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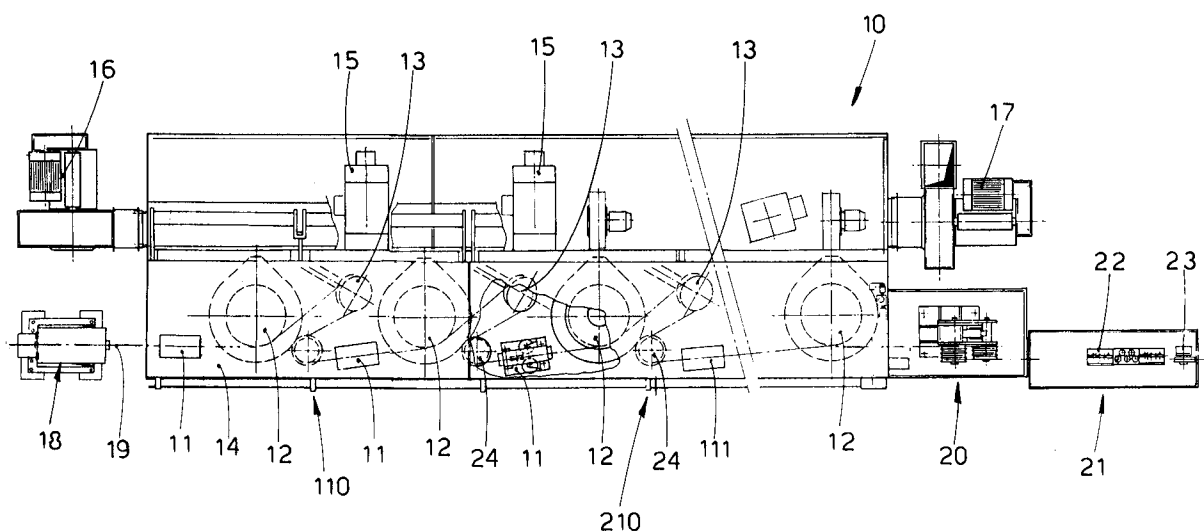
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I-33100 Udine(IT)(54) **Method for the cold processing of steel wire of a small section, and device suitable to carry out such method.**

(57) Method and device for the cold processing of steel wire of a small section, starting from rolled wire, which are suitable to produce smooth or ribbed wire having a section of 3 to 4.5 mm. and which arrange to pass the wire beforehand through a lubricant distribution unit (18) and to obtain reductions of wire by means of at least two pairs of rolls cooperating at least with a capstan (12), the wire being passed through a wire collection and take-up or regulation unit (20) and through a stretching and linearization assembly (21), pairs of reduction and finishing rolls (111) including at least three plus three rolls whereas the preceding pairs (11) always comprise two plus two rolls.

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This invention concerns a method for the cold processing of steel wire of a small section and also a device to carry out such method.

By steel wire of a small section is meant steel wire having a section ranging from 3 to 4.5 millimetres.

According to the invention the method can be used to produce smooth steel wire or steel wire with
5 surface ribs.

The method of the invention is a method to obtain steel wire by cold deformation by means of successive reduction passes.

It is known that metallic wire of a small section is used advantageously, but not only, for crack-resistant metallic mesh.

10 Steel wire of a small section, whether smooth or ribbed, is used not only for the production of electrically welded crack-resistant or containment mesh but also for trelliswork, fencing, etc.

In general, when wire is employed for metallic meshes or other constructional materials, it has to possess a range of mechanical and chemical properties and, among other things, has to be capable of being readily welded.

15 Moreover, the resulting wire has to possess well defined properties of strength and resilience which tend to exceed the capabilities offered by its chemical composition and by the method used to obtain both the material and the product of that material.

The production of steel wire by a cold deformation process is well known and is normally carried out by progressive deformation obtained by making the wire, originally made with a hot process, pass through
20 reduction elements, which may be die elements or roll elements.

Elements with two, three or four rolls are known and normally cooperate with the same number of rolls rotated by a given angle, which ranges from 45 to 90 degrees.

The document DRAHT, Vol.33, No.5, May 1982, pages 237-242, DAS WALZZIEHEN IM VERGLEICH ZUM GLEITZIEHEN, teaches a cold deformation process which employs assemblies of rolls including two
25 plus two pairs or three plus three pairs or else only three pairs of rolls.

A method to produce smooth steel wire is disclosed, for instance, in FR 2.340.146, which teaches cold-process reduction assemblies consisting of two plus two rolls or four rolls working at one and the same time.

The method in itself is praiseworthy but does not enable the quality of steel to be obtained which
30 modern users require; furthermore, the method disclosed therein and the machine proposed do not enable a complete process to be obtained, since they describe only some indications of possible reduction assemblies but not a coordinated harmonious whole which makes it possible to obtain a final required product possessing the final determined long-term constant properties.

FR 2.636.865, if on the one hand it provides a series of greater details, which are all already known, on
35 the other hand follows the method obtainable by means of FR 2.340.146 and teaches substantially the same method as that patent.

US-A-3,498,097 also discloses cold rolling by means of progressive reductions of the section of the product by means of two pairs of rolls.

The present invention, which is the outcome of long studies and experiments carried out by the present
40 applicant, overcomes the problems inherent in the known machines, adapts the number of reduction passes to the actual requirements, simplifies the operations of installation, maintenance and setting of the machine and also enables a product to be obtained which possesses capabilities and properties much higher than those that can be obtained with the known methods, even as compared to the methods disclosed in the documents cited above.

45 To achieve the above result the present applicant has studied, tested and obtained this invention, which is set forth and characterized in the main claims, while the dependent claims describe variants of the idea of the solution.

A first special feature of the invention consists of the fact that by merely replacing one well determined reduction assembly it is possible to produce smooth wire and ribbed wire with the same machine.

50 Another feature of the invention is that the ovalisation of the form of the product is reduced to a minimum and stays well within limits of 1.5% (one and a half per cent), this value being applied to a diameter size of 3.5 mm. and becoming smaller as the diameter increases.

Moreover, another special feature of the machine is the fact that the work of linearization and straightening and also of final stretching is obtained in a continuous manner, thus ensuring a finished
55 product of high quality.

Furthermore, this invention enables a very constant long-term quality to be achieved and reduces considerably the maintenance and setting-up work.

Besides, the method enables the exploitation of the machine to be optimized and to be adapted to the

minimum actual requirements so as to achieve a lower power consumption.

According to the invention the wire to be reduced is passed through a container of lubricant material, which covers and submerges the wire so as to ensure a correct and sufficient spreading of the lubricating material on the periphery of the wire.

5 The wire is sent from the container of lubricating material through two or more reduction assemblies.

According to the invention a last reduction and finishing assembly comprises three plus three rolls.

According to a variant the last reduction and finishing assembly comprises four plus four rolls.

According to the invention, to obtain smooth or ribbed wire it is enough to replace the last reduction and finishing assembly so that this assembly will either keep the wire smooth or will cause the required ribs in
10 its surface.

The ribs can thus be produced on two sides of the wire (by only two rolls out of four), on three sides or on four sides.

The first reduction assemblies comprise pairs of rolls rotated by 90 degrees to each other.

The wire is sent from the last reduction and finishing assembly to a capstan, whence the wire is passed
15 into a collection and slack-take-up system, or regulation system, and thereafter reaches a stretching and linearization assembly before going to the winding-up system.

According to the invention the stretching and linearization assembly comprises two straightening units having alternated rolls positioned at 90 degrees to each other.

According to a variant the stretching and linearization assembly comprises three straightening units
20 having alternated rolls positioned at 90 degrees to each other.

According to a further variant the stretching and linearization assembly comprises three straightening units having alternated rolls positioned at 120 degrees to each other.

According to the invention the minimum advisable reduction is of the order of 15/17% and advantageously of 16%, whereas the maximum advisable reduction is of the order of 30 to 35% and advantageously of 34%.
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Let us now see some examples of application of the invention in the following Table.

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Examples	Pass	Pairs of rolls	Surface of rolls L=smooth /N=ribbed of wire	Diameter of wire mm.	R=Reduction ratio	Working conditions
5 10 15 20 25 30 35 40 45 50						
φ input 5,5 φ output 3,0	0 1 2 3 4	2+2 2+2 2+2 3+3/4+4	/ L L L L/N	5,5 4,60 3,90 3,30 3,00	/ 30 28,1 28,4 17,4	4 capstans working (4 reductions)
φ input 5,5 φ output 3,5	0 1 2 3 4	2+2 2+2 2+2 3+3/4+4	/ L L L L/N	5,5 4,82 4,28 3,84 3,50	/ 23,2 21,2 19,2 17,1	4 capstans working (4 reductions)
φ input 5,5 φ output 4,0	0 1 2 3	2+2 2+2 3+3/4+4	/ L L L/N	5,5 4,90 4,40 4,00	/ 20,6 19,4 17,4	3 capstans working (3 reductions)
φ input 6,5 φ output 4,5	0 1 2 3	2+2 2+2 3+3/4+4	/ L L L/N	6,50 5,70 5,00 4,50	/ 23,1 23,1 19,0	3 capstans working (3 reductions)
φ input 5,5 φ output 4,5	0 1 2	2+2 3+3/4+4	/ L L/N	5,5 5,00 4,50	/ 17,4 19,0	2 capstans working (2 reductions)

This table shows the number of pairs of rolls, and the variants of the last reduction assembly are shown with its variables of three plus three (3+3) rolls or four plus four (4+4) rolls.

The table also indicates the condition of the surface of the rolls, which may be smooth (L) or ribbed (N) so as to be able to create ribs.

As we said earlier, in the state of four plus four rolls there may be ribs on two opposed rolls or on all

four rolls.

The percentage of the reduction ratio is reference with R%.

With the help of the attached figure, which is given as a non-restrictive example, let us now see a machine suitable to obtain the invention.

5 The figure shows a plan view of a drawing machine 10 with pairs of rolls.

Reduction assemblies 11-111, capstans 12, oscillatory rolls 13 to take-up slack of the wire and possible transmission pulleys 24 are positioned on a bench 14 having a substantially, but not necessarily, horizontal upper surface.

10 In this case the machine 10 is organized in two parts 110 and 210, each of which is served by its own motor 15 cooled by a cooling unit 16.

Each of the two parts 110-210 in this example contains two reduction assemblies 11-11 and 11-111 respectively together with their respective capstans 12. The two parts can be operated independently or in a synchronized manner.

A dust aspiration unit 17 cooperates with the drawing machine 10.

15 A unit 18 of a known type to spread lubricant on wire 19 to be reduced is included upstream of the drawing machine 10.

A unit 20 to collect and take up wire is located downstream of the drawing machine 10; a regulation unit may be included instead of the take-up unit 20.

20 The unit 20 to collect and take up wire may be of a type with a movable wheel or of a type with movable rollers.

A stretching and linearization assembly 21 is included downstream of the wire take-up unit 20 and in the example shown comprises three straightening units 22 positioned at 120 degrees to each other; the assembly 21 may be upstream of a measurement counter 23.

25 According to the invention all the reduction assemblies 11 consist of two plus two pairs of rolls, the processing surfaces of which are smooth.

The last reduction and finishing assembly 111 may include three plus three rolls or four plus four rolls. The processing surface of the rolls of the last reduction and finishing assembly 111, depending on requirements, may be smooth to produce smooth wire or may include recesses to produce ribbed wire.

30 The machine according to the invention can therefore carry out the cited method by actuating two or more reduction assemblies 11 and by pre-arranging the last reduction and finishing assembly 111 to produce the required finished product.

Claims

- 35 1. Method for the cold processing of steel wire of a small section, starting from rolled wire, which is suitable to produce smooth or ribbed wire having a section of 3 to 4.5 mm. and which arranges to pass the wire beforehand through a lubricant distribution unit (18) and to obtain reductions of wire by means of at least two pairs of rolls cooperating at least with a capstan (12), the wire being passed through a wire collection and slack-take-up or regulation unit (20) and through a stretching and linearization
40 assembly (21), the method being characterized in that pairs of reduction and finishing rolls (111) include at least three plus three rolls whereas the preceding pairs (11) always comprise two plus two rolls.
2. Method as claimed in Claim 1, in which the processing surface of the reduction rolls is smooth.
- 45 3. Method as claimed in Claim 1 or 2, in which at least some of the rolls of the pairs of reduction and finishing rolls (111) have a processing surface that includes recesses.
4. Method as claimed in any claim hereinbefore, in which the stretching and linearization assembly (21) comprises at least two straightening units (22) positioned at 90 degrees to each other.
- 50 5. Method as claimed in any of Claims 1 to 3 inclusive, in which the stretching and linearization assembly (21) comprises three straightening units (22) positioned at 120 degrees to each other.
- 55 6. Device for the cold processing of steel wire of a small section, starting from rolled wire, which is suitable to produce smooth or ribbed wire having a section of 3 to 4.5 mm. and which arranges to pass the wire beforehand through a lubricant distribution unit (18) and to obtain reductions of wire by means of at least two pairs of rolls cooperating at least with a capstan (12), the wire being passed through a

wire collection and slack-take-up or regulation unit (20) and through a stretching and linearization assembly (21) according to the method of the claims hereinbefore, the device being characterized in that it comprises reduction assemblies (11) including two plus two rolls having their processing surface smooth, whereas a final reduction and finishing assembly (111) comprises at least three plus three rolls.

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7. Device as claimed in Claim 6, in which the reduction and finishing assembly (111) comprises four plus four rolls.

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8. Device as claimed in Claim 6 or 7, in which the processing surface of the rolls of the reduction and finishing assembly (111) is smooth.

9. Device as claimed in Claim 6 or 7, in which the processing surface of at least two rolls of the reduction and finishing assembly (111) comprises recesses.

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10. Device as claimed in any of Claims 6 to 9 inclusive, which consists of two bodies (110-210), each of which bears two plus two reduction assemblies.

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11. Device as claimed in any of Claims 6 to 10 inclusive, in which the stretching and linearization assembly (21) comprises at least two straightening units (22) positioned at 90 degrees to each other.

12. Device as claimed in any of Claims 6 to 11 inclusive, in which the stretching and linearization assembly (21) comprises three straightening units (22) positioned at 120 degrees to each other.

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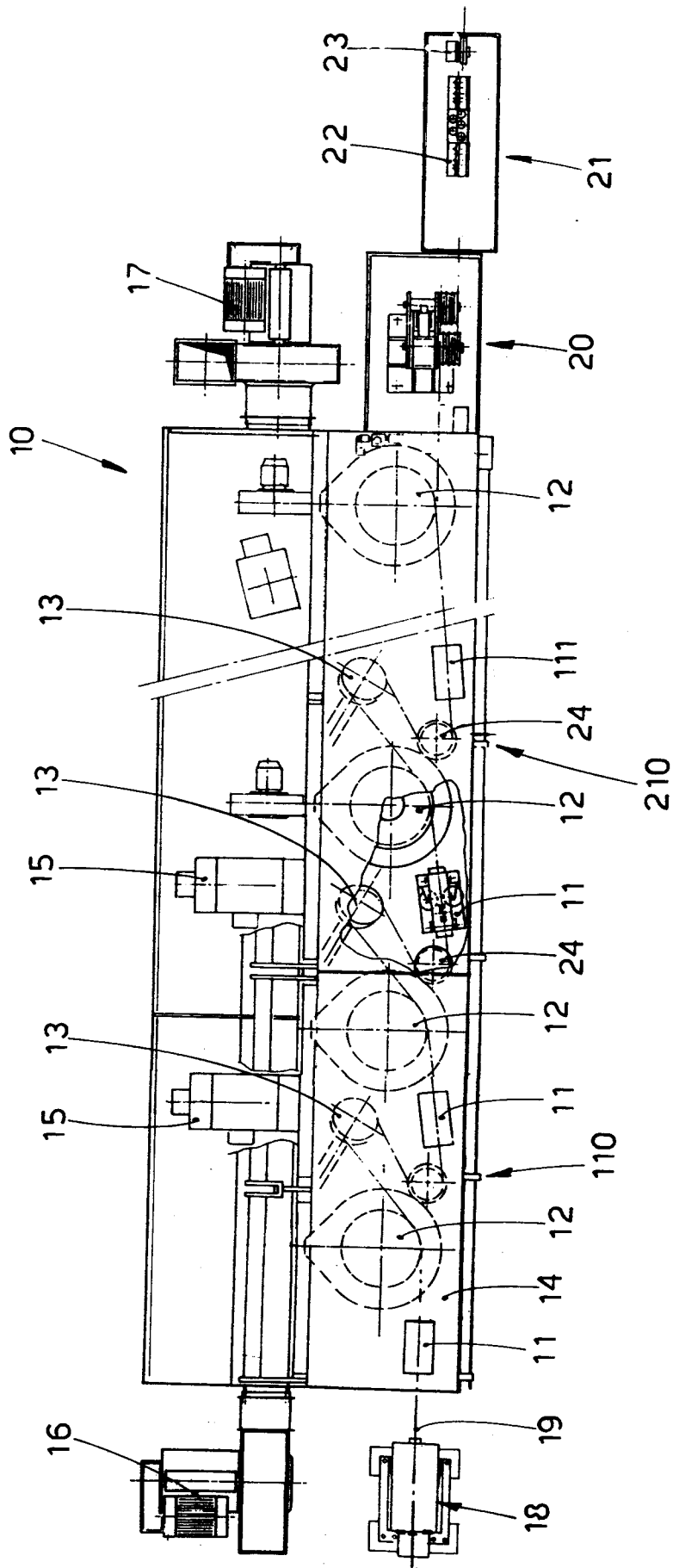
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EUROPEAN SEARCH REPORT

Application Number

EP 91 11 0411

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)
A	EP-A-0 362 055 (ACOR) * Abstract; claims 1,4; figures 1-6 * - - -	1,2,4,6,8, 11	B 21 C 3/08 B 21 C 19/00
D,A	FR-A-2 340 146 (ETS. G. FRUCHARD) * Page 6, line 28 - page 7, line 1; figure 7 * - - -	1,2,6	
A	PATENT ABSTRACTS OF JAPAN, vol. 7, no. 16 (M-187)[1161], 22nd January 1983; & JP-A-57 171 516 (SUMITOMO DENKI KOGYO K.K.) 22-10-1982 * Abstract * - - -	1,2,6,8	
A	GB-A-1 005 959 (HUFNAGL) * Claims 1,3,4; page 2, lines 12-15 * - - - - -	1-3,6,8,9	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 21 C
Place of search		Date of completion of search	Examiner
The Hague		07 August 91	THE K.H.
CATEGORY OF CITED DOCUMENTS			
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