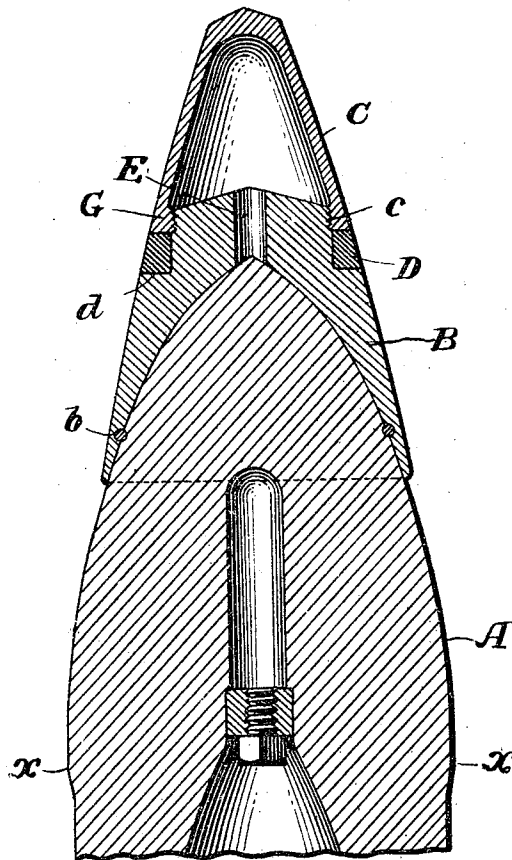


992,650.

Patented May 16, 1911.



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UNITED STATES PATENT OFFICE.

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PROJECTILE.

992,650.

Specification of Letters Patent.

Patented May 16, 1911.

Application filed February 23, 1910. Serial No. 545,503.

To all whom it may concern:

Be it known that I, EMIL GATHMANN, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

My invention relates to projectiles of the class known as "armor piercing shot and shell" in which a cap of relatively soft metal is applied to the point of the projectile proper.

The superiority of capped projectiles is now well established and it is well known that when the projectile strikes the plate the latter is dished by the cap and it is important that this dishing should be uniform or of approximately regular contour in order that the point of the projectile proper may not be deflected so as to enter the plate at an angle. It is also well known that where a cap of the usual type is applied to a projectile the velocity thereof is somewhat impeded owing to the resistance of the air encountered by the use of such caps. This objection has, however, been largely overcome by providing the capped projectile with what is known as a contour or wind cap which is so formed and applied as to increase the penetrating power of the projectile during its trajectory between the gun and the target with a given initial velocity.

The objects of my invention are: First. To improve the construction of the soft metal cap whereby it is caused to break or shatter with greater uniformity and thus produce a more uniform dish in the armor to receive the pointed end of the projectile and to protect the point more fully during the initial penetration. Second. To combine with said soft metal cap a wind cap in such a manner that the contour of the projectile as a whole may be most efficient without so reducing the strength of the soft cap as to impair its efficiency for effecting penetration of armor. Third. To so combine a contour cap with a soft metal cap that the former may reinforce the latter in a plane forward of the point of the projectile.

The accompanying drawing shows a longitudinal central section of the front portion of a projectile with my improvement applied.

The projectile A shown is of the shape now commonly employed, its largest diame-

ter being at $x\ x$. The cap B, of relatively soft metal, is securely fastened to the front end of the projectile by a key b of well known construction or it may be attached in any other suitable way. The cap B is shown as being formed with a bore E extending from its front end or point inwardly to the point of the projectile. The outer wall of this cap tapers correspondingly with the taper of the outer wall of the head of the projectile and it is formed with an annular recess d at its forward portion to receive reinforcing means D and the rear portion G of a contour cap C. Both the parts D and C may be made of steel or other suitable material. The contour cap C is connected with the outer side walls of the front end of the soft metal cap B by means of screw threads c or it may be attached in any other suitable way.

By the construction shown in the drawing the special reinforcing device D may be readily placed over the forward recessed end of the cap B and the contour cap C may have its rear portion adapted to abut against said special reinforcing device in the manner shown. By my invention the soft metal cap is reinforced both by the special reinforcing collar D and the rear portion G of the contour or wind cap in such a manner that the resistance to the splitting of the cap is materially increased and the energy of the impact of the mass of the projectile upon the immediate portion of the armor plate attacked is concentrated. The cap B and also the wind cap C are so constructed as to offer a minimum of resistance to the retardation of the projectile during its trajectory between the gun and the target and a maximum resistance, compared with the mass of metal employed, to shattering and uneven deformation as the point of the projectile impacts with and enters the outer layer of the target.

My improvements are especially intended for use in connection with projectiles where in the head is formed by two or more radii and in which the outer contour of the cap B and wind cap C are formed by radii greater than the radii forming the contour of the head of the projectile to which the cap is fitted. It is now established that in order to obtain a maximum efficiency of a capped projectile, a certain percentage of the kinetic energy of the impacting mass should be

transmitted to the target or armor plate by means of the cap. It has been demonstrated that the best ballistic results in attacking hard-faced armor plate are obtained by fitting the point of a projectile with a soft metal cap of a weight approximating

$$\frac{2W}{100} \frac{400}{D}$$

10 W being the weight of the uncapped projectile and the weights being expressed in pounds, and by making the frontal or impacting diameter of the cap of approximately 0.5 D, D representing the caliber or diameter of the projectile. This type of cap, 15 although ballistically satisfactory in so far as relating to the work done on the target, was found to retard the passage of the projectile considerably in its trajectory through the air, and forms of contour caps have been 20 developed of a frusto-conical or pointed shape which much lessens the resistance encountered during the passage through the air. These forms have lessened the resistance of the projectile through the air to a 25 remarkable degree, insuring a flatter and hence longer trajectory and higher remaining velocity for equal initial velocity and angles of departure. The ballistic efficiency 30 relating to the work done on the plate or target by the tapered or frusto-conical forms of caps, has, however, been greatly reduced, as the frontal diameter of the cap was lessened by the increase in the taper shape thereof. The cap B, being constructed of soft 35 steel, is instantly deformed upon impact with the hard face of an armor plate. To slightly retard this deformation and make it of a more uniform character I employ a reinforce for the cap which may be constructed as shown in my U. S. Patent No. 922,573 of May 25, 1909, reissued July 12, 1910, No. 13,132. The conical head of the projectile 40 shown in the accompanying drawing has a contour described by radii equal to $2\frac{1}{2}$ to four times the caliber of the major diameter of the projectile. The point which is integral with the head has a contour described by radii of 0.5 to 0.625 C, the caliber or 45 major diameter of the projectile being indicated by C in each instance. The soft metal cap covers the point of the projectile, its outer contour being preferably formed by greater radii than that forming the head of the projectile. The reinforcing means are 50 made to be flush with the outer contour of the soft metal cap and flush also with the wind cap, so that no additional resistance is offered to the passage of the projectile through the air by the reinforcing means. 55 The location of the reinforcing means should be forward of or approximately in line with a plane passing through the projectile at right angles to its point as it is at this location that the cap should be retarded some-

what in its deformation upon impact with the plate. When the plate is dished or depressed and the cap has been deformed the point of the projectile enters the hard face of the armor plate unbroken, and penetration is more readily accomplished. When 70 no contour cap is used, that is, when a projectile is provided with an old type cylindrical soft metal cap, the front end of this cap has commonly been made of a diameter 75 about one-half that of the maximum diameter of the projectile in order to obtain a large surface of impact against the armor plate for the purpose of forming a dish in the plate sufficient to overcome its elastic 80 limits and thus receive the hardened end of the projectile and cause the latter to enter the armor plate more readily. When, however, a wind cap is used, it is necessary to 85 reduce somewhat the diameter of the front end of the soft metal cap, primarily in order that the surface of the projectile as a whole may gradually taper from its largest diameter to the front end of the wind cap, and 90 secondly, some metal is usually displaced from the forward end of the soft metal cap, in order to make the attachment of the wind cap without breaking the contour of the soft metal cap.

By my improvements, while the diameter 95 of the front end of the soft metal cap is somewhat reduced, it is also reinforced to overcome the loss of material due to said reduction, and irregular spreading or shattering of the soft metal cap when the projectile encounters the armor plate, is avoided 100 more fully than if the material cut from the soft metal cap were not replaced or compensated for by a reinforcing means. The purpose of the central bore E is to prevent 105 side-wise or irregular breaking of the soft metal cap, which would tend to make the projectile wobble and therefore enter the armor plate at an angle.

I distinguish the soft metal cap, the function of which is to assist the projectile in penetrating armor, from the wind cap, the function of which is to reduce atmospheric resistance during the flight of the projectile, 110 by calling the soft metal cap the primary cap and the wind cap the secondary cap: the combined caps forming what I term the contour cap or a composite contour-impact 115 cap. The soft metal or primary cap B is of truncated conical form. The secondary cap is also of truncated conical form, the outer conical surface of the secondary cap merging 120 into or being approximately flush with the outer conical surface of the primary cap, thus forming the combined or composite contour-impact cap. 125

The wind cap is made hollow as usual but preferably as shown has that portion encircling the forward portion of the soft metal cap made thicker or heavier than its 130

forward side walls. Whether made thicker or not the rear portion of the wind cap where it encircles the soft metal cap reinforces or strengthens the latter. I prefer, however, to make the rear portion G of the wind cap thicker as shown and I also prefer to employ the additional reinforcing means D but where such means D are not used the recess *d* is suitably formed to receive the rear encircling portion of the wind cap. I have described the best way now known to me of carrying out my invention but it is obvious that my improvements broadly considered may be embodied in projectiles differing in detail of construction from what I have illustrated.

I claim as my invention:—

1. A projectile, comprising a body portion having a hardened tapered head and point, a tapered soft metal cap mounted upon said point, a hollow wind cap mounted upon the forward portion of the soft metal cap, and a reinforce located between the thin walls of the wind cap and the forward portion of the soft metal cap for the purpose specified.

2. A projectile comprising a body bearing a hardened, tapered head and point, a hollow primary metal cap of truncated conical form mounted on and locked to the said projectile point, and which cap is reduced in diameter at its forward portion, and a hollow secondary or wind cap of truncated conical form having its rear inner portion seated in the said reduced diameter of the forward outer portion of the primary cap, and having its outer conical surface approximately flush with the outer conical surface of the said primary cap, whereby the combined caps form a contour cap.

3. A projectile, comprising a body portion bearing a hardened tapered head and point, a hollow primary truncated conically formed soft metal cap mounted on, extending over, and locked to the rear portion of the said projectile point, and which primary cap has an annular recess on its outer peripheral portion forward of the point of the projectile, and a secondary hollow wind cap of truncated conical form having a rear thickened portion seated in the reduced diameter at the forward portion of the primary cap, said wind cap having its outer exposed surface formed of approximately the same contour and merging into the outer exposed surface of the soft metal primary cap, whereby the two caps form a combined impact and contour cap.

4. A projectile, comprising a body portion bearing a hardened tapered head and a point and a hollow primary metal cap of truncated conical form mounted upon the said projectile point, said primary cap having a recess on its outer, peripheral portion forward of the point of the projectile, and a hollow secondary cap or wind cap having its

rearmost portion mounted within said recess and reinforcing the primary soft metal cap, the outer or exposed surfaces of both the primary cap and the secondary cap being formed by approximately the same radii, whereby a composite impact and contour cap is obtained.

5. A pointed armor piercing projectile in combination with a hollow primary cap of truncated conical form mounted upon said projectile point, the said primary cap having an annular recess on its outer peripheral portion forward of the point of the projectile, and a hollow wind cap or secondary cap of truncated conical form having its rearmost portion mounted within said annular recess at the forward portion of the primary cap and reinforcing the said primary cap in a plane forward of the point of the projectile, the combined caps forming a composite impact and contour cap.

6. A projectile, comprising a body portion bearing a hardened tapered head and point and wherein the head and point are formed by two or more radii, a hollow primary cap of truncated conical form mounted upon, extending over, and locked to the rear portion of said projectile point and having an outer contour formed by radii greater than the radii forming the head of the projectile, a hollow secondary or wind cap of truncated conical form inclosing the front and forward peripheral portion only of the primary cap and secured to the said forward peripheral portion, the outer exposed surfaces of the primary cap and the wind cap and the head of the projectile forming an approximately similar contour, the two caps thus forming a combined contour and impact cap.

7. A projectile, comprising a body portion bearing a hardened tapered head and point, a hollow primary soft metal cap of truncated conical form mounted on and locked to the said projectile point, and which cap has an annular reduction in diameter at its peripheral portion forward of the point of the projectile, and a secondary or wind cap the rear portion of which is seated in said reduced diameter at the forward portion of the primary cap, and which wind cap has its outer exposed surface merged into the contour of the outer exposed surface of the primary cap, thereby forming a contour cap.

8. A pointed armor piercing projectile in combination with a primary cup-shaped metal cap of truncated conical form attached thereto, and a secondary or wind cap of truncated conical form locked to the forward peripheral outer portion of the primary cap in a plane forward of the point of the projectile, both the primary cap and the secondary cap having outer exposed surfaces of approximately unbroken similar

contour, the combined caps forming a contour-impact cap and merging into the contour of the head of the projectile.

9. A projectile, comprising a body portion
5 bearing a hardened tapered head and point, a hollow primary or impact cap of truncated conical form mounted on and locked to the said projectile point and which cap is reduced in diameter at its peripheral portion
10 forward of the point of the projectile, and a secondary or wind cap, the rear portion of which is seated in said reduced diameter

of the impact cap, the combined impact and wind cap forming a composite contour-impact cap designed to reduce the resistance 15 of the air during the trajectory of the projectile without impairing efficiency for effecting penetration of armor.

In testimony whereof, I have hereunto subscribed my name.

EMIL GATHMANN.

Witnesses:

ISABEL GATHMANN,
MARK GATHMANN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
