F. O. HOAGLAND.

PROJECTILE.

APPLICATION FILED JULY 18, 1913.

1,149,830. Patented Aug. 10, 1915.

Fig. 1.

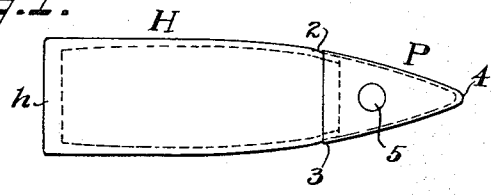


Fig. 2.

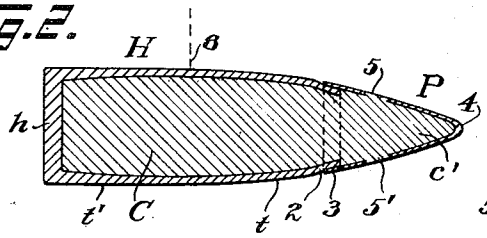


Fig. 6.a

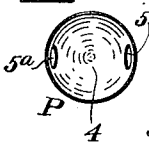


Fig. 6.

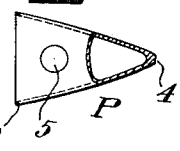


Fig. 3.

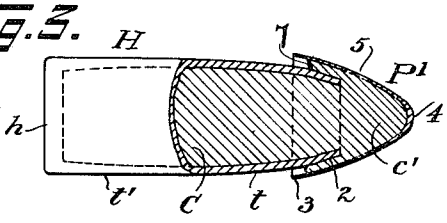


Fig. 7.

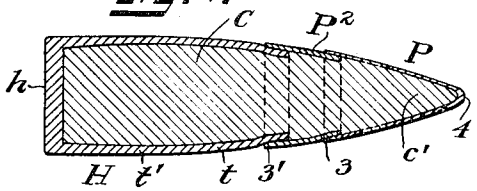


Fig. 4.

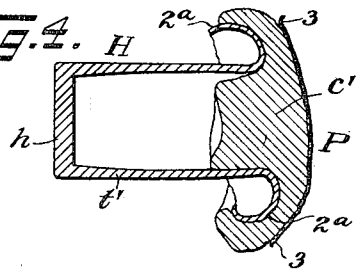


Fig. 5.

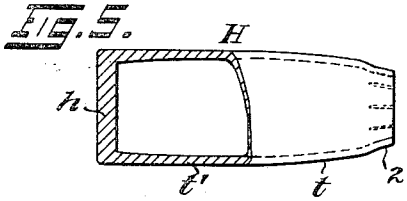
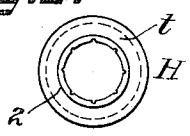


Fig. 5.a



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UNITED STATES PATENT OFFICE.

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PROJECTILE.

1,149,830. Specification of Letters Patent. Patented Aug. 10, 1915.

Application filed July 18, 1913. Serial No. 779,657.

To all whom it may concern:

Be it known that I, FRANK O. HOAGLAND, a citizen of the United States, residing in Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

This invention relates to projectiles of the general class known as expanding bullets,—also sometimes designated as "mushrooming" bullets,—and relates especially to such bullets for use in small-arms.

A principal object of my present invention is to furnish a projectile or bullet of that class, which shall be adapted to be made of small diameters and elongated form, and capable of being fired at high velocities without prematurely breaking up, while readily expanding, or "mushrooming" in an effective manner when meeting any considerable resistance.

While my present improvements are particularly applicable to bullets having their points of the elongated style and form herein illustrated, they are also adapted for use in bullets of varying styles and proportions, and to such bullets of various sizes. Heretofore in this art, bullets of an elongated form have sometimes been so made as to be crushable at the point-end, and thus become distorted and irregularly enlarged, but without a substantial reformation to a larger size, and without eliminating or materially reducing the normal tendency,—particularly when using high-power explosives,—of the crushing action to break up and scatter the core-metal. It is therefore an object of my present improvements to avoid those objectionable results, by furnishing an improved projectile construction, as hereinafter more fully explained, whereby the rearward part of the core-metal may flow forwardly during the period of target-resistance, out of the base-tube portion of a main core-case and become joined and incorporated with the more forward portion of the core-metal, and thereby transform or reshape the core into a relatively compact and tenacious mass or bullet-head of a much larger diameter and located forwardly of the re-formed base-tube.

In the accompanying drawing forming a part of this specification, I have illustrated my present improvements as applied in a preferred form thereof to a rifle bullet of a well-known elongated and pointed style or form usually made in sizes ranging between two-tenths and four-tenths of an inch in diameter.

In the drawing, Figure 1 is a side view, on an enlarged scale, of such a projectile or bullet for small-bore rifles, and made in accordance with my present invention and having the multi-part core-casing made with only two parts. Fig. 2 is a sectional side view, and is drawn in alinement with Fig. 1, to facilitate comparison therewith. Fig. 3 is a similar side view, but drawn as a diagram, for illustrating in an approximate manner an early stage in the operation of the bullet when subjected to initial expansion by striking a yielding but resistant object. Fig. 4 is a similar diagrammatic view for illustrating a later stage of the operation. Fig. 5 is a side view of the jacket in a preferred form thereof, and with some portions broken away, while Fig. 5^a is an end view of the jacket as seen from the right hand in Figs. 1, 2, 3 and 5. Fig. 6 is a side view of the point-case in a preferred form thereof, and with a portion broken away, while Fig. 6^a is an end view of the point-case as seen from the left-hand in Figs. 1, 2 and 6, but with a portion thereof broken away. Fig. 7 is a modification in which the multi-part core-casing has three parts.

Similar characters designate like parts in all the views.

The shell or "jacket" of the projectile or bullet, is designated in a general way by H, and consists of a suitable tube, as *t*, shaped at its forward end to receive a point-case and preferably provided at its rearward end with an integral head as *h;* in some instances however, this disk or head, *h*, may be omitted. The jacket H may be made of various materials,—and produced by turning or drawing processes, as desired,—but I prefer to use therefor a mild steel or a suitable alloy.

The forward end, as 2, of the jacket H is preferably reduced in diameter to interlock the jacket with core C, and also to receive thereon the rearward edge 3 of the point-case P, which should fit closely upon said reduced end-portion 2 of the jacket, preferably about as indicated, at 2, in Fig. 2. This over-lapping zone of the core-inclosing

members H and P, is preferably located substantially midway of the pointed portion of the bullet, these being about the proportions selected for illustration herein. This arrangement of said over-lapping members is found in practice to effect a suitable apportionment of the core-metal quantities, as regards the advance portion located within the point-case P and the main body, as C, located within the shell or jacket H, and as regards the effectiveness of the expanding operation when the projectile strikes either a yielding or a highly resistant object or target. This arrangement provides for a longitudinal movement or telescoping action of the members H and P, (each relatively to the other, on the beginning of the flowage of any part of the core metal within said member P,) and therefore provides for an instant and a proper mode of action directly the point of the bullet meets with any considerable resistance.

The point-case member P may usually be made thinner than the tube or shell *t*, and may be made of a relatively softer material (of copper, if preferred), since in the final operation, it is deemed to be desirable for the expansion to begin in this cap piece P, before the open forward end, 2, of the tube *t* shall begin to give way. The member P, in the form thereof which I prefer, may have one or more side openings, as 5, 5', (see Figs. 1, 2 and 6), into which the core-metal may extend, and thus form an interlocking of the point-case P with the core C; thus the members H and P may be held properly assembled by the inter-engagement of each with the same core member, and without any direct interlocking of the member H with the member P. This arrangement has the advantage that it provides for a relatively free movement for a slight distance of the point-cap P on and rearwardly over the outside of the member H at the instant when the core-metal begins to flow, and before the said retaining devices,—in this instance the lugs or projections at 5, 5',—are disengaged or become ineffective. A further advantage is that in the manufacture of the projectiles, when the members H and P are pressed together in the assembling dies and over a predetermined size (or quantity) of core-metal, this metal flows out to form the lugs at 5 and 5', while the absence of any direct interlock of the parts H and P, permits these to be brought together to a distance which may vary sufficiently to secure a complete filling of the interior space, even when this space may vary somewhat in different projectiles. By this means the construction and assembling of the parts are reduced in cost while securing a highly reliable and uniform quality, and overcoming the risk of there remaining within the projectile any space not completely filled by the core-metal, which would, of course, unfavorably affect the "balance" and flight of the projectile.

The forward open end, 2, Fig. 2, of the jacket H being fitted closely within the rearward end 3 of the point-case P, when the bullet is going at high velocity and the point 4 meets any considerable resistance, the said jacket end 2 operates within the case-point and at first, after the manner of a piston, and thus tends to force the flowable-metal, at C', in the bullet-point forward and outwardly by this fluid-like action. Also, and at the same time, the forward outer zone at 2 of the tube *t* of the jacket, especially when made somewhat tapering as illustrated, naturally operates as a wedge to assist in effecting or inaugurating an initial expansive movement in the rearward part of the said point-case. These initial features of the "mushrooming" operation, tend to open out the point-case approximately after the manner indicated in the diagram, Fig. 3, and thereby form an annular outlet at 7, through which the inner metal may flow out, and thus permit a continuance (under a reducing speed) of the forward movement of the jacket H during the upsetting of the point case by the resistance at 4. Thus, at one stage of the operation, the metal in the point-core C', is resisted from the front by the crushing in of the point 4 of the point-case, while being driven forward by the pressure of the filled jacket H. During this time, as will now be evident, the point-case will normally be rapidly expanded in advance of the expansion of the main core-casing H, into a broader cup-shape,—or "umbrella" form,—while the jacket itself is rapidly retarded in velocity. But the jacket being of relatively stable metal, while its core C is relatively fluid in character (after the manner of lead or soft alloys), this core C tends to continue its forward movement, and so flows forward and outward around the jacket-end, and then backward to thus form a substantial enlargement, or "mushroom" about such, for instance as described in connection with Figs. 3 and 4. By reason of the described re-forming of the said point-case P,—by the opposing forces and the flowing core-metal,—into a guide-cup, as P', Fig. 3, of relatively shallow form and enlarged size, the flowing stream of metal normally attains great force during the medial stage of the expanding operation (Fig. 3); with the result that after this operation is well advanced, the forward end of the jacket itself usually and naturally will be turned outwardly by such high-pressure stream or flowage of the core-metal and then will be curled or turned backwardly (see 2ª, Fig. 4), thereby forming an enlarged forward end on the jacket for assisting in maintain-

ing the re-formed core-metal in a compact mass, and in driving forward this re-formed mass by the combined force or momentum of that mass and of the jacket, while, at the same time, preventing the jacket from being driven through the re-formed core-metal and thus break up the bullet or reduce the effectiveness of the action and the shock of the impact. In order to further insure a proper operation in these respects, the jacket H, (see Fig. 2) is preferably made with base portions t' and h of an increased stability relatively to the stability of the forward end 2, so that the powder-pressure and the relative fluidity of the core-metal will not deform the base of the jacket, and so that this base-portion will stay intact and thus operate as an impelling member for the expanded forward end 2^a during the described reshaping of the same.

The advantage of a bullet having relatively large diameter, because of its greater "stopping effect," is well-known, while the use of a small caliber to secure a long range, is now regarded as a necessity. It is, therefore, one object of my present invention to secure the greater stopping effect of the larger bullet while retaining the small caliber. For this purpose the small-caliber projectile is made of a composite construction and is so organized,—as elsewhere herein explained,—that during its rapid retardation by the resistance of a target or other object, the projectile will be expanded or re-formed in a regular and effective manner into a much larger diameter. Thus, the projectile acts at first chiefly as a piercing instrument and during retardation becomes enlarged and so exerts a more destructive pressure or force over a greatly increased area.

In the operation of re-forming the projectile, this is accomplished,—as will now be evident,—by the direct-action of the target-resistance (this being applied mainly in a direction longitudinally of the core) combined with the outwardly-acting flowage-pressure of the core-metal within the point-tube, this pressure being, of course, developed by the target-resistance in proportion to the momentum and rate of retardation. These forces operate within and relatively to the point-tube which,—for this purpose,—should have a metal-status or character made up of,—or comprising,—the features of shape, size and ductility or temper, and be so proportioned that the out-spreading action extends initially around the circumference of the tube while beginning at its forward end, and thence proceeds in a progressive manner toward the base-tube. Thus the core-case is re-formed for supporting the re-formed core-metal, while the core itself,—including that part of it within the base-tube,—is simultaneously re-formed, or transformed, into a bullet-head of larger diameter located forwardly of the base-tube, and is supported by and against the original point-tube now out-spread as a backing therefor. In practice the metal-status and the proper proportioning of the point-tube may be readily ascertained and brought to a proper relation by the usual methods of trial and measurement, having in view the size and weight of the projectiles and the powder pressures and ranges to be employed in any given instance. During the time while the core metal flows forwardly out of the base-tube t' (see Fig. 4) the metal between the then reforming forward part of the main core-case, (as indicated at 2^a, Fig. 4) and the spread-out point-cap 3, will be rapidly flowing outwardly while integrally connected with the core-metal that is moving forwardly within and relatively to the said base-tube t', so that while the rearward part of the core-metal is normally carried forward by its own momentum it is also being drawn forward (by means of said integral connection) by the pull of the said outwardly moving core-metal; thus the continuity of the core-metal in a single elongated core coöperates with other features, during the rapid retardation of the projectile by target-resistance, in securing the complete and proper reformation, or transforming, of the small-diameter small arms projectile into the enlarged form as herein set forth. And in this transforming of the entire elongated core into a broadened bullet-head, metal is supplied to the forming head at the rearward side thereof by drawing such supply from within the rearward part of the core-case, this action normally occurring during the later stage of the out-spreading of the point-portion of the main core-casing.

When the several members are organized in the particular manner herein illustrated, one feature of the operation, when the projectile strikes the target, is a telescoping action which takes place in the multi-part core-inclosing casing. This casing,—comprising a rearward casing member as H, and a forward casing-member as P (see Fig. 2),—has the further feature that from the point 4 and going rearwardly therefrom, its component members have an increasing resistance to reformation by pressure from within. These features being associated in one combination, results in a complex and progressive action whereby the initial expanding of the forward part C′ of the core is regulated by the telescoping feature, and whereby the expanding action is finally extended to nearly or substantially the whole mass of the projectile. For further modifying and regulating these functions and results, the core-casing may in some instances be made up of a plurality of more than two

members, one such arrangement being shown in Fig. 7, in which the base member H and the point member P are joined through the intermediate band or ring P^2. When the member P^2 is made to have a low resistance and is made of ductile metal, it is evident the flowage of the core-metal will be regulated in a modified manner. In effect, the parts P and P^2 constitute one multi-part point-case, as regards the combinations specifying a two-part core-casing.

In applying my present improvements to the particular kind of expandible projectile shown in the drawing, I prefer to make such a reduction in diameter of the forward end of the main core-container or core-case H, as will bring the cross-sectional area at the telescoping zone 2, to a substantially smaller size, preferably about one-half of the area of the base-portion of said main-core casing. These approximate proportions, when taken in connection with the substantially conical construction of the telescoping portions of said members H and P in said zone 2, and in connection with a relatively high resistance to deformation of the member H and the relatively low resistance to deformation of the member P,—especially when the elongated soft-metal or flowable core C is made of lead or of an alloy nearly all lead,—result in a mode of action which I find, in practice, to be particularly reliable and regular under service conditions. Also, in this style of elongated projectile, I make the casing H substantially double the length of the point-case P, while the member P is about or substantially one-half the total length of the reduced or curved point-part, this extending from the projectile point 4 rearwardly to about 8, near the middle of the member H. Thus, in this preferred specific construction, the point-case P extends back to the middle of, or about midway of the point-curve, or point-portion as indicated by the line 2—3, Fig. 1, and at that point or zone has about one-half (preferably from forty to sixty one-hundredths) the cross sectional area of the rearward end of the casing H. In some cases, however, the point-curve may be from one-half to three-fourths the length of the projectile, and the two parts of the core-casing may join where the cross-sectional area of the projectile is substantially smaller than the base portion thereof. This construction gives favorable ratios as between the several members and their principal dimensions, and secures a proper "balance" of the projectile, while giving suitable proportions for the flowable core and providing for a sufficient expansion which will begin in a proper location and thence proceed in a relatively regular and uniform manner. In some instances, the elongated point-portion, as from 4 to 8, Fig. 2, may be conical or ellipsoidal, or be of a variable curvature, but I prefer a substantially circular curvature, about such as illustrated in the drawing, unless the projectile shall be made of a different style or considerably modified in its proportions.

The forward end of the casing-part H being largely reduced as at 2, preferably to about one-half of the cross-sectional area of the base portion, h, is so increased in resistance by this means and by the overlapping of the edge 3 of the cap P, as to delay the outward turning over of that reduced portion at 2, until a moment later than the initial expansion of the said edge-portion 3, (see Fig. 3) and until after the outflowing action of the core-metal has been inaugurated. After this, the shortening of the casing-part H by the continued outward flaring of its forward end, takes place concurrently with the continued out-flowing of the core-metal, and while this metal by its outward force operates against the outspreading end of the casing H (see Fig. 4) to increase the area of resistance for stopping the projectile. Thus the core-metal and the casing member H are re-formed in such a manner as to have the effect of a projectile of an enlarged size. And owing to the organization set forth the projectile is adapted for effective use at widely varying ranges, and with widely varying velocities.

The particular means herein illustrated and described as being one way for securing the point-cap P upon the core C, and which consists of the holes 5, 5′, in said cap and the core-metal projections extruded from the core and filling said openings, constitutes in part the subject-matter of a separate application, concurrently pending herewith, and to which reference may be had.

Having thus described my invention, I claim:—

1. In an expandible projectile, the combination of a two-part telescoping core-casing having a point-case extending rearwardly outside of the forward end of a main core-casing and a core filling the casing and having a separate interlocking engagement, respectively, with each part of the casing.

2. In an expandible projectile, the combination with a two-part telescoping core-casing having the forward part extending rearwardly outside of the rearward part and arranged for expansion in advance of the rearward part, of a core filling the casing and fixedly-connected directly with each part of the core-casing, whereby the two parts of the core-casing are held assembled by the core.

3. In an expandible projectile, the combination with a tubular main core-case, of the core having its point extending beyond said core-case, and a point-case covering the core-point and having its rearward end extending rearwardly outside the forward end of

said main core-case, substantially as described.

4. In an expandible projectile, the combination with the soft-metal core having a body-portion and a point-portion, of a main core-case extending over the body portion of the core and having a relatively high resistance to deformation, and a co-acting point-case covering the point-portion of the core and expandible forward of said main core-case and having a relatively low resistance to deformation.

5. In an expandible projectile, the combination with the integral soft-metal core having a body-portion and a point-portion, of the relatively high-resistance tubular casing for the main portion of the core and having a reduced forward end, and a relatively low-resistance point-case covering the point of the core and having its rearward end located in position for coacting with said reduced forward end of the high-resistance casing on the initial deformation of the core.

6. In an expandible projectile having an elongated point-portion, the combination with the core, of the main core-case containing the rearward end of the core and extending forwardly to a point about midway of such point-portion, and a point-case inclosing and thereby reinforcing the point of the core and also inclosing the forward end of said main core-case.

7. In an expandible projectile of the class described, the combination, with an integral soft-metal core, of a two-part deformable core-casing having a reduced point-portion more than one half the length of the projectile, and having the two parts of the casing with the forward part extending rearwardly outside of the forward end of the main core-casing at a point about midway of the length of said point-portion and having said casing parts proportioned for the forward part to expand earlier than the rearward part when the metal of the core is subjected to flowage, substantially as described.

8. In an elongated projectile of the class described, the combination with a soft-metal core, of a two-part core-casing having a reduced point-portion between one-half and three-fourths of the length of the projectile, and having the two-parts of the casing with the forward part over-lapping outside of the rearward part, at a point about mid-way of the length of said point-portion, and having such overlapping part located where the cross-sectional area of the core is substantially smaller than the base portion thereof.

9. In an elongated projectile, of the class described, the combination, with a soft-metal core, of a two-part core-casing having a point portion between one half and three fourths the length of the projectile, and comprising a main core-casing reduced at its forward end to a cross-sectional area of or between forty and sixty per cent. of that of the base portion thereof, and a point-casing having its rearward end larger and adapted for overlapping the reduced forward end of said main core-casing, whereby said casing members, when the projectile is expanded by a target resistance, have in connection with the flowing metal of the core, a telescoping co-action which begins in a location about mid-way of the point-portion thereof.

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