FLEXIBLE SEGMENTAL STARTING BAR FOR CONTINUOUS METAL CASTING MACHINES

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ABSTRACT OF THE DISCLOSURE

A flexible segmental starting bar for continuous casting machines in which the continuous tie means connecting the bar sections is flexible in one plane only so as to prevent angular deviation of the bar sections about the longitudinal axis of the bar.

Background of the invention

In conventional continuous strand metal casting machines it is known to employ starting bars which, before the beginning of the casting of the metal strands, serve for closing the bottom end of a flow mold and, by the starting of the strand casting, said starting bars are pulled by withdrawing rolls with a speed which corresponds to the metal casting speed. If the path of the metal strand is at least partially curved, flexible starting bars are employed which are adapted to follow the curvature of the casting strand guides. It has been already proposed to employ flexible starting bars made up of relatively short members connected together by means of hinges. This arrangement presents however the drawback that the hinge pins, after a short time of operation, become worn out. Consequently the clearance of the hinges become so important, that it is practically impossible to obtain a regular pull of the starting bar through the guides of the casting strand.

A starting bar for strand metal casting machines is also known, which is made of one piece elastic material, such as rubber, plastic material, fibrous material or the like, provided with a tie member made of a metallic wire rope and a metallic head piece which forms a temporary base floor for the flow mold at the beginning of the casting. With this arrangement, the stiffness of the material constitutes a drawback and the pull upon the starting bar, particularly at the beginning of the operation, is usually not sufficiently powerful and very irregular.

A segmental starting bar is also known, which is made up of separate sections provided with through holes and threaded like a string of pearls upon a flexible tie member and maintained under tension in longitudinal direction by suitable spring means. By this arrangement, like drawbacks as in the former case are experienced, due to the presence of spring means.

Summary of the invention

The invention has for its object a flexible segmental starting bar for strand metal casting machines of the kind having a continuous metal strand guide which is at least in part curved and by which said starting bar is composed of a plurality of relatively short separate sections threaded upon one or more flexible tie member or members which accommodate bending of the bar in one plane only and prevent twisting of the bar sections about the longitudinal axis of the bar.

The scope of the invention is to overcome the inconvenience of the known flexible starting bars and particularly to guarantee a uniform pull of segmental starting bars through the whole casting strand guide.

The invention consists in fastening to the flexible tie member at least some of the intermediate sections of the starting bar.

According to an embodiment of the invention, all the sections of the segmental starting bar are fastened to the flexible tie member.

According to another embodiment of the invention, some bar sections are fastened to the flexible tie member, while the intermediate sections are freely held under tension between said fixed sections.

The fastening of the single sections of the segmental starting bar to the flexible connecting member may be effected by screwing, clamping, welding or other conventional means whereby the flexibility is improved by effecting the fastening of the bar sections by one of their ends only.

According to the invention the form and arrangement of the tie members connecting the starting bar sections are such as to render easy the bending of the segmental starting bar in the direction of the curved guide members, while a considerable rigidity takes place at right angles to said direction.

Brief description of the drawings

The above characteristic features and the means for realizing same will be particularly described, by way of nonlimiting example in the following specification made with reference to the accompanying drawings, in which:

FIGURE 1 is a longitudinal section through a part of a segmental starting bar for continuous casting machines, by which all the starting bar sections are welded to the flexible tie or draw member in correspondence of one of their heads;

FIGURE 2 is a cross section of the starting bar on line II—II of FIGURE 1.

FIGURE 3 is a longitudinal section of another embodiment of starting bar by which the bar sections are clamped to the tie or draw member;

FIGURE 4 is a cross section through still another embodiment of starting bar;

FIGURE 5 is a cross section through a starting bar having a greater width and employed in bloom or like casting;

FIGURE 6 shows in side view a part of another embodiment of starting bar, and

FIGURE 7 is a cross section on line VII—VII of FIGURE 6.

Detailed description

The starting bar for continuous casting shown in FIGURES 1 through 3 comprises a number of separate relatively short rigid sections 2 having a cross section substantially equal to the section of the metal casting. The single sections 2 are closed, hollow box-like members threaded upon a flexible tie core 1, passing through suitable slits 3 provided in the head portions 102, 202 of the single sections 2.

The intermediate sections 2 are arranged in a known manner between two end sections rigidly fastened to the tie member 1 in a conventional manner and which therefore need not to be shown or described. The head section serves, as usual, for closing the pouring spout or as temporary base floor for the mold.

The intermediate sections 2 of the starting bar are fastened only with one of their head ends to the flexible tie member 1, namely either with the rear or trailing head end or with the front or leading head end as shown in FIGURE 1, in which the leading head wall 102 is welded, as indicated by reference 4 to the tie member 1.

In the embodiment as shown in FIGURE 3, the flexible tie member 1 is clamped between pairs of lugs 5 as by bolts and nuts 7. The said lugs 5 and bolts and nuts 7 project into a recess 6 formed in the opposite female bottom end 202 of the adjoining, next-following bar section. Said recess 6, in practice, is formed preferably either
by employing a U-shaped member or a concave lid piece for closing the said female or recessed head end. In both cases, however, between two adjoining bar sections, a sufficient clearance is left for permitting the necessary bending of the segmental bar in the continuous casting machine which is of conventional design and arranged in a known manner and therefore needs not to be described.

In order to permit this bending of the segmental bar, while ensuring a sufficient draw resistance, the flexible draw member is made either as a flexible flat steel bar \( \text{1} \).

**FIGURE 2**, a plurality of aligned flat bars, particularly in the case of wide casting strands or blooms, as that shown in **FIGURE 5** or also of a plurality of aligned flexible cylindrical bars or ropes \( \text{101} \), such as those shown in **FIGURE 4** or also of rectangular bars \( \text{201} \).

**FIGURE 7**.

In the embodiment as shown in **FIGURE 1**, the single sections \( \text{2} \) of the starting bar are provided at one of their head ends \( \text{102} \) with a small preferably rounded projection \( \text{4} \) inserted in a corresponding recess of the facing head wall of the next section, so as to form the equivalent of ball joint.

In the embodiment as shown in **FIGURES 6 and 7**, the flexible tie member of the starting bar comprises a pair of rectangular flexible bars \( \text{201} \), arranged aligned in spaced relation in the transversal plane \( \text{Y—Y} \) at right angles to the bending plane \( \text{X—X} \) of the segmental bar and the next-following casting strand (not shown). Said steel bars \( \text{201} \) are inserted into U-shaped side slots of the starting bar sections \( \text{2} \) and lie with their flat edges flush with the section side edges or walls. In this embodiment however not all the starting bar sections \( \text{2} \) are fastened as by side welding \( \text{104} \) to the flexible bars, but this said side welding \( \text{104} \) or other fastening means is performed each second or third starting bar section \( \text{2} \), while the intermediate sections are freely threaded under tension with their side slots upon the tie bars \( \text{1} \).

Of course, this fastening effected by each second or third starting bar section may be adopted also in the embodiments as shown in **FIGURE 1** through \( \text{5} \).

It may be mentioned that the above-disclosed and shown segmental starting bars are easily bent in a plane \( \text{X—X} \), which is the bending plane, but are quite rigid along a plane \( \text{Y—Y} \) which is perpendicular to the bending plane \( \text{X—X} \).

I claim:

1. A flexible segmental starting bar for continuous casting machines, comprising a plurality of independent bar sections, continuous tie means extending the length of the bar, and through said bar sections, said tie means being flexible in one plane only to accommodate bending of the bar in a single plane and prevent angular deviation of said bar sections about the longitudinal axis of the bar, and means securing each of said bar sections individually to said tie means.

2. A flexible segmental starting bar according to claim 1, in which said tie means comprises a single tie member, which has a flat cross section.

3. A flexible segmental starting bar according to claim 1, in which said flexible tie means comprises a plurality of tie members aligned on a plane at right angles to the bending plane of said bar.

4. A flexible segmental starting bar according to claim 1, in which at least some of said bar sections are fastened to said tie means by their head ends lying in the same direction.

5. A flexible segmental starting bar according to claim 1, in which all said bar sections are fastened to said tie means by their head ends lying in the same direction.

6. A flexible segmental starting bar according to claim 1, and by which the bar sections are provided with pairs of side U-slots and the tie means comprises two flat bars inserted into said U-slots and welded to said bar sections.

7. A flexible segmental starting bar according to claim 1, in which all said bar sections fastened to said tie means are provided with clamping means projecting from one end of said sections, while the opposite end of the adjoining sections is provided with a recess for housing said projecting clamping means.

8. A segmental starting bar according to claim 1, in which all said bar sections are welded at one corresponding end to said tie means and the projection formed by the weld is inserted into a shallow recess of the adjacent end of the adjoining section, so as to form the equivalent of ball joint.

9. A segmental starting bar according to claim 1, in which said bar sections are formed by hollow box-like members.

10. A segmental starting bar according to claim 1, particularly adapted for the casting of wide billets or blooms, and by which each bar section is provided with a plurality of spaced through slits having a width which is multiple of their thickness and through which band-like steel members are passed.

11. A flexible segmental starting bar according to claim 1 wherein the cross-sectional dimensions of said tie means is greater in a plane parallel to the guide plane of the casting machine than in the bending plane.

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