BENDING DEVICE FOR A BENDING MACHINE FOR OBLONG METAL ELEMENTS, AND RELATIVE BENDING METHOD

Bending device (10) and method for a bending machine (15) for oblong metal elements (11), comprising a plurality of bending units (12) each provided with contrast pins (13), a bending support (19) defining a bending plane (P) on which the oblong metal elements (11) are positioned, and bending pins (16) mounted mobile around the relative contrast pins (13), so as to bend the oblong metal elements (11), in cooperation with the contrast pins (13). The device also comprises a movement support (17) on which the bending units (12) are mounted, each of which comprises its own contrast pin (13) having different shape and sizes from the contrast pins (13) of the other bending units (12), and is selectively positionable by the movement support (17) in correspondence with a determinate operating bending position.
"BENDING DEVICE FOR A BENDING MACHINE FOR OBLONG METAL ELEMENTS, AND RELATIVE BENDING METHOD"

FIELD OF THE INVENTION

The present invention concerns a bending device for a bending machine for oblong metal elements, such as for example bars, whether from a roll or pre-sheared, in order to obtain shaped pieces such as reinforcement stirrups or other. In particular, the bending device according to the present invention comprises a plurality of bending units selectively positionable in cooperation with the oblong metal elements to be bent and each comprising its own bending element and its own contrast pin, the latter having different sizes from the contrast pins of the other bending units.

BACKGROUND OF THE INVENTION

Bending machines are known, for oblong metal elements to be shaped, such as for example bars from rolls or pre-sheared.

Known bending machines comprise at least a bending unit essentially consisting of at least a bending support or mandrel, generally disk-shaped, rotating around an axis, normally central, defining a bending plane and provided centrally with a contrast pin. On one spoke of the mandrel a bending element is provided, substantially co-planar with the contrast pin.

The bending element is able to rotate both in a clockwise direction and also anticlockwise around the contrast pin, so that the oblong metal element is shaped by plastic deformation around the contrast pin in one direction or the other.

These known machines normally have an abutment element for the bend, for example defined by the shears, or by a conveyor provided upstream of the bending unit, or by a specific, selectively openable holding and contrast unit, such as a gripper or other.

In the field of shaped irons for reinforcement, and in other fields, it is necessary to make special pieces having a sequence of bends with different diameters and/or shapes.

To perform this operation, while in any case guaranteeing the quality of the bends and respect for regulations, for example in the building trade, it is necessary to replace on each occasion the contrast pin with a different one,
suitable for the specific bending diameter.

This known solution is not only particularly difficult and dangerous for operators but also requires, every time, a long time for equipping and consequent down times of the machine.

Moreover, this solution needs a mandrel of great size, so as to allow the positioning of a large number of different contrast pins, also with relative large sizes.

Consequently, in order to allow the correct disposition of the larger contrast pin, the distance between the positioning axis of the contrast pins and the abutment element for the bend is chosen according to the sizes of the larger pin.

However, this solution entails that, when the smaller contrast pin is mounted, the distance between the axis of the pin and the abutment element for the bend remains unchanged, defining in this case a large segment of the oblong metal element that is not controlled.

The lack of control of an ample segment of the metal element, combined with a narrower radius of curvature defined by the smaller contrast pin, entails the formation of loops in the uncontrolled segment, and possible errors in the interaxis between the different bends.

These disadvantages, although more accentuated with the smaller pin, are also present with intermediate pins, and are gradually attenuated as the diameter increase.

Moreover, in traditional bending machines, it is known to make the tail-end bends using a second drawing unit disposed downstream of the bending unit and provided with its own abutment element for the bend.

Even with the same diameter of the contrast pin, the distance between the pin and the abutment element for the bend upstream of the bending unit and the distance between the contrast pin and the abutment element for the bend of the second drawing unit are in any case different, which entails different bending conditions.

Purpose of the present invention is to achieve a bending unit that allows to selectively vary the sizes of the contrast pin, also during the working of the same bar, without incurring the disadvantages of the state of the art.

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**

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.

In accordance with the above purpose, a bending device according to the present invention is applied for bending oblong metal elements such as bars, whether from a roll or pre-sheared, in order to obtain shaped pieces such as for example reinforcement stirrups or other.

According to the invention, the bending device comprises a plurality of bending units, each provided with contrast means, a bending support defining a bending plane on which the oblong metal elements are able to be positioned, and bending means mounted mobile around the relative contrast means, so as to bend the oblong metal elements in cooperation with the contrast means.

According to a characteristic feature of the present invention, each bending unit comprises its own contrast means having different shape and sizes with respect to the contrast means of the other bending units, and is mounted on a movement support, to be selectively positioned in correspondence with a determinate operating position of bending.

In this way, each bending unit with its own contrast means can be selectively replaced by another, by means of the movement support, and therefore without requiring the intervention of external lifters, such as cranes, gantries or suchlike.

With the present invention, the operations to replace the bending unit are performed substantially automatically and do not necessarily require the intervention of specialized labor.

With the present invention it is possible to provide specific sizing for each bending unit, and therefore to prepare specific optimized sizes between an abutment element for the bend disposed upstream of the bending unit, and the positioning axis of the contrast means.

In this way, especially with smaller contrast means, the positioning of each bending unit is not constrained by the sizes of the larger means, and so formations of loops and errors in the interaxis between the bends can be reduced.
to a minimum.

According to a variant, the movement support is conformed substantially as a carousel, so as to move in rotation the bending units toward the relative operating bending position.

The movement support comprises at least a rotatable plate on which the bending units are mounted.

In this solution, the bending units are disposed angularly offset with respect to each other on the rotatable plate.

According to a variant, the movement of the bending mean around the relative contrast means in order to perform the bending of the metal elements is independent with respect to the rotation of the plate of the movement support.

According to another variant, each bending unit is selectively positionable between a first bending position, substantially co-planar and/or raised with respect to the bending plane, and a second lowered inactive position, completely below the bending plane.

According to a variant, each bending unit is selectively movable between the first position and the second position, independently with respect to the movement support.

According to another variant, the bending units are movable between the first position and the second position in a manner coordinated with the movement support.

Each contrast means comprises at least a contrast pin having a determinate diameter.

BRIEF DESCRIPTION OF THE DRAWINGS

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 view of a bending device according to the present invention in a first operating condition;
- fig. 2 is a schematic view of the bending device in fig. 1 in a second operating condition;
- fig. 3 is a schematic view of the bending device in fig. 1 in a third operating condition;
fig. 4 is a schematic view of the bending device in fig. 1 in a fourth operating condition, subsequent to that in fig. 3. 

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

With reference to the attached drawings, a bending device 10 according to the present invention is applied to a bending machine 15 to bend by a desired angle, up to about 180° and more, in this case one or more metal bars 11, for example of the type for making stirrups or other shaped reinforcement pieces for the building trade.

The metal bar 11 is fed along an axis of feed "X" by a feed unit, of a known type and not shown in the drawings, disposed upstream of the bending machine 10.

The bending device 10 according to the invention comprises a rotary plate 17, or carousel, which defines a bending plane "P", and on which a plurality of bending units 12 are disposed.

Each bending unit 12 is mounted in a determinate position on the rotary plate 17, and comprises its own contrast pin 13, a mandrel 19 rotatable coaxially with the contrast pin 13 and a bending pin 16 mounted peripherally to the mandrel 19.

In this way, each bending pin 16 is selectively rotatable in a clockwise or anticlockwise direction around the relative contrast pin 13, so as to make the desired bend in the bar 11, in one direction or another, in cooperation with the contrast pin 13.

Each bending pin 16 is rotatable in an independent manner with respect to the rotation of the rotary plate 17.

In this case, on the rotary plate 17 four different bending units 12 are provided, angularly offset by 90° with respect to each other and each having its own contrast pin 13 of different sizes with respect to the contrast pin 13 of the other bending units 12.

In this way it is possible to make bends with proportionally different radii of curvature.

It cannot be excluded that on the rotary plate 17 a smaller number of bending units 12 may be disposed, for example two at 180° or three at 120°, or a higher number, for example six at 60°, eight at 45°, as well as with non-equivalent
angular dispositions.

In the attached drawings the bending units 12 have been schematically shown with contrast pins 13 of a substantially cylindrical shape, but it is also possible that in different operating solutions double or shaped contrast pins 13 may be provided, or of other sizes and shapes.

Advantageously, each bending unit 12 is selectively movable in a direction orthogonal to the bending plane P.

In this way, each bending unit 12 is selectively movable between a first raised operating position, in which the mandrel 19 is co-planar with the bending plane P and the pins 13 and 16 are disposed above the plane P, and a second lowered inactive position, in which both the mandrel 19 and also the two pins 13 and 16 are completely below the bending plane P.

This solution allows great versatility of use of the bending unit 10, allowing to make substantially any type of bend whatsoever.

Simply to give an example, in the attached drawings, the bending units 12 shown with the bold outline are understood to be in the second lowered position, whereas those shown with a normal outline are to be considered to be in the first raised position.

The bending machine 15 to which the bending unit 10 according to the invention is applied comprises a first drawing unit 20, shears 21 and an abutment element for the bend 22, all provided upstream of the bending device 10.

These elements of the machine 15 allow to feed the metal bar 11 to make the leading bends.

A second drawing unit 23 is also part of the machine 15 and is disposed downstream of the bending device 10, and a central abutment element 25, shown by a line of dashes, and disposed at the center of the rotary plate 17 in a fixed condition with respect to the axis of feed X.

The second drawing unit 23 and possibly the central abutment element 25 allow to make the tail end bends on the metal bar 11.

As can be seen from the comparison between the distance D1 shown in fig. 1 and the distance D2 shown in fig. 3, the distance between the median axis of the respective contrast pins 13 of the two different bending units 12 and the abutment element for the bend 22 is predetermined and variable according to the size of the
relative contrast pin 13.

This allows to optimize the length of a non-controlled segment of the metal bar 11, limiting to a minimum the formation of loops, deformations and errors in bending.

It should be noted that, if the distance D2 were maintained for all types of contrast pins 13, in the case of the contrast pin 13 used in fig. 1, the uncontrolled segment of bar 11 would be bigger, and easily deformable in an uncontrolled manner, during the bending steps.

The bending device 10 according to the present invention functions as follows.

First of all, a determinate bending unit 12 is taken to the first raised operating position. Then, the rotary plate 17 is rotated, so as to dispose said bending unit 12 in cooperation with the axis of feed X, downstream of the abutment element for the bend 22.

Then the metal bar 11 is fed through the first drawing unit 20. Once the metal bar 11 cooperates tangentially with the contrast pin 13 of the bending unit 12, the mandrel 19 moves the bending pin 16 around the contrast pin 13, so as to carry out the steps of making the leading end bends (fig. 1).

When the leading end bends are done, if it is necessary to make a tail end bend, the metal bar 11 is moved by the second drawing unit 23, possibly assisted by the central abutment element 25.

In this condition, the rotary plate 17 is rotated by about 180° in order to dispose the bending unit 12 downstream from the second drawing unit 23 (fig. 2) with respect to the direction of feed of the metal bar 11. In this case, the metal bar 11 is fed in a direction opposite to the direction of feed in fig. 1, in order to make the leading end bends.

In the configuration shown in fig. 3, the rotary plate 17 is rotated so as to prepare another bending unit 12 to make a different type of bend on a new metal bar 11.

Fig. 4 shows how, on the same metal bar 11 on which a leading end bend was made in fig. 3, a tail end bend is made with another bending unit 12, so as to make a bend of a different diameter.

It is clear however that modifications and/or additions of parts or steps may be made to the bending device 10 and relative bending method as described
heretofore, without departing from the field and scope of the present invention.

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 device for a bending machine for oblong metal elements, and relative bending method, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.
CLAIMS

1. Bending device for a bending machine for oblong metal elements (11), comprising a plurality of bending units (12) each provided with contrast means (13), a bending support (19) defining a bending plane (P) on which said oblong metal elements (11) are able to be positioned, and bending means (16) mounted mobile around the relative contrast means (13), so as to bend said oblong metal elements (11), in cooperation with said contrast means (13), characterized in that it also comprises at least a movement support (17) on which said bending units (12) are mounted, and in that each bending unit (12) comprises its own contrast means (13) having shape and sizes different from the contrast means (13) of the other bending units (12), and is able to be selectively positioned by said movement support (17) in correspondence with a determinate operating bending position.

2. Bending unit as in claim 1, characterized in that said movement support (17) is conformed substantially as a carousel, so as to move said bending units (12) in rotation toward the relative operating bending position.

3. Bending unit as in claim 2, characterized in that said movement support comprises at least a rotary plate (17) on which said bending units (12) are mounted angularly offset with respect to each other.

4. Bending unit as in any claim hereinbefore, characterized in that said bending mean (16) is able to move around the relative contrast mean (13) to perform the bending of said metal elements (11) in an independent manner with respect to the movement of said movement support (17).

5. Bending unit as in any claim hereinbefore, characterized in that each bending unit (12) is selectively positionable between a first bending position substantially co-planar and/or raised with respect to said bending plane (P), and a second lowered inactive position, completely below said bending plane (P).

6. Method for bending oblong metal elements (11), with a bending device comprising a plurality of bending units (12) each provided with contrast means (13), a bending support (19) defining a bending plane (P) on which said oblong metal elements (11) are able to be positioned, and bending means (16) mounted mobile around the relative contrast means (13), so as to bend said oblong metal elements (11), in cooperation with said contrast means (13), characterized in that
it comprises at least a movement step in which said bending units (12), each one having its own contrast means (13) of different shape and size from the contrast means (13) of the other bending units (12), are selectively moved by a movement support (17) of the bending device (10), so that a determinate bending unit (12) is positioned in correspondence with a determinate operating bending position.

7. Method as in claim 6, characterized in that during said movement step said movement support (17) moves said bending unit (12) with the relative bending elements (16) in rotation, toward the relative operating bending position.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search: 20 October 2009

Date of mailing of the international search report: 28/10/2009
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