June 10, 1958 C. M. SCHREIBER 2,838,000

PROJECTILE AND METHOD OF MAKING THE SAME

Original Filed Jan. 31, 1949 2 Sheets-Sheet 1

FIG. 1.

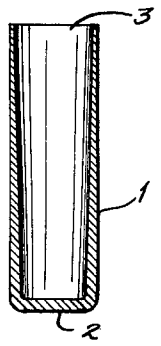


FIG. 2.

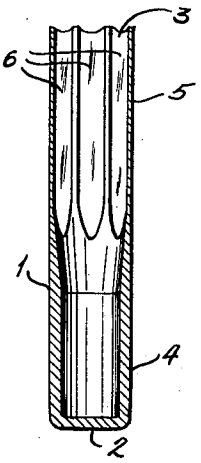


FIG. 3.

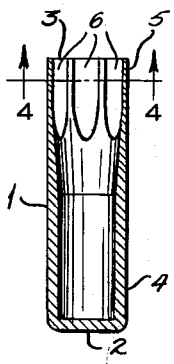


FIG. 4.

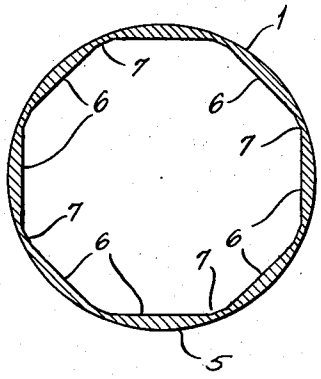


FIG. 5.

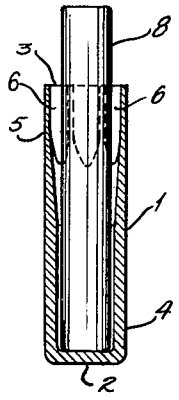


FIG. 6.

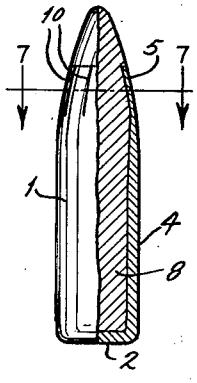


FIG. 7.

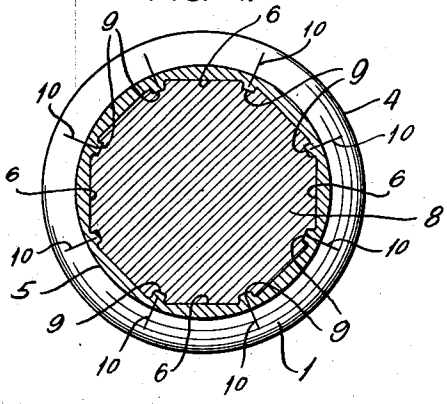
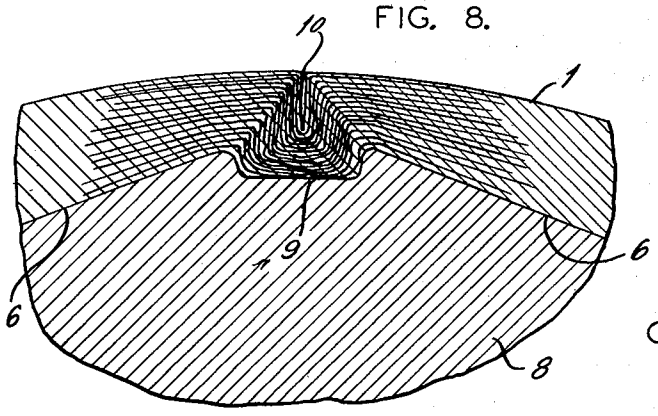


FIG. 8.



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PROJECTILE AND METHOD OF MAKING THE SAME

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FIG. 9.

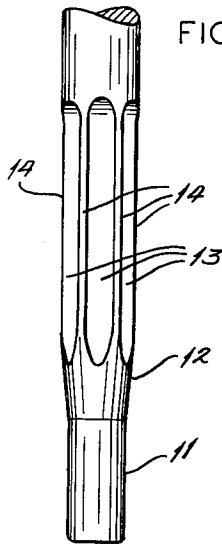


FIG. 10.

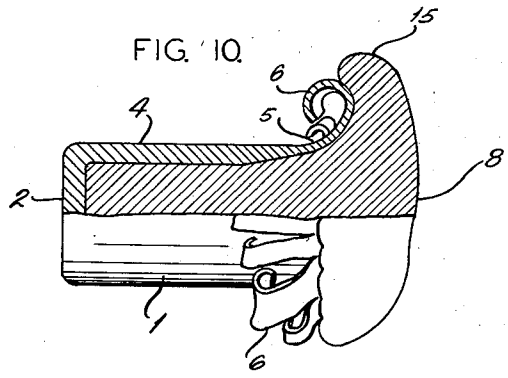


FIG. 11.

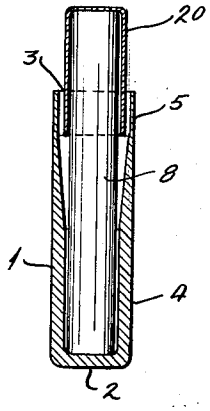


FIG. 12.

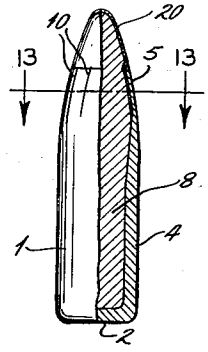


FIG. 14.

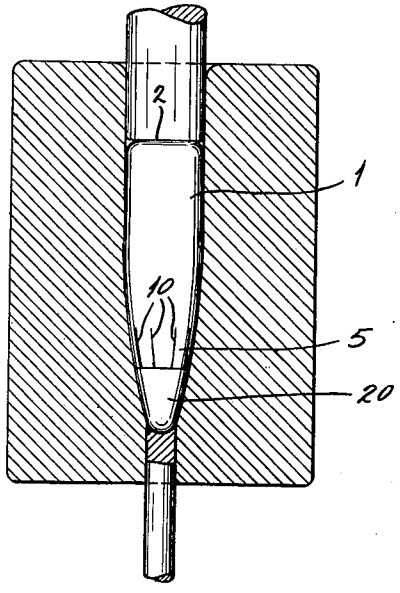
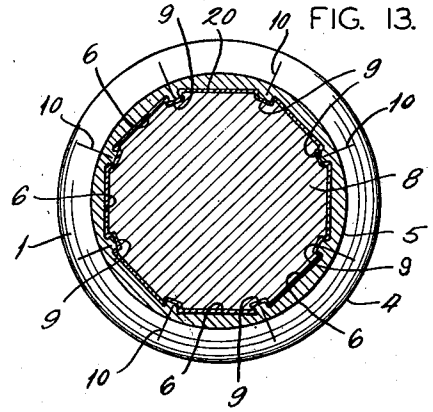


FIG. 13.



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United States Patent Office 2,838,000 Patented June 10, 1958

2,838,000

PROJECTILE AND METHOD OF MAKING THE SAME

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Continuation of application Serial No. 73,785, January 31, 1949. This application July 5, 1955, Serial No. 519,915

14 Claims. (Cl. 102—92.5)

This invention relates to projectiles and, more specifically, to projectiles of the expanding type, also known as mushrooming bullets, and to a method of making an improved bullet of this type.

This application is a continuation of my prior copending application Serial No. 73,785, now abandoned, filed January 31, 1949.

Since the adoption of smokeless powder as a propellant, most projectiles designed to expand with a desired increase in diameter comprise a core of soft malleable material, such as lead, and a relatively hard metal jacket not only capable of taking the rifling of the gun barrel but also capable of resisting the stripping or broaching action of the rifling. Since a fully jacketed bullet will ordinarily pass through the soft or flesh portions of an objective, such as an animal, without deformation, various modifications of the jacketed bullet construction have been made heretofore in order to provide an expanding projectile. One form involves the provision of circumferential grooves in the jacket adjacent the tip, or cuts or slits entirely through the jacket, and even holes drilled entirely through the bullet near the tip.

In another form, only the posterior portion of the lead core is provided with a "body jacket," leaving more or less of the soft core exposed at the nose. This type of projectile is known as a "soft point" bullet and is characterized by the objection that it deforms properly only at times or not at all.

In order to control bullet mushrooming action, resort has frequently been made to still other expedients such as the provision of voids in the core or hard metal inserts of various configurations.

Although the above noted prior constructions and various combinations thereof have provided projectiles tending to expand, they have, however, been characterized by the disadvantage of preferential expansion, i. e., effective mushrooming action at only close range or at only a particular distant range. This is a serious disadvantage making it impossible to realize the potential benefits of accurate shooting over a considerable range including extreme distances now possible with the use of powerful high velocity ammunition. In view of the fact that the velocity at which a fired bullet makes impact with an objective varies approximately inversely with the distance of the objective from the muzzle of the gun, the disadvantage of prior constructions can be described as the inability to provide proper expansion over the wide range of velocities at which the bullet may strike the objective. It has been observed, for example, that at low velocities, in the range from 600 feet per second to 1600 feet per second, even unencased lead projectiles may pass completely through a soft target without upsetting. On the other hand, at high velocities such as 2500 feet per second, jacketed bullets have been observed to virtually explode and disintegrate on impact with the objective. In this instance, only a superficial wound has been made with substantially no penetration into the vital organs of the objective. To be effective, i. e., to have the greatest stopping power, the bullet must deform completely not

upon impact but immediately after penetration. It would be further desirable that the bullet be effective at all ranges.

One object of the invention, therefore, is to provide a jacketed projectile which will upset and expand with a desired increase in diameter even at the low velocities of impact encountered at the great effective ranges now possible.

Another object is to provide a jacketed mushrooming bullet, the core of which will not strip explosively upon impact with the objective at high velocity, i. e., at extremely close range.

Still another objective of this invention is the provision of a jacketed bullet which will suffer the maximum deformation in diameter in passage through the softest parts of an objective over the entire range of effective velocities of impact encountered.

Other objects and advantages will be evident from the following description and the accompanying drawings, in which:

Figure 1 is a longitudinal cross-section of an embryonic jacket suitable for deformation to produce the jacket of the projectile in accordance with one embodiment of the invention;

Figure 2 is a longitudinal cross-section of the jacket shown in Figure 1 after having its anterior portion deformed in accordance with the present invention;

Figure 3 is a longitudinal sectional view of the jacket of Figure 2 with the trimming allowance removed;

Figure 4 is a sectional view taken along line 4—4 of Figure 3;

Figure 5 is a longitudinal sectional view of the jacket shown in Figure 3 with a slug inserted;

Figure 6 is an elevational view, partly in cross-section, showing the projectile in its final condition;

Figure 7 is a cross-sectional view taken along line 7—7 of Figure 6;

Figure 8 is a magnified cross-section showing in greater detail one-eighth of the circumference of the projectile shown in Figure 7;

Figure 9 is a perspective view of a drawing punch suitable for utilization in the process of the present invention;

Figure 10 is an elevational view, partly in cross-section, of a projectile constucted in accordance with the present invention after being deformed by impact with an objective;

Figure 11 is a view corresponding to Figure 5, but showing an assembly of parts for the production of a jacketed tip projectile;

Figure 12 is a view corresponding to Figure 6, but showing a jacketed tip projectile;

Figure 13 is a sectional view taken along line 13—13 of Figure 12; and

Figure 14 is a sectional view of a swaging die with the projectile in position therein.

In accordance with this invention, a projectile having the desired characteristic of expanding, with a substantially uniform increase of diameter not only at high impact velocities but also at effective low impact velocities and likewise over the entire range of velocities therebetween, is obtained by axially in-pleating the nose portion of the base jacket at a plurality of circumferentially spaced regions. To assure the formation of pleats of the proper proportions and in the proper areas, the invention contemplates that the pleat regions be of thinner web than the adjacent portions which it is not desired to pleat. Accordingly, the jacket is formed to have a polygonal, preferably octagonal, internal cross-section at and near its mouth, and it is also desirable that the legs of the polygon merge with each other on a radius rather than at sharp angles. The base jacket may be used not only on soft-point bullets but on jacketed tip bullets. In the

atter instance, a separate tip jacket, softer than the base acket, is applied over the soft core so as to extend within he mouth of the base jacket. In either case, the core (with or without tip jacket) is inserted within the polygon-mouthed base jacket and the assembly swaged so as o conform the nose (including part of the base jacket) o the desired ogival curve, and concurrently to in-pleat he mouth of the base jacket by reentrantly in-folding the hin sections at the junctures between the legs or flats of he polygon.

Referring now to the drawings for an illustrative embodiment of the invention, an embryonic jacket **1**, which is generally cylindrical on its exterior, and which preferably has its side walls slightly tapered from a closed end or base **2** toward its open end **3**, is provided. The alloy of which the embryonic jacket **1** is formed is essentially a good drawing metal and may be composed of 90% copper and 10% zinc.

The embryonic jacket **1** is then deformed by drawing with a punch of the character shown in Figure 9, while the jacket **1** is circumferentially confined within a suitable die. As a result of the drawing operation, the embryonic jacket is elongated, as shown in Figure 2, and deformed so as to have a posterior portion **4** of greater wall thickness than the anterior portion **5**. The anterior portion **5** is concurrently deformed to provide an interior which is substantially polygonal in cross-section, as shown in Figure 4, and consists, in the illustrated embodiment, of eight longitudinally extending flats **6** uniformly spaced about the internal periphery. The junctures **7** between the respective flats **6** thereby become wall sections of minimum web thickness. Preferably, the junctures **7** are formed on a radius in contradistinction to sharp angles. In the case of a .270 Winchester projectile, the jacket, as shown in Figure 2, may have a thickness of 0.039 inch in the posterior portion **4**, a maximum thickness of 0.013 inch at the midriff of the flats **6**, and a thickness of about 0.006 inch at the junctures **7**.

After the die-forming operation just described, the jacket is trimmed to appropriate length, as shown in Figure 3, thus removing the trimming allowance from the embryonic jacket.

Having thus preliminarily formed the jacket, a slug **8** of lead or other soft malleable material is inserted within the jacket, as shown in Figure 5. The assembly is then subjected to a swaging operation in the customary dies (such, for example, as shown in Figure 14), which deforms the portion of the slug **8** projecting beyond the mouth of the jacket, as well as at least some of the thin-walled anterior portion **5** of the jacket, to produce an ogival nose. Any ordinary female swaging die, whose interior contour corresponds to the desired exterior contour for the projectile, is suitable. In this swaging operation, the circumference of the anterior portion of the jacket is reduced, the excess material being taken up in the formation of in-pleats **9** at each of the thin web junctures **7** and in lengthening and thickening the walls. The pleats **9** extend axially of the jacket, reducing the radius thereof as far as the latter was contracted during the swaging operation. Preferably, the contraction during the swaging operation is of such extent that, at the mouth of the jacket, the pleats **9** constitute the minimum internal radius. In the swaging operation, the thin web of metal at the junctures **7** is folded inwardly to provide a ridge extending inwardly beyond the adjacent flats **6**. On the exterior of the jacket, opposite the pleats **9**, a hair-line crack **10** is observable with the aid of a microscope (and occasionally discernable by the naked eye). The penetration of the crack **10** is such that the integral web of metal is of minimum thickness opposite each pleat and consequently rupture of the jacket will inevitably occur at these regions.

In the swaging operation, the internal ridge formed by the in-pleating of the metal at junctures **7** becomes indented into the body of slug **8**.

In Figure 6 of the drawing, the swaged projectile is shown, the position of the hair-line cracks being indicated at **10** by lines which, however, exaggerate the proportions thereof. In actual practice, as indicated hereinbefore, the hair-line cracks **10** are not of such magnitude as to be normally discernible by touch or sight, and consequently the exterior contour of the jacketed projectile is free of ballistically undesirable discontinuities. After the swaging operation, the projectile may be circumferentially knurled (commonly called canneluring) in the usual manner, and thereafter (particularly if distortion occurs during knurling) reswaged.

Where it is desired to jacket the tip of the projectile, a suitable embryonic tip jacket **20** (in the form of a cup) is inverted upon the outer end of slug **8** and assembled with the base jacket, as shown in Figure 11, so that the open end of tip jacket **20** extends inside the anterior portion **5**. The tip jacket **20** is preferably of metal, somewhat softer than that of the base jacket, so that the former is readily deformed with the latter when the parts are swaged together. For example, aluminum or annealed gilding metal is suitable for the tip jacket. The assembly of base jacket, slug, and tip jacket is inserted in a die and swaged, as in the case of the soft-point bullet, to produce the desired contour and concomitantly contract the anterior portion **5** of the base jacket about the other parts, thus producing the fully jacketed projectile shown in Figure 12.

The punch illustrated in Figure 9 has a cylindrical tip **11** of diameter corresponding to the internal diameter of the posterior portion **4** of the jacket. Above the cylindrical portion **11** is a tapered portion **12**, and thereabove a polygonal portion **13**, the edges **14** of which are rounded. Such a punch is manipulated in a suitable press, while the embryonic **1** is circumferentially confined in a conventional die. Projectiles constructed in accordance with the process aforesaid have been found to have a remarkable degree of deformability at low impact velocities, i. e., at long range hits. This may be due to the fact that the confinement and anchorage of the slug within the jacket prevents complete dissipation of the energy of impact in core fragmentation and hydraulic extrusion and thus constrains the core deformation at the moment of impact to open the close formation of the flats **6**. Furthermore, the confinement and anchorage of the core by the jacket eliminates the stripping of the core from the jacket, a condition hitherto prevalent at high impact velocities of strikes at close range. Upon impact, the flats **6** are completely curled outward and rolled back toward the posterior portion **4** until the thick walls of the posterior portion are encountered, as shown in Figure 10. At the latter point, further deformation is resisted. The deformed portions **6** act to sustain the overhanging edges **15** of the expanded core during penetration of the objective.

Projectiles of the character above described, fired into a soft objective at various ranges corresponding to impact velocities varying from 3120 feet per second to 2320 feet per second for the 130 grain .270 Winchester bullet and varying from 2710 feet per second to 2050 feet per second for the 180 grain .30-06 caliber bullet, exhibited a remarkably uniform similarity (when retrieved) to the appearance of the expanded bullet shown in Figure 10. The range of velocities above indicated corresponds to a shooting range varying from muzzle to 300 yards.

This invention, therefore, provides bullets capable of expanding over a wide latitude of impact velocities with remarkable uniformity and stability of expanded shape. Furthermore, there is provided a bullet jacket construction limiting the degree of expansion of a soft core bullet both at high and low velocities. It is obvious that a superior mushrooming bullet has been provided.

Since the invention is believed to provide a novel bullet jacket construction giving a high degree of control over the bullet's expansion, it is to be understood that the embodiment of the invention shown and described is illustrative only, and that the scope of the invention is not to be limited thereby except as defined in the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. A projectile comprising a copper-base alloy jacket having an exteriorly smooth open-ended relatively thin nose portion comprising alternate longitudinally extending thick and thin portions of the type resulting from the drawing of the jacket on a polygonal punch to a cross-section which is circular on the exterior, said thin portions being reentrantly folded to form longitudinally extending internal ridges of greater radial dimension than said thick portions thereadjacent.

2. A projectile comprising a relatively soft metal core and a relatively hard metal body jacket about the base of the core, said jacket comprising a body wall having a thick portion adjacent the base thereof and a relatively thin-walled nose portion; the interior wall of said nose portion comprising a plurality of longitudinally extending flats and internally projecting longitudinal pleats intervening the respective flats.

3. A projectile comprising a core substantially of lead, and a copper-base alloy jacket closed at the base and having an exteriorly smooth open-ended nose portion, said jacket having been drawn on a polygonal punch to a cross-section which is circular on the exterior to provide a plurality of circumferentially equally distributed longitudinally extending sections having a relatively thick longitudinally extending midsection, and, intermediate each adjacent pair of said sections and integral with the relatively thin longitudinal margins thereof, a longitudinally extending interiorly projecting reentrant fold of said thin marginal jacket material forming, on the interior wall of said nose portion, a plurality of equally distributed longitudinal ribs.

4. In combination in a projectile having a soft malleable metal core and an open-nose base jacket, a relatively thick posterior body portion of said jacket, and a nose portion having a smooth outer surface of circular cross-section, said nose portion having on the interior surface thereof longitudinally extending alternate flats and inwardly projecting closed pleats.

5. In the art of making jacketed projectiles, the process comprising forming a metal jacket having a substantially cylindrical exterior and walls thinner at the anterior than at a position posteriorly thereof, said jacket being open at the anterior end, the interior of said jacket at the anterior end being substantially polygonal in cross-section, inserting a slug into said jacket with the nose of the slug projecting outwardly beyond the end of the anterior end, and ogivally deforming the projecting end of the slug and at least some of the anterior portion of the jacket.

6. In the art of making jacketed projectiles, the process comprising forming a metal jacket having a substantially cylindrical exterior and walls thinner at the anterior than at a position posteriorly thereof, said jacket being open at the anterior end, the interior of said jacket at the anterior end being substantially polygonal is cross-section, filling said jacket with core material, and mechanically reducing the circumference of the jacket at its anterior end to infold the wall metal at the junctures between the legs of the polygon.

7. The process of claim 6 wherein the reduction of circumference is such that the minimum internal radius is at the folds.

8. The process of claim 6 wherein the core material projects beyond the anterior end of the jacket to form a nose and the nose is enveloped by a tip jacket which extends within the anterior end of the metal jacket.

9. In combination in a projectile having a soft malleable metal core and an open-nose base jacket, a relatively thick posterior body portion of said jacket, a nose portion having a smooth outer surface of circular cross-section, said nose portion having on the interior surface thereof longitudinally extending alternate flats and inwardly projecting closed pleats, and a tip jacket less malleable than said core encasing said core and extending between the core and the base jacket at the mouth of the base jacket, said tip jacket being folded about the internal pleats in said base jacket.

10. A mushrooming projectile having a relatively soft metal core and a relatively hard metal base jacket about the posterior portion of the core, said base jacket having been drawn on a punch having a polygonal exterior cross-section at the part thereof which shapes the anterior portion of the base jacket, said base jacket being of circular exterior cross-section, said core and jacket being of smaller outside diameter at the anterior end than at the posterior end thereof, and said jacket having axially extending internal pleats at the positions corresponding to the several corners of said polygonal punch.

11. A projectile comprising a relatively soft metal core and a relatively hard metal body jacket about the base of the core, said jacket having a relatively thin-walled nose portion and a circular exterior cross-section; the interior wall of said nose portion comprising a plurality of longitudinally extending relatively flat regions and internally projecting longitudinal pleats intervening the respective relatively flat regions.

12. The process of making jacketed expanding projectiles comprising the steps of forming an elongate open-mouth jacket, mechanically working the mouth portion of said jacket along longitudinal circumferentially-spaced zones to form worked zones that are continuous with but of different properties from the intervening sections of the jacket, assembling said jacket with a soft core, and conforming the mouth portion of the jacket and the adjacent part of the core to an exteriorly-smooth tapering shape without fracturing the jacket.

13. The process of making jacketed expanding projectiles comprising the steps of forming an elongate open-mouth jacket, drawing the mouth portion of the jacket to an externally-circular internally-polygonal cross section to form zones that are continuous with but thinner than the intervening sections of the jacket, assembling said jacket with a soft core, and swaging the mouth portion of the jacket and adjacent part of the core to form an exteriorly-smooth tapering nose.

14. The process of making jacketed expanding projectiles comprising the steps of forming an elongate open-mouth jacket, drawing the mouth portion of the jacket to an externally-circular internally-polygonal cross section to form zones that are continuous with but thinner than the intervening sections of the jacket, said intervening sections being of a lenticular shape that feathers into said relatively thin zones, trimming the mouth of said jacket to an even end, assembling the jacket with a soft core, and swaging the mouth portion of the jacket and adjacent part of the core to form an exteriorly-smooth tapering nose.

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