Nov. 2, 1943. V. N. CRASNOFF 2,333,091

EXPANDING PROJECTILE

Filed March 29, 1940

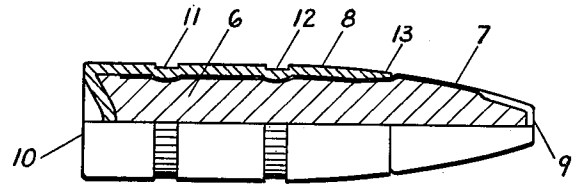


Fig. 1

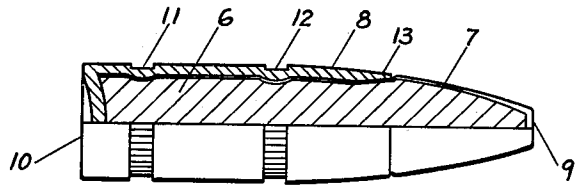


Fig. 2

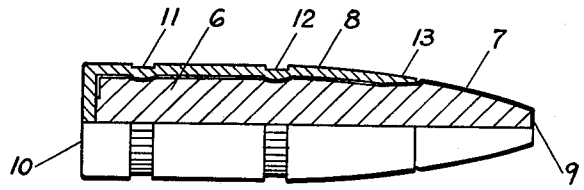


Fig. 3

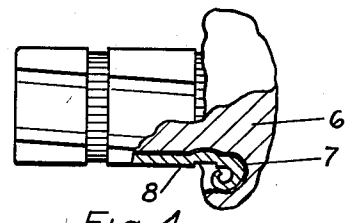


Fig. 4

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EXPANDING PROJECTILE

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12 Claims. (Cl. 102—91)

This invenion relates to projectiles of the expanding or mushroom type and in particular to projectiles adapted for use in high power rifles.

Expanding or mushroom projectiles are generally constructed with a core of lead, or other soft metal, and are designed to deform by spreading out or flattening in the forward portion when they encounter the resistance offered by the objective, thus increasing the effective area and destructive action of the projectile. Projectiles of this type are most effective when such deformation occurs within the objective itself, since less effective wounds generally result when the expansion occurs immediately upon impact, causing a superficial injury, or when the projectile passes through the objective without expanding.

Such projectiles are usually known as "soft point," when the rear portion of the soft metal core is covered by a hard metal jacket and the soft metal forming the nose of the projectile is left exposed, or as "hollow point," when the nose of the projectile is hollow, slit, or similarly weakened. In order to prevent deformation of the exposed soft core metal in the handling incident to manufacture and use, some expanding projectiles have been provided with tip jackets. Such tip jackets have been so constructed as to avoid any delay in the mushrooming action of the projectile upon impact with the objective by employing such expedients as weakening the tip jacket with grooves, slits, and the like, and by so forming the projectile that the tip jacket separates from the base jacket at the time of impact with the objective.

Expanding projectiles designed for use in high velocity ammunition have been constructed with increased resistance to deformation, brought about by such expedients as providing "soft point" bullets with only a small exposure of the soft metal in the nose, or "hollow point" bullets with only a small opening in the nose, or providing soft-cored projectiles with non-expandible tip jackets, belts, and the like, or by increasing the hardness of the core material.

However, bullets of such prior construction all have in common the disadvantage that for each given construction, the range of effective impact velocities is rather small, and consequently, the range of effective shooting distances is likewise small, since the impact velocity varies with the shooting distance.

This is indeed a serious disadvantage since it is now possible with high velocity ammunition and improved sighting equipment, to shoot accurately with the high power rifles over a range of distances much greater than the range in which such projectiles are effective. A given projectile of such prior construction, designed to expand at certain impact velocities will pass through the objective without expanding at appreciably lower impact velocities, thus expending only a small portion of the stored-up energy within the objective itself, or at appreciably higher impact velocities the projectile will expand too quickly, thus expending a greater part of the stored-up energy in the formation of a superficial wound without penetrating into the vitals of the objective.

A further disadvantage with projectiles of such prior construction is that when the projectile strikes a twig, small tree branch, or similar accidental minor resistance in its trajectory, it expands or disintegrates and, as a result, fails either to reach or penetrate the target. Consequently, the shooter is very much handicapped in shooting through brush, thickets, or the like.

One of the objects of this invention, therefore, is to provide an expanding or mushroom projectile so constructed as to be effective over the entire range of distances in which it is possible to shoot accurately with the modern rifle.

Another object of this invention is to provide an expanding or mushroom projectile so constructed as to temporarily delay the spreading or expanding action at the time of impact with the objective.

Another object is to provide such a projectile having a double jacket constructed and arranged to facilitate the rapid expansion of the forward portion or the point of the projectile after the complete entry of the projectile into the objective.

Another object is to provide such a projectile effective over a wide range of impact velocities, that is, effective over a wide range of shooting distances.

Another object is to provide such a projectile which, although having a soft core, is provided with a tip that is resistant to deformation when subjected to the usual handling incident to manufacture and use, or when striking an accidental minor obstruction in its flight to the target.

Further objects will appear from the description, taken in connection with the accompanying drawing, in which—

Figures 1, 2, and 3 are side views partly in section of certain projectiles embodying this invention.

Figure 4 is a side view partly in section showing the form taken by the projectile after impact.

In accordance with this invention, projectiles having the desired characteristics of expanding properly to mushroom shape at high impact velocity and likewise over a wide range of impact velocities, are secured by enclosing a soft metal core in a novel type of double jacket. An envelope or tip jacket of suitably hard resilient metal covers the forward portion of the core, while a second jacket, which is relatively strong, covers the base of the projectile, extends over the envelope and covers all but the forward portion or nose of the projectile.

The function of the tip jacket is to provide a decreased rate of, or temporary delay in, the expansion of the core on impact with the objective. This is accomplished by virtue of the strength and resilience of the envelope and by the fact that the two jackets are so joined or interlocked as to prevent a separation of the tip jacket from the base jacket upon impact with the objective. Although the point of the projectile is gradually deformed or bulged out in penetrating the objective, the jackets do not separate upon impact, and actual mushrooming does not occur until sufficient pressure has been built up in the underlying core, due to the resistance encountered, to rupture the tip jacket on the nose of the projectile. Thereupon, the core material rapidly spreads out to give the desired mushroom shape.

Satisfactory mushrooming action is accomplished at both high and low impact velocity, since a period of penetration is provided during which sufficient pressure builds up in the core to rupture the tip jacket and after the tip jacket is ruptured, a large portion of the soft core is exposed so that the projectile is mushroomed even at relatively low impact velocity. The base jacket, because of its relative rigidity, limits the degree to which the projectile expands. However, in the process of mushrooming, the front end of the base jacket is rolled back into a curl to form a supporting shoulder for the expanded soft core metal.

Referring to the accompanying drawing and more particularly to Figures 1, 2, and 3, a projectile embodying this invention is adapted for use in high power rifles and, accordingly, may have any desired suitable profile or shape, such as conoidal, ogival, blunt, round, pointed, or semi-pointed, but has the construction hereinafter described.

The core **6**, preferably having a narrowed or tapered forward portion, may be formed of any suitable material, such as lead, lead alloy, or material capable of deformation in a similar manner. The tip jacket **7** covers the forward portion of the core **6** and extends from the point **9** toward and preferably to within less than a caliber of the base **10**, or, if desired, it may extend onto the base **10**, or may even completely cover the core. This tip jacket is formed of material harder than the core, such as drawn copper, copper alloy, or other material having suitable resilience and hardness, and is of sufficient strength to delay expansion upon impact with the objective even though the core, being of lead or like material, is soft and malleable.

The base jacket **8** covers the base **10** and rear portion of the projectile, overlaps the tip jacket **7** and extends forward preferably to the narrowed portion of the tip jacket, a large portion of the tip jacket remaining exposed. The base jacket is formed of copper, copper alloy, or other suitable hard resilient material. The base jacket **8** is preferably chamfered at the open end **13** and may, if desired, be provided with one, or more, circumferential grooves **11** and **12**, or any other suitable indentation, which may be employed, for example, to retain a lubricant, or to provide a place for fastening the projectile to the shell case, as by crimping, or, when extended into the tip jacket and core, may serve to interlock the jackets and core more securely.

The base jacket, overlapping the tip jacket, is preferably extended only just past the point where the projectile starts to narrow in the forward portion, so that a relatively large portion of the tip jacket is left exposed. However, the base jacket should be thick and hard enough and should extend sufficiently forward to prevent the exposed tip jacket from engaging, or coming in contact with, the rifling of the gun barrel.

In order to obtain the desired delay in expansion and to prevent the projectile from mushrooming too quickly as a result of a separation of the two jackets upon impact at high velocity, the tip jacket is extended under the base jacket almost to the base of the core and, as stated above, may even overlap the base or completely cover the core. However, a somewhat shorter tip jacket may be used if some equivalent means of joining or interlocking the tip jacket to the base jacket, for instance, by soldering, welding, and the like, is employed to prevent them from separating upon impact.

The thickness of the two jackets may be varied to secure the desired results in accordance with such variables as the range of impact velocities in which it is required that the projectile be effective, the weight of the projectile, the surface of tip jacket exposed, the profile of the projectile, and the material from which the jackets are formed. For instance, thinner tip jackets may be employed when operating over a range of low impact velocities, or when a smaller surface of the tip jacket is exposed, or when the nose of the projectile is more pointed. Likewise, as the weight of the projectile is increased and the hardness and resilience of the material from which the jackets are made is decreased thicker jackets may be employed.

Some of these variables may be changed so as to have a compensating effect, thus not requiring any change in the thickness of the jackets. For example, in practice, instead of increasing the thickness of the jackets, when the weight or velocity of the projectile is to be increased, the same result may usually be accomplished by changing the profile, since a thinner tip jacket may be employed with a more pointed profile. Further, it is not essential that the jackets be of uniform thickness throughout. For instance, it may be desirable in some cases to have the tip jacket thicker on the forward portion of the nose than on the body of the projectile, and the base jacket may be thinner in the forward portion than it is at the base of the projectile.

In every case, however, the tip jacket should be thick enough and have sufficient strength and toughness to prevent splitting and tearing of the jacket immediately upon impact with the objective. Likewise, the tip jacket should be formed of material sufficiently ductile to permit upon compression a gradual bulging of the nose of the projectile before the jacket itself is split.

In order to illustrate a specific embodiment of the invention, following is a detailed description of a .300 H & H Magnum 180 grain bullet which has been found to have entirely satisfactory

mushrooming characteristics. A rough lead slug cast in a mold was swaged with a punch and die to the profile and weight desired to form the core. The tip jacket was formed by punching a cup from a metal sheet of copper alloy, composed of about 72% copper, 18% nickel, 9.25% zinc, and 0.75% manganese. The cup was then drawn in several stages with suitable intermediate annealing to a sidewall thickness of about 0.0075 inch, and a bottom thickness of about 0.020 inch. After the last drawing step, the cup was trimmed to the desired length so as to cover the core almost to the base and it was then annealed to an average grain size of 0.02–0.04 mm. The swaged lead core was then assembled in the drawn tip jacket and the assembly pressed in a die to the desired shape.

The base jacket was formed by punching a cup from a metal sheet of copper alloy composed of about 90% copper, 9.25% zinc, and 0.75% tin, and the cup was then drawn in several stages, with suitable intermediate annealing, to a thickness of about 0.030 inch. In the last drawing step the cup was chamfered at the mouth and then trimmed. The assembled core and tip jacket were then inserted in the base jacket and the assembly was pressed in a die to impart the desired profile to the projectile.

The base jacket was then cannelured, thus providing the projectile with two separately spaced circumferential grooves extended into the thin jacket and core in that portion of the projectile in which the base jacket and tip jacket overlap. As a final operation, the projectile was then sized to insure uniformity of diameter by passing it through a die. The assembled projectile was approximately $1\frac{3}{16}$ inches long, the base jacket extending up the projectile for $\frac{27}{32}$ of an inch. The exposed portion of the tip jacket was $\frac{11}{32}$ of an inch long, the tip being finished with a flat portion about $\frac{1}{16}$ of an inch in diameter.

It should be noted that the tip jacket is relatively thin having a wall thickness substantially less than 0.020 of an inch and that the base jacket having a thickness greater than 0.020 of an inch is substantially thicker than the tip jacket. Further, the base jacket overlaps the tip jacket, covering a large portion of the soft core with two jackets of relatively hard material while leaving a large portion of the tip jacket exposed. The projectile provided is of relatively simple construction and can be manufactured with little difficulty at low cost.

The effect and performance of the projectile are outstanding indeed. Referring to Figure 4, which shows a side view partly in section of the projectile of Figures 1, 2 and 3 after having been fired into a relatively soft objective, such as the flesh of an animal, at an impact velocity of 2500 feet per second, it will be seen that the rear portion of the projectile is substantially unchanged, whereas, the forward portion of the core 6 has been spread out substantially without disintegration into the shape of a mushroom similar to that assumed by the usual soft nosed bullet when fired at low velocity.

Due to the effect of the double jacket there is a tendency for the base jacket 8 to roll back without splitting from the open end 13 into a curl which forms a supporting shoulder for the expanded core. Such rolling action, which is not obtained with the usual jacketed mushroom bullet, is facilitated by providing a chamfer at the open end 13 of the base jacket, or, for instance, by annealing the jacket at this point, if it is formed of copper or copper alloy, in order to soften the metal. In the usual mushrooming bullet the base jacket splits into strips which are torn away from the projectile, thus leading to excessive disintegration of the bullet and making it less effective. Generally a smaller percentage of the weight of the projectile of this invention is lost after impact than is the case with the usual "soft point" or mushrooming bullet in which the base jacket splits or is detached from the core upon impact with the objective.

In contrast to expanding projectiles of prior construction designed for use in high velocity ammunition, in which the means employed for aiding penetration offers a more or less permanent resistance to expansion of the projectile, the projectile provided herein gives the desired penetration but the means employed for resisting expansion is only temporarily effective, the delay in expansion being terminated by the bursting of the tip jacket, so that thereafter the projectile is rapidly deformed to mushroom shape.

Thus, the projectile provides the advantages of a "soft point" bullet having a large area of the soft core exposed, without the attending disadvantages. The delayed expansion or reduced rate of expansion depends on the retention of the soft core material within the jackets until the tip jacket is ruptured or split. When the projectile is fired into a relatively soft objective, such as a game animal, the relatively thin tip jacket delays expansion until the projectile has penetrated through the thick hide and muscle tissue. During such penetration the internal pressure from the gradually compressed core causes the nose of the projectile to bulge out or swell. However, since such projectiles are usually narrowed, or tapered, in the forward portion, such bulging of the tip jacket does not appreciably increase the original diameter of the projectile and consequently the projectile does not lose much of its energy for about the first two inches, or so, of penetration. However, as the internal pressure from the compressed core material is increased, the tip jacket is ruptured, the soft core material rapidly spreads out and the projectile assumes the desired mushroom shape, thereby greatly increasing its effective area.

Thus, the greater part of the energy stored up in the projectile is utilized while the projectile is in its expanded form in the interior of the objective. As the projectile expands, the pressure transmitted to the base jacket causes the latter to curl back at the rim, thus forming a strong supporting shoulder for the expanded portion of the soft core material, and greatly increasing the destructive action of the projectile.

The exposure of a large portion of the soft core, after the tip jacket has been ruptured, causes the forward portion to expand even at low velocity in a manner very similar to that of the usual soft nose bullet. At both high and low velocity, however, the degree of expansion is limited so that the bullet is deformed to mushroom shape. For instance, the projectile described in the specific example above, when fired into a relatively soft objective, has been found to give effective mushrooming action at impact velocities ranging from about 3000 feet per second to 1950 feet per second, thus corresponding to shooting distances of from about 25 yards to 400 yards.

This invention accordingly provides expanding projectiles of simple and sturdy construction, so designed as to display effective mushrooming action, within the body cavity, after penetration of

the hide and muscle tissue of game animals, over a wide range of impact velocities. The construction by means of which this delayed expansion is secured furthermore tends to prevent mechanical deformation of the projectile during handling such as frequently occurred with the prior "soft point" bullets. Furthermore, the projectile is not upset in flight by twigs and the like.

It is to be understood that the embodiment of the present invention as shown and described are only illustrative, and that the scope of the invention is not to be limited thereby except insofar as is defined in the following claims.

Having thus described the invention what is claimed is:

1. An expanding projectile comprising a core of soft metal, a thin hard metal tip jacket covering the forward end of said core and extended thereon toward the base of the projectile, said tip jacket having its entire inner surface in contact with said core and adapted to delay expansion of said core until the projectile has penetrated the objective, and a hard metal base jacket thicker than the tip jacket covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

2. An expanding projectile comprising a core of soft metal, a thin hard metal tip jacket covering said core, said tip jacket having its entire inner surface in contact with said core and adapted to delay expansion of said core until the projectile has penetrated the objective and a hard metal base jacket thicker than the tip jacket covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

3. An expanding projectile comprising a core of soft metal, a thin hard metal tip jacket covering the forward end of said core and extended thereon toward the base of the projectile, said tip jacket being completely filled by said core and adapted to delay expansion of said core until the projectile has penetrated the objective and a hard metal base jacket thicker than the tip jacket covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core and provided with at least one circumferential groove, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket on impact with the objective.

4. An expanding projectile comprising a core of soft metal, a thin hard metal tip jacket covering the forward end of said core and extended thereon toward the base of the projectile, said tip jacket having its entire inner surface in contact with said core and adapted to delay expansion of said core until the projectile has penetrated the objective, and a hard metal base jacket thicker than the tip jacket covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, and provided with indentations extended into the tip jacket core, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

5. An expanding projectile having a narrowed forward portion compriisng a core of soft metal, a thin hard metal tip jacket covering the forward end of said core, and extended thereon toward the base of the projectile, said tip jacket being completely filled by said core and adapted to delay expansion of said core until the projectile has penetrated the objective and a hard metal base jacket thicker than the tip jacket covering the base of the projectile and overlapping on said tip jacket and extended on to the said narrowed portion of the projectile leaving a large portion of said tip jacket on said core exposed, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

6. An expanding projectile comprising a core substantially of lead, a thin copper alloy tip jacket covering the forward end of said core, and extended thereon toward the base of the projectile, said tip jacket having its entire inner surface in contact with said core and adapted to delay expansion of said core until the projectile has penetrated the objective and a copper alloy base jacket thicker than the tip jacket covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

7. An expanding projectile comprising a core of soft metal, a copper alloy tip jacket having a thickness less than 0.02 inch covering the forward end of said core and extended thereon toward the base of the projectile, said tip jacket having its entire inner surface in contact with said core and adapted to delay expansion of said core until the projectile has penetrated the objective, and a hard metal base jacket covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

8. An expanding projectile comprising a core substantially of lead, a tip jacket substantially of copper having a thickness of less than 0.02 inch covering the forward end of said core and extended thereon towards the base of the projectile, said tip jacket being completely filled by said core and adapted to delay expansion of said core until the projectile has penetrated the objective, and a base jacket substantially of copper having a thickness greater than 0.02 inch covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, said jackets being interlocked and adapted to prevent the tip jacket from separating from the base jacket upon impact with the objective.

9. An expanding projectile comprising a core of soft metal, a tip jacket of resilient metal having a thickness less than 0.02 inch covering the forward end of said core and extended thereon toward the base of the projectile, said tip jacket having its entire inner surface in contact with said core and adapted to delay expansion of said core until the projectile has penetrated the ob-

jective and a hard metal base jacket having a thickness greater than 0.02 inch covering the base of the projectile and overlapping on said tip jacket and extended over a major part but not the whole length of the core, said jackets being interlocked and adapted thereby to prevent the tip jacket from separating from the base jacket upon impact with the objective.

10. An expanding projectile having a narrowed forward portion comprising a soft metal core, a hard metal tip jacket having a thickness of less than 0.02 inch filled by said core and extending thereon to at least within a caliber of the base of the core and a hard metal base jacket having a thickness greater than 0.02 inch overlapping on said tip jacket and extending forward onto the narrowed portion of said tip jacket leaving a large portion of said tip jacket on said core exposed.

11. An expanding projectile comprising a core substantially of lead, a copper alloy tip jacket having a thickness less than 0.02 inch extending thereon toward the base of the core and adapted to delay expansion of said core and a copper alloy base jacket having a thickness greater than 0.02 inch overlapping on said tip jacket the front end of the base jacket being provided with a chamfer and terminated to expose a portion of said tip jacket on said core.

12. An expanding projectile capable of delayed expansion over a wide range of impact velocities comprising a soft metal core, a copper alloy tip jacket having a thickness less than 0.02 inch filled by said core and adapted to delay expansion thereof and a hard metal base jacket covering the base of the projectile and overlapping on said tip jacket and adapted to limit the degree of said expansion of said core and engage the rifling of the gun barrel, said jackets being interlocked to prevent the tip jacket from separating from the base jacket upon impact with the objective.

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