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(54) **Assembly for the controlled prerolling of thin slabs leaving a continuous casting plant**

Vorrichtung zum geregelten Vorwalzen von aus einer Stranggiessanlage austretenden Dünnbrammen

Dispositif pour le prélaminage de brames minces sortant d'une installation de coulée continue

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- **STAHL UND EISEN. vol. 109, no. 9,10, 16 May 1989, DUSSELDORF DE pages 453 - 462 H.-J. EHRENBERG ET AL.: 'Giessen und Giesswalzen dünner Brammen bei der Mannesmannröhren-Werke AG'**
- **Full text translations of JP-A-01271047 and JP-A-62130759**

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Description

This invention concerns an assembly for the controlled pre-rolling of thin slabs leaving a continuous casting plant, as set forth in the main claim.

To be more exact, the invention concerns an assembly located immediately downstream of the foot rolls of an ingot mould for the continuous casting of thin slabs. This assembly performs a controlled pre-rolling operation on thin slabs leaving the mould.

By thin slabs are meant here slabs with a width ranging from 1200 to 2500 mm. or more and a thickness between 25 and 70 mm.

This invention can also be applied to the continuous casting of billets, whether they be round, square, rectangular, etc.; it can also be applied to continuous casting plants which are straight or curved.

Nowadays pre-rolling assemblies comprise mechanical regulation systems with pre-regulation at the beginning of a casting cycle.

These assemblies are associated with continuous pre-rolling rolls, or rolls consisting of segments, or assemblies of rolls, or else assemblies of endless pressure belts positioned on rolls.

These known systems do not make possible an optimum regulation, nor a pre-rolling of a desired value, nor a continuously controlled path which is continuously related to the actual pre-rolling requirements.

JP-A-62130759 teaches the provision of a straightening assembly placed in a position distant from the continuous casting mould so as to process a slab or billet which no longer contains a liquid core.

The straightening action on a slab which does not have a liquid core is different from the pre-rolling action and requires great forces and strong complex structures to carry out an effective, useful action.

The prior document JP-A-1-271.047 includes reducing the thickness of the slab independently of whether there is a liquid core or not, and independently of the closing position of the liquid core.

Moreover, this document does not teach to include a fine control of the pre-rolling process, nor does it teach to begin the pre-rolling immediately after the foot rolls.

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

The invention is set forth and characterized in the main claim, while the dependent claims describe variants of the idea of the embodiment.

According to the invention, where the continuous casting plants are curved, the pre-rolling rolls are positioned downstream of the mould and immediately downstream of the foot rolls.

These pre-rolling rolls work and act on thin slabs which still contain a liquid core, and exploit the plastic condition arising from the temperature of the peripheral skin and the inclusion of the liquid core.

According to the invention, the pre-rolling rolls positioned on the outer curved side, or extrados side, are associated with load cells which control the pressure that the thin slab exerts on the rolls.

The pre-rolling rolls positioned on the inner curved side, or intrados side, are associated with hydraulic capsules, for instance of the type disclosed in EP-0444420.

The reason for this is that the displacement should be of a modest value and be perfectly controlled and capable of being controlled.

A transducer indicating pressure and position is included with the hydraulic capsule.

This description takes the outer curved side, or extrados side, as being the stationary part and the inner curved side, or intrados side, as being the movable part for the sake of an example, but in actual practice the two parts can be exchanged for each other.

According to a variant the inner curved side and outer curved side may each include a stationary part and movable part which cooperate respectively with a movable part and stationary part of the other side.

The whole assembly is governed by a control and data processing unit, which receives signals from the load cells and transducers and compares them with the rolling parameters, whether the latter be identified parameter by parameter or all the parameters, and thereby obtains information for the control and possible necessary regulation.

In this description by "rolls" are meant continuous rolls, or rolls consisting of individual segments, or endless belts supported on rolls, etc., thus covering any known system.

The regulation achieved is individual for each assembly of rolls or is general for the whole pre-rolling assembly.

The regulations may be added up algebraically.

Let us now see a preferred embodiment of the invention with the help of the attached figures, which are given as a non-restrictive example as follows:-

Fig.1	is a diagrammatic side view of a pre-rolling assembly for thin slabs produced by a curved continuous casting plant;
Figs.2 and 3	show two other possible types of pre-rolling rolls.

In the figures a pre-rolling assembly 10, of which only a segment is shown in Fig.1, is positioned immediately downstream of foot rolls 12 associated with a mould 11 which produces a thin slab 20 continuously.

In the zone where the pre-rolling assembly 10 operates, the thin slab 20 still contains a liquid core.

The rolls shown may be continuous rolls or may consist of segments of rolls 14-16 or be grouped in twos or more 114-116 or may support an endless belt 214-216 or be of yet another known type.

In the example shown the outer curved side, or extrados side, 13 is the stationary sector, while the inner

curved side, or intrados side,22 is the movable sector.

The rolls 14-114-214 and the other known rolls of the variants of the outer curved sector 13 are associated individually or in groups with at least one load cell 15, which transmits signals to a control and data processing unit 21.

The rolls 16-116-216 and the other known rolls of the variants of the inner curved sector 22 are associated individually or in groups with at least one hydraulic capsule 17.

The hydraulic capsule 17 is governed by a servovalve 19 and is associated with a transducer 18 which indicates the position and pressure.

The hydraulic capsule 17 enables even the smallest movement to be carried out in a controlled and controllable manner while providing a considerable force at the same time.

The servovalves 19 are governed by the control and data processing unit 21.

Each pressure and position transducer 18 transmits its signal to the control and data processing unit 21 and may receive control and verification signals.

At the beginning of a rolling cycle the parameters linked to the pre-rolling to be carried out are set or inserted on the control and data processing unit 21 and may be associated with the type of material cast and with the dimensions of the thin slab 20 and the characteristics of the liquid core.

The control and data processing unit 21 prearranges the rolls 14-114-214 and 16-116-216 and, when casting begins and the starter bar has gone past, controls and regulates the rolls 14-114-214 and 16-116-216 so that the desired pre-rolling takes place.

Claims

1. Pre-rolling assembly for the controlled pre-rolling of thin slabs (20) leaving a continuous casting mould (11) including foot rolls (12), the assembly comprising facing rolling sectors having stationary sector parts (13) and therewith cooperating movable sector parts (22), the rolling sectors being operatingly disposed along the two wide faces of the thin slab, and including respective pre-rolling rolls (14,114,214 - 16,116,216), the assembly being characterized in that it is positioned downstream of the foot rolls (12), and that the rolls (14,114,214) of the stationary sector parts (13) are associated at least one by one with a load cell (15) while the rolls (16,116,216) of the movable sector parts (22) are associated at least one by one with a hydraulic capsule (17) governed by a servovalve (19), each hydraulic capsule (17) being associated with a transducer indicating pressure and position (18).

2. Pre-rolling assembly as defined in claim 1, in which the load cells (15), the servovalves (19) and the pressure and position transducers (18) are associated with a control and data processing unit (21) comprising means for the insertion/introduction of the pre-rolling parameters and the characteristics of the liquid core.

3. Pre-rolling assembly as defined in claim 1 or claim 2 for curved continuous casting, in which the stationary sector parts (13) are positioned on the outer curved side, or extrados side, of the thin slab.

Patentansprüche

1. Vorwalzanordnung zum gesteuerten Vorwalzen dünner Brammen (20), die eine Form (11) für kontinuierliches Gießen mit Fußwalzen (12) verlassen, wobei die Anordnung folgendes aufweist: zugewandte Walzsektoren mit stationären Sektorteilen (13) und mit diesen zusammenwirkenden beweglichen Sektorteilen (22), wobei die Walzsektoren funktionsmäßig entlang den zwei breiten Flächen der dünnen Brammen angeordnet sind und sie jeweilige vorwalzende Walzen (14, 114, 214 - 16, 116, 216) enthalten, **dadurch gekennzeichnet,** dass sie stromabwärts bezüglich der Fußwalzen (12) angeordnet ist und den Walzen (14, 114, 214) der stationären sektorteile (13) mindestens einzeln eine Belastungszelle (15) zugeordnet ist, während den Walzen (16, 116, 216) der beweglichen Sektortelle (22) mindestens einzeln ein durch ein Regelventil (19) gesteuerter Hydraulikbaustein (17) zugeordnet ist, wobei jeweils ein den Druck und die Position anzeigender Wandler (18) zugeordnet ist.

2. Vorwalzanordnung nach Anspruch 1, bei der die Belastungszellen (15), die Regelventile (19) und die Druck- und Positionswandler (18) einer Steuerungs- und Datenverarbeitungseinheit (21) zugeordnet sind, die eine Einrichtung zum Einfügen/Eingeben von Vorwalzparametern und den Eigenschaften des flüssigen Kerns aufweist.

3. Vorwalzanordnung nach Anspruch 1 oder Anspruch 2 zum gekrümmten, kontinuierlichen Gießen, bei der die stationären Sektorteile (13) an der nach außen gekrümmten Seite, oder der Außenwölbungsseite, der dünnen Bramme liegen.

Revendications

1. Dispositif de pré-laminage pour le pré-laminage contrôlé de brames minces (20) quittant une lingotière de coulée continue (11) comportant des cylindres de pied (12), le dispositif comportant des secteurs de laminage disposés face-à-face et présentant des parties (13) d'un secteur stationnaire et des parties (22) d'un secteur mobile coopérant avec les premières, les secteurs de laminage étant, en fonctionnement, disposés le long des deux lar-

ges faces de la brame mince, et comportant des cylindres respectifs de pré-laminage (14, 114, 214 - 16, 116, 216), le dispositif étant caractérisé en ce qu'il est positionné en aval des cylindres de pied (12) et en ce que les cylindres (14, 114, 214) des parties (13) du secteur stationnaire sont associés au moins un à un à une jauge de contrainte (15), tandis que les cylindres (16, 116, 216) des parties (22) du secteur mobile sont associés au moins un à un à une capsule hydraulique (17) gérée par une servovalve (19), chaque capsule hydraulique (17) étant associée à un transducteur (18) indiquant la pression et la position.

2. Dispositif de pré-laminage selon la revendication 1, dans lequel les jauges de contrainte (15), les servovalves (19) et les transducteurs (18) de pression et de position sont associés à une unité (21) de commande et de traitement de données qui comporte des moyens pour l'insertion/introduction des paramètres de pré-laminage et des caractéristiques de l'âme liquide.

3. Dispositif de pré-laminage selon la revendication 1 ou la revendication 2, pour coulée continue incurvée, dans lequel les parties (13) du secteur stationnaire sont disposées sur le côté incurvé extérieur, ou côté d'extrados, de la brame mince.

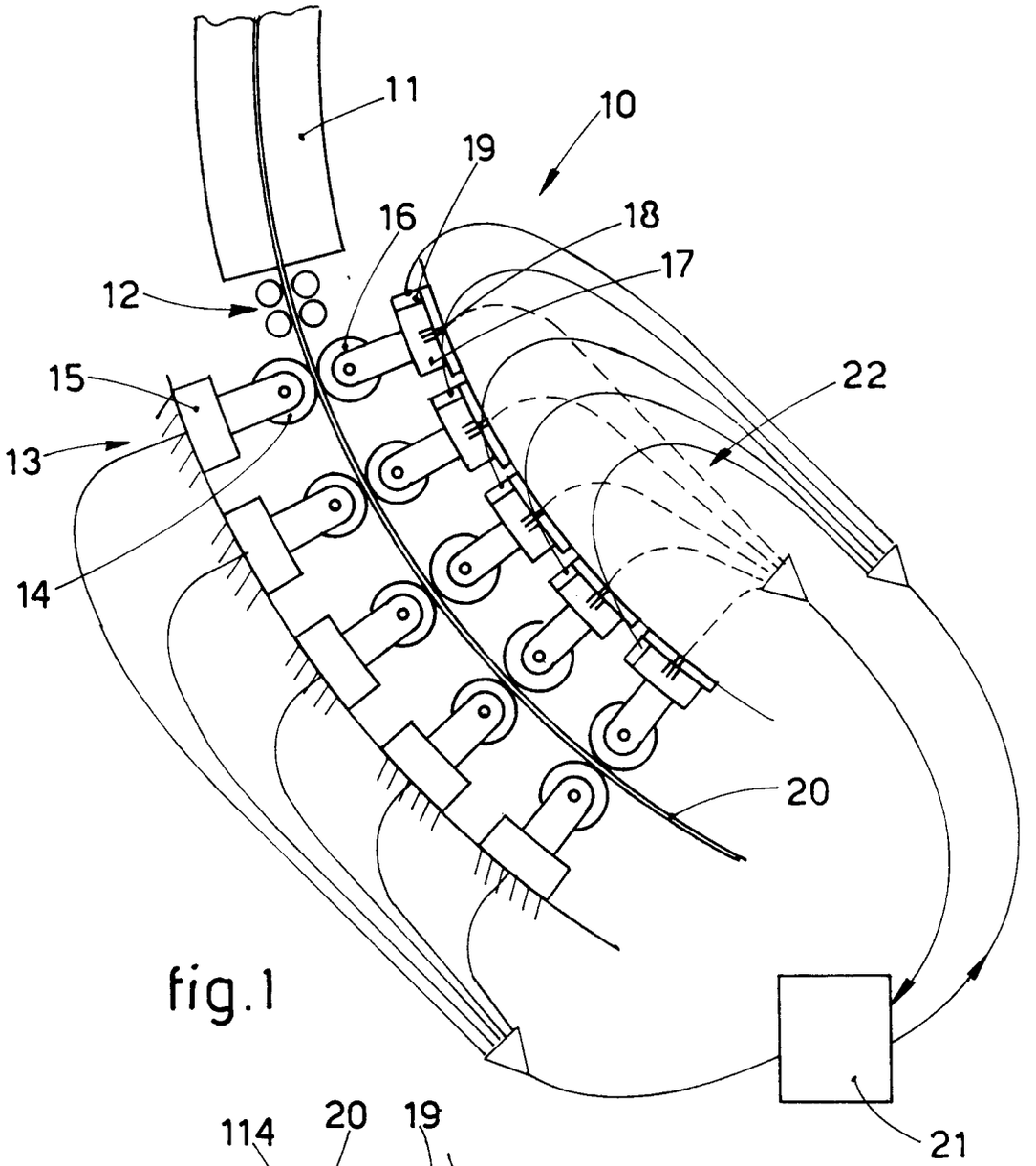


fig.1

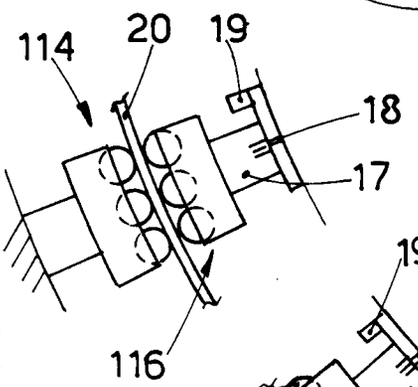


fig.2

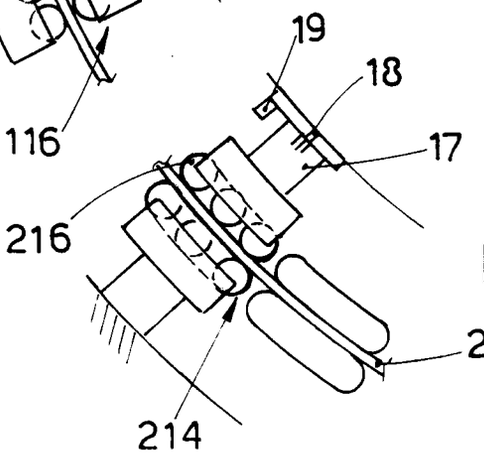


fig.3