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METHOD OF CONTINUOUSLY CASTING METAL USING CARBON DIOXIDE FOR COOLING

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FIG. 1.

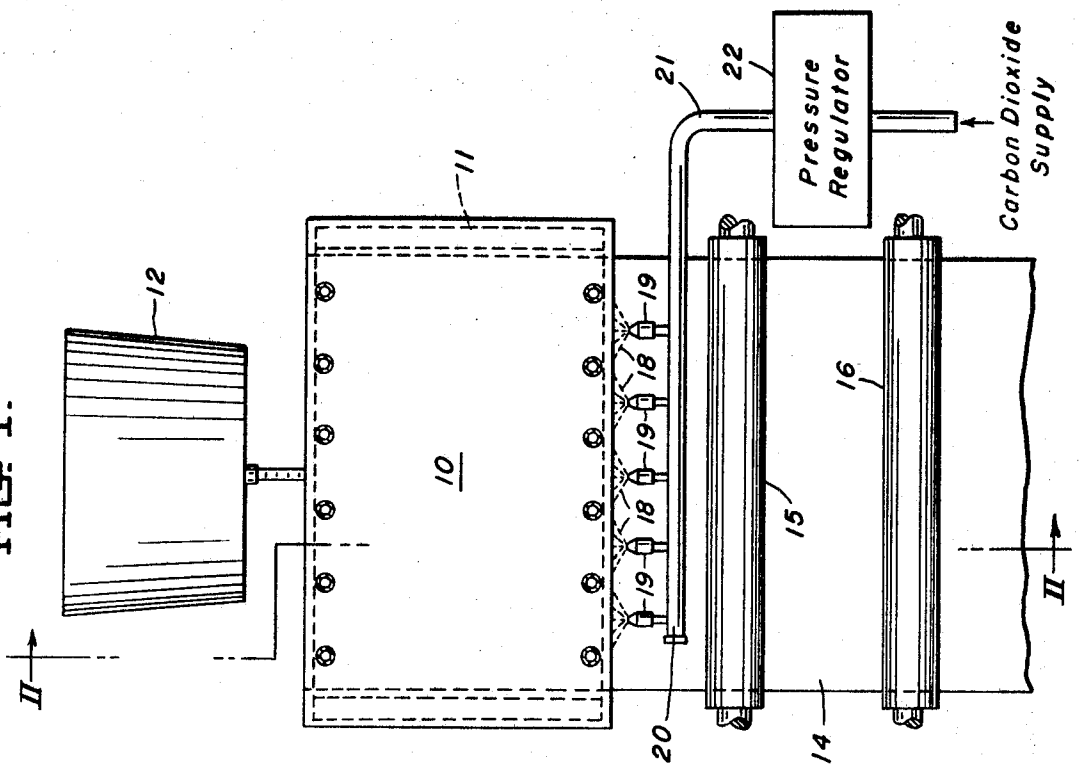
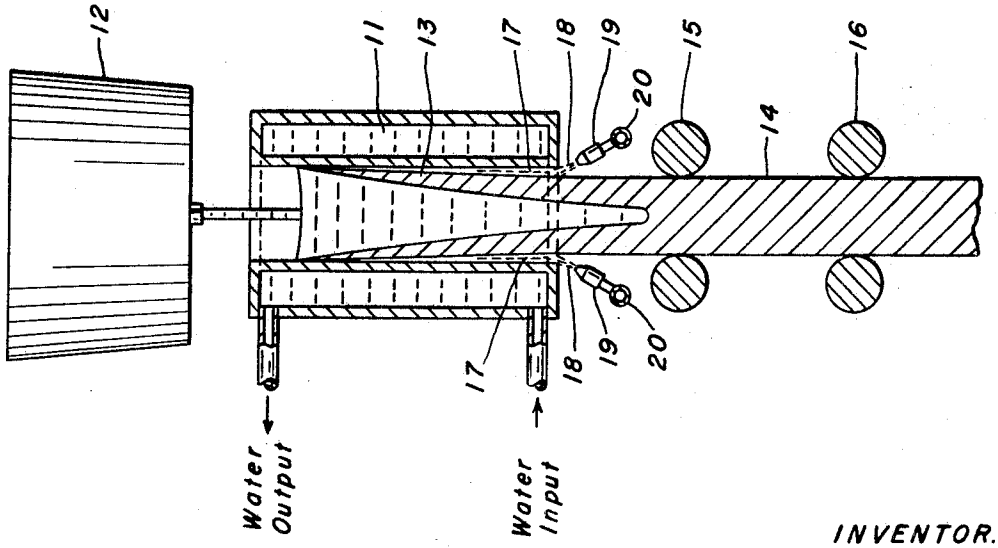


FIG. 2.



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METHOD OF CONTINUOUSLY CASTING METAL USING CARBON DIOXIDE FOR COOLING

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U.S. Cl. 164—82 1 Claim

ABSTRACT OF THE DISCLOSURE

Molten metal is teemed into a cooled, flow-through, tubular mold. A coolant gas (e.g., CO_2) is discharged into the gap at the bottom of the mold, between the walls thereof and the casting, caused by shrinkage of the casting away from the walls, thus increasing the absorption of heat from the casting.

This invention relates to continuous casting and, in particular to a method and apparatus for increasing the removal of heat from the casing while still in the mold and just prior to its exit therefrom.

Continuous casting is ordinarily carried on by teeming liquid metal into a tubular, flow-through mold, provided with forced cooling such as a jacket for circulating water. The problem is to abstract sufficient heat from the casting into the mold walls so that a skin of adequate thickness to contain the liquid center is formed by the time any point along the casting reaches the lower end of the mold. The problem is the more serious because the slight shrinkage of the casting resulting from solidification impairs the good thermal conductivity initially existing between the metal and the mold walls.

I have invented a method and apparatus whereby the aforementioned difficulty is largely obviated. According to my method, I inject a gas such as carbon dioxide into the spaces between the casing and mold walls which open up on shrinkage of the casting. My apparatus includes nozzles positioned appropriately adjacent the bottom of the mold walls. The nozzles are mounted on manifolds connected to a suitable gas source.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating the present preferred embodiment. In the drawings:

FIG. 1 is a side elevation of the apparatus of my invention in operative relation to a continuous-casting mold, and

FIG. 2 is a cross-section taken along the plane of line II—II of FIG. 1.

Referring now in detail to the drawings, a mold **10** of the tubular, flow-through type is mounted on a suitable support (not shown) and is provided with a cooling-water jacket **11**. Molten metal is teemed into the mold from a ladle **12** suspended thereabove and the cooling effected by the loss of heat from the metal to the mold walls causes the formation of a skin **13** confining the molten center

portion of a columnar slab **14** which descends from the mold progressively as it is formed, between guide rolls **15** and **16**. The thickness of the skin increases gradually and the resulting shrinkage of the casting opens up slight gaps **17** between the mold walls and the casting.

The foregoing is typical of continuous casting as practiced heretofore. In accordance with my invention, I discharged jets **18** of gas such as CO_2 under substantial pressure, into gaps **17**. To this end, nozzles **19** are spaced along manifolds **20** adjacent the bottom of the mold and the manifolds are connected to a gas reservoir by a pipe line **21** including a pressure regulator **22**. Jets **18** effect a strong cooling of the slab skin in several ways. In the first place, contact or convection cooling occurs. In the second, the CO_2 decomposes, absorbing more heat. Some oxidation of the casing surfaces is effected by the oxygen released by CO_2 decomposition. The oxide layer thus formed on the casting radiates heat more effectively than the original metal surface. As a result of all these factors, the flow of heat across gaps **17** is many times what it would be in the absence of the injected gas and the absolute temperature of the casting surface is substantially reduced.

The CO_2 also serves to lubricate passage of the casting through the mold and reduces wear on the interior surfaces of the mold walls. The slightly oxidized condition of the contacting surfaces, furthermore, reduces the possibility of welds forming therebetween.

Although I have disclosed herein the preferred embodiment of my invention, I intend to cover as well any change or modification therein which may be made without departing from the spirit and scope of the invention as set forth in the claim.

I claim:

1. In a method of continuously casting metal, the steps comprising teeming molten metal into the upper end of a cooled, tubular, flow-through mold, withdrawing a columnar casting from the lower end of the mold and injecting carbon dioxide upwardly into said lower end between the mold walls and the surface of the emerging casting.

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