

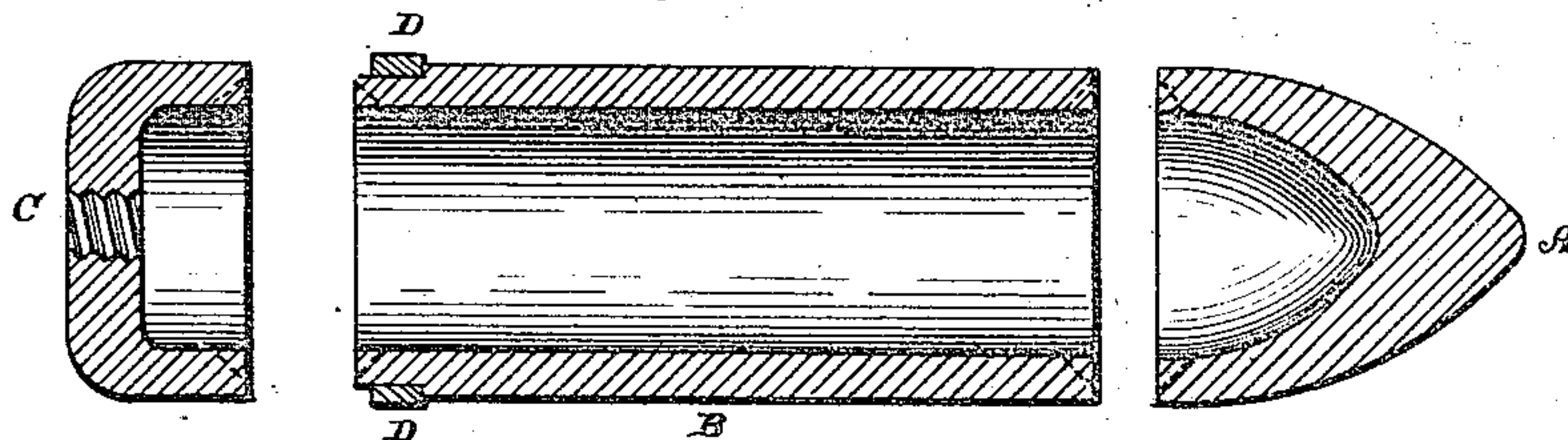
(No Model.)

W. M. WOOD.  
PROJECTILE.

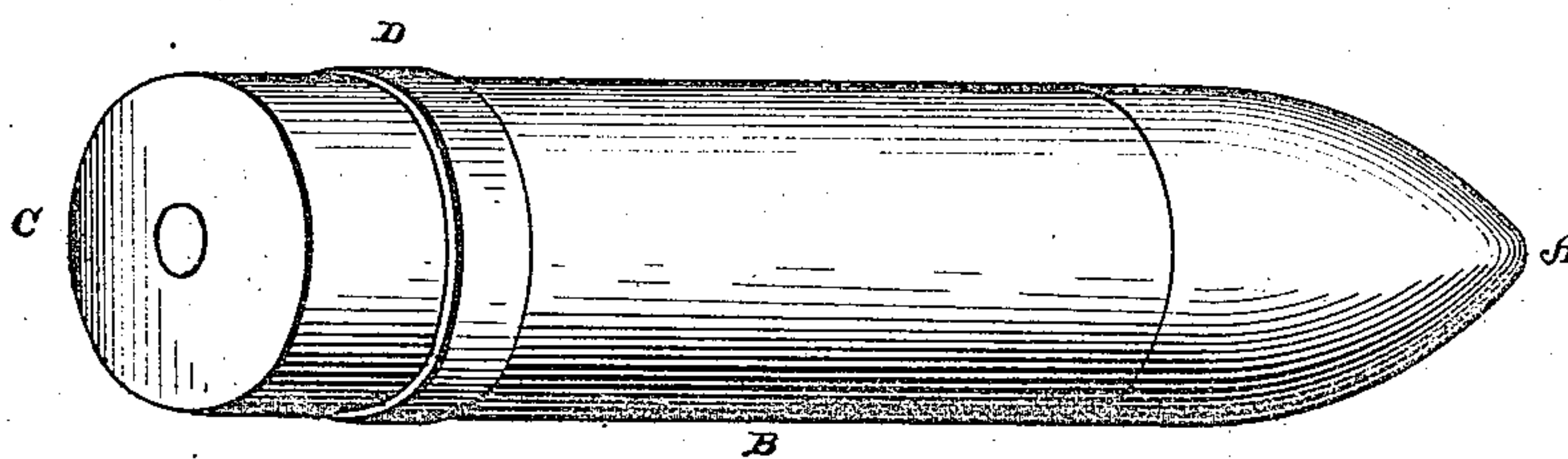
No. 424,442.

Patented Mar. 25, 1890.

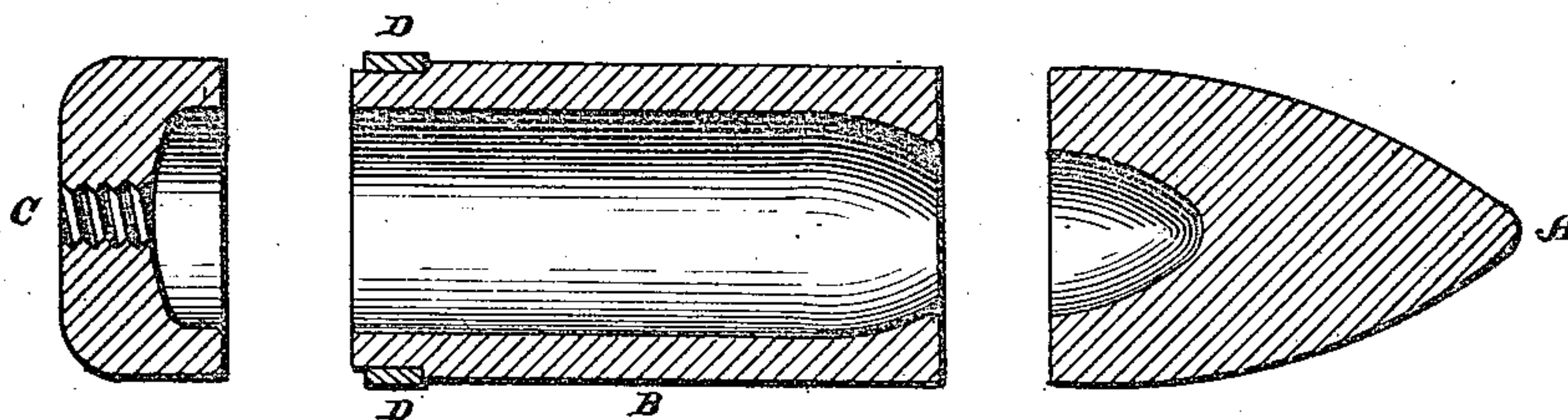
*Fig. 1.*



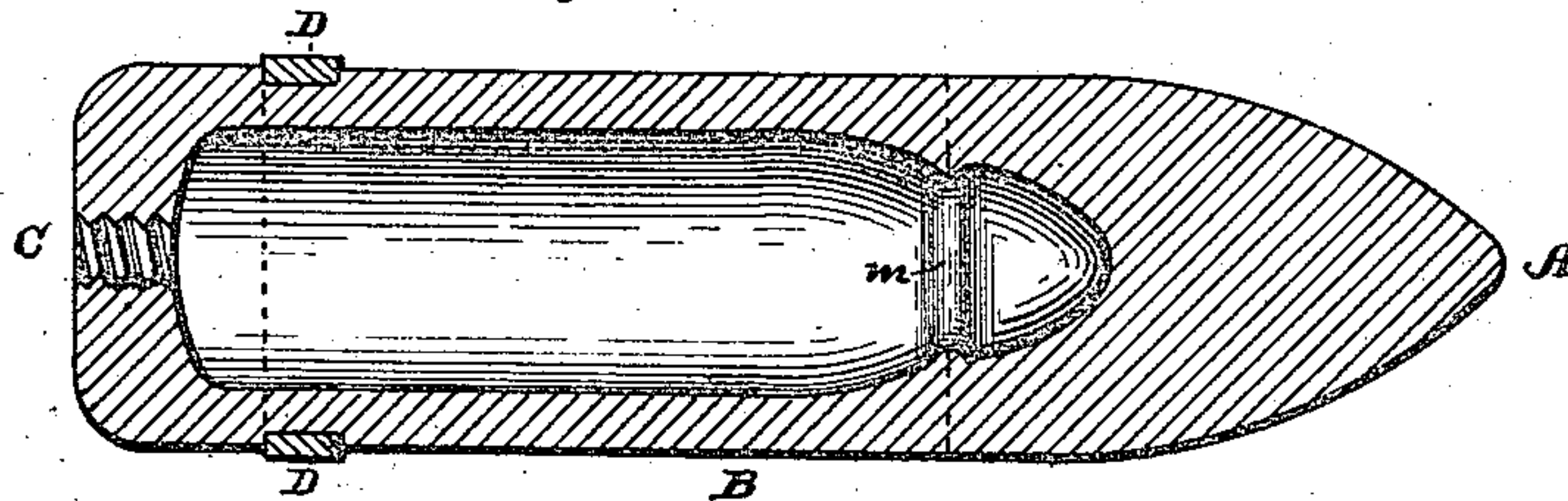
*Fig. 2.*



*Fig. 3.*



*Fig. 4.*



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# UNITED STATES PATENT OFFICE.

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TO THE THOMSON ELECTRIC WELDING COMPANY, OF BOSTON, MASSA-  
CHUSETTS.

## PROJECTILE

SPECIFICATION forming part of Letters Patent No. 424,442, dated March 25, 1890.

Application filed November 7, 1889. Serial No. 329,507. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM M. WOOD, a citizen of the United States, and a resident of Washington, in the District of Columbia, have invented a certain new and useful Projectile, of which the following is a specification.

My invention relates to the construction of hollow projectiles, but is especially useful for armor-piercing shells used in warfare.

The object of my invention is to produce a hollow projectile which may be cheaply made and which shall be of high strength and efficiency. Heretofore armor-piercing and other hollow projectiles have been made with a cast-metal body and point integral with one another, and in some cases it has been proposed to make a projectile in which the head, body, and base sections are formed integral by a sort of rolling operation. It has also been proposed to make projectiles with the head and body integral with one another by forming an ingot of the desired shape and then turning out the charge-chamber. In most forms of projectile the base of the projectile has been closed by a separate plug provided with a small fuse-hole. In the usual constructions the open end of the body at the rear end is closed by a screw-plug provided with a fuse-hole. In the projectile invented by me the body portion is formed as a single homogeneous hollow piece of metal, either separate or integral with the base-section, but preferably as a separate tubular piece open from end to end, and the point separately formed is welded to the forward end of such tubular or hollow body-section. The tubular body might be formed by casting, but is preferably a drawn or swaged piece of tubing open from end to end.

My invention consists, also, of a hollow projectile the body-section of which consists of a homogeneous tubular piece of metal, while the head and base, formed of separately-constructed pieces, are welded to the opposite ends thereof. This construction of projectile not only permits of the ready use of different grades of metal for the point and body, but is also capable of cheap and rapid manufacture. By making the body portion of a drawn

or swaged piece of tubing I secure increased strength, which is a valuable feature, especially in projectiles the walls of which are rather thin. This increase of strength at the weaker part of the projectile is due to the existence of the inner and outer skin or fibrous surface produced in the process of drawing. The manufacture is also greatly facilitated by making the body as a tubular section open from end to end, which is joined at its opposite ends respectively to the base and point.

My invention consists, further, in the provision, in a hollow projectile for armor-piercing purposes, of an internal strengthening burr or projection at the line of union of the head and body.

In the accompanying drawings, Figure 1 shows in longitudinal section the three portions of a common shell constructed in accordance with my invention. Fig. 2 shows in perspective the complete manufactured shell. Fig. 3 shows in longitudinal section the three parts of an armor-piercing shell constructed in accordance with my invention, but separated from one another. Fig. 4 shows in longitudinal section the complete shell.

A is the point or head, and B the body, of the shell. C is the base, which I prefer to form separately from the body, though this is not necessary. The head may be of the usual ogival form when used for an armor-piercing shell such as indicated in Fig. 3, and may be constructed by drop-forging, rolling, hydraulic pressure, stamping, or other usual method. The body of the shell B may be of the same or a different grade or kind of metal from the head. The body is formed of a single piece of metal, and preferably as a section of the projectile, open from end to end.

In order to give great strength to the projectile, I propose to form the hollow tubular body from a tube or section of tubing consisting of drawn tubing, since I am enabled thereby to get the benefit of the strengthening fibrous surface or skin produced in the drawing operation. The tubular section might be formed of a single homogeneous piece of metal by swaging or reaming out a section of tubing to the desired form or by any other method by which the interior cav-



ity will be given the proper shape to provide walls of proper thickness and proportion.

I am aware that it has been before proposed to make the body of the shell from rings or  
5 disks of metal alternately hard and soft, which are built up upon one another to form an elongated tube of the proper length to make the hollow charge-chamber of the projectile; but such construction is not only difficult and  
10 expensive to produce, but also requires that the exterior shall be turned down or finished off, a manipulation which is not necessary when the body is made of a single homogeneous piece of metal, such as drawn tubing.  
15 The base of the shell C may be made of the same thickness as the body and may be stamped out or flanged up or otherwise made into the form shown, so that when welded to the body the shell will have an unbroken  
20 outer surface continuing around from the side to or near the center of the base, at which point only it need be pierced for the introduction of the fuse. In ordinary constructions of projectile it has been usual to leave  
25 the base of the shell, or, rather, the end of the body-section, open and to fill the same by a plug.

In order to strengthen an armor-piercing projectile, I form the same with an internal  
30 burr or enlargement, as shown at *m*, Fig. 4. This burr or enlargement may be produced by the process of welding the point to the body, as hereinafter described. The several parts of the shell formed as described are  
35 electrically welded to one another in any suitable electric welding apparatus by placing the parts in their proper position in suitably-formed clamps with their meeting ends in abutment and passing a heating-current of  
40 electricity through them, so as to raise the parts to the welding temperature where the joint is to be formed. Pressure or other mechanical force is then applied, as well understood in the welding art, to complete the union,  
45 and, if desired or if required by the nature of the material employed, the exterior of the projectile may be ground off. When the body is made of drawn tubing and the point and base are forged into shape, no finishing is required  
50 after the completion of the union. When the ends of the parts where they abut are left square, the pressure used in the welding will produce the internal burr or projection *m*. If it be desired to avoid the formation of the  
55 internal burr in the ordinary shell, the welding may be done over a mandrel inserted at the joint and preferably of non-conducting

material, or the burr may be suppressed by suitably beveling the abutting ends, as well understood in the art of electric welding. 60

The formation of an external burr may be prevented by beveling the end or ends which abut from the outer surface inward.

D indicates the usual rotating band, which is applied at the junction of the body and  
65 base sections, and is secured in place by the welding of the sections together after the application of the band to the turned-down portion of a section.

I do not claim the improvement in the  
70 methods or processes of manufacturing projectiles hereinbefore referred to by forming the head separate from the tubular body and then welding the two together by electricity; nor do I claim the improvement which con-  
75 sists in separately constructing a base-section of the form shown and then welding it to the body by the electric welding process hereinbefore mentioned, as these form the subject of claims in my application for pat-  
80 ent of even date herewith, Serial No. 327,507.

What I claim as my invention is—

1. A hollow projectile having its entire body portion formed of a single homogeneous piece  
85 of metal open from end to end and its head and base of separately-formed pieces welded to the first, as and for the purpose described.

2. A hollow projectile, the entire body portion of which, having a suitable base, consists  
90 of a drawn or swaged tube welded to a point-section, as and for the purpose described.

3. A projectile composed of three longitudinal sections or parts, consisting of a tubular homogeneous body portion formed of one  
95 piece, the point and the base, said point and base being each made in a single piece and welded to the body.

4. A hollow projectile the entire body-section of which consists of a hollow or tubular  
100 piece of homogeneous metal having an inner and outer skin, as described, in combination with a separately-formed point-section welded to the first, as and for the purpose described.

5. A hollow projectile having its head welded to its body and provided at the point of  
105 union with an internal strengthening burr or projection.

Signed at New York, in the county of New York and State of New York, this 5th day of November, A. D. 1889.

WILLIAM M. WOOD.

Witnesses:

J. A. HURDLE,  
WM. H. CAPEL.