A jacketed bullet and high-speed method of manufacturing jacketed bullets are provided. The method includes the steps of providing tubing and inserting a wire into the tubing to form composite tubular stock. The inner surface of the tubing is bonded to the outer surface of the inserted wire to form bonded tubular stock. After the bonding step, an inner diameter of the tubing is substantially equal to the wire diameter such that, when viewed in section, the wire completely fills the tubing. After the bonding step, the bonded tubular stock is cut to form work-pieces of a desired length. The workpieces are then warm or cold forged to form jacketed bullets.
FIG. 6

FIG. 7
Cold Heading Apparatus

Ammunition Assembly Apparatus

FIG. 8
JACKETED BULLET AND HIGH-SPEED METHOD OF MANUFACTURING JACKETED BULLETS

TECHNICAL FIELD

[0001] This invention relates generally to bullets and high-speed methods of manufacturing bullets and, in particular, to jacketed bullets and high-speed methods of manufacturing such bullets.

Overview

[0002] The market for innovative bullet designs is expanding exponentially because of three main factors: government agencies are demanding lead free bullets, warfighter’s experience with insufficient stopping power of conventional rifle rounds (5.56 mm and 7.62 mm) and increasing public demand for situational ammunition.

BACKGROUND

Raw Materials

[0003] Bullets are made of a variety of materials. Lead or a lead alloy (typically containing antimony) is the traditional bullet core material. Traditional bullet jackets are made of copper or gilding metal, an alloy of copper and zinc. There are many other materials that are used in bullets today, including aluminum, bismuth, bronze, copper, plastics, rubber, steel, tin, and tungsten.

Designs

[0004] There are several different uses for ammunition, such as military, law enforcement, hunting, marksmanship/ target shooting, and self-defense, each requiring different bullet performance. There are also legal and public relations design considerations, such as lethality, threats to innocent bystanders, environmental impact, and appearance.

[0005] Bullet design is dependent on firearm design and vice versa. The bullet must fit into the barrel correctly. A bullet that is too small will not engage the rifling in the barrel, or it will bounce around in the barrel and not exit in a straight line. A bullet that is too large will jam in the barrel, possibly causing the firearm to explode from the pressure. The bullet weight must also match the amount of powder in the cartridge, so that it is fired at the correct speed.

[0006] Bullets are designed using calculations and data gathered from previous testing (firing) of bullets. This data can include variables such as accuracy (whether it hit the target), precision (whether more than one of the same bullet type produced similar results), speed of the bullet, effectiveness at a given range (distance to the target), penetration into the target, and damage to the target. Bullets are then tested against a target which resembles what they will be used against. There are several materials used to simulate the intended target, including bullet gelatin, a recently developed material used to simulate flesh.

[0007] Modern bullets can have many different design features. Some of these features concern the shape of the bullet and others the materials of construction. Most bullets look like a cylinder with a pointed end. The cylindrical section to the rear of the bullet is the shank and the pointed section to the front of the bullet is the tip or nose, though the tip may be flat instead of pointed. Bullets can be made of one or more materials.

[0008] Bullets made out of only soft material (such as lead) expand on impact causing more damage to the target. Bullets made out of only a harder material (such as steel) penetrate further into thicker targets, but do not expand much. A softer core can be enclosed or partially enclosed in a layer of harder metal called a jacket. This jacket can completely enclose the bullet or it can leave the softer tip exposed for expansion purposes. Varying the amount of jacketing alters the amount of penetration versus expansion.

[0009] The shank can have a flat base or a tapered base (boat tail). The flat base is heavier and provides greater penetration, but the boat tail provides greater accuracy over distance. The base of the shank can also have a base plate of harder metal to prevent deformation of the bullet during firing. The base sometimes has a conical indentation (a gas check) that expands on firing to seal the base of the bullet against the firearm barrel and trap all of the energy from firing to propel the bullet forward. The shank may also have grooves used to contain lubricating grease that helps the bullet move freely in the firearm barrel. Sometimes a single groove, called a cannelure, is cut into the bullet to mark how far the bullet is to be inserted into the cartridge and to provide a feature to crimp the cartridge to the bullet.

[0010] The tip of the bullet is usually pointed. This point may be curved (called an ogive). Sharper tips provide greater penetration. Wadcutters are bullets with no point or a sharp shoulder behind the point used in target shooting to cut paper targets cleanly. Semiwadcutters have a flat-tipped cone tip and can be used for target shooting, hunting, or self-defense. Target bullets are light and designed for speed and accuracy in a shooting range. They are usually not appropriate for other purposes.

[0011] Some tips are designed to expand on impact. This kind of bullet is banned from military use, but can be used for law enforcement, self-defense, and hunting. The tip or the entire bullet may be made of a soft material such as lead, but there are other design features that can aid bullet expansion. Hard material behind the softer tip provides more penetration and pushes the softer tip forward to expand more. The harder material can be the shank, a section of the tip, a portion of hard metal between the tip and the shank, or even a hard point on the tip that is driven backward on impact to expand the softer tip material.

[0012] Another feature that provides expansion is a hollow tip (or hollow point), an empty cone in the tip that points toward the rear of the bullet. When the bullet hits the target, the thin sides of the hollow tip expand outward. Even harder metals can expand, especially if they are scored (have grooves cut in them) to provide spaces to split apart.

[0013] Few bullets have separable parts. Some bullets have sabot, sleeves that surround the bullet while it is being fired but that fall off after leaving the firearm. Sabots allow smaller bullets to be fired from larger firearms at higher velocities than they would be fired from smaller firearms. Bullets can also contain multiple pellets or other particles that exit the bullet in a spray on impact or on leaving the target. This provides a higher chance of hitting something (from the many particles) or can cause many wounds in an easily damaged target.

[0014] Shotguns often fire shot (many small round pellets) or solid slugs (large, often soft bullets) out of an un rifled barrel, though some shotguns have rifled barrels. Air guns fire solid round or hourglass-shaped pellets.
Military bullets have special features, sometimes also used in law enforcement and self-defense. In order to get around the prohibition on expanding bullets, military bullets can be designed with heavier than normal back ends so that they tumble into the target on impact to create a larger wound. They can also be designed to break apart on impact with a similar effect. Some military bullets have incendiary (flammable) material in the base of the bullet that leaves a visible trail. This is known as a tracer bullet because it allows the shooter to track the bullet. Incendiary material can also be placed in the tip of the bullet so that it can start a fire on impact. Military bullets are usually made of harder materials or are fully jacketed. They are often designed for penetration. “Non-lethal” plastic or rubber bullets are designed to temporarily incapacitate rioters and demonstrators, but they have the ability to kill.

Law enforcement and self-defense bullets should incapacitate the target. Many of these bullets are designed to expand or shatter after hitting the target, causing maximum damage. These bullets can be made of harder material that has greater penetration through materials such as heavy clothing and body armor. Police and self-defense bullets should not “over penetrate” (go through the target) and endanger bystanders.

 Hunters have different requirements for different types of targets. Fast moving targets require faster, often lighter, bullets. Larger targets with heavy hides and large bones require bullets that can penetrate and inflict enough damage to drop the animal quickly. There are several different designs that address these conflicting demands. Many hunting bullets are designed to expand.Partitioned bullets and partially jacketed bullets are common for larger targets.

The Manufacturing Process

There are many types of bullet manufacturers, ranging from large companies and governments to smaller custom ammunition manufacturers to individuals who load and reload ammunition with a few simple tools. There are also many different bullet designs and a lack of consensus about which is most effective. Because of this, there is no uniform method of ammunition manufacture. Large ammunition manufacturers, including the United States government, automate some of the manufacturing steps. At appropriate points during the manufacturing process, special features may be added.

The Solid Bullet or Bullet Core

The two most common bullet-forming methods are casting and swaging. Hollow points can be formed by either method. Hard (harder than lead) solid bullets can be stamped (a metal punch cuts a bullet-shaped piece out of a bar or sheet of softer metal) and machined from metal stock. Machining includes any process where a machine is used to shape metal by cutting away portions. A typical machine used for bullets is a lathe. A lathe rotates the bullet metal against steel chisels to gradually cut away material.

Casting a Bullet

Casting is pouring molten metal into a mold. This mold is hinged and, when closed, has a hollow space that is in the shape of the bullet. The metal is melted in a crucible (a metal or ceramic pot that can hold molten metal safely) and then poured into the mold.

After the metal has cooled, the mold is opened and the bullet falls or is knocked out. Any imperfections are removed by cutting or filing. If the bullet is extremely deformed, it can be melted down and the process repeated.

To cast a bullet with multiple sections of different materials, the first material is poured into the mold to partially fill it. After this material has cooled and partially or completely solidified, the second molten material is poured into the mold to fill it partially or completely. This can be done several times, but most often is done twice to create a bullet with a heavier section (for penetration) behind a softer section (for expansion).

Swaging a Bullet

Swaging is a cold forming process which means that it involves shaping metal without heating to soften or melt it. The appropriate amount of material to be swaged (measured in grains) is placed in a die. A die is a harder metal container with a cavity (an empty space) shaped like the bullet without the back end. The die is part of a larger stationary object or is held in place on a platform.

A metal punch that fits into the open end of the die is forced into the die to the appropriate depth. As the punch forces the bullet metal into the die cavity, the material takes the shape of the cavity. The pressure can come from a manual or hydraulic press, from repeated hammer blows, or from a threaded punch that is screwed on. Excess metal is squeezed out of bleed holes.

The punch is removed from the die and the bullet is pushed or pulled out of the cavity. Any imperfections are removed by cutting or filing.

Multiple swaging steps can be used to insert partitions, to create a bullet out of multiple materials, and to further define the shape of the bullet. Sometimes several steps are necessary to add features such as a hollow point.

The Bullet Jacket

Some bullets have jackets of harder metal surrounding a softer core.

A coin-shaped piece of jacket metal is punched out of a strip or a sheet. The punch is usually a round metal cylinder that is pushed through the jacket material into a depression in a table. Some punches are rounded so that the piece of metal is shaped like a cup. Sometimes, tubing is used instead of a coin or a cup of metal.

If the jacket material is too hard to be formed easily, it can be annealed. Annealing is heating the metal, often with a gas flame, to soften it and make it more workable.

The jacket material is then placed in a die or over a punch and the punch is forced into the die. There may be several different punches and dies used to form specific features in the jacket. One of the usual steps is to make sure that jacket is of uniform thickness. The thickness is typically 0.03-0.07 in. (0.08-0.17 cm). Some bullets have a thin jacket electroplated onto the core.

Bullet Assembly

Jackets and multiple bullet parts can be joined by method such as swaging them together, casting one section on top of another, soldering, gluing, or electrical welding.

Traditional high volume bullets are made with a copper jacket and a lead core. They are assembled/swaged in a bullet press. The jacket is made by starting with copper strip,
then stamping the strip into a cup. There is quite a bit of material left over from the strip which is scrap (that gets recycled). The cup is then fed into a multi-station, deep draw stamping press, where the jacket is formed through a series of punches and dies. Then, lead is extruded into the proper diameter of wire. The lead wire is then cut off into proper lengths. The final operation is inserting the lead core into the copper jacket and swaging the two together in the bullet assembly press machine. Typical speed for this operation is 120 parts per minute.

The following U.S. patent documents are related to at least one embodiment of the present invention: U.S. Pat. Nos. 4,352,225; 4,387,492; 4,693,109; 4,829,906; 4,879,953; 4,947,755; 5,079,814; 5,208,424; 5,357,866; 5,399,187; 5,404,815; 5,528,990; 5,535,678; 5,621,186; 5,641,937; 5,852,858; 6,085,661; 6,095,052; 6,158,351; 6,182,574; 6,209,459; 6,374,743; 6,845,716; 6,916,354; 6,964,232; 6,973,879; 7,073,425; 7,299,733; 7,322,297; 7,493,862; 7,543,535; and 7,980,180, and U.S. patent publications 2002/0056397; 2002/0152917; 2003/0101891; 2005/006846; 2005/0066850; 2005/0183615; 2006/0243154; 2006/0278117; 2007/0204758; 2009/0183628; 2011/0203477; 2011/0290141; 2012/0067198; 2012/0085258; 2012/0216700; and 2013/0025490.

For purposes of this application, the following definitions apply:

1. “Bullet”—A bullet is a projectile, often a pointed metal cylinder, that is shot from a firearm. The bullet is usually part of an ammunition cartridge, the object that contains the bullet and that is inserted into the firearm. This application will use the word “bullets” to mean projectiles fired from small or personal firearms (such as pistols, rifles, and shotguns).

2. “Cold forging”—Various forging processes conducted at or near ambient temperatures to produce metal components to close tolerances and net shape. These include bending, cold drawing, cold heading, coining (forward or backward), punching, thread rolling and others.

3. “Cold heading”—Plastically deforming metal at ambient temperatures to increase the cross-sectional area of the stock (either sold bar or tubing) at one or more points along the longitudinal axis. Upsetting or cold heading gathers steel in the head and, if required, other locations along the length of the part. Metal flows at right angles to a ram force, increasing diameter and reducing length.

4. “Drawing”—Reducing the cross-section of forging stock while simultaneously increasing the length.

5. “Extrusion”—Forcing metal through a die orifice in the same direction as the applied force (“forward extrusion”) or in the opposite direction (“backward extrusion”).

6. “Backward extrusion”—Another cold forging process, produces hollow parts. Here, the metal flows back around a descending ram in the opposite direction.

7. “Forward extrusion”—A basic cold forging operation, reduces slug diameter while increasing length.

8. “Plastic deformation”—Permanent distortion of a material without fracturing it.

9. “Swaging”—Reducing the size of forging stock; alternately, forging in semicontoured dies to length a blank.

10. “Upset forging”—One made by upset of an appropriate length of bar, billet or bloom; working metal to increase the cross-sectional area of a portion of all of the stock.

11. “Upsetter” (forging machine)—A machine with horizontal action used to produce upset forgings.

**SUMMARY OF EXAMPLE EMBODIMENTS**

**[0046]** An object of at least one embodiment of the present invention is to provide a jacketed bullet and a method of manufacturing such bullets which provides higher production rates and less scrap than the prior art, while allowing for innovation in terms of materials used and ballistics.

**[0047]** Another object of at least one embodiment of the present invention is to provide a jacketed bullet and a high-speed method of manufacturing such bullets which may be “lead free”, have good “stopping power” and at least partially satisfy the public’s need for situational ammunition.

**[0048]** In carrying out the above objects and other objects of at least one embodiment of the present invention, a high-speed, jacketed bullet manufacturing method is provided. The method includes providing tubing made of a first material. The tubing defines an inner diameter and an outer diameter. The method also includes inserting a wire into the tubing to form composite tubular stock. The wire is made of a second material and defines a wire diameter. The first and second materials are different from one another. The method further includes bonding the inner surface of the tubing to the outer surface of the inserted wire to form bonded tubular stock. After the bonding step, the inner diameter of the tubing is substantially equal to the wire diameter such that, when viewed in section, the wire completely fills the tubing. After the bonding step, the method also includes cutting the bonded tubular stock to form work-pieces of a desired length. Finally, the method includes warming or cold forging the workpieces to form jacketed bullets.

**[0049]** The method may further include the steps of coiling the bonded tubular stock and uncoiling the coiled, bonded tubular stock prior to the step of cutting.

**[0050]** The step of forging may be performed by a warm or cold forging machine. The machine may include a series of horizontal punches and dies. Each of the bullets may be configured to be received within a standard caliber, small or personal firearm cartridge.

**[0051]** The second material may be harder than the first material.

**[0052]** The first and second materials may be first and second metals, respectively.

**[0053]** The tubing may be seamless metal tubing. The metal may be copper or a copper alloy.

**[0054]** The step of forging may include forming a nose for each of the bullets. The nose may include exposed material of the second material.

**[0055]** The step of bonding may include a step of drawing the tubular stock.

**[0056]** Further in carrying out the above objects and other objects of at least one embodiment of the present invention, a jacketed bullet made from warm or cold-forging-grade, composite tubular stock is provided. The bullet includes an outer jacket formed of a first metallic material. The outer jacket comprises a tube defining an inner tube diameter and an outer tube diameter and making up a percentage of a total cross-sectional area of the bullet. The bullet also includes an inner core formed of a second metallic material. The inner core material comprises a solid metallic wire defining a core diameter and making up the balance of the cross-sectional area of the bullet. The first and second metallic materials are different from one another wherein the inner tube diameter is substan-
tially equal to the core diameter such that, when viewed in section, the inner core completely fills the outer jacket.

The bullet may be configured to be received within a standard caliber, small or personal firearm cartridge.

The bullet may have a nose. The nose may include exposed material of the second material.

The second metallic material may be harder than the first metallic material.

The tube may be a seamless metal tube.

The first metallic material may be copper or a copper alloy. The composite tubular stock may comprise a solid coil of multi-metal wire such as a bi-metal wire.

While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

**DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS**

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention.

**FIG. 14** is a view, similar to the views of FIGS. 9-13, with two workpieces in different forging stations of the cold forging or heading apparatus; and

**FIG. 15** is a view, similar to the views of FIGS. 9-14, with multiple workpieces at various stages of forging and a finished bullet indicated by phantom lines.

**FIG. 16** is a side schematic view of a .50 caliber cartridge case 20 with a jacketed bullet, generally indicated at 22, manufactured in accordance with at least one embodiment of the present invention to form a round of ammunition, generally indicated at 24. FIG. 2 is a view, partially broken away and in cross section, taken along lines 2-2 of FIG. 1.

**FIG. 3** is a perspective schematic view, partially broken away, of tubing prior to the insertion of a wire therein;

**FIG. 4** is a view similar to the view of FIG. 4 after partial insertion of the wire into the tubing;

**FIG. 5** is a sectional view, taken along lines 5-5 of FIG. 4, of the resulting composite tubular stock after the wire has been completely inserted into the tubing;

**FIG. 6** is a schematic, partial block diagram of the tubular stock being drawn by a drawing apparatus or machine wherein the drawn tubular stock is pulled by and coiled on a rotating drum;

**FIG. 7** is a sectional view of the resulting drawn tubular stock taken along lines 7-7 of FIG. 6;

**FIG. 8** is a schematic, partial block diagram of the coiled, drawn tubular stock being cold forged by cold forging or heading equipment or apparatus to form jacketed bullets which are subsequently assembled with cartridge cases by ammunition assembly apparatus to form ammunition generally of the type shown in FIG. 1;

**FIG. 9** is a side schematic view, partially broken away and in cross section, showing uncoiled drawn tubular stock prior to cutting at a cutting station in the cold heading apparatus;

**FIG. 10** is a view, similar to the view of FIG. 9, after the tubular stock to form a workpiece;

**FIG. 11** is a view, similar to the views of FIGS. 9 and 10, with the workpiece raised and just prior to entering a first cold forging or heading station;

**FIG. 12** is a view, similar to the views of FIGS. 9-11, showing the cut workpiece in the first forging station and the tubular stock just before cutting;

**FIG. 13** is a view, similar to the views of FIGS. 9-12, of the first workpiece being cold forged or worked in the second forging station;
and the inner surface 38 of the tubing 26. In addition or in the alternative, a bonding agent can be applied between the copper tubing and the solid wire core to keep them together during the subsequent forging or forming process described herein.

**[0086]** FIG. 8 is a schematic, partial block diagram of the coiled (for example on a drum 40 or the drum 34), drawn tubular stock 32 being cold forged by cold forging or heading equipment or apparatus to form the jacketed bullets 22 which are subsequently assembled with cartridge cases 20 by conventional ammunition assembly apparatus to form ammunition 24, generally of the type shown in FIG. 1. However, it is to be understood that warm forming or forging may be used to shape the bullets instead of cold heading. Typically, the cold heading apparatus can operate at 250-500 parts per minute depending on the size of the bullet. This is in contrast with approximately 120 parts per minute of the prior art.

**[0087]** FIG. 9 is a side schematic view, partially broken away and in cross section, showing uncoiled drawn tubular stock 32 just prior to cutting at a cutting station 42 in the cold heading apparatus. The cold forging or heading apparatus is of a common design and typically has a series of horizontal dies 44 and correspondingly punches 46 located at forging stations 52, 54, 56 and 58 which follow the cutting station 42.

**[0088]** FIG. 10 is a view, similar to the view of FIG. 9, after cutting the drawn tubular stock 32 at the cutting station 42 to form a workpiece or slug 48.

**[0089]** FIG. 11 is a view, similar to the views of FIGS. 9 and 10, with the workpiece 48 raised by a rod 50 and just prior to entering the first cold forging or heading station 52 of the apparatus.

**[0090]** FIG. 12 is a view, similar to the views of FIGS. 9-11, with the cut workpiece 48 in the first forging station 52 and the tubular stock 32 just before cutting at the cutting station 42.

**[0091]** FIG. 13 is a view, similar to the views of FIGS. 9-12, of the first workpiece 48 being cold forged or worked in the second forging station 54.

**[0092]** FIG. 14 is a view, similar to the views of FIG. 9-13, with two workpieces 48 being forged at different forging stations 56 and 58 in the cold forging or heading apparatus.

**[0093]** FIG. 15 is a view, similar to the views of FIGS. 9-14, with multiple workpieces 48 in various stages of forging at forging stations 52, 54, 56 and 58 and a finished bullet exiting the apparatus by phantom lines 22 at an exit station 60 (also shown in FIG. 14).

**[0094]** While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

What is claimed is:

1. A high-speed, jacketed bullet manufacturing method comprising:
   - providing tubing made of a first material, the tubing defining an inner diameter and an outer diameter;
   - inserting a wire into the tubing to form composite tubular stock, the wire being made of a second material and defining a wire diameter, the first and second materials being different from one another;
   - bonding the inner surface of the tubing to the outer surface of the inserted wire to form bonded tubular stock,
   - wherein, after the bonding step, the outer diameter of the tubing is substantially equal to the wire diameter such that, when viewed in section, the wire completely fills the tubing;
   - after the bonding step, cutting the bonded tubular stock to form work-pieces of a desired length, and
   - warm or cold forging the work-pieces to form jacketed bullets.

2. The method as claimed in claim 1, further comprising the steps of coiling the bonded tubular stock and uncoiling the coiled, bonded tubular stock prior to the step of cutting.

3. The method as claimed in claim 1, wherein the step of forging is performed by a warm or cold forging machine.

4. The method as claimed in claim 3, wherein the machine includes a series of horizontal punches and dies.

5. The method as claimed in claim 1, wherein each of the bullets is configured to be received within a standard caliber, small or personal firearm cartridge.

6. The method as claimed in claim 1, wherein the second material is harder than the first material.

7. The method as claimed in claim 1, wherein the first and second materials are first and second metals, respectively.

8. The method as claimed in claim 1, wherein the tubing is a seamless metal tubing.

9. The method as claimed in claim 8, wherein the metal is copper or a copper alloy.

10. The method as claimed in claim 1, wherein the step of forging includes forming a nose for each of the bullets.

11. The method as claimed in claim 10, wherein the nose includes exposed material of the second material.

12. The method as described in claim 1, wherein the step of bonding includes the step of drawing the tubular stock.

13. A jacketed bullet made from warm or cold-forging-grade, composite tubular stock, the bullet comprising:
   - an outer jacket formed of a first metallic material, the outer jacket comprising a tube defining an inner tube diameter and an outer tube diameter and making up a percentage of a total cross-sectional area of the bullet; and
   - an inner core formed of a second metallic material, the inner core material comprising a solid metallic wire defining a core diameter and making up the balance of the cross-sectional area of the bullet;
   - wherein the first and second metallic materials are different from one another and wherein the inner tube diameter is substantially equal to the core diameter such that, when viewed in section, the inner core completely fills the outer jacket.

14. The bullet as claimed in claim 13, wherein the bullet is configured to be received within a standard caliber, small or personal firearm cartridge.

15. The bullet as claimed in claim 13, wherein the bullet has a nose.

16. The bullet as claimed in claim 15, wherein the nose includes exposed material of the second material.

17. The bullet as claimed in claim 13, wherein the second metallic material is harder than the first metallic material.

18. The bullet as claimed in claim 13, wherein the tube is a seamless metal tube.

19. The bullet as claimed in claim 13, wherein the first metallic material is copper or a copper alloy.

20. The bullet as claimed in claim 13, wherein the composite tubular stock comprises a solid coil of multi-metal wire.

21. The bullet as claimed in claim 20, wherein the wire is a bi-metal wire.

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