United States Patent

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[54] **METHOD OF EQUALIZING STRESSES IN THE CONVEYANCE AND GUIDANCE OF CONTINUOUS CASTINGS**
7 Claims, 2 Drawing Figs.

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[50] **Field of Search** 164/82, 273, 282, 283

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ABSTRACT: Conveying and guiding metal castings which had been cast in a mold in a continuous casting plant, by means of driven conveyor and support rollers. In order to preclude the formation of surface cracks and other faults in the castings, the supporting rollers are driven in such a manner that the rollers first encountered by the casting move at higher torque than subsequent rollers. Included are the travelling paths of the castings which have any shape, such as straight, curved or circular.

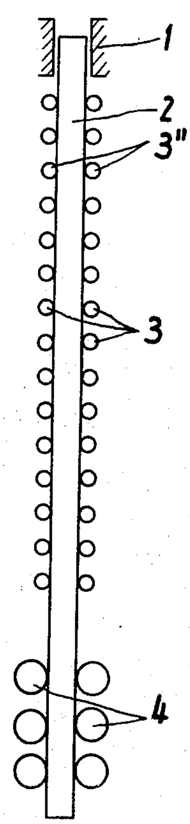

Fig. 1

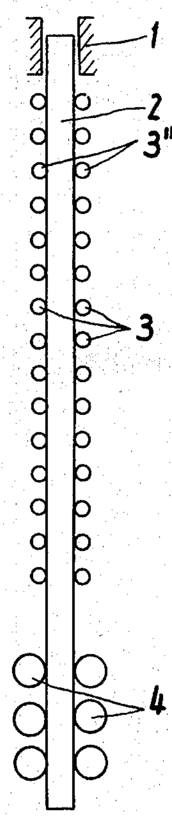

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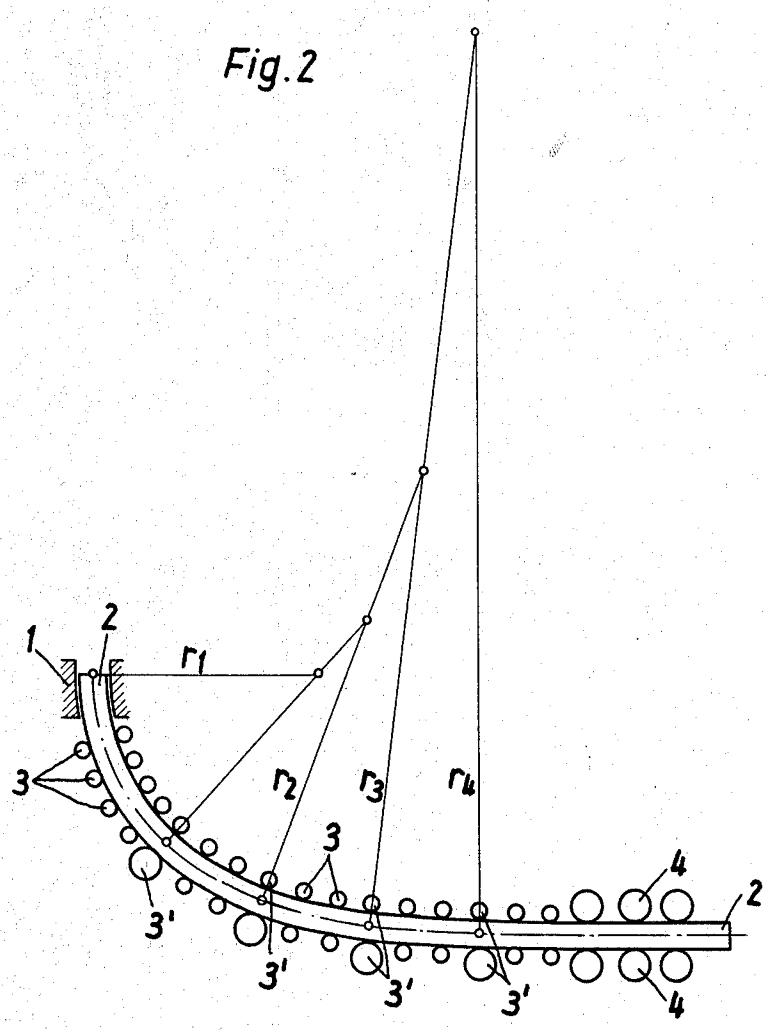
Fig. 2



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METHOD OF EQUALIZING STRESSES IN THE CONVEYANCE AND GUIDANCE OF CONTINUOUS CASTINGS

The invention relates to a method of conveying and guidance of metal castings from continuous casting devices, wherein the conveyor and support rollers are driven.

In continuing casting devices of this kind, the casting, after leaving the mold, is guided by support rollers and carried off by driven conveyor rolls through the roller stand. The conveyor rolls engage the casting after it has solidified throughout. In a known casting plant, any number of support rollers, disposed vertically, may additionally be driven.

It also is known to bend the casting which leaves the mold vertically, to straighten it and to separate it horizontally. Bending and straightening rollers are required, following the conveyor rolls, to shape the casting. In a known plant, the same is carried off by driven bending rollers, followed by synchronized straightening rolls.

Bending also can be carried out in multiple steps on castings whose core is still liquid, whereas they are straightened after solidification in a single step. Deformation occurs by the action of the supporting rollers which are disposed on a curved path, through which the casting is pulled with the aid of the driven conveyor rolls. In a device of this kind, the support rollers also may be driven.

In still another process, the casting, cast in an arched or curved mold, is straightened in multiple steps while its core still is in liquid form. The casting is shaped within the support roll frame whose rollers are aligned in a path consisting of a plurality of arcs of increasing diameter. Here again the support rollers may be driven, either all or a part thereof, in order to relieve the conveyor rolls. It also is feasible with such a device to convey the castings by means of the support rollers.

If the casting is bent while its core is still in liquid state, tensile stresses or strains occur on its surface, depending upon the prevailing conditions. If the limit of hot-formability is exceeded, surface cracks occur at least in the extended or stretched zone. Cracks also may form at the solid-liquid interface in the solidifying core zone. Similar faults are encountered when wide slabs or ingots are cast in continuous plants, particularly with those having a lateral length of more than one meter, on straight as well as on curved paths. The faults also occur, however, at small dimensions when materials sensitive to cracking are cast.

It is the object of the invention to convey and guide castings while averting the occurrence of faults, such as cracks.

It surprisingly has been found that no such faults will occur when the support rollers are driven in a definite manner, as will be more fully explained.

According to the invention, one or more rollers, at the start of the travelling path, are driven at a higher torque than the subsequent roller or rollers. In lieu of a single roller, a roller pair may be drive. In the instance of a curved shaping guidance path, at least one of the rollers, disposed at the start of said shaping path or shortly before it, is driven at higher torque. Also, the rollers disposed in the break of the curve may be driven at equal or higher torque than the subsequent rollers. The torques of the driven rollers may decrease in the direction of the travel of the casting. Thereby, several rollers following each other may constitute a group of equal torque, but greater than that of the next group.

Higher torque of the motors for each roller or each group of rollers is attained by imparting to them a controlled higher rotational speed. At corresponding adherence of the roller on the casting, equal rotational speed, but different torque are attained in all instances.

With the aid of the support rolls, preceding the conveyor rolls and driven at higher torque than the latter, the casting is pressed against the conveyor and guidance rolls which determine the travelling speed of the casting. In this manner, compressive strains are superimposed on the tensile stresses, thus eliminating the occurence of such faults in the casting as, e.g., surface cracks.

The invention now will be more fully explained with reference to the accompanying drawings. However, it should be understood that these are given merely by way of illustration, and not of limitation.

In the drawings, which are schematics,

FIG. 1 is an elevation of a vertical path for bars;

FIG. 2 is an elevation of a curved path.

Referring now to these drawings, casting **2**, cast in mold **1** and partly solidified, is conducted through a set of support rollers **3**. The latter idle, i.e., are not driven. They serve to guide casting **2** and to avert bellying or bulging of the skin which at that point is still rather thin. Driven conveyor or guidance rolls, respectively, **4** follow support rollers **3** and transport casting **2** from mold **1** through support rolls **3** at a speed which corresponds to their circumferential speed.

At least one of the first support rollers **3** in the travelling path is to be driven at higher torque than the succeeding rollers. In the device shown in FIG. **1**, these are the rollers designated as **3''**. Beside these, other support rollers may be driven. However, if so, their torques always must be higher than those of the next following rolls, e.g., conveyor rolls **4**. The torques decrease in the direction of the travel of casting **2**.

In the curved device shown in FIG. **2**, casting **2**, leaving mold **1**, first follows the direction determined by the shape of the mold, and then is straightened in the support roll stand while its core is still in liquid state. Support rollers **3** are disposed on a guide path which consists of a plurality of arcs of increasing radius, as indicated by r_1, r_2, r_3 and r_4 in the drawing, in whose breaks the support rollers **3'** are situated.

In this device, a roll **3'**, disposed at the start of the shaping guidance path, i.e., at the first break or shortly before it, is driven at higher torque than the succeeding driven rolls. Here again, further rollers or roller pairs **3** may be driven. However, it has been found opportune to drive the rollers **3'**, disposed in the breaks, according to the requirements of the invention. This effects driving of those rollers within the bending zone which absorb the forces of reaction arising from bending or the bending forces themselves.

When slabs are cast, the rollers must absorb not only the bending forces but also additional compressive forces because, in contrast to round, square or rectangular castings, the shell of the slab-shaped castings bulges or bellies more strongly and rests against the rollers.

The invention successfully is employed, aside from the straight and curved paths, in circular plants or in those which bend and straighten, particularly when shaping of the casting is carried out while the core still is in liquid shape. It is applicable in any and every plant where the supported length and width of the casting is very great.

I claim:

1. A method of conveying and guiding metal castings from a mold in a continuous casting plant provided with a travelling path for said castings and driven conveyor and support rollers along said path, which comprises imparting to at least one of said support rollers at the start of said path a torque which is higher than that of the subsequent rollers so as to equalize occurring tensile stresses with compressive strains and prevent the occurrence of surface cracks in said castings.

2. The method is defined in claim **1**, wherein said rollers are disposed in pairs opposite each other along said path; at least one of said pairs at the start of said path being driven at higher torque than the succeeding pairs.

3. The method as defined in claim **1**, wherein said path is a multiple-arced shaping path and at least one roller at the start of the shaping path is driven at higher torque than the succeeding rollers.

4. The method as defined in claim **3**, wherein the rollers disposed in the breaks of said arcs are driven at at least equal torque as the subsequent rollers.

5. The method as defined in claim **4**, wherein the rollers disposed in said breaks are driven at higher torque than subsequent rollers.

6. The method as defined in claim **1**, wherein the torque of said rollers successively decreases in the travelling direction of said castings.

7. The method as defined in claim **l**, wherein a plurality of successive rollers constitute groups, each group being driven at equal torque, but at higher torque than subsequent groups.