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ROLLING MILL STAND.

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References cited :
DE-A- 3 529 364
DE-U- 8 614 518
Patent Abstracts of Japan, vol. 7, n . 189
(M-237)(1334) & JP, A, 58-90307 (MITSUBISHI)
Patent Abstracts of Japan, vol, 10, n 130
(M-478)(2187) & JP, A, 60-257911 (ISHIKAWA-
JIMA)

Proprietor : **DAVY McKEE (SHEFFIELD)**
LIMITED
Prince of Wales Road
Sheffield S9 4EX Yorkshire (GB)

Inventor : **LISTER, Michael**
515 Hastolar Road South Richmond
Sheffield Yorkshire S13 8LF (GB)
Inventor : **MARSHALL, Robert**
12 Windermere Court North Anston
Sheffield Yorkshire S31 7GJ (GB)
Inventor : **TAYLOR, Leonard, Guy**
30 Dugdale Road
Sheffield S5 9NZ (GB)

Representative : **Kirk, Geoffrey Thomas et al**
BATCHELLOR, KIRK & CO. 2 Pear Tree Court
Farringdon Road
London EC1R 0DS (GB)

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Description

This invention relates to a rolling mill stand in which its work rolls are displaceable to a limited extent in the direction axially of their length.

During the rolling of metal strip, it is desirable to be able to move the work rolls in the direction of their longitudinal axis in order to spread out the wear on the rolls which occurs during a period of rolling.

It is known from JP-A-58-90307 to provide a rolling mill stand with axially displaceable work rolls. The rolls are displaced by hydraulic rams mounted on one of the mill housings and engageable and disengageable with a bearing chock assembly at the adjacent end of the roll. Each ram has a pivoted latch which is engaged and disengaged from a slot on the bearing chock assembly. Each latch has an additional piston-cylinder device by which it is pivoted.

According to the present invention, a rolling mill stand comprises a pair of spaced apart housings each defining a window; a pair of work rolls each supported at its ends by a pair of bearing chock assemblies located in respective housings windows; each roll having two rams associated with it, the rams being located on opposite sides of the roll axis and each having a first part secured to one of the housings and a part which is displaceable in the direction parallel to the longitudinal axes of the rolls; said displaceable part of each ram having means which is engageable with, and disengageable from, co-operating means on the adjacent bearing chock assembly whereby displacement of the displaceable parts of the rams, while the means are engaged with the co-operating means on the bearing chock assembly, cause the bearing chock assembly and, hence, the roll to be displaced in the axial direction of the roll; characterised in that the displaceable part of each ram is also rotatable with respect to the first part of the ram to engage and disengage said co-operating means on the ram and the bearing chock assembly and pairs of rams, one associated with each roll, have common means for rotating their displaceable parts.

The co-operating means on the bearing chock assembly for each ram may comprise a plurality of cooperating means arranged successively in the direction parallel to the longitudinal axes of the rolls whereby successive displacement of the parts of the ram, while the means are engaged, in turn, with the co-operating means, causes the bearing chock assembly and, hence, the roll to be displaced in the axial direction of the roll by a distance which is greater than the stroke of the ram.

The co-operating means on the displaceable parts of the rams and on the corresponding bearing chock assembly allow the bearing chock assembly and, hence, the roll which is supported in it to be displaced parallel to the longitudinal axis of the roll. By enabling the co-operating means to be disengaged,

the bearing chock assembly can be moved relative to the corresponding rams as, for example, at the time for changing the rolls.

The co-operating means conveniently take the form of latches mounted on the displaceable part of the rams and engageable with slots on the bearing chock assembly.

By engaging the co-operating means on the displaceable parts of the rams and on the bearing chock assembly, the bearing chock assembly and, hence, the roll which is supported in it can be displaced parallel to the longitudinal axis of the roll. By disengaging the co-operating means in the displaceable parts of the rams from one of said co-operating means on said bearing chock assembly and connecting the co-operating means with a second co-operating means on the bearing chock assembly, a further displacement of the bearing chock assembly can be made. By successively engaging the co-operating means on the bearing chock assembly, a displacement of the bearing chock assembly and, hence, the roll can be made which is greater than the stroke of the rams.

The cylinders of the first and second sets of rams may also include spindle supports which, when the cylinders of the first and second sets of rams are disengaged from the bearing chock assemblies, are positioned so as to support a drive spindle which is disconnected from the adjacent end of the work rolls. In this way, the spindles are supported in the correct location ready to receive the roll ends of the replacement rolls.

In order that the invention may be more readily understood, it will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional plan view of part of a rolling mill stand in accordance with the present invention, the right-hand side of the drawing showing the apparatus in the roll change position and the left-hand side of the drawing showing the rolling mill stand in its operative position;

Figure 2 is a diagrammatic end elevation of part of the apparatus shown in Figure 1; and

Figure 3 is a sectional plan of an alternative embodiment.

A rolling mill stand has a pair of work rolls 1, 3 supported at their ends in bearing chock assemblies 5, 7, respectively. The bearing chock assemblies at one corresponding end of the rolls are located in a window 9 in a housing 11 and the bearing chock assemblies at the other end of the rolls are similarly supported in the window of a mill housing (not shown). The rolls are driven by a pair of spindles 13, one of which is shown in Figure 1. The end of each spindle carries a coupling 15 by which the spindle can be releasably connected to the end of the corresponding work roll.

A pair of hydraulically operated rams 17 are mounted on the housing 11 on opposite sides of the

longitudinal axis of the upper work roll 1. A similar pair of hydraulic rams 19 are mounted on the same housing 11 on opposite sides of the longitudinal axis of the lower work roll 3. Each of the rams 17, 19 has a cylinder structure 21 with a piston structure 23 within it. The outer end of the piston structure is rigidly secured to the housing 11. By applying hydraulic fluid to the cylinders 21, the cylinders can be caused to move in the axial direction of the pistons 23 and the pistons are arranged so as to extend parallel to the longitudinal axes of the work rolls 1, 3.

The cylinder structure of each ram is rotatable relative to the longitudinal axis of its piston and it carries a lug 25 and a latch 27. The latch co-operates with a recess or slot 29 formed in an extension 31 of the appropriate bearing chock assembly. Hence, by rotating the cylinder structure of the ram, the latch 27 can be engaged with, or disengaged from, the recess 29 thereby either connecting the ram and the bearing chock assembly or disconnecting them. When the latches are engaged with the recesses, axial displacement of the cylinder structures causes the bearing chock assembly to be displaced in the direction of the roll axis from the position shown on the left-hand side of Figure 1 to that shown on the right-hand side of the figure. Rotation of each cylinder structure is brought about by a rack and pinion device 33 and the two rams on one side of the vertical plane containing the roll axes are connected to one rack 33 and the pair of rams on the opposite side of the vertical plane containing the roll axes are connected to a separate rack 33. By displacing the racks 33 in a vertical direction by a piston-cylinder device secured to the upper end of each rack, the cylinder structures can be rotated to engage or disengage their latches 27 in the appropriate recesses 29.

The cylinder structure of each ram also carries a support 35 for a spindle coupling 15. When the latches 27 are disengaged from the recesses 29, the two spindle supports are arranged in a position where the spindle coupling can readily be supported. As shown on the left-hand side of Figure 2, however, when the latches are engaged in the recesses, the spindle supports 35 are not in a locating position.

In use, the racks 33 are operated to rotate the cylinder structures so that the latches of all the rams are engaged in the corresponding recesses. When fluid is applied to the cylinder structures, the cylinder structures are displaced relative to the pistons and the bearing chock assemblies and the rolls are displaced in the direction axially of the rolls. The bearing chock assemblies slide on beams 37.

When the rolls are to be changed, the cylinder structures are rotated so as to disengage the latches from the recesses and to position the supports 35 ready to receive the spindle couplings. The couplings are removed from the rolls, the couplings supported on the supports and the rolls are withdrawn from the

housings.

In the arrangement shown in the figures, the cylinder structures are rotated with the aid of racks 33 which engage with toothed parts of the cylinder structures. Clearly, other means could be employed to rotate the cylinder structures. For example, electric or hydraulic motors could be employed either directly or indirectly.

Referring to Figure 3, which has some parts very similar to what is shown in Figures 1 and 2, the end of each work roll adjacent the housing 101 is the drive side of the mill stand and a drive shaft is removably connected to this end of the work roll. At the other side of the mill stand, a pair of hydraulically operated rams 113 are mounted on the housing 103. Each ram has a piston 115 which is connected at its outer end to the mill housing and a cylinder structure 117 surrounds part of the piston. When fluid is introduced into the cylinder structure, it moves relative to the piston in a direction parallel to the longitudinal axis of the roll 107. The cylinder structure 117 is rotatable with respect to the piston 115 and an operating rod 119 is connected to one side of the cylinder structure to enable a limited angular rotation to be applied to the cylinder structure. On the other side of the cylinder structure there is a latch 121. This latch co-operates with slots 123 formed on an extension 125 of the bearing chock assembly 111 at that end of the roll. The extension of the bearing chock assembly extends in the direction parallel to the longitudinal axis of the roll and the slots are spaced apart in the direction parallel to the longitudinal axis of the roll.

In Figure 3, the right-hand side of the drawing shows the upper work roll in its normal operating position and the left-hand side of the drawing shows the work roll after it has been axially displaced. Referring to the position shown on the right-hand side of the drawing, the latch 121 of each ram is located in the slot 123 which is furthest from the housing 103. When the rams 113 are actuated, the cylinder structures 117 are displaced by the full stroke of the rams and the bearing chock assembly is also displaced by an amount equal to the displacement of the rams. The cylinder structure of each ram is then rotated by the operating rod 119 in order to disengage the latch from the slot. The rams are actuated to allow the cylinder structure to move relative to the piston. The cylinder structure is rotated to engage the latch with the adjacent slot 123 and the rams are actuated again in order to displace the bearing chock assembly and, hence, the roll by a further distance equal to the stroke of the rams. The procedure is then repeated and the latches 121 are engaged with the grooves which are closest to the housing 103 and, again, the displacement of the cylinder of each ram causes further axial movement of the roll. Consequently, a series of operations of the rams can produce an axial displacement of the roll by a distance which is greater than the stroke of each

ram. The displaced position of the work roll is shown on the left-hand side of Figure 3.

Each of the rams may have a linear transducer associated with it so that the exact position of the bearing chock assembly and, hence, the work roll can be determined.

The sequential movements of the rams and the co-operating parts on the bearing chock assemblies can be controlled by a computer-based control system.

Although in the arrangement shown in Figure 3 the rams are on the opposite side of the mill to the drive side, where spindle positions allow the rams can be positioned on the drive side of the mill.

In Figure 3, the rams are shown associated with the upper work roll and a similar arrangement of rams co-operating with the bearing chock assembly of the lower work roll could also be provided. All the rams could be operated simultaneously so that the two rolls are displaced together or the rams associated with one of the rolls could be operated independently of the rams associated with the other roll so that the rolls move independently of each other.

In the arrangement shown in Figure 3, the co-operating means on the rams co-operate with means on the bearing chock assembly. In an alternative arrangement, each bearing chock assembly is supported on a pair of axially slidable blocks and the co-operating means on the rams co-operate with the slidable blocks to displace the blocks and, hence, the bearing chock assembly.

Claims

1. A rolling mill stand comprising a pair of spaced apart housings (11, 103) each defining a window (9); a pair of work rolls (1, 3, 107) each supported at its ends by a pair of bearing chock assemblies (5, 7, 111) located in respective housings windows; each roll having two rams (17, 113) associated with it, the rams being located on opposite sides of the roll axis and each having a first part secured to one of the housings and a part (21, 117) which is displaceable in the direction parallel to the longitudinal axes of the rolls; said displaceable part of each ram (17, 113) having means which is engageable with, and disengageable from, co-operating means on the adjacent bearing chock assembly whereby displacement of the displaceable parts of the rams, while the means are engaged with the co-operating means on the bearing chock assembly, cause the bearing chock assembly and, hence, the roll to be displaced in the axial direction of the roll; characterised in that the displaceable part (21, 117) of each ram is also rotatable with respect to the first part of the ram to engage and disengage said co-operating means on the ram and the bearing chock assembly and pairs of rams, one associated with each roll, have

common means (33, 119) for rotating their displaceable parts.

2. A rolling mill stand as claimed in claim 1, characterised in that said co-operating means comprise a latch (27, 121) insertable into, and withdrawable from, a slot (29, 123).

3. A rolling mill stand as claimed in claim 2, characterised in that the latch (27, 121) is on the periphery of the displaceable part of the ram and the slot (29, 123) is on the bearing chock assembly.

4. A rolling mill stand as claimed in any preceding claim, characterised in that a cylinder structure of each ram is rotatable relative to a piston of the ram and the means for rotating the cylinder structures of a pair of rams comprises a rack (33) displaceable in the direction of its length and engageable with pinion means associated with the cylinder structures.

5. A rolling mill stand as claimed in any preceding claim, characterised in that the cylinder structure of each ram carries a support (35) for a spindle, said support being in the spindle supporting position when the cylinder structure is disengaged from the bearing chock assembly.

6. A rolling mill stand as claimed in any preceding claim, characterised in that the co-operating means (121, 123) on said bearing chock assembly (111) comprises for each ram (113) a plurality of co-operating means (123) arranged successively in the direction parallel to the longitudinal axes of the rolls whereby successive displacement of the parts of the ram, while the means are engaged, in turn, with the co-operating means, causes the bearing chock assembly (111) and, hence, the roll (107) to be displaced in the axial direction of the roll by a distance which is greater than the stroke of the ram.

Patentansprüche

1. Walzgerüst mit zwei voneinander beabstandeten Gehäusen (11, 103), von denen jedes ein Fenster (9) bildet; zwei Arbeitswalzen (1, 3, 107), von denen jede mit ihren Enden von zwei Lagerklotzanordnungen (5, 7, 111) gestützt wird, welche in den entsprechenden Gehäusefenstern angeordnet sind; wobei jede Walze zwei zugehörige Stempel (17, 113) besitzt, wobei die Stempel an gegenüberliegenden Seiten der Walzenachse angeordnet sind und jeweils ein erstes Teil, das an einem der Gehäuse befestigt ist, und ein Teil (21, 117) besitzen, das in Richtung parallel zur Längsachse der Walzen verschiebbar ist; wobei das verschiebbare Teil jedes Stempels (17, 113) eine Einrichtung besitzt, die in Eingriff mit sowie außer Eingriff von einer zusammenwirkenden Einrichtung an der benachbarten Lagerklotzanordnung bringbar ist, wodurch eine Verschiebung der verschiebbaren Teile der Stempel, während sich die Einrichtung mit der zusammenwirkenden Einrichtung an

der Lagerklotzanordnung in Eingriff befindet, eine Verschiebung der Lagerklotzanordnung und somit der Walze in axialer Richtung der Walze bewirkt; dadurch gekennzeichnet, daß das verschiebbare Teil (21, 117) jedes Stempels ebenfalls gegenüber dem ersten Teil des Stempels rotierbar ist, um in Eingriff mit und außer Eingriff von der zusammenwirkenden Einrichtung am Stempel und der Lagerklotzanordnung zu gelangen, und die beiden Stempel, von denen jeweils einer einer Walze zugeordnet ist, gemeinsam Mittel (33, 119) zur Rotation ihrer verschiebbaren Teile besitzen.

2. Walzgerüst nach Anspruch 1, dadurch gekennzeichnet, daß die zusammenwirkende Einrichtung einen Riegel (27, 121) aufweist, die in einen Schlitz (29, 123) einsetzbar und aus diesem wieder herausziehbar ist.

3. Walzgerüst nach Anspruch 2, dadurch gekennzeichnet, daß der Riegel (27, 121) am äußeren Umfang des verschiebbaren Teils und der Schlitz (29, 123) an der Lagerklotzanordnung angeordnet ist.

4. Walzgerüst nach einem vorangegangenen Anspruch, dadurch gekennzeichnet, daß eine Zylinderstruktur jedes Stempels gegenüber einem Kolben des Stempels drehbar ist und die Einrichtung zur Rotation der Zylinderstrukturen von einem Paar von Zylindern eine Zahnstange (33) aufweist, die in Richtung ihrer Länge verschiebbar und mit zu den Zylinderstrukturen zugehörigen Ritzelmitteln in Eingriff bringbar ist.

5. Walzgerüst nach einem vorangegangenen Anspruch, dadurch gekennzeichnet, daß die Zylinderstruktur jedes Stempels ein Tragelement (35) für eine Spindel trägt, wobei das Tragelement sich in der Spindeltragstellung befindet, wenn sich die Zylinderstruktur außer Eingriff von der Lagerklotzanordnung befindet.

6. Walzgerüst nach einem vorangegangenen Anspruch, dadurch gekennzeichnet, daß die zusammenwirkende Einrichtung (121, 123) an der Lagerklotzanordnung (111) für jeden Stempel (113) mehrere zusammenwirkende Mittel (123) aufweist, die der Reihe nach in der Richtung parallel zur Längsachse der Walzen angeordnet sind, wodurch eine sukzessive Verschiebung der Teile des Stempels, während sich die Einrichtung wiederum in Eingriff mit der zusammenwirkenden Einrichtung befindet, eine Verschiebung der Lagerklotzanordnung (111) und somit der Walze (107) in axialer Richtung der Walze um eine Entfernung bewirkt, die größer als der Hub des Stempels ist.

Revendications

1. Cage de laminoir comprenant une paire de bâtis espacés (11, 103) définissant chacun une fenêtre (9), deux cylindres lamineurs (1, 3, 107) supportés chacun, à leurs extrémités, par deux empoises (5, 7,

111) installées dans des fenêtres de bâtis respectives, chaque cylindre lamineur comportant deux vérins (17, 113) qui y sont associés, les vérins étant disposés de part et d'autre de l'axe du cylindre lamineur et comportant chacun une première partie fixée à un des bâtis et une partie (21, 117) qui peut être déplacée dans un sens parallèle aux axes longitudinaux des cylindres, la partie déplaçable de chaque vérin (17, 113) comportant un moyen qui peut être engagé et déengagé par rapport à des moyens coopérants sur l'empoise adjacente, de sorte que le déplacement des parties déplaçables des vérins, tandis que les moyens sont engagés avec les moyens coopérants sur l'empoise, provoque le déplacement de l'empoise et, par conséquent, du cylindre lamineur dans le sens axial de ce dernier, caractérisée en ce que la partie déplaçable (21, 117) de chaque vérin peut également tourner par rapport à la première partie du vérin pour engager et déengager les moyens coopérants prévus sur le vérin et sur l'empoise, et des paires de vérins, une de ces paires étant associée à chaque cylindre lamineur, comportent des moyens communs (33, 119) pour faire tourner leurs parties déplaçables.

2. Cage de laminoir suivant la revendication 1, caractérisée en ce que les moyens coopérants comprennent un loquet (27, 121) pouvant être introduit dans une rainure (29, 123) et être retiré de celle-ci.

3. Cage de laminoir suivant la revendication 2, caractérisée en ce que le loquet (27, 121) est situé sur la périphérie de la partie déplaçable du vérin et la rainure (29, 123) est située sur l'empoise.

4. Cage de laminoir suivant l'une quelconque des revendications précédentes, caractérisée en ce qu'un cylindre de chaque vérin peut tourner par rapport à un piston du vérin et le moyen destiné à faire tourner les cylindres d'une paire de vérins comprend une crémaillère (33) pouvant être déplacée dans le sens de sa longueur et pouvant être engagée avec des pignons associés aux cylindres des vérins.

5. Cage de laminoir suivant l'une quelconque des revendications précédentes, caractérisée en ce que le cylindre de chaque vérin porte un support (35) pour une allonge, ce support se trouvant dans la position de support d'allonge lorsque le cylindre du vérin est déengagé de l'empoise.

6. Cage de laminoir suivant l'une quelconque des revendications précédentes, caractérisée en ce que les moyens coopérants (121, 123) sur l'empoise (111) comprennent, pour chaque vérin (113), une pluralité de moyens coopérants (123) disposés successivement dans le sens parallèle aux axes longitudinaux des cylindres lamineurs, de sorte qu'un déplacement successif des parties du vérin, tandis que les moyens sont engagés, tour à tour, avec les moyens coopérants, provoque le déplacement de l'empoise (111) et, par conséquent, du cylindre lamineur (107) dans le

sens axial de ce dernier, d'une distance qui est supérieure à la course du vérin.

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