(No Model.)

H. A. BRUSTLEIN.

PROCESS OF AND APPARATUS FOR HARDENING HOLLOW ARTICLES OF STEEL.

No. 449,998. Patented Apr. 7, 1891.

Fig. 1

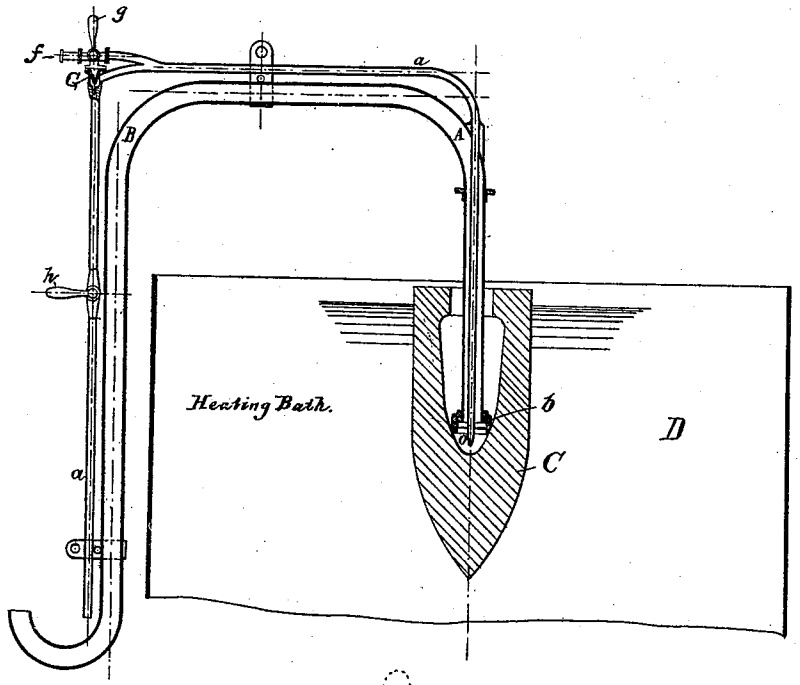
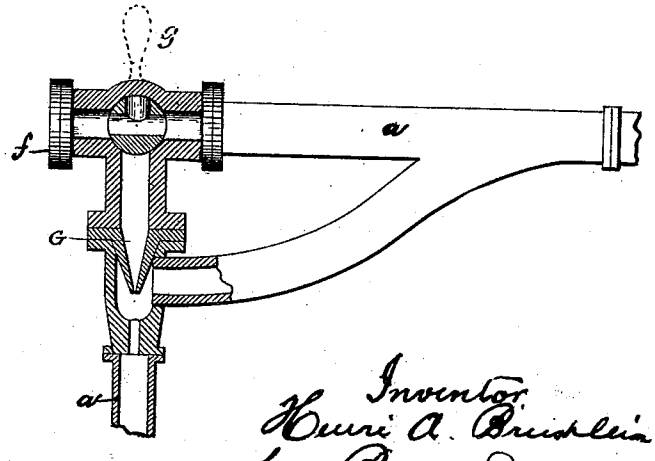


Fig. 2.



Attest:
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R. A. Edmonston.

Inventor
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by Pollock & Mauro
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UNITED STATES PATENT OFFICE.

HENRI AIMÉ BRUSTLEIN, OF UNIEUX, FRANCE.

PROCESS OF AND APPARATUS FOR HARDENING HOLLOW ARTICLES OF STEEL.

SPECIFICATION forming part of Letters Patent No. 449,998, dated April 7, 1891.

Application filed October 23, 1890. Serial No. 369,057. (No model.) Patented in France June 30, 1886, No. 177,119; in Belgium November 17, 1886, No. 75,258, and in England November 18, 1886, No. 15,001.

To all whom it may concern:

Be it known that I, HENRI AIMÉ BRUSTLEIN, of the city of Unieux, France, have invented a Process of and Apparatus for Hardening Shells and other Hollow Articles of Steel, (for which I have obtained Letters Patent in France, for fifteen years, dated June 30, 1886, No. 177,119; in Belgium, for fifteen years, dated November 17, 1886, No. 75,258, and in England, for fourteen years, dated November 18, 1886, No. 15,001,) of which the following is a full, clear, and exact description.

This invention relates to a process of and apparatus for hardening hollow articles of steel, such as explosive shells, whereby the cooling of the interior or a portion of the interior is effected before the hardening of the exterior.

In hardening hollow steel castings by the ordinary means the exterior cannot contract sufficiently while the interior portions of the metal are still hot and expanded, and at a later stage when the interior in turn tends to contract on cooling it is prevented from doing so in consequence of the external layer having become hard and cold, whereby strains are set up in the metal, which frequently cause flaws. For large steel castings it is therefore desirable to be able to cool the interior or a portion thereof before hardening the exterior. In order to effect this internal cooling while the exterior is kept hot, the shell or other hollow article of steel is placed either in a furnace or in a metallic, saline, or other bath at a red heat, with its base or open end upward and its point or face downward, so that the interior is readily accessible. When the shell or article has attained the hardening temperature, the cooling of its interior is effected without removing it from the furnace or bath in the following manner, reference being had to the accompanying drawings, which represent an arrangement of apparatus suitable for carrying out the invention.

Figure 1 is a view of the entire apparatus applied to a hollow projectile, and Fig. 2 an enlarged sectional detail of the three-way cock and ejector.

In the said drawings I have shown a shell C, placed base upward in a bath D, in which it has been heated to the hardening temperature. Into the interior of shell C is introduced the leg A of a siphon, terminating in an annular head or ring *b*, which may be made of metal or any material adapted to withstand the heat to which it is exposed. This head or ring makes a tight joint against the inner wall of the shell, inclosing a chamber *o*, through which water under pressure is kept flowing, the water entering by the small pipe *a* and flowing out by the siphon A B. The size of the chamber *o* depends upon the diameter of the packing-ring or head *b*, and by using a smaller or larger ring the extent of surface exposed to the action of the water may be increased or dimished. When the interior is sufficiently cooled, the siphon is first completely discharged of its contents, in order to avoid the water completely filling the cavity of the shell or other article, after which the pipes may be withdrawn.

The siphon may be emptied either by means of steam or gas under pressure, whereby the water is expelled, or by applying the water under pressure to act as the inducing-jet discharging from the cone of an ejector, as shown at G on the drawings.

In using the ejector the cock *g* is turned in such manner as to put the inlet *f* into communication with the cone of the ejector, and the cock *h* beneath the ejector is opened. The inducing-jet then acts in the well-known manner to empty (through the pipe *a*) the chamber *o* and the siphon.

The packing-ring may be detachable and be left in the shell or other article should it have become fixed therein by the contraction of the metal. The shell or other article can then be removed from the heating-bath D and the external hardening be proceeded with.

Modifications—such as changes in form and relative arrangement of parts—may obviously be made without departing from the spirit of the invention.

I claim—

1. The method of hardening shells or similar hollow articles of steel by placing such article with its closed end downward in a heating furnace or bath, closing the hollow part of the article, forcing a cooling-liquid into and out of the inclosed chamber, and after suffi-

ciently cooling the interior removing the article from the bath and hardening the exterior, substantially as described.

2. The herein-described means for effecting the cooling of the interior of hollow articles of steel while placed in the heating furnace or bath before hardening their exterior, said means consisting in the combination of a ring or annular head for fitting the interior of the article and forming a tight chamber therein, a supply-pipe leading to said head, an exit pipe or siphon leading therefrom, and means, such as an ejector, for emptying the siphon when the cooling operation is completed, substantially as described.

The foregoing specification of my process and apparatus for hardening shells and other hollow articles of steel signed by me this 22d day of October, 1890.

HENRI AIMÉ BRUSTLEIN.

Witnesses:
PHILIP MAURO,
RAPER L. HOGUE.