Oct. 18, 1938. W. ROHN 2,133,634

ELECTRIC INDUCTION FURNACE

Filed Nov. 10, 1936 4 Sheets-Sheet 1

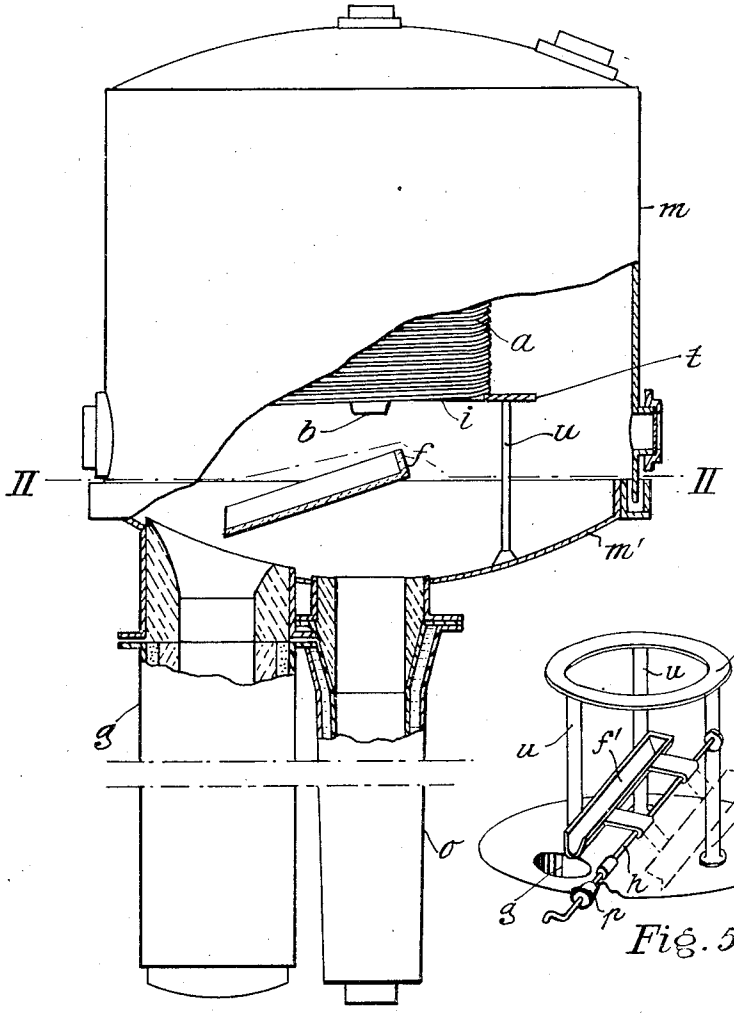


Fig. 1

Fig. 5

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ELECTRIC INDUCTION FURNACE

Filed Nov. 10, 1936 4 Sheets-Sheet 2

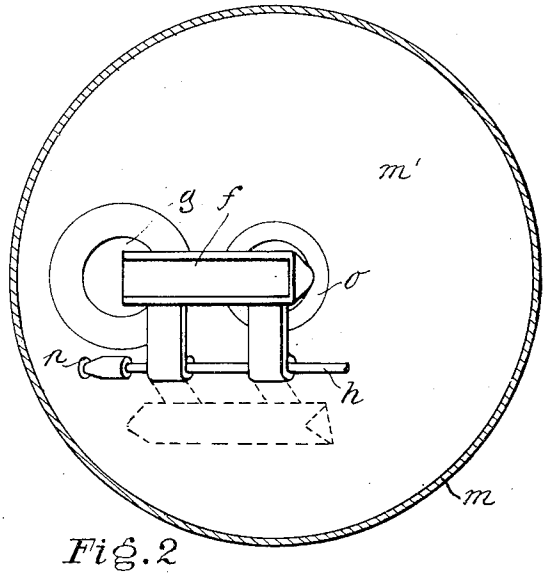


Fig. 2

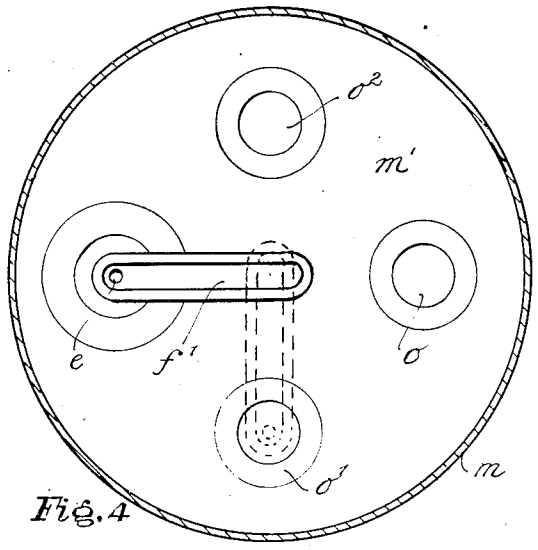


Fig. 4

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ELECTRIC INDUCTION FURNACE

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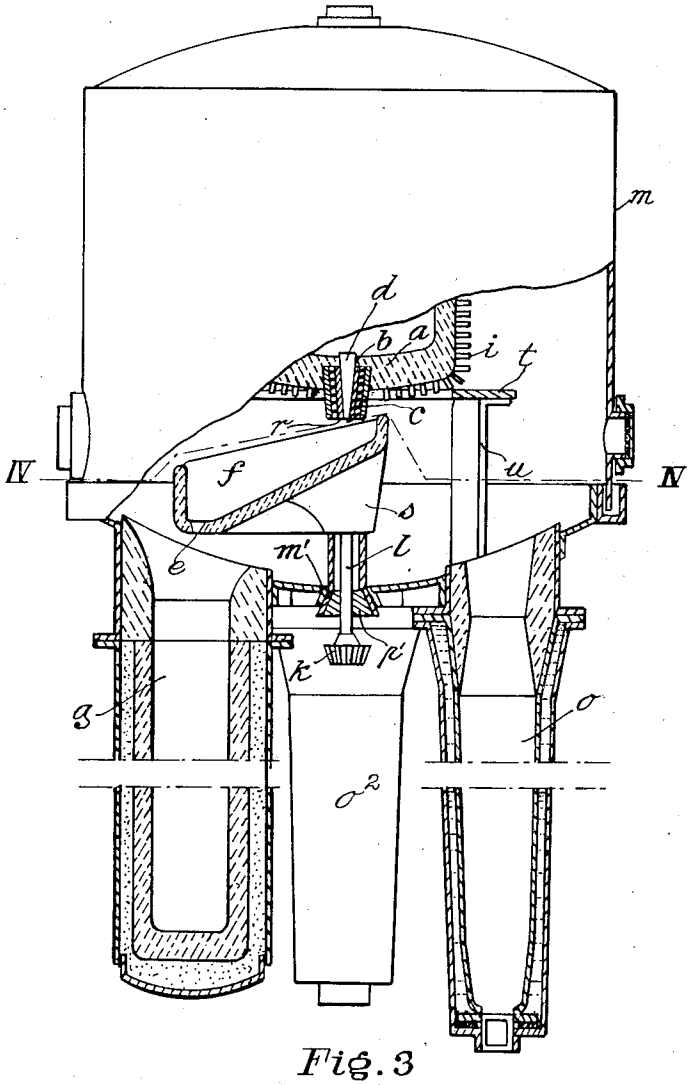


Fig. 3

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ELECTRIC INDUCTION FURNACE

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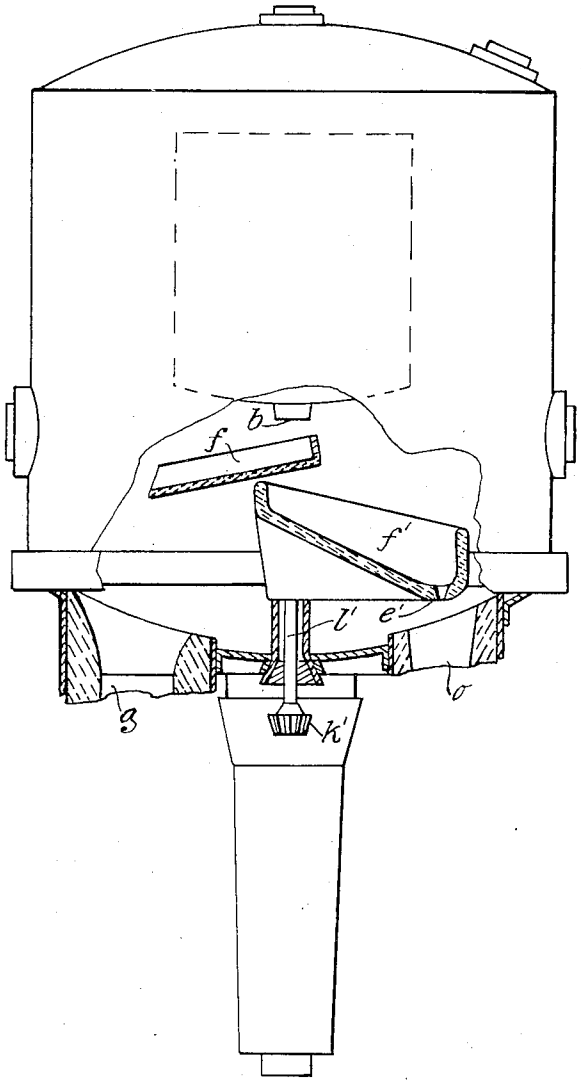


Fig.6

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UNITED STATES PATENT OFFICE

2,133,634

ELECTRIC INDUCTION FURNACE

Wilhelm Rohn, Hanau-on-the-Main, Germany

Application November 10, 1936, Serial No. 110,128
In Germany December 6, 1935

2 Claims. (Cl. 22—57)

This invention relates to apparatus for the manufacture of ingots free from blow-holes and slag. The specification of my copending application No. 10,895 describes and claims an apparatus for the manufacture from metals and alloys of ingots which are free from slag inclusions and blow-holes. In this apparatus the materials are melted in a coreless induction furnace which is operated in vacuo and is provided with a tap hole at the bottom. The tap hole is closed during the melting of the metal by a plug which can be fused at any desired time and is fused at the beginning of the casting process. Below the tap hole there is arranged a mold or molds which are also evacuated and into which the metal flows after the plug has been fused.

In many cases it is desirable for metallurgical reasons to employ water-cooled copper molds in combination with the apparatus described in my application No. 10,895. On the other hand, particularly for any new metallurgical problem, until the apparatus has been thoroughly tested by many years of practical operation and all details have been fully worked out, there is a danger that the plug in the tap hole may fuse prematurely under the effect of the molten metal in which case the liquid metal will run into the mold prematurely. Usually, the cooling water for the mold will then not yet have been turned on and consequently there is a danger of the copper mold being damaged by the molten metal which flows into it and of which the melting point is generally higher than that of the copper. Now the present invention relates to means whereby the destruction of the copper mold and consequential accidents are avoided should premature fusing of the plug occur.

According to the invention there is arranged below the tap hole a swingable trough made of or lined with a ceramic material.

Until the time when it is desired to begin casting the trough is situated below the tap hole and conducts any metal which may break through prematurely into a container or other collecting vessel of, or lined with, ceramic material which is arranged besides the copper mold or molds. When it is desired to begin casting, this trough is swung aside so that the molten metal can then flow through the tap hole into the copper mold below the tap hole.

A constructional embodiment of an apparatus in accordance with the invention is illustrated diagrammatically and by way of example in the accompanying drawings, in which:—

Fig. 1 is a view of the apparatus with the outer casing partly cut away and some parts in section;

Fig. 2 is a section on the line II—II of Fig. 1;

Fig. 3 is a vertical section through a modified form of construction of the apparatus, and

Fig. 4 is a horizontal section on the line IV—IV of Fig. 3.

Fig. 5 is a perspective detail view on a reduced scale showing the relative position of the spout or outlet, the trough and the container, and the means for swinging the trough aside.

Fig. 6 is a detail view showing the relative position of the spout and two deflecting troughs.

In the drawings the reference letters used in the specification of my application No. 10,895 are used for like parts. *a* is the crucible, which may be supported by an annular member *t* which rests on posts *u*, *i* is the induction coil which surrounds the crucible *a*. In the bottom of the crucible *a* an outlet or spout *r* of ceramic material which is surrounded by the coil *c* is inserted in the tap hole *b*. *d* is the plug which closes the tap hole *b* and is fused when casting is to begin by connecting the coil *c* to high frequency supply. *o* is a water-cooled copper mold. The mold and the crucible can be enclosed by a casing *m* which can be placed under vacuum. Below the tap hole *b* and above the mold *o* there is arranged a trough *f* of which one end is situated during the melting process above a container made of or lined with ceramic material, for example a fire clay container *g*. The trough can be swung about the axis *h* and, before the molten metal is cast into the copper mold, it is swung over into the position illustrated in dotted lines in Fig. 2, so that the molten metal can flow freely into the copper mold.

If, during the casting process, any irregularity should occur, for example if the outlet in the crucible should break or be washed out, the trough *f* can be swung back again into its original position which is illustrated in full lines and thus the rest of the melt can be diverted harmlessly into the fire clay container.

The swinging movement of the trough *f* can be effected in various ways, for example magnetically by an electromagnet placed inside the furnace, or from the outside by a revoluble spindle or shaft which passes through a wax sealed conus *p* and is coupled to the axis about which the trough swings, or by a spindle which is carried airtightly to the outside through a corrugated twistable metal tube or a flexible vacuum tube. Fig. 2 and more especially Fig. 5 show by way of example a device for turning or swinging the trough over. *m'* represents the bottom of the casing *m* (Fig. 1).

The lower end of the shaft h penetrates the bottom m' near its periphery and near the opening of the container g. Part of the bottom is shown broken away. A conical plug p coupled (or otherwise connected) with the shaft h is tightly inserted into a ground conical extension of the bottom. The upper end of the shaft h is fulcrumed in a bearing fixed, for instance, to one of the posts u.

Finally, a trough of this nature can also be employed in cases when several molds have to be filled in succession.

In this case the axis about which the trough swings is preferably vertical or one trough having a horizontal or inclined axis can be employed for diverting any metal which flows out prematurely and another trough which can be swung about a vertical axis can be employed for distributing the contents of the crucible to several molds in succession.

A trough turning around a vertical axis is shown in Figs. 3 and 4. The trough f' is located with its inner end beneath the tap hole b and has an outlet e which can be made to coincide with the axes of the molds o, o^1 or o^2 in succession by turning the trough by means of a pinion k and a shaft l conducted through the plug p'.

In Fig. 6 I have illustrated the arrangement of two deflecting troughs f and f'. The upper trough f can be swung aside by the means shown in Figs. 2 and 5 (here not visible). In the position shown the trough f will conduct any molten metal prematurely breaking through from the furnace into the container g. When beginning the casting operation the trough f is swung about an inclined axis so that the molten metal flows through the spout b into the trough f'. The latter is supported by the shaft l' which can be rotated by means of the pinion k'. Hereby the trough is swung about a vertical axis so that the outlet e' of the trough f' may be brought into successive positions above the molds o.

I claim:—

1. In an electric furnace operated in vacuo and provided with evacuated molds located beneath the bottom of the melting vessel and means for withdrawing the molten charge into these molds, a container of a material resistant to the molten charge, a trough situated with one end below the tap hole and with the other end above the said container, means operated from the outside for swinging the trough aside, a second movable trough beneath the first trough located with its one end below the tap hole, and means for bringing the other end of this second trough successively into positions above one of the said molds.

2. In an electric furnace operated in vacuo and provided with evacuated molds located beneath the bottom of the melting vessel and means for withdrawing the molten charge into these molds, a container of a material resistant to the molten charge, a trough situated with one end below the tap hole and with the other end above the said container, means operated from the outside for swinging the trough aside, a second trough adapted to be swung from the outside about a vertical axis beneath the first trough located with its one end below the tap hole, and means for bringing the other end of this second trough successively into positions above one of the said molds.

WILHELM ROHN.