



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.07.2013 Bulletin 2013/29

(51) Int Cl.:
B21D 11/12 (2006.01)
B21F 1/04 (2006.01) **B21D 11/07** (2006.01)

(21) Application number: **12193338.6**

(22) Date of filing: **20.11.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **16.01.2012 IT PN20120001**

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(54) **Method and machine for manufacturing continuous bent profiles**

(57) Method and machine for the production of continuous bent structural sections to be used to form electro-welded lattice girders, normally used in building construction, starting from a wire or metal rod (10).

The wire or the metal rod (10) is made to move forward linearly, determining the pitch of the structural section to be obtained by means of a feeding powered carriage (11) and accompanying powered carriage 16, said

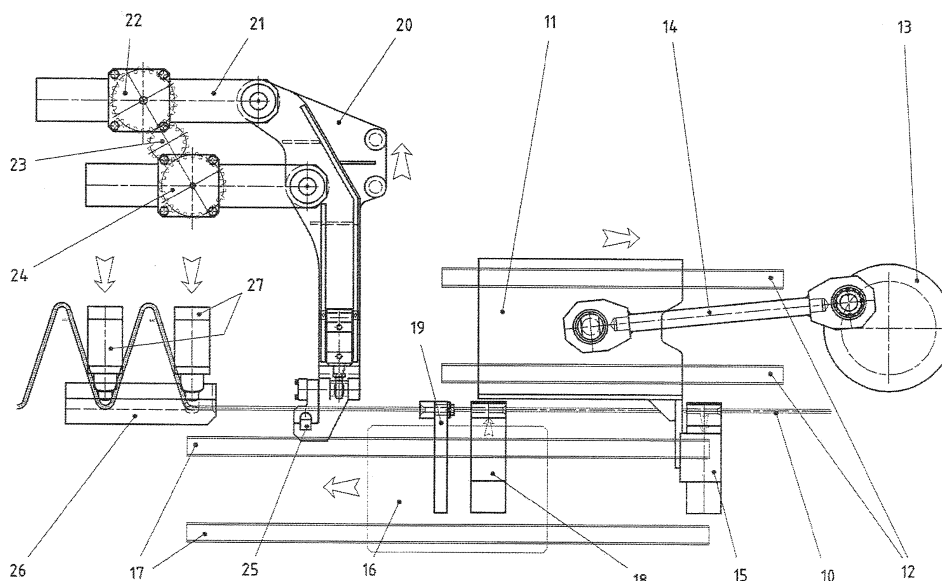
carriages being coordinated with each other so as to move alternatively in a reciprocally opposite direction.

The wire or metal rod is engaged by a shaping arm 20 that is driven to move vertically in a curvilinear trajectory and with a travel adjustable on the basis of the height of the structural section to be obtained.

The wire or metal rod is alternatively held locked and unlocked in fixed positioning point (26), downstream of the shaping arm, provided with restraining elements (27).

STRUCTURAL SECTION WITH SYMMETRICAL BENDING

FIG. 1



Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a method and a machine for the production of wires or metal rods in order to produce continuous bent structural sections to be used to form electro-welded lattice girders, normally used in the building construction field.

PRIOR ART TECHNIQUE

[0002] As it is known, the production of continuous bent structural sections, which are used to form electro-welded lattice girders, requires the feeding of wires or metal rods which are bent into a regular form through various automated driving and shaping means.

[0003] Patent IT 1238992 describes a method and a machine for the formation of continuous bent structural sections for electro-welded lattice girders wherein the rectilinear wire is made to pass through two opposing and reciprocally adjustable chains, having triangular shaped teeth or plates intersecting each other, so as to bend it in the form of a broken or continuous line. This situation has the inconvenience of requiring specific and difficult nearing and distancing operations of the two chains and/or substitution of the teeth or shaped carried by the chain links in order to adjust the amplitude of the bendings.

SUMMARY OF THE INVENTION

[0004] The object of the invention is to provide a method and a machine for the production of continuous bent structural sections to be used to form electro-welded lattice girders, which can overcome the inconveniences of the known prior art giving a solution which provides very precise and reliable results.

[0005] A further object of the invention is to produce continuous bent structural sections, starting from a wire or metal rod, with an adjustable height in a completely automated way, that is without the necessity of modifying the machine substituting the shaping operating elements.

[0006] Another object of the invention is to enable the production of continuous bent structural sections also with an asymmetrical configuration, that is with alternating inclined and vertical parts, as well as parts having different inclination and therefore different lengths.

[0007] These and other objects are achieved with the method and the machine whose characteristics are defined in the claims concluding the present description.

DETAILED DESCRIPTION OF THE INVENTION

[0008] Objects and characteristics of the invention will be more apparent from the following description, for exemplification only and not limited to, with reference to the

appended figures, wherein:

- Figure 1 schematically shows a machine for the production of continuous bent structural sections to be used to form electro-welded lattice girders, in a first step of the method of production, according to the invention;
- Figures from 2 to 5 schematically show the machine in figure 1 in some following steps of the method of production according to the invention;
- Figure 6 schematically shows a machine according to the invention relative to an operating variation;

[0009] From the construction point of view, a machine according to the invention comprises - as schematically shown in figures from 1 to 5 - few essential elements;

[0010] The wire or the metal rod 10 is fed through a feeding carriage 11, which is slidable on adapted rails 12 horizontal and integral with the machine frame (not shown) and which is driven by an electrical servomotor 13 through an articulated mechanism 14, such as link-work. The carriage 11 can therefore move alternatively and is equipped with a gripper 15 or similar means, which grips and drags wire 10 in the feeding step for a length the same as the "pitch" of the required bending, and releases it in the return travel.

[0011] An accompanying carriage 16 of the wire 10 is controlled in synchronism with the feeding carriage 11 in order to slide on adapted rails 17, equivalent to rails 12, so as to move alternatively in a direction reciprocally opposed to that of the feeding carriage 11 movement. The accompanying carriage 16 is equipped with a gripper 18, or similar means, which grips the wire 10 in the feeding step and releases it in the return travel.

[0012] Integral with the accompanying carriage 16, it is also provided a mold or a bending tool 19, through which wire 10 is driven and which is the lower geometrical reference for the wire 10 bending so as to form the Greek fret-shaped structural section.

[0013] The formation of the structural section is made through a shaping arm 20 mounted on the machine frame and which is able to move vertically in an alternative compound motion through an articulated quadrilateral mechanism 21, driven by an electric servomotor, or equivalent means (not shown), through a series of gearwheels 22, 23, 24. The shaping arm 20 ends at its lower end with a gripping means 25, to engage the wire or metal rod 10 to bend.

[0014] The shaping arm 20 also cooperates with a positioning device 26, which is provided with at least a couple of restraining elements 27 suitable to lock the wire 10 during the bending step and release it during the feeding and the unloading steps. In particular, the first restraining element 27 which encounters the wire 10 during its feeding has also the function of a bending tool corresponding to that of tool 19.

[0015] The operating control of all the members making up the machine in order to synchronise their move-

ments precisely, is carried out through a centralized control device (not shown) which is not claimed.

[0016] From the functional point of view, the wire or the metal rod 10 is first (figure 1) in the gripper 15 of the feeding carriage 11 and then in the gripper 18 of the accompanying carriage 16 and the bending tool 19, making it arrive at the positioning device 26 where it is locked by the first restraining element it meets. The feeding carriage 11 can start its return travel from the farthest feeding position of the wire 10, which is disengaged by the gripper 15 that is open. On the contrary, the accompanying carriage 16 can start its advancement travel with the wire gripped in the gripper 18. The shaping arm 20 is in its lower position with its gripper 25 placed below the wire 10 in a gripping position of the latter.

[0017] Then (figure 2), the shaping arm 20 is operated and it starts its travel vertically upward following a curvilinear trajectory lifting the wire 10 which is engaged to the gripper 25. Contemporarily, the feeding carriage 11 makes a return travel, while the accompanying carriage 16 moves in the opposite direction accompanying the wire 10 in its lifting. In this step, the wire 10 is locked in the gripper 18 of the accompanying carriage 16 and in the first restraining element 27 of the bending tool 19.

[0018] The distance A between the fulcrum of the arms of the articulated quadrilateral 21 and the axes of the gearwheels 23, 24, 25 determines the constant height of the bent structural section, because the arms of the articulated quadrilateral 21 rotate by a constant angle by means of the gearwheels 22, 23, 24. In order to vary the height of the bent structural section, it is necessary to vary the distance A by operating on the clamps 28 and on the screws 29. The adjustment of the distance A can be operated manually and/or through automatic devices known in themselves.

[0019] When the shaping arm 20 has reached the highest position (figure 3), corresponding to the height of the Greek fret-shaped structural section to be obtained, the accompanying carriage 16 has reached the end of its feeding travel and the bending tool 19 determines the lower bending point of the Greek fret-shaped structural section. At the same time, the feeding carriage 11 has reached the end of its return travel with the wire still disengaged from the gripper 15, but locked in the gripper 18. The front end of the wire 10 is still locked in the first restraining element 27.

[0020] In the following step (figure 4), the gripper 25 of the shaping arm 20 is unlocked from the wire 10, after which the shaping arm 20 starts its downward travel. The gripper 18 of the accompanying carriage 16 is opened releasing the wire 10 and the carriage starts its return travel. On the contrary, the wire 10 is gripped by the gripper 15 of the feeding carriage 11 which restarts its wire feeding travel. The first restraining element 27 of the bending tool 19 is open and so is the second restraining means wherein the bent wire is caused to pass.

[0021] In the following step (figure 5), the shaping arm 20 continues its downward travel until the gripper 25 is

made to be engaged with the wire 10. The feeding carriage 11, having the gripper 15 engaged with the wire 10, continues its wire feeding travel, while the accompanying carriage 16 completes its return travel.

[0022] Then, the cycle is repeated going back to the above described initial step.

[0023] The method described above, with reference to figures from 1 to 5, makes it possible to form continuous bent structural sections with symmetrical configuration presenting isosceles triangles, that is equal length rectilinear parts and with constant bending angle.

[0024] On the contrary, for the production of continuous bent structural sections with asymmetrical configurations presenting right-angle triangles or scalene triangles, that is with alternate inclined and vertical parts (figure 6), it is necessary to vary the travel of the accompanying carriage 16 (respectively B or C) with respect to the feeding carriage 11. The ratio between the travels of the two carriages 11 and 16 determines the amplitude of the bending angle and, consequently, the distance between two successive bendings of the structural to be obtained.

[0025] The described method and machine fully achieve the objects of the invention, in particular making it possible to obtain, with very simple and reliable means, continuous bent structural sections in order to form electro-welded lattice girders in the required shapes and dimensions, to be used in the field of building construction.

Claims

1. Method for the production of continuous bent structural sections to be used to form electro-welded lattice girders, normally used in building construction, starting from a wire or metal rod (10), **characterized in that:**

- the wire or metal rod (10) is made to move forward linearly, determining the pitch of the structural section to be obtained, by means of a feeding powered carriage (11) and an accompanying powered carriage (16), said carriages being coordinated with each other so as to move alternately in a reciprocally opposite direction,
- the wire or metal rod is engaged by a shaping arm (20) that is driven to move vertically in a curvilinear trajectory and with a travel adjustable on the basis of the height of the structural section to be obtained, and
- the wire or metal rod is alternately held locked and unlocked in a fixed positioning point (26), downstream of the shaping arm, provided with restraining elements (27).

2. Method for the production of continuous bent structural sections according to claim 1, **characterized in that** the travel of the accompanying carriage (16)

is variable with respect to the travel of the feeding carriage (11) so as to vary the amplitude of the bending angle of the structural sections and, consequently, the distance between two successive bendings of the structural sections, obtaining structural sections with asymmetrical configurations presenting right-angle triangles or scalene triangles.

3. Method for the production of continuous bent structural sections according to claim 1, **characterized in that** the height of the structural section to obtain is determined by adjusting the length of the shaping arm (20). 10

4. Machine for the production of continuous bent structural sections to be used to form electro-welded lattice girders, normally used in building construction field, starting from a wire or metal rod (10), **characterized in that** it includes 15
 - a carriage for linearly feeding (11) the wire or metal rod, driven by an electric motor, or equivalent means, through an articulated mechanism (14), and a carriage (16) accompanying the wire or metal rod (10), coordinated with the feeding carriage (11) so as to move alternately in a reciprocally opposite direction and provided with a bending tool (19), 20
 - said carriages (11, 16) being equipped with respective grippers (15, 18) for gripping the wire or metal rod (10), suitable to be controlled in coordinated and selective sequences by centralized control means, 25
 - a shaping arm (20) for the wire or metal rod (10), controlled to move vertically in a curvilinear trajectory and alternately through an articulated quadrilateral mechanism (21), said arm being equipped at its lower end with a gripping means (25) to engage the wire or metal rod (10), and 30
 - a positioning device (26), downstream of the shaping arm (20), wherein the wire or metal rod (10) is kept locked during the lifting of the shaping arm (20). 35

5. Machine for the production of continuous bent structural sections according to claim 4, **characterized in that** the shaping arm (20) comprises an articulated quadrilateral mechanism (21) driven through a series of gearwheels (22, 23, 24), and ends with a gripping means (25) for gripping the wire (10). 40 45 50

6. Machine for the production of continuous bent structural sections according to claim 5, **characterized in that** the articulated quadrilateral mechanism (21) is adjustable in length by operating on clamps (28) and screws (29) to vary the distance (A) between the fulcrum of the arms and the axes of the gearwheels (22, 23, 24). 55

7. Machine for the production of continuous bent structural sections according to claim 4, **characterized in that** the positioning device (26) is provided with at least one restraining element (27), suitable to lock the wire (10) during the bending step and to cooperate with the bending tool (19).

FIG. 1
STRUCTURAL SECTION WITH SYMMETRICAL BENDING

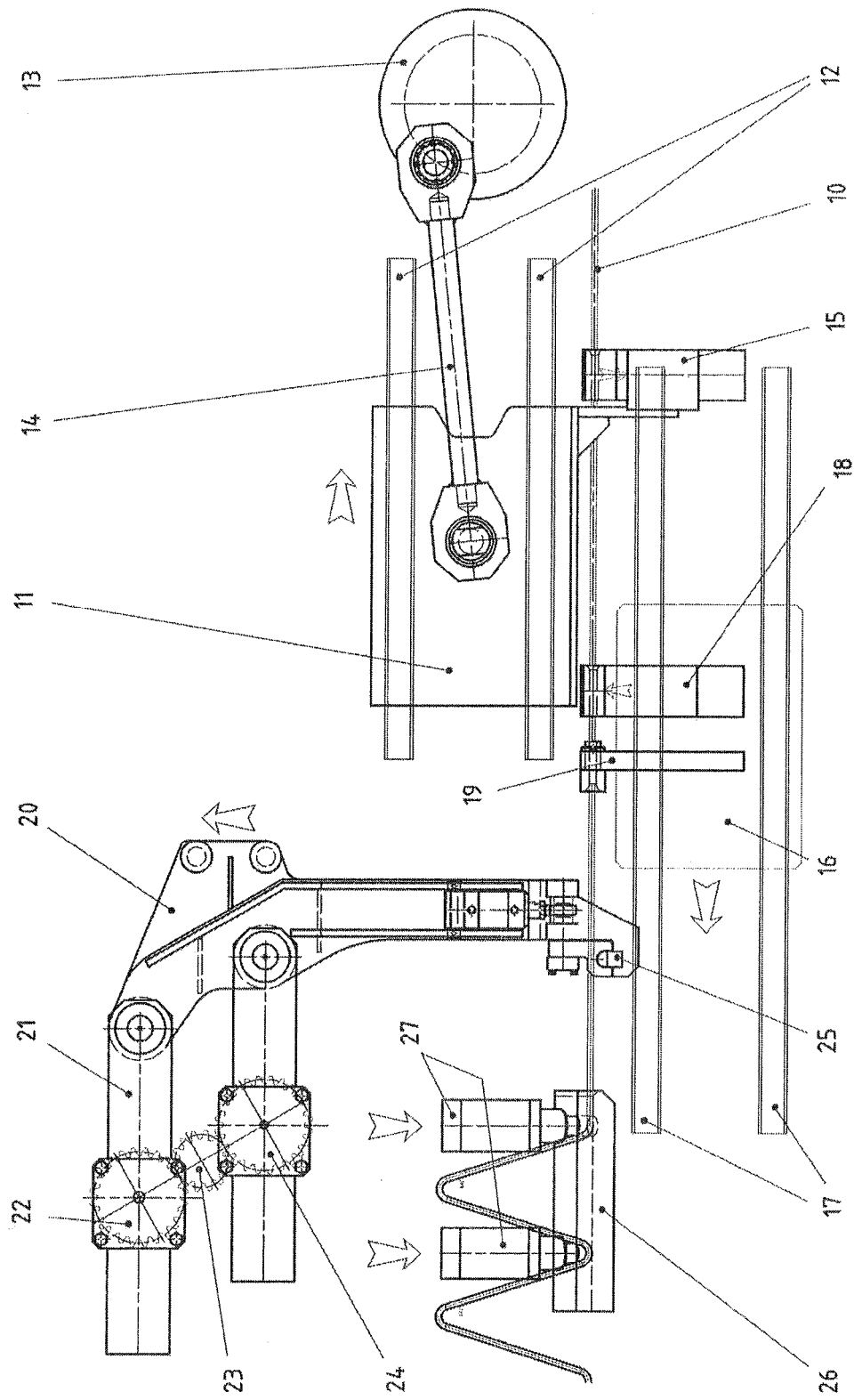


FIG. 2

STRUCTURAL SECTION WITH SYMMETRICAL BENDING

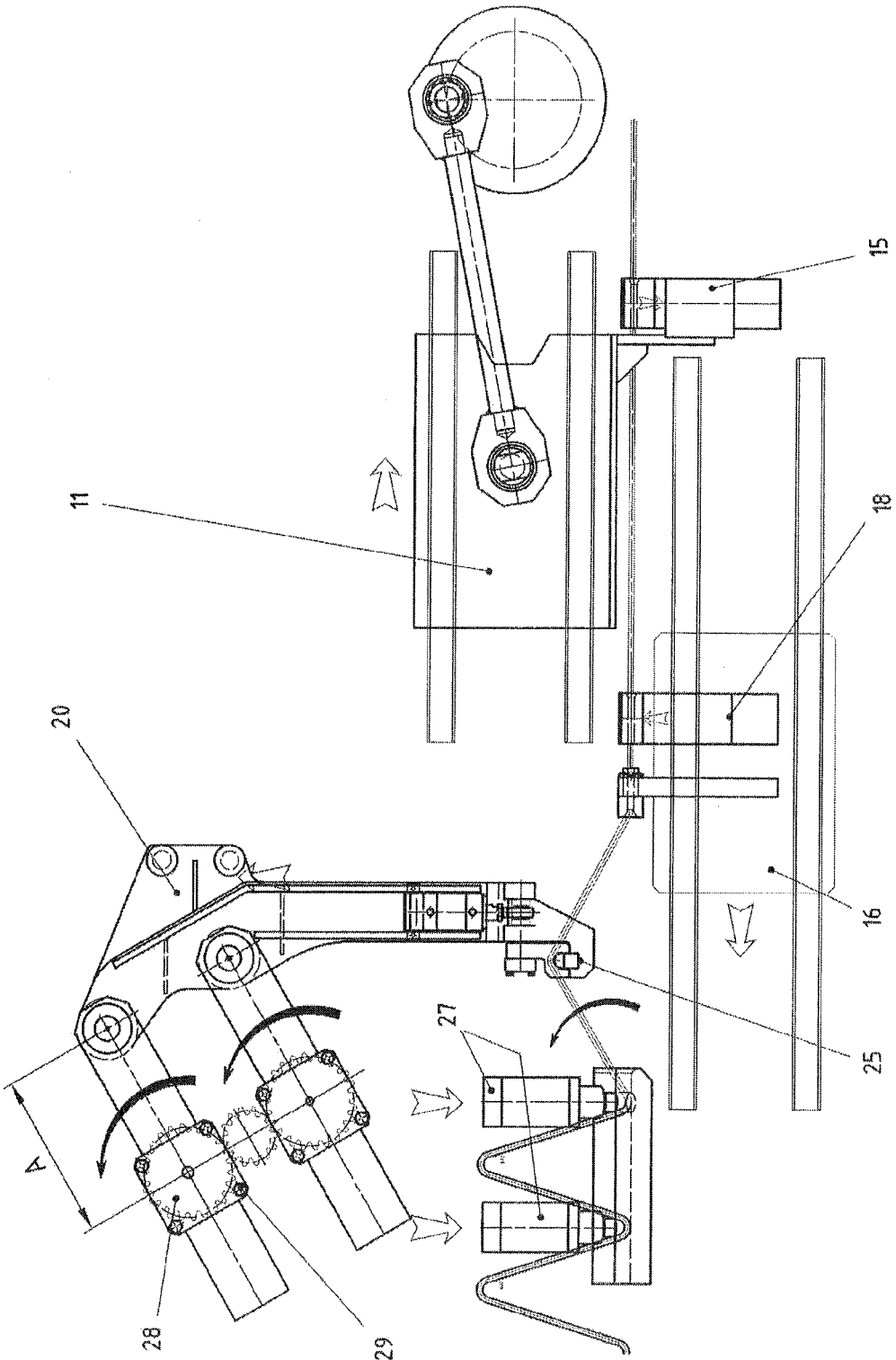


FIG. 3

STRUCTURAL SECTION WITH SYMMETRICAL BENDING

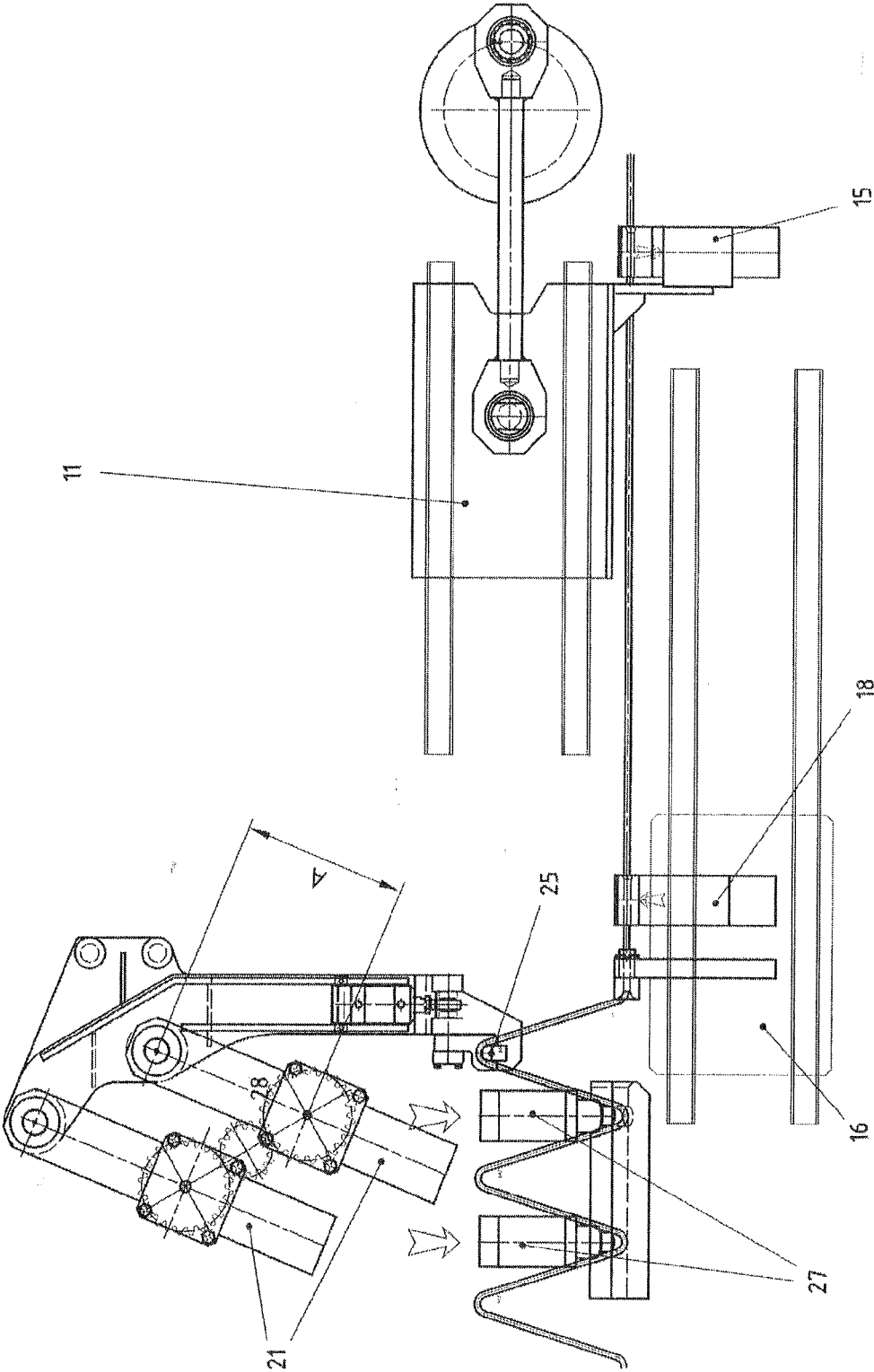


FIG. 4

STRUCTURAL SECTION WITH SYMMETRICAL BENDING

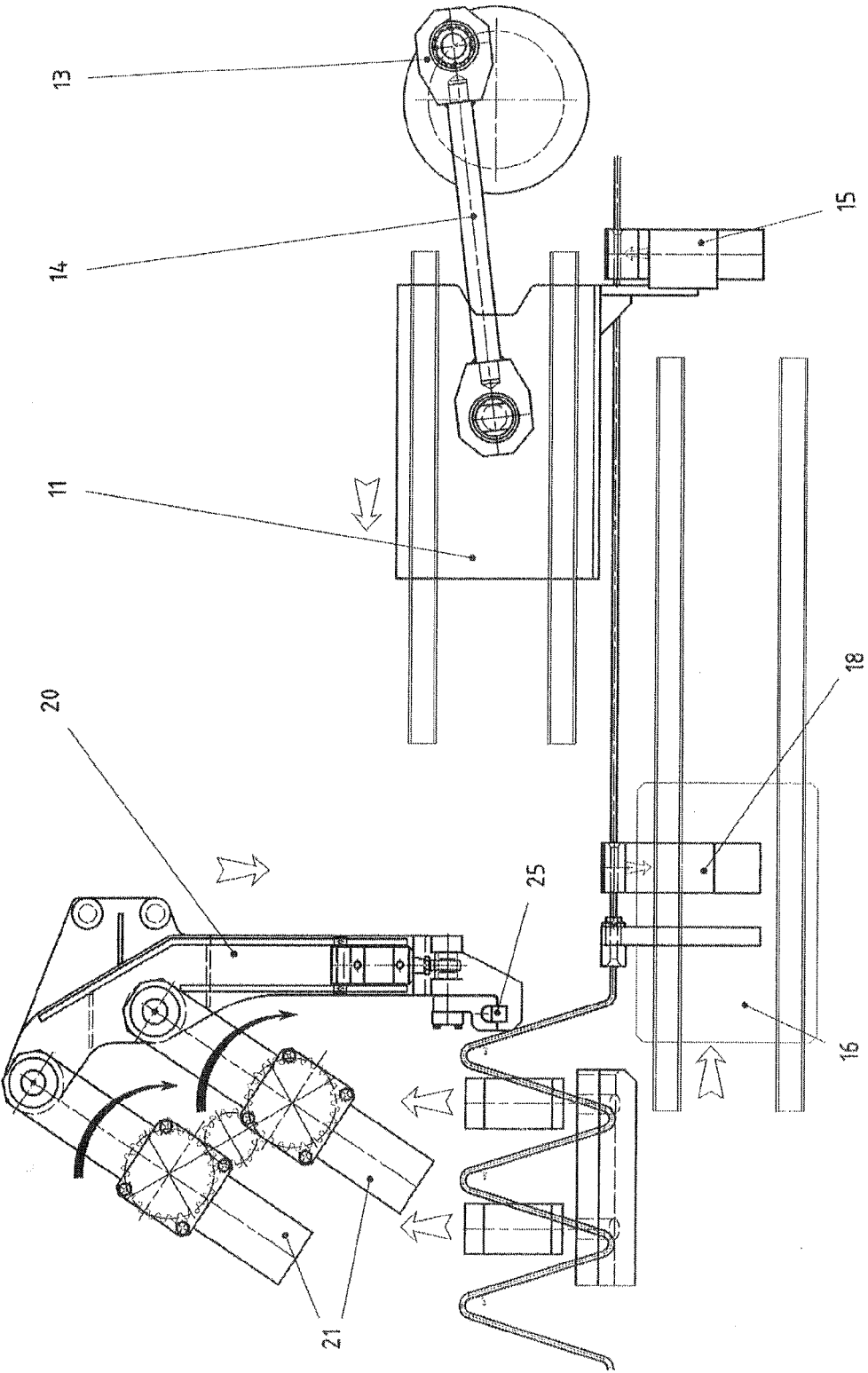
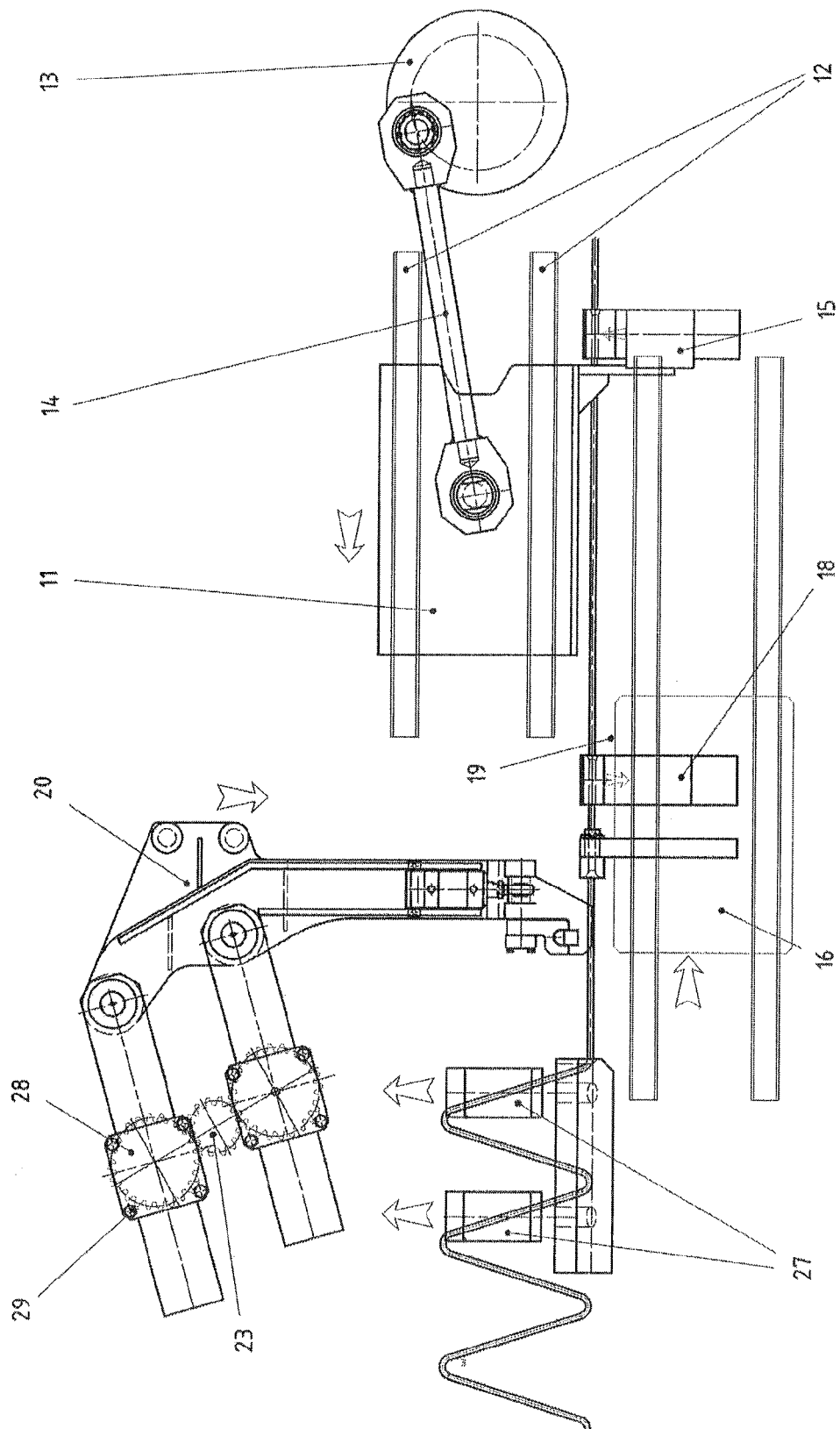


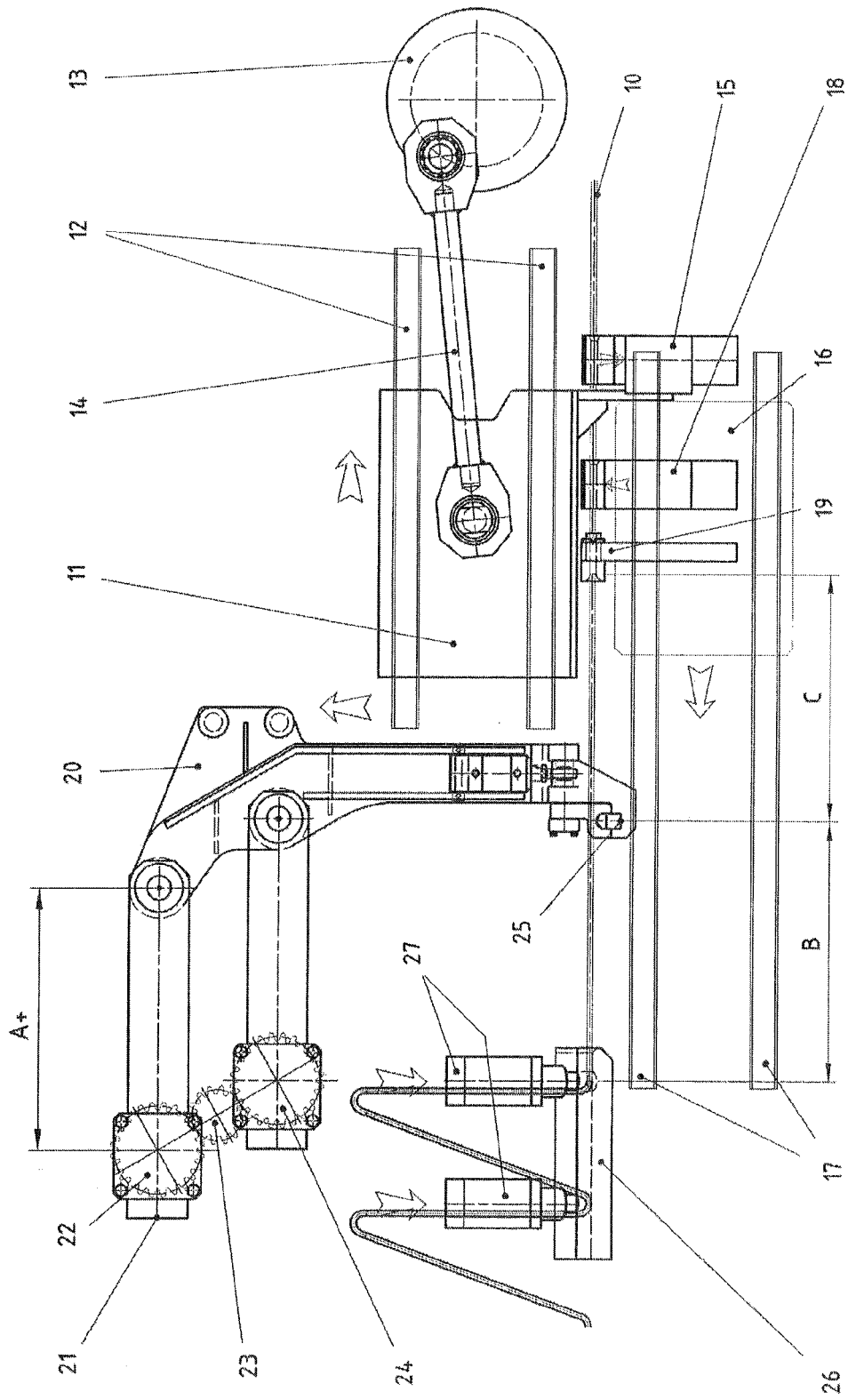
FIG. 5

STRUCTURAL SECTION WITH SYMMETRICAL BENDING



STRUCTURAL SECTION WITH ASYMMETRICAL BENDING

FIG. 6





EUROPEAN SEARCH REPORT

Application Number
EP 12 19 3338

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 December 2012	Examiner Vinci, Vincenzo
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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05-12-2012

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