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(54) Method to make bends in the trailing ends of bars for building work in bending-shaping machines, and bending-shaping machines for bars for building work which employ such method.

(57) Method to make bends in the trailing ends of bars for building work in bending-shaping machines which comprise in working sequence a drawing and/or straightening assembly (11), a shearing assembly (16), a bending assembly (12) and clamping means (17-117), which have a first retracted position under the working plane and a second working position, the bars for building work being obtained from a bar (10) coming from a feeding section (22) possibly wound in a roll, the bar (10) with all its bends already made except a bend (24) in its trailing end being separated from the feeding section (22) and being fed forwards downstream by a required length, the bend (24) in its trailing end being then carried out in cooperation with the clamping means (17-117).
Bending-shaping machine for bars for building work, which comprises in working sequence a drawing and/or straightening assembly (11), a shearing assembly (16), a bending assembly (12) and clamping means (17-117), which have a first retracted position under the working plane and a second working position, the bars for building work being obtained from a bar (10) coming from a feeding section (22) possibly wound in a roll, the machine comprising means for the controlled forward displacement (11-12) of the feeding section (22) partly pre-shaped and sheared to a required length.

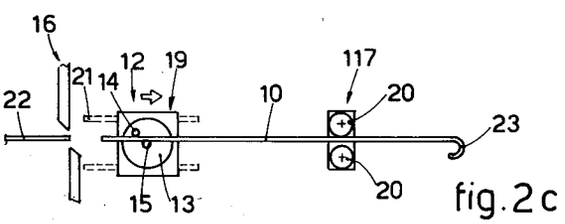

fig.2c

EP 0 537 496 A1

This invention concerns a method to make bends in the trailing ends of bars for building work in bending-shaping machines and concerns also bending-shaping machines for bars for building work which employ such method, as set forth in the relative main claims.

The method of this invention to make bends in the trailing ends is applied properly to the field of processing sections for reinforcements in reinforced concrete, the sections being in the form of bars or rolls of a round, square, polygonal or other cross section.

The bending-shaping machines of the state of the art which are characterized by having one single bending assembly downstream of a shearing assembly and of a straightening-drawing assembly, or a drawing assembly alone, entail the problem of making bends in the trailing end of the bar.

With these known bending-shaping machines it is not possible to make bends in the trailing end except where the length between the shearing plane and the axis of the abutment roll coincides with the required length of the bend in the trailing end. This fact restricts the output of the bending machines of the state of the art considerably.

Document IT-B-1024229 discloses a teaching of making the bend in the trailing end, lowering the bending assembly and bringing the section back to the required length before performing the shearing. This system entails long processing times and lowering and raising mechanisms which by their use involve great consumptions of energy and problems of wear and maintenance.

Document IT 83349 A/89 discloses a proposal to arrange the shears assembly separately above the bending assembly, but this proposal entails the problem of shearing the trailing end where the trailing end is long.

Documents IT 83543 A/90 and EP-A-0.379.043 disclose a bending-shaping machine which comprises a retractable drawing assembly located downstream of the bending assembly. This retractable drawing assembly enables the section to be clamped and, after the shearing operation, to be drawn downstream by a desired length so that the bend in the trailing end can then be made. This teaching is in itself interesting and useful but involves problems of overall bulk and of moving the drawing assembly, with resulting problems of wasted energy, maintenance, wasted materials and a complex structure.

Document DE-A-1.249.057 teaches a complex system for expanding the abutment roll for as to clamp the bar. This system cannot be applied to bending/shaping machines which produce up to 1500/1600 stirrups an hour because it has a very short life and is complex to handle.

Document DE-A-1.920.668 teaches the thrusting of a bar with an appropriate jack, but this teaching cannot be applied to bending/shaping machines owing to the high working speed, the need for simplicity and the necessity of not having any contacts during the travel of the bar.

EP-A-0.371.960 teaches the use of the bending pin of an end-bending assembly to clamp the bar while the other bending assemblies are positioned.

The present applicants have studied, tested and obtained this invention to obviate the shortcomings of the state of the art and to achieve further advantages.

This invention is set forth and characterized in the relative main claims, while the dependent claims describe variants of the idea of the main solution.

The invention consists in providing a normal bending-shaping machine for bars for building work and also a method which enables bends to be made in the trailing end of bars for building work, even when the end segment of the bent bar has a length different from the distance between the shearing plane and the axis of the abutment roll of the bending assembly.

A first formulation of the method to make bends in the trailing end of bars according to the invention provides that, after all the bends have been made except the bend in the trailing end and after shearing to size has taken place and has separated the bent bar from the feeding section, the bar is thrust downstream by the distance required by the feeding action of the feeding section.

When the feeding section has thrust the bent bar downstream by the distance required, the feeding section moves back to its starting position and the bend is made in the trailing end of the bar.

This first formulation includes clamping means or abutment means or other means suitable for the purpose which are positioned downstream of the bending assembly so as to hold the bar rigidly in position during the aforesaid step of making the bend in the trailing end of the bar.

These clamping means or abutment means or other means suitable for the purpose can be retracted below the working plane so as to enable the preceding bends to be made in the bar.

A second formulation of the method to make bends in the trailing end of the bar according to the invention provides that the bending assembly can move parallel to the axis of feed of the bar.

This motion of feed is achieved, for instance, by slider means able to move on suitable guides, the bending assembly being positioned on these slider means.

According to this second formulation, after all the bends have been made except the bend in the trailing end of the bar and after the shearing of the

bent bar to size has taken place and the bent bar has been separated from the feeding section, the bending assembly is rotated by an amount enough to clamp the bar by bending the same, and the bar will abut against a third retractable point; the bending assembly is then moved forwards downstream until it has displaced the bent bar by the required distance.

The bending assembly then releases the bent bar, which is clamped by an appropriate retractable assembly and is brought back upstream by a required value, at which the bend in the trailing end of the bar is made.

The attached figures, which are given as a non-restrictive example, show two variants of the invention as follows:-

Figs.1a, 1b and 1c
show a cycle of making a bend in the trailing end according to a first formulation of this invention;

Figs.2a, 2b, 2c, 2d, 2e and 2f
show a cycle of making a bend in the trailing end according to a second formulation of this invention.

Figs.1 show a cycle of making a bend in the trailing end of a bar according to a first formulation of the method of this invention.

Fig.1a shows a bar 10 coming in this example from a wound roll, the bar 10 having undergone all the bending operations except that of its trailing end; for the sake of simplicity the bends made consist here of one single bend 23, which in this case is a hook in the leading end of the bar 10.

The displacements of the bar 10 along the working plane are brought about by a drawing assembly 11 located upstream of a bending assembly 12.

The drawing assembly 11 may comprise also a straightening assembly or may consist of a straightening assembly alone.

The drawing assembly 11 and bending assembly 12 form part of the state of the art and are therefore unimportant for the purposes of the invention.

In this example the bending assembly 12 comprises a bending disk 13, a bending pin 14 and an abutment roll 15.

The rod 10 is sheared to the desired length by a shearing assembly 16 and thus is separated from a feeding section 22.

When all the bends 23 have been made except the bend in the trailing end, the sheared bar 10 is thrust downstream by the feeding section 22, which is drawn forwards by the desired length and cooperates by butting against the bar 10 (Fig.1b).

Next, the feeding section 22 is moved backwards and the bending assembly 12 makes the bend in the trailing end 24,in this case a lefthand bend (Fig.1c); this bend 24 in the trailing end can be of any type.

So as to keep the bar 10 rigidly in position during the step of bending the trailing end, clamping means 17 are positioned downstream of the bending unit 12 and consist, in this case, of two idler rolls 18 capable of a movement orthogonal to the working plane in this example.

These clamping means 17 are retractable so as to enable the preceding bends 23 to be made without the bar 10 coming into contact with the clamping means 17.

The clamping means 17 may also consist of a vice or, where they consist of rolls, may be capable also of rotary movement.

In Fig.1a the clamping means 17 are located below the working plane, whereas in Fig.1b the clamping means 17 position the bar 10 and let it slide, while in Fig.1c the clamping means 17 grip the bar 10 and keep it in position during the performance of the bend 24 in the trailing end.

Figs.2 show a cycle of making a bend in the trailing end according to the second formulation of the method of this invention.

Fig.2a shows a rod 10 coming, in this case, from a wound roll of a feeding section 22 and having all the bends 23, except bends 24 in the trailing end, already made; these bends 23 already made are summarized in this case with one single hook. With all these bends 23 made, the bar 10 is sheared to the desired length by the shearing assembly 16 (Fig.2a).

So as to carry out the method, the bending assembly 12 is positioned on a suitable slider 19 which can move on guides 21 parallel to the axis of feed of the bar 10.

After making the bends 23, but not bends in the trailing end, and after the bar 10 has been sheared to the desired length, the bending assembly 12 is rotated about its axis until the bending pin 14 rests against the bar 10 and compels the bar 10 to rest against a clamping means 117, so that the bar 10 is clamped between the bending pin 14 and the abutment roll 15 (Fig.2b).

In this case the clamping means 117 are retractable and consist of two idler rolls 20 capable, in this example, of a movement orthogonal to the working plane.

When the bar 10 has been clamped between the bending pin 14 and abutment roll 15, the bending assembly 12 (Fig.2c) is moved downstream by the desired distance and takes the bar 10 with it.

When the bar 10 has reached the desired position and while the clamping means 117 take action and clamp the bar 10, the bending pin 14 rotates in the opposite direction and releases the bar 10 from its grip (Fig.2d).

Next, the bending assembly 12 retreats to its bending position (Fig.2e), where it makes the bend 24 in the trailing end with the desired bending angle (Fig.2f).

The bending assembly 12 may be of any type and may carry out any other known auxiliary movement.

Claims

1. Method to make bends in the trailing ends of bars for building work in bending-shaping machines which comprise in working sequence a drawing and/or straightening assembly (11), a shearing assembly (16), a bending assembly (12) and clamping means (17-117), which have a first retracted position under the working plane and a second working position, the bars for building work being obtained from a bar (10) coming from a feeding section (22) possibly wound in a roll, the method being characterized in that the bar (10) with all its bends already made except a bend (24) in its trailing end is separated from the feeding section (22) and is fed forwards downstream by a required length, the bend (24) in its trailing end being then carried out in cooperation with the clamping means (17-117).

2. Method as claimed in Claim 1, whereby the downstream movement of the sheared bar (10) is achieved by means of a substantially axial thrust applied by the feeding section (22).

3. Method as claimed in Claim 1, whereby the forward movement of the sheared bar (10) is carried out by the bending assembly (12) after the bar has been clamped by the bending assembly (12) by means of rotation of a bending pin (14).

4. Bending-shaping machine for bars for building work, which comprises in working sequence a drawing and/or straightening assembly (11), a shearing assembly (16), a bending assembly (12) and clamping means (17-117), which have a first retracted position under the working plane and a second working position, the bars for building work being obtained from a bar (10) coming from a feeding section (22) possibly wound in a roll, the machine being characterized in that it comprises means for the controlled forward displacement (11-12) of the feeding section (22) partly pre-shaped and sheared to a required length.

5. Means as in Claim 4, in which the means for the controlled forward displacement consist of the drawing assembly (11).

6. Means as in Claim 4, in which the means for the controlled forward displacement consist of the bending assembly (12) able to move along the axis of the forward movement of the bar (10), the bending assembly (12) having a first position with the bar free, a second bending/shaping position and a third position of clamping the bar (10) for drawing the same.

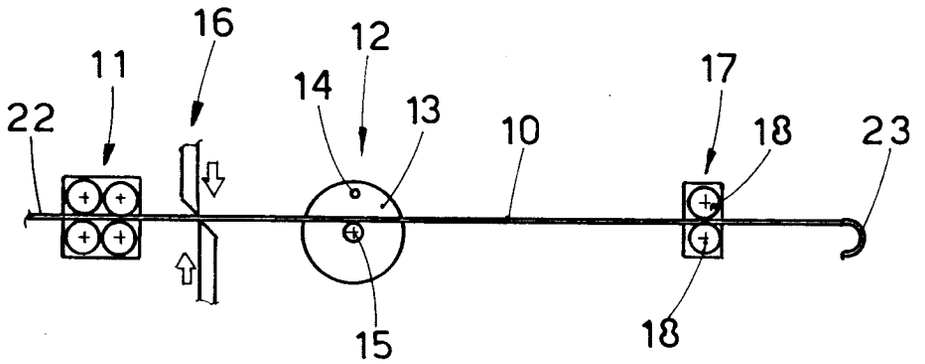

fig.1a

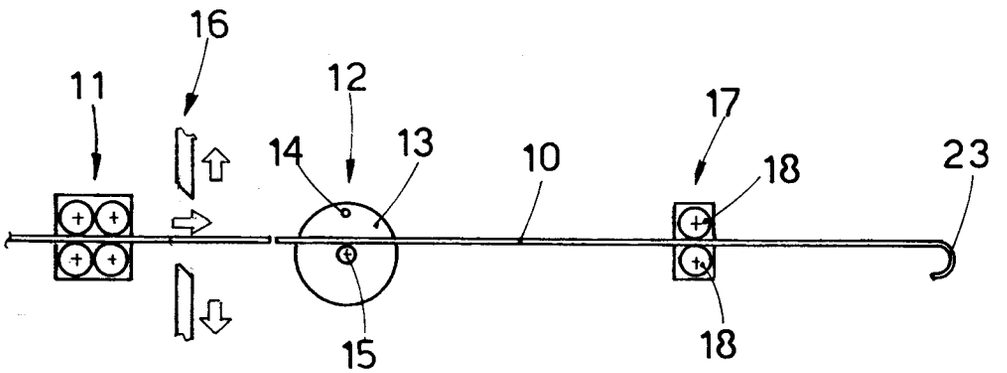

fig.1b

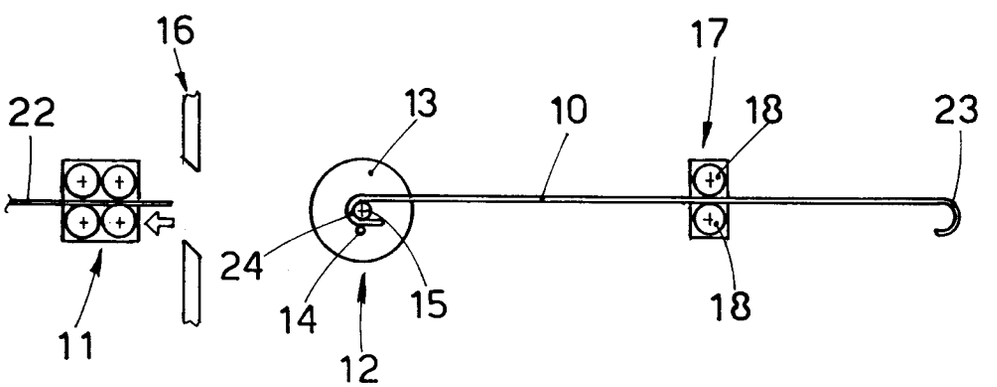

fig.1c

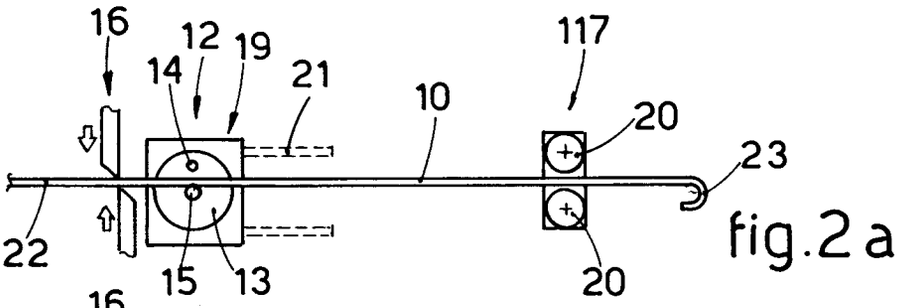

fig.2a

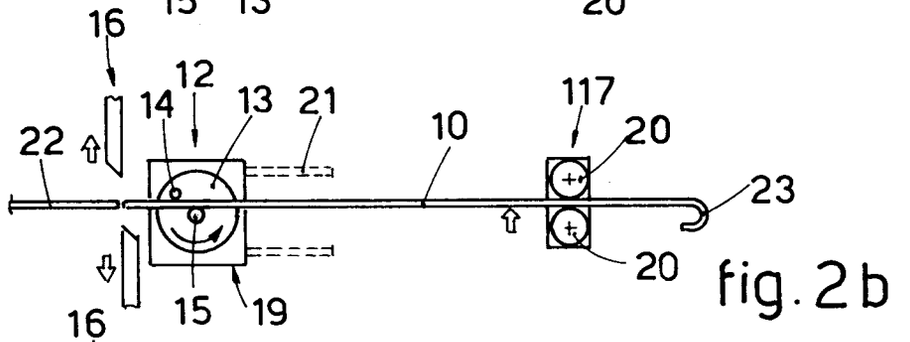

fig.2b

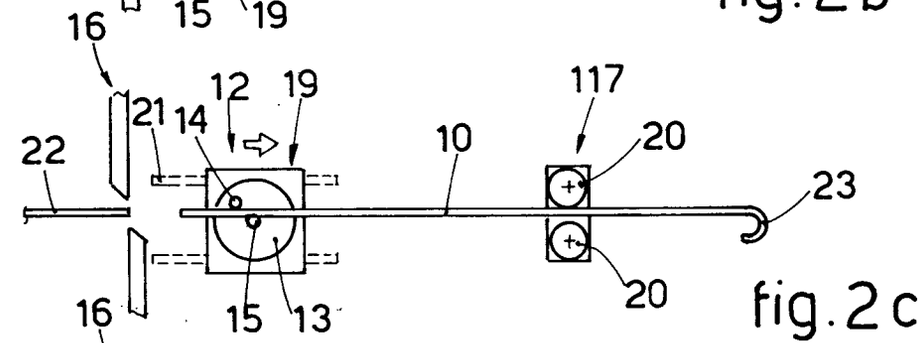

fig.2c

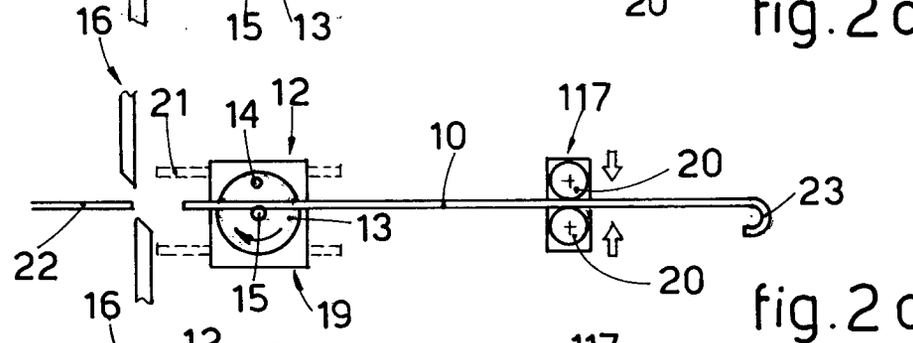

fig.2d

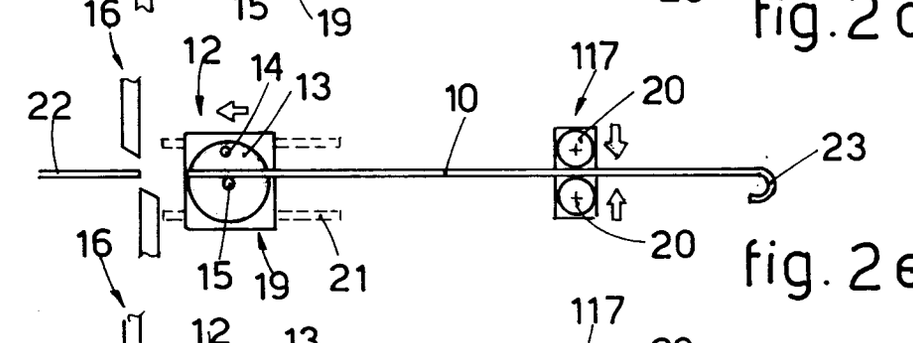

fig.2e

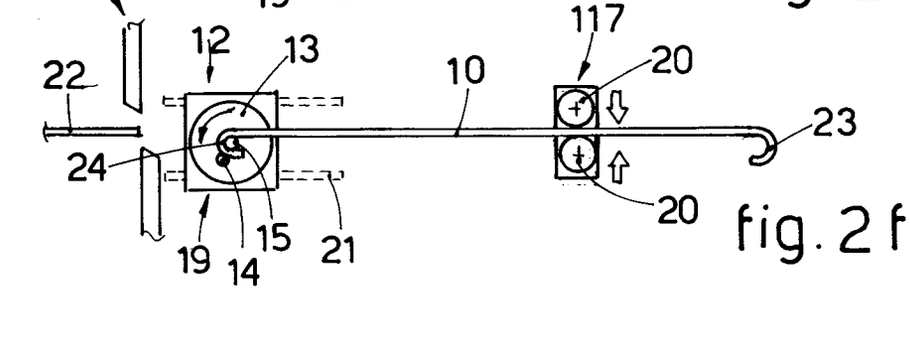

fig.2f

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EUROPEAN SEARCH REPORT

Application Number

EP 92 11 6005

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.5)
X	EP-A-0 379 043 (M.E.P.) * column 1, line 31 - line 46 * * column 3, line 40 - line 56 * * column 4, line 48 - column 6, line 52; figures 1-3 *	1,4	B21D11/12
Y		2,3,5	
Y	DE-A-1 920 668 (PINES) * page 6, line 8 - line 16 * * page 9, line 10 - page 10, line 16; figures 1-8 *	2,5	
Y	DE-B-1 249 057 (PEDDINGHAUS) * column 1, line 20 - line 26; figures 1,2 *	3	
A	EP-A-0 371 960 (RUHL) * column 1, line 1 - line 48; figure 1 *	1,3,6	
A	FR-A-2 290 969 (DEL FABRO)	-	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B21D
B21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 JANUARY 1993	MATZDORF U.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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