No. 621,646. Patented Mar. 21, 1899.

H. L. GANTT.

MOLD FOR STEEL INGOTS.

(Application filed Oct. 24, 1898.)

(No Model.)

Fig. 1,

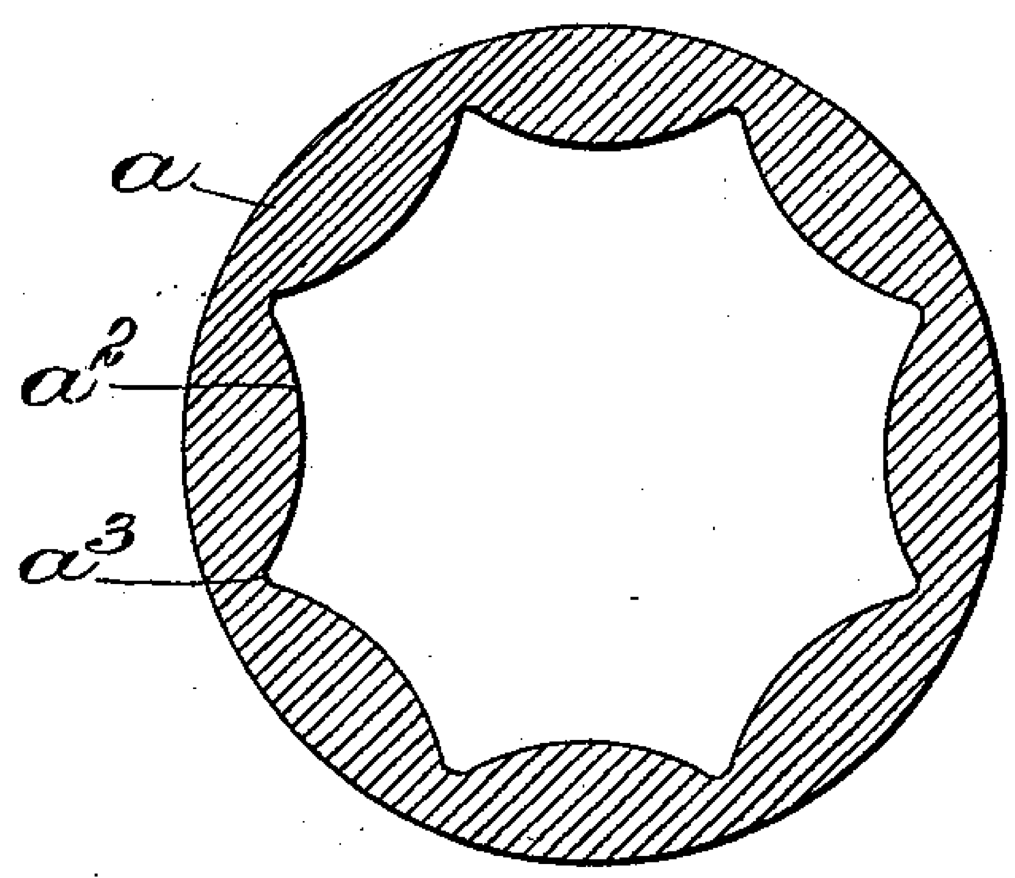


Fig. 2,

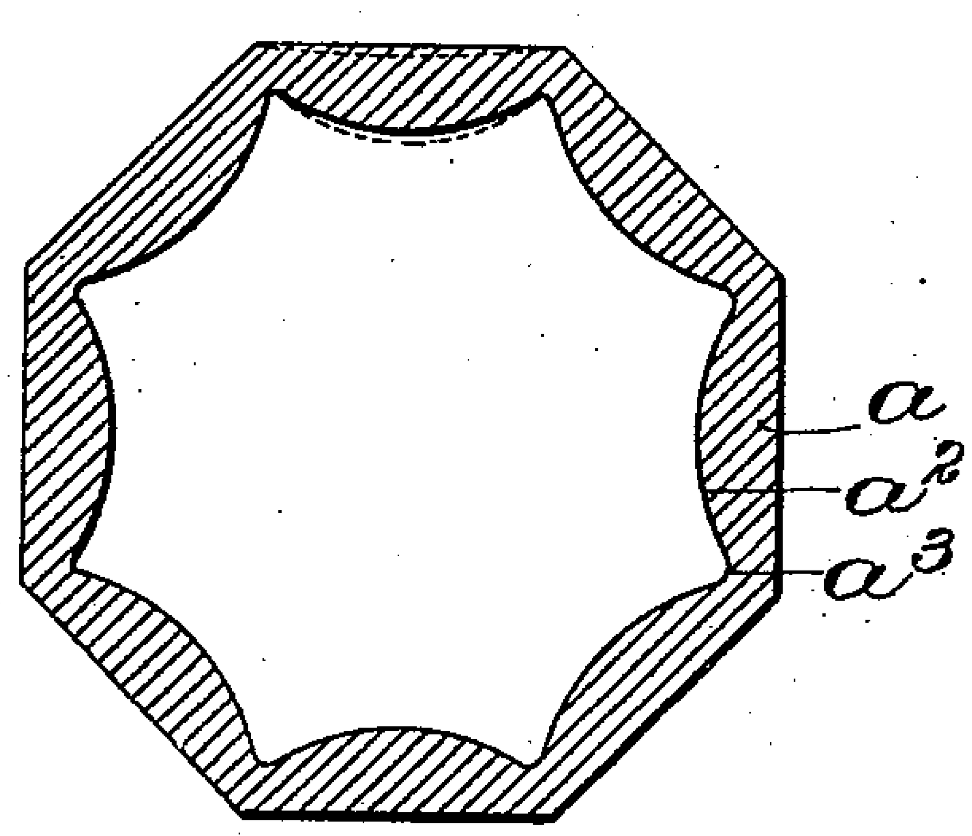
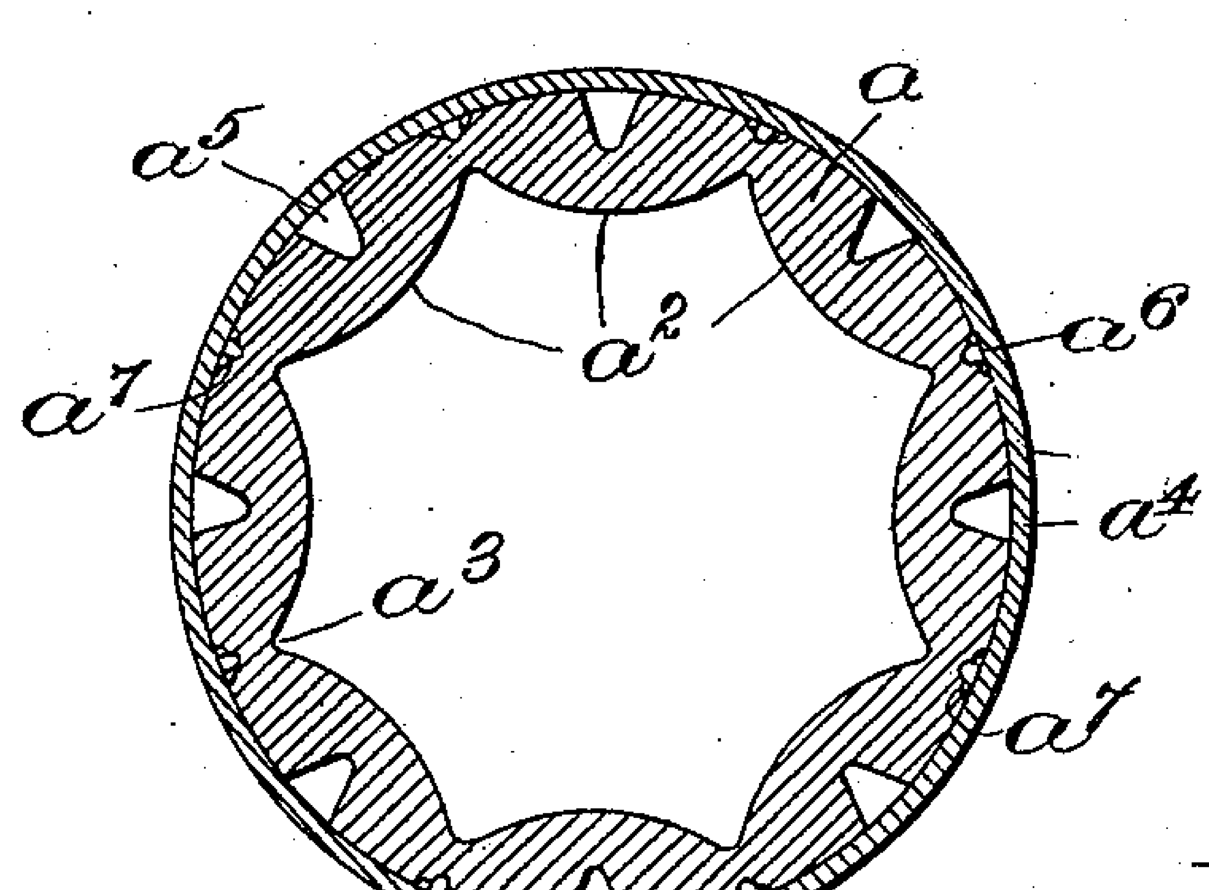


Fig. 3,



Witnesses
Jas. J. Maloney.
Nancy P. Ford

Inventor,
Henry L. Gantt.
by J. P. and H. Livermore
Att'ys.

UNITED STATES PATENT OFFICE.

HENRY L. GANTT, OF FITCHBURG, MASSACHUSETTS.

MOLD FOR STEEL INGOTS.

SPECIFICATION forming part of Letters Patent No. 621,646, dated March 21, 1899.

Application filed October 24, 1898. Serial No. 694,438. (No model.)

To all whom it may concern:

Be it known that I, HENRY L. GANTT, of Fitchburg, county of Worcester, and State of Massachusetts, have invented an Improvement in Molds for Steel Ingots, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The present invention relates to a mold for steel ingots, the object of the invention being to prevent the ingots from cracking along the surface, as frequently happens with the molds now commonly in use, the result being that the ingot cannot be properly forged and is therefore useless and must be broken up and remelted. It has been found in practice that the cracks occur usually where the surface of the ingot is convex or plane, the reason for this probably being that along such surfaces the pressure of the molten steel, which is exerted against the outer chilled portion or skin formed when the steel is first poured, is greater than can be withstood by such skin alone, while the heat of the molten steel, which is given out in the chilling of the outer surface or skin, is imparted to the mold itself, causing an expansion thereof, whereby the mold becomes separated from the skin and does not assist the same in withstanding the internal pressure. Furthermore, if there is a space between the mold and the skin the skin will lose heat to the mold by radiation only and will consequently increase in temperature and become softer and weaker. It is desirable, therefore, to reduce the extent of the convex or plane surface or surfaces of the ingot as far as possible; and to this end the mold embodying the invention is so formed that its matrix-cavity comprises a number of substantially contiguous convex surfaces, which of course produce corresponding concave surfaces upon the ingot. In this instance the "ferrostatic" pressure, as it may be called, in forcing the concave skin of the ingots outward has a tendency to contract the said skin rather than to stretch the same, thereby obviating the tendency of the skin to crack or split apart along the main portions of the surface of the ingot. Furthermore, the projecting or convex portions of the ingot where the concave surfaces adjoin one another are relatively smaller and therefore not only more readily chilled, but also less subjected to the heat of the molten steel within. The skin along these portions therefore will be of sufficient strength to resist the tendency to crack, the result being that a perfect ingot is nearly always formed.

It is obvious from the foregoing description of the effect on the ingot (namely, the greater relative rapidity of the chilling effect where the convex matrix-surfaces of the mold adjoin) that similar conditions exist in the mold itself. In other words, the greater heating effect along the convex surfaces will produce greater expansion along said surfaces than elsewhere, and consequently greater relative displacement due to expansion; but the exterior of the mold being relatively cooler and unexpanded the tendency of said surfaces will be to lengthen between relatively-fixed points. It is practicable, therefore, in accordance with the invention by properly proportioning and shaping the material of which the mold is made to cause an inward displacement of the convex surfaces in response to this expansion, so that the main portion of the mold upon expanding will remain in contact with the ingot and actually produce a pressure thereon until a skin of sufficient strength has been formed to resist by itself the ferrostatic pressure. This may be accomplished by properly proportioning the material of which the mold is made, so that there will be enough material at the convex portions to conduct away the heat, but not enough material to hinder or prevent the inward displacement of the mold along the convex matrix-surfaces.

Figure 1 is a horizontal section of a mold embodying the invention. Fig. 2 is a similar view showing a modification, and Fig. 3 a similar view showing a further modification.

The mold a, which is commonly made of cast-iron, has the surface of its matrix-cavity shaped as indicated, with a number of convex matrix-surfaces a^2 extending longitudinally along the mold and contiguous to each other at a^3, the surfaces at a^3 being shown as slightly rounded in order to facilitate the working of the ingot. As the steel is poured it is obvious that the steel which comes in contact with the mold at the parts a^3 will be exposed to the cooling effect of the mold on two sides, as it were, and will be chilled much more rapidly than the mass of steel which comes in contact with the said convex surfaces themselves, the mass of steel not only being smaller, but the cooling-surface larger. Consequently the skin formed on the projecting parts of the ingot is of sufficient strength to resist all tendency to crack, while the ferrostatic pressure tending to force the weaker skin outward between said parts or along the main surfaces of the mold will obviously tend to contract rather than stretch the said skin, thereby obviating all tendency of said skin to crack under the strain. For the same reason it is obvious that the portions a^3 of the wall of the matrix-cavity have less tendency toward expansion than the convex portions a^2, and will consequently have less tendency toward displacement, especially since they are held by the cooler non-expanded metal outside. The wall along the surfaces a^2 therefore will expand between comparatively-fixed lines—namely, the portions a^3—and in expanding the convex portions will tend to become more convex, especially if, as shown in Figs. 1 and 2, the material forming the wall of the mold is properly proportioned to conduct away the heat and at the same time to allow internal displacement. The main displacement of the walls of the mold due to expansion will therefore be inward, as indicated in dotted lines at the upper portion of Fig. 2, and said walls will not only remain in contact with the surface of the ingot, but will actually exert pressure thereon, thereby decreasing to a large extent, if not obviating, the "piping" of the ingot. It is desirable, however, that there should be a greater amount of material opposite the convex surfaces than at the parts where the said surfaces adjoin to absorb the excess of heat given off by the concave surfaces of the ingot and to thereby prevent that part of the mold where the concave surfaces are formed from expanding uniformly throughout. In the construction shown in Fig. 2, for example, the outer flat surfaces will obviously be less heated than the inner convex surfaces, having therefore less tendency to expand, and thereby helping to prevent displacement of the parts where the convex surfaces adjoin.

In the modification shown in Fig. 3 practically the same result is attained by surrounding the mold with a confining cylinder or band a^4, which may be of steel and which is far enough from the interior of the mold to be relatively unaffected by the heat, which is to a considerable extent dissipated in the body of the mold before it reaches the said band. To favor the inward displacement of the convex inner walls, the material at the exterior of said mold is shown as removed by forming indentations or recesses a^5 opposite the convex surfaces a^2, so that the walls of said recesses can draw together as the convex portions bulge and allow the walls of the mold to remain in contact with the surface of the ingot, there being therefore sufficient material to conduct away the heat, without, however, interfering with the inward displacement. In the expanding action the wall of the mold has a tendency to bend slightly along the parts where the convex surfaces adjoin, and in order to prevent damage from such bending in repeated use the exterior of the mold may be provided with recesses a^6, as indicated in Fig. 3. The material along these recesses, furthermore, may be strengthened by a strip of wrought-iron a^7, cast into the cast-iron of the mold, the wrought-iron being capable of withstanding the bending action for a longer time than the cast-iron alone is capable of doing.

It is to be understood that the action hereinbefore described is only temporary and ceases after the mold has become heated throughout, by which time, however, the skin of the ingot has become of sufficient thickness to alone withstand the ferrostatic pressure.

When, therefore, the mold has thus become heated throughout, it will expand as a whole and can be removed from the ingot, as usual.

It is not intended to limit the invention to any specific construction of the mold, except so far as relates to the inner surface of the wall thereof, since modifications may be made without departing from the invention.

I claim—

1. A mold for steel ingots, having substantially the entire surface of its matrix-cavity composed of a number of longitudinal convex matrix-surfaces contiguous to each other, substantially as set forth.

2. A mold for steel ingots, having substantially the entire surface of its matrix-cavity composed of a number of longitudinal convex matrix-surfaces contiguous to each other, the thickness of the wall of the mold being so proportioned as to conduct away the heat with sufficient rapidity to cause the matrix-surfaces to remain in contact with the cooling ingot, substantially as described.

3. A mold for steel ingots, having substantially the entire surface of its matrix-cavity composed of a number of longitudinal convex matrix-surfaces contiguous to each other, the wall of the mold having indentations extending longitudinally along the outer surface of the mold corresponding to the convex inner surfaces aforesaid, and a confining-band extending around the outer surface of the mold, substantially as set forth.

4. A mold for steel ingots, having substan-

tially the entire surface of its matrix-cavity composed of a number of longitudinal convex matrix-surfaces contiguous to each other, the wall of the mold having indentations extending longitudinally along the outer surface corresponding to the convex inner surfaces aforesaid, other indentations opposite the parts where the convex surfaces are contiguous, and a confining-band extending around the outer surface of the mold, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HENRY L. GANTT.

Witnesses:
HENRY J. LIVERMORE,
NANCY P. FORD.