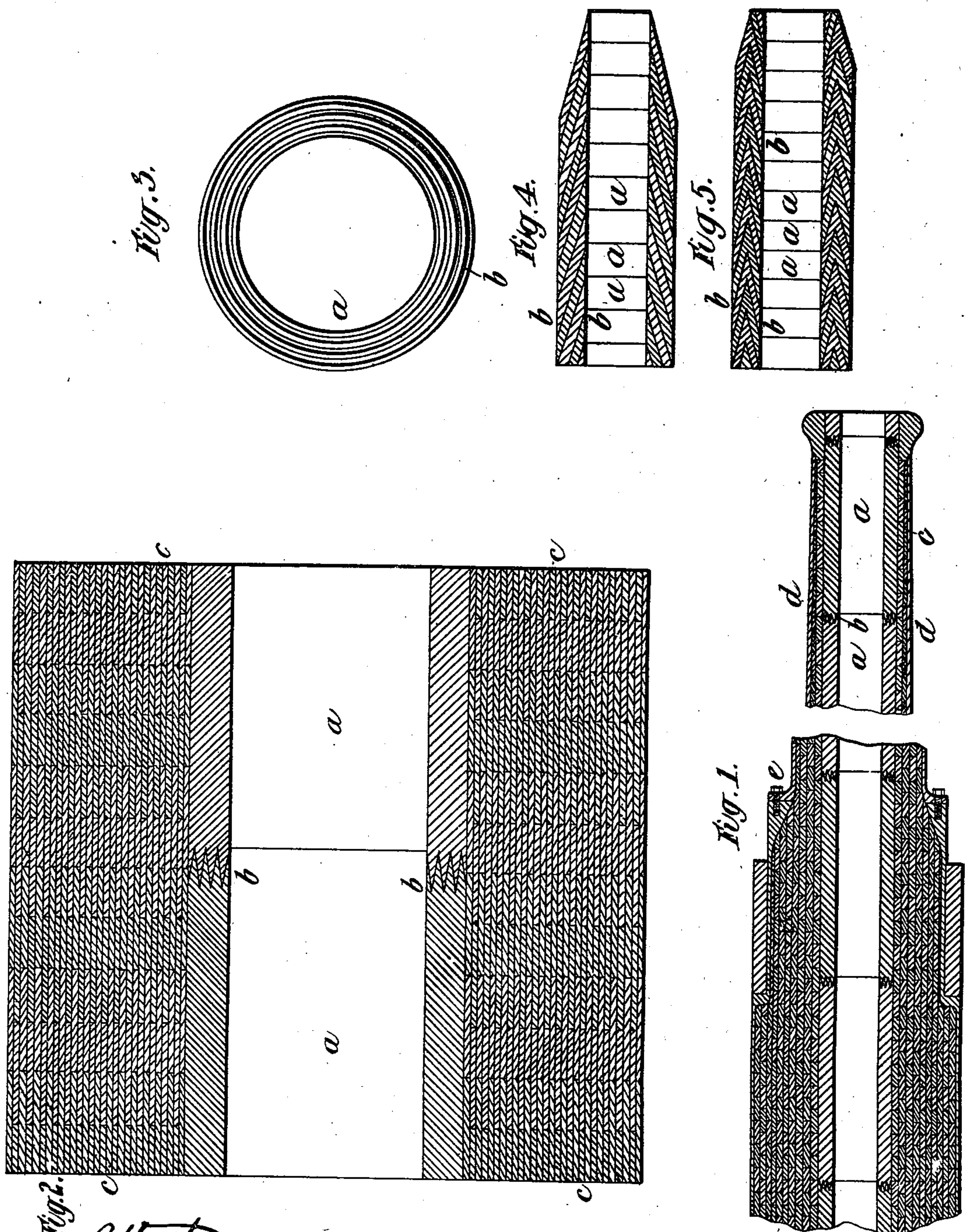


(No Model.)

H. S. MAXIM.
MANUFACTURE OF GUNS.

No. 373,466.

Patented Nov. 22, 1887.



Attest.
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UNITED STATES PATENT OFFICE.

HIRAM STEVENS MAXIM, OF LONDON, ENGLAND.

MANUFACTURE OF GUNS.

SPECIFICATION forming part of Letters Patent No. 373,456, dated November 22, 1887.

Application filed August 22, 1887. Serial No. 247,510. (No model.) Patented in England January 8, 1885, No. 288; in Italy June 6, 1885; in France June 19, 1885, No. 169,647; in Belgium June 20, 1885, No. 69,347; in Germany June 23, 1885, No. 36,329; in Sweden August 17, 1885, No. 882, and in Austria-Hungary August 19, 1885.

To all whom it may concern:

Be it known that I, HIRAM STEVENS MAXIM, mechanical engineer, a citizen of the United States of America, and a resident of London, England, have invented new and useful Improvements in the Manufacture of Guns, (for which I have obtained patents in Great Britain, No. 288, dated January 8, 1885; in France, No. 169,647, dated June 19, 1885; in Belgium, No. 69,347, dated June 20, 1885; in Germany, No. 36,329, dated June 23, 1885; in Austria-Hungary, dated August 19, 1885; in Italy, dated June 6, 1885, and in Sweden, dated August 17, 1885, No. 882,) of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to the manufacture of built-up guns wherein an inner steel tube or lining is employed. Steel tubes for such guns have been heretofore usually manufactured by first forging solid cylinders and then making the same hollow or tubular by boring them in a machine, which is a very tedious and costly operation.

One object of my invention is the construction of these tubes in such a manner that the work of boring the same will be considerably simplified and facilitated. For this purpose I unite by brazing a sufficient number of steel rings or short tubular sections to form a hollow cylinder or tube of the desired length and with a core so nearly of the required diameter that it can be very easily and cheaply finished.

Another object of my invention is to make built-up guns of greater strength in proportion to their weight than those heretofore manufactured. For this purpose I wind or coil upon an inner hub formed of rings or tubular sections, as above described, a band or ribbon of finely-tempered steel, as hereinafter set forth.

My said invention, moreover, comprises various improvements, hereinafter set forth.

In the accompanying drawings, Figure 1 is a vertical longitudinal central section of part of a gun manufactured in accordance with my present invention. Fig. 2 is a longitudinal central section showing a portion of one of my guns drawn to an enlarged scale. Fig. 3 is an end elevation of one of the aforesaid rings

or tubular sections. Figs. 4 and 5 are longitudinal central sections illustrating modifications of my invention.

Like letters indicate corresponding parts in all the figures.

a a indicate the rings or tubular sections, which are united at *b* to form a long hollow cylinder which constitutes the inner tube or lining of the gun.

c is the steel band or ribbon which is wound or coiled upon the said inner tube.

It is well known that when two pieces of metal are united by brazing the strength of the joint will greatly depend upon the extent of area of the brazed surfaces. Therefore to insure the greatest possible strength at the brazed joints I make the ends of the rings *a* in such a manner as to provide a large surface area for brazing. For this purpose the rings *a* are in some cases provided at their ends with annular grooves and projections, as clearly shown at *b* in Figs. 2 and 3, so that when the said rings are properly placed together the projections of one ring will fit the grooves in the adjacent ring, as shown in Fig. 2. In some instances the grooves and projections are radial instead of annular.

In some cases I make the hollow cylinders or tubes by brazing together a sufficient number of conical rings, which are conveniently made of sheet metal stamped to the required shape, and which fit one within another, as shown in Fig. 4; or I make the said hollow cylinders or tubes by brazing together a sufficient number of rings, V-shaped in transverse section, and which fit one within another, as shown in Fig. 5.

It is obvious that the hollow cylinders or tubes made up of rings, as above described, can be used either as the inner tubes or linings of built-up guns or as the outer portions of such guns. For brazing together the said rings or tubular sections I prefer to employ an alloy or compound of the following materials in or about in the proportions stated, viz: seventy parts, by weight, of copper, ten parts, by weight, of silver, and twenty parts, by weight, of spelter; but I sometimes use other suitable materials or alloys for this purpose.

In manufacturing one of my hollow cylin-

ders or tubes the desired number of the rings *a* are placed together and secured by a suitable clamp, the brazing-surfaces having been previously coated or covered with the said material or alloy. The said rings *a* are then heated to a bright-red heat and brazed. After brazing, the hollow cylinder or tube thus formed is allowed to cool until its temperature is sufficiently lowered. It is then plunged into oil to toughen it, and is afterward finished by boring and rifling, if necessary. It is obvious that as the rings *a*, of which the said tube is constructed, have an internal diameter nearly the same as the required bore of the gun, this finishing may be very quickly and inexpensively effected.

By the peculiar formation of the brazed surfaces, as above described, I provide for making the tubes as strong, if not stronger, at the brazed joints than at any other part thereof.

The steel band or ribbon *c* is coiled or wound upon the inner tube in layers in such a manner that the edges of the coils of the successive layers do not coincide with each other—that is to say, the contiguous edges of the coils of one layer coincide with and are covered by the central portions of the coils of the adjacent exterior layer; or the said ribbon is otherwise so wound as to insure the covering of the edges of the coils of one layer by the coils of the adjacent exterior layer. This winding on of the steel ribbon is continued until the gun is of the desired thickness and strength. While winding the outer coils the said ribbon is, as usual, subjected to greater tension than while winding the inner coils.

The coils of the ribbon are sometimes united and the interstices filled up by means of a metal or alloy—such as tin or solder—which melts at a lower temperature than that required to affect the temper of the steel ribbon. In this case the ribbon is preferably tinned previous to its being wound or coiled upon the inner tube, and the soldering is effected either while the ribbon is being wound upon the tube or after it has been wound thereon. By employing this thin steel ribbon, instead of the thick steel tubes usually employed for a similar purpose, I can use higher grades of steel than those heretofore used. I am thus

enabled to impart very great strength to the gun and to reduce its weight as compared with guns of the same strength heretofore constructed.

On the exterior of the coiled steel ribbon I sometimes fit a casing, *d*, of steel or other suitable metal, to more effectually insure the retention of the said ribbon in place and to enable a more highly-finished appearance to be imparted to the gun than would otherwise be practicable. The trunnions are formed integrally with or firmly secured to this casing, and the said casing is made in sections which are firmly united by bolts *e* or otherwise. I sometimes insert strips of india-rubber or other elastic material between the said casing and the coiled steel ribbon.

What I claim is—

1. The improvement in the art of making built-up guns, which consists in forming the hollow cylinders or tubes for the purposes above specified by brazing together a series of rings or annular pieces or short tubular sections, as herein described.

2. A built-up gun formed with a cylinder or tube composed of tubular sections brazed together, the portions of the said sections which are in contact with one another being formed with grooves and projections to increase the area of surface contact, as set forth.

3. A gun composed of an inner metal tube formed of rings or tubular sections, as described, in combination with a metal band or ribbon wound or coiled thereon, as set forth.

4. A gun composed of an inner metal tube formed of rings or tubular sections, as described, in combination with a metal band or ribbon wound or coiled thereon, and an external casing, as set forth.

5. A built-up gun formed of or containing a hollow cylinder or tube composed of conical rings or their equivalents, herein described, brazed together, as set forth.

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

HIRAM STEVENS MAXIM.

Witnesses:

ROBT. M. HOOPER,
DAVID T. S. FULLER.