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STEEL CASTING PROCESS AND MEANS FOR CARRYING OUT THE SAME

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Fig.1.

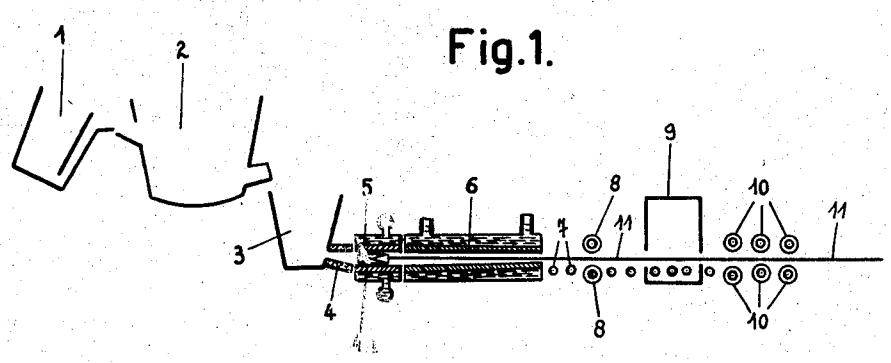
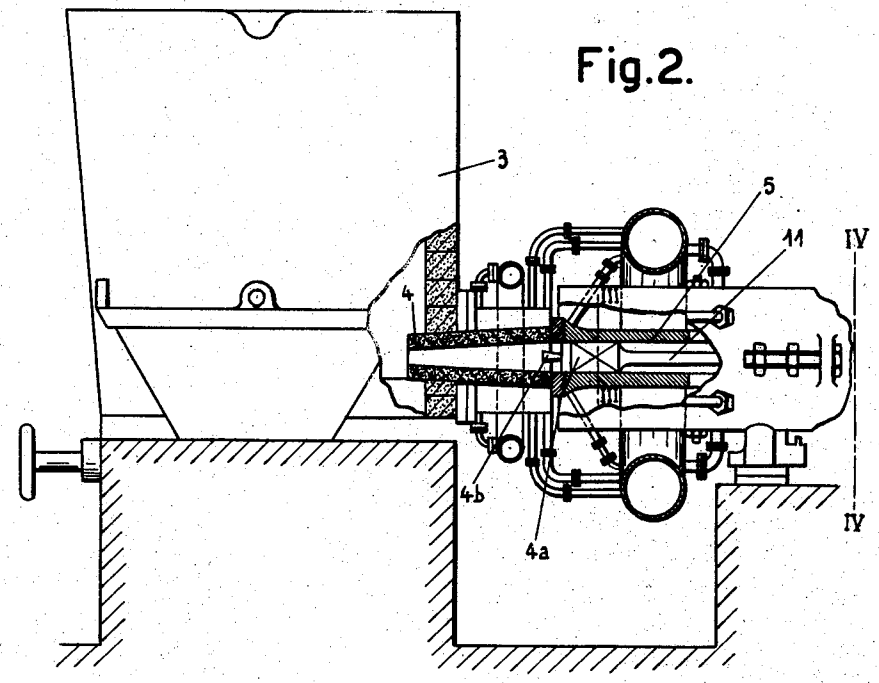


Fig.2.



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STEEL CASTING PROCESS AND MEANS FOR CARRYING OUT THE SAME

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Fig.1a.

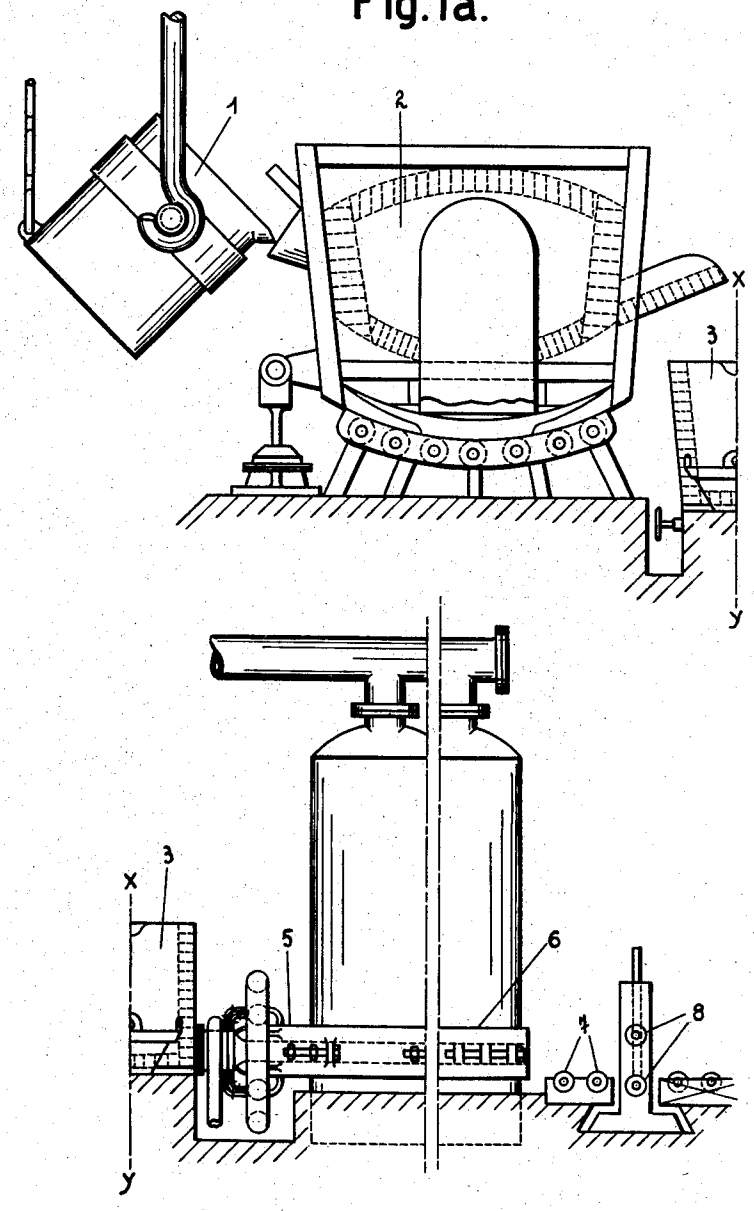

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Fig.3.

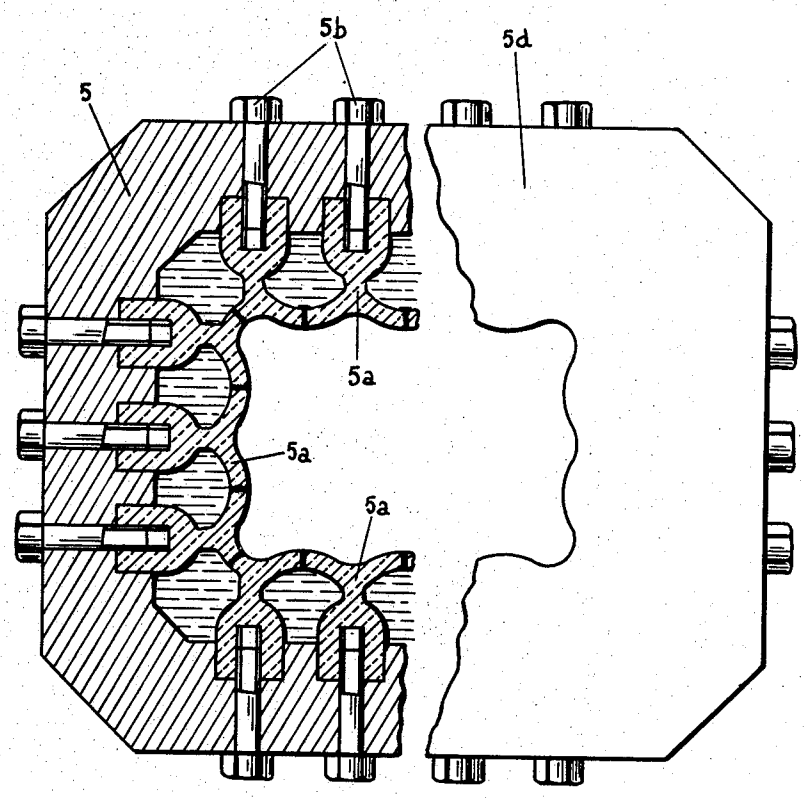

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Fig.4.

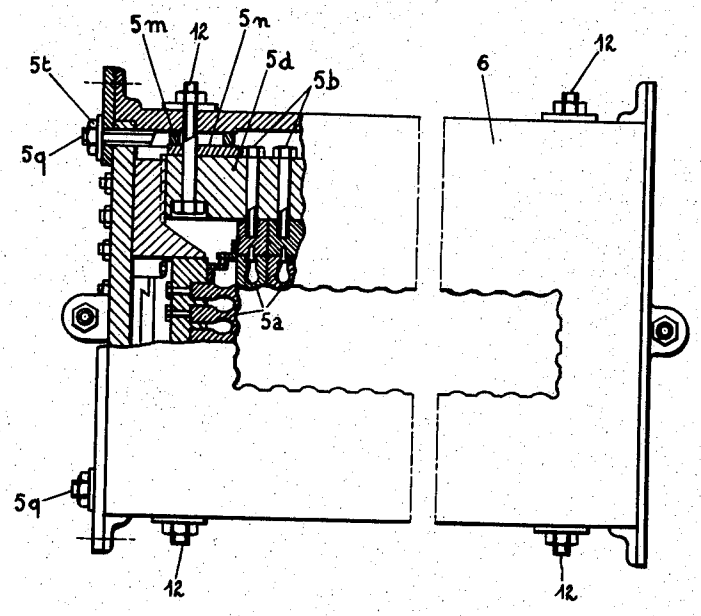
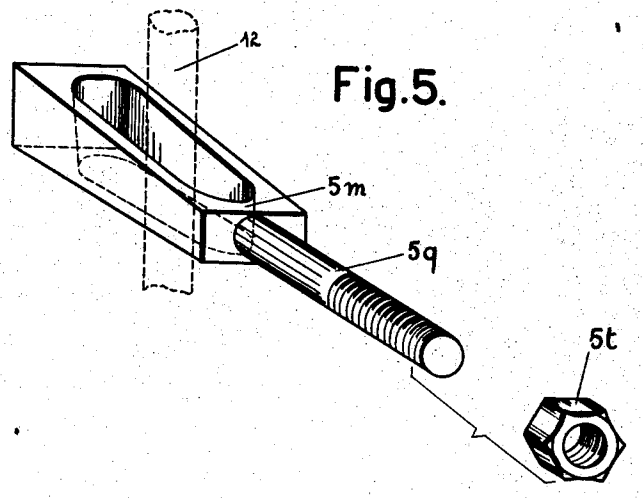


Fig.5.



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2,895,189

STEEL CASTING PROCESS AND MEANS FOR CARRYING OUT THE SAME

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Application August 22, 1956, Serial No. 605,611

Claims priority, application Belgium September 6, 1955

6 Claims. (Cl. 22—57.2)

There has been little change since early times in the art of steel casting in matrices, which is the initial operation in obtaining a finished product. The first step is taken with the aid of an ingot mould in which the metal is cast, the casting being removed from the mould and reheated to convert it into a more or less finished product.

At present, the operation of ingot casting is carried out in two ways:

(1) By the top casting method,
(2) By what is known as the bottom casting method.

The technique of ingot casting has not developed since the remotest times and still introduces many surface defects, such as scale and cracks; these have to be removed either with a chisel or with a blowpipe so as to obtain a clean bloom or slab before charging it in the direction of the finishing rolling mills.

Experience has shown that the best quality steels must be cast in ingot moulds of inverse conicity and lined with a mould of refractory material previously heated to reduce the formation of shrinkage holes. Despite all these precautions, the blooms or slabs still have to be cleaned before being charged. It has been demonstrated that continuous casting enables all the drawbacks encountered in ingot mould casting to be eliminated. Continuous casting is carried out in a single operation, starting from the fluid state of the metal, to obtain semi-manufactured products. The invention proposes a casting process which uses a horizontal ingot mould through which the fused metal is forced without risk of oxidation.

According to the invention, a casting process using a horizontal mould consists in pouring the molten metal from a ladle into a furnace; causing it to pass from the furnace into a molten metal container, and to pass from the latter through a conduit of refractory material and of a truncated conical shape; causing the molten metal to come into contact by its first jet with a conveying device having a dovetail or keying part by which the metal is cooled so that it is solidified therewith; causing, by the conveying device, the metal to pass through two ingot moulds, the first of which determines its final shape and both ensuring a progressive cooling of the metal, whilst the second mould has provision for taking up play; and finally causing the casting to pass between conveying and shaping rollers, so that a finished or semi-finished product can be obtained in a single operation.

According to the improved process, the danger of hollows is eliminated by the constant flow of the steel in the container which pushes the metal towards the ingot moulds under the action of the atmospheric pressure and the weight of the column of molten metal. In this way the slab is sound from end to end and the required chemical properties are uniform along its entire length.

After the metal enters the conduit of refractory material it is not in contact with the atmosphere, which eliminates all risk of oxidation. The great facility with which the fused metal is converted into a finished or semi-finished product results not only in a considerable

reduction of installation costs for a predetermined production but also in a reduction of maintenance costs, labour and danger to the workers.

Other characteristics will emerge from the following description, given by way of a non-restrictive example, the invention covering all processes, and mechanisms for carrying out the same, falling within the ambit of the appended claims.

In the drawings, which show an application of the invention by way of a non-restrictive example.

Figure 1 is a diagrammatic section through apparatus for carrying out the improved casting process.

Figure 1*a* is an elevational view of the said apparatus.

Figure 2 is an elevational view, partly in section, of part of the apparatus, showing the container and the conduit of refractory material.

Figure 3 is a section along the line III—III of Figure 2.

Figure 4 is a section along the line IV—IV of Figure 2.

Figure 5 is a perspective view of a wedge for taking up clearance due to shrinkage of the slab through the ingot mould.

Description

In the apparatus shown the horizontal mechanical casting device consists mainly of the following parts:

The mobile ladle **1** is moved in the direction of the intermediate furnace **2** and its contents are poured into the same; the fused metal passes at the desired time into the container **3** to be admitted into a conduit **4** made of refractory material, where it comes into contact with a conveying device which draws the metal into the interior of the first ingot mould **5** which imparts to the metal its final form before it passes into the ingot mould **6** which is provided along its entire length and width with devices for taking up play due to shrinkage. The rollers **8** which alter the shape of the slab, draw the latter over intermediate rollers **7** which serve as a roller track for the said slab to direct it through a furnace **9** (Figure 1) for maintaining its temperature before receiving its final form by passing in due course between the flattening rollers **10**.

To start the mechanism using the process described above, it is necessary to provide the outlet of the refractory conduit **4** (see Figure 2) with a plug 4^a which consists of fireproof material conforming to the shape of the ingot mould and the front of which is fitted with a steel nose 4^b, made in a dovetail or other shape, and cooled by suitable means.

When the fused metal comes into contact with the cooled nose 4^b it is cooled and solidifies about the same. This solidification diminishes towards the container **3**. The nose 4^b and the fireproof plug 4^a are rigid with a withdrawal member **11** which draws the metal in the direction of the ingot moulds. To facilitate detachment of the solidified cooled part of the metal from the nose 4^b the conduit **4** of refractory material is given the shape of a truncated cone whose large base is situated at the inlet side of the ingot moulds **5** and **6**. The ingot mould **5** is provided with a series of hollow longitudinal elements 5^a made rigid with an outside envelope 5^d by bolts 5^b which ensure tightness between the hollow parts 5^a and the said envelope 5^d. The hollow parts 5^a, in the interior of which the cooling water circulates, are made of a metal with a good heat conductivity, such as brass which ensures the required cooling of the metal under treatment. When the slab has assumed the interior shape of the ingot mould **5** it is carried by the member **11** inside the ingot mould **6** in which the surface cooling continues. As the metal is colder on emerging from the ingot mould **6** than it was when entering it, it is necessary to compensate for the shrinking which occurs all along the said ingot mould **6** and increasing in the outlet direction, by means of a device for taking up the play at

the inside envelopes 5^d which is held by the bolts **12** (see Figure 4). This is effected by controlling exteriorly, as the slab advances in the ingot mould **6**, the contraction of the hollow parts of this ingot mould. To do this, the outside envelope 5^d serving as a support for the hollow parts 5^a is fitted with ramps 5^n which, under the action of the wedges 5^m (Figure 5) which are controlled by bolts 5^q and the nuts 5^t, constrain the envelope 5^d to move in the desired direction, thereby putting into contact the hollow parts 5^a with the cooled slab, and contracting the ingot mould **6**; this regulation is carried out all along the ingot mould **6** and when the slab leaves the same and takes support on the roller track **7**, the device for taking up the play due to shrinkage is wedged in the acting position and should normally not be disturbed again as long as the casting continues, which depends on the quantity of metal fed into the container **3**.

For the purpose of reducing to the maximum extent the above-mentioned taking up of play, only three faces of the ingot mould are adjustable during the first passage of the slab through the same; the bottom horizontal face requires only one setting operation, which is carried out at the time of assembly. The adjusting members therefore act only on the sides and the horizontal top face.

I claim:

1. An ingot mold for the continuous casting of a metal comprising four exterior walls fixed in operative association to confine a chamber, a plurality of hollow members in the chamber and in operative association to provide four inner walls defining a passage open at both ends for movement of the ingot, the hollow members accommodating a cooling medium, wedge means between the exterior walls and the hollow members to adjust the relative positions thereof thereby to control the dimensions of the passage, and control means coupled to the wedge means and extending externally of the exterior walls to provide an external control of the dimensions of the passage.

2. A mold as claimed in claim 1 wherein the hollow members are of metal.

3. A mold as claimed in claim 1 wherein the hollow members are individually displaceable.

4. A mold as claimed in claim 1 wherein the hollow members are removable for changing the basic dimensions of the passage.

5. A mold as claimed in claim 1 wherein the hollow members have undulating surfaces constituting the inner walls and defining guides for the ingot.

6. A mold as claimed in claim 1 wherein the wedge means comprise prismatic members defining elongated slots and rods coupled with the exterior walls and positioned in the slots to constitute guides for the prismatic members.

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