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K. L. HAYDEN

2,091,635

PROJECTILE

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Fig. 1.

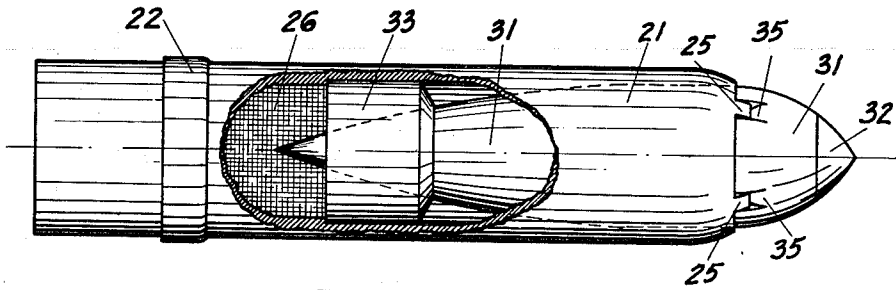


Fig. 2.

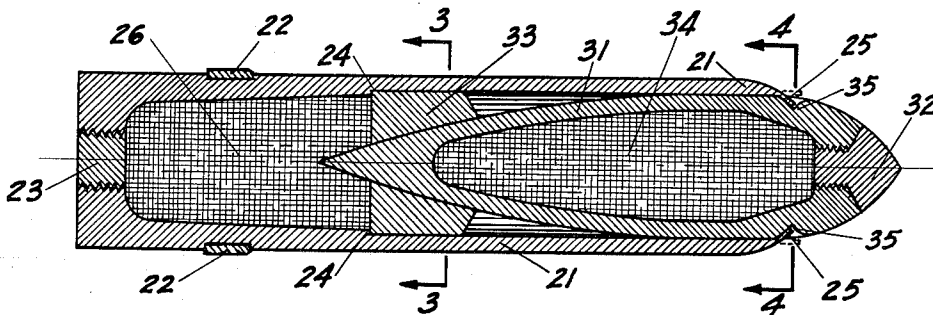


Fig. 3.

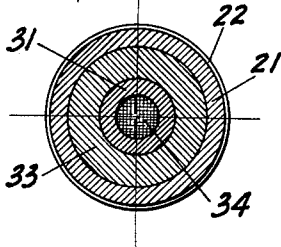
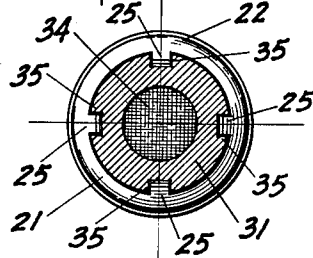


Fig. 4.



WITNESSES

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PROJECTILE

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5 Claims. (Cl. 102-29)

This invention relates to improvements in projectiles used for ordnance purposes; particularly the type of projectiles that are fired from rifled guns of the larger calibers, such as coast defense rifles, naval armament, and miscellaneous artillery provided with either fixed or mobile positions.

As is well known to those skilled in ballistics, the initial muzzle velocity received by a projectile upon its discharge into air, is progressively reduced along its trajectory; due to air resistance reacting thereupon, and since the value of the impact energy of such a projectile is theoretically one-half the mass times the square of the velocity, it is evident that the impact energy is likewise progressively reduced as well; continuing throughout the trajectory until the ultimate limit of the projectile's range is reached. It is readily apparent therefore that at or near the ultimate limit of the projectile's range, its impact energy is comparatively inconsequential, and becomes ineffective with respect to the amount of demolition it may accomplish.

In view of the above considerations governing the flight of projectiles, a projectile so devised as to regain a proportional percentage of its initial muzzle velocity at or near the limit of its ultimate range, would be both novel and new, would effect greatly increased impact energy at or near the limit of its range, and would likewise contribute substantially to the demolition effectiveness of such a projectile thereby.

Additionally, in view of the above-mentioned considerations governing projectiles and their trajectories, a projectile which could be so devised as to be dischargeable from a rifled gun into a sphere of rarified air, such as occur at high altitudes adjacent to the so-called stratosphere region; and which upon reaching such a rarified region would be capable of itself discharging a self-contained projectile, for the purpose of imparting additional velocity thereto; with such a self-contained projectile provided of substantial stream-line form and aerodynamically efficient with respect to the medium through which it travels, to effect a minimum of resistance and loss of velocity thereto:—such a projectile in consequence thereof, and of the renewed velocity imparted thereto, would establish a materially increased effective range, and increased impact energy as well to its self-contained projectile body comparatively with respect to that of conventional projectiles of like caliber and weight; such a projectile would be both novel and new to the

art of ballistics, and would contribute to the further advancement of that art as well.

It is realized in considering the theoretical value of the impact energy in such a complex projectile, that a reduction in mass is effected by the discharge of the self-contained projectile body, and may approximate as high as 50% reduction of the initial mass; however the gain in additional velocity received by such self-contained projectile body upon its discharge therefrom, plus its initial velocity retained at the moment of such discharge, materially exceeds in value the impact loss by reduction of such mass, substantially increasing the value in impact energy of the self-contained projectile body comparatively with respect to the initial mass before such discharge occurs.

Certain features of the invention, which is the subject matter of this application and hereinafter described, are to be found in my prior application, Serial No. 710,301 filed February 8, 1934, Patent Number 2,055,765.

An important feature of the invention is to provide a projectile with increased range limits, as well as increased impact energy, without the alteration of any part of the gun, or its equipment, excepting the re-adjustment of the sight scales thereof.

Another feature of the invention is the provision of a particularly long range complex projectile comprising a projectile jacket containing a powder charge and a stream-lined aerodynamically efficient projectile inclosed therein, and so devised and arranged as to effect discharge of the stream-lined projectile from within the projectile jacket at a prefixed time interval, after the projectile assembly has been discharged from its gun.

Another feature comprises the provision of an aerodynamically stream-lined projectile self-contained within a jacket projectile; with a means provided to secure assembled engagement effecting simultaneous rotation of the respective elements, upon discharge from a rifled gun; with the additional provision of imparting additional velocity to the stream-lined projectile at a predetermined point along the trajectory of the jacket projectile.

Another feature of the invention is to reduce the loss of velocity by air resistance, of a projectile along its trajectory, by discharging such a projectile into a sphere of rarified air, and thereat effecting discharge of a self-contained projectile.

Another feature of the invention is to increase the impact energy of a projectile along its line

of trajectory, by discharging a secondary projectile contained therein immediately before impact against its objective.

Other novel features of the invention will become apparent from the detailed description hereinafter given, which is illustrated in the accompanying drawing, forming a part of this application. It is to be clearly understood however, that the projectile structure shown and described constitutes but one embodiment of my invention or inventions, and is not to be taken as definite or for any other purpose than that of illustration. It is obvious that my invention and its various features may be embodied in various forms and constructions, and my invention is to be understood as limited only to such features and construction as are clearly defined in the appended claims.

In the drawing similar reference characters refer to similar parts in all of the views of which:

Figure 1 is a longitudinal view of the assembled projectile which is the subject matter of this application, and hereinafter referred to as a complex projectile; with a fragmentary portion removed to illustrate the internal relationship of the various parts.

Figure 2 is a longitudinal sectional view of the complex projectile assembly complete, revolved an eighth revolution from that illustrated in Figure 1.

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 2, illustrating the relationship of the various elements.

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 2, illustrating the securing means for engaging the projectile jacket with its self-contained projectile body.

By referring to the drawing it will be seen that the complex projectile comprises a projectile jacket 21, with an unobstructed orifice at its muzzle end, and provided with the bendable fingers 25 projecting therefrom; which before assembly of the component elements of the complex projectile are fashioned so as to extend longitudinally relatively with respect to the longitudinal axis of the projectile jacket 21. This projectile jacket 21 is also provided with the rotation band 22 circumferentially incised rearwardly about the periphery thereof, for engaging the lands of the rifling in the conventional gun barrel, and acting as a gas check thereto; and has the usual flat base provided, to effectively receive the pressure of explosive gases generated upon discharge of the projectile's gun; all in accordance with the usual conventional practice; with screw thread provision within the flat base of this projectile jacket 21 for insertion of any of various base time fuses 23; such as are used in conventional projectiles, and capable of being prefixed to detonate the powder charge 26 contained within the projectile jacket 21 at a predetermined time interval. Also within the jacket 21 an internal extending shoulder 24 is provided, to arrest and correctly position the separable sabot 33 of a self-contained projectile 31 contained within the projectile jacket 21.

This self-contained projectile comprising the body portion 31 together with its detonator head 32 threadably secured thereto, comprises in assembled relation, an ichthyoid form of substantial stream-line shape, and has provided forwardly on the waist portion thereof, the indented slots 35, to receive the bendable fingers 25 of the projectile jacket 21, and are so arranged as to permit insertion of the fingers 25 therein, to secure

engagement in fixed relation of the projectile jacket 21 and its self-contained projectile 31, 32, 33, when the fingers 25 are inwardly bent into engaged relation with the slots 35 thereof. The detonator head 32 of the projectile body 31 is to be provided with any of various point percussion or point time fuses, such as are used in conventional projectiles, to detonate the secondary powder charge 34 contained therein, either upon impact, or at a prefixed time interval as required, if an explosive type projectile is desired. Otherwise the projectile body 31, 32 may comprise any of various alternate classes of projectiles, such as armor-piercing projectiles, shrapnel projectiles, deck-piercing projectiles, etc. It is readily apparent that the engagement of the fingers 25 with the slots 35 effects simultaneous rotation of the self-contained projectile 31, 32 relatively with respect to its projectile jacket 21, when the complete assembly is rotatively discharged from a rifled gun, due to the rotative movement imparted thereto by the engagement of the rotation band 22 with the rifling lands of the gun tube.

This self-contained projectile body 31, 32 is provided with a conoidal shaped "nose" portion, a cylindrical shaped "waist" portion, and a conoidal shaped "tail" portion, comprising a stream-line form substantially as disclosed in my prior application Serial No. 710,301 filed February 8, 1934; and provided with a sabot 33 of flat base and bevelled front face construction including a conoidal shaped orifice contained therein and so arranged as to permit the "tail" portion of the body 31 to extend sufficient therethrough to permit alignment of the bendable fingers 25 on the projectile jacket 21 with the indented slots 35 of the projectile body 31, 32. The sabot 33, so arranged as to seat against the internal shoulder 24 of the projectile jacket 21, is secured against slidable movement rearwardly relatively with respect to the jacket 21, but is free to slide forwardly together with its projectile body 31, 32 when the fingers 25 of the projectile jacket 21 are out of engagement with the indented slots 35 thereof. The sabot 33 is in frictional engagement relatively with respect to its projectile body 31, 32 and its containing projectile jacket 21, and is effective for slidable movement forwardly relatively with respect to the projectile jacket 21, and slidable movement rearwardly relatively with respect to the projectile body 31, 32 when the component elements of the complex projectile are in unsecured assembled relation.

It will be noticed that the wall thickness of the powder chamber in the projectile jacket 21 has materially increased thickness relatively with respect to the forward portion thereof, for the purpose of resisting the explosive forces acting thereupon, while the forward portion of reduced wall thickness serves as a smooth bore barrel or tube to guide the self-contained projectile assembly 31, 32, 33, when discharged from the projectile jacket 21, and in addition thereto affords sufficient strength to confine the explosive discharge of the powder charge 26 to the base of the sabot 33.

The assembly of the complex projectile requires the partial assembly of the sabot 33 and its projectile body 31, which together are slidably inserted within the projectile jacket 21 until the base of the sabot 33 seats upon the shoulder 24 of the projectile jacket 21, and thereat rotated until the slots 35 align with the fingers 25 of the jacket 21, whereupon the fingers 25 are bent inwardly within the slots 35 to effect engagement

therewith and secure positive attachment of the jacket and its self-contained projectile thereby, additionally securing the projectile 31 against rotation relatively with respect to its projectile jacket 21. The primary powder charge 26 is next inserted within the primary powder chamber and the base fuse 23 is secured to the base of the projectile jacket 21, completing assembly of the projectile jacket portion. The secondary powder charge is likewise inserted within the secondary powder chamber 34 and the point fuse 32 is secured to the nose of the projectile body 31, completing the assembly of the complex projectile. The locations of the base fuse 23 and the point fuse 32 are provided to facilitate access to these fuses, for the purpose of prefixing them to the desired time intervals required, before insertion of the complex projectile into the shot chamber of the gun to be fired.

The loading operation of a gun using the complex projectile is similar in all respects to that followed with conventional projectiles, with the exception that the base fuse 23 must be prefixed to detonate at a predetermined time interval, and the point fuse 32 may be either prefixed if a time fuse is utilized, or the safety released, if a percussion fuse is utilized, to render the projectile effective. This type projectile would then be rammed into the shot chamber until the rotation band 22 carried by the jacket 21 engages the lands of the gun tube, and the gun's powder chamber charged, in accordance with the usual conventional procedure required at the present time.

However the discharge of the complex projectile creates phenomena peculiarly characteristic to this class of projectile, in that the base fuse 23 of the projectile jacket 21 detonates the powder charge 26 at a predetermined time interval after discharge thereof, which in turn discharges the self-contained projectile 31, 32, together with its sabot 33, bending outwardly the fingers 25 of the jacket 21 so as to release engagement with the slots 35, thereby releasing the projectile assembly 31, 32, 33 from the projectile jacket 21, and in addition thereto, imparting additional velocity to the projectile body assembly 31, 32, 33 due to the explosive force exerted thereupon by the detonated powder charge 26. The velocity of the projectile jacket at the instant of explosive separation from its inclosed projectile assembly is partially retarded by the recoil effect of that explosive discharge, while the projectile assembly 31, 32, 33 traveling at the same velocity at the instant of explosive separation, receives additional impetus from that explosive discharge, to further increase its velocity. In addition to this however, the aerodynamic drag resistance created behind the flat base or sabot 33 of the projectile body 31, 32; due to the inefficient shape it offers to passage through air; as previously disclosed in my prior application Serial No. 710,301 filed February 8, 1934, increasingly retards the velocity of the sabot 33; however the projectile body 31, 32 of efficient aerodynamic shape, offering a minimum of resistance to passage through air, and having only frictional connection of negligible resistance to its sabot 33, effects separation therefrom by the reduced resistance it offers, and continues along a new line of trajectory to its objective, whereupon by the point percussion fuse, or point time fuse provided, its inclosed powder charge may be effectively detonated against the particular objective selected.

Likewise, when utilizing the complex projectile at shorter ranges, to effect increased impact energy over that of conventional projectiles; the projectile would be discharged directly against its objective; but immediately preceding impact, by means of the base time fuse provided, would discharge its self-contained projectile against this objective and, if a point percussion fuse is utilized, effect its explosive force directly against this objective with substantially increased impact energy relatively with respect to its impact energy before its explosive separation from the projectile jacket 21, due to the additional impetus it receives in consequence of that explosive separation. In like manner, by utilizing a point time fuse instead of the point percussion fuse; the self-contained projectile 31, 32 may be so devised as to be discharged into or through its objective before it becomes effective for detonation, increasing the demolitionary effectiveness thereby.

A lubricant may be provided within the barrel end of the projectile jacket 21, and around the orifice of the sabot 33, also around the "tail" portion of the projectile body 31, to prevent any possibility of seizure of the various respective elements.

It is obvious to those skilled in the art, that a self-contained projectile body of the usual conventional form may be provided with the slots 35 incised therein and so arranged as to seat against the shoulder 24 of the projectile jacket 21, and secured in like fashion thereto, and effective for discharge therefrom in a manner similar to that of the self-contained projectile body structure illustrated and previously described.

As there are numerous variations and modifications of the invention described, it is understood that the description given, is of the preferred form of the invention. I therefor, do not wish to be limited to the construction set forth, but desire to avail myself of such variations and modifications as come within the scope of the appended claims.

What is claimed is:

1. A complex projectile for use in rifled guns having two or more elements initially dischargeable together and adapted to explosively separate thereafter into two or more components, comprising a chambered jacket projectile of closed base and hollow body structure carrying a rotation band, with a second projectile of substantial stream-line form forwardly inserted therein to form the head thereof, a sabot rearwardly disposed on said second projectile and readily detachable rearwardly therefrom upon projection of the second projectile from said jacket projectile, means inwardly projecting within said jacket projectile for positioning said sabot and thereby said second projectile, explosive means filling the space between sabot and jacket base together with fuse means for detonating the same, and securing means integral with said jacket projectile interlocking with slot means provided on said second projectile for yieldably securing the same.

2. A complex projectile as specified in claim 1 in combination with an explosive charge contained within said second projectile together with impact actuated means for detonating the same.

3. A complex projectile for use in rifled guns comprising a detachable jacket of flat base and hollow body structure carrying a rotation band; a self-contained projectile of substantial stream-line form including a separable sabot rearwardly

positioned in engaged relation therewith and effective for separation therefrom; said projectile forwardly disposed in assembled relation within said jacket and adapted to form the head thereof;

5 a powder charge rearwardly disposed within said jacket; a detachable time fuse secured to said base and effective for detonating said powder charge; fingers on said jacket inwardly bent to engage incised slots on said projectile for effect-

10 ing engagement thereof in fixed relation and secure said projectile against rotation relatively with respect to said jacket, the said fingers bendable outwardly to release engagement therewith upon detonation of said powder charge.

15 4. A complex projectile for use in rifled guns comprising a detachable jacket of flat base and hollow body structure carrying a rotation band; a self-contained explosive projectile forwardly disposed therein and adapted to form the head

20 thereof; a powder charge rearwardly disposed within said jacket; a detachable time fuse secured to said base and effective for detonating said powder charge at a prefixed time interval after discharge thereof; bendable fingers integral with

25 said jacket engaging slots incised on said projectile for effecting fixed engagement thereof and securing said projectile against rotation relatively with respect to said jacket, the said fingers bendable outwardly to release engagement upon

30 detonation of said powder charge effecting dis-

charge of said self-contained projectile; and a detachable point fuse secured to said explosive projectile for effecting detonation thereto subsequent to said discharge thereof.

5 5. A complex projectile for use in rifled guns comprising a detachable jacket of flat base and hollow body structure carrying a rotation band; a self-contained explosive projectile of substantial stream-line form including a separable sabot rearwardly positioned in engaged relation there-

10 with and effective for separation therefrom; said projectile forwardly disposed in assembled relation within said jacket and adapted to form the head thereof; a powder charge rearwardly dis-

15 posed within said jacket; a detachable time fuse secured to said base and effective for detonating said powder charge at a prefixed time interval after discharge thereof; bendable fingers integral

20 with said jacket engaging slots incised on said projectile for effecting fixed engagement thereof and securing said projectile against rotation relatively with respect to said jacket, the said fingers

25 bendable outwardly to release engagement upon detonation of said powder charge effecting discharge of said projectile assembly; and a detach-

able point fuse secured to said explosive projectile for effecting detonation thereto subsequent to said discharge thereof.

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