

C. DAVIS.  
PROJECTILE FOR ATTACKING FACE HARDENED ARMOR.  
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997,758.

Patented July 11, 1911.

Fig. 1.

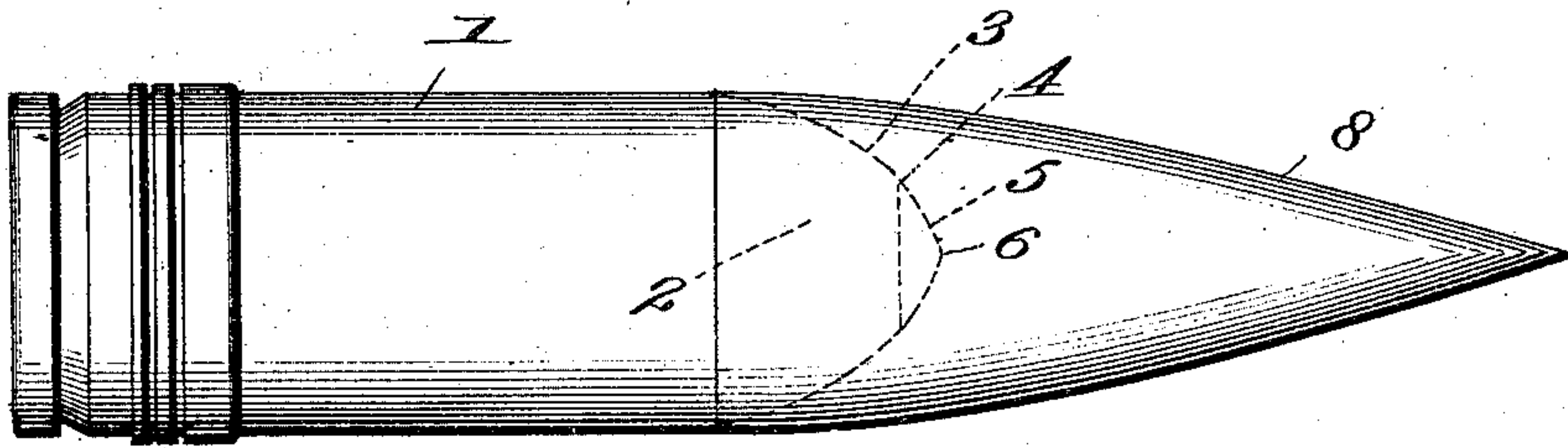


Fig. 2.

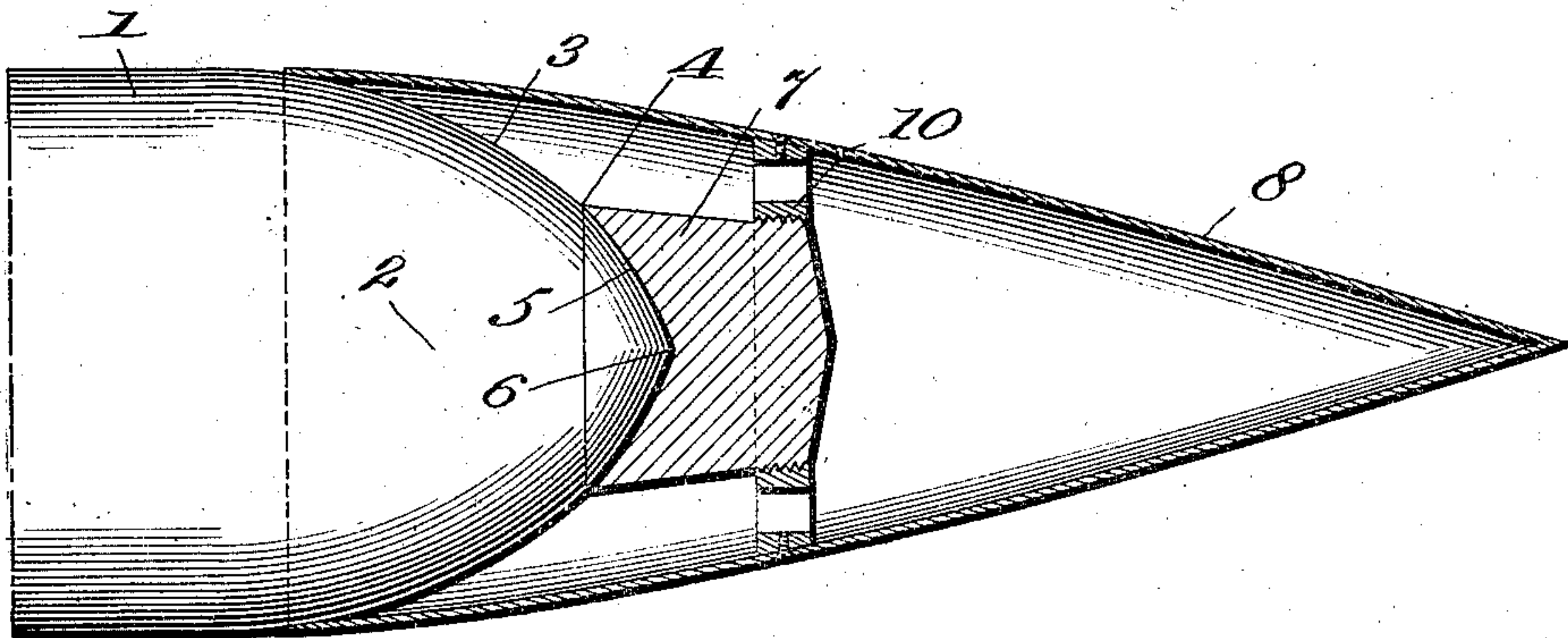
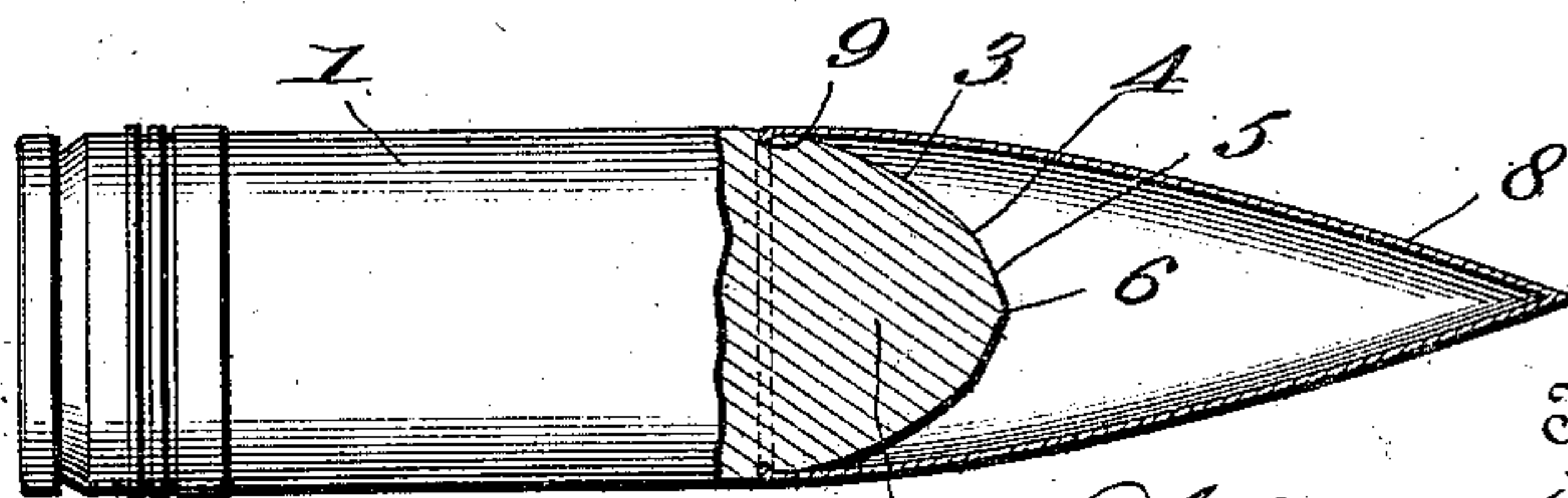


Fig. 3.



Witnesses

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# UNITED STATES PATENT OFFICE

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PROJECTILE FOR ATTACKING FACE-HARDENED ARMOR.

997,758.

Specification of Letters Patent.

Patented July 11, 1911.

Application filed June 14, 1910. Serial No. 566,838.

*To all whom it may concern:*

Be it known that I, CLELAND DAVIS, lieutenant commander United States Navy, and a citizen of the United States, at present  
5 attached to the U. S. S. *Mississippi*, have invented certain new and useful Improvements in Projectiles for Attacking Face-Hardened Armor; and I do hereby declare the following to be a full, clear, and exact  
10 description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to projectiles for attacking face hardened armor plates, and has  
15 for its object to produce a device of this nature which will be more efficient in action and more accurate in flight over long ranges than has been possible heretofore.

To these ends the invention consists in  
20 the novel details of construction and combinations of parts more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings  
25 forming a part of this specification, in which like numerals refer to like parts in all the views:—Figure 1 is a plan view of a projectile made in accordance with my invention; Fig. 2, is an enlarged detail sectional  
30 view of a slightly modified form of my invention; and, Fig. 3, is a view, partly in section, of a projectile not provided with a soft steel cap.

1 indicates the body portion of a standard  
35 projectile and 2 the hardened head thereof, formed with an ogival 3 struck with a radius of substantially one diameter up to the point 4, when the curve 5 continues with a radius of substantially three fourths of a diameter  
40 of the projectile up to the extreme point 6. The advantages involved in adopting these particular curves will be apparent when it is said that when an uncapped projectile with a tapering point strikes a non-face-  
45 hardened or homogeneous armor plate the strains produced in the latter are really local. The point of the projectile first enters the plate somewhat like a wedge; and at this stage, since the metal is necessarily  
50 displaced, and cannot escape either sidewise or to the rear of the plate, it is of necessity forced to flow to the front of the plate and forms the well known fringe around the shot hole. As the pointed projectile gets farther  
55 into the plate, however, the rear wall of the plate begins to give way, and the displaced

metal thereupon is forced first into the bulge formed at the rear, and later when the plate is perforated, it likewise forms the familiar rear fringe around the shot hole. With a  
60 face-hardened armor plate, however, the action is quite different when the projectile is not provided with a soft steel cap. In such case, upon impact the plate is first elastically dished without penetration. When  
65 it is in this condition it is evident that the strains and stresses are concentrated at or near the point of maximum displacement and react to throw the projectile back or out of the elastically dished portion, very much  
70 as a bow string under tension throws an arrow. Should the head of the projectile be sufficiently strong and have sufficient energy, its point will break through this elastically dished portion. The hardened face,  
75 however, of the plate will prevent any flow of metal toward the front, and the whole of the displaced metal, must, therefore, flow to the rear of the plate. Up to this stage in both cases, there is, of course, a great  
80 deal of energy consumed in displacing inappreciable quantities of metal sidewise, but much less energy is lost in this sidewise action in homogeneous plates, the projectiles being the same, than in face-hardened plates,  
85 because in the former case, the metal escapes to the front as above pointed out, and, therefore, the lateral compressive actions are not so severe. These actions, actually carrying metal to the rear and tending  
90 strongly to displace it laterally, continue in face hardened plates until the bourrelet enters the plane of the front face, when the further penetrative action becomes a pure  
95 punching or shearing action. A comparison of these two effects strongly indicates that while the best form of head for penetrating a non-face-hardened plate is a pointed or tapering one, the opposite is true of a face  
100 hardened plate. For it is evident, the less the lateral stress the greater will be the energy left in the projectile to be applied to shearing strains and to punching actions. In other words, projectiles for attacking  
105 face-hardened armor should be provided with heads best adapted for a punching action, and this is true whether the projectile is or is not provided with a soft steel cap 7. The function of such a cap in at-  
110 tacking face-hardened armor is to absorb the energy of impact and thereby relieve the point of the projectile of considerable strain.



while at the same time producing the elastic dishing of the plate above described. It, therefore, follows, when a soft steel cap is employed that the point of the projectile  
 5 after passing through the cap finds itself less strained and, therefore, stronger than when no cap is used, and the plate being already elastically dished is, of course, more easily penetrated. It follows, if the head  
 10 of the projectile is provided with the ogival contour above set forth, greatly improved destructive powers are imparted to the projectile, but, as is evident from the drawings, such contour is so blunt that it engenders an  
 15 abnormal resistance to the air in long flights. As pointed out in my prior patent, Number 945,492, January 4, 1910, in order to decrease this air resistance to a minimum, the contour of the head of the projectile as a  
 20 whole should be struck with a radius of about six or seven calibers. Therefore, in order to provide a projectile capable of piercing face-hardened armor with a maximum efficiency and at the same time capable  
 25 of piercing the air with a minimum resistance, and, therefore, of having a flatter trajectory and a greater danger zone and a greater accuracy over long flights than heretofore, I provide the projectile with an outer  
 30 contour cap or wind shield which is struck with a radius of substantially seven calibers. The contour cap 8 may be attached to the projectile by any suitable means, and in the drawings I have shown its rear end in Fig.  
 35 3 as being swaged or let into a groove 9, while in Fig. 2, I have shown a support 10 secured to the cap 7, as by screw threads.

It is obvious that those skilled in the art may vary the arrangement of parts and details of construction without departing from  
 40 the spirit of my invention and, therefore, I do not wish to be limited to such details, except as may be required by the claims.

What I claim is:—

1. The combination of an armor piercing  
 45 projectile having a head a portion of the contour of which is struck with a radius of substantially one diameter of the projectile, while another portion of said contour has a  
 50 radius of less than one diameter of said projectile; a soft steel cap carried by said head; a contour cap having a radius of curvature of substantially seven diameters of said projectile; and means for securing said contour  
 55 cap to said projectile, substantially as described.

2. The combination of an armor piercing  
 projectile having a hardened head a portion  
 60 of the contour of which comprises an ogival struck with a radius of substantially one diameter of the projectile over a greater portion of its surface, and an ogival struck  
 65 with a radius of less than one diameter of the projectile over a less portion of its surface; and a hollow contour cap having a radius of curvature of substantially seven diameters of the projectile, substantially as described.

In testimony whereof, I affix my signature, in presence of two witnesses.

CLELAND DAVIS.

Witnesses:

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 CARY RUY.