

B. B. Hotchkiss.

Rifling-Ordnance.

N<sup>o</sup> 73447

Patented Jan. 21, 1868.

Fig. 1.

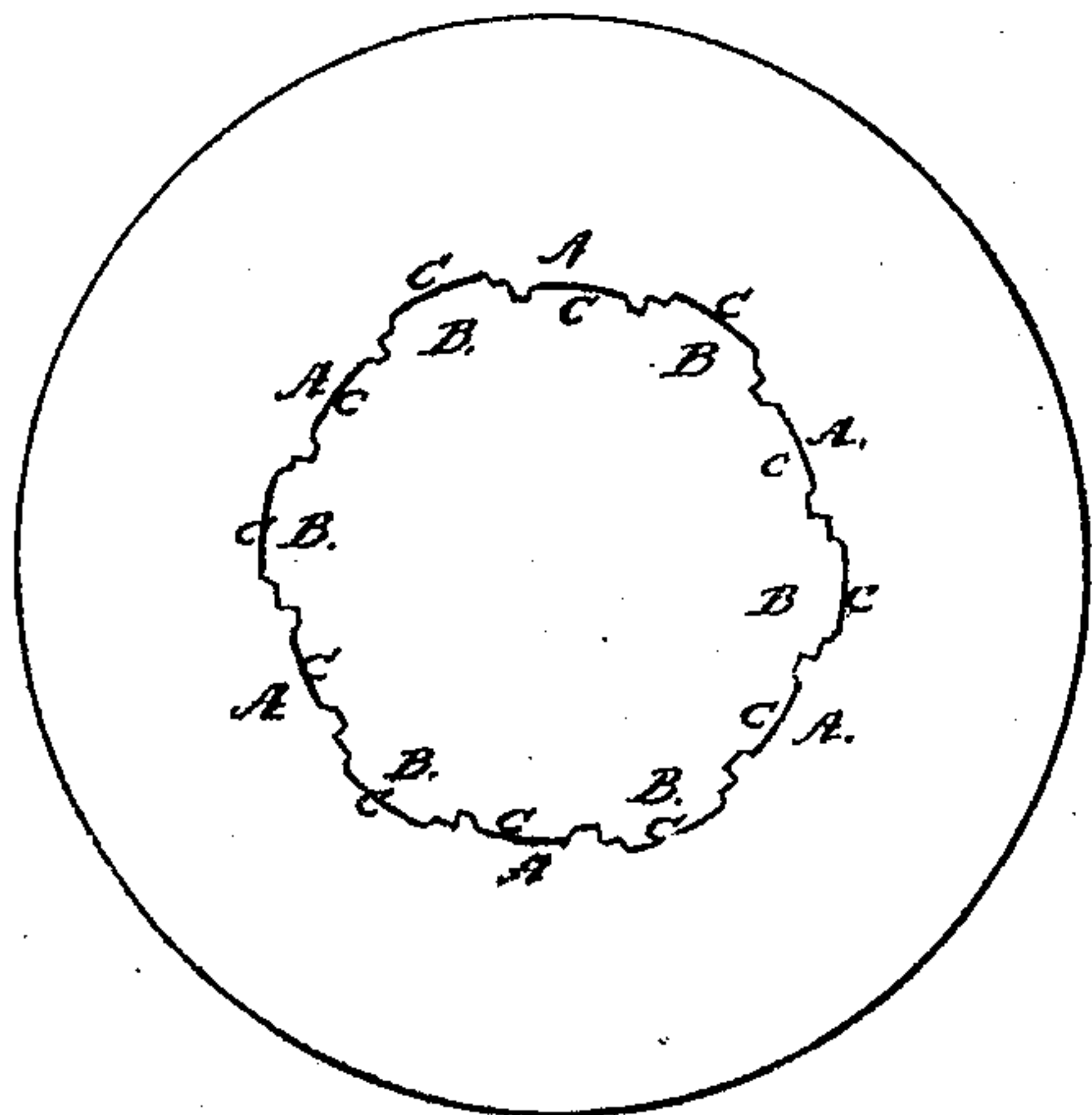


Fig. 2.

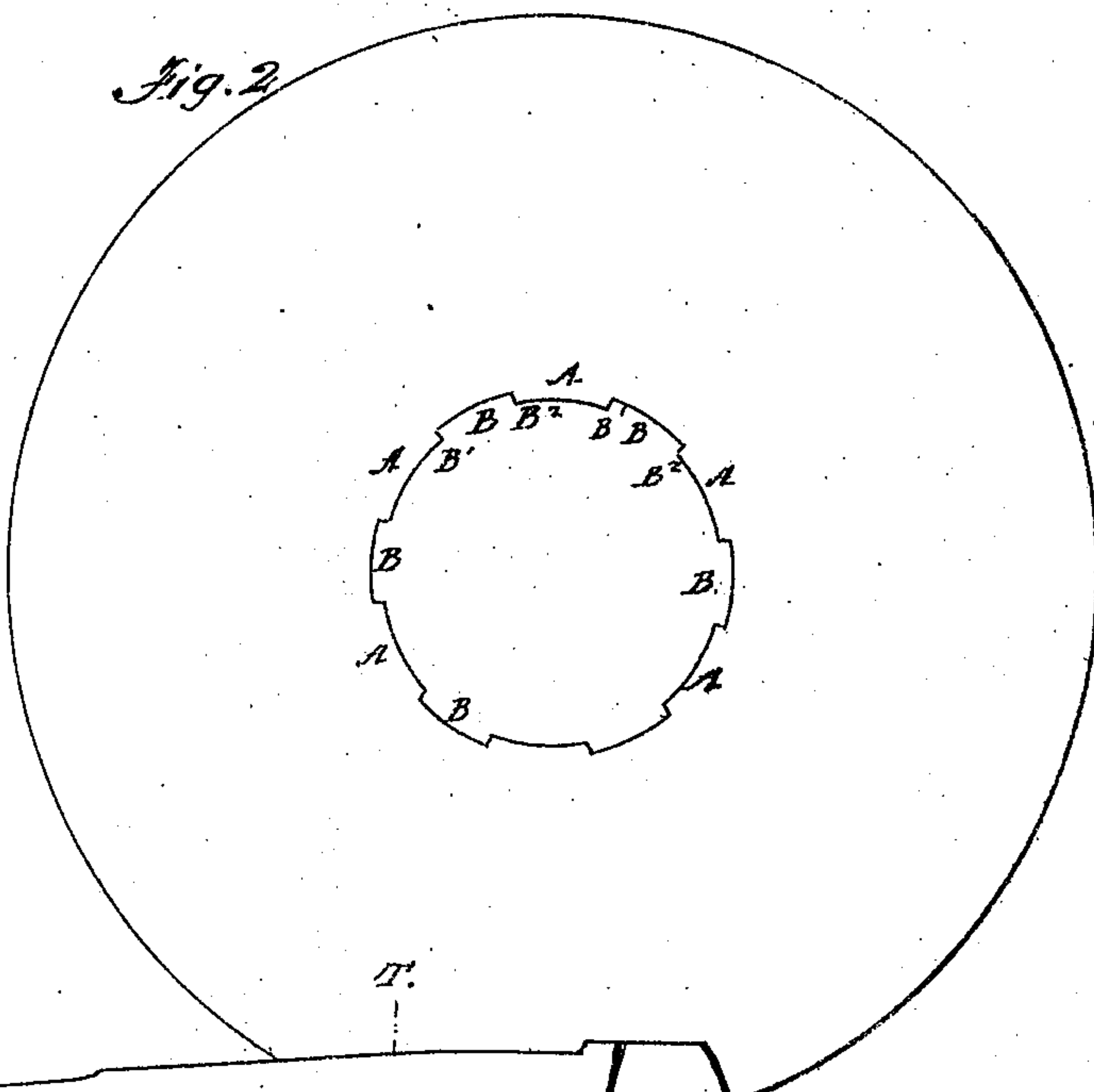
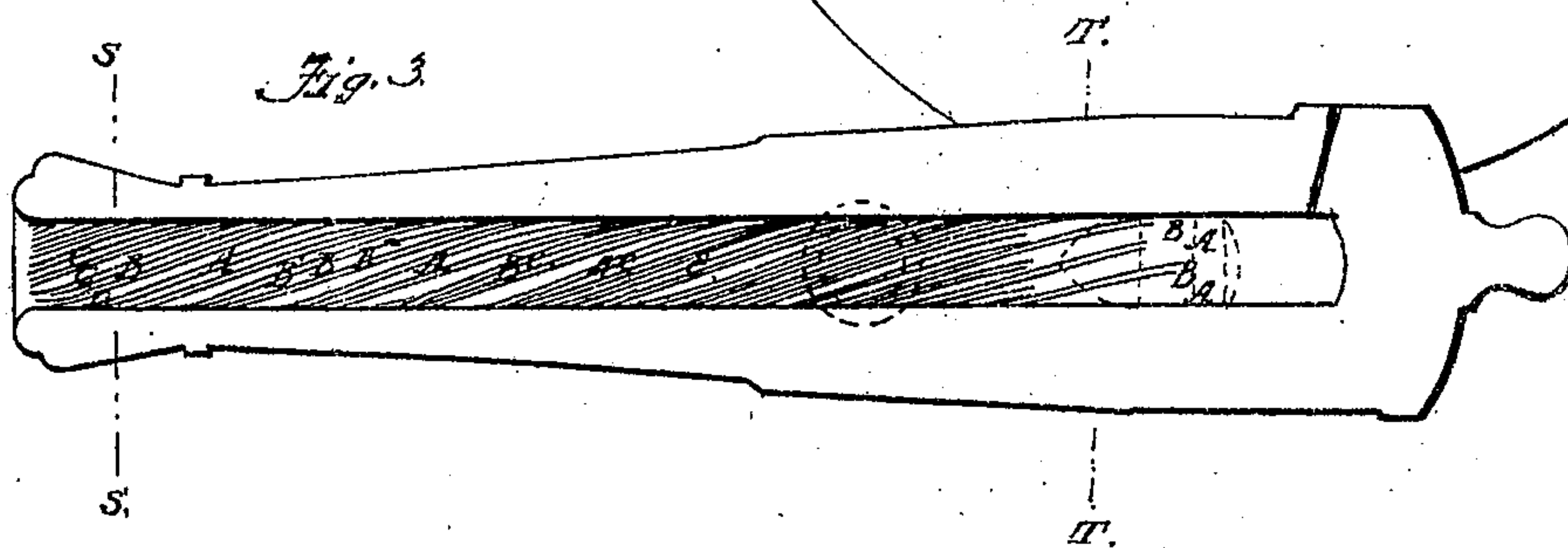


Fig. 3.



Witnesses;

Thos. D. Stetson

D. W. Stetson

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# United States Patent Office.

B. B. HOTCHKISS, OF NEW YORK, N. Y.

*Letters Patent No. 73,447, dated January 21, 1868.*

## IMPROVEMENT IN RIFLING ORDNANCE.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, B. B. HOTCHKISS, of the city, county, and State of New York, have invented certain new and useful Improvements in Rifled Cannons; and I do hereby declare that the following is a full and exact description thereof.

Figure 1 is a cross section through my gun near the muzzle.

Figure 2 is a corresponding section near the breech; and

Figure 3 is a longitudinal section through the entire gun on a smaller scale.

The dotted line S S indicates the position of the section seen in fig. 1. The dotted line T T indicates the section in fig. 2.

Similar letters of reference indicate like parts in all the figures.

My invention refers to the form of the interior surface of the gun. It is applicable to rifled guns of all sizes and proportions.

By the use of my invention a less degree of friction is produced between the gun and the projectile. It follows that the projectile may be thrown further with a given charge of powder, and that the strain on the gun is somewhat reduced.

To enable others skilled in the art to make and use my invention, in the best manner known to me, I will proceed to describe it, by the aid of the drawings and of the marks of reference denoted thereon.

The material may be cast iron. It may be moulded or cast in the usual manner. I produce a cylindrical hole in its interior by the ordinary means. I then proceed to cut grooves, extending longitudinally and spirally along the bore, by means ordinarily employed in rifled guns. The number of grooves, (of ordinary rifled grooves,) as also their breadth and depth, may be varied within wide limits. Their breadth and depth should depend on the kind of projectile which is to be used. I have represented my gun in this drawing as adapted to the use of the projectile manufactured by me, and known as the Hotchkiss projectile. This projectile has a packing of soft metal, which is expanded so as to fill all the grooves in the gun very perfectly so soon as fire is communicated to the propelling charge of powder.

In my gun I produce two kinds of grooves. The first kind is analogous in character to those usually known as rifled grooves. But mine differ in one respect from ordinary rifled grooves, as will be explained below. The second kind I term relieving-grooves. Their function is not analogous to ordinary rifled grooves. They do not (like ordinary rifled grooves) extend so far back in the bore of the gun as to reach the place from which the projectile commences its motion. The purpose of my relieving-grooves is to relieve the parts from friction, and not to assist in guiding the projectile or in communicating the rifled motion thereto.

My "lands," or spaces between the grooves, are indicated by A A, &c., my rifled grooves by B, and my relieving-grooves by C. My rifled grooves B extend rearward from the muzzle of the gun in the usual manner, and terminate at or near the line to which the powder fills the gun when the ordinary cartridge is used. My relieving-grooves C are produced along the centre of each groove B, and also along the centre of each land A. They extend rearwards from the muzzle to a plane a little forward of the place where the projectile lies. They may terminate by growing gradually shallower at their rear ends, or they may terminate abruptly; but it is very important that they should terminate finally before reaching the place where the soft packing of the projectile is expanded. When the powder is ignited, its expansive force acts violently against the rear end of the projectile, and induces the soft packing to expand suddenly, to a limited extent, as is well understood. In the act of so expanding, the soft packing is forced outward and tightly fills all the grooves which are presented at that point. As the projectile moves forward, the soft material is presented to the relieving-grooves C, but by that time the expansive action of the soft material has ceased, so that it does not expand further, and therefore does not fill the relieving-grooves C.

My relieving-grooves C are of uniform width throughout their entire length. My rifled grooves B are not of uniform width throughout; they are widest at the muzzle, and contract in width as they proceed rearward. In order to produce this form of my rifled grooves A, I usually subject the gun to two distinct rifling operations. I first cut my rifled grooves of uniform width from front to the rear. The width of the groove thus produced is equal to the width of my rifled groove B at its rear end. The subsequent rifling operation is for the sole purpose of widening the groove, and consists in recutting it with the same or a different tool, so operated as to cut a different spiral. I take care to so adjust the tools that the channels cut at both operations shall coincide at the rear end of my rifled groove B, so that the second operation shall have no effect at that point, but shall have the effect of widening the grooves at every other point, widening it most at the muzzle.



and less and less as it proceeds rearward. I can make the edges of my grooves perpendicular, inclined, or rounded to any required curve.

I have represented my relieving-grooves C as cut considerably deeper than I usually consider necessary or desirable in practice. I have represented them deep to enable them to be distinctly seen. I prefer, in practice, to make them about the width represented, and only about one sixty-fourth of an inch deep. I prefer to round both edges of the relieving-grooves C.

The rifled grooves B may be cut in the form of a "true screw," but I prefer to make them with what is called an "increasing twist." My relieving-grooves C may have the same twist as the front edge B<sup>1</sup>, or they may have a greater twist, like the rear edge B<sup>2</sup>. I prefer, however, to give them a medium twist, greater than the twist of the front edge B<sup>1</sup> and less than the twist of the rear edge B<sup>2</sup>.

I have already stated that the purpose of my relieving-grooves C is to reduce friction without inducing any perceptible leakage of the gas. It is important that the grooves C be of considerable width, so as to materially reduce the violent rubbing of the surface, and be, at the same time, so shallow that a strong current of gas shall not enter it. A quantity of gas equal in thickness to the depth of the groove will of course enter each of my relieving-grooves C; but if the depth of the groove is very small, the thin stratum of gas will not be able to make its way through the shallow passage to any considerable extent. The friction of the gas against the stationary surface that is presented to the exterior of the thin stratum very materially retards the motion of the gas through the passage.

The widening of my rifled grooves B, as the shot progresses, by giving the rear edge B<sup>2</sup> a quicker twist than the front edge B<sup>1</sup>, may attain an end corresponding closely to that attained by the relieving-groove C. As the projectile moves forward in the gun, it invariably presses against the front edge B<sup>1</sup> very firmly. In case my rifled grooves are uniformly wide throughout, as usual, the projectile would rub with considerable force against the rear edge B<sup>2</sup> along its whole extent. By widening the rifled groove a very little, I relieve the friction. If it is widened very much there will be a leakage of the gas along the groove close to the rear edge B<sup>2</sup>, provided the rifling is a true screw. I therefore make the difference between the twist of the front edge B<sup>1</sup> and the twist of the rear edge B<sup>2</sup> very small indeed in such guns. But when my rifled grooves are cut with the increasing twist, the conditions are changed, and I then make a very considerable difference between the twist of the front edge B<sup>1</sup> and that of the rear edge B<sup>2</sup>. I do this in order to avoid or reduce the change which must be wrought in the soft packing of my shot in moving along a gun thus rifled. Inasmuch as my soft packing assumes, at the instant of starting in the gun, the form of the bore at that point where it then lies, and of course conforms exactly to the twist which it finds at that point, it will be obvious that when the twist is an increasing twist, and is consequently greater at the muzzle, the form which the packing originally assumed cannot agree perfectly with the grooving at the muzzle. As guns are usually grooved, the soft packing of my projectile is subjected to distortion, or a continual change of shape, to adapt it to the changing twist as it moves along in the gun. My present invention avoids this evil; and the increasing width of my rifled grooves towards the muzzle allows the soft packing to maintain the same form, or very nearly the same, as it assumed when it first received the force of the powder. The precise quantity by which I increase the width of my rifled grooves B at the muzzle, above the width of the same grooves near the breech, consequently varies according as the rifled grooves are uniform or of an increasing twist. In case the rifling is of uniform twist, I make the grooves about one sixty-fourth of an inch wider at the muzzle than at the back end. In case the rifling has an increasing twist, (the twist of the front edge B<sup>1</sup>), increasing from one turn in twelve feet to one turn in ten feet, I then give to the rear edge B<sup>2</sup> an increasing twist of an analogous character, but considerably greater. It should be so much greater that each rifled groove B shall be, say, about one-eighth of an inch wider at the muzzle than at its rear end. This is assuming that Hotchkiss projectiles of ordinary proportions are to be used in the gun; and that the soft packing, after its compression, occupies about three inches of the length of the projectile. In case the length of the soft packing shall be greater, the increase in the breadth of the rifled grooves B should be greater; and in case the length of the soft packing should be less, then the increase of the width of the rifling should be less. This increase in the width of the rifled grooves towards the muzzle of the gun allows the corresponding ridges which are raised on the belt of soft packing to maintain their form about the same as was impressed on them when the projectile was first started forward in the gun; and it will be understood that the ridges of soft packing fill the grooves near the muzzle, by reason of their standing somewhat crosswise in the grooves at that point. In other words, the packing was swaged to correspond perfectly at the point where the said rifled grooves were narrow, and they continue to fill the grooves without changing their form when they approach the muzzle, where the grooves are wider, because they do not here coincide in twist with the rifled grooves, but stand slightly oblique with the grooves.

The relieving-grooves C may be omitted in the bottom of the rifled grooves B, and preserved on the lands A, or they may be omitted on the lands and preserved in the grooves. I prefer to employ them in both situations.

Having now fully described my invention, what I claim as my improvement in rifling arms, and desire to secure by Letters Patent, is as follows:

I claim the relieving-grooves C, for the purpose herein set forth.

B. B. HOTCHKISS.

Witnesses:

KIMBALL W. STETSON.

D. W. STETSON.