

S. B. DEAN.
Ordnance.

No. 90,244.

Patented May 18, 1869.

Fig. 4.

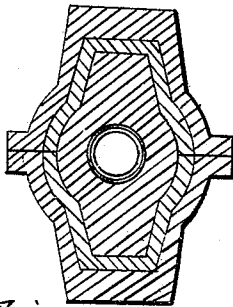


Fig. 5.

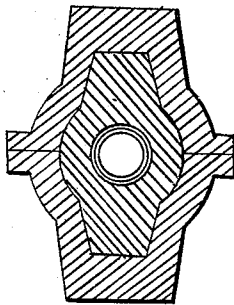


Fig. 1.

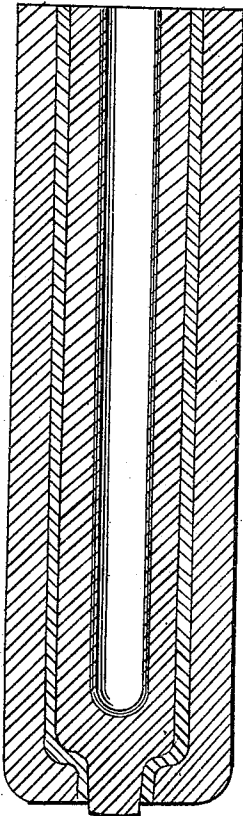


Fig. 2.

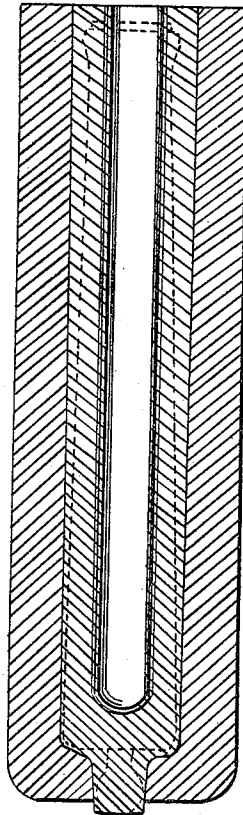
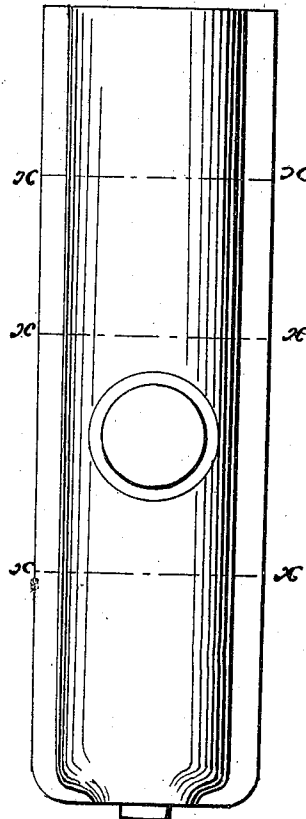


Fig. 3.



WITNESSES
S. B. Thayer
C. J. Farnen Brown

INVENTOR
S. B. Dean
By his Atty
Newly, H. H. H. & H. H.

UNITED STATES PATENT OFFICE.

SAMUEL B. DEAN, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN BRONZE ORDNANCE.

Specification forming part of Letters Patent No. **90,244**, dated May 18, 1869.

To all whom it may concern:

Be it known that I, SAMUEL B. DEAN, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Ordnance; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention, sufficient to enable those skilled in the art to practice it.

It is very desirable, in pieces of bronze ordnance, especially in bronze field-pieces and boat-guns, to produce a degree of hardness, smoothness, and accuracy of bore which has not hitherto been attained by the ordinary process of boring and reaming.

Even in the best bronze guns, as heretofore made, there are always defects in the bore, of a greater or less extent, caused by the porosity of the metal arising from coarse crystallization of the bronze in cooling. Slight cavities are also sometimes increased by the action of the boring-tool in tearing out comparatively loose particles of the metal. These defects are aggravated in the service of the gun by the action of the powder-gases consequent upon explosion of the charges.

Lack of sufficient hardness of the bore of bronze guns gives rise to permanent enlargement of the bore at the seat of the charge, where the gaseous pressure is greatest, and as the bore becomes enlarged the projectiles have increased windage, and often bound and rebound, first forming an indentation or elliptical cavity at the seat of the shot, and then rebounding and striking the bore on the upper side, and sometimes again upon the bottom, before leaving the gun, forming indentations at the points of impact.

By my invention I improve the quality of guns made of bronze in that I harden, condense, and smooth the metal surrounding the bore, rendering the bore of uniform size, and lessening its minor depressions and porosity. I effect this condensation substantially in the following manner: If a bronze gun is to be treated, I bore and ream the rough casting carefully, to secure the best bore possible by such means, of a diameter about one-eighth of an inch less than it is to be when finished. At this time the bore is inspected, and, if found free from such defects as would cause

the rejection of the piece by ordnance officers, it is ready to be prepared for treatment in accordance with my invention. The rough gun-casting is then to be inclosed in such hoops or flask as will constitute a strong casing; but as the exterior of the casting is rough and irregular, as is also the interior of the casing, I propose to leave between the gun-casting and the casing an annular space, to be filled with cement or other suitable cheap material, which will make a hard unyielding filling. It may, however, be preferable to rough-turn the gun-body and to bore out a casing, so as to fit upon the body, which casing may be made in halves, provided with flanges, by which the casing is secured and clasped upon the gun.

The incased gun is then to be placed in a frame, or upon a bed somewhat like a boring-mill for guns; but, instead of using a bar provided with cutters, I fix in the end of the bar a smooth cylindrical plug of hardened steel, of about five-hundredths of an inch larger than the diameter of the reamed hole in the gun.

The plug should be made of two frusta of cones, with their bases connected by a short cylinder.

For condensing the bores of rifled guns the plugs used should have ribs to correspond with the grooves previously made by a rifling-machine.

The bore being well lubricated, the steel plug is made to traverse the bore by a screw, or other suitable mechanical means, till it reaches the bottom of the bore, proper provision being made to allow air and excess of the lubricant to escape through a vent in the plug or at the bottom of the bore.

Instead of forcing a plug or plugs from the muzzle to the bottom of the bore, the condensation may be performed by commencing at the bottom of the bore and drawing the plug outward, in which case the plugs should be so made as to be expansible.

In breech-loading guns the condensation may be effected by forcing the plugs from the breech to the muzzle. After the first plug has been removed from the bore, two or more similar plugs are to be successively forced through, enlarging the bore to the desired size. Care should be taken that each succeeding plug shall have a diameter slightly larger than the one which preceded it, and each plug

should perform a slightly smaller amount of compression than its preceding plug, on account of the increasing hardness and density of the bore, which increases the resistance to be overcome by each successive plug. The bottom of the bore may be treated to produce a similar condition of the metal, either by powerful compression exerted upon the metal or by blows upon a set or former adapted to the shape of the bottom of the bore. During this operation of condensing the metal of the gun a considerable strain may be exerted upon the incasing hoops or flasks, and will be resisted thereby, thus insuring the gun against an injurious expansion of its walls. The gun thus condensed will of course have the densest, hardest metal upon the interior surface, and the density and hardness will rapidly diminish in an outward direction. Whatever tangential strain is created will be within the limits of the elasticity of the metal, since it is rigidly held by the hoops or casing against undue expansion. When this condensation is properly effected it will materially increase the strength and durability of a gun, not only because of the increase of the density of the metal immediately surrounding the bore, but because also of the increased hardness of the bore, hardness being a quality greatly desired and prized in bronze guns, and never heretofore found therein to the desired extent. Its inferiority in hardness to steel has caused the substitution of steel to a considerable extent, particularly for rifled field-guns.

By carefully-conducted experiments I have proved that the hardness and the tensile strength of the metal are increased by the condensation described.

In condensing the material surrounding the bore, I accomplish regularly and beneficially what is irregularly and injuriously effected in detached places during the ordinary extended service of a gun by pressure of the powder-gases and the balloting of the shot.

By condensation of the metal, substantially to the extent and by the means described, I do not impair the strength of the exterior metal, but put it in such relation to the inner condensed part as to secure the greatest combined usefulness in resisting rupture.

The benefit derived from casting and cooling guns upon the plan of General Rodman I impart to bronze guns by my process of finishing the bore, together with the quality of hardness at the surface of the bore and a de-

gree of smoothness hitherto unequaled, all of which add to the efficiency and durability of guns made as I have described over guns simply bored and reamed.

The drawings accompanying show the two methods of incasing a gun previous to its being treated, as before described, to enlarge the bore by condensing the metal of and near the boundaries thereof, Figure 1 being a sectional view of a gun incased by the employment of a filling between its exterior and the interior of the casing, Fig. 2 being a view similar to Fig. 1, showing the gun-casting as turned, and the casing as bored to fit the turning, Fig. 3 showing an outside elevation of the gun casing or flask, which may be made in sections, if desirable, joining at lines *xx*. Fig. 4 is a cross-section of the gun-case, the rough gun-body, and the filling between them, taken in a plane passing through the axial line of the gun-trunnions. Fig. 5 is a view similar to Fig. 4, except that the interior of the case is bored and the exterior of the gun is turned, so that contact of the gun with the case is obtained.

In Fig. 2 the dotted lines show an approximation to the form to which the rough gun-body *a* is to be finished after the condensation of the metal surrounding the bore is completed.

In Figs. 1, 2, 4, and 5 the metal surrounding the bore is more deeply colored or shaded than is the rest of the metal of the gun, and this may possibly be considered as a representation of the condition of the condensed boundary metal of the bore, the lighter-colored metal being that which is not sensibly affected by the condensation.

In treating a rifled gun to produce the desired condition of the metal around the bore, the plain or smooth bore may be first condensed, as before described, then the smooth bore thus improved may be rifled, and the bottoms and sides of the rifle-grooves may be smoothed, hardened, and condensed by forcing through the rifled bore ribbed plugs of hardened steel, suitably formed to produce the condensation required.

I claim—

As a new manufacture, a bronze gun in which the metal immediately surrounding the bore is put in the condition that is produced by the process of condensation set forth.

SAMUEL B. DEAN.

Witnesses:

JOS. W. HOWARD,
EDWARD REED.