

[72] Inventors **Boris Izraellevich Medovar**  
 bulvar Lesi Ukrainki, 2, kv. 8;  
**Leonty Vasilevich Chekotilo**, ulitsa  
 Scherbakova, 49a, kv. 10; **Rudolf**  
**Solomonovich Dubinsky**, Brest-Litovskiy  
 prospekt, II, kv. 15; **Viktor Leonidovich**  
**Artamonov**, ulitsa Sovetskaya, 9, kv. 4;  
**Leonid Viktorovich Pavlov**, ulitsa  
 Kartvelishvili, 5, kv. 331, all of Kiev,  
 U.S.S.R.

[21] Appl. No. 872,871  
 [22] Filed Oct. 31, 1969  
 [45] Patented Oct. 5, 1971  
 [32] Priority Nov. 11, 1968  
 [33] U.S.S.R.  
 [31] 1283250

[51] Int. Cl. .... B22d 27/02  
 [50] Field of Search ..... 164/252, 52

[56] **References Cited**

UNITED STATES PATENTS			
2,388,974	11/1945	Hopkins .....	164/52
2,397,789	4/1946	Hopkins .....	164/133
2,405,254	8/1946	Hopkins .....	249/180
3,268,958	8/1966	Sickbert .....	164/133 X

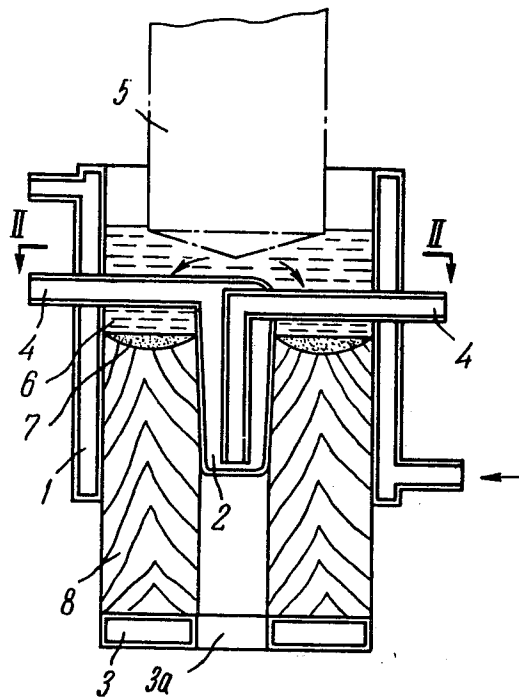
*Primary Examiner*—J. Spencer Overholser  
*Assistant Examiner*—V. K. Rising  
*Attorney*—Waters, Roditi, Schwartz & Nissen

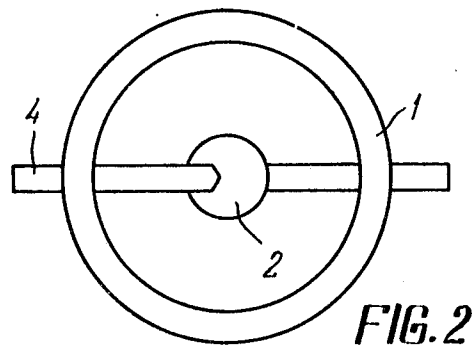
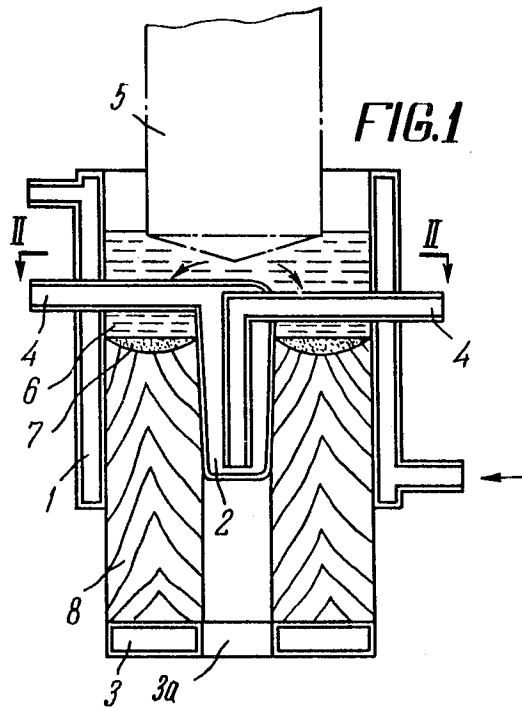
[54] **UNIT FOR MANUFACTURING HOLLOW METAL**  
**INGOTS**

1 Claim, 2 Drawing Figs.

[52] U.S. Cl. .... 164/252

**ABSTRACT:** The proposed unit is intended for manufacturing metal hollow ingots by the electroslag remelting of a consumable electrode in a cooled mold.





## UNIT FOR MANUFACTURING HOLLOW METAL INGOTS

The present invention relates to equipment for electroslag remelting processes, and, more particularly, to apparatus for manufacturing metal ingots by the electroslag remelting of a consumable electrode.

It may be employed for manufacturing tubular stack of steels, alloys and metals (ball bearing highly alloyed, heat-resistant, corrosion-resistant, high-strength, structural, etc., including those that are difficult to work), to be subsequently converted into pipes and other articles by pressing, rolling out, rolling and other operations.

Known in the prior art is a unit for manufacturing metal hollow ingots by the electroslag remelting of a consumable electrode, comprising a cooled mold accommodating a cooled rod to form the inner cavity of an ingot being made, which is retained on a bottom plate, the mold being provided with branch pipes for supplying and withdrawing a coolant.

In the known apparatus the rod is secured on the branch pipes and is capable of moving with regard to the mold.

The length of an ingot to be made is limited by the height and stability of the branch pipes. By using to advantage the abovesaid construction, it is possible to make ingots of a limited length (for example, up to 2,000 mm.).

The primary object of the present invention is to provide an apparatus for manufacturing hollow metal ingots by the electroslag remelting of a consumable electrode, featuring such an embodiment of a cooled rod which would enable manufacturing ingots of a considerably greater length as compared to the known apparatus.

In conformity with the above object, in the installation for manufacturing hollow metal ingots by the electroslag remelting of a consumable electrode in a water-cooled chill mold accommodating a cooled rod to form the inner cavity of an ingot being formed, which is supported on a bottom plate, and having branch pipes to supply and remove a coolant, according to the invention, these branch pipes are secured with one end in the mold wall and emerge therefrom, whereas their other end is attached to the upper portion of the rod, retaining it in the chill mold so that the upper portion of the rod together with the branch pipes is found in a slag bath between the consumable electrode and the surface of the metal bath of the ingot being formed.

An embodiment of the present invention, provided by way of example, is shown in the accompanying drawings, wherein:

FIG. 1 is a general view of the proposed apparatus complete with an ingot being formed, shown in longitudinal sectional view;

and FIG. 2 is a cross-sectional view of same, taken on line II—II of FIG. 1.

The proposed apparatus comprises a chill mold (FIGS. 1 and 2) accommodating a cooled rod 2 forming the inner cavity of an ingot being made, and a cooled bottom plate 3 intended for retaining the ingot to be formed and provided with an opening 31, into which enters the lower part of the rod 2 at the beginning of the remelting process.

Secured in the upper part of the rod 2 are branch pipes 4 serving to supply and remove a coolant for the rod 2.

The branch pipes 4 are welded or mechanically attached with their one end to the upper part of the rod 2, whereas their opposite end, on which a hose is put for supplying and removing the coolant, passes through the walls of the chill mold 1. The rod 2 is thus retained in the chill mold.

With a view to preventing the jamming of the lower part of the rod 2, resulting from a shrinkage of the ingot being formed, this rod is made tapering downwards.

A hollow ingot is produced in the proposed apparatus in the following manner.

Prior to starting a heat, the chill mold 1 is so adjusted that the lower part of the rod 2 enters opening 3a in the bottom plate 3.

Then a consumable electrode 5 is introduced into the chill mold 1, liquid slag 6 is poured thereinto according to any

known method, and the process is started according to the conventional electroslag remelting procedure. Fusion of the electrode 5 results in the formation of drops of molten metal, which flow over the upper portion of the rod 2 (as it is shown by arrows in FIG. 1) and over the branch pipes 4 secured therein, thus forming an annular metal bath 7, from which a hollow ingot 8 gradually solidifies.

As the ingot 8 grows up, it is extracted from the chill mold 1 together with the bottom plate 3 on which it is secured.

An embodiment of making a hollow ingot is possible, according to which the ingot together with the bottom plate remains stationary, whereas the chill mold along with the rod secured therein and forming a cavity in the ingot, move upwardly as the ingot is built up.

The speed of extracting the ingot or the speed of lifting the chill mold are selected such that the metal bath be lower than the branch pipes.

In this case, the branch pipes are protected against being clogged with metal so that the remelting process is not discontinued.

When using the proposed apparatus, the depth of the slag bath is selected such that it could accommodate the upper part of the rod together with the branch pipes. Such a layer of slag should be provided over the branch pipes and rod, which would enable the normal electroslag remelting process to be effected.

On completing a heat, the chill mold readily lends itself to be removed from the ingot.

In the proposed apparatus, the chill mold may be made either as a single piece or split both horizontally and vertically.

The use of split chill molds allows easy replacing of one rod by the other one in the case of its wear, and whenever it is required to vary the internal diameter of a casting.

The proposed apparatus is advantageous over the existing units of such type in that it allows making quality hollow ingots of a great length, considerably simplifying the equipment (for example, there are not required mechanisms for moving the rod, there is facilitated the retaining of the rod coaxially to the chill mold during the remelting process), and, hence, increasing the productive capacity of the apparatus.

One of the advantages of the proposed apparatus consists in a possibility of using therein inexpensive electrodes of a continuous section (for example, cast ones).

When describing this embodiment of the invention, specific terminology has been resorted to for the sake of clarity. The invention, however, is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Though the present invention is described in connection with its preferred embodiment, it is obvious that there may be allowed modifications and versions thereof that do not depart from the idea and scope of the invention, which will be readily understood by those skilled in the art.

These modifications and versions are to be considered as falling within the spirit and scope of the invention, as defined in the appended claims.

What we claim is:

1. An apparatus for producing hollow ingots by the electroslag remelting of a consumable electrode, comprising: a chill mold, in which a slag bath is created; a water-cooled rod disposed in said chill mold and intended for the formation of the internal cavity of an ingot being formed in the chill mold; a bottom plate, on which said ingot is secured; branch pipes to supply and remove a coolant to and from the said rod, respectively, which branch pipes are secured with one end in the chill mold wall and emerge therefrom, whereas their other ends are secured to the upper part of the said rod, retaining it in said chill mold so that the upper part of the rod together with the branch pipes are found in the slag bath between the consumable electrode and the surface of the ingot being formed.