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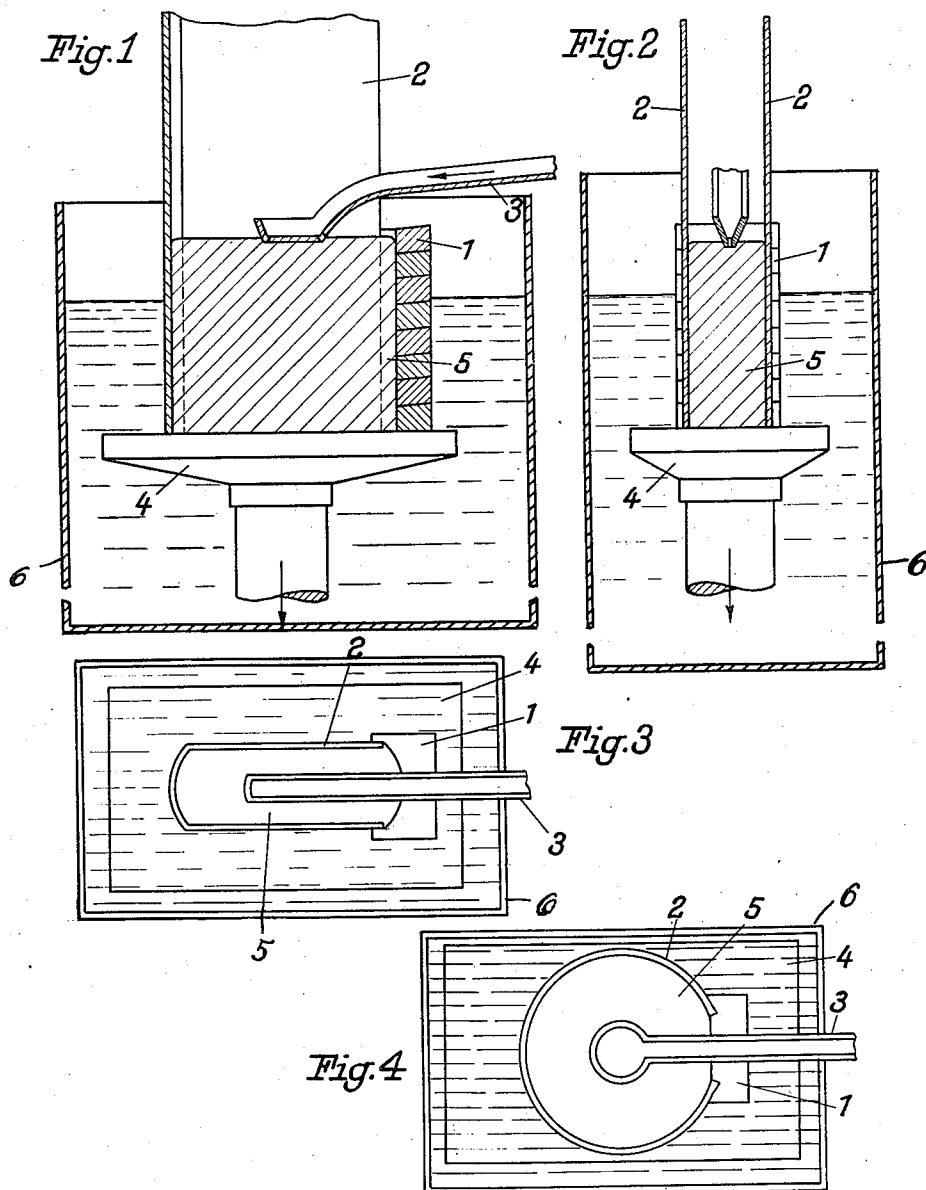
W. ROTH

2,264,456

METHOD OF CASTING METALS

Filed May 9, 1938

2 Sheets-Sheet 1



Inventor:
Walter Roth,
Walter Roth
Attorneys

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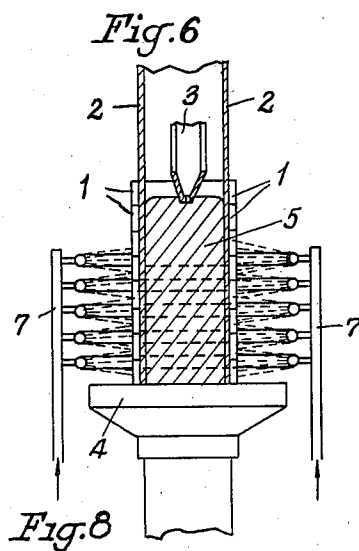
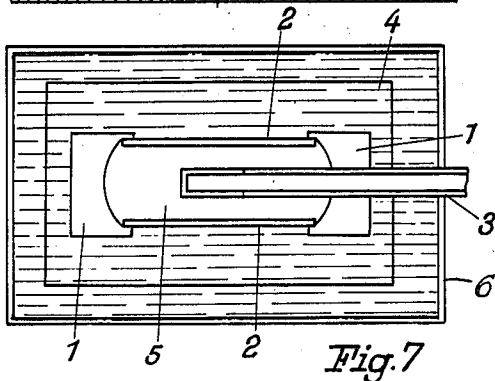
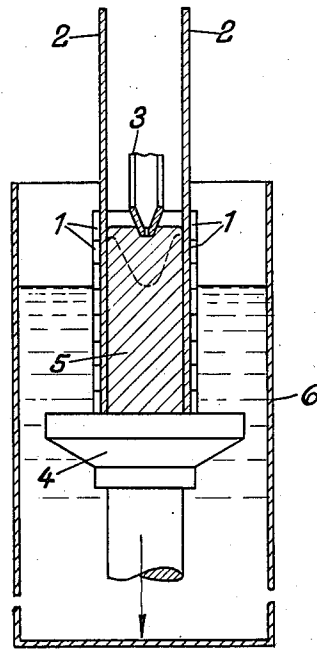
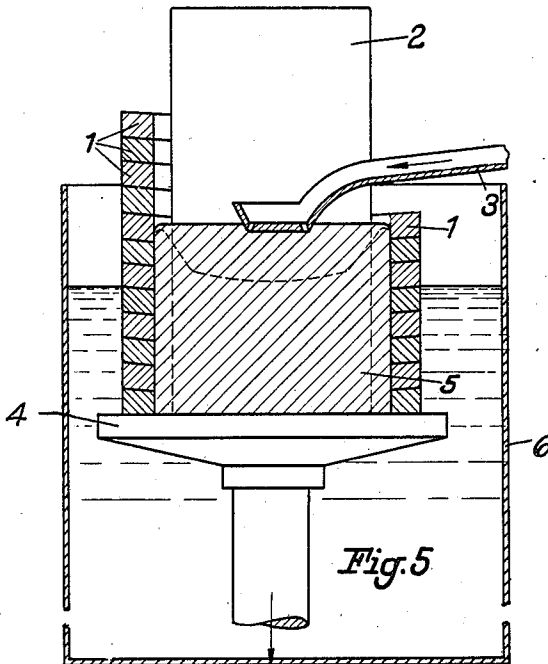
W. ROTH

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METHOD OF CASTING METALS

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2 Sheets-Sheet 2



Inventor:
Walter Roth,

Barley & Pearson
Attorneys

UNITED STATES PATENT OFFICE

2,264,456

METHOD OF CASTING METALS

Walter Roth, Buschhütten, near Kreuztal, Westphalia, Germany, assignor to Vereinigte Leichtmetall-Werke Gesellschaft mit beschränkter Haftung, Hanover-Linden, Germany

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5 Claims. (Cl. 22-209)

This invention relates to a method of casting metals, particularly to the casting of metal ingots in which the metal being cast is aluminum, or an aluminum alloyed with such metals as copper and/or magnesium.

Hitherto in the casting of metal ingots, particularly when the ingots are formed of aluminum alloys, considerable difficulty has arisen in the prevention of dross or oxidation, as well as piping, gas bubbles, and surface flaws. It is well known that such irregularities appearing in the ingot show up as flaws in the sheet metal obtained after the ingot has been rolled, and consequently it has been the effort of the art to obtain means for diminishing the formation of such irregularities. One of the prior art means has been to pour the ingot with a confined pouring stream. To do this, an iron shell mold has been built with one side open and the pouring spout inserted through this opening. As the metal in the mold increases, the mold is lowered and the open side closed with additional forming means, with the pouring end of the spout being kept in continual immersion within the poured metal.

It is an object of the instant invention to make a simple sheet metal mold which is capable of being used for pouring metal ingots.

Another object of the invention is to make a method of pouring metal ingots wherein the formation of irregularities is prevented by regulating the rate of cooling of the ingot.

A further object of the invention is to construct a metal mold which may become a part of the finished ingot and can remain a part of an article finished from the ingot.

Still another object of the invention is to construct a metal mold of lightweight construction which can be progressively reinforced as the ingot is being formed.

Basically the invention consists of an improvement over the molds and method of casting previously described with regard to the old art. The improvement primarily consists in providing sheet metal walls which form the mold, mounting these walls on a table, which can be lowered, providing means for cooling the sheet metal walls by spraying a cooling medium on it and/or by immersing it in a cooling bath, providing a segment-like fastening means for fastening together the free edges of the metal walls and closing the open sides of the mold, and pouring the ingot with the end of the pouring spout continually immersed in the molten sump in the ingot being formed while progressively building up and closing the open sides of the mold by the segments used to fasten together and reinforce the thin sheet metal walls.

Further objects and the means by which the objects of the invention are obtained may be more readily understood by reference to the following

specification taken in connection with the drawings, in which:

Fig. 1 is a vertical cross-sectional view of one form of the invention.

Fig. 2 is a cross-sectional view taken at right angles to Fig. 1.

Fig. 3 is a plan view of the invention shown in Fig. 1.

Fig. 4 is a plan view of a modified form of the invention; and

Figs. 5, 6, and 7 are views similar to Figs. 1 to 3, respectively, of a further modified form of the invention, and

Fig. 8 is a cross-sectional view of the mold being lowered into a water spray cooling device.

In Fig. 1, clamping and closure members 1 are shown for holding together the free ends of the sheet metal walls 2 of the mold. The pouring spout is shown at 3, and the end of the spout is in continual contact with the melted sump of the partially formed ingot 5. The mold, ingot, and fastening elements are mounted upon a movable table 4, which table is immersible in the cooling bath 6.

When the mold is first erected, the table 4 is slightly above, or approximately flush with the surface of the cooling bath. The thin sheet metal walls 2 forming some of the sides of the mold are placed on the table and clamped together by means of the lower-most of the fastening elements 1. As seen in Fig. 3, these fastening elements 1 are flat, block-like segments which clamp together the two free ends of the walls 2. The block-like elements 1 may be made of any desired material, either metal or ceramic, and if heavy enough are sufficient to clamp the walls 2 of the mold together. Additional fastening means may be provided if desired. As shown in Fig. 1, the segments 1 may be slightly inclined toward the interior of the mold which aids in preventing their being displaced by the outward pressure of the poured metal in the ingot 5.

When the pouring begins, the metal flows through the spout 3 and immediately forms a puddle on top of the table 4 within the confines of the mold. The table is lowered at a rate sufficient to keep the pouring end of the spout 3 in continual contact with the poured metal. As the ingot 5 grows, additional segments 1 are placed one on top of the other in advance of the height of the growing ingot, and as the table is being continually lowered. It is thus apparent that the spout 3 does not need to be moved, and that the segments can be built up in proportion to the rate of lowering the table.

This pouring method taken in connection with the novel construction of the mold, provides the following advantages: Contrary to the teachings of the prior art, the walls of the mold 2 are of thin sheet metal so that a rapid exchange of heat

can take place between the heat within the liquid and the cooling bath. The rate of cooling depends upon the temperature of the cooling bath and the rate at which the ingot is lowered into the bath. This method of cooling results in an improved dense ingot free of sweating and of fine, granular structure. As the pouring end of the spout is continually immersed within the molten sump of metal forming the ingot, oxidation is materially decreased. The rate of heat exchange is dependent upon the thinness and consequential heat conductivity of the thin metal walls 2, and the use of these walls is made practical by the reinforcement provided by the segments 1. It is apparent that as the height of the ingot increases within the mold, the greater the pressure upon the thin metal walls, which increase of pressure is compensated for by the added reinforcement provided by the increase in number of the segments 1.

Figs. 1, 2, and 3 show that the metal walls can be formed of a single sheet of metal 2 bent into U-shaped form, the single open side being closed by the segments 1. Various shapes of the metal wall can take place as illustrated in Fig. 2 wherein a circular, rather than a U-shaped form, is shown.

In Fig. 5 a variation of the formation of the metal walls appears in that two separate sheet metal plates are spaced apart upon the table 4 and each open end is closed by metal segments 1. As shown in Fig. 5, the metal segments on one side can be built up in advance of the metal segments on the side through which the pouring spout extends. This construction has the further advantage in that instead of building up segments on one side higher than those on the other side, the segments 1 can be built up at equal rates with a pouring spout inserted through each open side, and accelerated pouring thus being obtained. By use of the cooling bath an accelerated pouring through the use of two spouts is possible.

In Figs. 1 to 7, inclusive, the metal sheets 2 which form the shell-like mold may be made of iron, and after pouring one ingot, may be removed from the solidified ingot and used for casting a second ingot.

The cooling bath can be in the form of the tank of water 6 as shown in Figs. 1 to 7, inclusive, or alternatively, can consist of a spraying apparatus 7 as shown in Fig. 8. In both types of cooling devices, a rapid cooling of the ingot takes place through the thin sheet metal mold walls as the ingot is lowered into the cooling device.

The metal sheets provide a further advantageous means of casting metal ingots, for example, the sheets may be made of the same material as the ingot, as, if aluminum alloys of the Al-Cu-Mg-type are being cast, plates or sheets 2 of the same material can be used for the walls of the material. Even though the pouring temperature of the molten metal is somewhat higher than the fusing temperature of the metal, the intensive direct cooling of the plates 2 by means of the water bath is such as to prevent a melting of the plates 2. Again, if the plates are well cleaned as by brushing, pickling, or the like, the ingot becomes solidly welded to the sheet metal walls of the mold. Such results in an ingot having a surface which is entirely smooth and free from irregularities. This provides an especial advantage in the casting of aluminum alloys, particularly those containing copper, because the

surface of ingots cast by old methods in the art are usually irregular and rough because of sweating and other causes, and such ingots must be machined or planed off before further working. From the above, it is seen that it is possible to pour plated ingots. For example, the material to be used as the plating need not be the same as the material cast, but may be made of a material which will weld to the cast material. A desired plated ingot can thereby be obtained.

Having now described the means by which the objects and advantages of the invention are obtained, what is claimed is:

1. A casting apparatus comprising a platform adapted to support at least one sheet metal element having an inner mold forming surface and an outer surface, and having at least one open slot in a side thereof, and a plurality of clamping members, each of which being arranged to close a portion of said slot, and bearing upon the outer surface of said sheet metal element to reinforce the same adjacent said slot, said members being progressively applied to said element to close said slot entirely.

2. A method of casting a plated metal ingot comprising erecting upon a vertically movable table a mold at least two walls of which consist of thin sheet metal walls which are adapted to form the plates united to the cast ingot, pouring molten metal within said walls and simultaneously lowering said table so that the top surface of the molten metal within the sheet metal walls stays in substantially the same plane, and intensively cooling and solidifying said ingot by externally applying a liquid cooling medium directly to said sheet metal walls slightly below said top surface, and as said table and mold are simultaneously lowered.

3. In the process of casting an ingot comprising pouring molten metal through a slot in a mold while simultaneously lowering the mold, closing said slot, and solidifying the metal in the mold; the steps of forming a mold cavity at least one wall of which consists of a thin sheet metal sheet, applying members to said slot which members engage that surface of said sheet which is outward of the mold cavity to close said slot and reinforce said metal sheet.

4. A method of casting a metal ingot comprising erecting upon a table a sheet metal mold composed of at least one thin plate defining a mold cavity, and being opened on at least one side, closing by clamping means the lowest portion of said open side, pouring molten metal into said mold while lowering said table and mold and progressively adding further clamping means engaging the surfaces of said plate adjacent said open side and which lie outwardly of said cavity to seal said open side and reinforce said mold, and solidifying said ingot by lowering said table and mold into a liquid cooling bath.

5. In the process of casting a plated ingot comprising pouring molten metal through a slot in a mold while simultaneously lowering the mold, closing said slot, and solidifying the metal in the mold; the steps of forming a mold cavity at least one wall of which consists of a thin metal sheet, which is adapted to become a plated surface of the ingot, applying members to said slot which members engage that surface of said sheet which is outward of the mold cavity to close said slot and reinforce said metal sheet.

WALTER ROTH.