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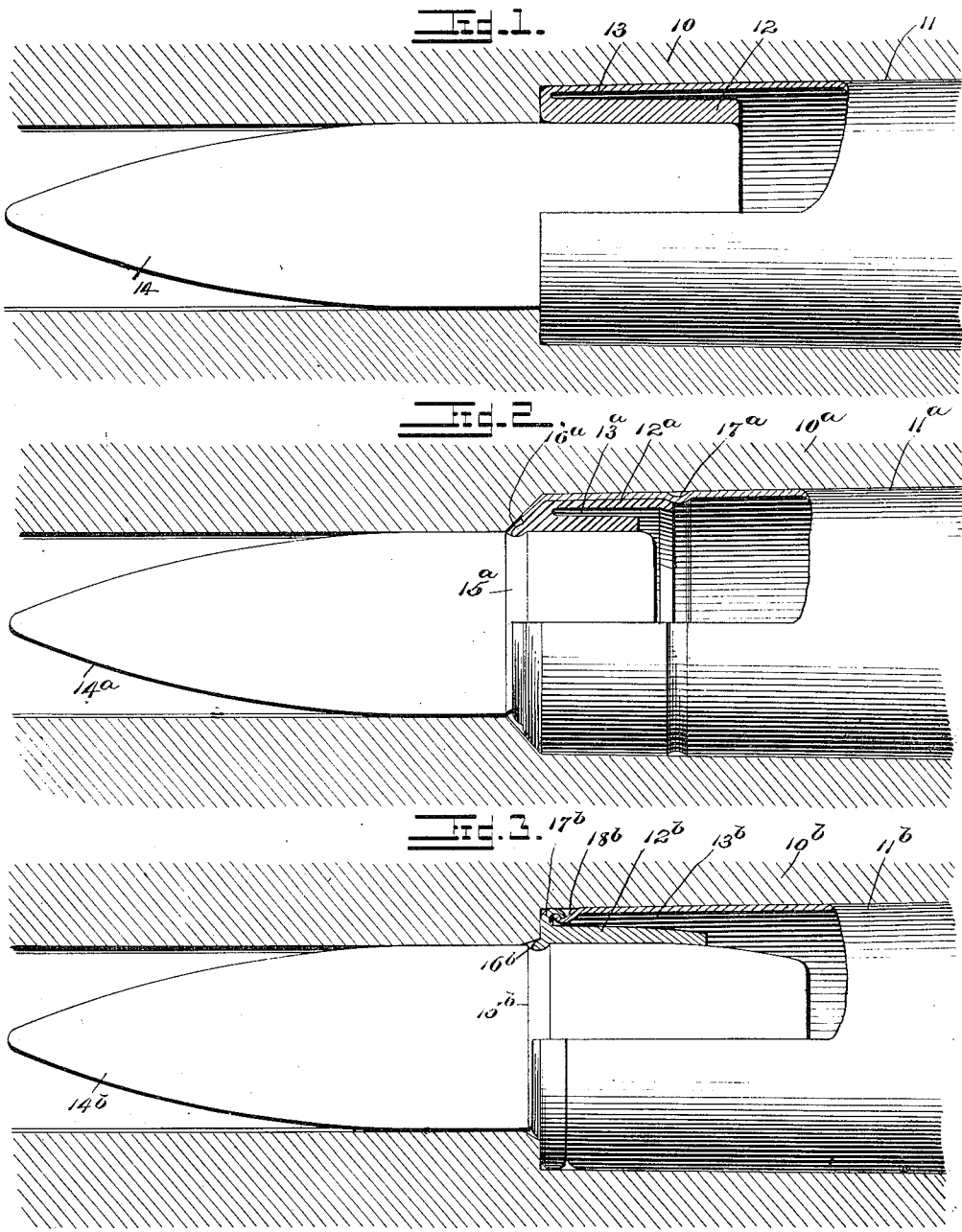
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M. F. BÉHAR

GUN AND AMMUNITION THEREFOR

Filed April 20, 1920

4 Sheets-Sheet 1



INVENTOR.
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Oct. 16, 1923.

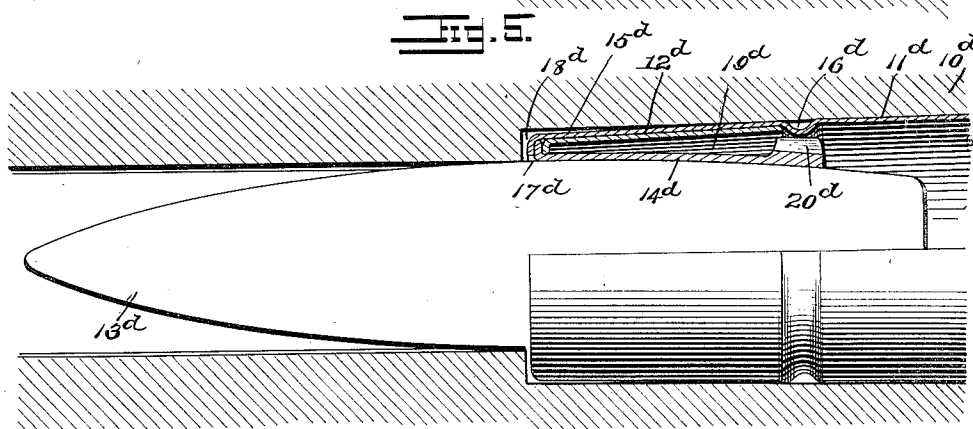
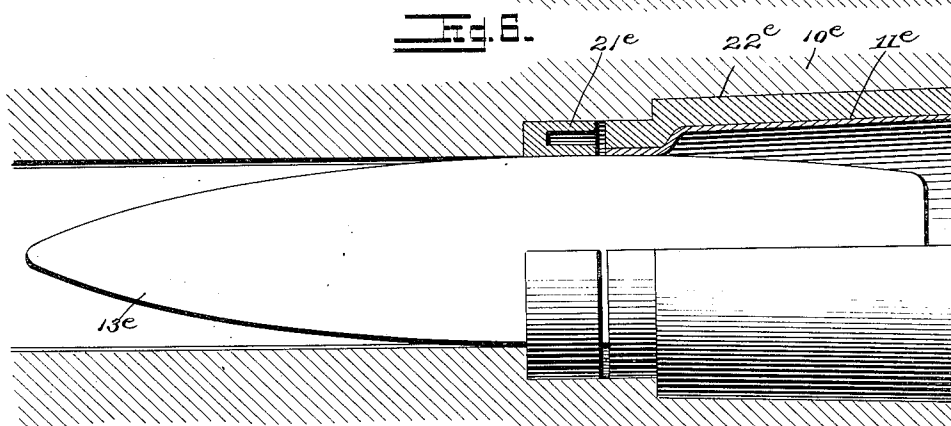
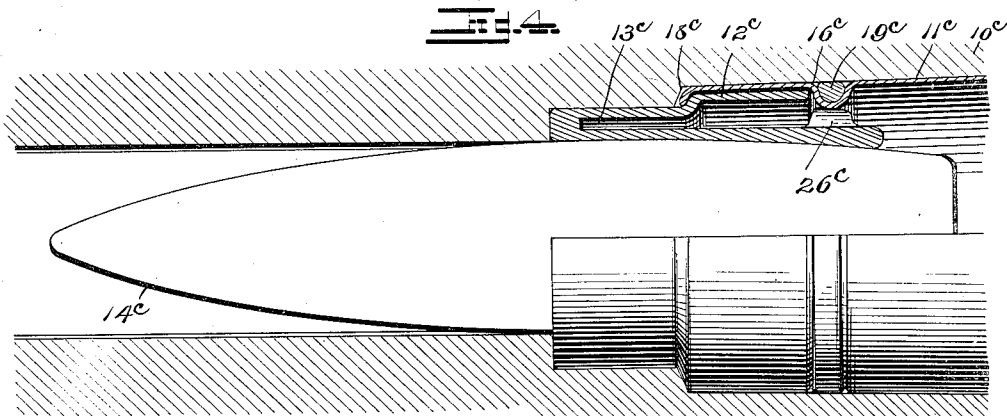
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4 Sheets-Sheet 2



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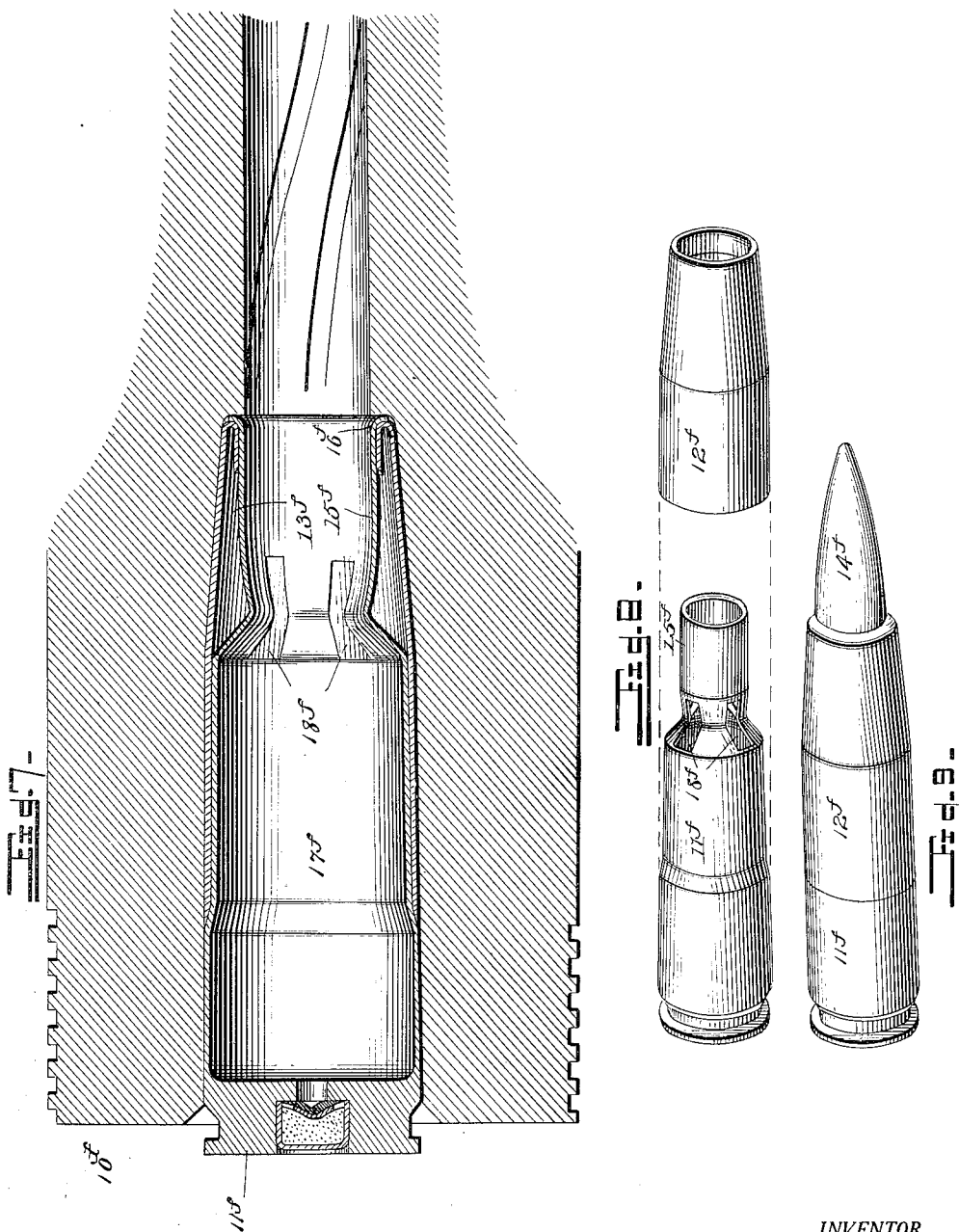
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GUN AND AMMUNITION THEREFOR

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4 Sheets-Sheet 3



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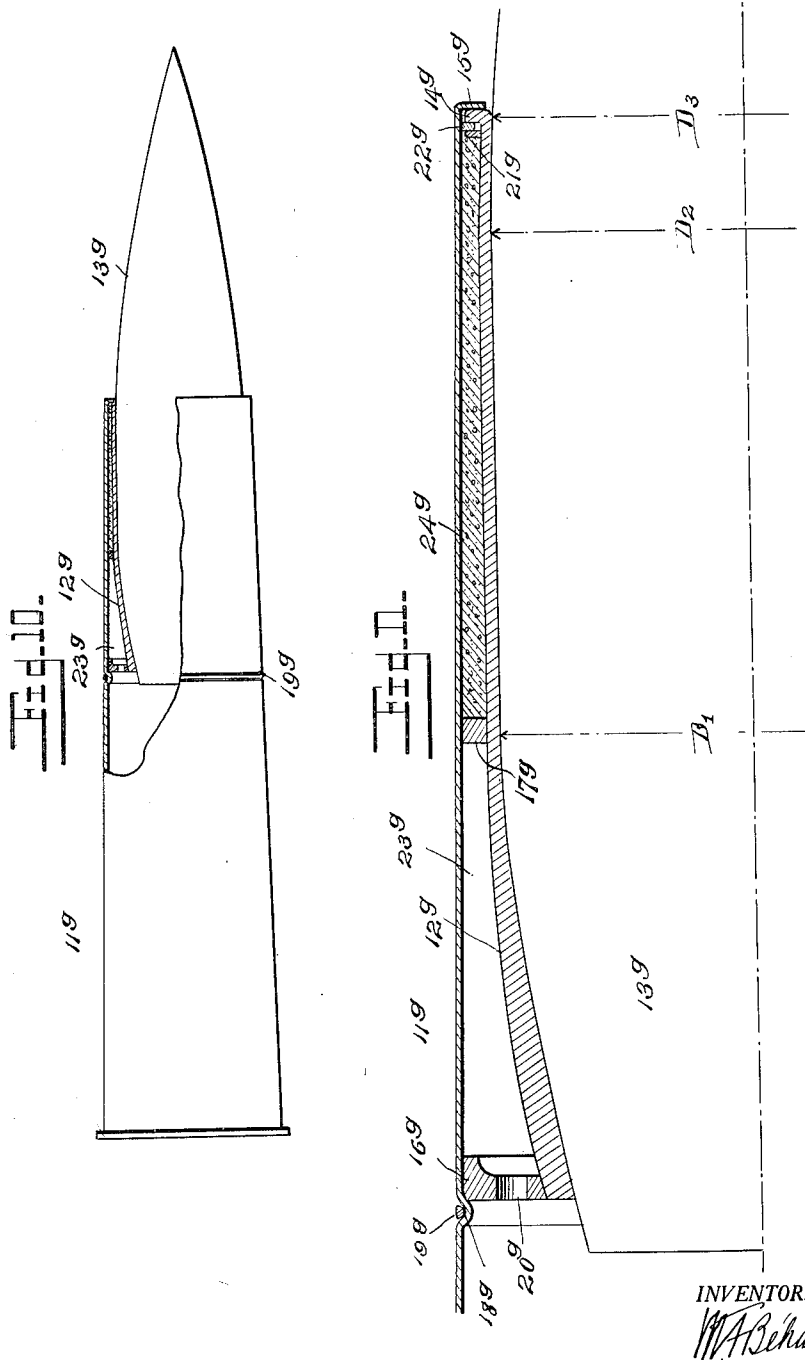
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GUN AND AMMUNITION THEREFOR

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE.

MANOËL FÉLIX BÉHAR, OF THE UNITED STATES ARMY.

GUN AND AMMUNITION THEREFOR.

Application filed April 20, 1920. Serial No. 375,370.

To all whom it may concern:

Be it known that I, MANOËL FÉLIX BÉHAR, Lieutenant, Ordnance Department, United States Army, a citizen of the United States, stationed at Daytona, Florida, have invented an Improvement in Guns and Ammunition Therefor, of which the following is a specification.

The subject of this invention is a cartridge of the fixed ammunition type and relates more particularly to the case thereof.

The value of a firearm depends upon the degree of probability with which, when it is properly aimed, its projectile can be relied upon to hit a desired target. It is known that in the best of firearms now manufactured, using the best ammunition obtainable, the accuracy of the barrel steadily decreases from the firing of the very first shot.

The principal causes of inaccuracy in a rifled barrel of any caliber are those conditions which produce changes either in the form of the projectile or in its normal velocity of rotation while it progresses through the bore. It is evident that such changes can be effected only by irregularities inherent in the form and dimensions of the bore and therefore loss of accuracy is due ultimately to the agencies at work producing such irregularities. These agencies are the erosive action of the powder gases and the friction of the projectile or its band on the rifling. Of these two, the latter is negligible. The accuracy life of a barrel therefore depends upon the rate at which erosion proceeds. It is known that the erosive action of the powder gases attacks the bore originally in the immediate vicinity of the seat of the projectile, that is to say at the rear end of the bore, and that its effect in all stages is most pronounced at that point. This is because the temperature is highest there, the duration of heating is longest, but principally because the gases can escape past the projectile until the latter has moved forward far enough to seal the bore. It is this rush under tremendous pressure of white hot gas and possibly also of liquids and of incandescent and yet ungasified explosive which produces erosion. Erosion takes place mainly between the mouth of the cartridge case and the sealing point and progresses along the bore by gradually advancing this point. As this point advances, the distance the projectile must pass over be-

fore it takes the rifling continually increases. In its passage through this eroded portion the projectile is not centered in the bore and as this distance increases the velocity acquired by the projectile when it strikes the rifling increases. The result is that the projectile in almost every case enters the rifling obliquely, which causes it to be deformed unsymmetrically and even though the projectile after leaving the eroded section passes through four-fifths or more of the bore the lands and grooves of which have remained practically unchanged, it is usually eccentric, irregular in shape and the jacket and core are no longer disposed symmetrically about the axis of rotation. In a larger gun the velocity of the projectile when it strikes the rifling at a certain distance may be too great for it to be rotated at all. Neither of these conditions is corrected by the projectile's passage through the remainder of the bore and either is sufficient to destroy the accuracy of its subsequent flight.

The first purpose of this invention is to provide a means of effectually preventing this escape of gas around the projectile.

In firearms using fixed ammunition another detrimental condition is the deformation of the projectile due to unavoidable clearances between the cartridge case and the chamber and between the projectile and its seat. It is manifestly impracticable to manufacture a lot, or series, of barrels of which the chambers, bullet seats and bores all have dimensions varying not more than one-thousandths of an inch. It is equally impracticable to manufacture a lot, or series, of rounds of fixed ammunition of which the outer dimensions do not vary more than one-thousandths of an inch. Thus in almost all firearms using fixed ammunition with the usual "necked-down" cartridge case, even in the most modern and carefully made, when the cartridge is introduced into the chamber, the close fit is at the shoulder and there is an annular space between the neck of the cartridge case and the neck of the chamber. The inevitable consequence is that upon the explosion of the powder, before the projectile begins to move forward appreciably, the neck of the cartridge case expands up to the full diameter of the neck of the chamber and there is caused an annular space between the projectile and the neck of the cartridge case before the former has left the latter; and under the pressure of the powder

gases, which in high power modern fire arms is twenty-five tons per square inch, the initial movement of the projectile is not a true motion along the axis of the bore, but consists of a series of oscillations known as "wabbling" or "tipping," the projectile being thrown sidewise with great force always at least once and in most cases a number of times from the very beginning of its forward motion until it reaches the sealing point, and at the same time the powder gases are rushing past it at great speed, contributing to the erosive action above described.

It is a second purpose of this invention to prevent this oscillation or "wabbling."

With the modern high velocity rifle or cannon, an important factor affecting accuracy is the shape of the projectile. It has been found that irregularities on the outer surface decrease the range and accuracy. In the smaller calibers the cannellure around the bullet, which serves to position it in the mouth of the cartridge case, tends not only to lessen accuracy, but, in the case of jacketed bullets, to weaken the jacket, so that ruptures sometimes occur, the rear portion of the jacket remaining in the bore. The cannellure around bullets has been found also to cause "ringed bores" or enlargements in the bore of the rifle barrel. Other things being equal, therefore, the ideal projectile is one with a smooth exterior surface. It has also been found that a projectile with a tapering rear portion, so that its longitudinal section somewhat resembles a boat, is the one that offers the least resistance to the air. However, it has heretofore been found impracticable to position such projectiles accurately in the mouth of the cartridge case or at the beginning of the bore without having a rotating band, cannellure, or other irregularity on the surface of the projectile so as to form an abutment.

It is a third purpose of this invention to provide means for holding and accurately positioning projectiles having a perfectly smooth exterior surface whether they be flat based or "boat tailed."

The modern high velocity powder burns progressively, that is to say it does not develop its highest pressure at the instant of ignition but when the projectile has begun its progress along the bore. This has many advantages, but on the other hand a disadvantage is that it prevents early upsetting of the projectile, that is to say its radial expansion up to the full diameter of the bore. If an instantaneous powder were used, the great pressure developed at the start would be sufficient to cause certain jacketed projectiles thus to expand and seal the bore, thereby preventing the premature escape of gas around them, but with the modern high velocities a pressure sufficient to do this would compel employing barrels and breech mecha-

nisms so heavy that the disadvantage of their weight would outweigh the advantage of early bore sealing. This has necessitated manufacturing fixed ammunition with the projectile gripped tightly in the mouth of the cartridge case, the latter being generally crimped on the former, the aim sought but never yet attained being to delay the start of the projectile until after the pressure on its base has made it expand radially up to the diameter of its seat.

It is a fourth purpose of this invention to obtain early bore sealing even with progressive powders, without the necessity of a tight fit between the projectile and the cartridge case or the crimping of the cartridge case on the projectile.

Attempts have heretofore been made to prevent erosion, to prevent oscillation of the projectile at the beginning of the progress along the bore, to position the projectile accurately in the mouth of the cartridge case and to bring about the early upsetting of the projectile, which attempts in most instances consisted in a modified design of the projectile, but the result has been either a retardation of the flight of the projectile or a destruction of the accuracy of its travel. Real progress toward the solution of the above-described problems has been rather in the more careful manufacture than in any changes of design. The fits or clearances have been made smaller and smaller, but the mechanical difficulties encountered impose a certain limit beyond which the expense would be too great, and therefore while guns, rifles and cartridges manufactured now give less trouble than when high velocity powders were first used, the above described faults are still present, and the limit of manufacturing improvement has long ago been reached.

It is a fifth purpose of this invention to permit a greater degree of tolerances in the manufacture of firearms and ammunition.

In rifles, machine guns, and guns using a charge-containing case, the space between the rear end of the chamber of the barrel and the front end or "face" of the bolt or breech block, known as "head space" must be filled exactly by the base or head of the charge-containing case. When the case is too long it is difficult or impossible to close or lock the breech. When the case is too short the result is in most cases a rupture thereof, the front portion of the case remaining in the front of the chamber and causing a delay in the firing until this ruptured front portion is extracted, which is sometimes a difficult operation. These conditions, known respectively as excessive head space and insufficient head space, are found in practically all kinds and makes of charge-containing cases even after they have passed

final inspection at the factory or arsenal, and their existence is due to the fact that head spacing is regulated by the abutment of a frustum of a cone in the cartridge case against a corresponding surface in the chamber.

It is a sixth purpose of this invention to regulate the head spacing by means of the abutment of a plane surface on the charge-containing case against a corresponding plane surface in the chamber, both of the plane surfaces being perpendicular to the axis of the bore. This design permits a far greater degree of manufacturing facility, a far greater degree of ease and certainty of inspection, and a far greater assurance of correct head spacing, than in the present types of charge-containing cases.

With the present type of cartridges, reloading is attended with various difficulties incident upon resizing the case and positioning the bullet.

It is a seventh purpose of this invention to do away with these reloading difficulties.

With these and other objects in view, the invention resides in the novel arrangement and combination of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed without departing from the spirit of the invention.

Practical embodiments of the invention are disclosed in the accompanying drawings, wherein:—

Figure 1 is a fragmentary view in side elevation partly in section, of a preferred form of the invention; the cartridge being shown in the cartridge chamber of a rifle;

Figure 2 is a similar view of a modification of the invention;

Figure 3 is a similar view of a still further modification;

Figures 4 and 5 are similar views of another modification;

Figure 6 is a similar view of a modification wherein the gas check is provided in a built-up breech;

Figures 7, 8 and 9 are views of a modification wherein the gas check is provided in the neck of the cartridge case itself;

Figures 10 and 11 are views of a modification for the larger calibers of fixed ammunition, wherein means are provided, in addition to the gas check, for strengthening the charge-containing case and for simplifying reloading.

Referring to the drawings by numerals of reference:—

A portion of the breech end of a rifle is indicated at 10, and inserted in the chamber thereof is the cartridge-base 11 which is formed with an integral inturned socket

12, positioned in the mouth thereof and spaced from the outer wall of the cartridge case to form an annular recess or pocket 13. A bullet or projectile 14 is held in the socket 12.

Referring to Figure 2, a fragment of the breech end of a rifle is indicated at 10^a, and inserted in the chamber thereof is a cartridge-case 11^a having secured in the mouth thereof a socket 12^a formed with integral spaced-apart walls to provide an annular recess or pocket 13^a. The socket 12^a is held in position in the mouth of the cartridge-case 11^a in any suitable manner but, as herein shown, by means of an inwardly pressed annular beading 17^a which abuts the rear end of the socket and an inturned lip at the mouth of the cartridge case which overlies the forward end of the socket. The projectile 14^a has its rear end positioned within the inner wall of the socket 12^a and is formed with a cannellure 15^a adapted to receive a beading, crimping or flange 16^a formed on the socket 12^a, which serves to hold the bullet firmly in place.

In Figure 3, a fragment of the breech end of the rifle is indicated at 10^b and within the chamber thereof is positioned a cartridge case 11^b having a socket 12^b secured in the mouth thereof and spaced from the walls of the cartridge-case to form the annular recess or pocket 13^b. The socket may be secured in the mouth of the cartridge-case in any suitable manner but, as herein shown, the socket is provided with a rolled portion 17^b which overlies the outwardly flared rim 18^b of the mouth of the cartridge-case. Seated in the socket 12^b is the rear portion of a bullet or projectile 14^b which is formed with a cannellure 15^b adapted to receive a beading or flange 16^b formed on the socket 12^b, which serves to hold the bullet firmly in place in the cartridge-case.

In Figure 4 is shown a fragment of the breech end of a rifle at 10^c in which is positioned a cartridge-case 11^c formed with an inwardly pressed beading 16^c which may be held against crushing by a wire or other suitable ring 19^c. In the mouth of the cartridge-case is secured a socket 12^c formed with integral spaced-apart walls to provide an annular recess or pocket 13^c. The socket projects beyond the end of the cartridge-case, in which it is held in place by having its rear end abut the beading 16^c and the inturned lip 18^c of the cartridge-case engaging an annular shoulder formed on the socket. The inner wall of the socket preferably projects into the cartridge-casing beyond the outer walls thereof and is held in suitable spaced relation thereto by means of the lugs 20^c which are spaced apart annularly of the inner wall and which en-

gage the inwardly pressed beading 16°. A bullet or projectile 14° has its rear end held in the socket 12° the inner wall of the socket being sufficiently resilient to allow the curved end of the projectile to be inserted therein.

In Figure 5 is shown a slight modification of the form shown in Figure 4. The breech end of the rifle is indicated at 10^d and in the chamber thereof is inserted a cartridge-case 11^d formed with an inwardly pressed annular beading 16^d which may be held against crushing by a suitable wire as was shown in Figure 4. A bushing 12^d is inserted in the mouth of the cartridge-case with its inner end abutting the beading 16^d. The bushing is formed at its outer end with an inturned annular flange 15^d upon which is seated the outturned annular flange 17^d formed with the forward end of a socket member 14^d which projects into the cartridge-case and which is spaced from the bushing 12^d to form an annular recess or pocket 19^d. The socket member is held in suitable spaced relation by means of lugs 20^d which are spaced-apart annularly of the socket member and which abuts the beading 16^d. The socket member is preferably held in place by means of an inturned lip 18^d formed at the mouth of the cartridge-case and overlying the flange 17^d. A bullet or projectile 13^d has its rear end positioned in the socket member 14^d, the member having sufficient spring or resiliency to allow the rear end of the bullet to be inserted therein.

In practice, when the explosive in the cartridge-case is ignited, the gases formed are trapped in the annular recess or pocket causing the outer annular walls of the socket member to expand radially and causing the inner wall to grip the bullet more closely thereby cutting off escape of gases between the bullet and the socket member and also momentarily retarding expulsion of the bullet. In the case of a bullet having a core of soft metal, which is the usual form now used for high velocities, while the bullet is momentarily retarded, the pressure of the gases will force the soft metal of the core forwardly in the bullet jacket, expanding the same and causing the bullet to completely fill the bore and rifling of the rifle before any gas can escape past it, so that, when the bullet has left the cartridge-case and travels along the bore, no gas can escape around it and erode the rifle-bore.

In the modification shown in Figure 6 a fragment of a rifle breech is indicated at 10°, the breech of which is counter-bored to receive a U-shaped ring 21° and a filler or liner 22° which forms a chamber for the cartridge case. The cartridge-case is indicated at 11° and it is formed with an inwardly pressed neck adapted to grip the bullet 13°.

In practice, when the cartridge is fired,

the gases initially escaping about the projectile enter the annular recess in the U-shaped ring 21° and constrict the ring to cause the inner wall to grip the projectile and thereby form a gas-tight joint which will prevent the escape of gas beyond the bullet into the bore.

In the modification shown in Figures 7, 8 and 9, the breech of a rifle is indicated at 10°, and in the chamber thereof is inserted a cartridge case 11° formed with a neck 15° adapted to hold the projectile 14° around which it fits snugly. A sleeve 12° fits over the forward portion of the cartridge case 11° the mouth of which 16° is crimped thereon after assembling. An annular recess or space 13° communicates with the powder space 17° by means of several perforations 18° in the cartridge-case.

In practice, when the cartridge is fired, a portion of the powder gases passing through the apertures 18° enters the annular space 13° and causes the neck 15° to constrict the projectile 14° thereby preventing the premature escape of gas into the bore.

In the modification shown in Figures 10 and 11 the charge containing case is indicated at 11°. Seated in the mouth of the cartridge-case is a socket 12° which is shaped to fit around the projectile 13° and is formed with an outwardly turned flange 14°. An annular space is left between the case 11° and socket 12°. The socket 12° is positioned longitudinally at a predetermined point by its flange 14° being held down by an inwardly-turned flange 15° at the mouth of the cartridge-case 11°, and by means of a ring 16° which abuts an inwardly-pressed beading 18° which is held against crushing in any suitable manner, but as herein shown, by means of a wire 19° or other suitable ring. The socket 12° is also kept exactly concentric with the charge containing-case by means of the rings 16° and 17°. The ring 16° has a number of apertures 20°. The space 24° between the ring 17° and the flange 14° is filled with a mixture of asbestos and steel wool or other suitable gas-check pad composition, and at the forward end of that space are two rings 21° and 22°.

In practice, the shell or projectile 13° is forced down into the socket 12°, and when its tapered rear portion impinges upon the corresponding surface in 12°, the beginning of its ogive or pointed forward portion is held by the forward portion of the socket 12° of which, as will be seen by referring to Figure 11, the diameter D^s is smaller than the diameter D^a or D^b. This design, combined with the resiliency of 12° prevents the shell or projectile 13° from accidentally falling out or starting from its position when the round of ammunition is carried point down, jarred, etc. In practice when this round of ammunition is fired in a gun a

portion of the powder gases passes through the apertures 20^s into the annular space 23^s and causes the socket 12^s to constrict the projectile 13^s before the latter's inertia has been overcome. The powder gases drive the ring 17^s forward thus reducing the space 24^s and causing the cylindrical portion of the socket 12^s to constrict the shell or projectile 13^s at its cylindrical portion. This modification of the invention being designed for the larger calibers in which the duration of pressure is many times greater than in the smaller calibers, it is expected that a portion of the powder gases will in practice not only drive the ring 17^s forward but pass between it and the case 11^s and the socket 12^s into the space 24^s; but this space being filled with the gas check pad composition they will tend to be checked at that point; and if not they then will be checked positively by the two rings 21^s and 22^s, which are provided in addition to the design of the flanges 14^s and 15^s which two flanges in the smaller calibers would be sufficient to prevent escape of gas. As the projectile starts forward, its cylindrical portion (between diameters D¹ and D²) being slightly larger than the mouth of the socket 12^s an additional means

is thus provided for preventing the premature escape of gas. When the round has been fired, the forward opening or mouth of the socket 12^s returns to its original diameter D³ owing to the resiliency of the socket 12^s.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A cartridge, embodying a case, an annular pocket formed at the mouth of the case and opening therein and a projectile seated within the inner wall of the pocket whereby gas is trapped to cause the inner wall to grip the projectile to slightly delay expulsion of the projectile from the case.

2. A cartridge, embodying a case and an annular pocket formed at the mouth of the case and opening therein whereby gas is entrapped upon explosion of a powder charge in the case.

3. A cartridge, embodying a case and an annular pocket positioned at the mouth of the case and forming a part thereof for the entrapment of gas, the inner wall of said pocket forming a seat for a projectile.

MANOËL FÉLIX BÉHAR.