(No Model.) 2 Sheets—Sheet 1.

B. B. HOTCHKISS.

WIRE WOUND GUN.

No. 269,936. Patented Jan. 2, 1883.

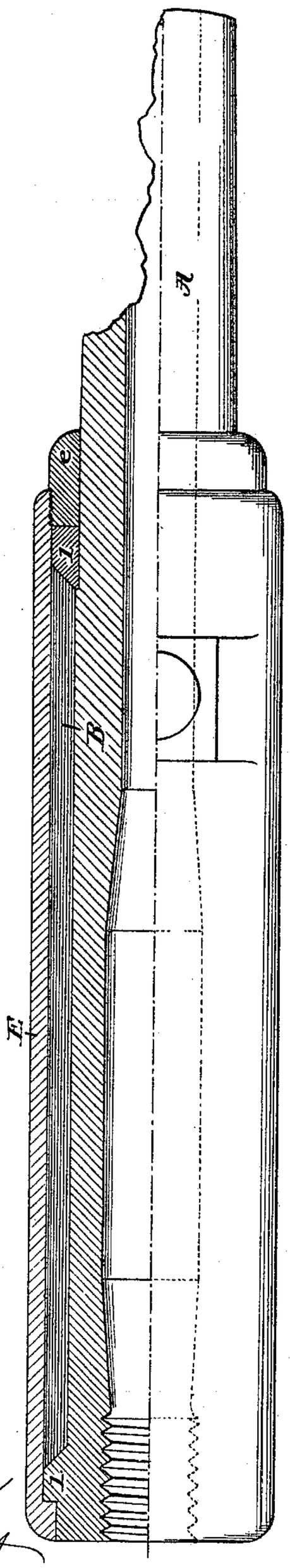

Fig. 2.

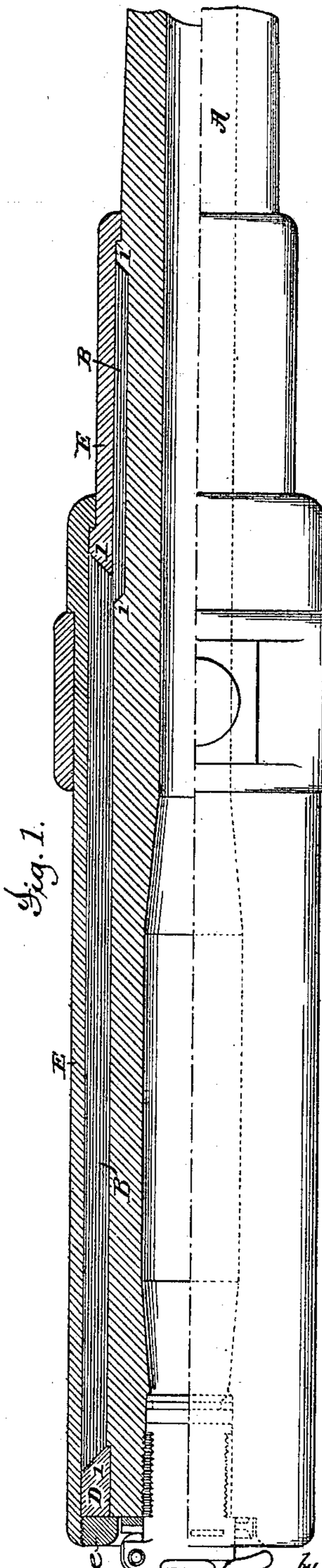

Fig. 1.

Attest;

Geo. H. Graham

Alex. Scott

Inventor;

B. B. Hotchkiss,

by Munson & Philipp

Attys.

(No Model.) 2 Sheets—Sheet 2.

B. B. HOTCHKISS.

WIRE WOUND GUN.

No. 269,936. Patented Jan. 2, 1883.

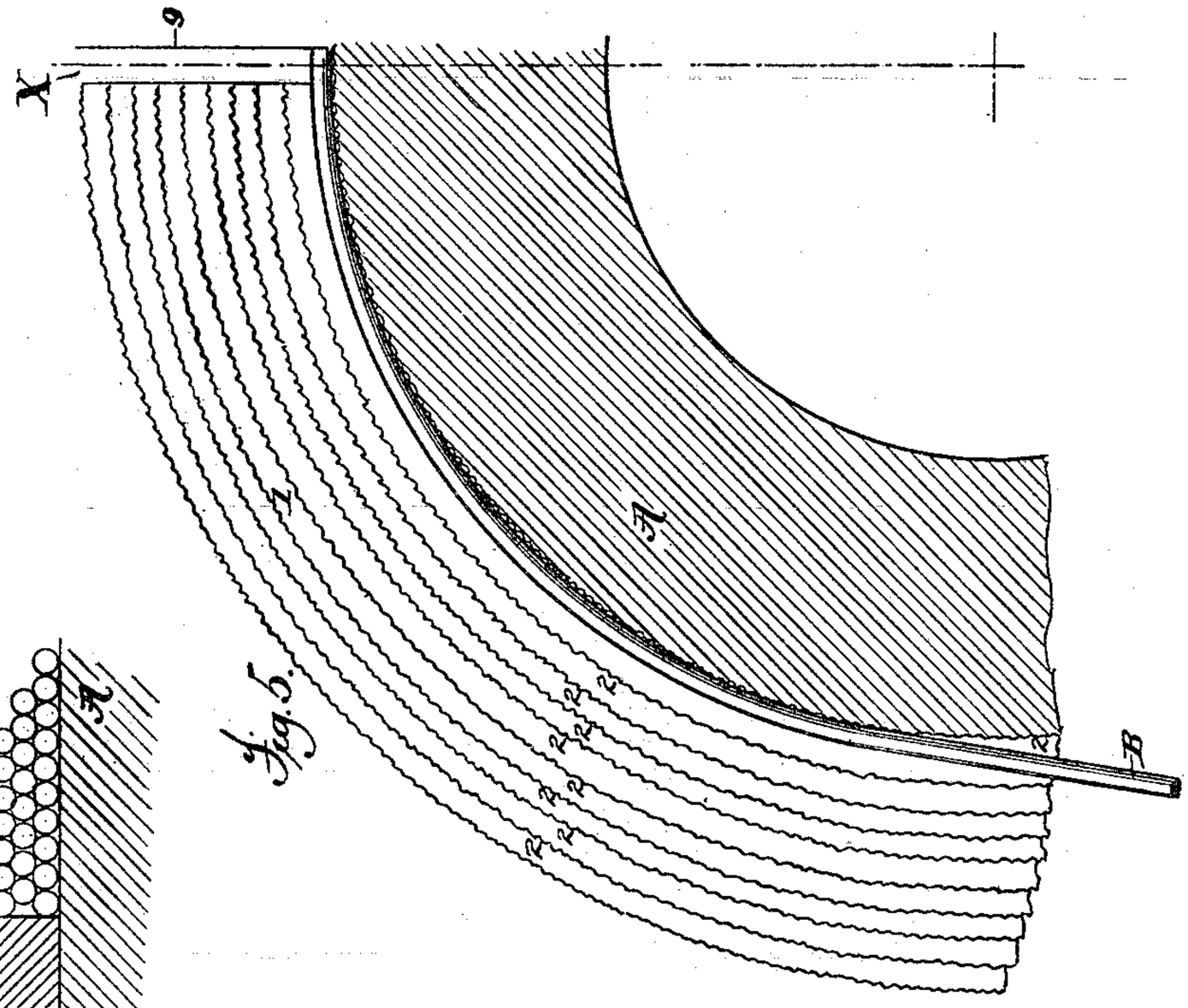

Fig. 5.

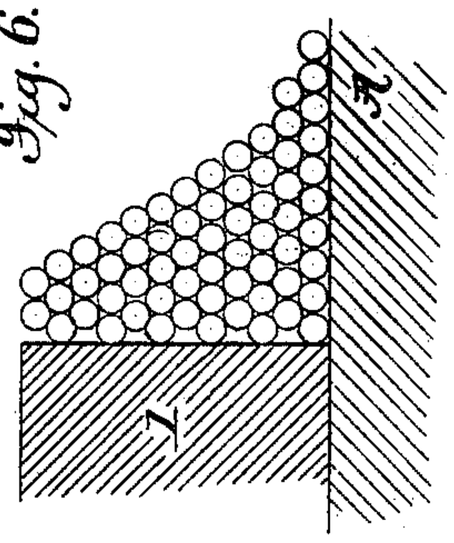

Fig. 6.

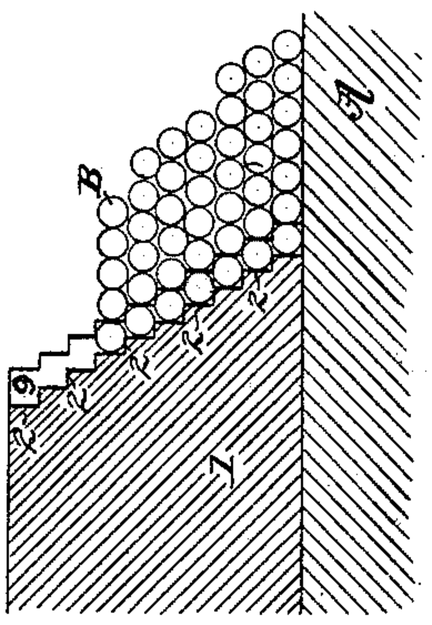

Fig. 7.

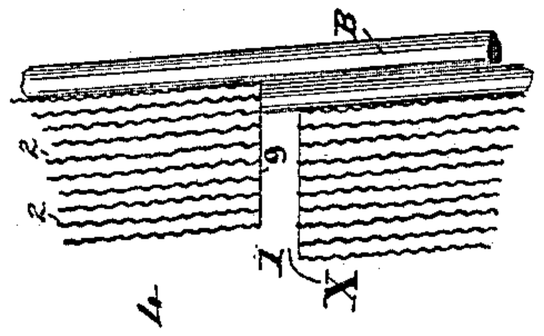

Fig. 4.

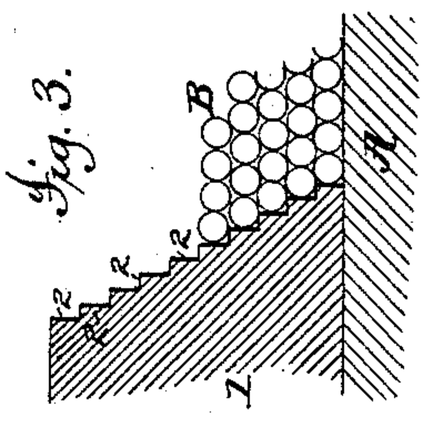

Fig. 3.

Attest;
Geo. K. Graham
Alex. Scott

Inventor,
B. B. Hotchkiss,
by Munson & Philipp
Attys.

UNITED STATES PATENT OFFICE.

BENJAMIN B. HOTCHKISS, OF PARIS, FRANCE.

WIRE-WOUND GUN.

SPECIFICATION forming part of Letters Patent No. 269,936, dated January 2, 1883.

Application filed May 11, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN B. HOTCHKISS, a citizen of the United States, residing in the city of Paris, Republic of France, have invented certain new and useful Improvements in Ordnance, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to that class of ordnance in which the tube or barrel is enveloped by wire coiled about it under determined tension, the object being to impart great strength within small compass, and thus to obtain a powerful but light armament. In such built-up systems it is necessary to support the layers of coils and to secure the wire at the beginning and ending of the wound coil, for the reason that the built-up pile must be retained in close contact to form a solid mass and be secured in a solid mass, in order to attain the purposes of its use, and also that the securement of the ends of each layer of coils should be at least of equal strength to the actual tensile strength of the cross-section of the wire. If it is not so supported and secured, as the wire must be wound under tension, the tendency would be to spread or uncoil, so that the coils would open or the layers press outward, and the very purpose of the use of the tightly-wound mass of wire be destroyed.

One feature of my invention consists in the means for supporting the coils of wire, another in the mode of fastening the ends of each layer of coils, others are found in the structure of parts and their combinations, all of which is specifically set out and claimed.

In the drawings, Figure 1 illustrates by a longitudinal elevation, partly in section, a gun provided with my improvements. Fig. 2 illustrates by a similar view a modification of the same. Fig. 3 is an enlarged longitudinal sectional elevation of the layers of coiled wire. Fig. 4 illustrates the spiral form and roughened surface of the stepped abutment. Fig. 5 illustrates a cross-section through the breech of the gun, and shows in elevation the stepped abutment and first layer of wire. Fig. 6 shows the mode of securing the coil as applied in connection with a vertical faced abutment. Fig. 7 shows the mode of securing the coil as applied in connection with a stepped abutment of spiral form.

A gun involving my improvements consists of a barrel or body, A, constructed of steel or other appropriate material, and provided with the usual bore or chamber or lining-tube, to the breech portion of which barrel, body, or tube are applied re-enforcing-coils of wire B B. The wire, which preferably is round, but may be of any shape of cross-section, is wrapped about the tube or barrel in helical coils, and in any appropriate number of layers suited to the caliber and desired power of the gun. These layers of coiled wire are confined at each end between abutments 1, which may present straight walls, either vertical or inclined, which inclined walls may be stepped to afford separate seats for the end bends of each layer of coils, and which steps may be helical. As several layers of coiled wire are superposed, the bend of each layer, added to the primary one, will seat itself in the space formed between two bends of the next lower layer of coils, it follows that the end bends of one layer of coils (if continued far enough) will project a distance equal to one-half the diameter of the wire composing it laterally beyond the like bend of the next lowermost layer of coiled wire, and hence the face of the abutment is preferably made inclined, to provide a solid seat for such extended end bends of the several layers of coils, and thus not only confine the coils in each layer in snug contact, but cause the superposed layers to sustain each other laterally. The same result may, however, be attained by an abutment having a vertical wall. This result is perfectly attained by the use of wire round in cross-section, and its equivalent will be accomplished where wire of rectangular cross-section is used by so lapping its bends as to break joints.

To adapt the inclined abutments to fit the end bends of each layer of coils, they are provided with steps, 2, (see Fig. 3,) of dimensions suited to the gage of wire used, and to provide for a more perfect fitting of the spiral form such bends have, the said steps 2 are given a helical form, (see Figs. 4, 5, and 7,) whereby the said end bend of each layer of coiled wire is provided with a perfect seat in all directions its spiral form takes. This seat or step 2 may be shaped to suit the sectional form of the wire used, though this is not essential, in consequence of the small size of wire used, which

is preferably from one to two millimeters in diameter. These abutments 1 may be formed by a part of the solid structure of the tube or barrel, as seen at the breech end of the gun shown in Fig. 2, or as shown in connection with the forward mass of coils B in Fig. 1. They may be formed by separate pieces, as the collars D in Fig. 1 and C in Fig. 2, or be provided at the end of a jacket, as in Fig. 1.

To securely fasten the wire at the beginning and at the finish of its coiling, the end portion of the wire, constituting the first and last bends of each coil, is soldered or brazed to the surface against which it is laid. Practically soldering to the extent of two or three inches is sufficient; but it may be continued to the extent of one complete bend or spiral of the wire, or farther, if desired. This unites the wire homogeneously to the body of the gun at the beginning and the ending of each layer of coiled wire, and as it is done while the wire is under tension it therefore retains the layer of coiled wire in its tightly-wound condition.

To prevent the end bends of each layer of coils from slipping, the surfaces of the steps 2 of the abutments 1 are roughened (see Figs. 3 to 7) to present a surface similar to that of a file or burring, upon which the wire under tension will rest and be frictionally held. The wire should be of high steel, but may be in some instances of low steel, and even iron or other metal. As each layer of coiled wire begins at the abutment toward one end—as the breech—and finishes at the other—as the muzzle—it may be explained that where such abutments have vertical faces, as in Fig. 6, the starting end of the wire which is to be soldered or brazed may either be of full size, as shown by Figs. 4 and 5, in which case the space between the end of the wire and the wall of the abutment may be filled with solder, or a wedge-shaped piece of metal may be used, which latter can of course be provided by beveling off the end of the wire, the same thing resulting, though in a reverse direction, at the opposite or finishing end of each layer of coiled wire. The starting of the next layer will be made in the same way, but a distance rearward of the first, and so on, the finishing end of each added layer extending beyond that of the preceding layer, thus bringing the starting and finishing of each layer at different points circumferentially.

With a vertical-faced abutment the end bends of each alternate layer of coils will, since the wire must rest in the space between two wires of the next lower layer of coils, even though the extreme end of the wire is beveled and secured to the face of the abutment in part of its circuit, stand away from the abutment by a distance equal to one-half the diameter of the wire, as shown in Fig. 6. This space, however, is practically of no consequence, owing to the small size of wire used, but may be filled with solder, if desired; but this beveling may be continued far enough to entirely fill the space. Such space is compensated for in the stepped form of abutments shown in Figs. 4, 5, 7, in connection with which the layers of coils are laid and fastened, as last described.

In obtaining the spiral form of the stepped abutment an inclined slot, X, is cut for the insertion of a cutting-tool, which tool, in completing one circuit, finishes at a distance in advance of its starting cut, (see Fig. 7,) and thus cuts each step 2 in helical form. This gives each step a head, as 9, against which the full-sized end of the wire of each coiled layer may start, as in Figs. 4 and 5, and a similar head for it to finish against, as will be readily understood, which helical form also affords a perfect seat for each end bend suited to its spiral form.

When the space for the reception of the layers of coiled wire is filled and the coils are secured by brazing or soldering, as described, the coiled wire is protected by the use of an external jacket, as E, and as my improvement contemplates winding the wire in sections, commencing toward the muzzle end, as in Fig. 1, where two sections of re-enforcing wire coils are shown, it also includes providing each such section of wire coils with a jacket, as in said figure.

In producing the structure of Fig. 1 the foremost section of wire coil is wound and fastened in place, and is then covered by its jacket, which is long enough to mainly cover its section or mass of coiled wire, the surface of which is even with the gun body, barrel, or tube, and hence will form in part the seat for a portion of the next rearward section or mass of coiled wire. The next section toward the breech is treated in like manner, and so on, according to the number of sections used, each jacket hooking at its forward end onto the body of the gun or a jacket. Each of these sections of re-enforcing coils of wire, except the last or outermost, may be wholly or partially covered by a jacket—that is, they may extend more or less toward the breech—so that each section of coiled wire added toward the breech may partially rest upon that which extends beyond it muzzleward, such jacket thus mainly covering and strengthening its section of coiled wire. The structure thus made has a number of sections or masses of coiled wire, each rearward section or mass overlapping the next forward section or mass far enough to practically form a gun strengthened by a continuous mass of coiled wire.

Where two or more sections or masses of coiled wire are used, as in Fig. 1, and the last or outermost jacket is in place, it will extend beyond the rear end of the gun-body and be secured by a screw-ring, *e*, or a screw-plug, if the gun is to be a muzzle-loader, inserted in the threaded rear end of said jacket. This ring, properly tightened, will draw the jackets snugly into place.

Where only one mass or section of wound wire is used, as in Fig. 2, the above-described fastening may be used; or the shoulder on the gun-body against which the jacket abuts may

be at the rear, in which case the fastening screw-ring *e* will be slipped over the muzzle and enter the threaded front end of the jacket E. This mode of holding the jackets E secures all the parts together and gives a continuous longitudinal tension throughout the whole structure, thus imparting to it great longitudinal strength.

In the structures shown the trunnions are, in the case of Fig. 2, cast upon the jacket, and in Fig. 1 applied thereto by means of a carrying-sleeve, from which construction it will be observed that the strain resulting from the discharge is more evenly distributed than in ordinary constructions of built-up guns.

In order to attain the greatest longitudinal strength, I make the outer jacket, E, which protects the coils of wrapped wire, of bronze or a metal that will elongate more rapidly by heat than does steel, of which the wire is preferably made, as may be the barrel of the gun or its lining-tube.

The heat created by the combustion of the powder-charge, being greatest at the central or interior portion of the gun and least at the exterior, would, if all the parts were of the same metal, cause an unequal expansion and consequent elongation; but as the jacket of bronze or similar metal is more readily expanded than steel it follows in this improved construction that the heat induced by the firing of the gun will cause the inner parts of steel and the outer part of bronze to elongate in about the same ratio, and consequently not cause any disproportionate strain.

It has been stated that the abutments supporting the coiled wire have roughened surfaces to prevent slip. This is contemplated whether these abutments are plane surfaces, as in Figs. 1, 2, and 6, or stepped surfaces, as in Figs. 3, 4, 5, and whether vertical or inclined, and in order to prevent, by means of frictional surfaces, any slip of the wire throughout all of its coilings, I make the wire with roughened exterior and the whole seating-surface for it upon the gun-body with a like roughening, so that all of its coils have a frictional seat.

What I claim is—

1. A gun strengthened by layers of coiled wire wrapped about its body between abutments under tension, the ends of each layer of the coiled wire or its first and last bends being secured in place by means of soldering or brazing, substantially as described.

2. A gun strengthened by layers of coiled wire wrapped about its body under tension, and having the surface or surfaces with which the extreme ends or bends of each layer of coiled wire have contact roughened to prevent slipping, substantially as described.

3. A gun strengthened by layers of coiled wire wrapped about its body under tension, and having the surface or surfaces with which the extreme ends or bends of each layer of coiled wire have contact roughened to prevent slipping, and said ends or bends secured by brazing or soldering, substantially as described.

4. In a gun strengthened by layers of coiled wire wrapped about it under tension, stepped confining-abutments to support the extreme or end bends of each layer of coiled wire, substantially as described.

5. In a gun strengthened by layers of coiled wire wrapped about its body under tension, confining-abutments provided with stepped supports disposed in helical form to adapt them to receive the extreme or end bends of each layer of coiled wire, substantially as described.

6. In a gun strengthened by layers of coiled wire wrapped about its body under tension, confining abutments having stepped supports with roughened surfaces for the support of the end bends of each layer, substantially as described.

7. In a gun strengthened by layers of coiled wire wrapped about its body under tension, a roughened surface upon the gun-body with which the coiled wire has contact, substantially as described.

8. A gun wound with wire in sections from the muzzle toward the breech, each rearward section overlapping the next forward section, substantially as described.

9. In a gun strengthened by layers of coiled wire wrapped about its body under tension, a wire-receiving supporting-area having roughened surface and a re-enforcing wire with roughened exterior, whereby all slip of the coils is prevented by frictional resistance, substantially as described.

10. In a gun strengthened by layers of coiled wire wrapped about its body under tension, the combination, with the body of the gun, composed of steel or iron, and its coiled-wire wrapping, of an outer jacket composed of bronze or similar metal, whereby a more uniform elongation is provided throughout the gun, substantially as described.

11. The combination, with the interior body or tube of a gun and strengthening-coils of wire, of an external jacket constructed in sections, one hooked over another, said jacket being fastened to the gun-body at one end by a hook and at the other by a screw, substantially as described.

12. In a gun strengthened by layers of coiled wire wrapped about its body under tension, a number of sections or masses of coiled wire arranged upon the body in succession rearward from the muzzle and toward the breech, substantially as described.

13. In a gun strengthened by layers of coiled wire wrapped about its body under tension, a number of sections or masses of coiled wire arranged upon the body in succession rearward from the muzzle toward the breech, each of which sections or masses of coiled wire is mainly covered by a jacket, part of which jacket affords an abutment for the next rearward section of coiled wire, substantially as described.

14. In a gun strengthened by layers of coiled

wire wrapped about its body under tension, a number of sections or masses of coiled wire arranged upon the body in succession rearward from the muzzle toward the breech, each of which sections or masses is mainly covered by an external jacket or jackets, which jackets are confined to the gun-body by a shoulder and a fastening-screw, substantially as described.

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

B. B. HOTCHKISS.

Witnesses:
ROBT. M. HOOPER,
JOSEPH S. J. EATON.