Jan. 19, 1965 A. H. BURNS, JR., ETAL 3,165,809

BULLET MAKING

Original Filed Oct. 2, 1959

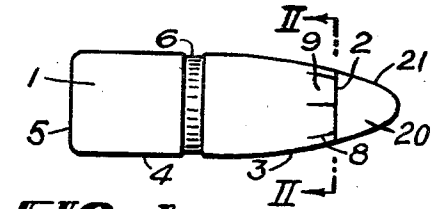

FIG-1

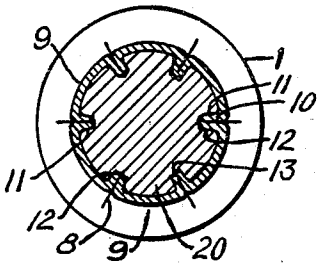

FIG-2

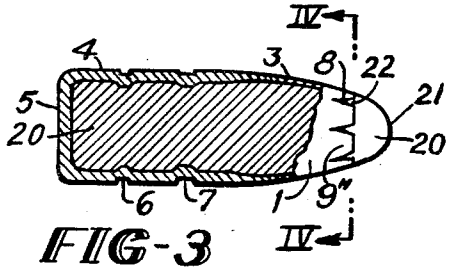

FIG-3

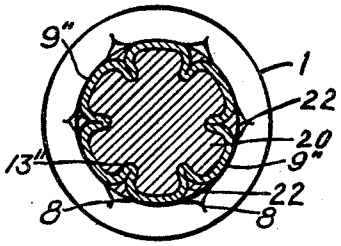

FIG-4

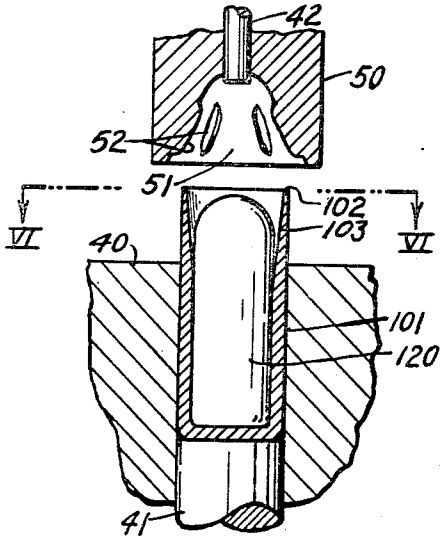

FIG-5

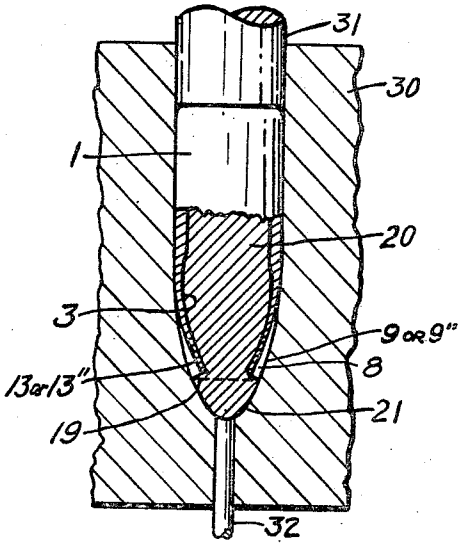

FIG-7

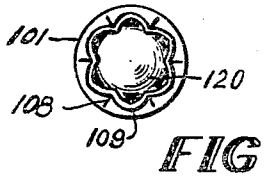

FIG-6

INVENTORS:
ARTHUR H. BURNS, JR.
CHARLES M. SCHREIBER

BY John D. Wilkins

ATTORNEY

United States Patent Office 3,165,809 Patented Jan. 19, 1965

3,165,809

BULLET MAKING

Arthur H. Burns, Jr., and Charles M. Schreiber, Alton, Ill., assignors to Olin Mathieson Chemical Corporation, East Alton, Ill., a corporation of Virginia

Original application Oct. 2, 1959, Ser. No. 844,062, now Patent No. 3,143,966, dated Aug. 11, 1964. Divided and this application Dec. 24, 1962, Ser. No. 253,777

2 Claims. (Cl. 29—1.23)

This application is a division of copending patent application Serial No. 844,062, filed October 2, 1959, issuing August 11, 1964, as U.S. Patent No. 3,143,966.

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

Expanding bullets comprises a core of soft malleable material, such as lead or an alloy lead, and a relatively hard jacket of any suitable material, usually copper-base alloy, capable of resisting stripping from the core while being capable of taking not only the rifling, but also the mushrooming action.

The jacket may completely enclose the core, or leave a nose portion of soft core material protruding from it to make in the latter instance, a "soft point" type of bullet. In any event, the jacket is designed to enable deformation largely at the nose without separation of the jacket from the rest of the core. Such a jacket generally includes at least a base jacket and sometimes also includes a tip jacket, generally thinner and more easily deformed than the base jacket.

Heretofore, various modifications have been made in this general jacketed bullet construction in order to improve the expansion characteristics of this type of bullet. According to one modification, metal is removed from the interior of the base jacket to provide it with longitudinally extending cuts or slits partially through it at the mouth. This arrangement has been tried with or without a tip jacket. The cuts have been extended all the way through to indent the edge and provide spaced petals or serrations at the mouth of the base jacket. Such projectiles have also been constructed with a recess in the point. According to other and more complicated modifications, holes have been pierced from one side of the point to the other, separate anvil pieces have been embedded in the point and corrugations have been tried in the tip jacket. More recently, however, such bullets have been improved in accordance with prior U.S. Patent Nos. 2,765,738 and 2,838,000.

How the objects and advantages of this invention are obtained will become apparent from a general discussion together with a description of specific embodiments shown in the drawing in which:

FIG. 1 is an elevational side view of one embodiment of the projectile according to this invention;

FIG. 2 is a transverse cross sectional view of the embodiment of FIGURE 1 taken slightly to the rear of line II—II after enlargement;

FIG. 3 is another elevational side view of a still further preferred embodiment shown partly in section adjacent the base;

FIG. 4 is a transverse section taken slightly to the rear of line IV—IV of FIGURE 3 after enlargement;

FIG. 5 is an elevational side view in longitudinal cross section showing a die apparatus with a preliminary assembly positioned therein for an intermediate manufacturing operation for making a bullet of this invention;

FIG. 6 is an end view taken on line VI—VI looking down upon the assembly of FIGURE 5 after completion of the operation shown; and

FIG. 7 is an elevational side view showing a point

shaping die in cross section and the completed bullet partly in section at and adjacent the nose.

In accordance with this invention, there is provided an expanding bullet similar to the type shown in the above noted patents, but having a base jacket constructed with special creasing and swaging at the mouth so as to achieve a splitting or at least a proclivity to splitting along predetermined lines while at the same time offering yielding but firm support to the expanding core with a scoop-like unfolding structure to avoid excessive core fragmentation and separation. This is done without cutting away and removing any part of the much needed jacket support to give a significant improvement in uniformity of mushrooming, particularly at maximum ranges, i.e. at the lowest velocities. In a uncomplicated and economical way, the uniform expansion characteristics of this type of bullet are further extended so that the bullet behavior even at very low velocities has a remarkable uniformity which is comparable with that obtained at other ranges and velocities including the closest range and highest velocity.

The improvement is obtained by pinch-pleating the tapering mouth of the base jacket by means of creasing in such a way as to form staves and a plurality of deeply inwardly extending folded webs, each between adjoining staves to form stave-like flanged panels at the edge of the jacket. Each folded web involves one very sharp bend, a single 180° bend, at which the metal is overstressed to have at least a pronounced proclivity to split.

The webs and a like number of staves form either an uninterrupted continuation or an abutted array of each other around the circumference at the mouth from jacket metal of substantially uniform thickness circumferentially. Each stave or panel is flanged as its margins; and the staves are abutted at least at their flanges. There is preferably a "necking in" and a longitudinal fracture at the sharp bend to accomplish a pulling apart and a splitting between the contiguous flanges beginning at the edge itself. In other words, flanged slits preferably are formed in the jacket wall at the edge. The resulting flanged and abutted stave structure of the jacket edge provides desired core support while permitting expansion with improved uniformity. Splitting is achieved by severe working rather than by complete removal of part of the jacket edge.

Each resulting stave-like panel member is a part of the jacket wall which is thinner along its length than the wall of the rest of the jacket and preferably tapers in thickness in each panel to a finitely thick edge providing thinner section at the edge of the mouth as compared to the relatively thick posterior portion of the rest of the base jacket, which is locked to the soft core by one or more cannelures involving knurls of the type shown in prior U.S. Patent 1,730,871, which provides an interior portion of the jacket of decreased diameter.

In the finished bullet, the longitudinally extending staves or panels take the form of from three to nine, but preferably from five to seven, and usually six, marginally flanged, longitudinally as well as circumferentially curved staves not only integral with the rest of the jacket but also at least contiguous, if not integral as well with adjacent sectors. Adjoining staves are buttressed and are largely interconnected by a tapering pinch pleated structure providing the greatest marginal flanging at the open edge of the base jacket but tapering to the least flanging at the root of each where the staves join the rest of the jacket. The minimum inward extension of each flange at the edge must exceed the thickness of the jacket edge and is preferably not less than about 1½ times the thickness of the base jacket edge. Preferably the extension does not exceed about five times the thickness of the base jacket material at the edge, which varies

from about 0.010 of an inch to about from 0.015 of an inch for the small arms ammunition contemplated according to this invention. The pleated web, therefore, should extend inwardly at its leading edge to an internal diameter from about 1/32 to about 3/16 of an inch less than the exterior diameter at the edge of the jacket at the mouth.

Nine or less staves are desirable with the construction of this invention because, especially with smaller jacket mouth openings, more results in either shallow or too deep corrugating rather than flanging to the necessary depth. Too few, however, result either in too diluted an effect or in notching of the soft core at the nose too deeply; and usually too few staves and pleats give a predisposition to excessive irregularity in the jacket with respect to its edge and the axis of the bullet, unless special precautions are taken. Six creases were found suitable usually and these provide a hexafoil formation of the jacket mouth as shown in FIGURES 2 and 4. In practice the number of staves and pleated webs selected is determined by the jacket thickness, size of jacket mouth opening and the extent of bullet nose taper involved to give the necessary flanging.

By holding the hardness of the jacket to a minimum, and/or by otherwise varying the metal thickness and degree of infolding at the pleats, it is possible to reduce the sharpness of the bend somewhat and thereby avoid pre-splitting at each reverse bend while maintaining a stress concentration predisposing the jacket to split uniformly along predetermined lines. This provides a variation in the degree of constraint offered the core making the jacket mouth more suitable for certain varieties of this type of bullet, the point of which may vary from the more sharply pointed point to the more rounded nose point.

By still further variation, including a greater softness in the core and/or greater working of the nose of the bullet, more pronounced external cusps may be formed in the pleats and some soft nose material may be extruded rearwardly into these cusps to overly them at least in part as extensions or scallops on the nose to better streamline bullets intended for effectiveness with accuracy at the greatest ranges.

Because of necking in of the jacket mouth, i.e. bending in of each stave, the entire edge of the base jacket at the nose is sloped rearwardly with respect to the axis of the bullet to provide an outwardly flared, but unnotched and unscalloped edge including the substantially identically beveled leading edge of the pleated flange and rib forming webs. The slope is substantially at a right angle to the jacket curvature tangent.

Upon impact this bevel provides a wedge action on the protruding nose of the bullet to advantageously initiate the outward expansion of the core in all radial directions uniformly.

This invention requires that in the pleated region there be an abutted substantially double flange structure substantially thicker circumferentially than the greatest wall thickness of the adjacent sectors. As shown and described, it is about double. In this region, the jacket metal is gradually deformed except at the apex or sharp inner bend of the cusp where bending is sufficiently severe to create a single line of proclivity to splitting, leaving the flanges integral with the staves, or to fracture the jacket along these lines.

In fabrication of the bullet in accordance with this invention, there is followed the procedure of blanking and cupping from a strip of desired base jacket metal, assembling with a slug of core material placed within the jacket cup, edge creasing to provide circumferentially spaced indentations adjacent the open edge of the cup-shaped blank from which the jacket is shaped to final finished form, and swaging the creased assembly to finish the bullet shape at its nose.

The indentations are achieved with a "pie-cut" edge creaser having a circumferential array of radial directed wings or fins corresponding in number to the number of pleats desired at the open end of the jacket. This sort of creasing turns in the open end of the jacket to form a frusto-conical shape (FIGURE 6) having a circumferentially spaced series of edge flutes and cusps at the latter of which the pleated web will be formed in the final swaging operation. According to the process of this invention, there is provided sufficient inward extension and thickness in the pleated region to make a sufficiently severe bend and thereby achieve a predetermined line of preferential splitting without any jacket cutting or difficult jacket drawing to create grooves, indentations, or scallops.

Projectiles like those shown in FIGURES 1 and 3 made according to this invention include among others, bullets known as .243 Winchester 100 grain soft point bullets, .270 Winchester 150 grain soft point bullets, 30–30 Winchester 170 grain soft point bullets, .308 Winchester 180 grain soft point bullets, 30–06 Springfield 220 grain soft point bullets, and various other expanding bullets of still other calibers and weights.

In the embodiment of FIGURE 1, the bullet has a base jacket 1 from the open edge 2 of which there protrudes a nose portion 21 of the soft core 20. Bordering the nose there is thin jacket portion 3 having the substantially full circular annular jacket edge 2 on the outside of which there are longitudinally extending parting lines indicative of the existence of uniformly distributed rather tightly closed internally projecting pinch pleats 8. The lines are seen at the apex of tiny cusps beginning at the edge 2 and tapering away from the edge to a hairline. The longitudinal extension is not great and usually is about from one to two times the average circumferential expanse of each panel 9 produced because of the internal structure better shown in FIGURE 2.

Each pinch pleat 8 consists of a pair of flanges 11 and 12 which are integral extensions of the lateral margins of the staves 9. These are abutted internally along a line 10 at which the flanges 11 and 12 are in continguity at least adjacent their inner ends at which the flanges are at least partially split from each other, however along only a very small part of the length at the inner end 13 of each pinch pleat 8. Therefore, the alternate pleats and panels form a continuous array of flanged metal staves adjacent the jacket edge 2 interrupted by no spaces.

It will be noted that at the edge 2 the thickness of the flanges 11 and 12 and thickness of the intervening staves 9 are substantially equal to make each pleat 8 an internal rib of about twice the thickness extending inwardly by more than the double thickness. The mouth portion 3 of jacket 1 tapers from least thickness at the edge 2 to maximum thickness where it adjoins the thicker rear part 4 of the base jacket where the jacket is provided with a knurl 6 forming a circumferential indentation in the thick circular cylindrical wall of the base jacket. In this instance, remotely from edge 2 each pleat 8 becomes not only shallower but its web thicker so that splitting by fracture at 13 occurs only at edge 2.

When the bullet of FIGURES 1 and 2 strikes its objective and has achieved substantial penetration, the flanged panels bulge outwardly to form curved scoop-shaped flutes and eventually splitting occurs at the apex all the way back between the flutes as the pleats unfold. Finally continued bulging and the concomitant fracturing is further accompanied by a bending back or rearward furling of the panels 9 which at the heaviest impact will ultimately peel back the relatively thin front end 3 of the jacket until peeling is stopped at the thickened walls of the cylindrical jacket wall 4 adapted to take the rifling of the gun barrel.

In the embodiment of FIGURES 3 and 4, the bullet also comprises a base jacket 1 and a soft core 20. Adjacent the base 5 of the jacket there is the relatively thick cylindrical wall portion 4 having not only knurl 6 but

also another circumferential knurl 7 closer to the base 5. These form a reduced internal part of the jacket for better holding the core in it. Adjacent the front edge 2 of the jacket there is a thinner walled tapered jacket wall 3 formed with part of the bullet ogive and a plurality of pinch pleats 8 which, however, extend inwardly somewhat more deeply and form a series of more pronounced tapered recesses or cusps in the jacket wall at the edge of the jacket. In the absence of more severe swaging, the apex 13'' of each cusp is not so severely bent and, therefore, fracturing does not occur so completely. The resulting staves 9'', are more scoop-shaped and more interconnected at the relatively unsplit flanges. In this embodiment, rearwardly extending substantially identical scallops 22 extend from the nose portion 21 of the core to occupy at least a part of the external cusps. As is more clearly shown in FIGURE 4, these scallops 22 tend to reduce any interruption or discontinuity occurring circumferentially in the bullet ogive adjacent the jacket edge 2. This form of the bullet provides a smoother exterior by filling up at least part of the recesses.

In fabrication of the bullet, there is used an edge crimping device of the type shown in FIGURE 5, and a nose shaping or swaging device of the type shown in FIGURE 7.

In the cavity of die 40 (FIGURE 5) there is a seating pin 41 upon which there is placed a jacket cup 101 containing a slug 120 of core material.

As shown in FIGURE 5, the cup 101 has a posterior portion of greatest thickness adjacent its closed base and also a tapering anterior portion 103 terminating in the reduced straight or unnotched edge 102 of the open end of the cup. Similar thinness may be obtainable by a conical flare terminating in an enlarged cylindrical portion adjacent the edge 102. Either of these types of cups will provide a suitable thin front end 103 for making the ogival part 3 of the finished bullet jacket 1 shown in FIGURES 1–4.

The thin walled portion 103 is creased with a crimping die 50 having in its cavity 51 a suitable number, such as six, of radially arrayed equally spaced creasing fins 52. When the jacket cup edge 102 is thrust into cavity 51 by die 40 and its pin 41, these fins crease the cup 101 at 108 until there is developed the intermediate foil shaped edge and flutes 109 shown in the hollow end structure of FIGURE 6.

The crimped assembly is then subjected to a further operation in a suitable female swaging die 30, the interior contour of which corresponds to the desired finished contour for the projectile at its nose and along its sides. As punch 31 moves in during swaging, the circumference of the anterior portion 3 of the jacket 1 is reduced as the pinch pleats 8 are formed to make the final finished tapered part at the mouth of the jacket. Swaging causes the web to fold inwardly to provide a series of ribs of double thickness projecting from the adjacent sectors without any thinning and with little, if any, work hardening except at the inner-most fold at the midpoint 13 or 13'' of the web in the finished rib. Here the bending gives a single line of predisposition to part the flanges in the rib. As a result of this operation, at this stage parting lines on the exterior of the jacket are discernible by the naked eye, inasmuch as they form external indentations in the jacket in the shape of cusps intermediate adjacent convexly extending panels 9 or 9''.

In the formation of these stave-like sectors or panels, their open edge 19 at the front end of the jacket is bent inwardly to slope the edge rearwardly to grip the soft core 20 more snugly and indent it not only at the ribs opposite the external cusps but also at the convex or scoop-shaped flanged staves 9 or 9''. Consequently, the edge of the jacket 1 does not protrude laterally beyond the exposed nose 21.

As a result, at edge 2 the jacket is folded but is not scalloped; but according to another embodiment, rearwardly extending scallops 22 (FIGURES 3 and 4) are provided on the relatively soft nose by drawing or extruding extensions from the core. These extend rearwardly from this portion to overlie and fill at least the most open part of any cusp space which might be formed between the staves at each pinch pleat at the base jacket edge. This scalloping of the core provides a more nearly smooth bullet periphery circumferentially which is desirable ballistically. This embodiment, even more so than the other, avoids formation of any edges, particularly thin ones during firing which would extend forwardly into the air stream. All of the edges at 2 sweep back to streamline or overshadow the jacket edge and there is no need for chamfering.

Finally, the jacket is provided with one or more circumferential indentations, each a continuous knurl or any other suitable indentation, producing an interior portion of decreased diameter in the wall of the jacket to indent the core and thereby interlocking the jacket and core.

The expansion action of the structure of this invention appears to be more uniform because of the combination of (*a*) relatively thin paneling in the staves and (*b*) regular, thick and rather deep internal webbing, which notches the core while reinforcing the paneling longitudinally. The combination at first requires unfolding and only thereafter spreads or splits easily while simultaneously increasing in resistance. This minimizes erratic upsetting of the core all the way up to maximum impact because it gives a preferred variation in the tendency of the jacket to tear at regularly spaced intervals with the least initial resistance at the lowest velocities of impact and with the most final resistance at the end of impact at greatest deceleration from highest velocity.

At the lowest velocities of impact, the finished bullet because of the liberal pleating and heavy webbing provides pre-splitting with edge reinforcement at the very edge of the jacket. The flanged split offers the least resistance to expansion on account of accordion action while at the same time offering desired initial monetary delay in expansion in the initial circumferential confinement to the expanding core on account of the flanging. Thus, expansion occurs readily even at distant ranges where the energy is considerably spent and the velocity low, but premature mushrooming is avoided to allow sufficient penetration of the bullet to occur first. The leading edge of the relatively heavy double flange being deeper than the rest of the flange improves the delaying action.

Along the length of the inner bend of each pinch pleat the metal of the jacket is severely worked but is most severely worked and usually split at the leading edge and the least worked adjacent the root of each stave where it joins the rest of the jacket. Each is thus made prone to progressive splitting at extreme stages of any degree of expansion including the severest expansion reached at higher velocities; and this together with the notches or voids in the core, made by the unfolding pleats back of the nose, controls the expansion so as to make it more uniform both circumferentially as well as radially in all directions at any given velocity. The voids take part of the deformed nose inside rather than outside the jacket to aid expansion. As the severity of impact is increased, a desired continuation and increase of resistance is offered because the part of the jacket pleats coming into action becomes shallower but broader so that at each stage the web there will not open initially between the moving staves but will continue to offer confinement to the upsetting core until the required unfolding followed by complete splitting occurs. Wherever the pleated web is finally split, progress of the split becomes more difficult as the webbing tapers away and the degree of metal stressing and hardening at the bend decreases, whereupon the increasing bulk of expanded core material continues to encounter support and guidance as the staves, scoop-shaped

in the form of a flute, open outwardly and finally furl back with increasing resistance.

Although the foregoing described embodiments now are believed to be preferred, it will be understood that various changes and modifications may be made in the embodiments described by those skilled in the art without departing from the spirit and scope of this invention.

What is claimed is:

1. The process of making a base jacketed, soft core bullet comprising the steps of assembling a slug of core material with an open mouth jacket cup having a front nose edge at the mouth and a cylindrical wall of substantially uniform thickness around said nose edge of the mouth, creasing the cup wall inwardly adjacent said mouth along uniformly circumferentially spaced lines intersecting said edge, and swaging the cup adjacent said creased wall to contract said mouth and the adjacent part of said slug to conform them to finished jacket shape about said material and to a finished bullet nose and form a pinch pleat at each of said lines by an inwardly extending bend of substantially 180° between bends each of about 90° providing a radial rib in said jacket having proclivity to splitting.

2. The process of making an expanding bullet comprising the steps of forming from relatively hard metal an elongated open mouth jacket cup thinner at the mouth than at the closed base thereof and of generally circular interior and exterior cross section at said mouth, assembling said cup with a slug of relatively malleable core material having a reduced end disposed adjacent the open

jacket mouth in a manner adapting said slug to form the soft core and nose of said bullet, inwardly creasing said cup mouth on a plurality of circumferentially equally spaced lines sloping forwardly with respect to the bullet axis to form cusps around the nose edge of said cup mouth, and inwardly swaging said reduced end and cup at said mouth to shape said slug to a nose and conform said mouth thereto by substantially closing each of said cusps by a single reverse bend to form a finished bullet jacket holding said core back of said nose and having at the nose edge of said jacket a plurality of longitudinally extending staves and intervening pinch pleats corresponding in number to said cusps and forming longitudinally extending marginal flanges on the lateral edges of said staves, thereby forming staves of substantially uniform thickness over the bullet circumference integral with said jacket and said marginal flanges, said flanges of adjacent staves being in radial contiguity in pairs to form longitudinal ribs about twice the thickness of said staves.

References Cited by the Examiner

UNITED STATES PATENTS

1,095,502	5/14	Hoagland	102—91
2,792,618	5/57	Walker	29—1.23
2,838,000	6/58	Schreiber	102—91 X
2,932,253	4/60	Auxier	29—1.23 X

RICHARD H. EANES, JR., *Primary Examiner.*

WHITMORE A. WILTZ, *Examiner.*