Feb. 7, 1967 K. G. SPEITH ETAL 3,302,251

MOLYBDENUM LINED MOLD FOR CONTINUOUS CASTING

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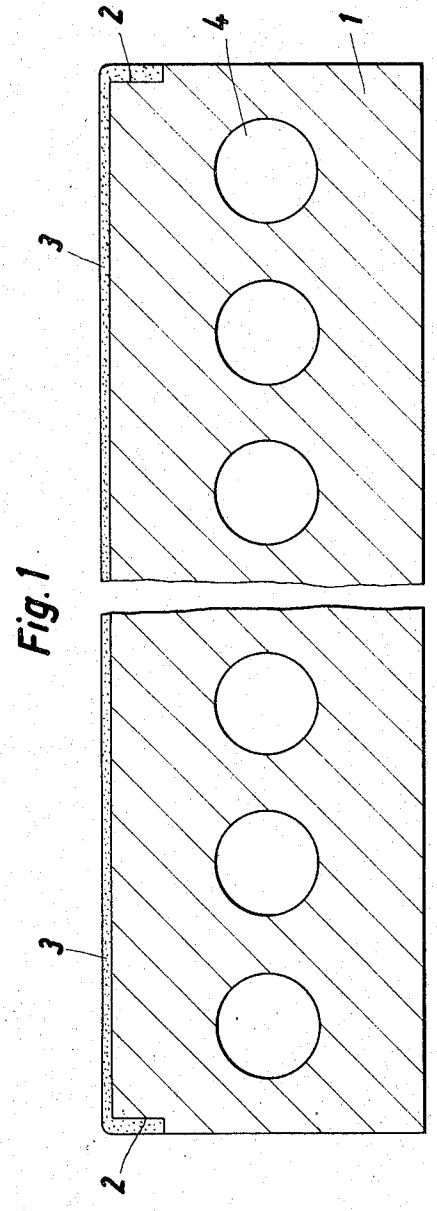

Fig. 1

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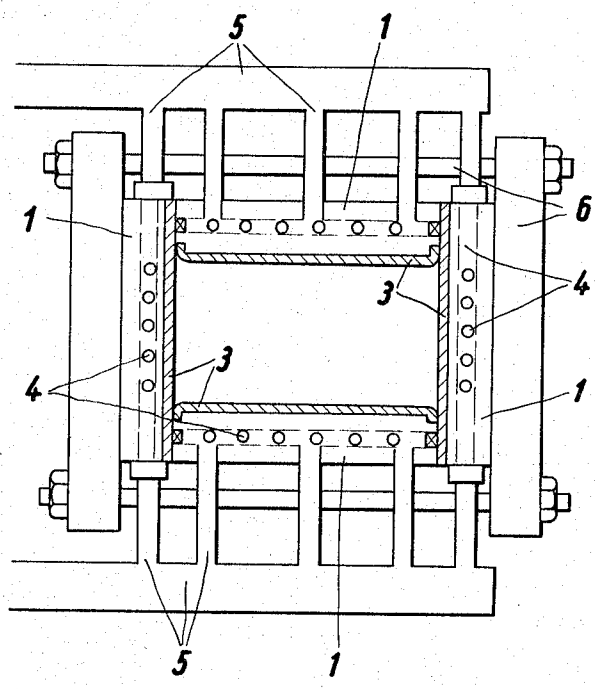
Fig. 2



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MOLYBDENUM LINED MOLD FOR CONTINUOUS CASTING

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The invention relates to continuous casting, and relates more particularly to molds for continuous casting which have a casting mold passage that is open at top and bottom.

Still more particularly, it relates to molds of this type wherein the passage is lined for increased resistance against wear and abrasion.

It will be understood that the term "continuous casting" as used herein includes not only continuous casting but also semi-continuous casting and the like.

It has been known to provide objects that have a low wear resistance with a covering made of a material with high resistance to wear or abrasion. Various wear resistance materials and methods of applying these materials have been used in the past. The problem of how to increase the resistance to wear or abrasion of copper objects, however, has heretofore eluded attempts at solution, particularly the problem on how to increase the wear resistance of copper molds for continuous casting.

It has been proposed to solve the problem by the galvanic application to the copper of coverings made of metals having a high melting point, for instance silver or chromium, but this solution was disappointing in that such coverings could be used only when highly polished. This alone made the foregoing method very costly. Furthermore, such coverings were found to be unstable because thin coverings, of 0.1 millimeter or less thickness, while adhering well were subject to rapid wear, and on the other hand, coverings of greater thickness had the tendency to chip off and thus were likewise unsatisfactory.

For the casting of brass it has been proposed to use Tungsten as a covering material.

The solutions advanced all proposed to use such metals for the coverings that would have no tendency to form alloys with the metal to be cast.

It is among the objects of the invention to provide a casting mold that includes a copper structure, the internal surface of which is lined with a covering that is highly resistant to wear and abrasion, particularly in the casting of iron and steel.

It is another object of the invention to provide for such a covering that has been applied by spraying.

A still further object of the invention is to provide such a covering that need not be highly polished.

It is yet a further object of the invention to provide such a covering made of molybdenum.

It is still another object of the invention to provide such a lining for such a passage formed of copper plates, wherein the covering extends along the inner surfaces of these plates and beyond the inner surfaces into grooves formed on the plates.

With the above and other objects of the invention in view, the invention consists in the novel construction, arrangement and combination of various devices, elements and parts, as set forth in the claims hereof, one embodiment of the same being illustrated in the accompanying drawings and described in the specification.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary sectional view of a plate of a mold for continuous casting, in accordance with the invention; and

FIG. 2 is an elevational view partly in section, on a smaller scale, of a mold for continuous casting, the mold passage of which is surrounded by plates of the type shown in FIG. 1.

Referring to FIG. 1, there is provided a plate **1** that is composed of copper and which forms a structural element to be used in assembly with other similar plates in a continuous casting mold of the type shown in FIG. 2.

In accordance with a preferred embodiment, grooves **2** are formed in the abutment end surfaces of the plate **1**. Each groove **2** has a width of about .7 millimeter and a depth of about 3 millimeters. On the inner surface of the plate, there is a layer or covering **3** of sprayed-on molybdenum. The inner surfaces of the plates are joined in the mold to surround an open casting mold passage through which the casting metal, for instance molten iron and steel, passes. The sprayed molybdenum covering **3**, as best shown in FIG. 2, lines the passage, and thereby renders the passage, which is surrounded by copper, nonetheless highly resistant to wear and abrasion.

The abutment end surfaces form edges with said inner surface. The grooves **2** are disposed adjacent and angularly offset from said inner surface of the plate **1** that is covered by the covering **3**.

As best shown in FIG. 1, the sprayed molybdenum covering extends not only on the inner surface, but also beyond the aforesaid edges of the inner surface into the grooves **2** in the end faces of the plate **1**. Where grooves **2** are provided, the sprayed material will fit the grooves, as it extends from the covering **3** into the grooves **2**.

The thickness of the covering **3** along the inner surface is from about 0.1 to about 0.8 millimeter and preferably from 0.2 to 0.5 millimeter.

The covering **3** requires but light smoothing, and dispenses with the need for a highly polished surface.

The extension of the covering into the grooves **2** has the advantage that it avoids an overlapping of the base metal, and renders possible the assembling of the plates without need for finishing the abutment end faces. It furthermore serves as a safety measure in that, should the plates **1** warp and thereby the joints between adjoining plates open up, the casting metal will be prevented from coming in touch with the base metal.

Each plate **1** has cooling channels **4** which, as best shown in FIG. 2, are connected to a cooling conduit **5**. The plates **1** are held together in their assembled state in the mold by means of a well known suitable holding device **6**.

Certain of the advantages of the invention have already been herein referred to. It may be useful, however, to allude particularly at this point to the advantage of having for the first time covered copper with a wear resistant metal, namely molybdenum, to line the casting passage of a continuous casting mold adhering well to the copper in considerable thickness. It holds better and is far more wear resistant than the aforementioned galvanic chromium deposits in such copper molds, as the molybdenum lining requires only little smoothing and needs no costly high polishing. In spite of the relatively rough surface, the cast ingots have been found to have satisfactory characteristics.

Furthermore, the good heat conductivity characteristics of molybdenum as compared to chromium offers the advantage that an increased thickness of the covering **3** does not adversely affect the cooling effects of the mold.

As compared to the galvanic lining of the prior art, the instant sprayed covering **3** offers simplicity and economic advantages; repairs are done faster and at less cost.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent is as follows:

1. A water cooled mold for use in continuous casting, formed of a plurality of copper plates having inner surfaces defining an open casing mold passage, each inner surface having a sprayed molybdenum covering, whereby said passage will be lined by the molybdenum covering of the plates, each plate having abutment end faces adjacent said surface, said end faces defining edges with said surface, and grooves defined in each end face adjacent said edge, each of said grooves having a width of about 0.7 millimeters and a depth of about 3 millimeters, said covering extending into said grooves.

2. A copper plate, forming a part of a continuous casting mold, said copper plate defining cooling channels and having a surface lined with a sprayed molybdenum covering and defining grooves adjacent and angularly offset from said surface, said covering extending into said grooves.

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