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V. A. BUTKEVICH ET AL
DEVICE FOR SECONDARY COOLING OF THE INGOT OF
THE CONTINUOUS CASTING MACHINE
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3,375,864

FIG. 1

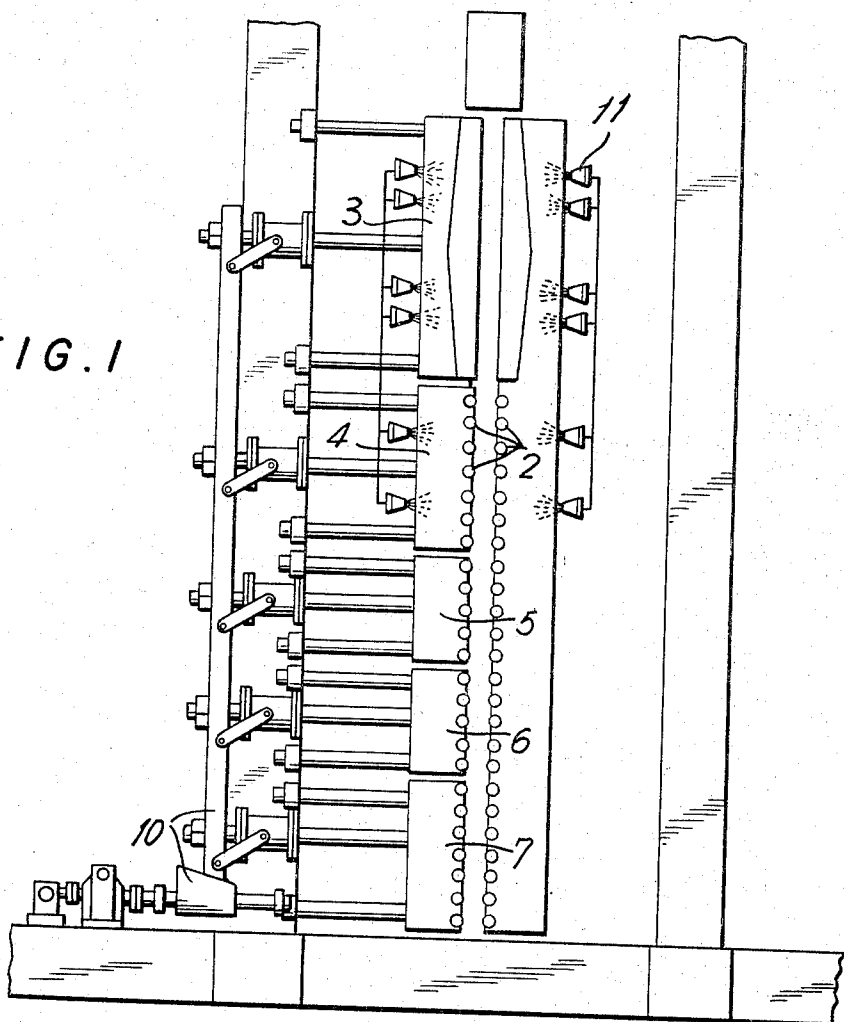
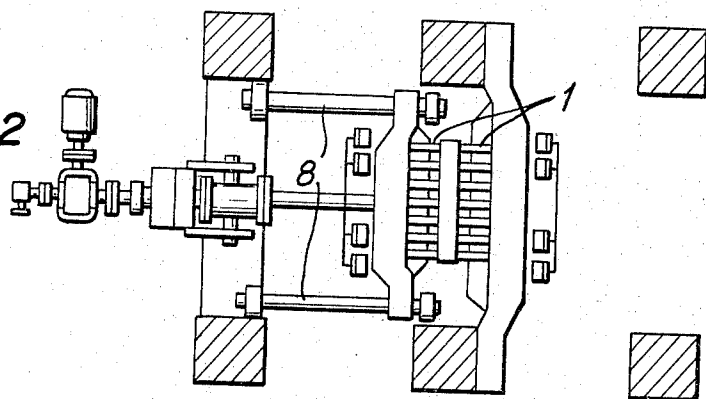


FIG. 2



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DEVICE FOR SECONDARY COOLING OF THE INGOT OF THE CONTINUOUS CASTING MACHINE

Vladimir Alexandrovich Butkevich, Petrovich Dmitry Evteev, Alexandr Stepanovich Kaushansky, Viktor Alexandrovich Karpeka, Georgy Romanovich Korotkov, Viktor Sergeevich Pravdin, Viktor Saveljevich Rutes, Veniamin Veniaminovich Fulmakht, and Alexandr Kononovich Fisjun, Moscow, U.S.S.R., assignors to Tsentralny Nauchno-Issledovatel'skiy Institut Chernoi Metallurgii im. I. P. Bardina and Gosudarstvenny Sojuzny Institut proektirovaniya metallurgicheskikh Zavodov, both of Moscow, U.S.S.R.

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7 Claims. (Cl. 164—282)

This invention relates to continuous casting of metals, and more particularly, to secondary cooling of an ingot in machines for continuous casting of metals.

There are known devices for the secondary cooling of an ingot, in the form of guiding bars. However, when casting ingots of a large cross-section, the zone of the secondary cooling may be as high as 14 metres. The total ferrostatic pressure transmitted to the supporting elements will amount to hundreds of tons, which develops a high friction between the ingot skin and the guiding bars.

This phenomenon and its harmful influence are well known. An object of the present invention is to provide a device for the secondary cooling of ingots, which eliminates the above-mentioned disadvantages.

The device for the secondary cooling is a combined arrangement of an upper portion equipped with guiding bars, and a lower portion provided with guiding rollers, the bars and rollers being grouped, with no interconnection between them, into separate movable sections, which restrain the ingot from swelling under the action of the ferrostatic pressure at the length where the sections come into contact with the ingot; each section is supported by a hydraulic cylinder designed to sustain the ferrostatic pressure acting onto the section and serving as a shock absorber to save the bars and rollers from damage whenever critical loads occur.

In connection with the above, there is next given a description of the invention with reference to the attached drawing submitted for illustration purposes and wherein:

FIG. 1 is a side view diagrammatically showing a device for the secondary cooling of ingots;

FIG. 2 is a sectional view taken along line II—II in FIG. 1.

The device consists of a rigidly installed construction with bars 1 and rollers 2 arranged in five sections 3, 4, 5, 6, 7 all mounted on plungers 8 (FIG. 1 and FIG. 2).

In the upper section 3 bars 1 act as guides, whereas in the sections 4, 5, 6, 7 the same function is performed by rollers 2. The horizontal stresses induced by the ferrostatic pressure which act on all the sections, are absorbed by hydraulic cylinders 9, while the stresses resulting from errors in alignment are absorbed by plungers 8. The height of the bars in the section 3 is selected depending on the optimum friction stresses induced by the ferrostatic pressure and transmitted through the skin of the solidifying ingot.

The height of the roller sections is determined by the strength of the roller assembly, which is equivalent to the total load from the ferrostatic pressure on each particular section.

The rated loads to be sustained by the hydraulic cylinders are also estimated on the basis of the total load produced by the ferrostatic pressure and transmitted onto the section.

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If the loads acting on a section exceed those of the hydraulic cylinders, the sections move aside saving the enclosed components from damage.

The maximum permissible distance the opposite sections are allowed to move towards each other is limited by mechanism 10 preset for the required thickness of the ingot being cast.

The guiding device can also be designed with two sections—left and right—symmetrically moving towards each other, and with thrusting forces of the ingot being restricted inside the proposed system by fixing the plungers 8 in cross-members, on which are mounted the hydraulic cylinders, and in the stationary parts of the sections 3, 4, 5, 6, and 7.

The cooling of the ingot is accomplished by water which is projected on the ingot faces by water jets or sprayers 11.

The device described hereinabove insures the following advantages:

(1) A combined guiding device consisting of bars and rollers prevents the consideration increase of load required to withdraw the ingot and the resultant increase of pressure on the withdrawing rolls and, therefore provides an increase of both the power rating and overall dimensions of the drive and supporting metal structures.

(2) Since in the lower portion of the zone of the secondary cooling, the solidified skin of the ingot attains considerable thickness and strength, which prevents the development of local cracks, the distance between the roller axes can be increased.

(3) All the advantages inherent in a cooling system with the use of guiding bars are retained by the provision of the guiding bars in the region adjoining the mold.

(4) The use of hydraulic cylinders and the principle of the installation thereof ensure safe operation of the secondary cooling guiding device.

(5) Since the hydraulic cylinders function as hydraulic springs, should excess stresses develop, the breakage of the components is precluded.

What is claimed is:

1. An apparatus for guiding an elongated ingot in a secondary cooling zone of a continuous casting machine with a vertically mounted mold, said apparatus comprising a plurality of guide rollers arranged in two vertical columns beneath the mold for receiving an ingot therefrom, means supporting the guide rollers in at least one of said columns in respective groups as independent sections, said sections being vertically aligned in spaced relation beneath the mold and being independently displaceable transversely towards and away from the ingot, and hydraulic piston and cylinder means coupled to each of said sections for independently moving the same in a transverse direction relative to the ingot and for undergoing displacement to permit yielding of said sections under load from the ingot.

2. An apparatus as claimed in claim 1, comprising a frame supporting all of said hydraulic piston and cylinder means and means connecting said frame and said hydraulic piston and cylinder means for adjusting the minimum spacing between the two columns of rollers.

3. An apparatus as claimed in claim 1, further comprising two columns of guide bars located between the mold and the guide rollers in alignment with the latter.

4. An apparatus as claimed in claim 3, further comprising cylinder and piston means for independently displacing the guide bars in at least one of said columns towards and away from the ingot.

5. An apparatus as claimed in claim 4, further comprising means located adjacent said columns proximate the mold for supplying a cooling medium to the ingot.

6. An apparatus as claimed in claim 1, wherein the means supporting the guide rollers comprises a body supporting a respective group of rollers, and plungers slidably supporting said body and bounding the space between the rollers in which the ingot passes.

7. An apparatus for guiding an elongated ingot in a secondary cooling zone of a continuous casting machine with a vertically mounted mold, said apparatus comprising: two columns of guide bars located underneath the mold for receiving the ingot from the mold, guide rollers arranged in columns beneath the guide bars in continuation thereof, means supporting the guide bars in at least one of said columns as a separate independent section and said guide rollers in said one column in respective groups as independent sections, said sections being vertically aligned in spaced relation beneath the mold and being independently displaceable transversely towards and away from the ingot as the latter passes between the bars and rollers, and hydraulic piston and cylinder means coupled to each of said sections for independent movement of the same in the transverse direction relative to

the ingot, to prevent overload on said sections from the ingot.

References Cited

UNITED STATES PATENTS

5	3,256,559	6/1966	Boggs.	
	3,263,284	8/1966	Orr et al.	164—154
	3,283,368	11/1966	Homan	164—282
	2,284,503	4/1942	Williams	164—282
	2,770,021	11/1956	Harter et al.	164—89
10	2,895,190	7/1959	Bungeroth et al.	164—282
	3,167,829	2/1965	Hess et al.	164—282
	3,015,862	1/1962	Rustmeyer et al.	164—277

FOREIGN PATENTS

15	761,401	11/1956	Great Britain.	
	762,513	11/1956	Great Britain.	
	895,913	4/1962	Great Britain.	

J. SPENCER OVERHOLSER, *Primary Examiner*.

20 R. S. ANNEAR, *Assistant Examiner*.