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(54) Rolling stand element and rolling stand obtained therewith

(57) Element for a finishing or post-finishing rolling stand for thin products with a nominal diameter or transversal dimension between 4 and 16 mm, able to be associated with another element to obtain a rolling pass, the element comprising a support box (14), a driving shaft (24) and a driven shaft (25) bearing a cantilevered rolling roll or ring (12). The driven shaft (25) is rotatably mounted on a flange (13) which is mounted on the support box (14) in such a manner that the flange can rotate around the rotational axis (16) of the driving shaft (24) for angularly moving the driven shaft (25) with respect to the driving shaft (24), while maintaining the two shafts (24, 25) meshed therebetween.
A corresponding rolling stand for finishing and post-finishing, including at least a pair of elements (10) as above, in which, when several pairs are provided, the center distance between one pair and the adjacent one is between 130 and 450 mm.

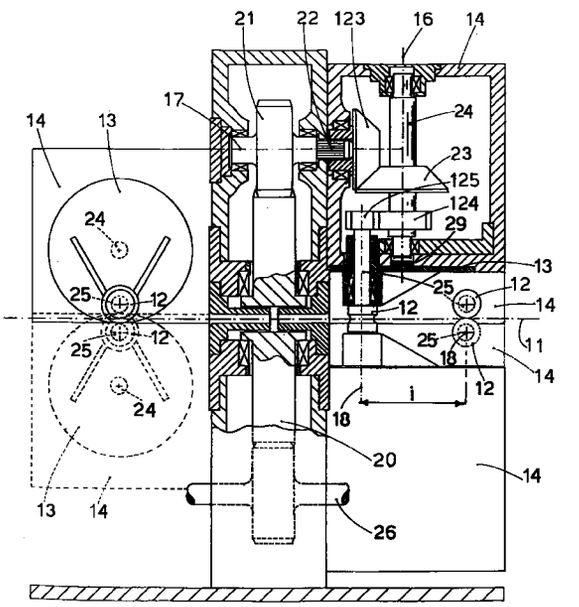

fig. 2

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Description

FIELD OF INVENTION

This invention relates to an element for a rolling stand, and also the rolling stand obtained with this element, as set forth in the respective main claims.

More in particular, the invention refers to a modular element to obtain a finishing stand or a post-finishing stand in a rolling line.

The invention also refers to a finishing or post-finishing stand obtained with one or more pairs of elements according to the invention.

The invention is applied in the field of hot rolling of thin products, having rounded, squared, hexagonal, rectangular, or other transversal section, of a nominal diameter or transversal dimension between 4 and 16 mm,, made of steel and particularly during the finishing and post-finishing steps which precede the arrival of the product on the coil-forming head or before the cooling bed or cooling belt.

BACKGROUND OF THE INVENTION

The state of the art covers post-finishing stands with two or four rolling passes to obtain the desired finish to the hot rolled products having a thin section normally of between 4 and 16 mm.

During this rolling step, the real obtainable rolling speed differs from the theoretical rolling speed for a lot of reasons.

In the state of the art, it is known to carry out the pre-finishing passes where the reduction has a fixed or variable sizing, whereas the last two or more finishing or post-finishing passes are with a variable sizing and define the final form of the product, which can possibly be diversified.

In the present state of the art, while the theoretical speeds is of 120÷130 m/sec., the real speed is no more then 105÷110 m/sec.

State of the art post-finishing rolling stands have rolling rolls or rolling rings with a minimum diameter of between 160 and 190 mm and necessarily need guide boxes to guide the rolled product both at the inlet and at the outlet of the relative rolling rings/rolls.

This is because the center distance between two stands, or between two subsequent post-finishing passes, cannot at the present time go below 650÷750 mm.

As a consequence of this considerable distance between two contiguous passes, the guide boxes are necessary; however, due to problems of rotation, centring and interference with the rolled stock, they limit the real rolling speed, as we have said.

Document US-A-4.785.653 proposes a rolling stand with two rolls which pivot horizontally around their axis of feed, in order to increase the rolling speed.

Although this proposal is valid, it does not solve the problem at all, firstly due to the presence of the axis of feed and also due to the fact that it is not possible to include, on the same structure, another pass rotated by 90°, except with considerable constructional and operational complexities.

Moreover, even if there were a further pass, it would be too distant to allow the boxes to guide the rolled stock to be eliminated.

Document "Neues Draht- und neues Mittelstahlwalzwerk fur die Ukraine", Rolf Schenke, 2454 Draht, vol. 44, no. 12, 1 December 1993, describes a rolling plant for wire rods, wherein the rolling stands have the rolling rolls cantilevered mounted and offset with respect to the corresponding driving shafts. In this document nothing is taught about the variability of the distance of rolling rolls with respect to the rolling axis and about the reduced center distance between the rolling rolls of the rolling stands, whereby the above mentioned problems are not solved.

Document JP-A-57-190703 describes a rolling stand constituted by two groups, each having a rolling roll cantilevered mounted on a corresponding support flange rigidly fixed to a driving box on which a driving motor is mounted. In this document, wherein each rolling roll is offset with respect to the axis of the motor, for varying the distance between the rolling rolls, one entire group, is moved with respect to the other, including the driving box and the motor,

Document DE-A-29 15 295 describes a rolling stand with cantilevered mounted rolling rolls for the production of wire rods, wherein a single motor causes the rotation of three groups of rolling rolls disposed at 120° one with respect to the others. In this document each group of rolling rolls is swinging with respect to the driving axis by means of complex and expensive actuating hydraulic cylinders.

Document GB-A-502,456 describes a very old system for regulating the distance between the rolling rolls of a rolling stand, constituted by two autonomous groups, wherein each group is slidably mounted on a fixed frame and wherein the rolling rolls are cantilevered mounted and offset with respect to the driving means. Also in this system, for varying the distance between the rolling rolls, the two groups are reciprocally moved with respect to the fixed frame, whereby the system itself is cumbersome and unsuitable, and does not solve the problem of the reduced center distance between the rolling rolls.

The present applicant has therefore designed and tested this invention, which overcomes the limitations of the state of the art, and makes it possible to obtain finishing stands, with one or more passes, which work at a much higher speed than that which can be obtained at present.

SUMMARY OF THE INVENTION

The invention is set forth and characterised in the

respective main claims, while the dependent claims describe variants of the idea of the main embodiment.

According to the invention, a modular element is included which bears rolling rolls or rings with a minimum diameter of about 70 mm and a maximum diameter of about 140 mm.

According to the invention, it is advantageous to include a range of diameters of the rolling roll/ring of between about 90 mm and about 110 mm.

According to the invention, the axis bearing the rolling roll/ring is borne offset by a disc or ring type flange which can rotate around its own axis and allows the roll/ring-bearing shaft, which is parallel to the axis of rotation of the flange, to rotate describing at least a arc of a circumference.

The roll/ring-bearing shaft is supplied with motion by a gear which is coaxial to the axis of rotation of the flange.

According to a variant, the gear which carries the motion coaxial to the flange receives motion directly from a kinematic motion common to all the elements of the stand.

According to another variant, each element receives motion from its own drive device.

According to another variant, the gear which carries the motion coaxial to the flange receives motion from a pair of tapered gears which is made to rotate by a common kinematic motion.

With this invention, two rolling rings or rolls can be made to cooperate so as to constitute a finishing stand or pass, with the respective support boxes or shaft-bearing elements on which the flanges are positioned, without there being any interference between the boxes themselves; the boxes are thus facing each other, offset and inverted with the axes of the rolling rolls or rings offset but parallel therebetween.

With the present invention, in the free areas between the two elements or support boxes which carry the respective rolls or rings to constitute a rolling pass, it is possible to place two other elements, in order to obtain another rolling pass with a minimal center distance from the previous pass.

With the present invention it is therefore possible to obtain one or more finishing rolling passes with a minimum center distance between about 130 and about 450 mm with regards to size.

It is within the scope of the present invention to include a minimum center distance between about 140 mm and about 250 mm.

According to the variant which includes the pair of tapered gears, it is possible to include a single source of motion, placed vertically for example, with four or more outlets to be connected to the respective support boxes, as the outlets are substantially parallel to the rolling axis.

The source of motion, for example, including a vertical plate with the desired kinematic chain or reduction unit inside, may include on one face two outlets which are connected to two elements according to the invention so as to constitute a first finishing pass.

According to a variant, on the same face the source of motion may include two plus two outlets so that four elements according to the invention (two plus two) may be installed so as to constitute two successive finishing passes.

According to another variant, on the other face it is possible to obtain respectively two or four outlets so that with a single plate as many as four finishing passes may be obtained.

The elements according to the present invention include means to position them rapidly on the motion means.

It is thus possible to change each individual element rapidly so as to facilitate not only maintenance operations but also equipping operations and operations to change measurements.

According to the invention, in a side view, the element is shaped like a "P", with the rolling roll or ring mounted on the lower terminal end of the leg of the "P".

BRIEF DESCRIPTION OF THE DRAWING

The attached figures are given as a non-restrictive example, and show the invention as follows:

Fig. 1 shows an example of an application of the invention with four elements so as to create two finishing rolling passes;

Fig. 2 shows a further example of another application of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the attached figures, each modular element 10 includes a support box 14 to which is associated a disc type flange 13 which is provided of a pivot 29 which allows the flange 13 to rotate around a first rotational axis 16.

The support box 14 is able to be removably fixed, for example to a frame 30, in a predetermined position with respect to a rolling axis 11.

In the support box 14 is rotatably mounted a driving shaft 24, coaxial to the first rotational axis 16 and provided with a driving gear 124 of cylindrical form.

A driven shaft 25 is rotatably mounted on the flange 13, coaxial to a second axis of rotation 18, which is parallel and offset with respect to the first rotational axis 16. At an external end of the driven shaft 25 is cantilever mounted a rolling roll or ring 12 having a diameter between 70 and 140 mm., advantageously between 90 and 110 mm.

The driven or roll-bearing shaft 25 is provided on an internal end with a driven gear 125 meshed with the driving gear 124,

According to first embodiment, the driving shaft 24

is directly associated to an autonomous drive motor 15, so that in the case of a rolling stand with four rolling elements 10, which constitute two pairs of rolling rolls or rings 12, or two rolling passes, four drive motors 15 are provided (fig.1).

According to a variant, shown in fig.2, the driving shaft 24 is provided with a first tapered gear 23, meshed with a second tapered gear 123, which receives motion from a motion-inlet axis 17 which is parallel to the rolling axis 11.

According to this variant, the modular element 10 may be associated with a reduction unit 19 which contains any kind of kinematic chain whatsoever, which is associated with a drive device 26.

It is clear that in this latter case, wherein a single drive device is provided, the single motors are not necessary.

The reduction unit 19 comprises a central gear 20, coaxial to the rolling axis 11, able to supply motion to a driven gear 21 which, by means of a fast coupling 22, can be easily connected to the tapered gear 123.

The axis of the driven gear 21 coincides with the axis 17 whereby motion enters the element 10.

The center distance "i" between the rotational axes 18 of two adjacent pairs of rolling rolls or rings 12 is therefore very small, for instance between 130 and 450 mm., advantageously between 140 and 250 mm.

Fig. 2 shows an embodiment with three rolling passes.

Fast centring means and fast assembly/detachment means may easily be provided to removably fixing each element 10 to the frame 30.

With this invention, successive rolling passes can be rotated by 90°, or an intermediate pass may be not rotated.

Therefore, with this invention it is possible to obtain at least the following combinations:

oval-round (2 passes);
round-oval-round (3 passes);
oval-round-round (3 passes);
round-oval-oval-round (4 passes);
oval-round-oval-round (4 passes).

Claims

1. An element for a finishing or post-finishing rolling stand for thin products with a nominal diameter or transversal dimension between 4 and 16 mm., comprising a support box (14) fixedly mounted with respect to a rolling axis (11), a driving shaft (24) rotatably mounted in said support box (14) around a first rotational axis (16) and provided with a first gear (124), a flange (13) coupled to said support box (14), a rolling roll or ring (12) cantilevered mounted at an end of a driven shaft (25) which is rotatably mounted on said flange (13) around a second rotational axis (18) and is provided with a second gear (125) meshed with said first gear (124), said first and second rotational axes (16, 18) being parallel and offset therebetween, characterised in that said flange (13) is mounted on said support box (14) so as to rotate around said first rotational axis (16) for angularly moving said driven shaft (25) with respect to said first rotational axis (16), maintaining said first and second gears (124, 125) constantly meshed therebetween, whereby the distance between said rolling roll or ring (12) and said rolling axis (11) can be selectively varied by means of the rotation of said flange (13) with respect to said support box (14).

2. An element as in claim 1, wherein said driving shaft (24) is connected to a corresponding motor (15).

3. Element as in Claim 1, wherein said driving shaft (24) is connected to a motor element (26) through a reduction unit (19).

4. An element as in claim 3, wherein said driving shaft (24) is provided with a first tapered gears (23) meshed with a second tapered gears (123) connected to said reduction unit (19).

5. An element as in claim 4, wherein centring and fast connecting means (22) are provided between said second tapered gears (123) and said reduction unit (19).

6. An element as in claim 1, wherein said rolling roll or ring (12) has a diameter between about 70 and 140 mm.

7. An element as in claim 1, wherein said rolling roll or ring (12) has a diameter between about 90 and 110 mm.

8. An element as in claim 1, wherein said support box (14) has a substantially parallelepiped shape and wherein said driven shaft (24) protrudes from said support box (14) near to a lateral side thereof, parallel to said rotational axes (16, 18), whereby said element (10) is substantially "P" shaped with said rolling roll or ring (12) placed at the lower terminal end of the leg of the "P".

9. A rolling stand for finishing and post-finishing for thin products with a nominal diameter or transversal dimension between 4 and 16 mm., comprising a pair of rolling elements associated therebetween to define at least a rolling pass, characterized in that each one of said elements is constituted by an element (10) according to any of the claims hereinbefore.

10. A rolling stand for finishing and post-finishing for

thin products with a nominal diameter or transversal dimension between 4 and 16 mm., comprising at least two pairs of rolling elements associated therebetween to define at least two rolling passes, characterized in that each one of said elements is constituted by an element (10) according to any of claims 1-8 hereinbefore, the center distance between the rolling rolls or rings (12) of said two pairs being between about 130 and 450 mm.

11. A rolling stand for finishing and post-finishing for thin products with a nominal diameter or transversal dimension between 4 and 16 mm., comprising a plurality of pairs of rolling elements associated therebetween to define a plurality of rolling passes, characterised in that said plurality of pairs comprises at least four pairs of said elements which define at least four corresponding rolling passes, and that each one of said elements is constituted by an element (10) according to any of claims 1-8 hereinbefore, the center distance between the rolling rolls or rings (12) of each one of said pair being between about 140 and 250 mm.

12. A rolling stand as in claims 10 or 11, wherein each one of said rolling passes is rotated by about 90° with respect to the adjacent rolling pass.

13. A rolling stand for finishing and post-finishing for thin products with a nominal diameter or transversal dimension between 4 and 16 mm., comprising a plurality of rolling rolls or rings (12) cantilevered mounted at an end of corresponding support shafts (25) driven by motor means (24), characterised in that the diameter of said rolling rolls or rings (12) is between about 70 and 140 mm. and the center distance between a pair of said rolling rolls or rings (12) and the adjacent one is between about 130 and 450 mm.

14. A rolling stand as in claim 13, wherein the diameter of said rolling rolls or rings (12) is between about 90 and 110 mm. and the center distance between a pair of said rolling rolls or rings (12) and the adjacent one is between about 140 and 250 mm.

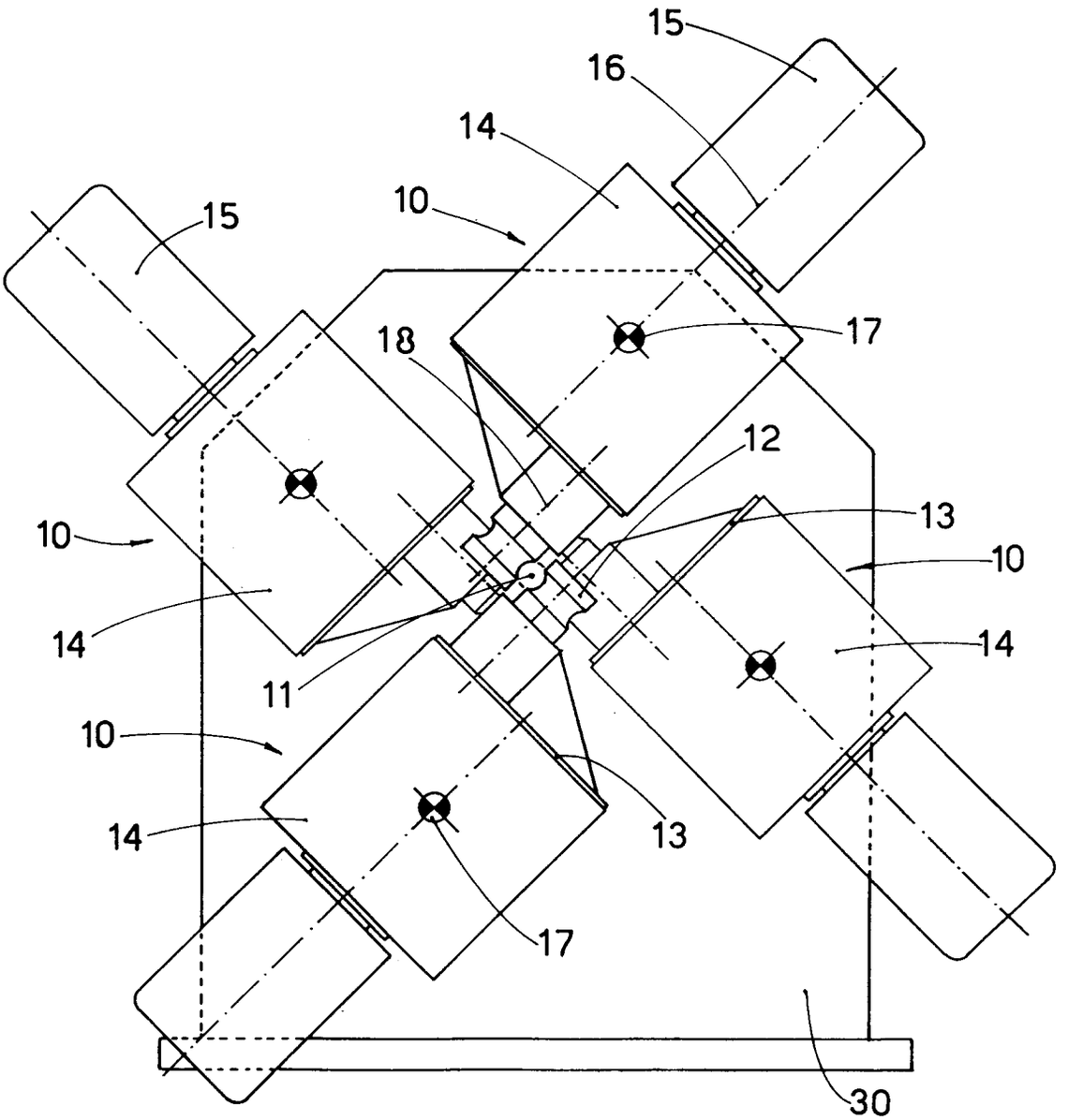

fig. 1

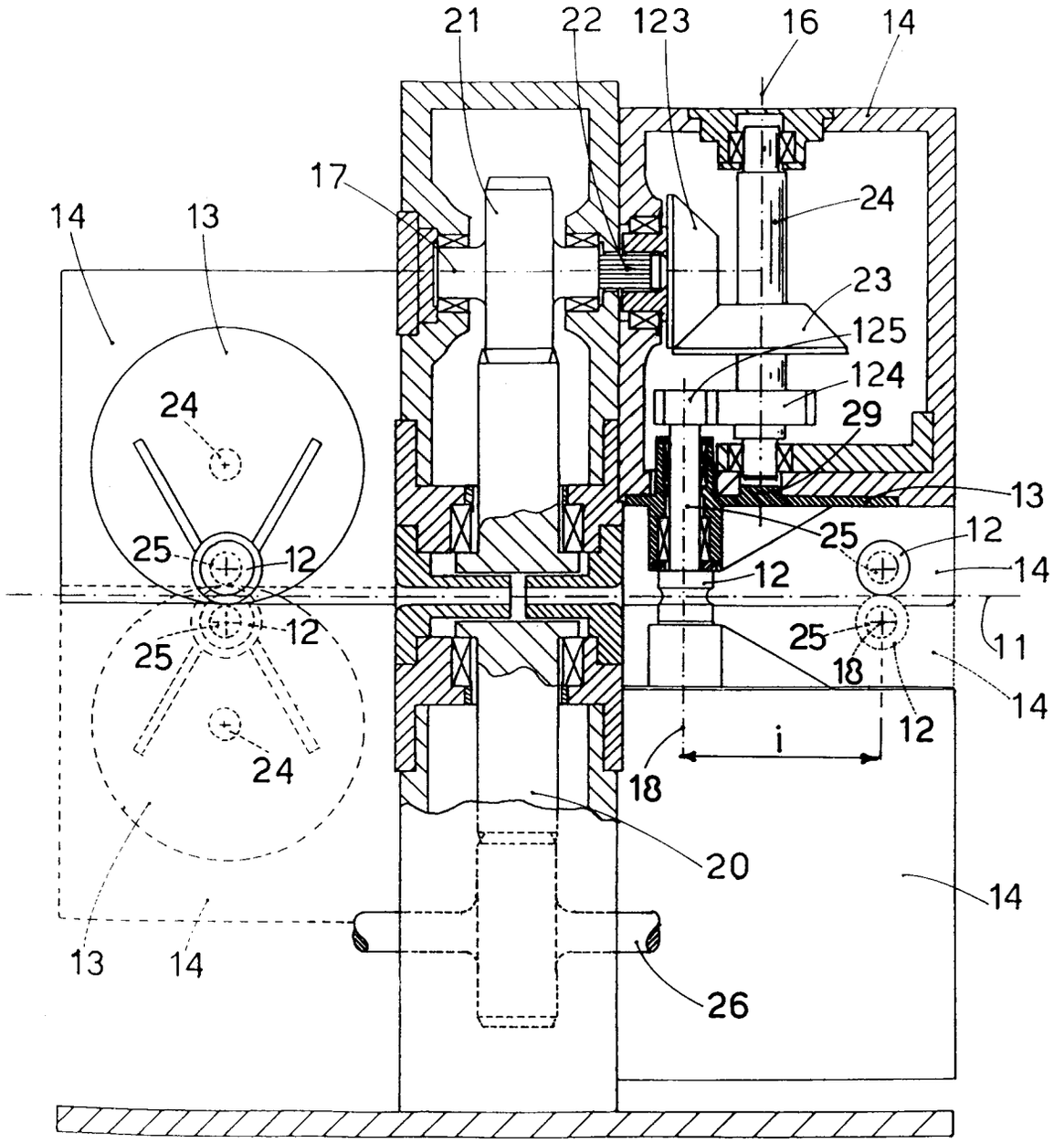
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fig. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 10 8990

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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Y	FR 2 036 245 A (DEMAG AG) 24 December 1970 * page 2, line 32 - page 3, line 2; figures *	1-3,8,9	
D,A	SCHENKE R: "NEUES DRAHT- UND NEUES MITTELSTAHLWALZWERK FUR DIE UKRAINE" DRAHT, vol. 44, no. 12, 1 December 1993, pages 689-691, XP000426087 * page 689, middle column, line 13 - line 14; figure 3 *	1,3,4,8, 9	
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A	FR 1 465 519 A (WISSENSCHAFTLICH-TECHNISCHES ZENTRUM) 24 March 1967 * page 2, right-hand column, line 17 - line 28 *	5	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 August 1998	Plastiras, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

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A	BUDDE D ET AL: "NEUE ENTWICKLUNGEN DER DRAHTWALZTECHNIK FUER HOCHLEGIERTE WERKSTOFFE" STAHL UND EISEN, vol. 112, no. 11, 9 November 1992, pages 83-89, 136, XP000339458 * figures 1-4; tables 1,2 *	6,7, 12-14	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 August 1998	Plastiras, D

CATEGORY OF CITED DOCUMENTS

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