

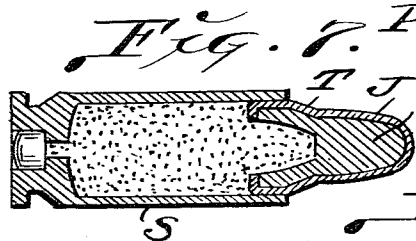
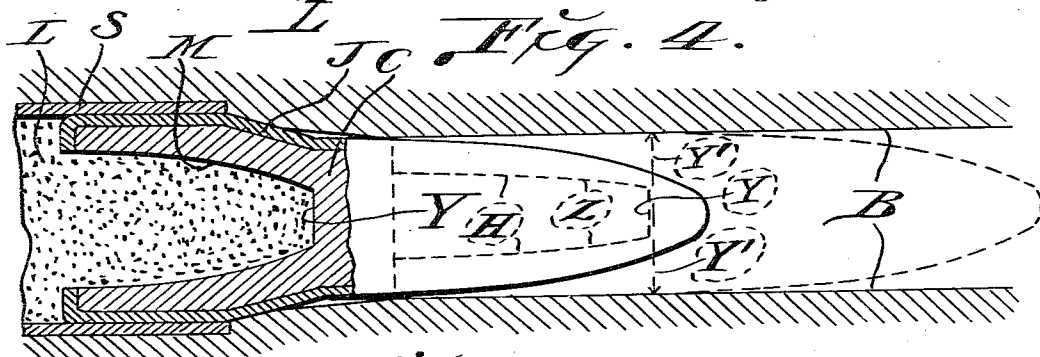
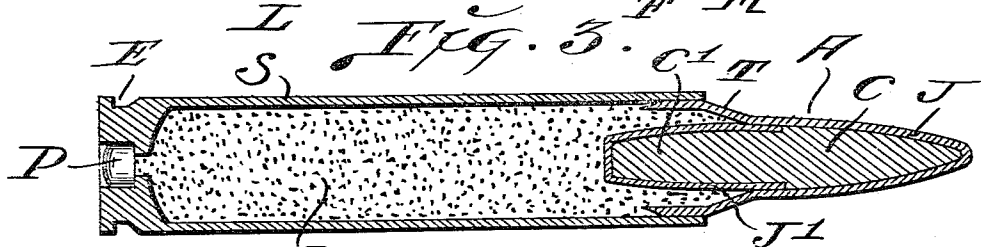
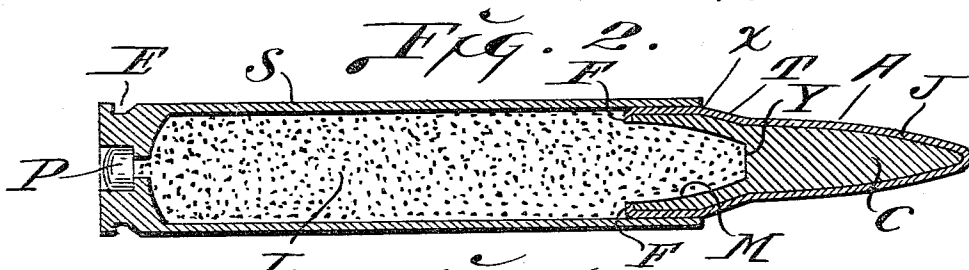
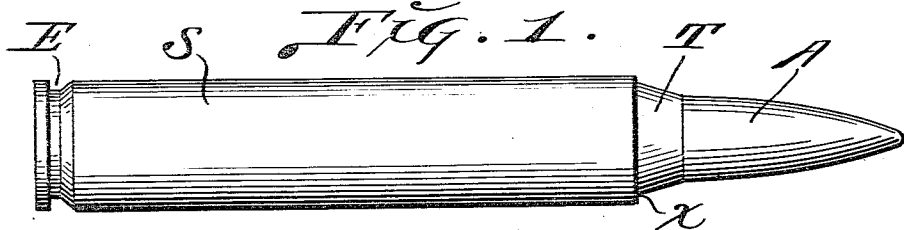
May 15, 1928.

1,669,969

W. A. CARUTH

GUN CARTRIDGE

Filed Sept. 22, 1926



Inventor:—
Wm. A. Caruth.
By Martin P. Smith, atty.

Patented May 15, 1928.

1,669,969

UNITED STATES PATENT OFFICE.

WILLIAM A. CARUTH, OF LOS ANGELES, CALIFORNIA.

GUN CARTRIDGE.

Application filed September 22, 1926. Serial No. 136,984.

My invention relates generally to gun cartridges and more particularly to that class of metallic and paper cartridges that have a powder chamber of enlarged diameter as compared to the diameter of the projectile and bore of the gun.

In the operations incident to the manufacture of the shell component or case in high power small arms ammunition the requirements call for the contraction or crushing down of the straight drawn metallic cartridge shell, thus producing a tapered shoulder near the forward end of the shell and forming a neck of reduced caliber to receive and hold the projectile. This crushing or contraction process, carried out for the purpose of producing at the forward end of the cartridge shell a shoulder and a neck of reduced diameter, causes inherent weaknesses at both the taper and neck of the shell and further the operations incident to the reduction of diameter or "bottle necking" of the shell add materially to production costs.

My invention has six principal objects:

First, the production of a cartridge with an explosive containing chamber of superdiameter as compared to the caliber of the projectile and bore of the gun, together with the elimination of the shoulder and neck at the forward end or mouth of the shell.

Second, the provision of a cartridge shell having exterior and interior wall surfaces following a modified taper, or if specifications require, with straight cylindrical exterior and interior wall surfaces, said shell having an explosive chamber of superdiameter, thus contributing to strength at the nozzle or mouth of the shell and enabling the shells or cartridges to be readily produced and with minimum cost of manufacture.

Third, the accomplishment of an automatic obturator or gas check by the projectile due to the shape of the rear portion thereof, whereby at the first instant of explosion, the escape of powder gas between the cartridge shell and the projectile is stopped. This action materially increases the efficiency of the combustible charge by preventing escape of power, and such action also protects the bore of the gun from erosion caused by the usual swift passage of superheated gas around and in front of the projectile before the same has moved forwardly into and completely filled the bore diameter of the gun.

Fourth, the elimination of loss of power

and accuracy in the case of fire arms that have been bored irregularly or above the usual limits of the maximum tolerance that is allowed over standard bore diameters. This is obtained by having my improved projectile made in two diameters, the diameter of the forward or reduced portion of the projectile conforming to the standard bore and rifling of the gun and the diameter of the larger rear portion of the projectile being that of the outer rim of a hollow cup that moves forward and contracts and shapes itself into the reduced actual bore diameter during the first instant of combustion of the explosive charge.

Fifth, the provision of a suitable stop or check to restrain the cartridge from moving too far forwardly into the breech or chamber of the gun while being inserted therein, said stop or check also serving to support the cartridge shell against the forward thrust of the firing pin at the time of discharge. This stop or check, which is to hold the cartridge in proper place within the chamber or breech of the gun, is in the form of a shoulder, preferably tapered so that its diameter gradually increases toward the rear of the body of the projectile. Thus, my improved cartridge does not require as a chamber stop the heretofore generally used rim or semi-rim that projects from the base of the shell, nor does it require the commonly designed stop shoulder in the "bottle neck" of the rimless cartridge case.

Sixth, the reduction of recoil and the lessening of gun barrel strains and vibrations by the elimination of all changes and irregularities of gas pressure and projectile velocity while the projectile is passing through the bore of the gun.

With the foregoing and other objects in view, my invention consists in certain novel features of construction and arrangement of parts that will be hereinafter more fully described and claimed and illustrated in the accompanying drawings in which:

Fig. 1 is an elevational view of a cartridge constructed in accordance with my invention.

Fig. 2 is a longitudinal section taken on a plane through the center of my improved cartridge.

Fig. 3 is a sectional view of a cartridge embodying the principles of my invention and which includes a "boat tail" projectile.

Fig. 4 is a sectional view showing the

forward portion of the shell or case with the projectile therein, said parts being shown positioned within a gun barrel and with dotted lines showing the contracted position of the rear portion of the projectile as the same passes through the bore of the gun.

Fig. 5 is a longitudinal section taken through the center of a cartridge of my improved construction and with the rear end of the shell or case provided with a projecting rim.

Fig. 6 is a longitudinal section through the center of a shell constructed in accordance with my invention and which is particularly adapted for automatic rifles, machine guns, self-loading rifles, and the like.

Fig. 7 is a longitudinal section taken through the center of a cartridge constructed in accordance with my invention and which is suitable for use in automatic pistols and sub-machine guns.

Referring by letters to the accompanying drawings, and particularly to the form of cartridge illustrated in Figs. 1 and 2, A designates the projectile, S the cartridge shell or case, T the tapered shoulder on the projectile, E the cannellure or groove for the accommodation of the shell extractor and X the circumferential line between the rear end of the tapered shoulder T and the front end of the portion of the projectile that has the greatest diameter, which portion of greatest diameter is positioned in the forward portion of the shell or case so that the line X between said portion of greatest diameter and the rear end of the tapered shoulder T practically coincides with the straight shoulder at the forward end of the wall of the shell or case S.

Projectile A is made up of a jacket J or relatively hard metal having great ductility and a core of lead or analogous metal and which core is provided in its base or rear portion with a substantially conical recess M and the inner end or bottom of said recess is made substantially flat so as to provide a pressure face Y. Jacket J wholly encloses the enlarged base or rear portion of the projectile and the rear edge of said jacket is preferably flanged inwardly over the end of the wall of core C that surrounds chamber M, as designated by F.

When the projectile is properly seated in the shell or case S, the chamber M within the hollow base of the core C provides a forward extension for the loading space L within the shell S that receives the combustible charge. Seated in the base or rear end of the shell S is the usual primer and fulminate P.

In Fig. 3 I have illustrated a projectile of the type generally described as a "boat tail" and where this form of projectile embodies my invention, the rear portion of the

core C of the projectile terminates in a "boat tail" portion C¹ that is enclosed by a jacket J¹ and this jacketed "boat tail" portion is concentrically arranged within that portion of the projectile jacket J that is seated in the mouth or forward end of the shell S, there being an annular space between the rear portion of jacket J and the "boat tail" portion of the projectile.

In Fig. 4, L designates the loading space for the combustible charge, S the shell or case of the cartridge, J the jacket of the projectile, C the core of the projectile, B the bore of the gun barrel, and Y the pressure face at the inner end of the recess in the base or rear portion of the projectile.

The dotted lines Z within the right hand portion of the bore B in this figure illustrate the form assumed by the base portion of the projectile after it has received the first impulse of forces resulting from combustion of the charge and when said projectile has been moved forwardly into the bore of the gun. Inasmuch as the recessed base of the projectile is collapsed when said projectile enters the bore of the gun, the recess M will be materially reduced in diameter and it will take substantially the form as indicated by dotted lines H.

In Fig. 5, I have illustrated a cartridge provided at its base or rear end with a rim or flange, but as a result of my invention of a dual caliber projectile, or a projectile having an enlarged hollow base, the shell has a superdiameter explosive chamber without resorting to the usual "bottle neck" in the forward portion of the shell. The case or shell S illustrated in this figure is uniformly tapered throughout its entire length.

It is obvious that it is one of the purposes of my invention to preclude the necessity of a rimmed cartridge shell such as Fig. 5 portrays, but this design is to show the possibility of the use of a projectile of my invention in a cartridge suitable for use without sub-alteration of the chamber in a firearm constructed for handling cartridges with shells having rimmed heads.

The form of cartridge illustrated in Fig. 6 is especially adapted for use in automatic rifles, machine guns and self-loading rifles of the so-called "blow back" type. In this instance, the case or shell has the same external diameter throughout its length and the formation of a semi-rim or stop behind the extraction cannellure at the base of the cartridge is avoided by the provision of the tapered shoulder T on the intermediate portion of the projectile.

In Fig. 7, I have illustrated a cartridge particularly designed for use in automatic pistols and sub-machine guns. This particular cartridge is very similar to the structure illustrated in Fig. 6 in that the car-

tridge case is of uniform external diameter throughout its length and the tapered shoulder T on the projectile obviates the necessity for a semi-rim at the base of the cartridge shell or case.

Thus it will be seen that my invention contemplates a cartridge shell or case consisting of a straight drawn metallic or paper casing having a suitable head or base, the latter being cannellured or rimmed for extraction and carrying the usual primer, the chamber within the shell or case being adapted to receive the explosive charge and said shell or case holding at its forward end a projectile having two different diameters, the portion of greatest diameter being seated in the shell, there being a tapered shoulder between the two portions of the projectile of different diameters and the enlarged base of the projectile being recessed.

Drawing is one of the least expensive forms of metal working and by eliminating the "bottle neck" and the turned semi-rim, manufacturing operations involving component weaknesses and excessive costs are avoided. The shell per se herein described include nothing new or original and no claim is made thereto, except as combined with a projectile of the particular construction herein described and illustrated.

My invention has been described as relating to certain forms of rifle cartridges and pistol ammunition, but it should be understood that my invention is applicable to cartridges for all arms and ordnance using fixed and complete unit ammunition. It is generally known and understood that the term "fixed and complete unit ammunition" herein referred to describes ammunition in which the primer or fulminate is placed in the base of the cartridge case, the explosive charge occupying the greater portion of the chamber within the cartridge case and the projectile or lethal load being carried in the forward portion of the shell or case or seated therein and projecting forwardly therefrom, all of the part just mentioned being firmly joined together and providing a fixed and complete unit of handling and loading for each discharge of the gun.

The projectile contemplated by my invention may be properly described as being of dual caliber inasmuch as it is formed with two different external diameters, the portion of smaller diameter being arranged in front and conforming with the caliber of the bore or rifling of the gun. The rear portion of the projectile has the greater diameter and this portion is fitted into the forward portion or mouth of the shell or casing. The projectile may be swaged into the shell by pressure or crimped therein. The tapered portion of the projectile that connects the portions of different diameters provides a shoulder and stop for the car-

tridge when the latter is positioned in the breech or chamber of the gun and likewise furnishes support when the firing pin strikes the primer to fire the cartridge.

It is obvious that if the forward edge or rim of the shell be of sufficient thickness to abut against a corresponding shoulder in the gun barrel it will assist the shoulder in the projectile in sustaining the forward thrust of loading and firing, but where the cartridge case or shell is of thin metal this assistance would be insufficient to function in support of the forward thrust against the shell.

The enlarged base and tapered portion of the projectile are provided with a centrally or concentrically arranged recess or chamber which, it will be readily understood, permits the enlarged rear portion of the projectile to contract or crush inwardly as the projectile enters and passes through the bore of the gun.

Sub-caliber or contracted diameter projectiles with hollow or recessed bases have been long known and used and I make no claim for the invention of a hollow base projectile recessed or cupped out within a portion of its rear body where the outer diameter is less or no greater than the bore of the gun.

The phrase "super-caliber" used herein refers to the commonly constructed cartridge with an enlarged diameter powder chamber.

My invention comprehends a cartridge containing a projectile having a hollow rear portion or base with an outer diameter substantially greater than that of the front portion of said projectile and which front portion conforms to the bore of the gun. My invention further includes a cartridge containing a projectile having an enlarged rear portion, the diameter of which is substantially greater than that of the bore of the gun, the forward portion of said enlarged rear end having a tapered exterior surface, said enlarged and tapered rear portion being cupped or recessed so that it will contract as it enters the bore of the gun, and which bore is smaller in diameter than the diameter of the recessed enlarged rear portion of said projectile.

The recess that is formed in the base or rear portion of the projectile must be large enough to still remain a recess or cavity when the larger rear portion of the projectile is collapsed or compressed when it enters and passes through the caliber diameter of the bore, and in order that this result may be attained, the recess is preferably tapered toward its forward end and of necessity it must extend forwardly until its forward end or the surface Y is practically coincident with or a slight distance forward of the forward end of the tapered shoulder T. In other words the recess or cavity extends en-

tirely through the rear portion of the largest diameter and through that portion of the projectile body encompassed by the external tapered shoulder and the forward smaller end of the recess terminating within the body at a point coincident with or slightly forward of the transverse plane where the forward portion of smaller diameter joins the forward end of the tapered shoulder T.

Projectiles have been made with super-caliber solid bodies, but only the slightest and almost inconsiderable increase in diameter can be accomplished thereby owing to the tremendous increase in breech pressures involved. My invention, by the use of a projectile with a body of super-diameter in its rear and recessed within said super-diameter, insures the contraction of a base of materially enlarged outer diameter without undue pressures being incurred.

A further decided advantage arising from my invention is the prevention of practically all gas escape between the shell and projectile during the first instant of combustion of the explosive charge, for as the projectile is forced from the mouth of the shell, a perfect seal is effected between the enlarged base portion of the projectile as it passes the tapered shoulder within the gun bore against which the tapered portion T of the projectile normally rests. The high speed rush and wash of gas preceding the projectile through the "lead" and bore is impossible and thus the full power of the explosive charge is conserved.

Another advantage of my invention arises from the fact that the modified tapered or straight cartridge shells that receive the dual caliber projectiles will not stretch with high pressure loads and said shells may be readily resized as to diameter for reloading, whereas the shells of the "bottle neck" type of cartridge when used with high intensity charges, become lengthened and cannot be successfully recharged and used again. The "bottle neck"-shell also requires more careful metallurgical selections and testing than does the straight shell, and in times of large and urgent quantity manufacture, the "bottle neck" cartridge is always a product of doubtful and uncertain quality.

A further advantage that prevails in fixed ammunition by the use of my invention is the tapered recess or chamber in the rear or base of the projectile for, by referring to Fig. 4 it will be seen that the projectile has full bore diameter at the point designated by the dotted line Y and to the rear of this line as the projectile moves forward into the gun bore the pressure of gases within the contracted recess holds the cupped and tapered rear portion of the projectile firmly against the rifling and maintains complete contact with the bore of the gun. The flex-

ibility of the powder gas within the contracted chamber H tends to counteract the effects of any irregularities in the bore and hence provides for equable pressures.

A further advantage to be noted is that the manufacture of the cartridge embodying my invention requires only the primary "drawing" and shaping processes for making the shell and the relatively simple stamping or die process for shaping the projectile, together with the usual assembly of the component parts of the cartridge, so that all complex operations requiring special gauging and inspection are avoided.

A further advantage obtained by the use of a cartridge with a projectile of my invention, is that gas pressures within the bore of the gun are regulated more evenly than is the case with the ordinary cartridge having a projectile of the usual shape and form. With the commonly designed cartridge, at the instant of first ignition of the combustion charge, the projectile at zero breech pressure leaps out of the mouth of the cartridge shell and travels in the small bore rifle a distance of approximately two inches before shaping itself into the bore at a point of maximum pressure and low velocity. From this point forward, the full impetus of maximum pressure having been received, the projectile travels toward the muzzle of the gun with a constantly decreasing pressure and with a constantly increasing velocity.

It is an axiom among authorities on internal ballistics that high pressure on the part of the gases from the combustion at a point within the bore, means low velocity on the part of the projectile at said point, and vice versa. A rising curve of gas pressure, means a decreasing velocity for the projectile, and a falling curve of gas pressure, means an increasing velocity for the projectile.

By my invention the full height of the pressure curve, calculated within the bore during the firing of the cartridge is developed by the explosion and expansion of the combustion charge at a point nearer the breech and at least two inches farther back toward the chamber of the piece than is usual. Therefore my invention by forcing, at the first instant of discharge a reduction in diameter and a contraction of the rearward hollow super-caliber section of the projectile retards the customary sudden leap of the projectile into the bore, and avoids the subsequent slowing down of the projectile velocity at a point of high pressure materially forward in advance of the cartridge chamber.

My invention hence, provides for the cartridge, a projectile that develops an immediately substantially high pressure with low velocity at its first advance up the bore; and there is no primary increase, intermediate

decrease and final increase in the velocity of the projectile, but instead only a regular increase of the velocity accompanied by a constantly reduced pressure curve as the projectile approaches the muzzle of the piece. My invention, therefore, by eliminating velocity changes within the bore during the discharge of the cartridge, produces a reduction and an evenness of recoil and relieves unnecessary strains and vibrations within the gun barrel.

While I have herein illustrated and described the projectile as being composed of a lead core and ductile jacket, it will be understood that my invention comprehends a projectile composed wholly of lead, lead alloy, or any other suitable metal or combination of metals.

It will be understood that minor changes in the size, form and construction of the various parts of my improved cartridge may be made and substituted for those herein shown and described without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. A cartridge comprising a shell having a super-caliber chamber adapted to receive an explosive charge, a projectile having two different diameters, the forward portion of which projectile, and which has the smaller diameter being adapted to enter the bore of a gun, the rear portion of the projectile and which has the larger diameter being seated in the mouth of the super-caliber explosive chamber within the cartridge shell the portions of different diameter of said projectile being joined by a tapered shoulder and the larger rear portion of said projectile being provided with a tapered recess that extends forwardly through the shouldered portion of the body of said projectile to the caliber diameter thereof.

2. A cartridge comprising a shell and a projectile having two different diameters, the forward portion of said projectile having the smaller diameter being adapted to enter the bore of a gun, the rear portion of greater diameter of said projectile fitting snugly within the forward portion of the super-caliber explosive chamber in the shell, the portions of said projectile having different diameters being joined by a tapered shoulder that is adapted to bear against a shoulder within the cartridge chamber of the gun in which the cartridge is positioned, and the larger rear portion of said projectile being provided with a tapered recess that extends forwardly through the shouldered portion of the body of said projectile to the caliber diameter thereof.

3. A cartridge comprising a shell and a projectile having two different diameters, the forward portion of said projectile having the smaller diameter being adapted to enter

the bore of a gun, the rear portion of greater diameter of said projectile fitting snugly within the forward portion of the super-caliber explosive chamber in the shell, the portions of said projectile having different diameters being joined by a tapered shoulder that is adapted to bear against a shoulder within the cartridge chamber of the gun in which the cartridge is positioned so as to function as a stop to support the cartridge in proper position against the forward thrust of the bolt in loading and the forward blow of the firing pin at the time of discharge and the larger rear portion of said projectile being provided with a tapered recess that extends forwardly through the shouldered portion of the body of said projectile to the caliber diameter thereof.

4. A cartridge comprising a shell, a projectile having two different diameters, the portion of said projectile having the greatest diameter being seated in the forward portion of the shell, the portion of least diameter of said projectile being adapted to enter the bore of the gun in which the cartridge is positioned, the portions of different diameter of said projectile being connected in front of and outside the shell by a tapered shoulder that is adapted to bear against a corresponding shoulder within the chamber of the gun to support said cartridge in proper position against the forward impulses of loading and firing and the larger rear portion of said projectile being provided with a tapered recess that extends forwardly through the shouldered portion of the body of said projectile to the caliber diameter thereof.

5. A cartridge comprising a shell, a projectile having the forward portion of its body reduced in diameter so as to conform to the bore of the gun in which the cartridge is fired, the rear portion of the body of the projectile having greater diameter than the forward portion, the portions of different diameters being joined by a tapered shoulder and the enlarged rear portion of said projectile being formed with a centrally arranged recess that is open to the rear of the body of the projectile and which extends forwardly through that portion of the body that is encompassed by the tapered shoulder.

6. A cartridge comprising a shell, a projectile having the forward portion of its body reduced in diameter so as to conform to the bore of the gun in which the cartridge is fired, the rear portion of the body of the projectile having greater diameter than the forward portion, the portions of different diameters being joined by a tapered shoulder and the enlarged rear portion of said projectile being formed with a concentrically arranged chamber that is open to the rear of the body of the projectile and which extends forwardly through that portion of the

body that is encompassed by the tapered shoulder.

7. A cartridge comprising a shell having an external wall of straight cylindrical form throughout its length, a projectile having a body of two diameters, the front portion of the projectile body having the smaller diameter and which conforms to the bore of the gun in which the cartridge is fired, the rear portion of the body of the projectile having the greatest diameter enclosing a hollow segment, the outer wall of which conforms to the internal diameter of the front portion of the super-caliber explosive chamber within the cartridge shell and the chamber within the hollow segmental rear portion of the body extending forwardly to the transverse plane occupied by the rear portion of the projectile body that conforms to the bore of the gun.

8. A cartridge comprising a shell, a projectile seated in the forward portion of said shell said projectile having an externally arranged tapered shoulder intermediate its

ends, so that the forward portion of said projectile is smaller in diameter than the rear portion, and the larger rear portion of said projectile being provided with a forwardly extending tapered recess that extends through that portion of the body of the projectile that is encompassed by the tapered shoulder.

9. A cartridge comprising a shell, a projectile seated in the forward portion of said shell said projectile having an externally arranged tapered shoulder intermediate its ends, so that the forward portion of said projectile is smaller in diameter than the rear portion, the larger rear portion of said projectile being provided with a forwardly extending tapered recess that extends through that portion of the body of the projectile that is encompassed by the tapered shoulder, and the forward end of which recess terminates in a flat pressure receiving face.

In testimony whereof I affix my signature.
WILLIAM A. CARUTH.