ELASTICALLY DEFORMABLE CURVED SUPPORTING AND GUIDING CONSTRUCTION FOR CAST BARS

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ABSTRACT
An improved supporting and guiding construction for deflecting a continuously cast bar vertically leaving the mould into the horizontal direction. The novel construction comprises at least two inner and two outer, roll-supporting, curved, longitudinal carriers mounted in a stationary curved frame-work composed of spaced-apart frame carriers having rigid connections, said inner or outer longitudinal carriers, or both, being adjustable and adapted to be urged towards said frame work under elastic deformation by adjusting means acting upon their ends. This arrangement ensures that the rolls are always so positioned as to provide a continuous path following a predetermined curve, thus avoiding any undue stressing of the solidifying bar.

10 Claims, 5 Drawing Figures
ELASTICALLY DEFORMABLE CURVED SUPPORTING AND GUIDING CONSTRUCTION FOR CAST BARS

The invention relates to a curved supporting and guiding construction for cast bars, in particular for cast bars destined to be worn to slabs, which construction comprises curved longitudinal carriers with rolls, at least one of said longitudinal carriers being adjustable for adaptation to varying thicknesses of the bar.

In continuous casting plants for slabs in which cast bars are produced which are about 1000 to 2000 mm wide and about 150 to 300 mm thick there are difficulties in the formation of appropriate curved supporting and guiding constructions for the bars which are drawn out of the mould and transferred from the vertical to the horizontal direction. Circularly and false elliptically curved guiding constructions as well as guiding constructions following other curves have been proposed and realized in various designs. It is known that the core of the cast bar is liquid still over a long distance below the mould, i.e. the liquid core reaches far into the curved guiding construction. It is difficult to support the solidifying shell of the cast bar. When the curved supporting and guiding construction is designed faultily cracks will occur at the surface of the cast bar.

It has therefore been proposed to arrange each individual roll of such curved guiding construction to be adjustable by means of two hydraulically actuated cylinders so that the rolls may be pressed onto the bar in dependence on the thermostatic pressure. This, however, necessitates great forces for drawing the bar, and the costs for the construction are considerable; the hydraulic means are complicated and there is a great danger of their being destroyed when the bar breaks through. Furthermore, it has been proposed to divide the curved guiding construction into several segments which are adjustable independently from each other so that they may be adapted to bars of varying thickness. This has the disadvantage that these segments cannot always follow the desired curved path. Thus, between the individual curved segments transitions will be created which locally exert an increased pressure on the shell of the bar so that cracks may occur. According to another proposal a curved guiding construction is provided with rolls mounted on curved longitudinal carriers; the rolls of the inner curve are connected with the rolls of the outer curve by means of guiding rods and adaptable to bars of varying thickness by adjustment of the inner longitudinal carriers in guiding means designed as coulisse-type guiding means. Although the rolls are easily adjustable to different dimensions of the bar it is not possible to arrange them exactly in a predetermined curved path so that the bar shell is unevenly supported and subjected to varying pressure forces. Here too, the costs for the construction are very high.

The invention is aimed at creating a curved supporting and guiding construction for heavy and wide cast bars, which construction comprises at least one adjustable curved part, the rolls being arranged in exactly predetermined curved paths so that also when the curved parts are displaced in relation to each other no impermissible and locally limited forces are exerted upon the bar shell.

The invention solves this task in the curved supporting and guiding construction mentioned in the introduction, in that the curved longitudinal carriers, i.e. at least two inner and two outer curved longitudinal carriers, are arranged in a curved stationary frame work comprising rigid frame carriers arranged at a distance from each other and rigid connections, and that either the inner or the outer longitudinal carriers or both are adapted to be adjusted in relation to and urged towards the frame work under elastic deformation by adjusting means acting upon their ends.

Preferably, the longitudinal carriers are adapted to be urged towards the frame work through the intermediary of interposed exchangeable spacers.

Advantageously, the rolls are articularly connected to the longitudinal carriers by supporting means comprising two pivoted links. Preferably, the pivots of the roll supporting means are arranged on the neutral fiber of the longitudinal carriers.

The roll supporting means or a part thereof may be resilient.

The adjustable longitudinal carriers are preferably provided with lugs having slits in which slide stones are arranged to be displaceable, said slide stones being connected by bolts and wedges to the frame carriers so that relative movements between the longitudinal carriers and the curved frame work are possible.

The total thickness of the spacers at each point of support is suitably at least equal or greater than the maximum adjusting path.

The longitudinal carriers are preferably adjusted by hydraulically actuated cylinders.

The longitudinal carriers are advantageously designed in a manner that the unstressed condition of the longitudinal carriers corresponds to about the means adjustment path.

In a manner known per se, the curved frame work may be releasably connected to the steel construction of the pouring platform and/or to the foundation and may be moved out as a compact constructional unit by means of wheels on rails.

In order that the invention may be more fully understood it shall now be explained by reference to the drawings, in which

FIG. 1 is a lateral view of the curved supporting and guiding construction,

FIG. 1a shows a detail of FIG. 1 on a greater scale, and

FIG. 2 is a vertical sectional view along the line II—II of FIG. 1a through the longitudinal carriers.

FIG. 3 shows a similar illustration as FIG. 2 but for another embodiment.

FIG. 4 shows a resilient supporting element.

The inner curve of the supporting and guiding construction according to the invention comprises several curved longitudinal carriers 1, 2, 3, 4, 5, 6, 7, 8 arranged side by side and the outer curve comprises the curved longitudinal carriers 1', 2', 3', 4', 5', 6', 7', 8'. The longitudinal carriers are connected with each other by cross connections 9, 10, and 9', 10'.

The longitudinal carriers 1, 2, 3, 4, 5, 6, 7, 8 are provided with several lugs 11 having slits in which slide stones 24 are displaceably arranged. The slide stones 24 are releasably connected with the frame carriers 15, 16, 17, 18, 19, 20, 21 by bolts 12, 13 and by wedge connections 14. The frame carriers 15, 16, 17, 18, 19, 20, 21 are rigidly connected with the frame carriers 15',
3,710,847

16', 17', 18', 19', 20', 21' by connecting pieces, not shown in the drawing, and form closed frames which are held together by the connecting members 22, 22', 23 to form a curved frame work. The longitudinal carriers 1', 2', 3', 4', 5', 6', 7', 8', are releasably connected with the frame carriers 15', 16', 17', 18', 19', 20', 21' by bolts 13' so that the outer curve may be exchanged but not adjusted. Obviously the outer curve may alternatively be arranged to be adjustable or both the outer and the inner curve may be adjustable. In FIG. 1 an embodiment is shown in which the inner curve may be adjusted by loosening the wedge connections 14 and mutual exchange of the spacers 25, 26. The longitudinal carriers 1, 2, 3, 4, 5, 6, 7, 8 are displaced at their ends by hydraulically operated cylinders 38, 39 and tightened to the frame carriers 15, 16, 17, 18, 19, 20, 21 after the spacers 25, 26 have been exchanged so that an elastic deformation is effected. The neutral fiber of the longitudinal carriers is denoted with numeral 37 in FIG. 1a. When, e.g., the maximum adjustment path a (FIG. 2) amounts to 100 mm, it is advantageous to form the longitudinal carriers in a manner that the tensionless condition corresponds to about the mean adjustment path. Thus, when the curve radius amounts to e.g. 7500 mm, this is the tensionless condition and an adjustment by elastic deformation to all radii between 7550 and 7450 mm, i.e. by a total of 100 mm, is possible. The spacers may have different thicknesses and be formed in one or two parts or U-shaped, the total spacer thickness at each point of support being at least equal to greater than the maximum adjustment path a.

The guiding rolls 28 are articulately connected to the longitudinal carriers by means of supporting elements 30. With slabs of greater widths it is advantageous to connect the rolls 28 to the longitudinal carriers (FIG. 2) at several places by supporting elements 30, so as to prevent deflection of the rolls or to be able to employ smaller roll diameters. FIG. 3 shows an arrangement of rolls 29 which are connected to the longitudinal carriers by supporting elements 30 only at their ends. This embodiment is suitable for narrow cast bars. In small plants it is also possible to make do with a total of two longitudinal carriers for the inner curve and the two longitudinal carriers for the outer curve.

The supporting elements are advantageously arranged in a manner that their respective pivots on the longitudinal carriers lie on the neutral fiber 37 so that the curved path of rolls remains unchanged when the longitudinal carriers are bent. The supporting members may also be designed as spring elements 35 with meander-shaped recesses 36 for resilient absorption—in the direction indicated by the arrows (FIG. 4)—of impact shocks or excessive forces that may occur when the bar or the dummy bar (cold bar) is guided through. Suitably each roll 28, 29 is provided both with supporting members 35 which cannot be elastically deformed and with supporting members 35 acting as spring elements.

The curved frame work is fastened to the steel construction of the pouring platform or to the foundation. It may be displaced by means of wheels 31, 32 on rails, which are not shown in the drawing, and furthermore, it may be suspended at the lug 33 by means of the bores 34 and be exchanged by means of a crane against another curved supporting and guiding construction.

Spray jets and supply ducts for cooling water are customarily arranged at or within the arcuate frame work.

What I claim is:

1. A curved supporting and guiding construction for continuously cast bars, comprising a stationary curved frame work comprising rigid frame carriers and rigid connecting members, a set of inner curved longitudinal carriers and a set of outer curved longitudinal carriers positioned within the frame work, at least one of said sets of longitudinal carriers being elastically deformable, a plurality of guiding rolls connected to each of the sets of longitudinal carriers, adjustable support means for adjusting the curvature of the elastically deformable set of longitudinal carriers, and displacing means connecting the ends of the elastically deformable set of longitudinal carriers to the frame work for elastically deforming said elastically deformable set of longitudinal carriers and adjusting the curvature thereof, whereby a predetermined curved path of substantially constant cross section is maintained for the continuously cast bars.

2. The construction set forth in claim 1, wherein the guiding rolls are supported in at least two points by links pivoted to the longitudinal carrier and the roll, the pivots on said longitudinal carriers being situated in the area of the neutral fiber thereof.

3. The construction set forth in claim 1, wherein the unstressed condition of the longitudinal carriers corresponds to about the mean adjustment path.

4. The construction set forth in claim 1, wherein said frame work is releasably connected to a platform of a continuous casting plant, said construction being movable as a unit on rails by wheels.

5. The construction set forth in claim 1 wherein said adjustable support means comprise exchangeable spacers.

6. The construction set forth in claim 5 wherein the exchangeable spacers have a thickness at least equal to the maximum adjustment path of the elastically deformable set of longitudinal carriers.

7. The construction set forth in claim 1 wherein the guiding rolls are articulately connected to each of the sets of longitudinal carriers by two pivoted links.

8. The construction set forth in claim 1 wherein the guiding rolls are articulately supported on each of the sets of longitudinal carriers by resilient links.

9. The construction set forth in claim 1 wherein said elastically deformable carriers are provided with lugs having slits in which slide stones are arranged, said slide stones being connected by bolts and wedges to the frame work and adapted to be displacable.

10. The construction set forth in claim 1 wherein the displacing means comprise hydraulically operated cylinders.

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It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

First page, Item [30], "A 5149/69" should be --A 5140/69--; Col. 2, line 35, for "means" read --mean--; and Col. 3, line 32, for "to" read --or--.

Signed and sealed this 29th day of May 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents