United States Patent

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[54] **EXTERNALLY LUBRICATED PROJECTILE AND METHOD OF MAKING SAME**
3 Claims, 2 Drawing Figs.

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[51] **Int. Cl.** **F42b 11/14**
[50] **Field of Search** 102/92.2, 93, 52

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ABSTRACT: A bullet having a core which is secured to a jacket. At least the piercing end or extremity of the core is coated with a low-friction fluorocarbon resin, such as polytetrafluoroethylene. The resin may also be used to secure the jacket to the core.

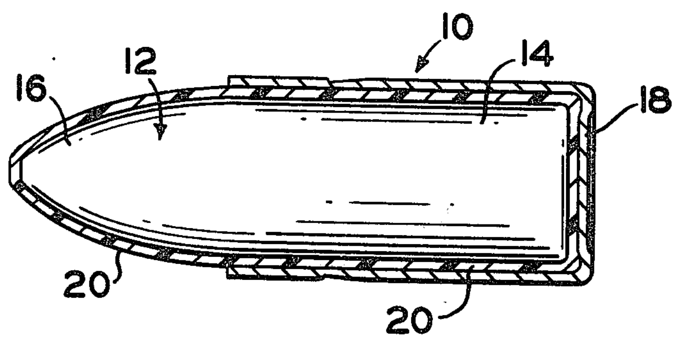
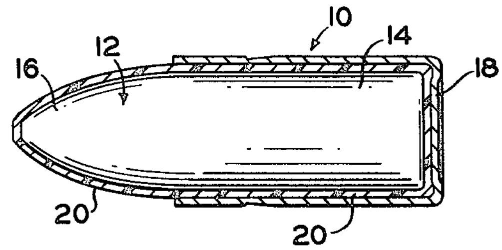


FIG. 1



TEST FIRINGS OF BULLETS* THROUGH .019" STEEL PLATES, 8" APART, AT 21 FOOT MUZZLE - TARGET DISTANCE			
TYPE OF AMMUNITION	BULLET WEIGHT IN GRAINS	MUZZLE VELOCITY IN FT./SEC.	NUMBER OF PLATES PIERCED
FACTORY AMMUNITION			
WADCUTTER	148	770	4
LEAD BULLET	158	855	8
HIGH SPEED LEAD BULLET	150	1065	10
STEEL JACKET - LEAD CORE	158	855	10
EXPERIMENTAL AMMUNITION			
STEEL JACKET - STEEL CORE	150	1000	10
GILDING-METAL JACKET - STEEL CORE	147	800	11
GILDING-METAL JACKET - SILICON COATED STEEL CORE	147	800	11
GILDING-METAL JACKET - "TEFLON" COATED STEEL CORE	146	800	13
* ALL BULLETS ARE .38 CALIBER SPECIAL LOADINGS			

FIG. 2

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EXTERNALLY LUBRICATED PROJECTILE AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

Partially jacketed metal-piercing ammunition is generally composed of a hard metal core partially encased by or secured to a soft metal jacket member. The nose and piercing end or extremity of the core is generally left exposed. The core is usually made of steel or other hard metal while the jacket is composed of a softer metal, such as gilding metal, a zinc-copper alloy. Utilization of a soft metal jacket prevents damage to the rifling in the bore of the weapon as the bullet is discharged.

Users of half-jacketed or semijacketed metal-piercing ammunition, police officers, for example, are primarily concerned with maximum penetration while maintaining safe and reasonable velocity ranges. Their objective is deep and sustained bullet penetration of a metallic object as opposed to the desire of the game hunter to employ a bullet which strikes, penetrates and then mushrooms thereby to resist deeper penetration.

Attempts to increase bullet penetration have generally been directed to three factors: 1. increasing the hardness of the bullet core; 2. decreasing the weight of the bullet; and 3. increasing the velocity of the bullet. One factor, however, which also appears to be extremely pertinent to the performance of metal-piercing ammunition but which has been generally neglected, is the friction and subsequent resistance generated by the surface of the piercing end or nose of the core as it enters and passes through the target. Perhaps inattention to this factor can be attributed to the inoperability or impracticality of known methods of friction reduction when applied to ammunition. These, of course, would include the oiling or greasing of metallic surfaces. Application of such lubricants to the surfaces of bullets presents problems in transporting, storing and otherwise handling the ammunition because of the attraction of dust, dirt and other debris to the lubricated surface. Some small caliber bullets do have cores lubricated with oil films. These films, however, are used to protect the gun barrel from harsh combustion gases and the like and are burned off before the bullet leaves the gun barrel.

The U.S. Government in attempting to solve internal weapon, not ammunition, lubrication problems under field conditions used, as reported in Government Bulletin PB 121-161, polytetrafluoroethylene (Teflon) films on interior weapon surfaces such as rifle, pistol and large artillery barrels or bores as well as on bullet cartridges to aid in the passage of the cartridge through the breechlock mechanism. A bullet having a lubricant bonded to its piercing surface or core in order to reduce friction upon entry and travel through a metallic surface, however, has not been available.

SUMMARY OF THE INVENTION

This invention concerns a metal-piercing semijacketed bullet which has a core coated with a low-friction fluorocarbon resin, such as polytetrafluoroethylene. Polytetrafluoroethylene may also be used to secure the jacket member to the core. The low-friction fluorocarbon resin increases the penetration of the bullet by imparting to it self-lubricating and friction-reducing properties as it enters and passes through the target.

The bullet to which this invention is primarily directed has a core secured to a jacket member. Since a bullet of this type is generally used for piercing metallic targets, the core is composed of a hard metal such as steel or steel alloy of carbide or tungsten. Without a softer metallic protective jacket surrounding at least a portion of the core, the firing of such a bullet would soon destroy the interior surfaces of the gun barrel. Since these surfaces carry the rifling which imparts the spin and therefore effects the accuracy of the bullet, such a result is to be avoided. The jacket member is, therefore, commonly composed of a gilding metal, that is, a zinc-copper alloy which is considerably softer than the hard metal core.

The accuracy of semi- or half-jacketed bullets of the type described is to a certain extent dependent upon the length of time the jacket remains secured to the core as the bullet penetrates the target. Conventional metal-piercing ammunition generally secures a gilding metal jacket to a steel core by means of solder. Since solder has a melting point lower than the temperature frequently developed by a bullet passing through metal, the solder often melts and thereby causes the core to disengage from the jacket. Such disengagement will generally adversely effect the subsequent path of the bullet. Since Teflon generally melts above the melting point of solder, this problem is frequently avoided when the core and jacket are secured with Teflon only or a Teflon-solder combination. Thus by using a coating of a low-friction fluorocarbon resin to coat not only the outer surface of the core, but also to secure the core to the jacket, this invention increases the penetrating ability of the core and increases the strength of the jacket-to-core securement.

One method of producing a bullet embodying the principles of this invention contemplates application of a coating of polytetrafluoroethylene to the bullet core with subsequent placement of the core in the jacket. The core and jacket are then dried and sintered until fusion occurs between the coating and core and core and jacket. Thus, a bullet is produced which upon entering a metallic target surface presents a piercing surface which is self-lubricating and friction reducing. The end result, of course, is increased penetration. In addition, since a fluorocarbon resin, such as polytetrafluoroethylene, sinters at 500°–600° F. (Higher than most solders) the jacket will remain secured to the core after impact for the full or greater part of bullet flight.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view in partial section of a bullet embodying the principles of the invention;

FIG. **2** is a table recording data obtained while using various types of conventional and experimental ammunition.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As seen in FIG. **1**, bullet **10** is composed of a core **12** having body and nose portions **14** and **16**, respectively. Core **12** is received in a jacket **18**. A coating **20** of a fluorocarbon resin having a low coefficient of friction, such a polytetrafluoroethylene, is bonded to at least the nose portion or piercing end of core **12**. Jacket **18** or a similar jacket member may also be secured to the core by means of a fluorocarbon resin. The resin may be used as the sole means of securement of jacket to core or in addition to solder or other conventional bonding agents.

A low-friction fluorocarbon resin which has been found particularly effective is an aqueous dispersion of polytetrafluoroethylene. An aqueous dispersion is preferred because of its ease of application as well as strength of its bond to the core and core to jacket. Dupont Teflon 30 TFE has been found to be an excellent material for use with this invention. Teflon 30 comprises an aqueous dispersion of polytetrafluoroethylene solids (about 60 percent by weight) and Rohm and Haas Triton X–100 (about 5 percent by weight). Triton X–100 essentially comprises alkyl aryl polyether alcohol.

Teflon 30 has a low coefficient of friction, high heat stability and is inert to attack by almost all chemicals. Although an aqueous dispersion of polytetrafluoroethylene, Dupont Teflon 30 TFE in particular, has been found to be extremely effective, it is believed that other fluorocarbon resins may also be suitable. Such resins should be capable of easy application and, therefore, preferably available as an aqueous disperson. Methods of application or manufacture which can eliminate the necessity of application by means of aqueous dispersion are also contemplated. In addition, the coefficient of friction of the resin preferably should be within the range of polytetrafluoroethylene, that it about 0.03 to 0.10 cm./sec.

(static coefficient of friction against polished steel). Ability to form a strong bond to the core and core-to-jacket is also desirable.

The core **12** of metal-piercing ammunition is generally made of hard steel. Carbide and tungsten alloys, however, have been used with success. Since the hardness of the core material is an important factor in determining a bullet's penetration potential, the core should preferably be composed of a metal having a Brinell Hardness Number in excess of 95. Tungsten-steel alloys for example can have a Brinell Hardness Number of about 97 and are frequently used in making bullet cores because of their favorable metallic cutting qualities. Commercially available steels may have Brinell Hardness Numbers in excess of 700.

The core **12** may be of any operable shape, but generally has a nose portion **16** which is pointed or somewhat reduced in size in comparison with the body portion **14** to facilitate initial entry and subsequent penetration of the target. Nose portion **16** in FIG. **1** is typical of an acceptable bullet piercing end or nose for a .38 caliber Special loading. The body portion of the core may be of any diameter or shape conducive to proper securement to a jacket and unrestricted travel in a gun barrel. Body portion **14** of core **12** in FIG. **1** illustrates an acceptable configuration. The shape of the body portion is also dictated by bullet caliber, by intended use, velocity desired and the size and shape of the cartridge (not shown) which carries the explosive charge used to propel the bullet.

Although the extent to which the jacket member may cover or encase the core may vary, it should preferably leave at least a portion of the nose or piercing end of the bullet exposed. This, of course, ensures that the most rigid portion of the bullet, the core, makes initial contact with the target surface. The principles of the invention can also be utilized with a jacket member of the type frequently used with artillery-type ammunition. In this case, a core, similar to core **12** has attached to it, opposite the nose portion, a narrow jacket member or band which leaves the base of the core and most of the body portion exposed. Its purpose, like other jacketing members of different sizes and shapes, is to prevent direct engagement of the hard metal core with the rifling in the bore.

Therefore, although FIG. **1** shows a particular core-jacket configuration, it should be understood that the principles of this invention are equally applicable to other metal-piercing ammunition utilizing a jacket and core construction. For example, it has been found that this invention may be practiced on metal-piercing ammunition suitable for firing in the following, inter alia, weapons: .357 Magnum, .38 Special, .38 automatic, 9 mm. parabellum, .35 and .351 caliber rifle.

As previously discussed the fluorocarbon resin or polytetrafluorethylene, in particular, may be used to secure the jacket member to the core. It is contemplated that the resin may be continuous or discontinuous. That is, the entire core may be coated with the resin disposed between the core and jacket serving to secure each to the other. On the other hand, manufacturing procedures may dictate coating only the tip or extremity of the nose portion and then applying a separate or discontinuous coating between the core and jacket member. Further, the fluorocarbon resin may be used in addition to other bonding agents solder, for example, to secure the jacket to the core.

One of the many methods which may be employed in producing a bullet in accordance with this invention encompasses the following steps. A hard metal core is completely coated with a low-friction fluorocarbon resin, such as polytetrafluoroethylene (Teflon). Coating of the core may be accomplished by dipping or spraying. Since spraying generally requires the use of two or more coatings consecutively applied, dipping is preferred. After the core has a uniform coat of Teflon on its outer surface it is placed in the jacket with the nose portion exposed. The jacket and core are then allowed to air dry. After the Teflon has dried, the core-jacket combination is placed in an oven and heated to a temperature of from 600° to 800° F. until the coating sinters and fusion occurs. This heat also anneals, or softens, the jacket so that it more readily conforms to the rifling.

To achieve better adhesion of the Teflon to the core it is advisable to thoroughly clean the core before application of the Teflon. Rinsing with a solvent to remove grease, oil and the like or sandblasting have proven extremely effective. Sandblasting is almost a necessity if a Teflon enamel is used.

Referring to FIG. **2** of the drawings, there is shown test data obtained by firing various kinds of .38 caliber Special loadings under identical conditions, i.e. firing each bullet at a 21-foot muzzle-target distance through 0.019-inch steel plates, spaced 8 inches apart. Under the heading "Factory Ammunition" is listed data recorded when various commercially available bullets of varying weights were fired at different velocities. Similar data is recorder under the heading "Experimental Ammunition." All jacketed ammunition used (with the exception of the Teflon coated bullet) secured the core to the jacket with solder.

It is apparent that the Teflon-coated steel core and gilding-metal jacket combination gave superior results while requiring a smaller bullet weight and equal or less velocity than other ammunition tested. This increase is believed to be directly attributable to the reduced friction caused by the Teflon-coated core as it enters the plates.

The steel core and gilding-metal jacket combination treated with silicon used Dow Corning Molykote M-8800. As shown, the use of silicon produced the same result as the plain steel core gilding-metal jacket combination under the same weight and velocity conditions.

The Teflon-coated bullet was capable of being decreased in weight by one to 12 grains and fired at equal or reduced velocity than other ammunition yet still was capable of piercing from two to nine additional plates than other tested ammunition. Solely in terms of plates pierced, the Teflon-coated and bonded core-jacket combination gave an increase in penetration of better than 18 percent over the closest competing bullet (plain steel core and solder bonded jacket) and over 300 percent in excess of the wadcutter.

The advantages of a bullet having a Teflon or comparable fluorocarbon resin coating its core and bonding the core and jacket are obvious in any situation where metal-piercing ammunition is used. In law enforcement applications especially, the principles of the invention can be used to produce a bullet capable of increased penetration potential. This can effectively be utilized when the police officer, for example, finds it necessary to shoot through metallic objects such as doors or automobiles.

We claim:

1. A bullet comprising; a core having a generally cylindrical body portion, an inwardly tapering nose portion at one end of said body portion, said core being formed of a relatively hard metallic material, a cuplike jacket member telescopically fitted over said body portion at the end thereof opposite said nose portion, said jacket member and said body portion having axial regions parallel to and closely adjacent each other, and a thin coating of fluorocarbon resin on said core, said coating being bonded to both the core and the jacket and being the sole connecting means connecting said jacket to said core.

2. A bullet according to claim **1** in which said resin is polytetrafluoroethylene.

3. A bullet according to claim **2** in which said polytetrafluorethylene coating is sintered in situ in the space between the said axial regions of said core and said jacket member.