

## Zaid et al.

[15]      **3,680,485**

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[54] **SALVO SQUEEZEBORE PROJECTILE**

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[51] **Int. Cl.**.....**F42b 11/02**

[58] **Field of Search**.....102/38, 93, 83, 94, 92.4

[56] **References Cited**

## UNITED STATES PATENTS

3,450,050	6/1969	Robinson.....	102/92.4
815,992	3/1906	Wheeler et al.....	102/93
847,149	3/1907	Barlow.....	102/93
1,044,360	11/1912	Du Bois.....	102/93
3,013,495	12/1961	Stevenson.....	102/87

3,412,681	11/1968	Schirneker.....	102/38
926,431	6/1909	Luger .....	102/38
1,376,530	5/1921	Greener.....	102/38
1,669,969	5/1928	Garuth.....	102/38

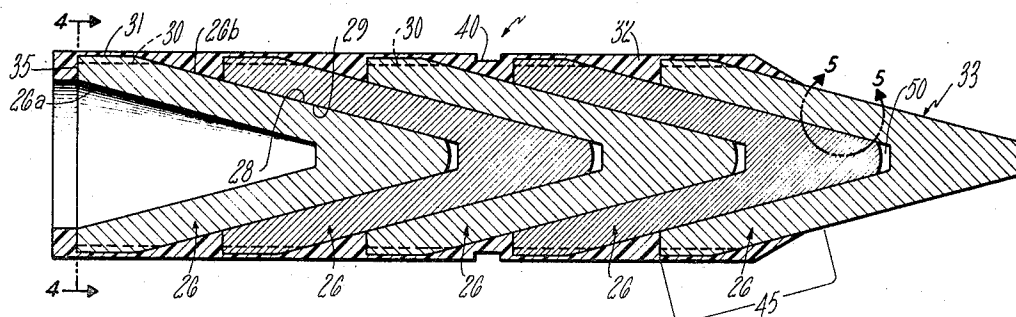
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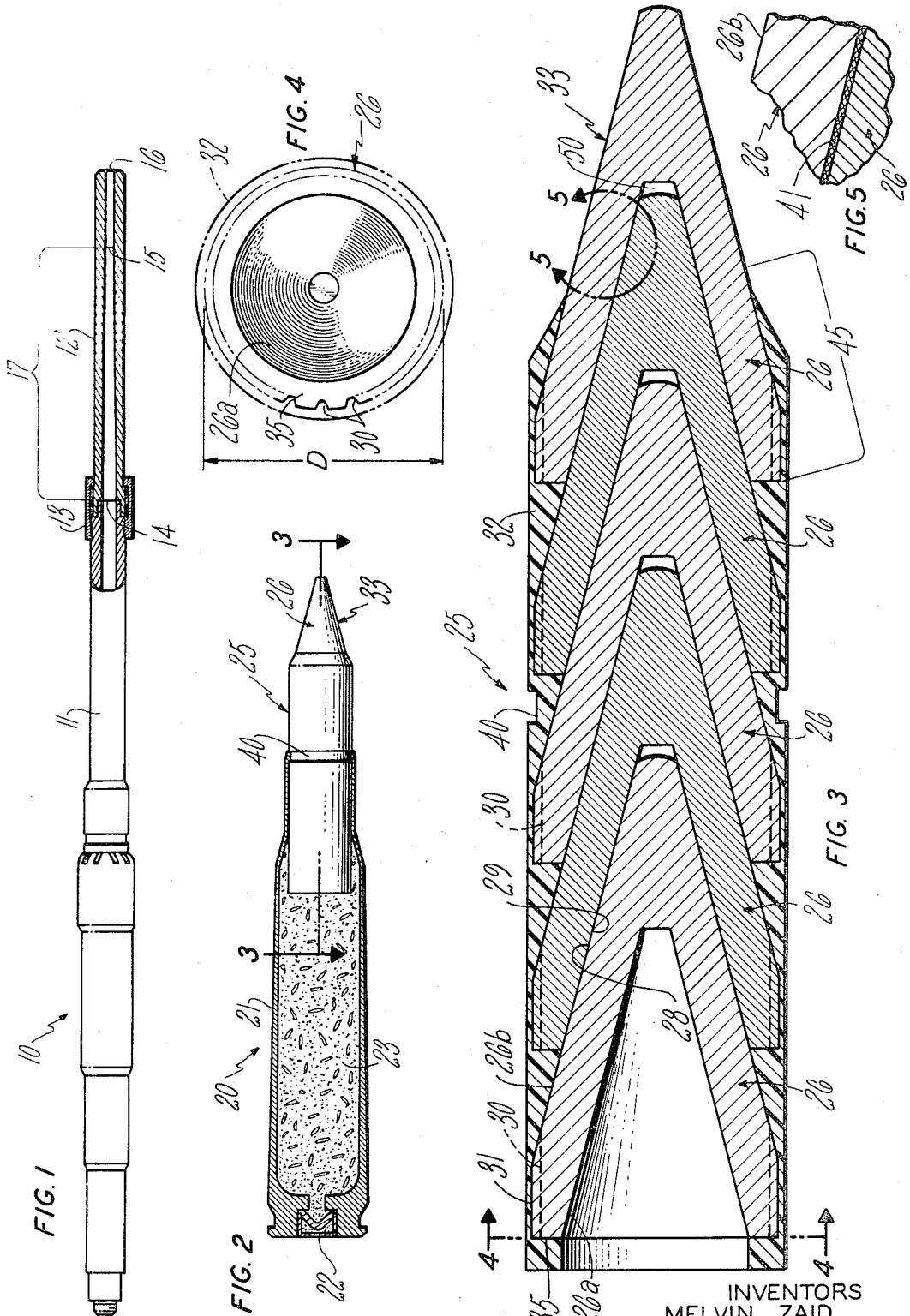
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[57] **ABSTRACT**

A series of substantially identical subprojectiles are secured together to form a projectile assembly with the subprojectiles in intimate engagement to substantially eliminate voids and trapped volumes between adjacent subprojectiles or between the projectile assembly and the gun barrel. The projectile assembly is secured in a cartridge case to form a cartridge for use in a squeezebore firearm barrel, wherein the projectile assembly separates to form a salvo of separated subprojectiles. Additionally, provision is made to alter the identity of the subprojectiles to permit inclusion of a tracer projectile, an armor piercing subprojectile or the like.

**14 Claims, 11 Drawing Figures**





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FIG. 6

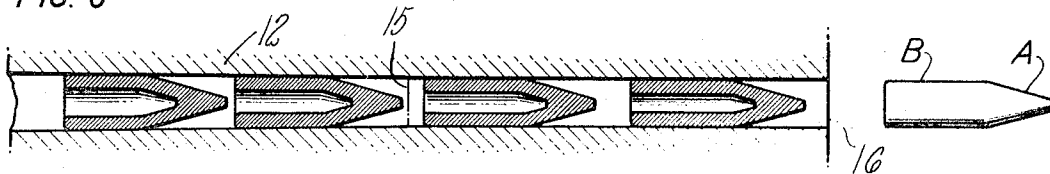


FIG. 7

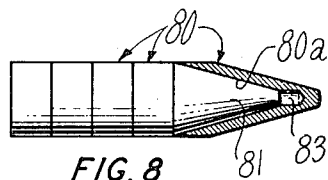
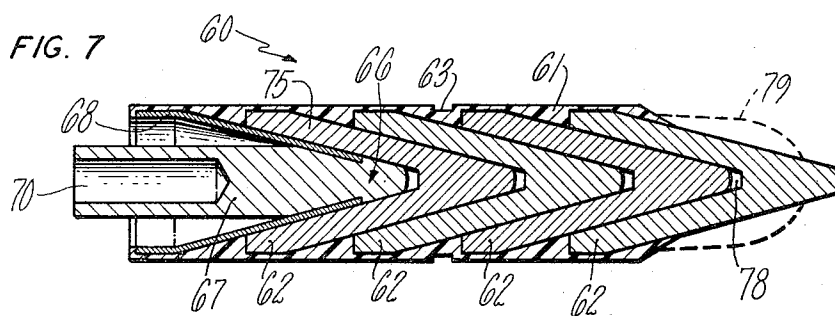


FIG. 8



FIG. 9

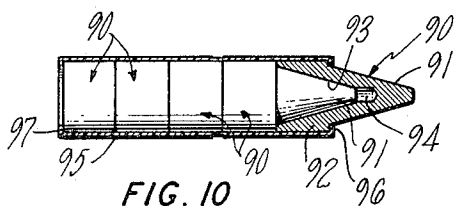


FIG. 10



FIG. 11

## SALVO SQUEEZEBORE PROJECTILE

This invention generally relates to ammunition for firearms of the squeezebore type and is particularly directed to the provision of improved squeezebore ammunition wherein the firing of a single round produces a salvo of separated subprojectiles.

As exemplified by U.S. Pat. No. 3,450,050 issued to Russell S. Robinson and assigned to the assignee of this invention, squeezebore guns are known in the art and are generally characterized by a gun barrel whose bore is larger in diameter at its breech end than at its muzzle end; such barrels may be rifled or smooth with various taper forms. Similarly, ammunition for use in such firearms is known and has utilized projectiles of various forms including the projectiles of the aforementioned Robinson patent, which introduced the concept of forming a projectile assembly from a plurality of specially formed subprojectiles, each subprojectile cooperating with its adjacent subprojectile to form a sealed cavity with the side wall of the tapered barrel bore to effect separation of the subprojectiles while the assembly travels the length of the barrel.

It is a principal object of this invention to provide an improved salvo squeezebore projectile assembly wherein the subprojectiles are of simplified shape and form such that subprojectile separation during movement of the projectile assembly through the squeezebore of the barrel is obtained without utilizing auxiliary propellants between subprojectiles, trapped fluids or volumes, or the like.

It is a further object of this invention to provide a salvo squeezebore cartridge wherein the subprojectiles are easily and reliably secured together with the resulting projectile assembly assembled in the cartridge case in a facile manner without interfering with subprojectile separation, and while at the same time permitting normal handling of the cartridge without inadvertent separation of the subprojectiles; included within this object is the provision of a projectile assembly wherein the leading subprojectile is guided during movement through the squeezebore.

It is an additional object of this invention to provide a salvo squeezebore assembly wherein at least one of the subprojectiles can perform a function, such as a tracer, that is different from the function of the other subprojectiles and without interfering with the intended operation of the entire projectile assembly.

It is a still further object of this invention to provide a salvo squeezebore cartridge of low cost construction that is susceptible of fabrication and assembly by modern manufacturing techniques with the resultant assembly being possessed of normal storage life under customary environmental conditions while being subjected to customary ammunition handling.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

A better understanding of the objects, advantages, features, properties and relationships of this invention will be obtained from the following detailed description and the accompanying drawings which set forth illustrative embodiments and are indicative of the ways in which the principles of this invention are employed.

In the drawings:

FIG. 1 is a plan view partially broken away of a standard machine gun barrel modified to include a squeezebore portion at the muzzle end;

FIG. 2 is a plan view of a salvo squeezebore cartridge of this invention partially broken away to show details of the cartridge case;

FIG. 3 is a cross section view taken along the lines of 3—3 of FIG. 2 and showing details of the projectile assembly;

FIG. 4 is a cross section generally taken along the lines of 4—4 of FIG. 3;

FIG. 6 is an enlarged partial cross section view of that portion of the projectile that is identified by the lines of 5—5 of FIG. 3;

FIG. 6 is a schematic cross section view of a typical arrangement of subprojectiles exiting from the squeezebore section of the gun barrel of FIG. 1;

FIG. 7 is a cross section view of an alternative embodiment of a projectile assembly;

FIG. 8 is an alternative embodiment of the projectile assembly using modified subprojectiles;

FIG. 9 is a cross section view of a subprojectile of the assembly of FIG. 8 after firing;

FIG. 10 is a partial cross section view of still another embodiment of the invention; and

FIG. 11 is a cross section view of a single subprojectile of the embodiment of the invention shown in FIG. 10 after firing.

Turning first to FIG. 1 for an understanding of a typical barrel for use with the salvo squeezebore projectile assembly of this invention, it is seen that the barrel designated 10 is comprised of a standard barrel section 11 of reduced length and a squeezebore barrel section 12 which are secured together by barrel nut 13. For purposes of this description barrel section 11 can be considered to be part of a standard .50 caliber barrel, the muzzle end of which has been removed to accommodate the squeezebore section 12. In the preferred embodiment, the entrance caliber 14 of squeezebore barrel section 12 is .50 caliber which diameter tapers uniformly to point 15 in the barrel at which point the final desired caliber, in this case .30 caliber, is provided with a substantially straight barrel from point 15 to muzzle end 16. Rifling (not shown) and other normal characteristics of a standard .50 caliber barrel can be retained in barrel section 11 whereas tapered barrel portion 17 can be left smooth to accommodate a change in spin velocity of the subprojectiles occasioned by their reduction in diameter by passage through the barrel portion 17. It is to be understood that the barrel 10 is described only for purposes of a more complete understanding of the invention and that any suitable squeezebore barrel can be utilized with the projectile assembly of this invention.

Turning now to FIG. 2 and the cartridge 20, it is seen that a standard .50 caliber cartridge case 21 is utilized having a conventional primer 22 and a standard propellant powder load 23. If desired, the projectile assembly generally designated 25 may be selected to have a mass substantially equal to the mass of a standard .50 caliber projectile, a preferred embodiment of the projectile assembly of the present invention being shown in enlarged cross sectional view in FIG. 3. Salvo squeezebore projectile assembly 25 is seen to include five substantially identical, generally conically shaped subprojectiles 26, each of which is provided with a conical recess 26a in its trailing surface arranged coaxial with and having the same included apex angle as the conical leading surface 26b. That is to say each subproj-

jectile is a shell-like structure having a conical outer surface and coaxial conical inner surface such that leading surface 28 of each projectile is in intimate engagement with trailing surface 29 of each preceding subprojectile over substantially the full length thereof. As best seen in FIG. 4, the outer diameter of the outer trailing edge of each subprojectile in the preferred embodiment is provided with a diameter "D" of substantially .50 caliber and is also provided with a plurality of grooves 30 extending longitudinally over the flat portion 31 of each subprojectile. There is cast about the projectile assembly a plastic sleeve 32 embracing the forward section of the lead projectile 33 and running continuously along the assembly to embrace the trailing surface 35 of the last projectile; the grooves 30 function to assist the flow of plastic during the jacketing operation to insure a longitudinally continuous structure and are believed to assist in transmitting the spin velocity caused by the standard barrel rifling to the projectile assembly. An annular groove 40 is provided in the plastic jacket to facilitate structural assembly of the projectile assembly into the cartridge case by providing a recess into which the lip of the cartridge case is crimped. Because the plastic performs no function in subprojectile separation, its selection is not critical although nylon has been found to be effective.

During travel of the subprojectile through the barrel, the outer diameter of each subprojectile is reduced from the initial .50 caliber to the final .30 caliber diameter; it is therefore essential that at least the trailing skirt portion which is generally designated 45 be formed from a deformable or frangible material to accommodate such a reduction in diameter. In practice, it has been found that subprojectiles formed from copper throughout provide the desired deformability and avoidance of excess wear on the barrel squeeze-bore while being effective as projectile. However, other materials can be used depending upon desired subprojectile purpose.

Turning now to FIGS. 5 and 6 as further explaining the construction and operation of the preferred embodiment of projectile assembly of this invention, it is seen that the squeeze-bore portion of the barrel functions much the same as the squeeze-bore barrel of the aforementioned Robinson patent in that the subprojectiles are reduced in outer diameter, become somewhat elongated, and are separated so that five discrete spaced subprojectiles exit from the muzzle end 16 of the barrel. The specific mechanics of the separation of the subprojectiles of the present invention, while not being fully understood are believed to be such that the surfaces 28 and 29 of each subprojectile are caused to slide relative to each other by the compressive force of the tapered barrel portion, there being no trapped volume to contain a fluid or auxiliary inter subprojectile propellant. The included angle of the tapered recess (and the taper of the nose portion) must therefore be selected to preclude a wedging action and frictional welding between adjacent subprojectiles; it has been found in the preferred embodiment that an included angle of approximately 30° is eminently suitable. Because of the sliding movement between the adjacent abutting conical surfaces of the subprojectiles, it has been found useful to provide (as schematically illustrated in FIG. 5) a thin lubricant film 41, which

lubricant can be a plated coating, a conventional soap film, an oxide film or other lubricant disposed in a thin layer to assist the separation of the subprojectiles and to preclude a frictional welding between subprojectiles which might jam the weapon. As seen in FIG. 6, the lead portion A of each subprojectile remains substantially unchanged as the trailing portion B is successively reduced in diameter by the squeeze-bore of the barrel with the onset of separation of the projectiles occurring during travel through the squeeze-bore portion of the barrel so that the resulting projectiles are well separated and each has the general configuration of a hollow .30 caliber bullet.

Turning now to the alternative embodiment of FIG. 7, it is seen that the projectile assembly 60 is substantially identical to that of FIG. 3 including a plastic sleeve 61 to hold the assembly together, the plurality of subprojectiles 62, and the groove in the sleeve 63 to facilitate crimping of the cartridge case. In this embodiment, however, the final subprojectile 66 is comprised of a body 67 to which is secured a deformable or frangible skirt to create an external appearance similar to that of the preceding subprojectile. The manner of securing the skirt 68 to the body 67 is not essential to the invention nor is the specific material utilized to form the skirt since it is merely desired to achieve a propellant gas seal while being deformable or frangible during passage through the squeeze-bore portion of the barrel. The body 67 is however selected from a material and conically configured at its leading edge to insure its separation from the preceding subprojectile while providing a hollow cavity 70 in which, for example, a tracer mixture can be carried to be ignited by the propellant mixture. Such a constructional combination can also be used to accommodate an armor piercing subprojectile whose body would have a fixed diameter while being provided with a skirt to provide the desired gas seal. For completeness it can be pointed out that the specific configuration of the gas seal and the material from which it is made does not constitute a part of the present invention, for example, a frangible plastic mass would be suitable.

To further illustrate the diversity of functions possible in the assembly, a subprojectile 75 having a configuration identical with the preceding copper subprojectiles but being formed of a different substance, as for example of mild steel rather than copper, can also be used as part of the projectile assembly.

Again referring to FIG. 7, there is shown in dotted lines 79 an integral extension of plastic jacket 61 extending forward along the leading subprojectile. While length and shape of such projection is not critical, such a plastic mass has been found useful in maintaining the orientation of the first subprojectile coaxial with the barrel during travel therethrough.

To more fully describe the substantial variety of alternative subprojectile configurations that can be utilized within the present invention concept, the embodiment of FIG. 8 has been provided wherein trailing surfaces 80a of each subprojectile 80 fully engages the leading surface 81 of the succeeding subprojectile so that the resultant projectile assembly is one of a pointed nose with a continuous body. Such subprojectiles can be held together as desired as, for example with a light film of oil or wax, and have been success-

fully fired from a barrel of the type shown in FIG. 1 to achieve substantially the same subprojectile separation as obtained with the embodiment of FIG. 3 and with a configuration of the resultant subprojectile as being shown in FIG. 9.

Another embodiment of subprojectile configuration is shown in FIG. 10. Each subprojectile 90 has a conical nose 91 portion with a cylindrical trailing portion 92; a conical recess 93 is provided to accept the nose portion of the succeeding projectile. A heat shrinkable plastic tubing 95 extending from the front cylindrical edge 96 to the rear cylindrical edge 97 provides integral packaging such that firing from the barrel of FIG. 1 produces projectile separation as in the preceding embodiment; the resultant subprojectile cross section after firing being substantial as shown in FIG. 11.

From the foregoing description of the projectile assembly of FIGS. 8 and 10 it is seen that a projectile which substantially eliminates all trapped volumes and/or chambers between the adjacent subprojectiles as well as between subprojectiles and the barrel, nonetheless produces the desired separation of the subprojectiles so long as the included nose angle (and the angle of the recess) is selected to preclude wedging and/or frictional welding during travel through the squeeze-bore portion of the barrel. It has been observed from test firings that the plastic material filling the spaces between the subprojectiles of the embodiments of FIG. 3 and FIG. 7 and the nose portion of the embodiment of FIG. 7 has usually been found after test firing as small pieces or rings of plastic. For completeness it is pointed out that the recess 50 shown in FIG. 3, recess 78 in FIG. 7 and recesses 83 and 94 of FIGS. 8 and 10 result solely from the manufacturing techniques employed, are exceedingly small in size and provide no functional contribution to the separation of the subprojectiles.

From the foregoing description of the structure and operational theory of the salvo squeeze-bore assembly, it is seen that a low cost easily manufactured subprojectile can be packaged to multiply the fire power of an easily modified standard weapon and that within the projectile assembly there can be provided dissimilar subprojectiles to perform different functions.

As will be apparent to persons skilled in the art, various modifications, adaptations and variations of the foregoing specific disclosure can be made without departing from the teachings of the present invention.

We claim:

1. A projectile assembly for use in squeeze-bore firearms comprising a plurality of subprojectiles arranged in coaxial relationship with the lead portion of one of said subprojectiles being received in an inwardly tapered recess formed in the preceding subprojectile of the assembly, the side wall of the recess in the preceding projectile being in intimate engagement with the outer side wall of the lead portion of said one subprojectile throughout substantially the full axial length of the recess, at least the outer radial extremity of said subprojectiles being capable of being reduced in diameter by the squeeze-bore of the firearm at least the rearmost subprojectile being imperforate with its outer radial extremity engageable with the side walls of the bore of the firearm barrel whereby the propulsion force is exerted on said rearmost projectile thereby to push the projectile assembly down the barrel of the firearm.

2. A projectile assembly as set forth in claim 1 wherein the outer radial extremity of each of said subprojectiles is engageable with side walls of the bore of a gun barrel throughout substantially the full length thereof.

3. A projectile assembly as set forth in claim 1 wherein a lubricant is disposed between the engaging walls of adjacent subprojectiles.

4. A projectile assembly as set forth in claim 1 wherein means are provided in engagement with each of said subprojectiles to secure the projectile assembly together, said means being separable upon engagement of said subprojectiles with the squeeze-bore of the firearm.

5. The projectile assembly as set forth in claim 4 wherein said means is a plastic sleeve.

6. The projectile assembly as set forth in claim 1 wherein the final subprojectile has a main body diameter substantially equal to the final diameter resulting from the squeeze-bore and has sealing means secured thereto, the outer diameter of the sealing means being engageable with the side wall of the bore of the firearm barrel preceding the tapered squeeze-bore portion.

7. The projectile assembly as set forth in claim 6 wherein the trailing portion of the main body carries a pyrotechnic compound to provide visible subprojectile trace.

8. The projectile assembly as set forth in claim 1 wherein each of said subprojectiles is generally of conical shape and is provided with a conical recess for receiving the next subprojectile.

9. A projectile assembly for use in squeeze-bore firearms comprising a plurality of identical subprojectiles arranged in coaxial relationship each of said subprojectiles having a recess formed in its trailing surface that is complementary in shape to its leading surface and means securing each of said subprojectiles to each adjacent subprojectile with the lead surface of each of said subprojectile in intimate engagement with the side walls of the recess of the preceding subprojectile throughout substantially the full axial length of the recess at least the rearmost subprojectile being imperforate with its outer radial extremity engageable with the side walls of the bore of the firearm barrel whereby the propulsion force is exerted on said rearmost projectile thereby to push the projectile assembly down the barrel of the firearm.

10. A cartridge for firearms or the like comprising a projectile assembly including a plurality of subprojectiles secured together in nested relationship by a plastic sleeve embracing each subprojectile, a circumferential groove formed in said plastic sleeve and a cartridge case surrounding at least a portion of the projectile assembly and deformed into the groove in said sleeve to secure the projectile assembly to the case at least the rearmost subprojectile being imperforate with its outer radial extremity engageable with the side walls of the bore of the firearm barrel whereby the propulsion force is exerted on said rearmost projectile thereby to push the projectile assembly down the barrel of the firearm.

11. The cartridge as set forth in claim 10 wherein the subprojectiles are substantially identical and each is provided with axially extending grooves in locking engagement with said plastic sleeve.

12. A projectile assembly as set forth in claim 1 wherein guide means are provided on the leading sub-

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projectile of the projectile assembly to assist in maintaining said subprojectile substantially coaxial with the axis of the firearm barrel during travel therethrough.

13. A projectile assembly as set forth in claim 4 wherein said means extends forwardly of the trailing edge of the first subprojectile and engages the bore of the barrel to maintain said first subprojectile substan-

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tially coaxial with the axis of the bore.

14. The cartridge of claim 10 wherein said plastic sleeve extends along the conical leading surface of the first subprojectile to form guide means to assist in maintaining said subprojectile coaxial with the barrel.

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