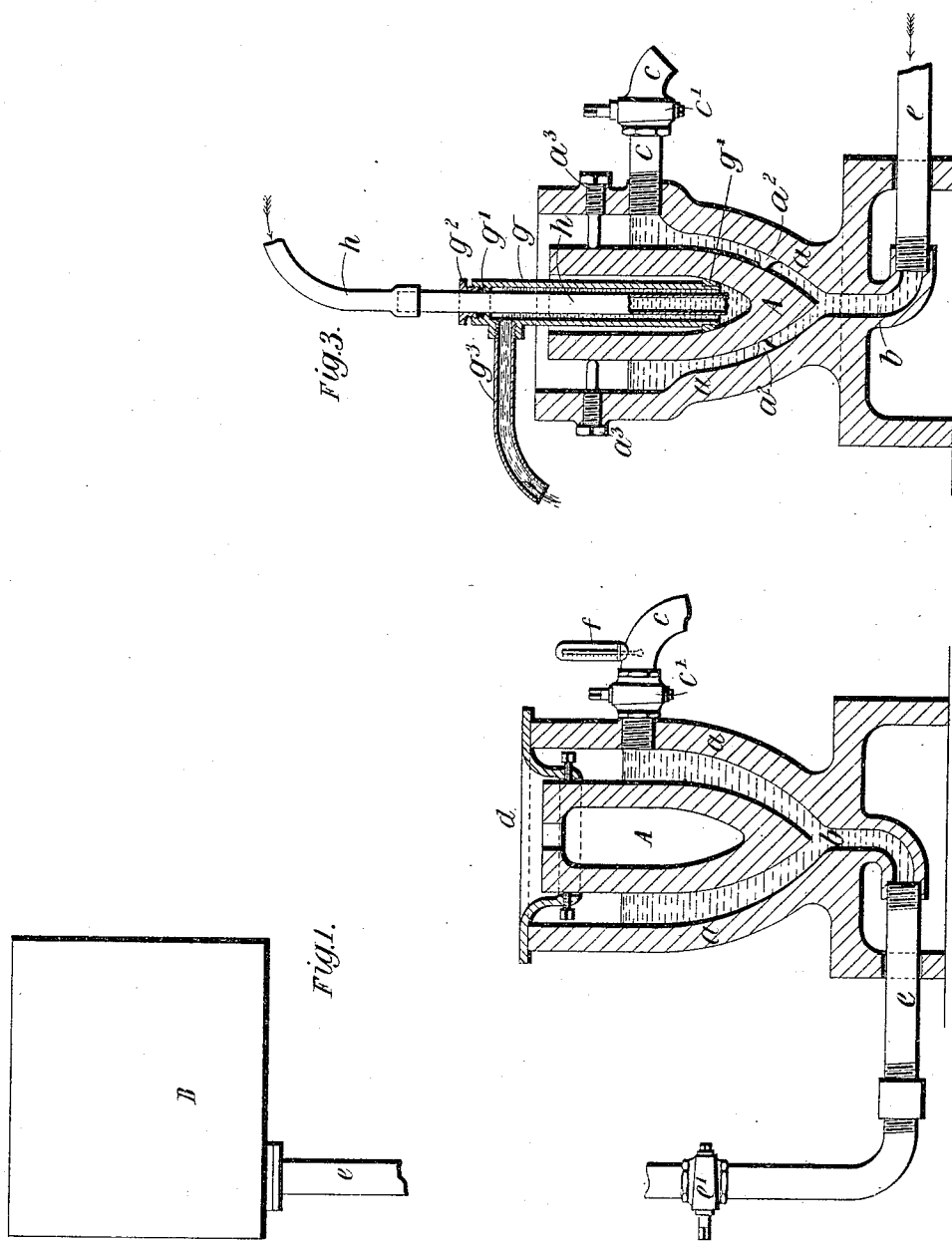


A. ANDERSON.
HARDENING OR TEMPERING PROJECTILES OR SHELLS AND
APPARATUS THEREFOR.

No. 461,698.

Patented Oct. 20, 1891.



Witnesses:
J. A. Ruthford.
Geo. H. Rea.

Inventor:
Alexander Anderson.
By James L. Norris.
Attorney.

(No Model.)

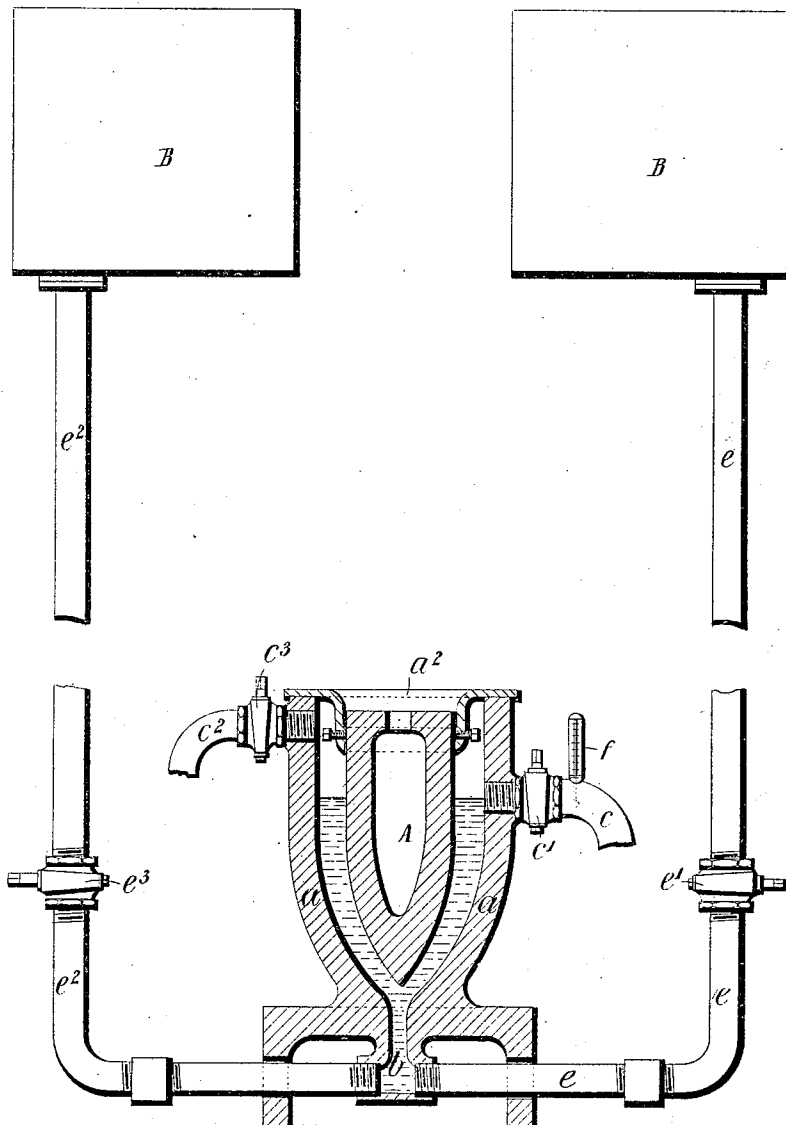
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Fig. 2.



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UNITED STATES PATENT OFFICE.

ALEXANDER ANDERSON, OF WOOLWICH, ENGLAND.

HARDENING OR TEMPERING PROJECTILES OR SHELLS AND APPARATUS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 461,698, dated October 20, 1891.

Application filed July 26, 1890. Serial No. 360,052. (No model.) Patented in England June 28, 1888, No. 9,449.

To all whom it may concern:

Be it known that I, ALEXANDER ANDERSON, engineer, a subject of the Queen of Great Britain, and a resident of Woolwich, England, have invented certain new and useful Improvements Relating to the Hardening or Tempering of Projectiles or Shells and to Apparatus Therefor, (for which I have obtained a patent in Great Britain, No. 9,449, dated June 28, 1888,) of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to the hardening or tempering of projectiles or shells and to apparatus therefor.

My invention consists in the method of and apparatus for hardening or tempering a projectile or shell, as hereinafter described and claimed.

In the accompanying drawings I have shown how my said invention may be conveniently and advantageously carried into practice.

Figure 1 is a side elevation, partly in vertical central section, showing one form of my improved apparatus. Fig. 2 is a similar view showing another form or modification of the said apparatus. Fig. 3 is a longitudinal vertical central section showing a further modification thereof.

Like letters indicate corresponding parts throughout the drawings.

a is a vessel in which is placed the projectile A to be hardened or tempered. This vessel is provided with a central inlet-aperture b at the bottom thereof and with an overflow or outlet pipe c near the top thereof, as shown, or at any other desired level. The interior of this vessel a is made of approximately the same shape or configuration as the exterior of the projectile or shell A , but of somewhat larger diameter than the said projectile or shell, so that while the liquid can flow freely upward in the space around the projectile contact of the said liquid with the surface of the head of the projectile will be effectually insured.

For retaining or supporting the projectile or shell in the vessel a in such a manner as to leave the required space between the said projectile or shell and the interior surface of

the said vessel, I provide a collar or clip d , which is secured in any convenient manner upon the projectile at or near the base thereof and is adapted to rest upon the upper edge of the vessel a .

The inlet b is connected with a tank or reservoir B by a pipe e , provided with a suitable valve or cock e' , so that water or other liquid contained in the said tank can be caused to enter the said vessel at the bottom thereof and flow upward around the projectile or shell until it attains the level of the overflow-pipe c . In this overflow-pipe I provide a regulating valve or cock c' .

In tempering or hardening a projectile with the apparatus above described the said projectile, after being heated to a suitable temperature, is suspended in the vessel a , as shown. The cocks c' and e' are then opened, so that liquid from the tank B may enter the vessel a through the inlet b . The liquid thus admitted will first come in contact with the pointed end of the projectile and will then flow upward around the projectile and will be discharged through the overflow-pipe c . If the valve or cock c' be partially closed or entirely closed at intervals, the liquid will rise above the level of the overflow-pipe c , and consequently the cylindrical portion of the projectile will be surrounded by and in contact with a body of liquid having no circulation at a point above the overflow-pipe. This body of liquid becomes heated to a comparatively high temperature and remains above the cooler flowing liquid by reason of its lower specific gravity. In prior methods of tempering the butt-end of a die is covered by a ring, which protects it from direct contact with the liquid, so that the butt-end of the die retains its heat. This is objectionable, because the metal will be hardened below the ring and kept soft above the lower edge of the ring, and consequently there will be a definite line of demarkation between the hard and soft parts. This is entirely avoided by my invention, as the body of heated water above the overflow-pipe, while it remains above the cooler flowing liquid by reason of its lower specific gravity, does not produce a well-defined line of demarkation, the hot and cool liquid, where in contact, mixing more or less,

so that the temperature gradually increases from the point to the base of the shell. It will be obvious that the ingress and egress of the liquid can be regulated by properly manipulating the inlet and overflow valves or cocks, and the temperature can be maintained uniform, or approximately so.

f is a thermometer connected with the overflow-pipe c , so that the temperature of the liquid may be readily ascertained at any time. This thermometer may, however, be dispensed with, if desired, and the temperature ascertained by placing the hand or finger in the liquid which flows from the pipe c .

In the arrangement illustrated in Fig. 2 the vessel a is provided with a second overflow-pipe c^2 , and the inlet-aperture b is connected by means of a suitable pipe e^2 with a second tank or reservoir B' for containing oil or hot water or other liquid, as well as with the tank B for containing cold water or other liquid. The pipe e^2 is provided with a valve or cock e^3 , so that first oil or hot water or other liquid and then cold water or other liquid can be caused to flow through the said vessel a . The oil or hot water or other liquid is admitted until the projectile or shell A has been partially cooled, and then cold water or other liquid is admitted to complete the hardening or tempering. The second overflow-pipe c^2 is also provided with a regulating valve or cock e^3 . In some instances the water may be admitted first and oil afterward to complete the hardening, this plan being desirable for certain kinds of projectiles.

Fig. 3 illustrates a modification wherein I insert in the chamber or cavity of the projectile or shell A a tube g , the lower end of which is provided with a ring g^* of asbestos or other suitable material, which will fit closely to the surface of the said chamber or cavity a short distance from the inner end thereof. The upper extremity of the tube g is provided with a stuffing-box g' and a gland g^2 . I insert in the tube g a pipe h , passing through the said stuffing-box g' and gland g^2 for admitting water or other liquid, and I provide the said tube g with a suitable overflow or outlet pipe g^3 . The liquid admitted through the tube h comes in contact with the metal at the lower or inner end of the said chamber or cavity and then flows upward in the said tube g and escapes through the said overflow or outlet pipe g^3 , as indicated by the arrows, but is prevented by the ring g^* from coming in contact with those parts of the wall of the projectile which do not require to be hardened. I thus provide for cooling the projectile at the point or head simultaneously on the interior and on the exterior thereof without hardening the body or rear part of the projectile.

To retain the projectile or shell A in its proper position in the vessel a , I provide projections or bosses a^2 upon the interior of the vessel a and set-screws a^3 , which are passed through correspondingly screw-threaded holes

in the upper portion of the said vessel a . In some instances I toughen or refine the material of which the projectile is composed by heating it to a suitable temperature and then cooling it in oil, and then, if desired, repeating this operation previously to the final tempering, as above described.

What I claim is—

1. The herein-described method of hardening or tempering a projectile or shell, consisting in first heating the same and securing it with its point downward in a suitable vessel, then maintaining a flow or circulation of the cooling-liquid in contact with the conoidal portion or head of the projectile or shell from the point toward the cylindrical portion or body thereof through a space or passage which gradually increases in transverse sectional area and at the same time keeping the said cylindrical portion surrounded by a body of liquid having no circulation in contact therewith and allowing this liquid to become heated to a comparatively high temperature, and then regulating the ingress or egress of the liquid, and thus maintaining this temperature uniform or approximately uniform, for the purpose above specified.

2. The herein-described method of hardening or tempering a projectile or shell, consisting in first heating the same and then securing it with its point downward in a suitable vessel, causing the cooling-liquid to flow through the said vessel in contact with the exterior of the projectile or shell from the point toward the cylindrical portion or body thereof through a space or passage which gradually increases in transverse sectional area and permitting the outflow of the liquid at a regulated velocity from the said vessel at a point below the base but above the head of the projectile or shell and at the same time causing a stream of cooling-liquid to flow through the inner end of the chamber or cavity of the projectile or shell while preventing contact of the said liquid with the inner surface of the body or rear part of the said projectile or shell, for the purposes above specified.

3. The herein-described method of hardening or tempering a projectile or shell, consisting in securing the heated projectile or shell with its point downward in a suitable vessel and then maintaining a circulation of the cooling-liquid in contact with the interior and exterior surfaces of the conical or conoidal portion of the said projectile or shell while keeping the said liquid out of contact with the interior surface of its cylindrical portion or body and while the said cylindrical portion or body is surrounded by a body of comparatively hot liquid, for the purposes above specified.

4. An apparatus for hardening or tempering projectiles or shells, comprising a vessel having its interior of approximately the same shape or configuration as but of larger diameter than the exterior of the projectiles or shells to be treated therein and provided

with a clamping device for securing the projectile or shell therein with its point downward, an inlet-pipe at the lower end of the said vessel, and an overflow-pipe a short distance above the conoidal portion thereof, and means, substantially such as above described, for regulating or controlling the outflow of the liquid, for the purposes above specified.

5. The herein-described method of hardening or tempering a projectile or shell, consisting in heating the same and then subjecting it externally to the action of cooling-liquid and at the same time causing a stream of cooling-liquid to flow through the inner end of its chamber or cavity while preventing contact of the said liquid with the inner surface of the body or rear part of the projectile or shell, for the purposes above specified.

6. The combination of a vessel the interior of which is of approximately the same shape or configuration as but of larger diameter than the exterior of the projectiles or shells to be treated therein, pipes for the ingress and egress of oil, and pipes for the ingress and egress of cold water or other liquid, and cocks or valves for regulating the flow of the liquid through the said vessel, the inlet-aperture being at the conical or conoidal end of the said

vessel, substantially as and for the purposes set forth.

7. The combination of a vessel *a*, having a conical or conoidal part corresponding to but of larger diameter than the head of the projectile or shells to be treated therein, an inlet-pipe *b* at the conical or conoidal end of the said vessel, an overflow-pipe *c* at or near the larger end of the said vessel, means, substantially such as above described, for supporting the projectile in the desired position in the said vessel, a tube *g*, provided with a ring of packing and with an overflow-pipe *g*³ and extending into the inner end of the chamber or cavity of the projectile, and a pipe *h* for the admission of cooling-liquid into the inner end of the said chamber or cavity, substantially as and for the purposes set forth.

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

ALEXANDER ANDERSON.

Witnesses:

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