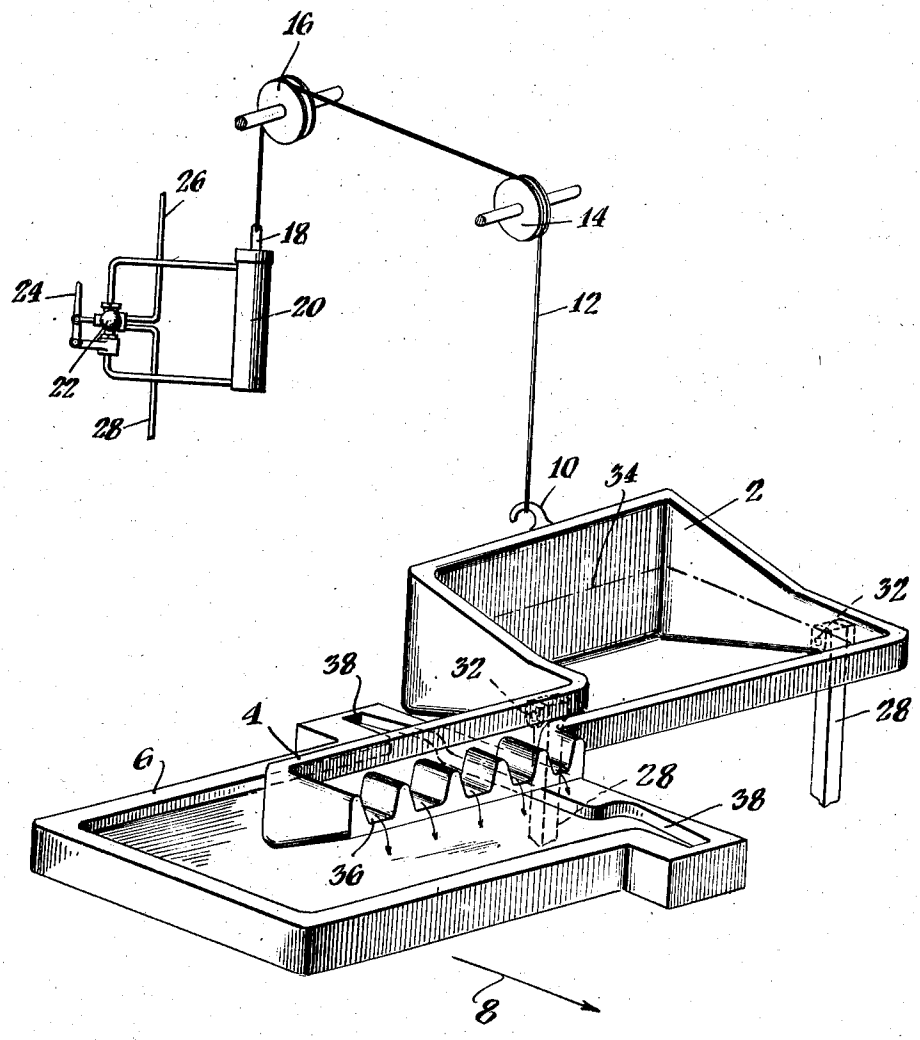
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METHOD AND APPARATUS FOR CASTING COPPER ANODES

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METHOD AND APPARATUS FOR CASTING COPPER ANODES

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In the production of electrolytically refined copper, it is customary to cast the anodes to be refined by introducing the copper into the anode molds by means of a ladle which receives the copper directly from the anode furnace.

The anode molds are mounted customarily on some type of casting wheel which brings the molds successively under the discharge of the ladle whereby the copper flows from the ladle into each successive mold for filling the latter. The customary construction of the ladle provides for an end discharge of the copper from the ladle into the mold beneath it, and, consequently, it is necessary to stop the rotation of the casting wheel as the mold is filled thereby bringing each mold to a stop beneath the discharge end of the ladle until the mold is filled. When the mold is filled, the wheel is actuated again until the next mold of the series is brought into filling position.

This intermittent operation of the casting wheel and the end pouring of the copper from the ladle are open to decided disadvantages.

Thus, when the wheel is started after each mold is filled, the copper in the mold is still molten or plastic so that the inertia of the copper results in a tendency of the copper to surge against the side of the mold when the wheel is started thereby producing a rolled edge on the cast anode. The presence of such rolled edges acts to diminish, very materially, the ampere efficiency of the refining cell, because in the refining operations, it is impossible to obtain a positioning of the cathodes with respect to the anodes so as to have an equal distance between all portions of the anode and cathode surfaces. Where the rolled edges are present on the anodes, the excess copper along such edges presents a less distance between such copper and the cathode surface than is present between the remaining portions of the electrode surfaces, so that there is a tendency to build up on the cathodes excrescences or projections of metal opposite to the rolled edges of the anodes, which reduce the path of current travel from the anode to the cathode, tending to short circuit the cell and to increase gold and silver losses.

The elimination of such rolled edges on the anodes becomes, therefore, a very desirable result.

A further disadvantage of the usual practice of casting copper anodes lies in the fact that when the anodes are operated so as to be stationary below the ladle, there may be variations in the pouring time which has an important effect on the application of the necessary mold dressing to the succeeding molds.

In this connection it is to be borne in mind that a mold wash is applied to each mold before the copper is poured into the mold. The mold wash comprises usually a thin slurry of bone-ash, which slurry obviously is of a substantially constant density or specific gravity for each mold. The molds of course are hot, so that if there should be a substantial variation in the pouring time for the molds as they reach pouring position, the succeeding molds will have the mold dressing applied thereto for varying periods of time before the molds are filled with the copper. This may result in an insufficient drying of the mold dressing, or an excessive drying thereof. The former condition is conducive to trouble upon the application of the copper to the mold, because of the presence of moisture in the mold dressing or an inefficient adherence of the mold dressing to the mold. When there has been excessive drying of the mold dressing, there is also a tendency of the dressing to separate from the mold because of caking or spalling of the dressing. In either case there may be excessive inclusion of the mold dressing in the castings, or there may be difficulty in discharging the castings from the molds.

A further disadvantage in the usual practice of discharging the copper from the end of the ladle into the anode molds lies in the fact that the copper reaches the mold in a position which is towards what will be the bottom of the anode. Each mold is provided at what is to be the top of the anode with portions which define the contact lugs of the anodes when the latter are in operation in the refining cells. It is necessary to have these lugs well formed in order for efficient contact to be made between the anodes and the bus-bars of the cells. This means that the portions of the mold which define the anode lugs should be well filled with copper and, accordingly, therefore, the copper should be fully liquid when it flows into the lug recesses of the mold. In accordance with the usual methods of casting, the copper flows backwardly from the point of pouring which means it has reached its lowest casting temperature when it is ready to flow into these lugs. In order to have sufficient fluidity to fill these lug portions in a satisfactory manner, it is evident the copper must be well superheated when placed in the mold.

This superheat, however, tends to produce a localized burning of the mold where the stream of copper strikes the mold, the stream usually being

too heavy for efficient cushioning action to be maintained by the body of copper in the mold.

Furthermore, the intermittent operation of the casting wheel involves the consumption of a considerable amount of time in the manipulations required to start and to stop the casting wheel for each mold.

The present invention provides an improved method and apparatus for casting copper anodes for use in the production of electrolytic copper, which will obviate the above, and other, disadvantages of the recognized standard procedure as outlined above, permitting the casting of the anodes without stopping of the casting wheel when each mold is to be filled. In accordance with the present invention, the copper is poured into the molds from an improved type of ladle which enables the casting wheel to be operated in a continuous, instead of in an intermittent, manner.

Further objects of the invention will become apparent as the description proceeds and the features of novelty will be pointed out in detail in the appended claims.

In accordance with the present invention, the copper is poured into the molds from a ladle which introduces the copper preferably as a plurality of small streams, laterally of the mold, that is to say in line with the direction of travel of the molds.

Pouring the copper in this manner prevents localized burning of the molds and enables an effective cushioning action to be set up by the body of copper in the mold thereby facilitating the production of anodes of uniform surface.

Furthermore, pouring the copper in this manner into the molds enables the molds to be filled without any break in the operation of the wheel, so that the effects of inertia incident to stopping and starting the wheel during casting with the consequent production of the rolled edges referred to above, is eliminated. This continuous operation of the casting wheel is obtained by proportioning the time of pouring to the speed of the movement of the molds so that the molds are filled while traveling, and the constant speed of travel of the molds makes it easy to introduce the proper amount of copper into each mold for the production of anodes of standard size and weight.

Furthermore the continuous operation of the casting wheel permits a close control of the temperature of the molds, all molds being at the same temperature when they are subjected to the application of the mold dressing whereby a uniform disposition and adherence of the mold dressing to the molds is obtained, and, all molds arrive at the pouring position at approximately the same temperature.

The invention will be understood more particularly by reference to the accompanying drawing which shows a diagrammatical perspective view of the improved ladle and tilting mechanism therefor, the ladle being shown in position ready to pour copper into the anode mold.

Referring more particularly to the drawing, the ladle comprises the metal receiving, or reservoir, portion 2, which receives the metal from an anode furnace (not shown) and which communicates with an elongated discharge launder 4 extending over the molds longitudinally thereof, one of the molds being indicated at 6. The mold 6 is understood to be one of a series of molds mounted on any conventional type of casting wheel (not shown) so that the longitudinal axis of the molds will extend radially of the casting wheel. In view of the fact that the casting wheel is of any standard construction, it is not indicated on the drawing, the arrow 8 showing the direction of travel of the molds.

The reservoir 2 of the ladle communicates through passage 5 with the discharge launder 4, the latter being provided with a plurality of laterally disposed discharge channels 36, which are distributed so as to avoid localization of impact of copper onto the mold but which are adapted to pour a plurality of small streams of copper into the mold, which streams are cushioned by the copper in the mold, splashing of the copper being minimized thereby with attendant avoidance of the formation of fins on the edge of the cast anodes. Furthermore, the distribution of copper in the mold is such that the copper is fully fluid when it flows into the lug portions 38 of the mold thereby producing well defined lugs for the anode which result in effective contact with the anode bus-bars during electrolysis of the anodes. The number of channels for the discharge of the copper is not, necessarily, a fixed number, this being determined by the particular operating conditions.

In addition to preventing the formation of fins on the cast anode, the small streams of copper flowing from the discharge channels 36 of the ladle prevent local overheating and burning of the mold.

The reservoir portion 2 of the ladle is provided with a member 10 for attachment of a tilting cable 12, which cable passes over sheaves 14 and 16, and which is connected to the end of a piston rod 18, operating an hydraulic cylinder 20. The flow of hydraulic fluid to the cylinder 20, is controlled by valve 22, which is operated by a lever 24 in the usual way, the fluid inlet and outlet lines for the valve being indicated at 26 and 28, respectively.

Suitable supports 28 and 30 are provided for the ladle, these supports having trunnions 32, 32, upon which the ladle tilts. The metal line in the ladle is represented by 34, this being merely an indication of depth of metal in the ladle.

As the mold 6 passes beneath the launder 4, the ladle is tilted by a suitable actuation of the tilting mechanism, so that copper will flow from the reservoir 2 into the launder 4 and out through the laterally positioned discharge channels 36 as a plurality of fine streams into the mold 6 thereby filling the latter.

It will be observed that the copper enters the mold in line with the direction of travel of the mold as indicated by the arrow 8, and that the streams of copper are well distributed over the mold. Since the time of pouring is proportioned to the speed of movement or travel of the molds, the mold, which may be of standard size of approximately 36" x 36" x 1¾" and holding 650 pounds of copper, may be filled without interrupting the speed of travel of the mold, so that the mold will be filled with copper by the time it passes out from beneath the launder 4 of the ladle; whereupon the ladle is tilted backwardly to stop the flow of copper from the launder until the succeeding mold reaches pouring position, the casting wheel thereby being continuously rotated throughout the operation.

This continuous rotation of the wheel avoids the production of rolled edges on the cast anodes due to the effects of inertia of the metal incident to starting and stopping the rotation of the casting wheel, thus assuring increased efficiency in

the electrolytic refining of the anodes; furthermore, the continuous operation of the casting wheel means that the pouring time is constant, so that the mold dressing is applied under constant conditions to each empty mold prior to its reaching pouring position; and also there are produced anodes of more uniform surface than have been obtainable uniformly by the pouring procedure which has been regarded as standard practice, as previously outlined herein.

The tilting mechanism described above affords a means for proportioning the pouring rate to the rate of travel of the mold so as to enable each mold to be filled during its passage beneath the launder 4 without stopping the movement of the mold.

What is claimed is:

1. A ladle for introducing copper from an anode furnace into a series of traveling anode molds comprising a reservoir portion, a launder portion extending from the reservoir portion over the mold and adapted to receive metal from the reservoir portion when the ladle is tilted in one direction, mounting means for the ladle enabling the said ladle to be tilted laterally, laterally disposed discharge means in the launder for distributing metal into the mold laterally thereof and in thin streams as the mold moves beneath the launder whereby the said mold may be filled with metal while continuing its movement beneath the launder, and means for tilting the ladle to inoperative position upon completion of the filling of the mold.

2. A ladle adapted for use in casting anodes for electrolytic refining comprising a reservoir portion adapted to receive molten metal from an anode furnace, a launder communicating with the reservoir portion, the said launder having a multiple spout adapted to discharge metal in thin streams from the ladle into an anode mold laterally thereof without interruption to the travel of the mold beneath the ladle as the mold reaches filling position, and means for tilting the ladle laterally between operative and inoperative positions relative to the mold as the mold reaches and leaves filling position.

3. A method of casting copper anodes for use in the production of electrolytic copper which comprises progressively moving a series of anode molds into casting position at substantially uniform speed, filling the molds with copper by leading thereto molten copper from an anode furnace through a suitable ladle and pouring the copper from the ladle in a plurality of streams in line with the direction of travel of the mold, and adjusting the pouring rate to the speed of travel of the molds so as to fill completely each mold with copper without stopping the travel of the molds.

4. Apparatus for casting copper anodes for use in the production of electrolytic copper comprising the combination with a plurality of anode molds disposed for continuous travel on a suitable conveyor, of a ladle for supplying copper to the mold from a melting furnace, the said ladle comprising a multiple discharge spout having outlets adapted to deliver a plurality of fine streams of copper to the mold in line with the direction of travel of the mold, the said outlets being arranged with respect to the mould so as to distribute the copper uniformly in the mold as the mould moves beneath the ladle.

5. Apparatus for casting copper anodes for use in the production of electrolytic copper which comprises the combination with a plurality of anode molds disposed for continuous travel on a suitable conveyor, of a ladle for supplying copper to the mold from a melting furnace, the said ladle comprising a discharge spout having laterally directed discharge openings adapted to deliver a plurality of fine streams of copper to the mold longitudinally of the mold and distributed uniformly over the surface of the mold, and mechanism for controlling the speed of delivery of copper from the ladle in accordance with the rate of movement of the mold so that the mold will become filled with copper as it passes beneath the said spout without variation in the rate of movement of the mold.

6. A process for casting copper anodes which comprises introducing copper as a plurality of fine streams into a continuously traveling anode mold in line with the direction of travel of the mold, the said streams being sufficiently fine to be cushioned by copper already in the mold for obviating splashing of the copper and formation of fins on the resulting cast anode.

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