

[54] **APPARATUS FOR ELECTROSLAG SMELTING OF SHAPED INGOTS**

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[22] Filed: **Mar. 5, 1974**

[21] Appl. No.: **448,224**

**Related U.S. Application Data**

[63] Continuation of Ser. No. 301,509, Oct. 27, 1972, abandoned.

**Foreign Application Priority Data**

Jan. 13, 1972 U.S.S.R. .... 17323522

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

[51] Int. Cl. .... **B22d 27/02**

[58] **Field of Search** ..... 164/52, 136, 252; 219/73, 219/126

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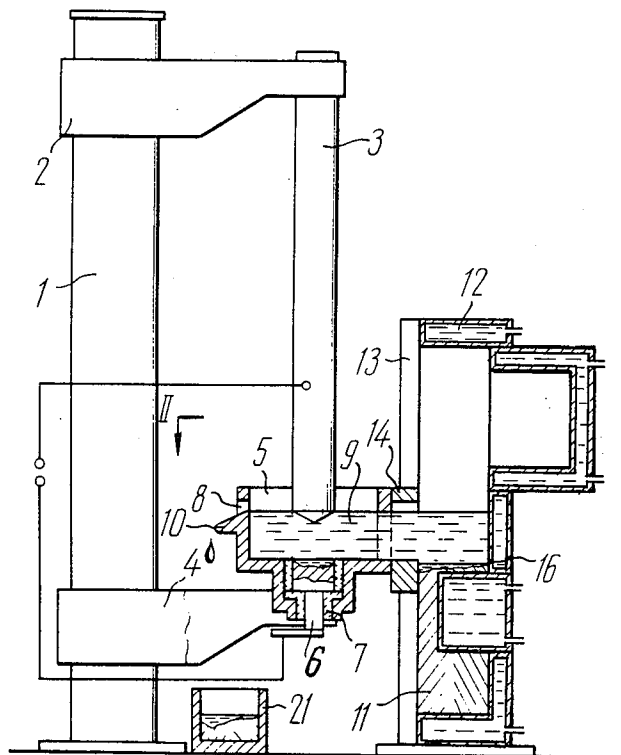
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**ABSTRACT**

[57] An apparatus for electroslag melting of shaped ingots having a mould with a longitudinal side slot in which a slide with a smelting vessel and a gauge for determining the level of metal in the mould are secured.

**3 Claims, 5 Drawing Figures**



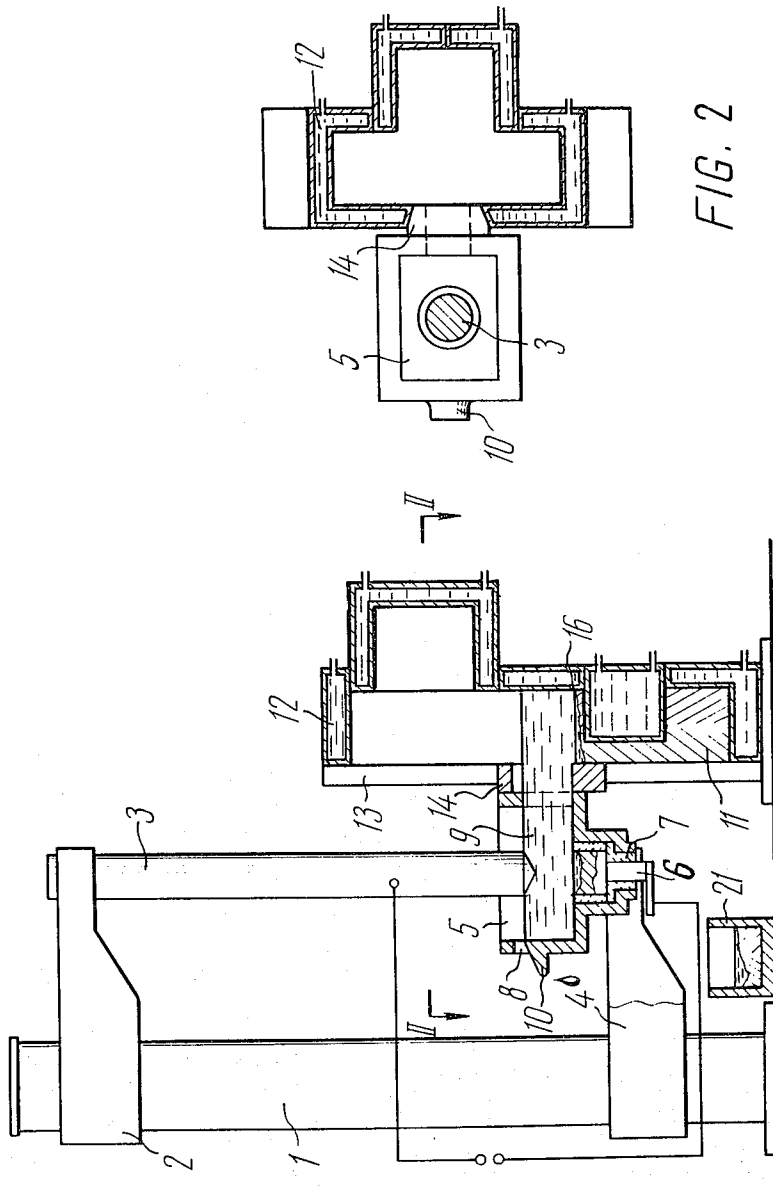


FIG. 2

FIG. 1

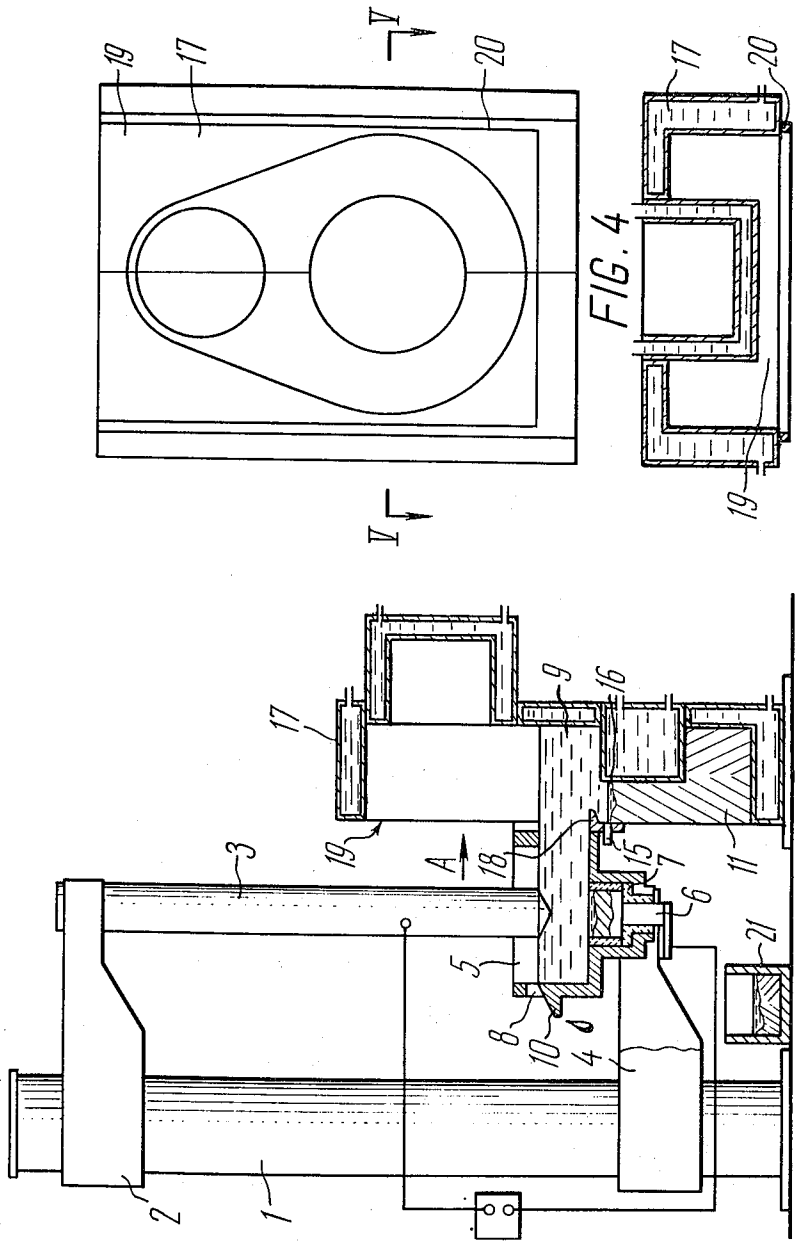


FIG. 4

FIG. 5

FIG. 3

## APPARATUS FOR ELECTROSLAG SMELTING OF SHAPED INGOTS

This is a continuation, of application Ser. No. 301,509, filed Oct. 27, 1972, now abandoned.

### BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for electroslag smelting of shaped ingots of variable cross and longitudinal sections, used as castings for manufacturing articles, such as cranks of large crankshafts and gears.

Apparatus for producing shaped ingots, which are essentially split cooled moulds filled with liquid metal which is produced in different furnaces and is kept therein until complete solidification of the ingot are known.

The ingot thus produced is subjected to additional treatment: it is cleaned of moulding sand, excessive portions and gates, as well as various rolls and metal flows, are removed, and pits are cleaned and eliminated by means of, for example, electric welding.

However, in the case of manufacture of ingots of an intricate shape, such as cranks of crankshafts of ship diesel engines, very often foundry faults and their elimination are not allowed.

Elimination of outer defects of ingots involves employment of manual labor and auxiliary equipment, and requires considerable consumption of energy and time.

Besides outer defects, ingots often have inner defects that cannot be eliminated at all.

A rather high and stable quality of castings is ensured by apparatus for electroslag remelting of metal, in which ingots are shaped in cooled moulds. Such apparatus are usually used for producing ingots that are simple in shape and are round, square or rectangular in their cross sections which are, at the same time, constant.

Attempts were made to provide an apparatus for producing ingots of variable longitudinal and cross sections, for instance, ingots have the shape of a truncated cone, by way of electroslag remelting of consumable electrodes in a split cooled mould (see for example U.S.S.R. Inventor's Certificate No. 265,143).

Such an apparatus has a split cooled mould having longitudinal slots provided in the side walls thereof. The slots mount slides capable of displacing in the vertical direction, and are provided with drives for effecting displacement. These slots are designed to drain excessive slag, and the slides are designed to hold the metal and slag baths which move upwards as the ingot is being shaped.

However, the apparatus does not make it possible to produce shaped ingots of the type of crank webs of the crankshafts of ship diesel engines, and to produce castings for manufacturing large gears. Such ingots can be produced by employing conventional apparatus for electroslag remelting, provided use is made of complex devices for fastening consumable electrodes, and the latter are fed from sources of great power.

Absence of an apparatus that would ensure accelerated economical smelting of high-quality shaped ingots with minimal machining allowances gives rise to serious difficulties, especially in heavy machine building.

### SUMMARY OF THE INVENTION

The main object of the present invention is the provision of an apparatus for electroslag smelting of shaped

ingots, whose shape would be close to that of the product.

Another object of the invention is to simplify servicing of the machine and, consequently, to reduce the number of personnel.

These objects are accomplished by provision of an apparatus for electroslag smelting of shaped ingots, comprising a split cooled mould having a longitudinal slot made in a side wall thereof, and accommodating a slide mounted therein and having a drive used for its displacement in the vertical direction, and a consumable electrode fastened to an electrode holder, in which apparatus, according to the present invention, a smelting vessel communicated with the mould through the slide provided with a metal level gauge rigidly mounted on the slide.

This apparatus will ensure economical manufacture of shaped ingots, as well as high efficiency and higher quality of ingots of an intricate shape, such as cranks of the crankshafts of ship diesel engines.

It is desirable to provide an opening in a side wall of the smelting vessel, the opening being disposed above the level of the slag bath. This opening will be used for draining excessive slag to ensure a preset level of the slag bath.

A non-consumable electrode may be mounted in the bottom of the smelting vessel. This will preclude heat losses of the molten metal while it is flowing from the smelting vessel into the mould, and will make the whole apparatus more reliable.

It is expedient to provide a visor mounted on the slide above the level gauge, which visor prevents jets of flowing-down metal from getting onto the gauge. This allows to preclude wrong readings of the gauge.

### BRIEF DESCRIPTION OF THE DRAWINGS

The following description of exemplary embodiments of the present invention is given with reference to the accompanying drawings, in which:

FIG. 1 shows a vertical cross-sectional view of an apparatus comprising a mould with a narrow slot;

FIG. 2 is a sectional view taken along line II—II in FIG. 1;

FIG. 3 is a view of an apparatus comprising a mould with a slot extending along the whole width of the wall thereof;

FIG. 4 is a mould, a view taken along arrow A in FIG. 3; and

FIG. 5 is a sectional view taken along line V—V in FIG. 4.

### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

The apparatus comprises a column 1 (FIGS. 1 and 3) having an electrode holder 2 which is mounted in the upper portion thereof in such a manner that it can be displaced in the vertical direction and which has a consumable electrode 3 secured therein. Disposed in the lower portion of the column 1 is a trolley 4 which carries a smelting vessel 5 and is capable of being displaced along the column 1. Mounted in the hearth of the smelting vessel 5 is an electrode 6 which melts down in its upper portion and, therefore, is called a liquid metal one. This non-consumable electrode 6 is electrically insulated from the smelting vessel 5 by a layer 7, which precludes heat losses and increases the service life of the hearth. The side wall of the smelting

vessel 5 has an opening 8 disposed above the level of a slag bath 9. The opening 8 and a trough 10 attribute to removal of excessive slag during growth of an ingot 11 at the points where a split cooled mould 12 has a smaller cross section. A side wall of the mould 12 has a longitudinal slot 13 with a slide 14 mounted therein, rigidly connected with the smelting vessel 5 and displaced together with the latter by a drive (not shown in the drawing). The slide 14 is provided with a gauge 15 (FIG. 3) for determining the level of liquid metal 16 in a split cooled mould 17. The slide 14 is also provided with a visor 18 disposed above the gauge 15 and preventing jets of the metal supplied from the smelting vessel 5 from getting onto the gauge 15.

The apparatus may be also provided with a mould 17 (FIGS. 4 and 5) having a slot 19 extending along the whole width of the wall, the slide 14 being essentially a portion of the wall (a shortened wall), held with the aid of a bead 20 secured to the main wall of the mould 17.

In the apparatus under description, an ingot is smelted in the following way.

The smelting vessel 5 is set in its extreme lower position so that the liquid metal level gauge 15 is disposed opposite to the lower edge of the shaping space of the mould 12. Thereafter, preliminarily molten flux is poured into the smelting vessel 5, and the consumable electrode 3 and the electrode 6 are energized. The liquid metal produced as a result of the electrode 3 melting down flows from the smelting vessel 5 via the slot made in its wall and the slide 14 into the space of the mould 12. As the level of the ingot 11 being grown in the mould 12 rises, which is registered by the gauge 15, the smelting vessel 5 is moved upward. Owing to the change in the cross section of the space of the mould 12, the depth of the slag bath 9 changes, and, in order to prevent the depth of the slag bath 9 from exceeding the critical one, which would distort the process, excessive slag is removed from the smelting vessel into a slag accumulating tank 21 through the opening 8 along the

trough 10. Metal flowing down the wall of the slide 14 does not get onto the gauge 15 and does not distort its readings since the visor 18 is disposed above the gauge 15 and directs these jets in the direction opposite to the gauge 15. With the melting process completed, the mould 12 is brought away from the smelting vessel 5, and, after the mould 12 is split, the ingot 11 is extracted.

The apparatus equipped with the mould 17 having the wide slot 19 operates similarly and can be used depending on the shape of the ingot 11 to be grown.

As it is seen from the above-described examples, the apparatus is simple in design and convenient in operation; thanks to the constant gap between the electrodes the current value does not depend on the height of the ingot being grown, and the apparatus ensures a high stability of the process of remelting consumable electrodes and production of high-quality ingots.

We claim:

1. An apparatus for electroslag melting of shaped ingots comprising: a split cooled mould with a longitudinal slot formed in a side wall thereof; a slide mounted in said slot of said split cooled mould; a smelting vessel rigidly secured to said slide and communicated through the latter with said split cooled mould; a non-consumable electrode electrically insulated from said smelting vessel mounted in the hearth of said smelting vessel; a gauge for determining the level of liquid metal mounted on such slide in said split cooled mould; and drive means for moving said slide with said smelting vessel in a vertical direction.

2. The apparatus as claimed in claim 1, wherein an opening is formed in the side wall of said smelting vessel, the opening being disposed above the level of the slag bath.

3. The apparatus as claimed in claim 1, further comprising a visor mounted on said slide above said gauge for preventing jets of flowing-down metal from getting onto said gauge.

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