



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.10.2008 Bulletin 2008/43

(51) Int Cl.:
B21F 27/20 ^(2006.01) **B21F 1/04** ^(2006.01)
B21F 11/00 ^(2006.01)

(21) Application number: **07150103.5**

(22) Date of filing: **19.12.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(72) Inventor: **Miconi, Sandro**
33030 Buia (Udine) (IT)

(74) Representative: **Gonella, Mario et al**
Propria S.r.l.
P.O. Box 365
Via della Colonna, 35
33170 Pordenone (IT)

(30) Priority: **18.04.2007 IT PN20070023**

(71) Applicant: **Promostar S.r.L.**
33030 Buia (Udine) (IT)

(54) **Apparatus and method for manufacturing beam-reinforcement latticework-like wire structure on a just-in-time basis**

(57) The present invention relates to an apparatus for manufacturing latticework-like wire structures intended as reinforcement structures for beams and girders, such as in particular concrete beams and girders, and the related manufacturing method. An apparatus according to the present invention comprises a first in-feeding unit (1) adapted to supply a plurality of first wires, a second in-feeding unit (2) supplying a plurality of second wires (9) to a forming unit (4) provided with forming

means (6) adapted to bend said second wires (9), a welding unit (5) for joining said first and second wires to each other. The apparatus according to the present invention is characterized in that said forming unit (4) comprises cutting means (14) adapted to cut off the second wires (9), and in that a selection unit (3) adapted to select said second wires (9) is provided upstream to said forming unit (4) for selecting said second wires (9) according to the gauge thereof.

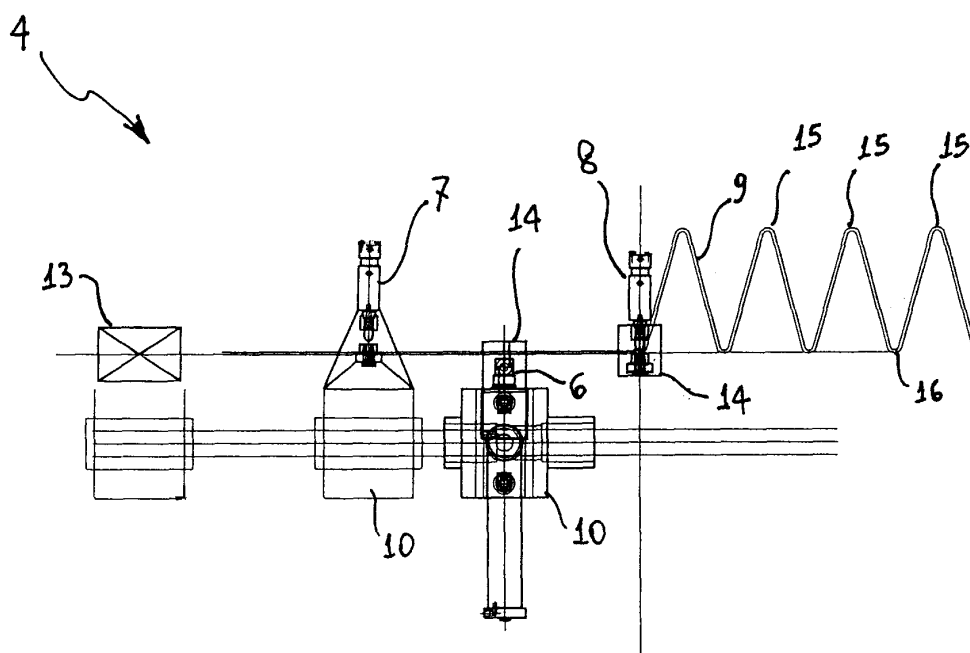


FIG. 2

Description

[0001] The present invention refers to an apparatus for a just-in-time manufacture of latticework-like wire structures intended as reinforcement structures for beams and girders, such as in particular concrete beams and girders; it also refers to the related manufacturing method.

[0002] In the building industry in general, and the pre-fabricated construction industry in particular, use is largely made of beams and girders that are made of a reinforcement latticework-like structure of crisscrossed metal rods, i.e. wires embedded in concrete. Usually, a latticework-like reinforcement of this kind suiting the particular application is comprised of a pair of metal wires - generally termed lower longitudinal stringers in the art - extending at the same level in a mutually parallel arrangement, and joining to a third metal wire - generally termed upper longitudinal stringer in the art - extending parallel to the lower stringers, but at a different level relative thereto. The connection of the lower longitudinal stringers with the upper longitudinal stringer is done by welding a further pair of wires that are previously bent to form two corresponding undulate brackets.

[0003] Latticework-like reinforcements of the above-described kind are manufactured with the aid of rather complicated equipment, starting generally from coiled wire, i.e. wire wound on reels. According to the manufacturing methods generally used nowadays, these wires are first unwound from the reels, then properly positioned in accordance with the shape that the lattice-work-like reinforcement is due to take, and straightened so as to level them out by eliminating the curvature due to the wire having been wound on the reels. The wires that are due to form the afore-cited welding brackets are bent so as to take an undulate pattern and - jointly with the wires forming the longitudinal stringers - they are then conveyed towards the welding units that will electrically weld the thus formed brackets onto the longitudinal stringers. Upon leaving the welding units, the thus formed latticework-like reinforcement is cut to desired length with the aid of appropriate cropping machines and is eventually sent to the packaging station. Anyway, use is currently made also of latticework manufacturing apparatus, in which the latticework-like reinforcement structures are made starting from bundles of wires that are pre-cut to the desired length and are delivered in this state to the required forming and welding operations.

[0004] Apparatuses of this kind are designed to mass-produce a large number of lots of invariably identical latticework-like reinforcements, and do not provide any possibility for variations to be introduced in the process so as to cope with desired changes in the dimensions of the wires or rods that make up the latticework-like reinforcements being produced, such as for instance changes in the wire or rod diameter or variations in the pitch, or spacing pattern, and the height of the curvatures imparted to the wires or rods forming the welding brackets. In other

words, apparatuses of the above-described kind cannot be used in any such case in which some kind of just-in-time manufacturing scheme is needed or desired, i.e. are not practicable whenever the kind of production being made or contemplated calls for a high degree of co-ordination between the time at which the latticework-like reinforcements are actually needed at the building or any similar site of use thereof, and the time at which they have to be produced and made available for delivery to the customers. In manufacturing apparatuses of this kind, any variation to be introduced in production or product parameters can in fact only be done at the cost of considerably long down-times.

[0005] In more recent times, the need has been increasingly felt in the building industry for varied types of concrete beams and girders having differing strength properties, and - as a result - differing dimensional specifications of the metal reinforcement embedded in the same beams and girders, to be used within a same construction, i.e. building unit. Now, such requirement cannot be complied with by any of the currently known beam fabrication apparatuses and related manufacturing methods, owing to their poor flexibility in adapting to different production needs and patterns in an acceptably quick manner.

[0006] It is therefore a main object of the present invention to provide an apparatus, along with a related method, for manufacturing latticework-like reinforcements for beams and girders, which does away with the typical drawbacks and disadvantages of prior-art apparatuses and methods.

[0007] Within this general object, it is a purpose of the present invention to provide an apparatus and a method for manufacturing latticework-like reinforcements for beams and girders, which are highly flexible to enable the form and shape of latticework-like reinforcements being produced to be changed whenever this is needed, without any downtime, i.e. without any need arising for the production process itself to be temporarily stopped.

[0008] Another purpose of the present invention is to provide a manufacturing apparatus and method, which enable latticework-like beam reinforcements in a wide range of sizes, in particular having longitudinal wire stringers and welding brackets with diameters that can be selected to comply with varying needs, to be produced.

[0009] Yet another purpose of the present invention is to provide an apparatus for producing latticework-like beam reinforcements, which is capable of being derived from an existing prior-art apparatus through a reduced number of modifications.

[0010] It is a further, equally important purpose of the present invention to provide an apparatus for producing latticework-like beam reinforcements, which is capable of ensuring an improved hourly output rate as compared with existing prior-art apparatuses.

[0011] According to the present invention, these aims, along with further ones that will become apparent from

the following disclosure, are reached in an apparatus for producing latticework-like beam reinforcements, which incorporates the features and characteristics as recited in claim 1 appended hereto, and a related method for producing latticework-like beam reinforcements, which incorporates the features and characteristics as recited in claim 10 appended hereto.

[0012] Further features and advantages of the present invention will anyway be readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a block diagram of an apparatus for producing latticework-like beam reinforcements according to the present invention;
- Figure 2 is a schematical view of a machine for forming the welding brackets for the latticework-like beam reinforcements, as viewed in a first phase of the forming process thereof;
- Figure 3 is a schematical view of the forming machine shown in Figure 2, as viewed in a second phase of the forming process thereof.

[0013] With reference to Figure 1, the apparatus according to the present invention comprises a first in-feeding unit 1 adapted to supply a plurality of first wires that are substantially rectilinear in form. Preferably, such first in-feeding unit works by withdrawing wires that are wound on reels, using appropriate unwinding machines to this purpose; the thus withdrawn wires are then straightened out and cut to the desired length by means of appropriate cutting tools. As an alternative thereto, the in-feeding unit 1 may be adapted to withdraw, i.e. take in wires that are pre-cut according to the length that the latticework-like beam reinforcements to be produced are due to have at the end of the fabrication process. The diameter, i.e. gauge of the wires supplied by the first in-feeding unit may be varied according to actual needs and requirements by means of appropriate machines that are inherently known as such in the art and, in particular, are adapted to effect, i.e. carry out a reduction in the diameter or gauge of the wires. The wires supplied by the first in-feeding unit will be used as the longitudinal stringers needed to form each latticework-like beam reinforcement.

[0014] A second in-feeding unit 2 uses appropriate forward-moving and positioning means to supply a plurality of second wires having diameters that differ from each other to a so-called selection unit 3 that is capable of selecting such wires on the basis of, i.e. according to the diameter or gauge thereof. The selection process is carried out in accordance with the type of latticework-like beam reinforcement that is due to be produced, as well as the extent or amount of reinforcement that it is required to impart to the beam or girder in which it is going to be

embedded. Upon having been in this way selected in the selection unit 3, these second wires, which will form the brackets used in the fabrication of the latticework-like beam reinforcement, are supplied into a forming unit 4, in which they are preferably formed according to an undulate pattern and eventually cut to the desired length and size. Such forming unit 4 will be described in greater detail below with reference to Figures 2 and 3.

[0015] The brackets that are formed by and output from the forming unit 4 are conveyed towards a welding unit 5, which also receives the afore-cited first wires, i.e. the longitudinal stringers being supplied by the first in-feeding unit 1. This welding unit 5 works by electrically welding the brackets onto the longitudinal stringers so as to complete the latticework-like beam reinforcement structure.

[0016] With reference to Figures 2 and 3, the forming unit 4 comprises forming means 6 interposed, i.e. provided between two respective clamping means 7 and 8 that are generally constituted by pincers or similar tools that are adapted to grip a wire 9. The forming means 6 comprise a translationally moving pushing member, the length or extent of the translational displacement of which can be adjusted with the aid of appropriate adjustment means as they are largely known as such in the art, so as to enable the wire 9 to be formed according to a wide variety of shape patterns. Further clamping means may be provided for association with the forming means 6. In order to form the wire 9 according to an undulate pattern, at least one of the pincers 7, 8 is movable relative to the other one, so that when the forming means 6 enter into contact with the wire 9 (cf. Figure 2), the resulting action exerted on such wire 9 causes the pincers 7, 8 retaining the wire 9 to move closer to each other. In the embodiment illustrated in Figures 2 and 3, the forming unit comprises a single movable pincer 7 and a second stationary pincer 8. The motion of the pincer 7 is a linear one and is operated with the aid of appropriate driving means 10, such as a rack-and-gear drive, a sliding-shoe drive or other straight-line motion mechanisms of any kind generally known as such in the art. Further motion imparting means 10 may be provided to vary the distance between the forming means 6 and each one of the pincers 7, 8 associated therewith, in view of forming along the wire 9 a pattern of waves or corrugations in a wide range of shapes, such as corrugations in the shape of an isosceles triangle, a right-angled triangle, etc.

[0017] In addition, the pitch and the height of the waves, i.e. corrugations formed on the wire 9 can be varied by acting on the adjustment means provided to adjust the travel, i.e. the displacement of the pushing member associated to the forming means 6, whereas the movement of the wire 9 is controlled by proper forward-moving and positioning means 13 during the forming process thereof.

[0018] The forming unit 4 is provided with cutting means 14, which enable the wire 9 to be cut off at a region thereof corresponding to a bend formed thereon or at any other region of the wire 9, as the case may be. In

particular, such cutting means 14 may be provided and accommodated within or in close association with either one or both pincers 7, 8 and/or the forming means 6 themselves. In this manner, the wire 9 can be cut off at a point corresponding to the crests 15 and/or the roots 16 formed thereon, or at any other point of the wire 9. With reference to Figure 3, when the wire 9 has desirably to be cut off at a crest 15, the same wire is solely clamped by the pincer 8 situated downstream from the forming means 6.

[0019] Fully apparent from the above description is therefore the ability of the present invention to effectively reach the aims and advantages cited afore, in that it provides an apparatus and a method for manufacturing latticework-like beam reinforcement structures, which are capable of enabling such latticework-like beam reinforcement structures to be produced in a wide range of different sizes and shapes on a just-in-time basis, since the possibility is given for not only the shape and pattern of the brackets used to join the longitudinal stringers, but also the diameter, i.e. gauge of the wires used to fabricate the latticework-like beam reinforcement structure and the length of the latter to be varied in response to changing needs, actually.

[0020] Fully apparent is also the ability of an apparatus and a method embodied according to the present invention to ensure a considerable increase in the hourly output rate, i.e. in the number of latticework-like beam reinforcement structures produced in a given time unit, since they do not require any disadvantageous down-time to introduce variations in the shape and/or size specifications of the latticework-like beam reinforcement structures to be produced.

[0021] Furthermore, the manufacturing apparatus according to the present invention is fully able to be advantageously implemented with just a few modifications starting from any existing prior-art equipment of the same kind, i.e. used to manufacture latticework-like beam reinforcement structures in the traditional manner.

Claims

1. Apparatus for manufacturing latticework-like wire structures intended as reinforcement structures for beams and girders, such as in particular concrete beams and girders, comprising a first in-feeding unit (1) adapted to supply a plurality of first wires, a second in-feeding unit (2) supplying a plurality of second wires (9) to a forming unit (4) provided with forming means (6) adapted to bend said second wires (9), a welding unit (5) for joining said first and second wires to each other, **characterized in that** said forming unit (4) comprises cutting means (14) adapted to cut off the second wires (9), and **in that** a selection unit (3) adapted to select said second wires (9) is provided upstream to said forming unit (4) for selecting said second wires (9) according to the gauge thereof.

2. Apparatus for manufacturing latticework-like beam reinforcement structures according to claim 1, wherein said forming unit (4) comprises forming means (6) provided between a pair of pincers (7, 8), said cutting means (14) being provided in correspondence to either one or both said pincers (7, 8).
3. Apparatus for manufacturing latticework-like beam reinforcement structures according to claim 1 or 2, wherein said cutting means (14) are provided on said forming means (6).
4. Apparatus for manufacturing latticework-like beam reinforcement structures according to any of the preceding claims, wherein at least one of said pincers (7, 8) is movable relative to the other one and said forming means (6) comprise a translationally displacing pushing member along with adjustment means for adjusting the travel, i.e. extent or length of displacement of said pushing member.
5. Apparatus for manufacturing latticework-like beam reinforcement structures according to claim 4, wherein motion imparting or actuation means (10) are provided to vary the distance between said forming means (6) and said pincers (7, 8).
6. Apparatus for manufacturing latticework-like beam reinforcement structures according to any of the preceding claims, wherein said forming means (6) comprise clamping means for retaining said second wires (9).
7. Apparatus for manufacturing latticework-like beam reinforcement structures according to any of the preceding claims, wherein said first in-feeding unit (1) comprises reels on which said first wires are wound, unwinding means for unwinding said first wires from said reels, and straightening and cutting means for said first wires to be given a substantially rectilinear form and a pre-determined length.
8. Apparatus for manufacturing latticework-like beam reinforcement structures according to any of the preceding claims, wherein said first in-feeding unit (1) comprises means adapted to reduce the diameter, i.e. gauge of said first wires.
9. Apparatus for manufacturing latticework-like beam reinforcement structures according to any of the preceding claims, wherein said second in-feeding unit (2) is provided with forward moving and positioning means for handling said second wires.
10. Method for manufacturing latticework-like wire structures intended as reinforcement structures for beams and girders, such as in particular concrete beams and girders, comprising the steps of

- a) feeding in a plurality of first wires;
b) feeding in a plurality of second wires (9);
c) selecting said plurality of second wires (9) on the basis of the diameter, i.e. gauge thereof;
d) bending said plurality of second wires in a forming unit (4) and cutting off said second wires (9) with the aid of cutting means (14) provided on said forming unit (4);
e) welding said plurality of first wires and said plurality of second wires together.
11. Method for manufacturing latticework-like beam reinforcement structures according to claim 10, wherein said step (a) comprises unwinding said plurality of first wires from the reels on which they are wound, and then straightening said first wires and cutting them to a pre-determined length.
12. Method for manufacturing latticework-like beam reinforcement structures according to claim 10 or 11, wherein said step (a) comprises reducing the diameter or gauge of said plurality of first wires.
13. Method for manufacturing latticework-like beam reinforcement structures according to any of the claims 10 to 12, wherein said step (d) comprises forming said plurality of second wires (9) into an undulate pattern.
14. Method for manufacturing latticework-like beam reinforcement structures according to any of the claims 10 to 13, wherein said step (d) comprises cutting off said second wires (9) at any pre-determined region of the bends formed by means of said forming unit (4).

40

45

50

55

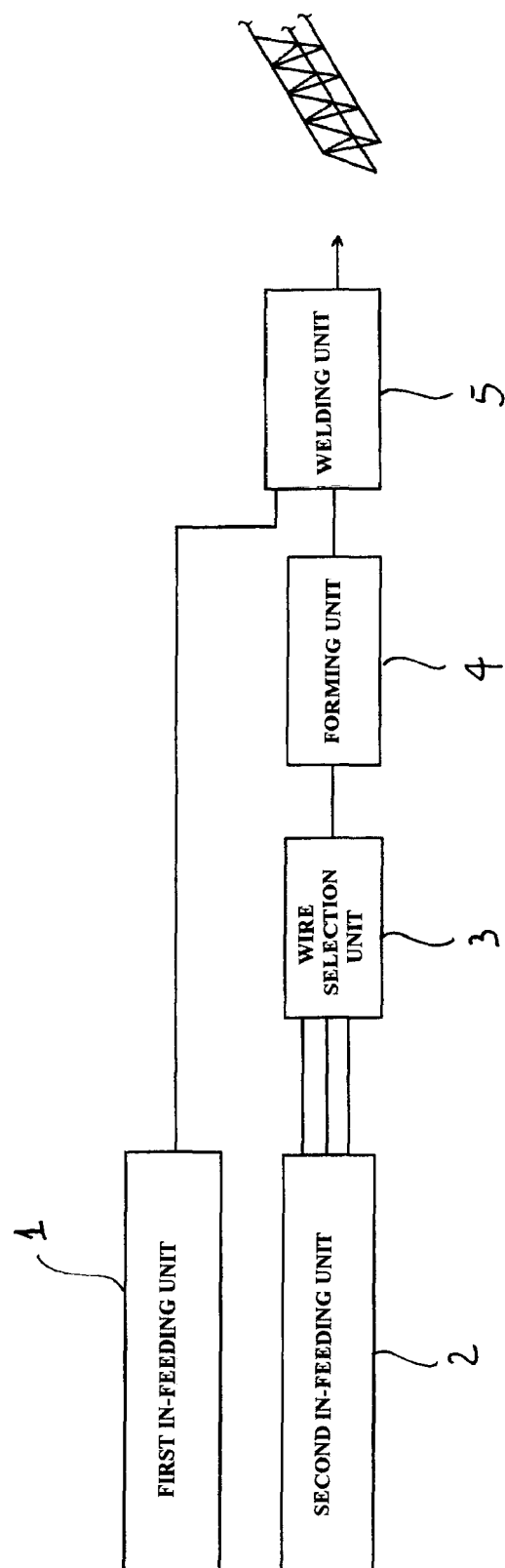


Fig. 1

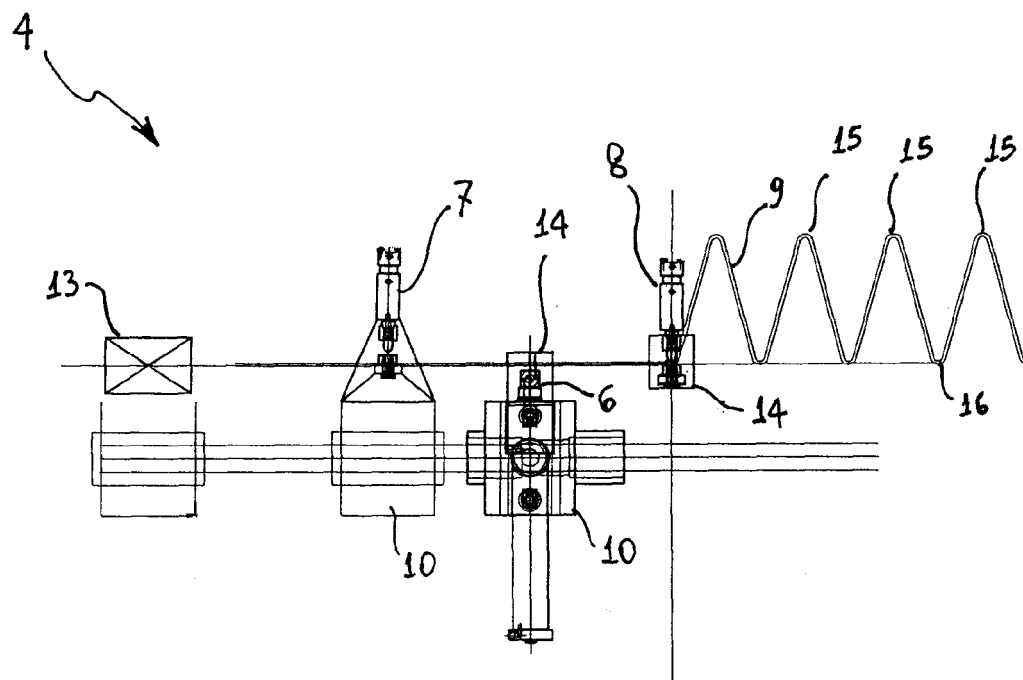


FIG. 2

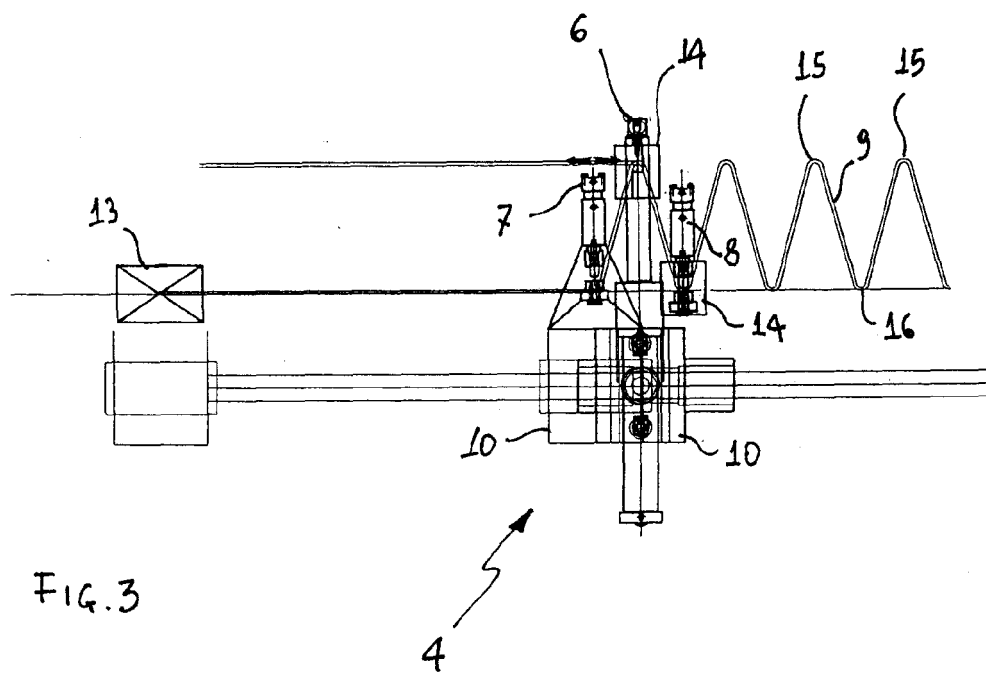


FIG. 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 15 0103

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 355 776 A (BITTLMAYER HUGO BITTLMAYER HUGO [DE]) 28 February 1990 (1990-02-28) * column 3, line 12 - column 5, line 23 * * figures 1,2 *	1,2,6,7, 9-11	INV. B21F27/20
A	EP 1 199 117 A (GUERRIERI GIULIANA [IT]) 24 April 2002 (2002-04-24) * paragraphs [0031] - [0043], [0074], [0094]; figure 2 *	1-6,10, 13,14	ADD. B21F1/04 B21F11/00
A	GB 707 525 A (HANS PETER GEORGII) 21 April 1954 (1954-04-21) * page 2, lines 50-79; figure 1 *	8,12	
A	MEP: "AUTOMATIC PRODUCTION OF REBAR FROM WIRE UP TO 16 MM" WIRE INDUSTRY, MAGNUM PUBLICATIONS LTD. OXTEDE, GB, vol. 63, no. 751, 1 July 1996 (1996-07-01), page 462, XP000622583 ISSN: 0043-6011 * the whole document *	1,10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B21F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 August 2008	Examiner Augé, Marc
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			

1
EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 15 0103

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-08-2008

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0355776	A	28-02-1990	AT DE	122271 T 3828596 A1	15-05-1995 08-03-1990

EP 1199117	A	24-04-2002	IT	B020000585 A1	10-04-2002

GB 707525	A	21-04-1954	NONE		

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82