M. W. GILMARTIN.

PROJECTILE.

APPLICATION FILED JAN. 15, 1906.

996,403.

Patented June 27, 1911.

3 SHEETS—SHEET 1.

FIG. 1.

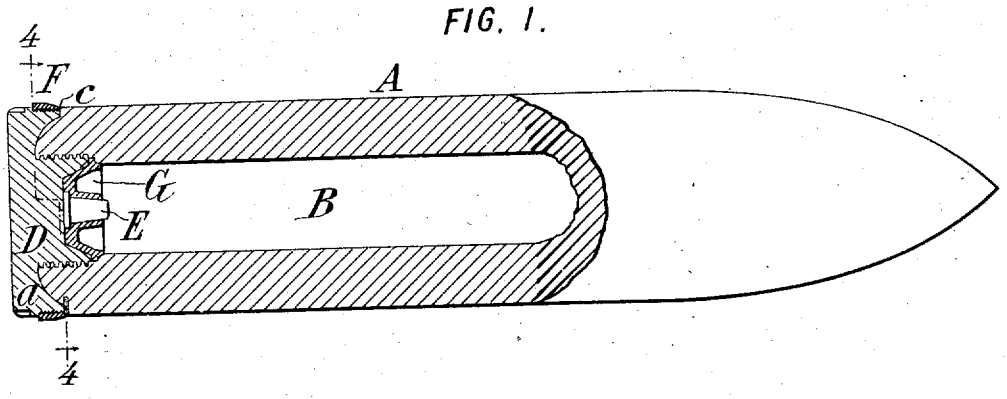


FIG. 2.

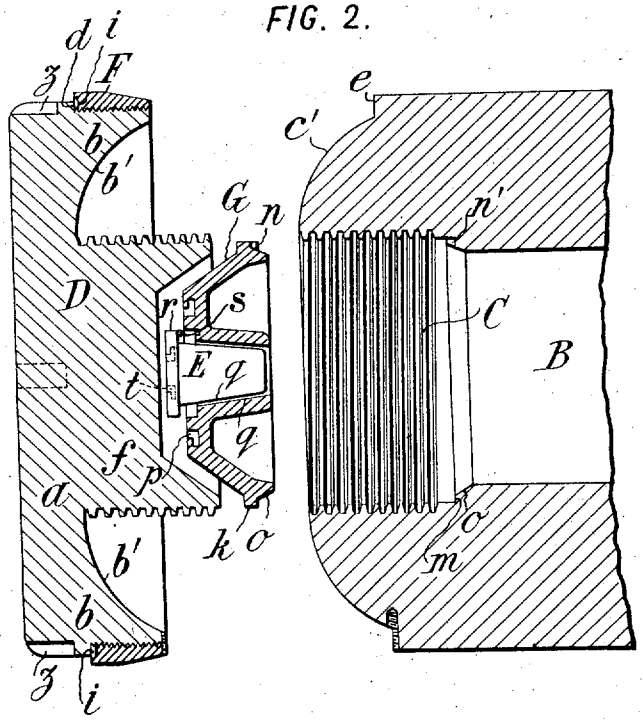


FIG. 3.

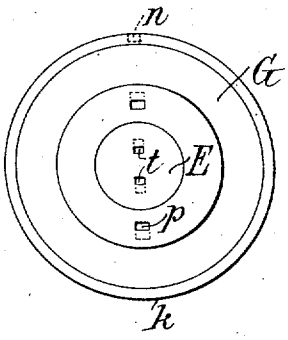
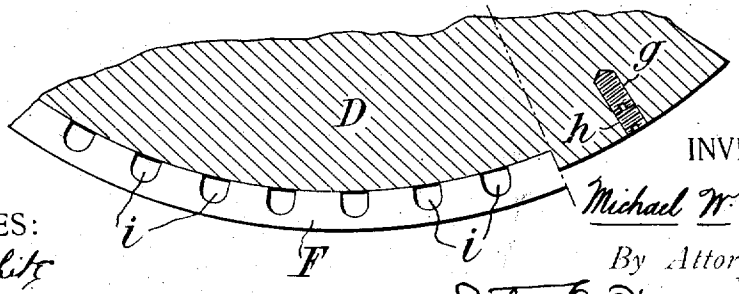


FIG. 4.



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3 SHEETS—SHEET 2.

FIG. 5.

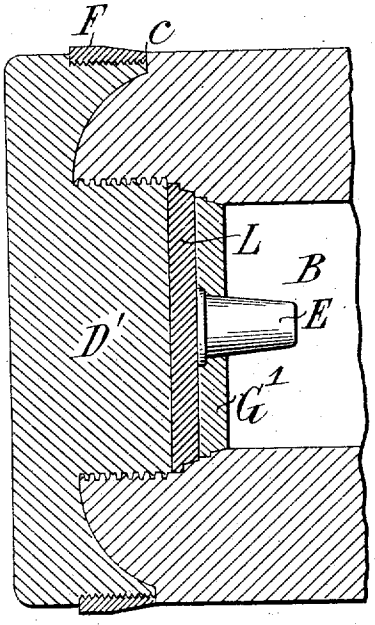


FIG. 6.

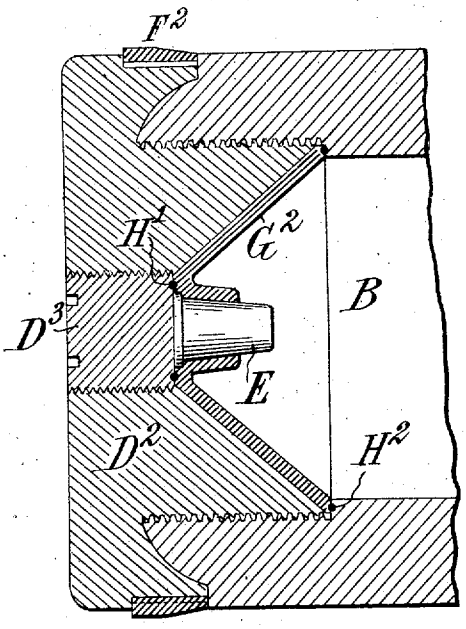


FIG. 8.

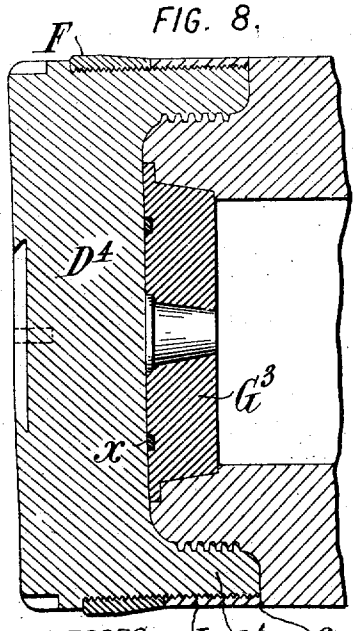
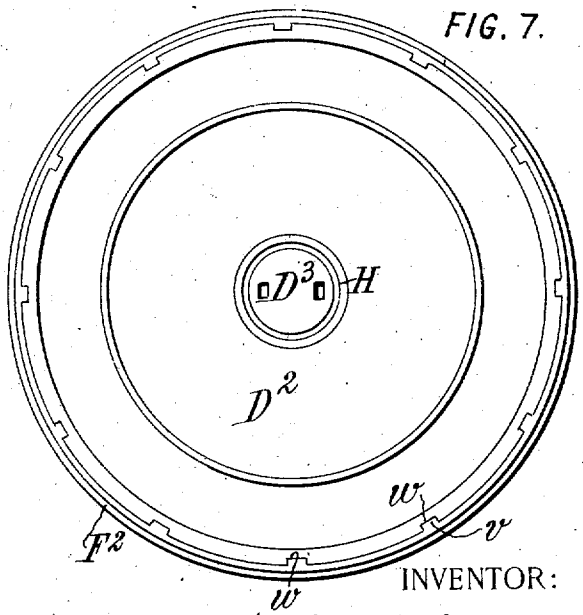


FIG. 7.



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3 SHEETS—SHEET 3.

FIG. 9.

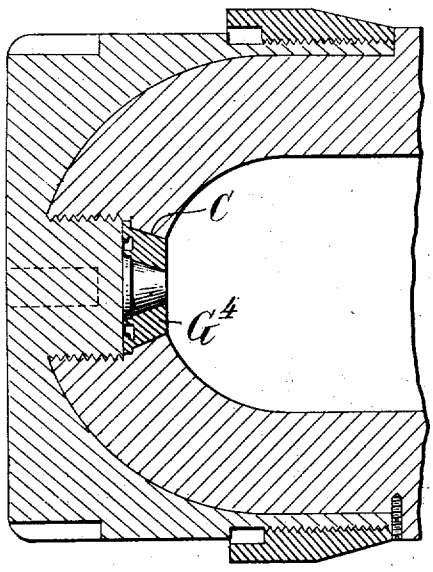


FIG. 10.

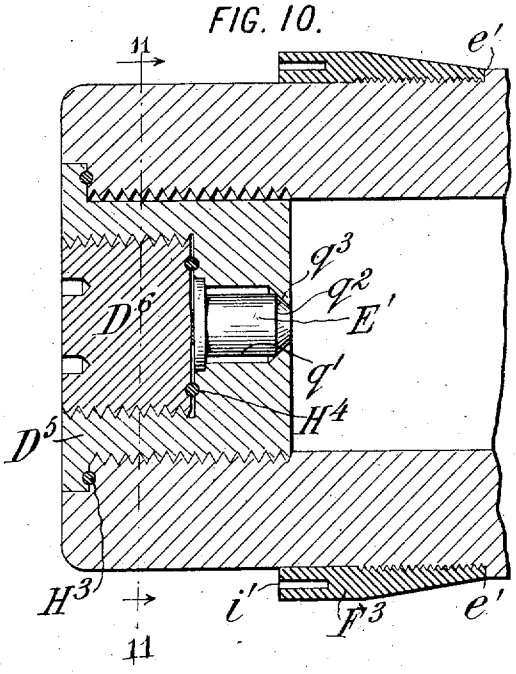


FIG. 12.

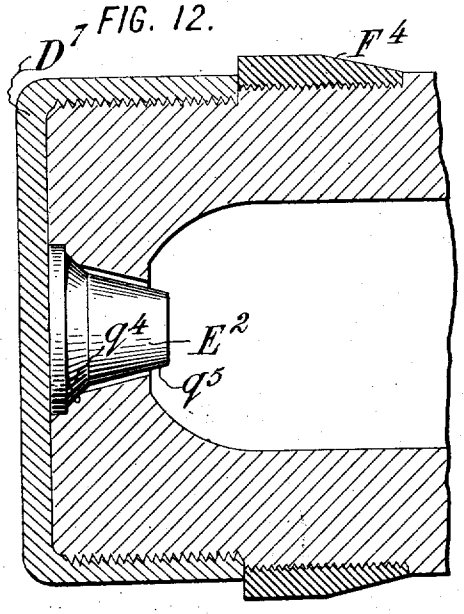
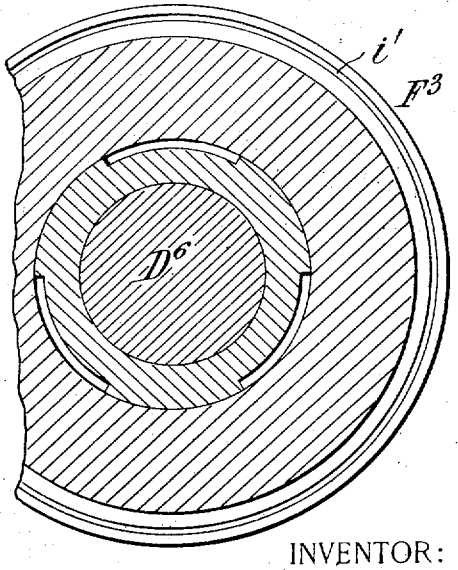


FIG. 11.



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UNITED STATES PATENT OFFICE.

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PROJECTILE.

996,403. Specification of Letters Patent. Patented June 27, 1911.

Application filed January 15, 1906. Serial No. 296,143.

To all whom it may concern:

Be it known that I, MICHAEL W. GILMARTIN, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

This invention relates to projectiles and aims to provide certain improvements therein.

My invention, while applicable generally to projectiles which are designed to explode after leaving the gun, is especially directed to armor-piercing and other projectiles for heavy rifled ordnance. This general type of projectile is formed with a bore or chamber in which is carried a bursting charge of gun-powder or other high explosive which is designed to be fired by a suitable fuse ignited by the shock of the impact of the projectile against the target or otherwise. In this type of projectile it is necessary to provide a passage for the introduction of the bursting charge and for the insertion of the percussion or other fuse, and in the smaller calibers principally used in the United States and other navies, a screw-threaded passage for this purpose has been provided in the wall of the projectile, the fuse being constructed to screw into such passage and form a closure therefor. In the larger calibers such screw-threaded passage has been formed in a detachable base, which is usually constructed as a screw-threaded plug of a diameter approximating that of the interior of the shell. This construction has been adopted to provide a large passage for the introduction of the bursting charge.

For constructional reasons the fuse has ordinarily been placed in the circular rear wall or base portion of the shell, and in this position the joints between the fuse, base plug and shell have been exposed to the direct effect of the firing charge. It has been found in practice that the gases under the extremely heavy pressure developed at the moment of explosion have found their way through such joint into the interior of the shell and ignited the bursting charge. The effect has been that the projectile has exploded within the gun, disrupting the latter and causing in some cases considerable loss of life. An effort has been made to prevent such accidents by the use of a soft metal disk which has been tamped into an undercut circular groove on the base of the projectile surrounding the fuse, (and the base plug when used), but this has proved to be unsatisfactory in use because of the difficulty of removal and replacement.

Conditions of service have demanded the frequent removal of the fuse to inspect and replace its fulminate cap or other percussion device, as well as the operating mechanism therefor, and for the inspection and occasional removal of the bursting charge. Such projectiles are usually stored for a considerable length of time in the various magazines and arsenals, and it has been found that the bursting charge, at least in part, soon becomes reduced to a fine powder which adheres to the interior of the projectile, and finds its way between the screw threads of the fuse and base plug and projectile body. It has also been found that the metal forming these parts is especially liable to corrosion on the interior of the projectile so that the fuse and plug not infrequently becomes so rusted in place as to require considerable force to unscrew them. The friction engendered in removing these parts has in many cases generated sufficient heat to ignite the particles of powder around them and explode the bursting charge, and many serious accidents have resulted from this cause.

My invention aims to provide an explosive projectile in which all of the ordinary service operations may be performed with perfect safety.

According to the preferred form of my invention I provide a means which is arranged between the detachable base portion of the projectile and the projectile body, which is adapted to prevent the passage of gases of the firing charge into the interior of the projectile.

In its preferred form my invention provides a detachable base portion having a forwardly extending flange which surrounds the rear of the projectile, and a soft metal rotating band encircling the latter at the exterior joint between the base and projectile body, and compressed between such parts. Preferably I utilize for this purpose the usual soft metal rotating band now employed for engaging the rifling of the gun to turn the projectile. In this case I preferably so proportion the parts that the joint between the detachable base and the projec-

tile body is located in advance of the soft metal rotating band, so that as the latter is forced by the firing charge into the rifling of the gun at the rear of such joint, it shall constitute a gas check to prevent the passage of the hot gases through such joint to the interior of the projectile. Preferably such soft metal band is secured to the detachable base by screw threads or otherwise, so that when adjusted in position, it will be non-rotatively connected thereto in the direction in which the rifling of the gun tends to relatively rotate such parts.

My invention also provides means between the detachable base (or other detachable part) and the projectile by which the entrance of powder between such detachable base and the projectile body is prevented, so that such base may be removed without danger of exploding the bursting charge. Preferably I provide an intercepting plate extending completely across the base inwardly of the latter, such plate being in effect imperforate so as to constitute a complete closure for the interior chamber of the projectile, whereby to prevent communication with the passage to the exterior of the projectile.

My invention also provides a projectile having a fuse which is removable therefrom without undue friction so that premature explosion from this cause is impossible. Preferably the fuse, or the part which carries it (and by preference each) is formed to fit closely against the wall of the projectile, so as to exclude the entrance of powder dust between them, and the contacting surfaces are so disposed relatively to the direction of movement of the fuse upon withdrawal, that they separate without moving upon each other to any appreciable extent.

My invention also provides certain other features of improvement which will be hereinafter referred to.

Referring to the drawings which illustrate several modifications of my invention, Figure 1 is a longitudinal section partly in elevation of one form of my invention; Fig. 2 is a fragmentary view on an enlarged scale of the rear portion of the projectile shown in Fig. 1; the parts being shown as separated. Fig. 3 is a rear elevation of the intercepting plate detached; Fig. 4 is an enlarged fragmentary cross-section on the lines 4, 4, in Fig. 1; Fig. 5 is a longitudinal section of the rear portion of an armor-piercing projectile of the general proportions now in use; Fig. 6 is a similar view of a usual type of explosive projectile; Fig. 7 is a front elevation of the base shown in Fig. 6, detached; Fig. 8 is a longitudinal section of the rear portion of a modified form of armor-piercing projectile; Figs. 9 and 10 are similar sections showing my invention as applied to small caliber projectiles; Fig. 11 is a cross-section of Fig. 10 on the line 11, 11; Fig. 12 is a longitudinal section of the rear portion of a modified form of projectile.

Referring to the drawings, let A indicate the body of the projectile, which is formed with a bore or chamber B designed to contain the bursting charge, which, in the present instance is introduced through a passage C at the rear of the projectile designed to be closed by a detachable base D. The fuse which is indicated by the letter E is mounted with its inner end projecting into the chamber B, and is as to its mechanism of any well known construction.

According to the preferred form of my invention I provide between the detachable base D and the projectile body, a means for preventing the passage of the hot gases of the firing charge through the joint between the base and the body. Preferably I utilize for this purpose the usual soft metal rotating band F, which is designed to enter the grooves of the rifling and form a gas tight packing between the projectile and the interior of the gun barrel. For this purpose I so form the base that its joint with the projectile body is in advance of the band F so that the latter in effect forms a check or shield to prevent the gas from entering such joint. To this end the detachable base D is formed with an imperforate head portion *a* of approximately the full diameter of the projectile, which head portion is formed with a circumferential flange *b* extending forwardly and surrounding the rear portion of the projectile body. Preferably the head and flange are formed with a curved front wall *b'* which is adapted to fit a similar wall *c'* formed on the projectile body, this construction affording the maximum strength for a given thickness of metal. This construction also accomplishes the very important result of securing a positive fragmentation of the projectile after the bursting charge within the shell has ignited. Many of the shells now in service fail to explode, notwithstanding the ignition of the bursting charge. The probable cause of this is that the metal of the shell expands under the great pressure of the bursting charge until the grip of the screw threads on the fuse is so reduced that the fuse is blown out of the shell thus affording a comparatively large outlet for the gases. In the present construction while the shell expands, its rear end is confined by the over-hanging walls of the base, so that the latter cannot be blown out of the body, the screw threads of the body retaining their secure hold on the base. As the charge cannot be relieved by blowing out the base, its force must be exerted against the walls of the body of the shell, so that the latter must be disrupted. Preferably the band F is carried on the flange *b*, with at least a portion of its body at the rear

of the exterior joint *e* between the flange and projectile body A, and preferably also with its forward edge at such joint.

Preferably the flange and projectile body are formed with oppositely arranged shoulders *d*, *e* between which the band is pressed. By this construction the band is utilized to form a packing between the base and body which aids in preventing the ingress of gases to the explosion chamber of the projectile. The base may be united to the projectile in any suitable manner. In the construction shown in Figs. 1 and 2 the base is provided with a plug portion *f* which is designed to screw into the screw-threaded passage C formed at the rear of the body A.

As heretofore constructed the projectile has been formed with a circumferential groove cut in its cylindrical wall, and the soft metal band has either been formed as a cut ring and closed into such groove, or it has been formed as a continuous ring of sufficient diameter to pass over the projectile body and has been compressed into such groove. In both of these constructions great difficulty has been experienced in making a rigid connection between the band and projectile body. In some instances the body of the projectile has been roughened or struck up at the bottom of the groove and the band has been forced inwardly upon such projections by hydraulic pressure. In none of these constructions has there resulted a perfectly rigid connection, and many shots have been lost for this reason.

When any slipping takes place between the band and body, the projectile fails to receive the proper rotary movement and "tumbles" after it leaves the gun. By my invention I obviate this difficulty and provide a perfectly rigid connection between these two parts. Preferably the band is made as a continuous or uncut ring of the same diameter as the external diameter of the part of the projectile body which is to carry it, and is applied thereto axially thereof with or without a rotative movement and without any diminution of diameter in the act of applying it. By this means I am enabled to previously form the band and body with co-acting abutments which prevent relative rotation of the parts. Preferably I provide a band which is adapted to screw upon the projectile body, with means for preventing the unscrewing of the band during firing.

In the construction shown in Figs. 1 and 2 the band F is provided with an internal screw-thread which engages a circumferential thread formed on the flange *b*. The shoulders *d* and *e* constitute in this case abutments which prevent rotation of the band in either direction thus making a rigid connection between the band and projectile body. Any other suitable construction may be adopted which will prevent relative rotation of the band and body during firing.

The direction of the threads of the plug portion *f* of the base D should be such that the rifling of the gun acting through the soft metal band F tends to screw the base farther into the projectile body. With a right-hand rifling, the plug portion should be formed with a right-hand thread. Preferably the band F should be formed with a thread which tends to force it against the shoulder *e* of the projectile body, that is to say, a right-hand thread for a right-hand rifling. It is, of course, within my invention to provide set screws or other devices of sufficient strength to resist the tendency to relative rotation of these several parts, but I prefer for simplicity and economy to so construct the latter that such devices will be unnecessary. I prefer, however to make use of a single small set screw *g* to prevent possible relative rotation in handling, etc., such screw being tapped into the projectile body close to the meeting joint of the flange *b*, the band F and body A, as shown in Fig. 2. As there is a possibility of such screw working out of its socket and projecting beyond the band F, I prefer to provide a soft metal plug or screw *h* which is screwed in upon the top of the screw *g* as best shown in Fig. 4. In case the screw plug *h* accidentally stands in a protruding position during firing it will have no effect on the gun barrel or rifling, while with a steel screw there would be danger of injury to these parts. My invention also includes a certain improvement in the construction of the soft metal rotating band itself. At present such bands for a breech-loading projectile are made of a diameter to fit the grooves of the rifling of the gun, the soft metal being displaced during firing so as to admit the lands of the rifling. In use, however, the rifling of the gun frequently wears unequally with the result that during a part of the passage of the projectile through the gun the explosion gases leak past the projectile, thereby reducing the range of the latter. This wearing of the rifling of the gun is partly due to friction of the projectile passing along it, but is also due to the fact that the rotating bands now in use are of such character that they permit the explosive gases of the firing charge to leak past the projectile, thus causing an erosion with a cutting and wearing effect on the rifling. By my invention I give to this type of band a capability of expansion so that it will be forced outwardly by the firing charge and hug closely the surface of the barrel irrespective of the differences in diameter of the latter. This construction thus prevents any possible leak of the gases and not only maintains the maximum pressure of the firing charge, but prevents to a large degree the wear upon the rifling of the gun.

One form of my improved construction is shown in Figs. 2 and 4 wherein I have shown the band as provided at its rear with a series of recesses *i* which are adapted to admit the powder gases to expand the entire rear portion of the band outwardly into contact with the barrel. Such recesses are arranged sufficiently close together to produce the required effect, and may, if desired, be joined to form an annular groove extending around the rear face of the flange, as will be described with reference to Figs. 10 and 11.

While it is desirable to provide a large passage to the interior of the projectile for the purpose of charging and recharging the latter, it has been found in practice that this has involved a considerable element of danger, owing to the difficulty of forming a closure therefor of sufficient tightness to prevent the entrance of powder between the parts. As before stated considerable friction is engendered in unscrewing the base, which is sometimes sufficient, if powder be present, to ignite the latter and explode the charge. By my invention I avoid this disadvantage by providing a means for preventing the powder from finding its way between the base and the projectile body, and preferably by providing an intercepting plate G which extends completely across the passage C so as to entirely separate the latter from the chamber B. The plate G and projectile body are formed with opposite shoulders *k*, *m*, which fit closely against each other, and the parts are so proportioned that as the base D is screwed home upon the projectile body it will press the plate G so firmly to its seat as to prevent the powder of the bursting charge from working past the plate. It is particularly important that the plate G shall be prevented from rotative movement during unscrewing of the head, and to this end I provide a suitable lug *n* fitting a recess *n'* in the projectile body as shown in Fig. 2. If it is found necessary in some cases to make the plate G and its seat a ground fit, the lug *n* may be replaced by any suitable device adapted to be adjusted in place after the grinding of the parts. Preferably I form a tapering or conical surface on the projectile body and plate as indicated at *o* in Fig. 2, thus providing an extremely close fit between the parts. When it is desired to remove or replace the bursting charge, the detachable base D may be unscrewed with perfect safety, and the intercepting plate G lifted by an appropriate tool without rotary movement, and hence without danger of premature explosion. Suitable undercut sockets *p* are preferably provided in the plate for engagement with the withdrawing tool.

It is preferable that the screw-threaded engagement of the base D and projectile body shall be as extensive as is practical in order to provide a strong connection between these parts. Service conditions, however, in some cases demand a maximum capacity for the bursting chamber B. To conform to these conditions the intercepting plate G and the inner end of the base are preferably made concave or cup-shaped as shown, thereby considerably increasing the capacity of the chamber without materially weakening the connection.

My invention provides an important improvement in the construction and mounting of the fuse E. The standard fuse now used in service is so constructed that its operative parts are accessible only from the inner end of the fuse, and this has necessitated the removal of the fuse from the projectile whenever it is necessary to inspect or replace such operative parts. As the fulminate of the fuse is liable to rapid deterioration, frequent removal and inspection of the fuse is a practical necessity. With all projectiles having removable fuses with which I am acquainted, the walls of the projectile and fuse are so formed as to produce a grinding action between such walls during the removal of the fuse. As the parts can be thoroughly cleaned before insertion, such action is not of special importance at that time. After insertion, however, the dustlike grains of powder from the bursting charge adhere to the walls of the fuse and work in between it and the projectile body and are liable to cause an explosion of the projectile during unfusing. According to my invention I overcome this difficulty by so forming the walls of the projectile and fuse with relation to the direction of movement of the fuse during withdrawal that they separate without friction. While this end may be attained in various ways, I prefer to form the fuse with at least a portion of its wall tapered inwardly, and to form that part of the projectile which carries the fuse with a correspondingly tapered seat portion adapted to closely receive the tapered portion of the fuse and to exclude as far as possible the entrance of powder dust between them. With such construction, the tapered wall of the fuse will, upon withdrawal, separate from the seat without moving upon the latter to any appreciable extent, and will not generate sufficient friction to ignite the powder should there be any present between the surfaces. This is true, even though the surfaces be rusted together to a considerable extent which is frequently the case in practice. With a cylindrical or other fuse fitting a corresponding seat, under like conditions the friction generated by the continued grinding action of the surfaces during withdrawal of the fuse is often sufficient to ignite the charge. Preferably the fuse is tapered practically throughout its entire length and fits within

a correspondingly tapered seat, as shown at *q* in Fig. 2. In this figure the fuse is shown as formed with a flanged head *r* which rests in an annular depression formed around the seat.

The fuse provided by my invention may be carried in any suitable part of the projectile, but I prefer to utilize the intercepting plate G for this purpose. By forming the fuse and its seat in the manner indicated, there is little or no liability of powder working up between the fuse and its seat, but if necessary a second intercepting plate may be provided between the detachable base D and the head of the fuse so as to prevent access of the powder to the inner surface of the rotatively removable base, such a plate being shown at L in Fig. 5.

It is important that the fuse E shall be prevented from rotating during its removal, and with this form of fuse the tendency to rotate during withdrawal is reduced to the minimum. I may, however, form a lug *s* on the fuse which is received in a corresponding recess in the plate G. The fuse is also provided with undercut recesses *t* for engagement with any suitable withdrawing tool. For inspection purposes the base D may be unscrewed by any suitable spanner wrench engaging faces *z* formed on the head *a* and if it is desired to inspect the fuse only, the withdrawing tool is applied against the plate G and the fuse withdrawn. For gaining access to the charge of the projectile, the intercepting plate G is removed, carrying with it the fuse and leaving the passage C free for withdrawal of the charge or other purpose. Either of these operations may be accomplished without danger to the operator, as may also those of replacing the various parts.

In Fig. 5 I have shown my invention as applied to the regular armor-piercing shell of the United States service, the proportions being substantially those used in practice. In this type of projectile the walls are relatively thick to obtain the maximum penetrating power and the bursting chamber is correspondingly small as only a moderate bursting effect is required in this type of shell. In this construction the intercepter G′ is formed as a flat plate, and the base D′ has its rear end formed as a plane surface instead of being cupped as in Fig. 2.

In Fig. 6 I have illustrated my invention as applied to the ordinary explosive shell of large caliber now in use. In this type of shell the maximum bursting effect is desired and to this end the capacity of the chamber B is made as great as is practical. The intercepting plate G^2 in this construction is designed to increase the capacity of the chamber B as much as possible, the plate being concave, and preferably of funnel shape as shown. In this construction the base D^2 is formed with a central screw-threaded passage for the insertion and removal of the fuse, such passage being closed by a screw-threaded plug D^3 as shown. In this construction there is danger of the passage of the hot gases of the firing charge into the chamber B between the plug D^3 and the remainder of the base. To prevent this, I provide a soft metal ring H′ between the plate G^2 and the plug D^3 which prevents such gases from passing between the fuse and its seat, and also a ring H^2, which prevents their passage along the outer wall of the intercepting plate and past the inner edge thereof to the bursting chamber. The soft metal rotating band F^2 encircling the base D^2 prevents, as before, the ingress of gases to the bursting chamber through the exterior joint between the base and the projectile. In this figure I have illustrated a modified mode of preventing rotation of the soft metal band F^2 relatively to the base D^2. In this construction the band is formed with a series of lugs *v* which fit recesses *w* formed in the base as best seen in Fig. 7.

In Fig. 8 I have illustrated a construction of an armor-piercing shell which is somewhat different from that shown in Fig. 5. In this figure the detachable base D^4 instead of being provided with a screw-threaded plug, has its flange b^4 screw-threaded on its interior face to engage exterior threads formed at the rear of the projectile body. In this figure to obtain the desired weight of metal at the rear of the projectile, I form the intercepting plate G^3 of a thickness nearly equal to the length of the fuse. In this construction I have shown a soft metal ring *x* held in an annular recess on the top of the plate to assist in seating the latter and to relieve the friction between the base and the plate in unscrewing the base. In this construction I have also shown the soft metal rotating band F as located considerably at the rear of the external joint *c* between the base and projectile body, so that it acts only as a gas check in the rear of such joint, and has no additional function as a packing device as in the previous figures. The band F is held in place in this construction by a steel ring J of the same diameter as the projectile. Obviously the band may be screwed onto the projectile from the rear thereof, and held in place by the ring J applied behind the band; or by providing suitable means for preventing relative rotation of the projectile and band during firing, the ring J may be omitted, such construction being illustrated in a succeeding figure.

In Fig. 9 I have illustrated by invention as applied to a projectile of small caliber. In this type of projectile the charging passage is relatively small, usually but little larger than the diameter of the fuse. In

this construction the intercepting plate G^4 is formed as a gasket with its inner wall tapered to receive the fuse. It is obvious that instead of supporting the fuse upon the intercepting plate as in the previous figures, it may be mounted in any other part of the projectile.

In Fig. 10 I have illustrated the fuse as carried upon the detachable base plug D^5 of the usual type of projectile. In this construction to prevent the gases from the firing charge from reaching the bursting chamber, I have provided soft metal rings H^3, H^4 interposed between the base and the projectile body, and the base and removable plug D^6, respectively. In this figure and in Fig. 11 I have shown the plug and projectile body as formed with interrupted screw-threads so as to permit attachment and detachment of the base plug with comparatively slight rotation of the latter. This construction also illustrates a novel form of soft metal band F^2 which instead of being formed with recesses i, is provided with an annular recess or groove i'. The gases from the firing charge enter this recess and expand the band against the rifling, as before described with reference to Fig. 2. These figures also illustrate the application of my improved soft metal rotating band to ordinary service projectiles now in use. This is accomplished by turning down the rear of the projectile to slightly less than its original diameter and screw-threading the contiguous wall of the projectile to a sufficient extent to receive the band. The wall of the projectile may be sufficiently reduced to leave a shoulder e' against which the band may be screwed, as shown in Fig. 10. In this figure I have also illustrated one modification of the fuse provided by my invention. In this construction the fuse E′ is formed with a cylindrical wall q', and a tapered end portion q^2 which fits in a seat q^3 formed upon the inner part of the detachable base D^5. Preferably in this construction the base is formed with a cylindrical socket of slightly larger diameter than the fuse as shown. It is obvious that the tapered portion q^2 of the fuse may be omitted and the cylindrical end of the fuse contact directly with the seat q^3; it is also obvious that such seat may be flat instead of tapered as shown.

In Fig. 12 I have shown the base D^7 as constructed in the form of a cap and in this construction the soft metal rotating band F^4 is screwed directly on the cylindrical wall of the projectile itself, instead of being carried by the base. By screwing the base firmly against the band, the joint between the base and projectile is sufficiently packed for most purposes to prevent entrance of the gases from the firing charge into the bursting chamber, even though the exterior joint of the base and projectile body is in this instance located at the rear of the band F. In this figure I have shown a further modification of fuse which, in this instance is carried in the wall of the projectile. The fuse E^2 in this figure is formed with a tapered portion q^4 near the flange thereof, while the body of the fuse is formed with a taper q^5 of less inclination. The projectile is formed with correspondingly tapered portions as shown.

In the projectile shown in Figs. 1, 2, 5, 8, 9 and 12 it will be seen that the fuse is mounted in the interior of the projectile with an imperforate base extending entirely across the head of the fuse, and that in Figs. 2 and 5 such base is of substantially the full diameter of the projectile and is formed with a plug portion of substantially the diameter of the bore of the projectile. By these constructions there is no liability of the fuse being blown out of the projectile when the fuse explodes. In many instances it has been found that with the ordinary construction the fuse itself has been blown out of the projectile without igniting the bursting charge, the projectile failing to explode because the hot gases have not been able to reach the bursting charge when the fuse was forced out. This is particularly liable to happen in the case of fuses which carry magazines at their inner ends for the purpose of intensifying the firing action of the fuse. My invention avoids this difficulty in the manner just stated.

I do not herein claim the construction of fuse and fuse socket herein described, such construction forming the subject matter of Patent No. 890,900, granted to me on the 16th day of June, 1908.

Though I have described herein several modifications of my invention, I do not wish to be limited thereto, as many changes may be made therein without departing from my invention.

What I claim is:

1. An explosive projectile having an interior bore and an opening to said bore in the rear of the projectile, means for closing said opening having a part extending to the cylindrical wall of said projectile, and a separately formed rotating band of softer metal than said closing means, said band being located at the exterior joint of said closing means and said projectile wall and adapted to oppose the passage of gases through said joint.

2. An explosive projectile having an interior bore and an opening to said bore in the rear of the projectile, means for closing said opening having a part extending to the cylindrical wall of said projectile, and a separately formed rotating band of softer metal than said closing means, said band being lo-

cated at the exterior joint of said closing means and said projectile wall and adapted to oppose the passage of gases through said joint, said rotating band being carried upon said closing means.

3. An explosive projectile having an interior bore and an opening to said bore in the rear of the projectile, a detachable base formed of hard metal and having a portion extending to the exterior cylindrical wall of said projectile, and a rotating band located at the exterior joint between such base and wall and adapted to oppose the passage of gases through said joint, and said band being formed of soft metal.

4. An explosive projectile having an interior bore and an opening to said bore in the rear of the projectile, a detachable base formed of hard metal and having a portion extending to the exterior cylindrical wall of said projectile, and a rotating band located at the exterior joint between such base and wall and adapted to oppose the passage of gases through said joint, said rotating band being carried by said base, and being formed of soft metal.

5. An explosive projectile having an interior bore and an opening to said bore in the rear of the projectile, a detachable base formed of hard metal and having a portion extending to the exterior cylindrical wall of said projectile, said base and projectile having a groove formed between them, and a rotating band arranged in said groove and adapted to oppose the passage of gases through the exterior joint between the projectile body and base, and said band being formed of soft metal.

6. An explosive projectile having an interior bore and an opening to said bore in the rear of the projectile, a detachable base formed of hard metal and having a portion extending to the exterior cylindrical wall of said projectile, said base and projectile having a groove formed between them, and a rotating band arranged in said groove and adapted to oppose the passage of gases through the exterior joint between the projectile body and base, said band and projectile having engaging portions to prevent relative rotation thereof, and said band being formed of soft metal.

7. A projectile having a detachable base formed with a circumferential screw-thread and a soft metal band screwed on said base.

8. A projectile comprising a cylindrical body having a bore open at its rear, said opening being of substantially the same diameter as the bore, and a base adapted to close said opening and having a wide exterior flange surrounding the rear of the projectile body and extending forwardly thereon, the outer diameter of said flange being substantially that of the projectile body, and a soft metal rotating band carried by said projectile.

9. A projectile having an interior bore and an opening at the rear of said bore, and a base to close said opening, said base having a wide exterior flange surrounding the rear of said projectile and extending forwardly thereon, the outer diameter of said flange being substantially that of the projectile, and said flange being adapted to embrace substantially the entire rear end of the projectile so as to reinforce the latter, and a soft metal rotating band carried by said projectile.

10. An explosive projectile formed in two parts, said parts comprising a hollow cylindrical body and a detachable base, said base being connected with the body and closing its rear end and having a wide flange extending forwardly over the projectile body, said flange being of substantially the same diameter as said body, and embracing substantially the entire rear end of said body, and a soft metal rotating band carried by said projectile.

11. A projectile having a base, said base having a central plug portion, a circular head, and an exterior flange projecting forwardly from said head, and surrounding the rear of the projectile body, and said projectile body having a curved surface at its rear, and said head and flange being formed to fit said surface.

12. A projectile having a member adapted to screw thereon, a set screw adapted to prevent unscrewing of said member, and a soft metal plug fitting over said set screw.

13. A projectile having a rotating band of larger diameter than the bore of the gun the lands of the rifling, said band bein adapted to be swaged rearwardly by suc lands when the projectile is fired, the rear of said band having a series of recesses with intervening unrecessed portions, the latter being adapted to prevent closing of the recesses during such swaging action, and the former being adapted to admit powder gases to expand said band, whereby inequalities in the bore of the gun are compensated for.

14. A projectile having a passage in communication with the interior thereof, a closure fitting said passage, and a plate formed of stiff material arranged at the interior joint between such closure and projectile to prevent entrance of explosive between such parts from the interior of the projectile.

15. A projectile having a passage in communication with the interior thereof, a closure screwing into such passage, and a plate formed of stiff material for preventing the explosive from the interior of such projectile from entering between the respective threads of the closure and projectile.

16. A projectile having a passage in communication with the interior thereof, a closure fitting said passage, and a concave plate interposed between said closure and the body of the projectile.

17. A projectile having a passage leading to the interior thereof, a closure adapted to rotatively engage said projectile, means between said closure and the body of said projectile for preventing communication between the interior of the projectile and the joint between the projectile and such closure, and means for preventing rotation of said first named means.

18. A projectile having a bore, a screw-threaded plug for closing such bore, and a non-rotative plate formed of stiff material interposed between said plug and the projectile body.

19. A projectile having a bore and a shoulder surrounding the latter, a closure for said bore, and a plate formed of stiff material extending across said bore and pressed against said shoulder by said closure.

20. A projectile having a bore, a closure therefor, a plate extending across said bore inwardly of said closure and a fuse carried by said plate.

21. A projectile having a bore, a closure therefor, a plate extending across the bore inwardly of the closure, said plate being interposed between the closure and the body of the projectile, and a fuse carried by said plate.

22. A projectile having a bore in its body, base detachably connected therewith, a e located between said base and bore extending across the latter, a fuse car- by said plate, and a rotating band ...mped between said base and said projectile body.

23. A projectile having a bore in its body, a base detachably connected therewith, a plate located between said base and bore and extending across the latter, a fuse carried by said plate, and a rotating band clamped between said base and said projectile body, said base having a forwardly extending flange embracing the rear of said projectile, and said rotating band being located at the exterior joint between the projectile body and said flange.

24. A projectile having a detachable base, and means independent of the projectile body and base for mounting a fuse within said base.

25. A projectile having a means for carrying a fuse, said means and projectile having surfaces fitting closely together, such contacting surfaces being so disposed with relation to the direction of movement of such means in removing it as to separate without undue friction.

26. A projectile having a means for carrying a fuse, said means and projectile having contacting surfaces one of which is tapered, whereby such means may be withdrawn without undue friction.

27. A projectile having means for carrying a fuse, said means and projectile having contacting surfaces, such surfaces being tapered whereby such means may be withdrawn without undue friction.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

MICHAEL W. GILMARTIN.

Witnesses:
EUGENE V. MYERS,
THEODORE T. SNELL.