(No Model.)

G. H. CHASE & H. L. GANTT.

PROCESS OF CASTING ARMOR.

No. 485,784. Patented Nov. 8, 1892.

Fig. 1.

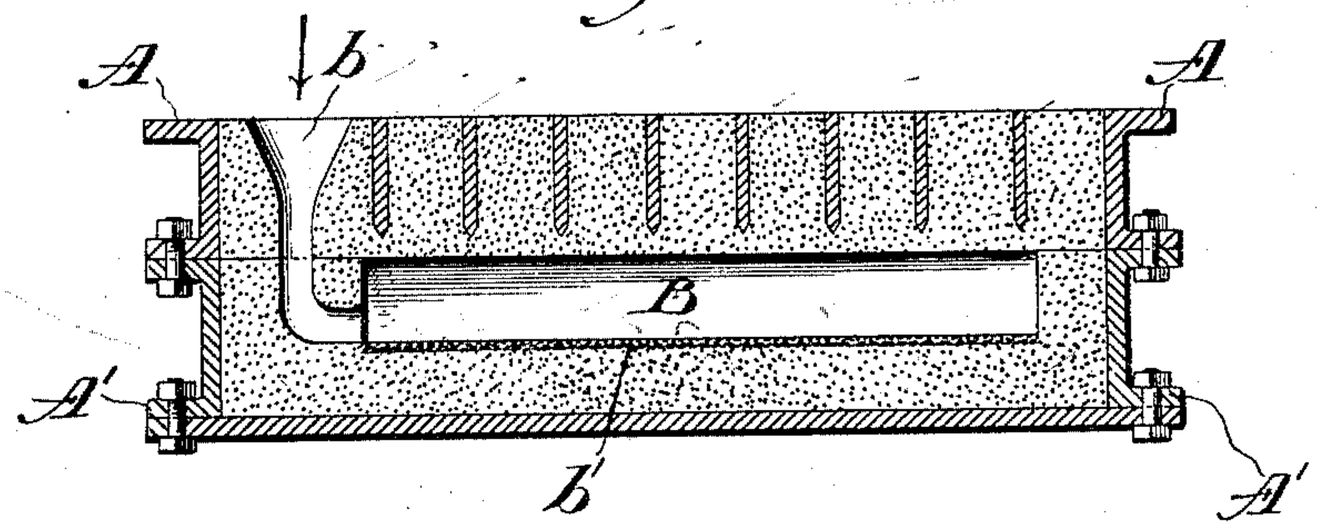
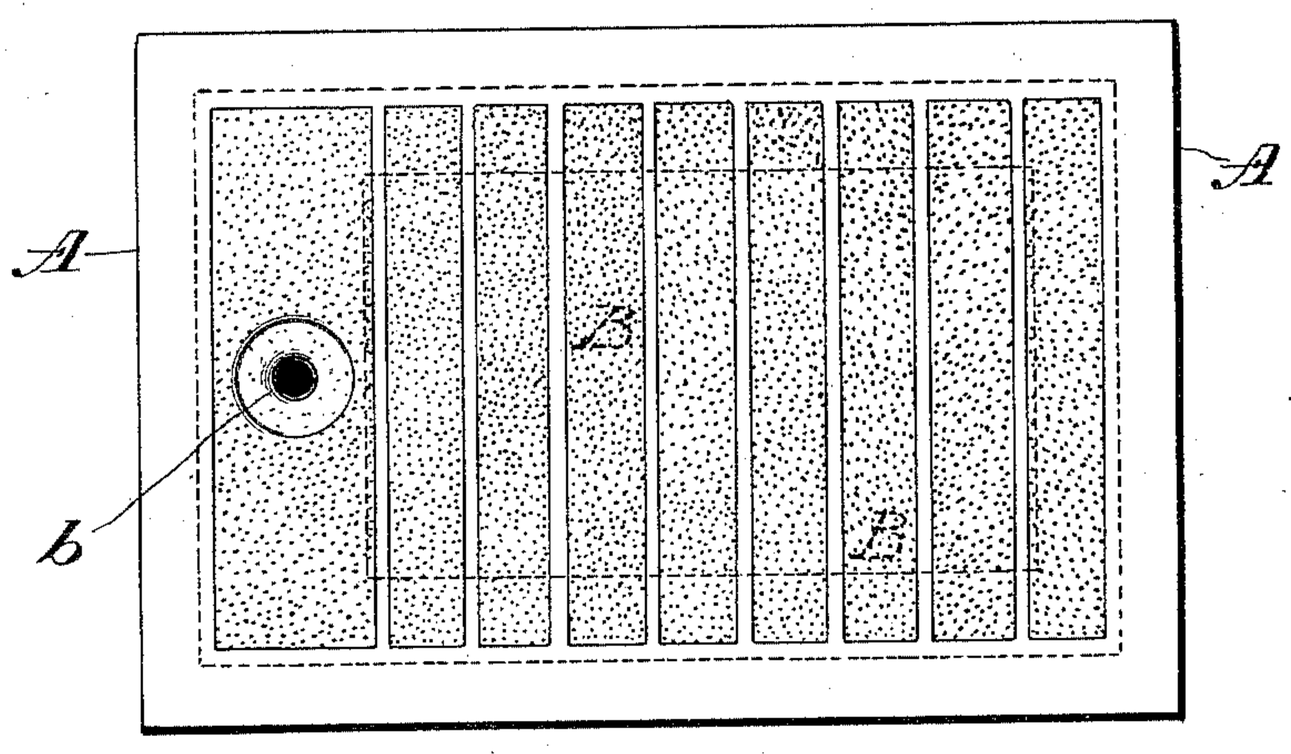


Fig. 2.



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UNITED STATES PATENT OFFICE.

GEORGE H. CHASE AND HENRY L. GANTT, OF PHILADELPHIA, PENNSYLVANIA.

PROCESS OF CASTING ARMOR.

SPECIFICATION forming part of Letters Patent No. 485,784, dated November 8, 1892.

Application filed December 22, 1891. Serial No. 415,907. (No specimens.)

To all whom it may concern:

Be it known that we, GEORGE H. CHASE and HENRY L. GANTT, of the city of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in the Process of Casting Armor, &c.; and we do hereby declare the following to be a full, clear, and exact description thereof.

Our invention has relation to the manufacture of steel armor, rolls, and other objects requiring a hardened surface; and it consists in improved process for casting armor-plate, &c., as hereinafter particularly described.

The object of our invention is to produce in a single piece of steel a surface or surfaces which shall be of a different degree of hardness from the interior portion or other surfaces of the same piece. In other words, the object is to produce in a single piece of steel a hardened exterior grading into a softer interior or rear surface.

A special application of our process is in the manufacture of steel castings for armed vessels or forts.

The objection to the chilled iron which is now principally used in fort construction is that although the surface is extremely hard the metal is exceedingly brittle and readily cracks under the impact of shots fired from the high-power guns. The ordinary steel castings do not break or crack, but are not hard enough to resist the projectiles. By our method we provide a surface nearly if not quite as hard as chilled iron with a back or interior of softer material.

Our method also provides among numerous other important structures a valuable roll for rolling-mills, having both a hard surface and great strength, both of which features are essential in this class of rolls. The same also applies to dies for hammering iron and steel.

When molten steel or other alloy of iron is brought into contact with a wall composed or partially composed of manganese, silicon, or other fusible material with which the steel will alloy, the surface of the metal in immediate contact with the aforesaid fusible material will alloy therewith and produce a harder steel, as will also the parts of the metal adjacent to such surface, such portions graduating in hardness toward the interior until beyond the reach of the effect of the alloying-surface when the interior or rear portions are of the same composition and hardness as provided in the original composition of the metal when poured into mold and softer than that operated upon by the alloying surface or surfaces.

We are aware that, broadly speaking, the process of hardening by the employment of carbon is not new, but that carburizing wholly or partially the surface of ingots or plates of metal to a given depth has been known. We, however, have discovered that fusible metallic alloys when brought into contact, as in mold-walls, with the molten steel by reason of their chemical composition in alloying with the metal and of their fusible character produce superior results. We have carefully experimented with various fusible alloys in mold walls or linings and have discovered that those which produce the best results are mold-walls of fusible alloys composed largely or in part of such hardening materials as spiegeleisen, ferro-silicon, silico-spiegel, ferro-mangenese, ferro-chrome, and ferro-tungsten, &c. The chemical properties of these are such as to alloy in a highly-satisfactory manner with the molten steel coming in contact therewith and to uniformly harden the face of the steel, graduating in hardness toward the interior.

The accompanying drawings illustrate a mold of ordinary construction having an interior wall composed of fusible metallic alloying material.

Figure 1 is a sectional view on the line *x x* of Fig. 2. Fig. 2 is a plan view.

A is the upper section of the casting of the mold-box of ordinary construction, and A′ is the lower section, joined together, as indicated in the drawings, by bolts or other suitable means, so that the sections can be separated after the casting has been made and in this manner removed from the mold.

B is the inner chamber of the mold, into which the molten steel is poured through the runner *b*.

In the drawings only one wall *b′* of the chamber B is composed of the alloying material, while the remaining walls are composed of sand or other suitable material.

In carrying out our invention molds of a desired size and shape are provided, the walls of which are composed wholly or partially of any material which will fuse and alloy or combine with the heated steel and harden the same, as described. Other fusible materials may be employed, which produce a like effect, though, as before described, spiegeleisen, ferro-silicon, silico-spiegel, ferro-manganese, ferro-chrome, ferro-tungsten, and similar metallic alloys are preferable. Molten steel of any desired composition is run or poured into the said molds, when the molten metal coming in contact with the prepared walls fuses the inner surfaces of such walls and combines or alloys therewith, hardening the surfaces of said steel and such parts as are adjacent thereto, the hardness diminishing toward the interior. All the walls of the molds may be composed of the alloying material, or where it is desired to harden only the one surface of the steel but one wall of the mold is composed of such material, while the other walls are constructed of any suitable non-alloying material. The inner stratum only of one or more of the walls of the mold, may be only partially composed of the alloying material, though the body of the walls may be largely composed of the same, if desired. The alloying material may be applied to the walls of the mold as a lining in any desired manner. It is to be noted that our steel after being cast may be treated by any of the well-known methods in vogue for improving the quality of cast-steel, such as forging, rolling, oil-tempering, annealing, hardening, and toughening. When a required piece of armor is of such a simple shape as may be forged or rolled from a mass of cast-steel of another shape, the armor will probably be all the better for such working.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The process of producing a steel casting having a hard surface gradually decreasing in hardness from the surface, consisting in providing a dry mold with a lining or facing of a readily-fusible alloy, pouring steel into said mold and causing said alloy to be fused and entirely incorporated by alloying with the outer portion of the molten steel, and cooling and removing the casting from the mold, as set forth.

2. The process of producing steel castings having a hardened surface or surfaces gradually decreasing in hardness toward the interior, consisting in pouring molten steel into a mold of dry sand, one or more of the inner walls of which is provided with a lining or facing composed wholly or in part of a readily-fusible alloy and causing said alloy to be fused and entirely incorporated by alloying with the outer portion of the molten steel, and cooling and removing the casting from the mold, as set forth.

3. The process of producing a steel casting having a hard surface gradually decreasing in hardness from the surface, consisting in providing a dry mold with a lining or facing composed in part of an alloy containing ferro-chrome, pouring steel into said mold and causing the said alloy to be fused and entirely incorported by alloying with an outer portion of the molten steel, and cooling and removing the casting from the mold, as set forth.

In witness whereof we have hereunto set our hands this 21st day of December, A. D. 1891.

GEORGE H. CHASE.
HENRY L. GANTT.

Witnesses:
HORACE PETTIT,
J. HENDERSON.