No. 875,023. PATENTED DEC. 31, 1907.

C. VAN C. WHEELER & A. G. McKENNA.

PROJECTILE.

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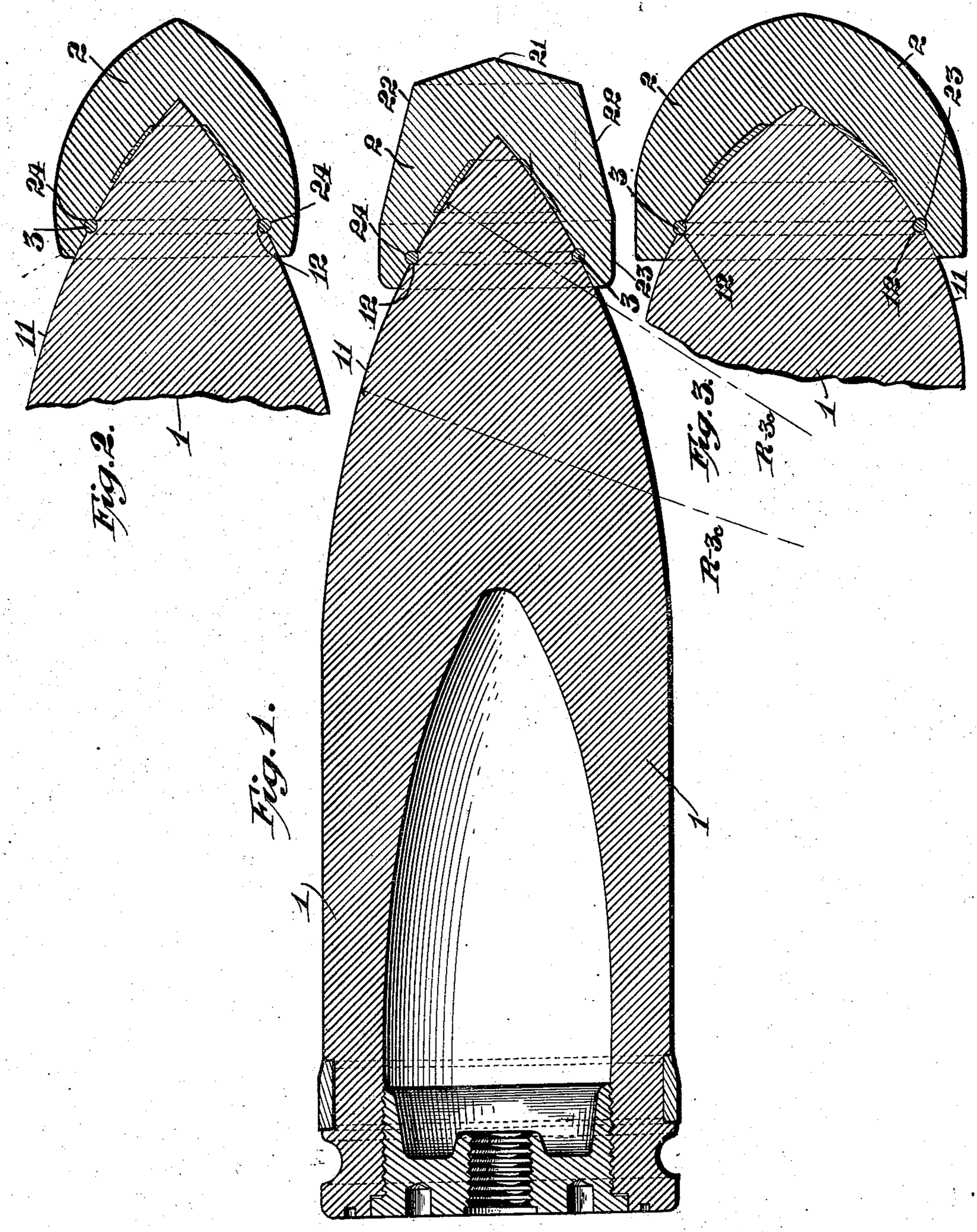

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UNITED STATES PATENT OFFICE.

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PROJECTILE.

No. 875,023. Specification of Letters Patent. Patented Dec. 31, 1907.

Application filed November 2, 1905. Serial No. 285,601.

To all whom it may concern:

Be it known that we, CHARLES VAN CISE WHEELER, a citizen of the United States, and resident of the city of Pittsburg, State of Pennsylvania, and ALEXANDER GEORGE McKENNA, a citizen of the United States, and resident of Braddock, Pennsylvania, have invented certain new and useful Improvements in Projectiles, of which the following is a specification, accompanied by drawings.

The invention relates particularly to capped projectiles.

The object of the invention is to improve the penetrating power and range without weakening the shell.

The invention is also applicable to a certain extent to dummy or practice shells having the same contour, the same weight and same location of the center of gravity and preferably also the same distribution of mass in all respects as the capped shell but made or cast in a single piece and not hardened or finished with the same nicety as the armor piercing shell but designed to have exactly the same range and trajectory as the armor piercing shell, thus indirectly involving as an imitation the same distribution and consequently the same problem as regards shape required to penetrate as the armor piercing shell. It is known that a cap of relatively soft steel increases the penetrating powers of the projectiles, and it has been supposed by some persons highly skilled in the art, that this was caused by reason of a lubricating action of the soft metal. Other persons have assumed that it was caused, at least partly, by the lateral support which the cap gives to the tip of the shell at impact. A third theory advanced but apparently since abandoned, is that the cap assists in penetrating because it makes impact with the plate slightly before the projectile and depresses the plate by its momentum, so that the tip of the projectile shall attack the plate at a moment when the resisting powers of the plate are lessened. In the attempt to test this last theory and possibly to improve the penetrating powers of the capped projectile, tests were carried out under the auspices of the United States Government, with an elongated cap which, by reason of its length and the position of its center of gravity well in front of the tip of the projectile, should deliver its blow further in advance and allow additional time for the elastic yielding of the plate before the projectile tip should reach it. It was hoped that this would in effect correspond with the delivery of two successive blows, and to increase this effect, tests were tried with a cap, the forward end of which was hollow so that the first blow would be caused by the hollow portion, succeeded by an increase of pressure upon the plate immediately thereafter produced by the heavier solid portion of the cap, before the hard tip of the projectile reached the plate. These tests, however, caused the abandonment, or suspension, of any attempt to so modify the cap.

The present invention is based upon a discovery that was made by us and brought about by tentatively adopting the hypothesis that it is not so much the time interval that is important between time of the blow struck by the cap and the blow struck by the projectile, but rather the relative momentum of the two bodies and their relationship to the inertia of the plate. The center of gravity of the present standard cap is not far from the tip of the shell itself and the blow delivered by the cap cannot therefore much precede the impact of the tip of the projectile itself. If the shell point should strike the plate as the plate is moving backward with the momentum derived from the cap, this should produce a greater disruptive and penetrating effect upon the plate than if the shell were to strike the plate when already dished or forced back by the mass of the cap. Notwithstanding therefore that it had been shown that an increased weight and prolonged length of cap was entirely unsuccessful, we conducted tests to discover whether or not a change in the relation of the force of the blow delivered by the cap to the blow delivered by the projectile without any material change in the times of delivery of these blows would improve the penetrating powers of the combined cap and projectile.

A series of successful experiments was made with caps of a size and weight much greater in relation to the weight of the shell than was considered practicable before our

invention. The penetration of the shells so capped was greatly increased. While the most advantageous relative weight of the cap and the shell were found to vary to some extent with the size of the shells, we adopted as a minimum formula $C=\frac{2\,W+400}{100}$, C being the weight of the cap and W that of the uncapped shell, both weights being expressed in pounds. Our experiments satisfied us that this minimum cap weight could well be exceeded fifty percent. in large shells; the surprising result being that the increase in the weight of the cap far beyond the necessities of mere lubrication and mere mechanical lateral support of the tip at impact, with the compensating loss of weight in the shell itself, improves instead of detracts from the penetration of the shell, notwithstanding that the *vis viva* of the hard shell itself is materially lessened. Further experiment however indicated that these heavy caps as first tried by us, and of the ordinary outline substantially cylindrical for the greater part of their length, were open to the objection of somewhat reducing the distance or range to which the shell could be thrown with a given initial velocity. We then adopted a hypothesis that it was not the displacement of mass or center of gravity but more the effect produced in the contour that detracted from the range, and proceeding and experimenting on such lines we have invented an improved cap and capped shell and corresponding dummy shell, as follows: We have devised a cap which in its best form is not less than the minimum relative weight given above, and is of frusto-conical or other taper form for at least the greater part of its length and we have found that this form of heavy cap is of particular advantage in combination with a shell having a long ogival point, say, with a radius of longitudinal curvature between 2.25 and 4 times the caliber of the shell and preferably 2.5 times such caliber, as pointed out in U. S. Patent No. 721,487, granted to us and dated March 24, 1903.

In the accompanying drawings Figure 1 represents in longitudinal section a shell with a cap embodying our invention. Figs. 2 and 3 represent modified forms of both the shell point and the cap.

Referring to Fig. 1, 1 designates the body of a shell of which 11 is the point. 2 is the cap shown as having the usual blunt point 21, tapered or conical portion 22, and cylindrical rear end 23. The cap 2 is shown as secured to the shell point 11 by means of a curved rod 3 occupying registering annular grooves 12 and 24 on the shell and cap respectively. This manner of securing the cap on the shell is described in U. S. Patent No. 748,827, granted on our application and dated Jan. 5, 1904. It is obvious that any other method may be employed if it provides the requisite security of attachment of the cap to the shell.

In Fig. 2 the shell is of the form shown in Fig. 1, the cap being approximately semi-elliptical in longitudinal section. Fig. 3 shows a shell of shorter tip, and a cap of a somewhat similar outline. The mass of the cap is in both cases within the limits above given.

We make no separate illustrations showing the application of our discovery to dummy or practice shells since these may be similar in all respects with the exception that they may be finished with less accuracy and less consequent expense, or indeed may be cast with the cap and shell in one piece; in which latter event the cap cannot be weighed, but its weight can be calculated from its contour and section on the assumption that the contour of the ogival point of the shell proper extends into the cap precisely as it does when the shell and cap are separate and distinct.

It is of course understood that we do not give our theories as to the cause of the better effect of impact as being anything more than hypotheses, but ample and repeated tests have demonstrated the superior penetration and greater range of our shell with heavy cap. Other tests have as clearly shown that the heavy cap of frusto-conical, or tapered form does not diminish the effective range of the shell.

What we claim is:

1. A projectile having a cap of a weight not less than $\frac{2\,W\,+\,400}{100}$ (W being the weight of the uncapped projectile and the weights being expressed in pounds.)

2. A shell having a cap of a weight not less than $\frac{2\,W\,+\,400}{100}$ (W being the weight of the uncapped projectile, the weights being expressed in pounds) and of frusto-conical form.

3. A shell having a point the radius of curvature of the base portion of the point of which is not less than 2.25 times its caliber surmounted by a cap of a weight not less than $\frac{2\,W\,+\,400}{100}$ (W being the weight of the uncapped projectile, the weights being expressed in pounds) and of frusto-conical form.

4. A shell having a point the radius of curvature of the base portion of the point of which is not less than 2.25 times its caliber surmounted by a cap of a weight of not less than $\frac{2\,W\,+\,400}{100}$ (W being the weight of the uncapped shell, the weights being expressed in pounds) and gradually tapered from rear to point.

5. A capped projectile combining an armor piercing projectile and an attached cap upon the point of the said projectile, the said cap exceeding the weight $\frac{2\,W + 400}{100}$ where W is the weight of the uncapped projectile, whereby the momentum of the said cap at impact substantially in advance of the projectile itself may materially affect the resisting powers of the plate to the projectile in contradistinction to the heretofore known or assumed effect of lubrication.

In testimony whereof we have signed this specification in the presence of two subscribing witnesses.

CHARLES VAN CISE WHEELER.
ALEXANDER GEORGE McKENNA.

Witnesses:
E. B. WHEEDEN,
F. G. HARRISON.