E. GATHMANN.

INGOT MOLD.

APPLICATION FILED JUNE 14, 1909.

940,386.

Patented Nov. 16, 1909.

Fig. 1.

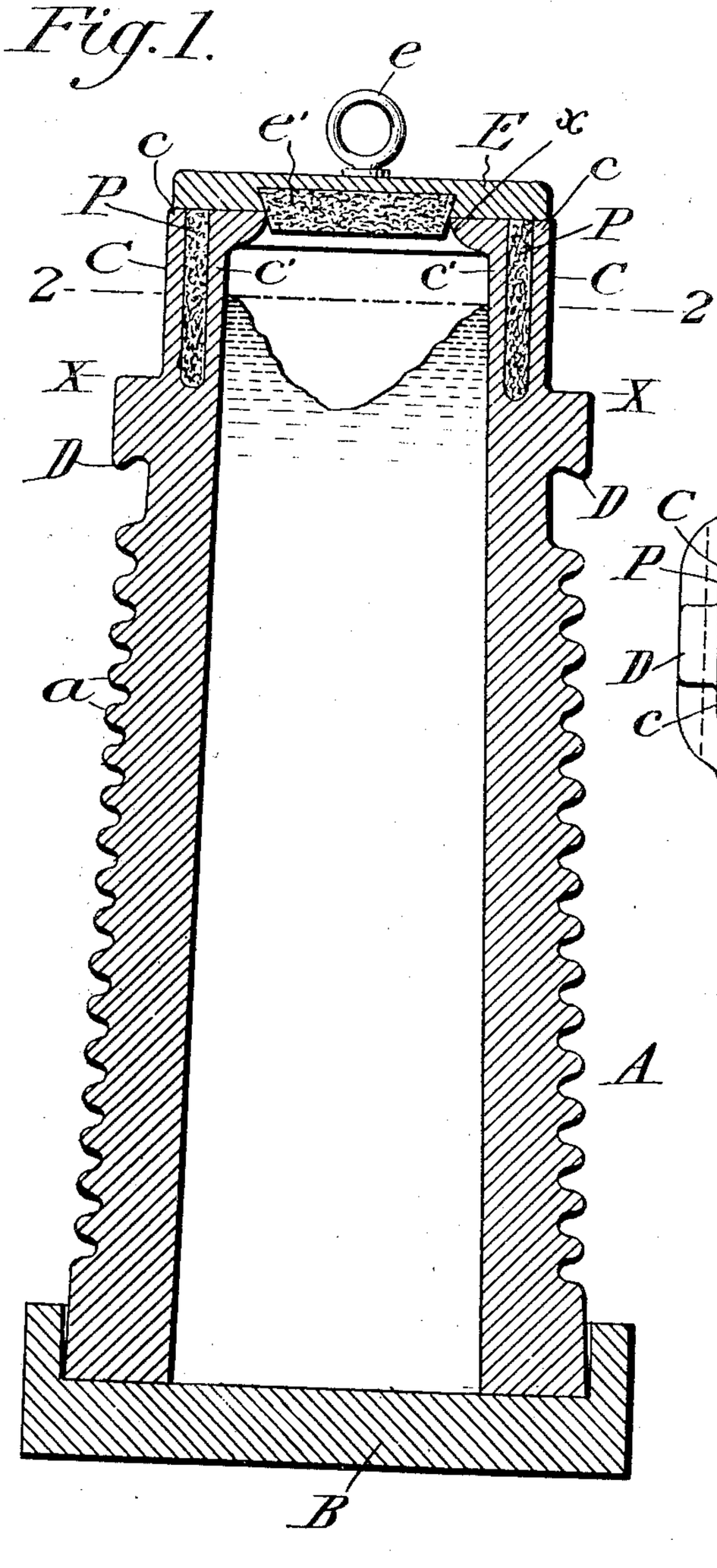
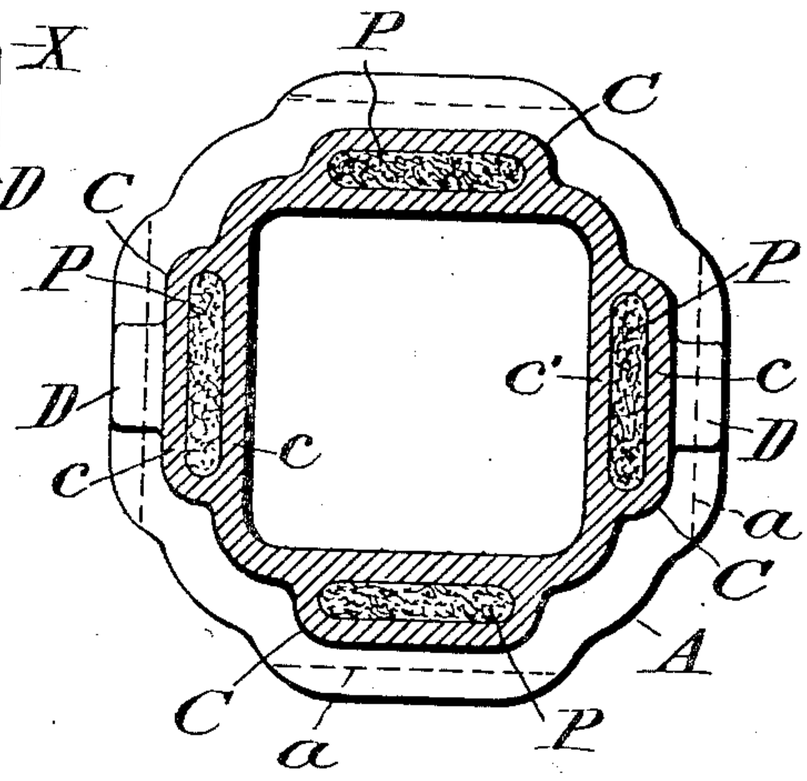


Fig. 2.



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UNITED STATES PATENT OFFICE.

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INGOT-MOLD.

940,386. Specification of Letters Patent. Patented Nov. 16, 1909.

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To all whom it may concern:

Be it known that I, EMIL GATHMANN, a citizen of the United States, residing in Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Ingot-Molds, of which the following is a specification.

My present invention constitutes certain improvements on the ingot mold shown in my U. S. Patent No. 921,972 of May 18, 1909. A characteristic of the mold shown in my patent is that the construction is such that all that part of the molten mass below a relatively small part thereof at the upper end of the mold is cooled more rapidly than the remainder of the metal in order that the upper portion of the molten mass may feed molten metal to the pipe or cavity formed in the lower portion of the mass while the latter is freezing or contracting and until the solidification of the ingot is completed. The metal in the lower portion of the mold below a relatively small part thereof at the top is frozen in a sidewise direction, while the relatively small portion of the molten metal at the top of the mold is frozen upwardly. This is done by conserving the heat of the ingot at the top of the molten mass and in the relatively small upper portion thereof in order to cause the upper portion of the ingot to freeze last. The solidification at the upper portion progresses upwardly, there being always liquid steel on the top of the ingot until the solidification is completed.

I have found that the line of rapid cooling of the ingot should extend to at least 85% of the vertical mass of the ingot when in the molten or liquid state. By so doing the upper part of the mold represents in extent approximately twice the extent of the vertical shrinkage of the metal during solidification and by conserving the heat to the extent just specified I have found that piping is practically eliminated from the ingot and that the depressed portion is so far reduced as to be inconsiderable.

My present invention relates particularly to the upper end of the ingot whereby the heat of the molten mass may be conserved for the purposes above specified.

In the accompanying drawings I have shown one way of carrying out my invention.

Figure 1 shows a vertical central section through an ingot mold with my improvements applied. Fig. 2 shows a transverse section on the line 2—2 of Fig. 1.

The lower part of the mold below the line X—X is relatively thick while the upper part of the mold above the line X—X is relatively thin and this upper part is provided with means for conserving the heat of the molten mass which will be hereinafter more particularly described. The lower part of the mold below the line X—X is provided with roughened or serrated surfaces, as indicated at *a*. As shown these surfaces are provided by employing horizontally arranged ribs and intervening grooves as I find this construction to be well adapted to favor heat radiation.

The mold shown has side walls A which rest on a stool B, of well known construction, and these side walls preferably taper upwardly, as indicated, where they join the four side walls of the upper part C of the mold which are also preferably tapered. The upper part C is provided with a pouring opening which may be surrounded by a flange *x* which is mainly for the purpose of strengthening the upper part of the mold. The part C is formed with pockets P which preferably extend from top to bottom of the part C and are filled with non-conducting material, such as calcined lime. The walls *c*, *c'*, it will be observed, are relatively thin, each being preferably about 1½ inches thick for a mold 19 inches by 23 inches. I also preferably provide a cover E having a handle *e* or a device by means of which the cover may be lifted and lowered, and this cover, as shown, carries a mass *e'* of non-conducting material such as calcined lime, but other substances which are at once non-conductors or poor conductors of heat and which have no chemical effect on the material from which the ingot is cast, may be employed. The parts *a* of the mold are arranged to give an increased radiating surface per superficial foot area of the side walls of the lower part of the mold. The upper portion of the mold may be formed with laterally projecting lugs D for convenience in handling for stripping the mold.

A mold thus constructed will reduce or practically eliminate piping in the ingot and the depressed area at the top of the ingot is prevented. The exact location of the line

X—X at which the radiation favoring and non-favoring surfaces of the mold meet cannot be definitely determined except by experiment for specific sizes and depths of molds, but for the best results I have found that the line of rapid cooling of the ingot should extend to at least 85% of the vertical mass of the ingot when in the molten or liquid state. This does not necessarily mean 85% of the actual height of the mold, but relates to the volume of the same. If the mold were made very wide or of large cross section at the bottom, the line referred to would be lower than where the mold is made relatively narrow at the bottom or is of the same width at the bottom as at the top.

I have shown the upper part of the mold as being provided with pockets containing non-conducting material for the purpose of conserving the heat in the upper portion of the mold, but it is obvious that other means may be employed for the same purpose. By so constructing the mold not only is heat radiation prevented, but a uniform shrinkage of the molten mass is insured and the formation of a depressed area at the top of the ingot is prevented.

I claim as my invention:

1. A metallic mold, the lower portion of which is provided with a roughened surface to accelerate heat radiation and to thus favor the cooling of the molten mass to a greater extent at the bottom part of the mold than at the upper part thereof, and the upper part of which is provided with means outside its inner walls for conserving the heat of the adjacent molten mass within the mold.

2. A metallic mold, the lower portion of which is ribbed to accelerate heat radiation and to thus favor the cooling of the mold while the upper portion is equipped with means for preventing heat radiation and for conserving the heat of the molten metal adjacent said upper portion.

3. A metallic mold, in which all that part of the mold below a relatively small part thereof at the upper end is constructed with means for favoring the radiation of heat from the molten mass, which lower portion constitutes approximately 85 per cent. of the entire contents of the mold, while the upper portion of the mold, which represents in extent approximately twice the extent of the vertical shrinkage of the metal during solidification, is provided with heat insulating means.

4. A metallic mold, the lower portion of which is ribbed or roughened to favor heat radiation, while the upper portion is provided with heat insulating means arranged between the inner and outer walls of the upper portion of the mold and out of contact with the fluid metal.

5. A metallic mold, the lower portion of which is ribbed or roughened to favor heat radiation, while the upper portion is surrounded by heat insulating means and which is closed at the top by a cap or covering of insulating material which is a poor conductor of heat and which has no chemical effect on the material from which the ingot is cast.

In testimony whereof, I have hereunto subscribed my name.

EMIL GATHMANN.

Witnesses:

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