Fig. 1.

Fig. 2.

INVENTOR:

MARIO TAMA

BY

ATTORNEY
UNITED STATES PATENT OFFICE

2,552,876

METAL PUMPING AND SIPHONING

Mario Tama, Morrisville, Pa., assignor to Ajax Engineering Corporation, Trenton, N. J.

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1 Claim. (Cl. 183—1)

This invention is a continuation in part of my copending patent application Serial No. 647,831, filed February 15, 1946, which has matured into Patent No. 2,556,325 dated January 2, 1951; the invention relates to a method and a means of transporting molten metals from an induction furnace into a ladle or similar type of container.

In conformity with my prior invention the molten metals are pumped from an induction furnace through the sole expedient of electromagnetic forces which are created in the metal bath by a current flowing in a direction parallel to the discharge direction of the molten metal.

This molten metal transporting scheme which necessitates the constant supply of a comparatively high voltage current serves its purposes well in all those cases where the metal flow requires frequent interruptions; this situation applies, for instance, to the direct mold-casting from the furnace or to the discharge of smaller fractions of the molten metal charge; it involves as above indicated the continuous supply of a high voltage current with its resulting costs.

It is the main object of this invention to modify and to economize the molten metal transporting method of Patent No. 2,556,325 by restricting the current expenditure to a fraction of the time required for emptying the charge from the furnace.

It is a further object of the invention to initiate the metal flow from the furnace by the use of electromagnetic forces induced by high voltage current in the metal bath, but to continue and complete the metal outflow from the furnace without the occurrence of this rather costly operating source.

It is also an object of the invention to produce a calmer outflow of the molten metal from the furnace by the elimination of eddy currents and similar disturbances which are an unavoidable consequence of induced electromagnetic forces of high voltage.

With these and other objects in view, which will become apparent as this specification proceeds, the invention consists of a method for the continuous transport of the entire molten metal charge or of a substantial part thereof from an induction furnace of the submerged resistor type into a container, for instance a ladle; this method comprises passing by electromagnetic induction a current through a lower section of the metal bath contained in this furnace, superimposing in the lower section of the metal bath an induced electromagnetic pressure upon its hydrostatic pressure, creating thereby in the lower bath section a zone of a higher liquid pressure than this hydrostatic pressure, placing the one end of a tube of an electrically conductive refractory material in the zone of the high liquid pressure and the other end of this tube outside of the metal bath at a lower level than the first tube end, creating by the said higher liquid pressure a flow of the molten metal from the furnace through the tube and thereupon siphoning the molten metal from the furnace by the level difference at the tube ends.

The invention is illustrated by way of example in the attached drawings.

Fig. 1 is a vertical sectional elevation of submerged resistor type induction furnace equipped for the performance of the invention.

Fig. 2 is a vertical sectional elevation on line 2—2 of Fig. 1.

The furnace shown in Figs. 1 and 2 is similar to the furnace disclosed in my copending application Serial No. 647,831.

The furnace contains an upper receptacle or hearth 7 for the molten metal, a secondary melting loop located underneath this hearth and lower inductor unit consisting of two secondary blocks all encased by an outer housing 3 lined with a suitable refractory 4.

The secondary loop system consists of three vertical channels 15, 16, 17, a bottom channel 18 connecting their lower ends and a bottom groove 16 provided in the hearth.

A transformer assembly consisting of the primary copper coils 19, 20 and the laminated iron core 13 which is closed in itself is provided in the customary manner.

A U-shaped tube 21 made of a suitable electrically conductive refractory material such as, for instance, graphite is inserted into the melting channel 17 with its one branch or section 21a into center channel 17 of the secondary loop; this tube branch 21a extends vertically upwards through the molten metal charge 12, is then bent into a horizontal section 21b which leads from the furnace and finally into a downwardly extending section 21c. This latter section ends at a level which is situated below the end of tube section 21a.

A ladle 11 adapted to accommodate the entire metal charge of the furnace is located underneath the end of tube section 21c.

The operation of the furnace for the purpose of this invention will now be described.

The hearth is filled with the molten metal 12. A high voltage current is generated by induction within the secondary loop. Due to the high electromagnetic pressure created in the channel 17...
which pressure is superimposed on the hydrostatic pressure of the molten metal, the latter is forced into the lower end of tube sections 21a and flows upward into tube section 21b and from there through tube section 21c into ladle 11.

The current supply is maintained until a steady flow of the molten metal is secured through the tube into the ladle; then the current is interrupted and the discharge of the metal is completed by a syphoning action only caused in the usual manner by the level and pressure difference at the two ends of tube sections 21a and 21c.

The generally known liquid syphoning principle is here combined with the electromagnetic pumping method of Patent No. 2,536,325 dated January 2, 1911, and applied in a highly efficient and economical manner to the transport of molten metal from an induction furnace into a ladle for the purpose of emptying the charge in a continuous manner into the latter and greatly reducing the costs of the metal discharge.

I claim:

An electromagnetic induction pump for molten metals comprising a receptacle to hold a molten metal bath and a secondary melting loop beneath said receptacle, the said melting loop consisting of a bottom channel spaced from said receptacle and melting channels connecting said bottom channel and said receptacle, a transformer assembly to induce current in said secondary melting loop and to superimpose in the same an electromagnetic pressure upon the hydraulic pressure of the molten metal, a U-shaped refractory tube reaching with the end of its first branch into the upper end of a melting channel, leading upwardly into a location of reduced pressure, so that a unidirectional flow takes place to start the syphoning action from said receptacle and reaching downwardly with the end of the second branch to a point located underneath the end of said first branch.

MARIO TAMA.

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