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PROJECTILE CONSTRUCTION

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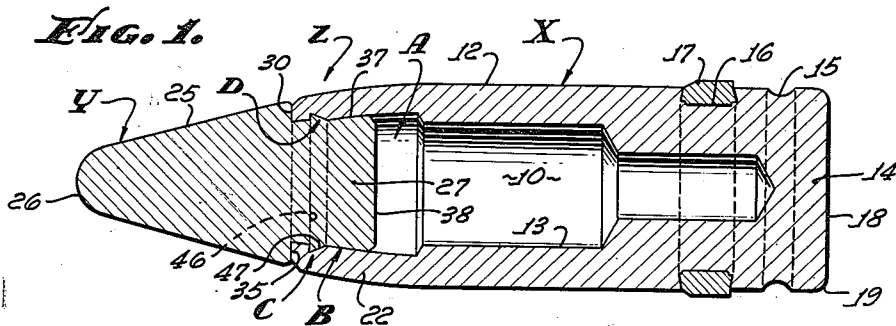


FIG. 2.

FIG. 3.

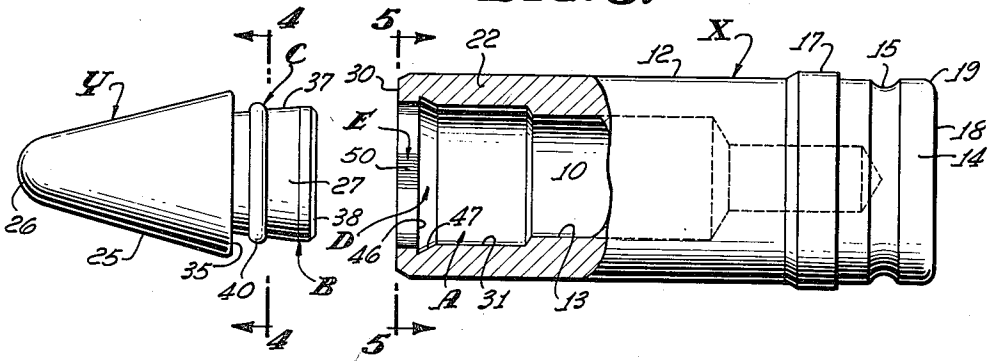
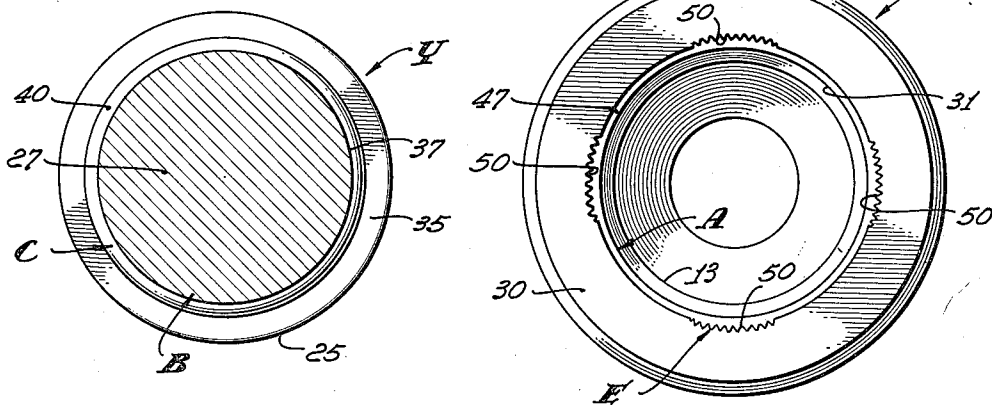


FIG. 4.

FIG. 5.



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## PROJECTILE CONSTRUCTION

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This invention relates to a projectile construction and is particularly concerned with a "dummy" or practice projectile or shell to be fired from a gun, it being a general object of this invention to reliably secure the nose of the projectile to the body thereof.

Projectiles or shells are made in different manners and for various purposes. For example, explosive shells are employed and which involve a chambered body packed with an explosive charge, and a fused nose. A charged shell, however, is too dangerous to use during practice exercises, etc., and therefore, "dummy" or practice ammunition is used.

"Dummy" or practice ammunition is made so as to conform with the configuration and weight of charged ammunition, although the actual construction of the projectile or shell may differ. In actual practice the body of the projectile is drilled or bored out leaving a wall thickness that compensates for the weight of the powder charge that is omitted. Also, the nose that is secured to the body is made to correspond with the shape and weight of a fused nose that would be used in an explosive projectile or shell. Ordinarily, "dummy" or practice projectiles are made with the usual screw threaded connection between the body and nose, in which case each assembly of parts requires an exacting amount of torque to insure a tight and secure connection. Further, testing is required in order to be assured that the connection will withstand the required amount of torque.

Precautions are taken to prevent unscrewing of the nose from the body of the projectile. For example, adhesive cements are applied to the threaded connection so that torque developed during acceleration of the projectile is not so apt to loosen the nose. However, in spite of all precautions, threaded noses come loose or free themselves from the projectile body. Further, the use of cements is troublesome and time consuming. These free noses are dangerous and adversely affect operation of aircraft and particularly jet propelled aircraft or turbine driven aircraft. When said projectiles are fired from aircraft these noses when free from the projectile will be drawn into the turbine power plant, to the end that the aircraft is lost, etc.

It is an object of this invention to provide a connection between a projectile body and nose that eliminates screw threads, that eliminates exacting assembly procedure, that eliminates the need for using adhesive cements, and that eliminates the necessity of testing or examining each round or assembly.

It is another object of this invention to provide a connection of the character referred to that locks the body and nose together against axial and rotative movement relative to each other.

It is still another object of this invention to provide a very simple and inexpensive projectile construction wherein the parts or elements thereof are easily made and which are quickly assembled, resulting in a reliable product. With the construction that I provide, only visual inspection is necessary to determine whether or not the assembly is reliably secured and fastened together.

The various objects and features of this invention will be fully understood from the following detailed description of a typical preferred form and application thereof, throughout which description reference is made to the accompanying drawings, in which:

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FIG. 1 is a longitudinal sectional view of a projectile embodying the features of construction of the present invention. FIG. 2 is a view of the nose portion of the projectile shown in FIG. 1. FIG. 3 is a longitudinal view, partially in section, and showing the manner in which the body portion of the projectile is initially formed. FIG. 4 is an enlarged sectional view taken as indicated by line 4-4 on FIG. 2, and FIG. 5 is an enlarged front end view of the body taken as indicated by line 5-5 on FIG. 3.

The present invention involves, generally, a projectile body X, a nose Y and a connection Z that joins or fastens the nose Y to the body X. The body X is a heavy part, preferably machined from steel bar, or the like, and has a chamber 10 formed therein. The nose Y closes the chamber 10 and is in the shape and of the weight of a fuse unit that would ordinarily be employed in an explosive projectile.

The body X illustrated in the drawings is a typical shell body, and is shown in the form of a 20 mm. shell body. It is to be understood, however, that the present invention may be applied to any projectile of the type under consideration. As shown, the body X involves an outer wall 12 contoured to define the outer configuration of the body, an inner wall 13 defining the chamber 10, and a base 14 that closes one end of the body, preferably the back end thereof. The outer wall 12 is round and is substantially parallel in configuration, the forward end thereof being tapered inwardly somewhat to fair into the fuse unit Y. The rear portion of the wall 12 is provided with a peripheral groove 15 adapted to receive a portion of a cartridge case (not shown), and is provided with a peripheral channel 16, forward of the groove 15, to receive and hold a rotating band 17. The rotating band 17 is pressed or rolled into the channel 16 and is provided to engage with rifling in a gun bore. The base 14 has an outer wall 18 in a plane normal to the axis of the body X and joining the outer wall 12 at a rounded corner 19. The base 14 is of substantial thickness, and the inner diameter of the wall 13 at the forward end portion 22 of the body X is formed to receive the fuse unit Y, as later described.

The nose Y is shown in the form of a closure for the chamber 10 and has a tapered outer wall 25 and a rounded nose 26. The rear portion 27 of the nose is stepped to enter the chamber 10 as later described. In carrying out the invention the nose Y is machined from aluminum and is a solid integral body of material.

In accordance with the invention I have provided the connection Z which involves, generally, a bore A in the body X, an extension B on the nose Y and adapted to enter the bore A, an anchor rib C projecting from the extension, a recess D adapted to receive the rib C to secure the nose and body from axial separation, and grip means E engageable between the nose and body to secure them against rotation relative to each other. As shown in FIGS. 2 and 3, the nose Y and body X are each formed or machined in one configuration after which the two parts are assembled and portions of the body X and nose Y are deformed or bent to engage with each other to prevent their separation and rotation relative to each other.

The bore A, as best illustrated in FIG. 3 of the drawings, is provided at the forward end portion of the body X, the body having a fiat front end face 30 in a plane normal to the central axis of the body. The outer wall 12, as originally formed (see FIG. 3) is straight and cylindrical in form, and the bore A as originally formed is also straight and cylindrical in form. In practice, a straight turned counterbore 31 forms the bore A, the said counterbore 31 extending axially into the body a distance more or less coextensive with the forward portion 22 of the body X that is finally tapered inwardly (see FIG. 1).

Note that when the projectile is in its final form both the outer wall 12 and counterbore 31 are inwardly faired or tapered.

The extension B, as best illustrated in FIG. 2 of the drawings, is provided at the rear of the nose Y. The nose Y has a rear face 35 in a plane normal to the central axis of the structure and adapted to have flat engagement with the front end face 30 of the body X. The extension B is a round elongate part that projects rearwardly from the face 35 and is adapted to enter into the bore A. The extension B is characterized by a conically shaped outer wall 37 that flares outwardly and rearwardly as shown. The taper or flare of the wall 37 may be varied as circumstances require, and is preferably substantially parallel with the taper of the forward end portion 22 of the finished projectile body (see FIG. 2). The extension B terminates in a flat rear end face 38.

The anchor rib C, as best illustrated in FIG. 2 of the drawings, is initially formed in one configuration and is afterwards bent or deformed into another configuration. As initially formed, the rib C is a rounded projection 40 that extends continuously around the periphery of the extension B. That is, the projection 40 is an annular element that projects outwardly or radially from the wall 37, and it is located intermediate the face 35 and the end face 38, above referred to. The cross sectional configuration of the projection 40, as originally formed, is convex or arcuately curved, preferably 180° of a circle.

The recess D, as best illustrated in FIG. 3 of the drawings, is preferably formed in the body X since the body of steel is harder in substance than the nose Y which is of aluminum, or the like, a softer material. The recess D is adapted to engage with and deform the anchor rib C and is provided in the body X rearward of the face 30 and positioned to receive the rib C when the faces 30 and 35 are in abutment with each other. The recess is formed by cutting a channel in the counter bore 31. The channel is a continuous annular channel or groove and it is preferably tooth-shaped in cross sectional configuration, for example buttress shaped. As shown, the channel has a front wall 46 in a plane normal to the axis of the structure, and a rear wall 47 that is rearwardly and inwardly convergent. The said rear wall 47 extends from the front wall 46 to the counterbore 31. The cross sectional area of the recess D is substantially the same as that of the rib C so that the rib is simply deformed or compressed when the nose Y and body X are in final condition (see FIG. 1).

The grip means E, as best illustrated in FIG. 5 of the drawings, like the recess D, involves the form of the body X which is of harder material than the nose Y. The means E, in the preferred form of the invention, involves teeth or serrations 50 that face inwardly from the counterbore 31 to engage with the outer wall 37 of the extension B. There are several teeth 50, and preferably circumferentially spaced groups of teeth that may be formed in the counterbore 31 as by a rolling operation. The teeth 50 as illustrated, may be located at the forward end of the bore A between the face 30 and the recess D. When the nose Y and the body X are in final condition the teeth 50 bite into the wall 37 deforming the metal forming the nose Y whereby the nose and body are secured against relative rotation.

From the foregoing specification it will be readily apparent that the forward end portion 22 of the body X is bent or deformed from its original form (see FIG. 3) so that the bore A is constricted onto the extension B. During this process or operation of swaging or rolling, the recess D is engaged with the rib C compressing the rib so that it fills the recess. Further, the teeth 50 of the grip means E bite into the extension B by deforming the wall 37 of the extension B. The exterior taper or curvature at 22 of the body X is controlled by employing suitable tools to the end that the finished projectile is permanently assembled and the parts thereof secured

together so that they cannot be separated even under the most severe conditions.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an inwardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular recess in the tapered portion of said bore adjacent its open end, a solid nose of softer material than said body and having an extension entering the tapered portion of said bore and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, and an annular radial projection on said extension filling said recess in said bore.

2. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an inwardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular recess in the tapered portion of said bore adjacent its open end, a solid nose of softer material than said body and having an extension entering the tapered portion of said bore and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, an annular radial projection on said extension filling said recess in said bore, and grip means between said body and said nose to stop rotation therebetween.

3. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an inwardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular recess in the tapered portion of said bore adjacent said open end, said tapered portion of the bore having inwardly disposed teeth, a solid nose of softer material than said body and having an extension entering the tapered portion of said bore and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, and an annular radial projection on said extension filling said recess in said bore.

4. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an inwardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular recess in the tapered portion of said bore adjacent its open end, a solid nose of softer material than said body and having a rearwardly flared cone-shaped extension entering the tapered portion of said bore and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, and an annular radial projection on said extension filling said recess in said bore.

5. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an inwardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular tooth-shaped recess in the tapered portion of said bore adjacent its open end, a solid nose of softer

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material than said body and having a rearwardly flared cone-shaped extension entering the tapered portion of said bore and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, and an annular radial projection on said extension filling said recess in said bore.

6. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an inwardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular recess in the tapered portion of said bore adjacent its open end, a solid nose of softer material than said body and having a rearwardly flared cone-shaped extension entering the tapered portion of said bore, and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, an annular radial projection on said extension filling said recess in said bore, and grip means between said body and said nose to stop rotation therebetween.

7. A projectile of the character described including, an elongate body having a flat front face, said body being formed with a straight cylindrical portion and an in-

wardly tapering portion terminating at said face, and with a bore entering therein from said flat front face and having corresponding straight and tapered portions, an annular recess in the tapered portion of said bore adjacent its open end, a solid nose of softer material than said body and having a rearwardly flared cone-shaped extension entering the tapered portion of said bore and engaged therewith throughout its length, said nose extension terminating short of the end of said bore remote from said face, and an annular radial projection on said extension filling said recess in said bore, said body having teeth engaging said extension to stop rotation therebetween.

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