(No Model.) 2 Sheets—Sheet 1.

T. L. WILLSON.

CANNON.

No. 475,071. Patented May 17, 1892.

FIG. 1.

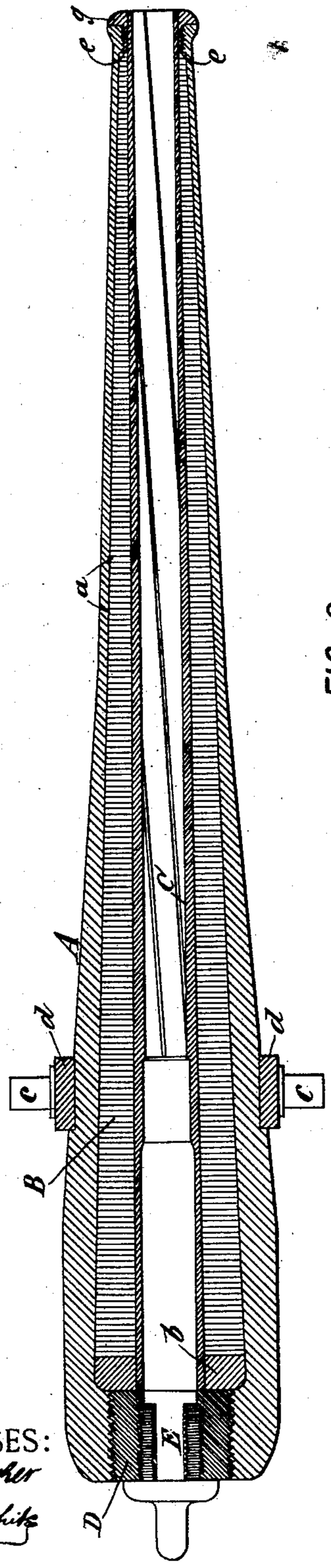
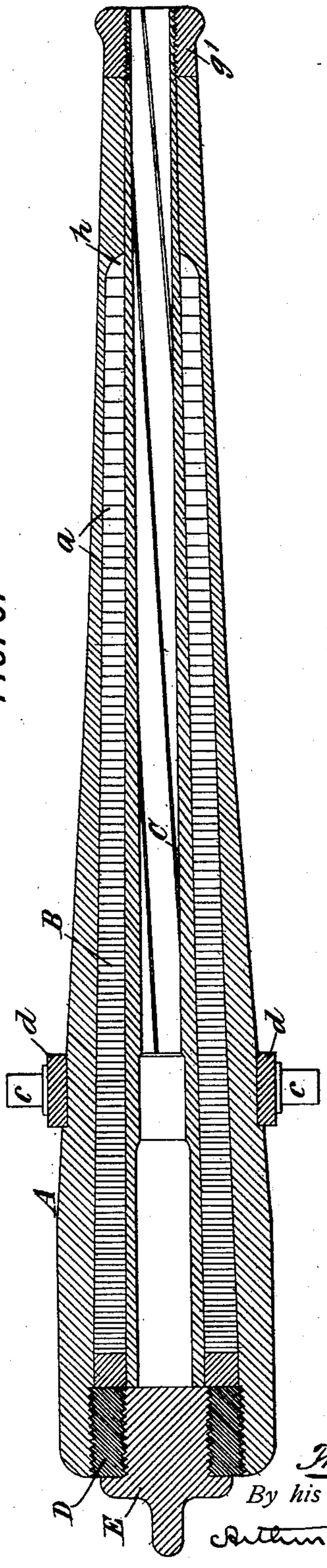


FIG. 3.



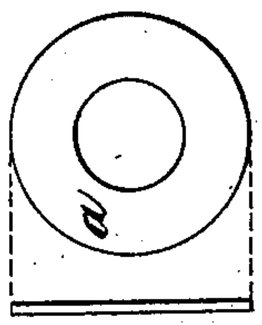


FIG. 2.

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(No Model.) 2 Sheets—Sheet 2.

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FIG. 4.

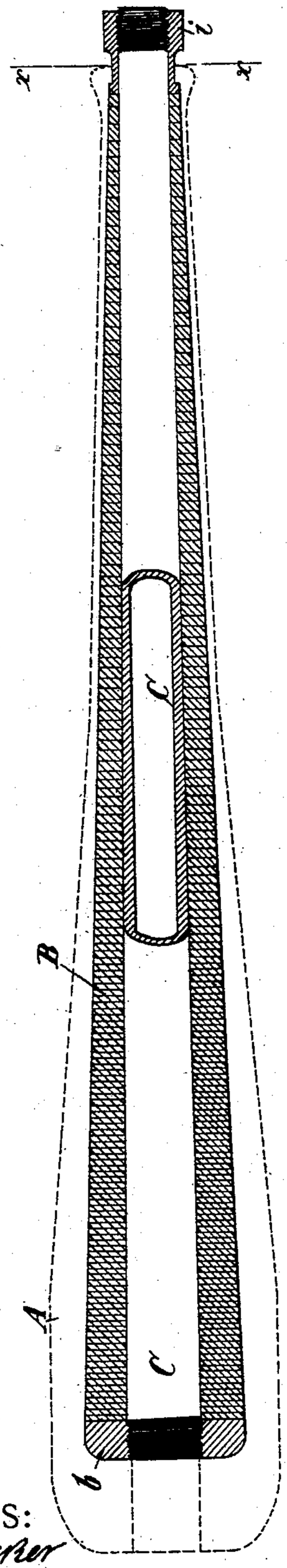
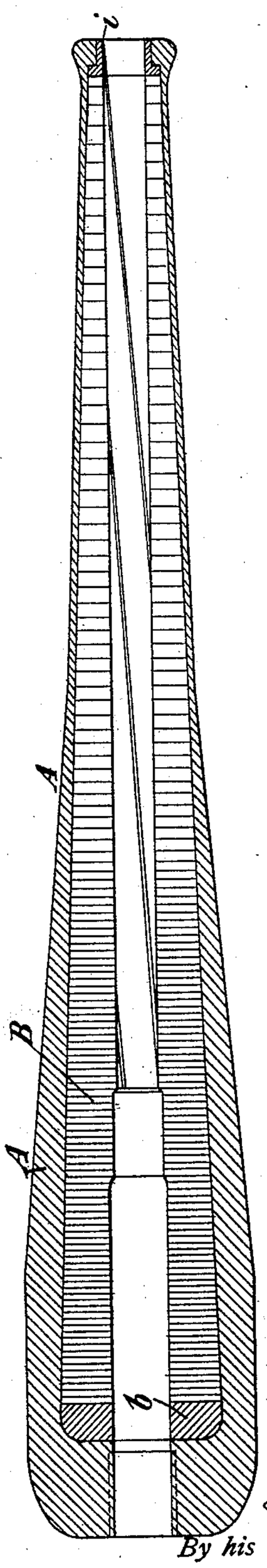


FIG. 5.



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UNITED STATES PATENT OFFICE.

THOMAS L. WILLSON, OF BROOKLYN, NEW YORK.

CANNON.

SPECIFICATION forming part of Letters Patent No. 475,071, dated May 17, 1892.

Application filed May 5, 1891. Serial No. 391,625. (No model.)

To all whom it may concern:

Be it known that I, THOMAS L. WILLSON, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Cannons, of which the following is a specification.

This invention relates to the construction of cannons or heavy guns or ordnance. Its object is to provide an improved and cheapened construction of composite or built-up gun in order to produce guns of superior resistance to bursting strain and to admit of the manufacture of heavy guns in any well-equipped machine-shop.

According to my invention I construct the gun with a body portion built up of disks or lamina in planes perpendicular to the axis of the gun and inclosed within and held tightly together by an exterior sheath or tubular jacket. The laminated body of the gun is designed to resist the bursting strain, while the function of the jacket is to hold the lamina pressed firmly together and resist longitudinal strains and strains of flexure. Within the laminated body is arranged by preference a tubular lining forced tightly to place and within which the rifling is formed. This may, however, be omitted and the rifling formed directly against the bore in the laminated body.

Figure 1 of the accompanying drawings is a longitudinal mid-section of a heavy gun constructed according to my invention. Fig. 2 is an edge and face view of one of the disks or lamina of which the body of the gun is built up. Fig. 3 is a longitudinal section showing a modified construction of gun. Fig. 4 is a longitudinal section showing a modified method of constructing the gun. Fig. 5 is a longitudinal section showing a further modification of the gun.

Referring to Fig. 1, let A designate the outer jacket, which may be assumed to be of cast iron or steel; B, the laminated body portion of the gun, built up of a succession of disks juxtaposed and forced together, one of which is shown separately in Fig. 2, and C the tubular lining of the gun.

D is a fixed breech-piece, and E is any usual removable breech-block, by removing which the gun may be loaded.

In the construction of this gun I proceed, preferably, in the following manner: Disks *a a*, similar to that shown in Fig. 2, are cut, forged, cast, or otherwise formed from any suitable metal, preferably being forged or cast from steel plate of the proper quality, and are surfaced off to fit accurately together face to face. All are bored to the same size, and they are threaded upon a mandrel. The disks are exteriorly of different sizes, so that when placed upon the mandrel they constitute a tapering mass, and preferably a thicker disk *b* is placed at the breech end. The disks are forced intimately together either by hydraulic pressure or by a screw or otherwise, after which the mass of disks is placed in a suitable lathe and turned down exteriorly to a suitable taper, preferably to a true cone. The laminated body B having thus been prepared, it is placed in a mold and the shell or jacket A is cast around it. This shell is preferably made of the finest cast-iron; but a casting of steel, bronze, or other metal may be employed. This casting in cooling shrinks tightly around the body portion B, and in contracting longitudinally draws the disks of which the body portion is composed into even more intimate contact than before. The molten metal forms a union with the exterior surface of the disks after the manner of a weld, as is well understood in the art. The exterior shell A may then be turned off in order to remove any irregularities due to the casting. The diameter of the body B at each point in its length being known, the shell may be turned to any desired thickness by turning it down to the corresponding external diameter. The concentricity of the shell is assured by it being thus turned from the same centers as the body. The mandrel being now no longer needed is unscrewed and withdrawn. The body portion B is then bored out to a larger bore and preferably to a gradual taper, and the lining-tube C, of fine steel, is turned exteriorly to the same taper and to the same or very slightly larger diameter, and this tube is then forced into the body under suitable pressure, so that it shall be compressed exteriorly to an extent at least equal to the bursting strain to which it shall be subjected less its own capacity for resisting such strain. The lining-tube C is bored

out to the proper diameter and is rifled in the usual manner, these operations being performed either before or after it is forced into the body, preferably after.

The breech end of the cast shell A is bored out and screw-threaded and a breech-block D screwed in tightly against the disk *b* and also preferably against the breech end of the lining-tube. The usual removable breech-block E is then applied, having segmental screw-threads or other means for locking it in place engaging reciprocal threads or provisions in the fixed breech-block D.

In order to mount the gun, it is provided with trunnions *c c*, formed on a ring *d*, which is preferably shrunk on a suitably-turned portion of the exterior of the shell A. In order to form a neat finish at the muzzle, where the cast metal projects at *e* beyond the end of the body portion in order to cause it to exert in shrinking a longitudinal contraction against the body portion, this projecting portion *e* may be turned out and screw-threaded and a nipple *g* screwed into it. The lining-tube C preferably projects through this nipple, as shown. A gun thus constructed has its body portion B, which alone is relied upon for resisting the bursting strain, made of juxtaposed disks or plates of the finest rolled steel, which has the utmost tensile strength, and the plates of which are so thin as to admit of the most perfect inspection and testing of each piece before incorporating it into the gun. This body portion, therefore, for a given diameter affords the highest possible resistance to a bursting strain. The sole function of the outer shell or jacket A is to hold the disks of the body portion together in proper alignment, resisting both flexure and the longitudinal strain due to the rearward pressure against the breech-block in firing. The rearward strain being exerted against a much less area than the bursting strain requires much less strength to resist it, so that the outer jacket, even if made of only moderate thickness, affords ample strength for this purpose. By reason of the tightness with which the jacket is shrunk or applied around the body portion it embraces each of the lamina thereof with a strongly-frictional grasp probably sufficient of itself to resist and prevent any endwise displacement of the laminated body due to the strain in firing. Flaws in the casting of this outer jacket are not likely to occur, because its thickness is nowhere great, and if they do occur they can be readily discovered and only a very extended and improbable flaw would seriously impair the strength of the gun.

The lining-tube has the same function as the lining-tube of segmental guns heretofore made—namely, to prevent the entrance of powder or gases between the segments of the body portion and to form an uninterrupted surface for receiving the rifling.

Fig. 3 shows a modified construction wherein the outer jacket A instead of being cast around the body is formed of forged steel and is accurately bored out beforehand, and the disks constituting the body are forced into it either singly or together. The body portion is first mounted on a mandrel and turned down upon the exterior to precisely the same outline as the interior of the jacket, after which the body portion as a whole is or the individual disks thereof in succession are forced into the jacket under hydraulic or screw pressure. The fixed breech-piece D is then screwed in, holding the disks of the body portion firmly in place within the jacket. Subsequently the body portion is bored out and the lining-tube is forced in, a cap *g'* being screwed on its projecting end at the muzzle.

In Fig. 3 I have shown the body portion B as extending part way only to the muzzle, terminating at *h* some distance back from the muzzle. This may be done in order to avoid the expense of cutting so many disks at the muzzle portion of the gun, where the bursting strain is much less than toward the breech and where the strength of the comparatively inferior metal of the jacket is ample for resisting the strain. I have also shown in this figure the construction of the body of disks of varying thickness, being thinnest at the breech portion of the gun and becoming thicker toward the muzzle, whereby the finest steel is secured for the breech portion where the greatest bursting strain occurs, and steel which is somewhat less perfect, by reason of being rolled in thicker plates, is employed toward the muzzle.

Fig. 4 shows still another method of making the gun. Instead of assembling the disks of the body upon a mandrel, they are assembled upon the lining-tube C. This tube is turned exteriorly to a uniform and very gradual taper—that is, to the same taper that it is eventually to have in the gun—and the disks are bored out accurately to the same taper and are forced on from the small end of the sleeve toward the large end, being seated thereon against the disk *b*, which is screwed upon the sleeve. The disks may be thus forced on by hydraulic or screw pressure one by one until all are applied, whereby by overcoming their friction against the tube individually they may be forced on much tighter than if the tube were forced into them subsequently. The final disk is held in place by screwing on a nut *i*. The disks are turned down exteriorly either before or after applying them on the tube. The whole is then placed in a mold and the outer jacket A is cast around it in the manner first described, as shown in dotted lines, or it may be made of forged steel and turned out, as described with reference to Fig. 3, and the body portion forced into it. In this figure I have shown the omission of the breech-piece D, the cast-metal jacket being carried around the breech and inwardly as far as the bore or sufficiently far for engagement with the removable breech-block. When the gun is

otherwise completed, the tube C and its nut *i* may be cut off at the muzzle on the line *x x*.

The use of the lining-tube C is not strictly essential to my invention, and may be omitted, as shown in Fig. 5. In this case the gun may be constructed by the same method as described with reference to Fig. 1, with the exception of the insertion of the tube C. After the mandrel is withdrawn the body B should be accurately rebored and then rifled. In case this construction is adopted the disks should be very accurately surfaced, so as to leave no interstices between them, into which powder or gases might find their way during the firing of the gun.

The disks or laminæ used in the construction of my improved cannon may be made from any cast or wrought metal having suitable qualities—as, for example, disks cast from aluminum or other bronzes of great strength or from cast-steel may be used.

I am aware that several constructions of so-called "wire-wound guns" have been devised, in all of which layers of wire or ribbon have been wound around a lining tube or section in order to afford the requisite resistance to bursting strains. The strength of a gun thus constructed is necessarily dependent upon the wire or ribbon being wound under heavy tension, in order that when at rest the wound body portion may exert a compressive stress upon the tube sufficient to reinforce it against the expansive stress to which it will be subjected during the firing of the gun. The winding of a wire or ribbon while it is held extended under the heavy pressure requisite to accomplish this result is an operation of great difficulty, requiring special machinery, and even with the utmost care it is impossible to wind on the successive convolutions under a tension sufficiently uniform to secure an equal distribution of the strain. For these reasons wire-wound guns are necessarily expensive and difficult to construct, although when properly constructed they give admirable results. My invention avoids the difficulties incident to their manufacture and produces a gun of equal or even greater strength. By the subdivision of the metal of the body into disks the complete inspection and testing of the metal is rendered possible, while the operations required are such as can be performed in any machine-shop adapted for handling heavy work, and by exact boring and finishing the parts may be put together so as to afford an equal distribution of the strains. I also avoid the loss of strength due to the numerous interstices that are necessarily left in the wound body portion of a wire-wound gun.

I make no claim in this application to the herein-described method of making the gun or cannon.

I claim as my invention the following-defined novel features or combinations, substantially as hereinbefore specified, namely:

1. A cannon comprising a body portion built up of juxtaposed disks, and a shell or jacket inclosing and closely embracing the individual disks of such body portion and receiving the reaction of the breech thereof, whereby it resists longitudinal strains and holds the disks together longitudinally.

2. A cannon comprising a body portion built up of juxtaposed disks, and a shell or jacket shrunk upon such body portion, whereby by its contraction it forces the disks intimately together in longitudinal direction.

3. A cannon comprising a body portion built up of disks, a shell or jacket inclosing such body portion, closely embracing the individual disks thereof and holding the disks together longitudinally, and a lining-tube within said body portion.

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

THOMAS L. WILLSON.

Witnesses:
GEORGE H. FRASER,
CHARLES K. FRASER.