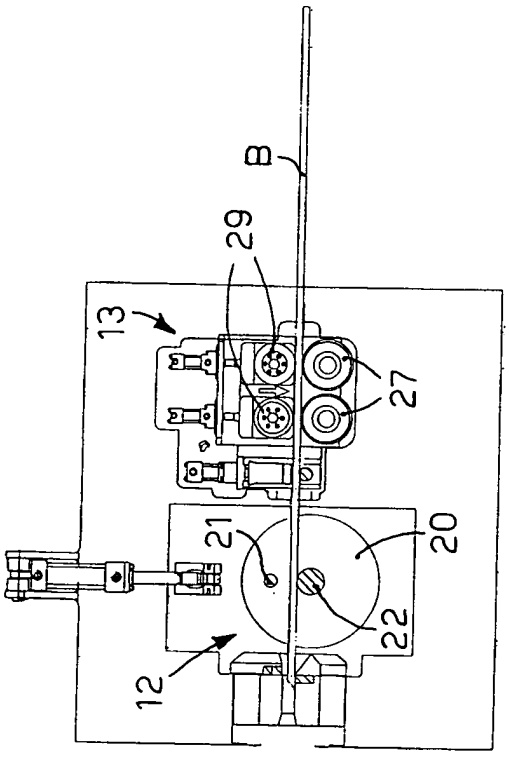

fig. 5

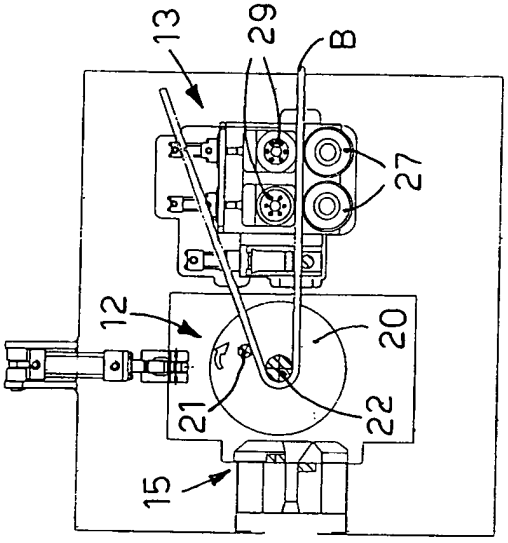

fig. 7

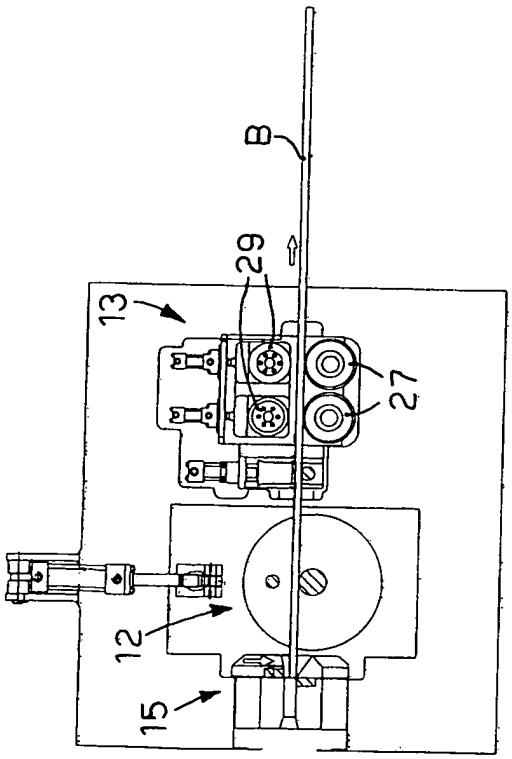

fig. 4

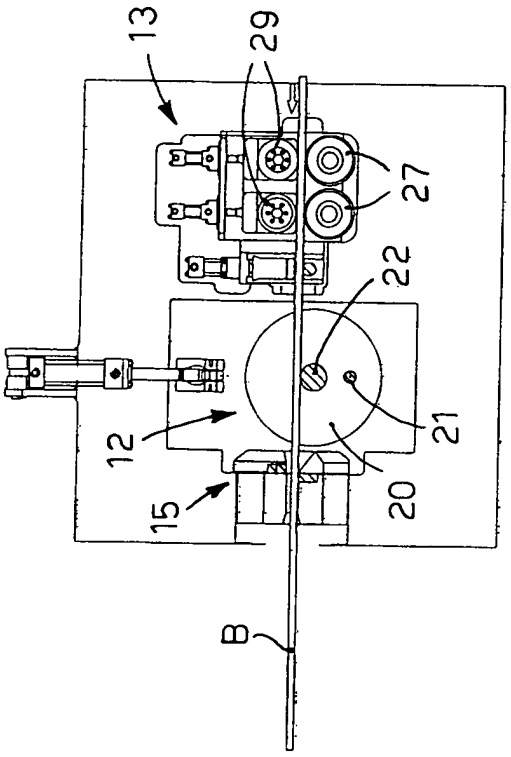

fig. 6

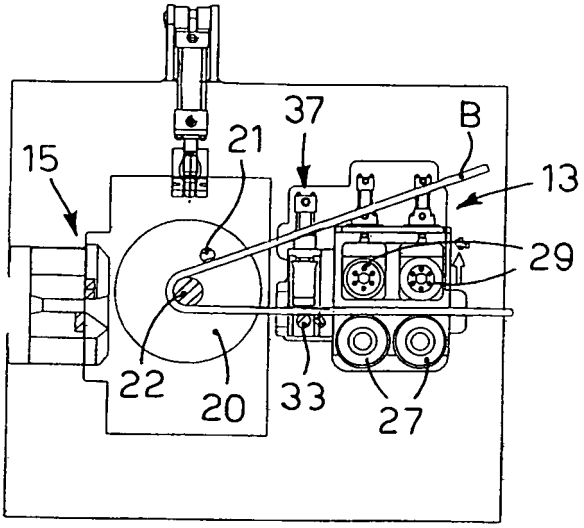

fig. 8

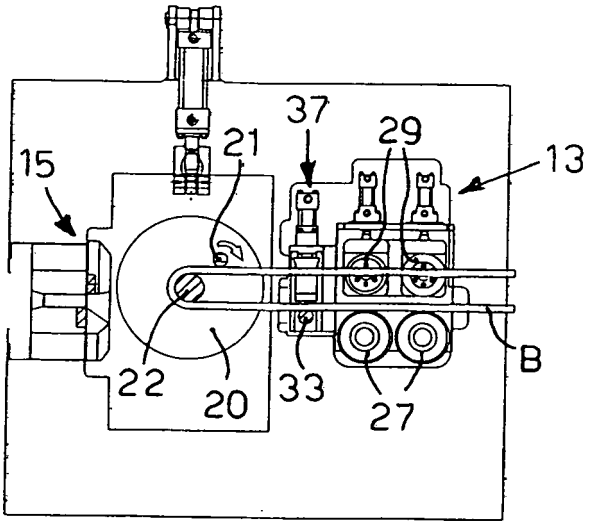

fig. 9

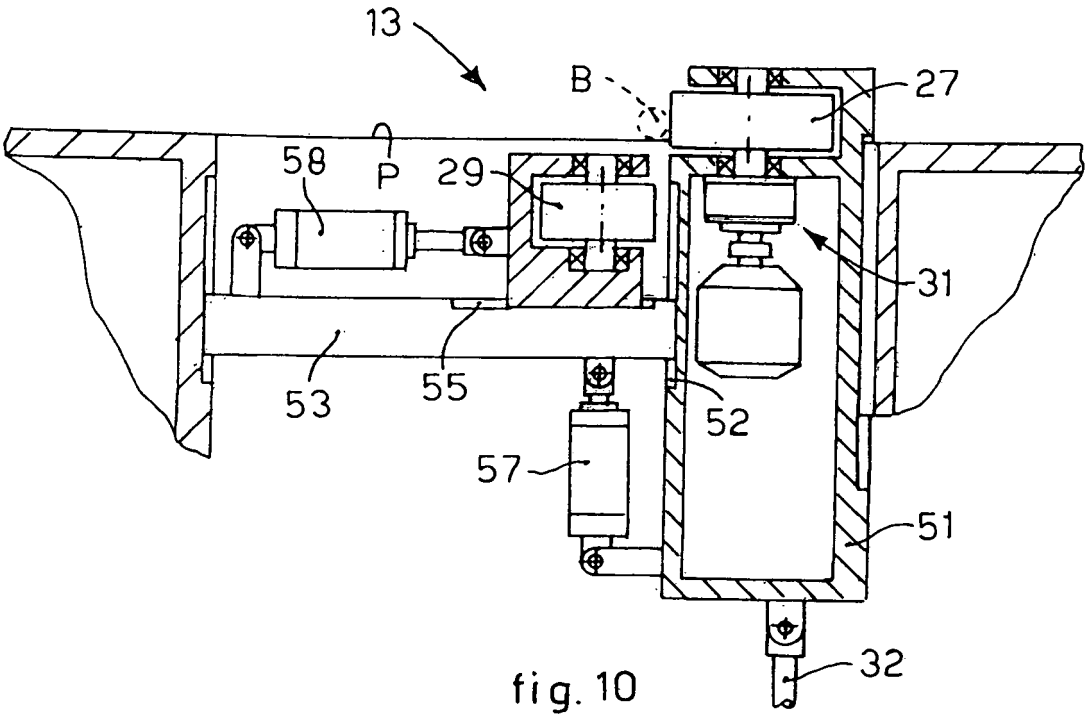

fig. 10

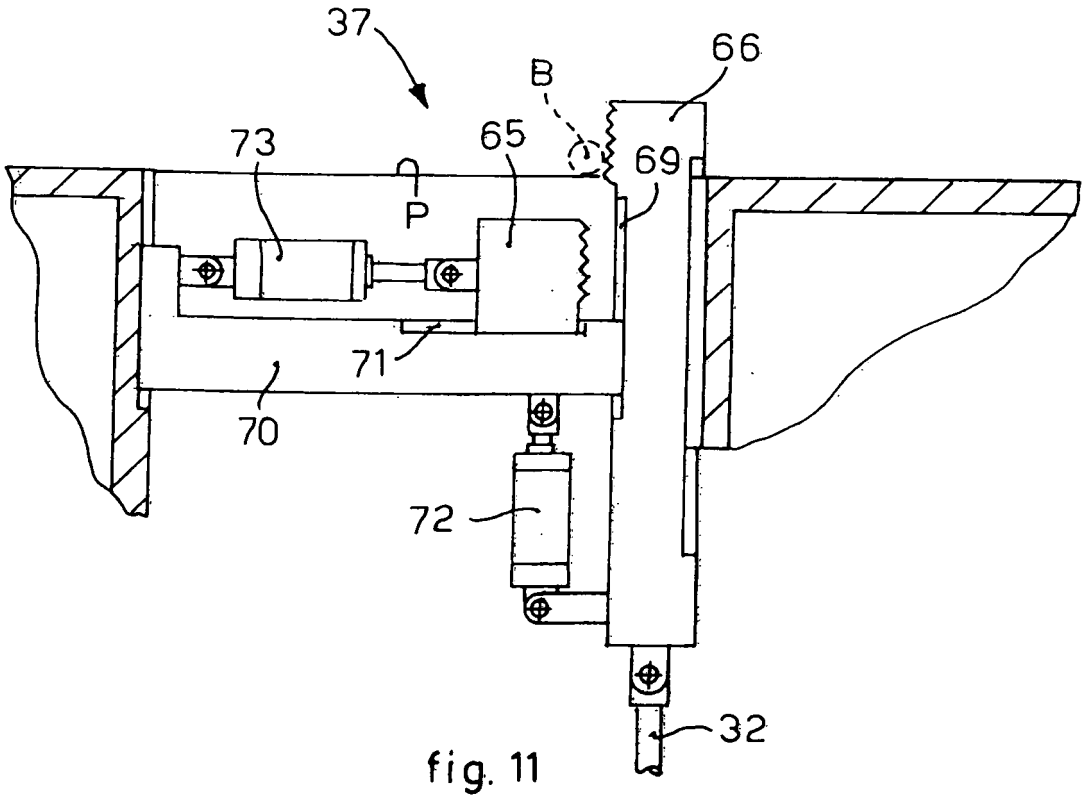

fig. 11

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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