Sept. 29, 1942. R. E. BOMAR 2,297,130

DRAG PREVENTING MEANS FOR PROJECTILES

Filed Aug. 13, 1940

Fig. 1

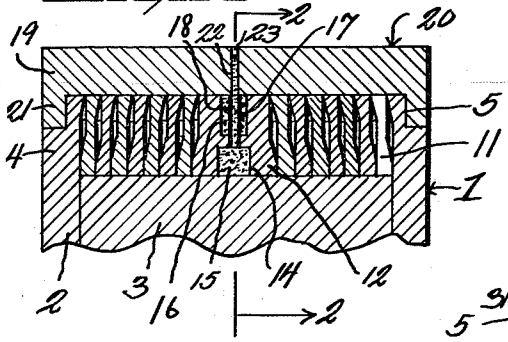


Fig. 2

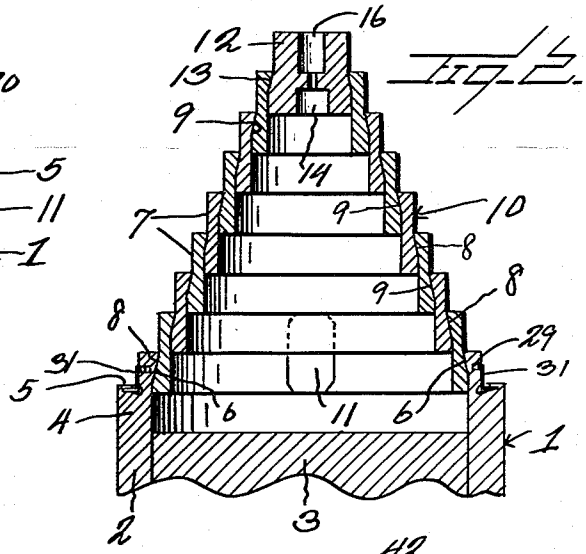


Fig. 3

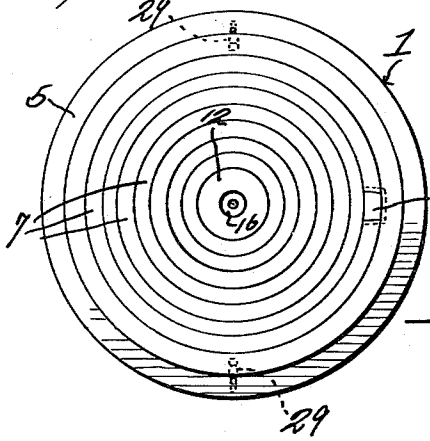


Fig. 6

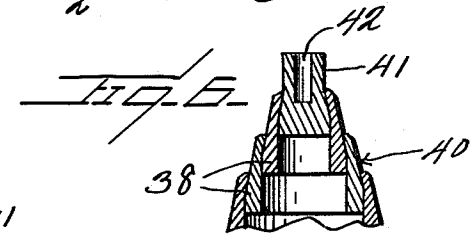


Fig. 4

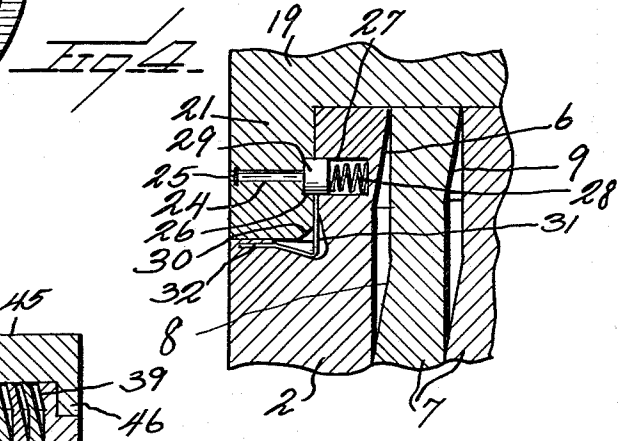
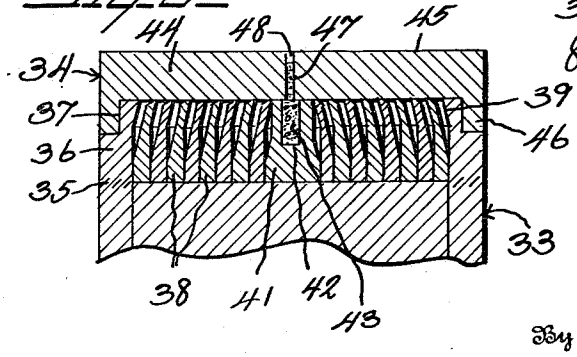


Fig. 5



Inventor

R. E. Bomar

By Watson E. Coleman

Attorney

Patented Sept. 29, 1942 2,297,130

UNITED STATES PATENT OFFICE

2,297,130

DRAG PREVENTING MEANS FOR PROJECTILES

Raymond E. Bomar, Oklahoma City, Okla.

Application August 13, 1940, Serial No. 352,433

8 Claims. (Cl. 102—50)

This invention relates generally to the class of ammunition and pertains particularly to improvements in projectiles which are designed to improve the flight of the same.

It is recognized that in the passage through the air of heavy projectiles having flat rear ends, a definite vacuum is set up due to the movement of the air along the surface of the projectile and across the square end thereof, which causes a certain drag on the projectile which consequently reduces to some extent the effective range of the same.

The present invention has for its primary object to provide a means for reducing or eliminating such drag upon the rear end of a projectile so that the range and accuracy of the projectile will be greatly increased.

Another object of the invention is to provide a device of the character stated which is applicable to all projectiles, regardless of the diameter, which are projected into the air by an explosive force applied at the rear thereof and propelled at a rate of speed great enough to cause a drag or partial vacuum at the rear of the same while it is in motion, which will prevent the development of such drag.

Still another object of the invention is to provide a device of the character stated which is so designed that it cannot be damaged in any manner by the force which must be applied thereto upon the ignition of an explosive charge behind the shell for the purpose of propelling the shell into the air, the construction of the device being such that the movable parts are covered and protected from such explosive force and protected against fouling until the projectile has left the bore of the gun.

A still further object is to provide a drag preventing device which is applicable to the rear end of a projectile of any caliber, which forms a tapering cone at the end of the projectile after the latter leaves the gun and which has associated therewith a means for positively moving the device or the movable parts thereof into operative position where the naturally created drag or vacuum may not be sufficient to shift such parts into the proper working position.

Still another object is to provide a drag preventing device for use upon the rear end of a projectile which assumes the form of a rearwardly tapering cone when the projectile has left the gun, together with a means for protecting the device against damage from the power applied thereto when in the gun and a novel means for releasably holding such protecting means in position until after the propellant charge for the projectile has been ignited.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawing forming part of this specification, with the understanding, however, that the invention is not to be confined to any strict conformity with the showing of the drawing but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawing:

Fig. 1 is a sectional view taken on the plane extending longitudinally of a projectile and through the device embodying the present invention, showing the device in inoperative position.

Fig. 2 is a sectional view on the line 2—2 of Fig. 1, showing the drag preventing device extended.

Fig. 3 is a view in end elevation of the structure shown in Fig. 1, with the cover cap removed.

Fig. 4 is a detailed fragmentary section through a portion of the drag preventing device and the cap therefor illustrating the locking means between the cap and the jacket of the projectile.

Fig. 5 is a sectional view through a modified form of the device and a portion of the projectile to which it is attached.

Fig. 6 is a fragmentary view showing in longitudinal section the outer end portion of the modified structure in extended or operating position.

The device of the present invention is applicable to projectiles of both large and small caliber, in other words, to projectiles which may be attached to a cartridge or those which are introduced directly into the gun and have the powder charge introduced separately. It is also possible and within the scope of the present invention for the drag reducing device to be built as an integral part of the projectile or to be built separately and applied to the rear end of the projectile by welding or in any other suitable manner. In describing the invention, reference will first be had to the form of the invention as designed for use in connection with projectiles of 6-inch or larger caliber and which have no cartridge attached.

Referring more particularly to the drawing, the numeral 1 designates in Figs. 1 to 4, a projectile of the larger caliber size having combined therewith the present drag reducing device. The numeral 2 designates the jacket of the projectile while the numeral 3 designates the main body portion thereof.

In accordance with the present invention,

where the same is to be built as an integral part of the projectile, the jacket 2 is extended at the rear of the projectile to provide a fixed sleeve 4 which is provided at its end with the encircling recess 5. The inner surface of the sleeve 4 is undercut to provide the shoulder 6 which is of smaller diameter at its outer end than at its inner end.

The numeral 7 designates a series of movable or shiftable sleeves which are arranged coaxially with the fixed sleeve 4 and which are of decreasing diameter from the fixed sleeve to the central one of the movable sleeves, such movable sleeves each having an outer shoulder 8 near its inner end and an inner shoulder 9 adjacent its outer end. The shoulder 8 of the outermost one of the movable sleeves is designed for contact with the inner shoulder 6 of the fixed sleeve and the inner and outer shoulders of the remaining movable sleeves are designed to come into engagement when the sleeves are drawn outwardly away from the end of the projectile so as to form the rearwardly extending cone-like terminus for the projectile, which is indicated as a whole by the numeral 10.

The movable sleeves are all of the same height and are of the same height as the fixed sleeve 4. Thus it will be seen that when the cone-like terminus is collapsed, all of the sleeves will lie in one plane and will have their outer edges in a common plane with one another and with the outer edge of the fixed sleeve.

In order to facilitate the placing of the outermost one of the movable sleeves in position within the fixed sleeve, the said outermost sleeve has a key piece 11 cut therefrom which facilitates the reduction of the diameter of the outermost movable sleeve when the key piece is removed, so that such sleeve may be readily introduced into the fixed sleeve and after it is so introduced, the key is replaced, thus completing the original form of the outermost sleeve.

Disposed within the group of sleeves and adapted to be connected with and extend rearwardly from the central or innermost one of the sleeves 7 is a cylindrical core body 12 which in effect constitutes a solid or substantially solid center sleeve. This core body is shouldered, as indicated at 13, so that its movement axially with respect to the other sleeves is limited by engagement of such shoulder with the inner shoulder of the adjacent encircling sleeve 7.

The inner end of the core body is provided with a pocket 14 in which is placed a charge of powder 15 and the outer end of the core is provided with an axially extending chamber 16 which opens through the outer end of the core and which is intended for the reception of tracer powder 17. A powder train 18 extends through the tracer powder to the powder 15 which, when ignited, functions as a booster for moving the rings outwardly into the cone-like form which they assume after the projectile leaves the gun.

As previously stated, when the rings are in nested relation, their outer end edges will all be in a common plane extending transversely of the projectile. In order to protect the rings against damage from the exploding powder charge and also to protect the tracer powder charge from being destroyed, there is provided the cap 19 which has a flat outer or back surface 20 which is presented to the burning powder and against which the propulsive force of the charge is exerted. This cap covers the end of the skirt and the rings therein and has the surrounding flange 21 which engages in the annular recess 5 in the manner illustrated in Fig. 1.

Formed through the center of the cap body is a powder train carrying passage 22 which at its inner end joins the train 18 when the cap is in place. The outer end of this passage is closed by a non-corrosive destructible plug 23 which ignites when the explosive charge is ignited so as to effect the ignition of the powder train, but this plug is designed to delay the ignition of the powder train so that the projectile will be leaving the gun before the booster powder charge 15 becomes ignited to cause the rings and the core to be propelled rearwardly from the projectile to form the desired rearwardly tapering drag preventing cone body.

In order that the cap may be held in position against accidental displacement during the handling of the projectile, an automatically releasing coupling means between the cap and the fixed ring is provided, the details of which coupling means are illustrated particularly in Fig. 4. It is preferred that there be two diametrically opposed couplers between the cap and fixed ring and these couplers are constructed in the following manner.

The skirt portion 21 of the cap is provided with a relatively small diameter passage which extends transversely thereof from the inner to the outer side of the skirt, as indicated at 24. In the outer end of this passage there is secured the thin non-corrosive disk 25 which is made of slightly larger diameter than the bore and held in place by crimping the lip of the bore or passage over the edge of the disk. At the inner end of the passage 24, the passage is slightly enlarged as indicated at 26, and this enlarged portion of the passage alines with a bore 27 formed in the opposing face of the ring 4. In the ring bore is a light expansion spring 28 and connecting the bores 26 and 27, when the cap is in position is a key cylinder 29. As shown, the spring 28 forces the cylinder outwardly and the cylinder lies partly within the two passages, thus extending across the abutting faces of the ring 4 and cap skirt 21 and locking the two parts together.

The inner edge or corner of the cap skirt is beveled off, as indicated at 30, to facilitate putting the cap onto the skirt and forcing the key 29 inwardly against its spring.

Slidably disposed in a suitable groove in the face of the inner wall of the recess 5 is a reciprocable spring finger 31 which engages against the side of the latch 29 when the latter is in operative position and moves across the face of the latch when the latter is moved in against the spring 28. This movement of the spring finger is effected by securing the inner end of the finger in the wall of the skirt, as indicated at 32, and biasing the inner portion of this secured end in such manner that it will flex in a direction to shift the finger 31 toward the rear of the projectile at the proper time.

In the operation of the form of the invention thus far described, when the projectile propellant charge is ignited, the entire force of the expanding gases will be imposed against the flat surface 20 of the cap 19, as previously stated. At the same time, the fusible plug 23 will be ignited so as to slowly ignite the powder train 18. Also occurring at this time is the penetration of the thin disk 25 by the burning gases which will enter the passage 24 of the cap latching means and exert sufficient pressure upon the latch 29 to force the same inwardly against the spring 28. When the

latch 29 has been forced inwardly a sufficient distance, the securing finger 31 will move into position in front of the latch and keep it from returning to cap latching position. The cap will then be free to drop away from the rear end of the projectile as the same leaves the gun muzzle. It will also be readily apparent that due to the igniting of the booster charge 15 in the inner end of the core 12, the expanding gases developed between the core and the end of the projectile will elongate the drag preventing body into the conical form in which it is illustrated. Due to the fact that the outer end of each of the rings is of a diameter slightly less than the inner end of the ring which it encircles, it will be readily seen that these rings can only move a limited distance axially with respect to one another before they lock together and before the central ring locks with the core 12, thus forming a rearwardly tapering conical body which has the effect of streamlining the air off of the end of the projectile which prevents the formation of a vacuum and consequent drag on the projectile. In addition to the explosion of the booster charge in the inner end of the core tending to shift the sleeves axially, this movement of the sleeves is also assisted by the inertia of the same and by the vacuum which will form at the rear end of the projectile and of the cap when the projectile leaves the gun. Such vacuum first causes the protecting cap to fall away from the projectile and then assists in the formation of the tapering body.

In Figs. 5 and 6, there is illustrated a slightly modified form of the invention which may be formed integral with or applied to a projectile of smaller caliber or, in other words, a projectile which is secured in a cartridge. In these views, the projectile body is indicated generally by the numeral 33. The drag reducing or preventing device is indicated as a whole by the numeral 34 and is shown as having been applied to the end of the projectile and welded thereto on the line 35. While no other means is here illustrated for securing the device to the projectile, it will be obvious that other suitable means might be employed. In this simpler form of the drag preventing device, the fixed sleeve is indicated by the numeral 36 and has the encircling recess 37. Within the fixed sleeve are nested the shiftable sleeves 38. Each of these sleeves is at its inner end of slightly greater overall diameter than the interior diameter of the outer end of the encircling sleeve and the outer or larger one of the movable sleeves 38 engages at its inner end against the interior shoulder 39 of the fixed sleeve in the same manner as the outer one of the sleeves 7 bears against or engages the shoulder 6 of the fixed sleeve 4. These movable sleeves 38 are tapered slightly toward their outer ends so that when they are shifted or extended axially from the projectile, they will form the conical body which is indicated generally by the numeral 40 which has a relatively smooth or unbroken outer surface.

Within the inner or central one of the movable sleeves 38 is a core body 41, the inner end portion of which is of slightly greater diameter than the interior diameter of the outer end of the encircling sleeve so that it cannot leave this sleeve when the conical body takes its form.

Formed in the core from the outer end thereof is a bore or pocket 42 for the reception of tracer powder 43.

Like the sleeves 7 of the first-mentioned form of the invention, the movable sleeves 38 are all of the same height so that when they are in nested relation, their top edges will be in the same plane and in the plane of the top edge or outer edge of the fixed sleeve. All of the sleeves will, therefore, be engaged by the cap body 44 when it is placed in position upon the end of the fixed sleeve, this cap body having the flat rear face 45 and the skirt 46 which engages in the annular channel 37 of the fixed sleeve. At the center of the cap is an axial passage 47 which, when the cap is in place, joins the tracer powder bore or cell 42 and this passage is filled with suitable powder and is closed at its outer end by the ignitible plug 48.

The simpler form of the invention just described functions entirely by the drag which is initially applied thereto after the projectile leaves the gun barrel and has had the cover cap 44 pulled off by such drag. When the cap has fallen away from the projectile, the said drag created by the vacuum established behind the projectile pulls the sleeve members 38 and the core 41 rearwardly to form the tapering cone 40 which streamlines the air from the rear of the projectile and thus prevents the formation of the retarding drag or pull which would otherwise be set up.

By the use of the present invention there is eliminated the resistance created at the rear of a projectile, therefore, the power, range and accuracy of the projectile will be greatly increased. This increased power will be especially noticed at the far end of the trajectory where, with the present type of projectile which has the rear end cut off square, the power of the projectile has been diminished to a point insufficient to overcome the resistance or drag and the greatest displacement of power to resistance takes place. It is at once apparent that upon elimination of one of the factors generating the resistance, the displacement of power to resistance will occur more gradually and allow the projectile to travel much farther.

What is claimed is:

1. A drag preventing means for a projectile, comprising a series of annular sleeves arranged in nested relation at the rear end of and concentric with the projectile, the outermost one of the sleeves being integral with the projectile, the sleeves being relatively shiftable axially of the projectile to form a rearwardly extending cone-like body, a cover member detachably secured over the nested sleeves and forming a shield to protect said sleeves from the effects of an explosive charge ignited behind the projectile, and explosive means for removing said cover and effecting the positive relative axial movement of the sleeves to form the cone.

2. A drag preventing means for a projectile, comprising a series of nested annular sleeves disposed at the rear end of the projectile and concentric therewith, the outermost one of the sleeves being fixed to the projectile, the other sleeves being axially movable relative to the fixed sleeve and to one another to form a rearwardly extending cone-like body, a core disposed within the innermost one of the movable sleeves, a cover for said sleeves detachably secured to the fixed sleeve, and an explosive charge carried by said core at its inner end which when ignited effects removal of said cover from the fixed sleeve, the said axial movement of the sleeves to form the cone.

3. A drag preventing device for a projectile,

comprising a plurality of nested concentrically related sleeves disposed at the rear end of the projectile and coaxially therewith, the outermost one of the sleeves being secured to the projectile, a member closing the inner one of the sleeves, the movable sleeves when axially shifted relative to the projectile forming a rearwardly extending cone-like body, a cap covering the nested sleeves and forming a shield therefor against the effects of an explosive charge, and a pressure released latching means between the cover and the fixed sleeve.

4. A drag preventing device for a projectile, comprising a plurality of nested concentrically related sleeves disposed at the rear end of the projectile and coaxially therewith, the outermost one of the sleeves being secured to the projectile, a member closing the inner one of the sleeves, the movable sleeves when axially shifted relative to the projectile forming a rearwardly extending cone-like body, a cap covering the nested sleeves and forming a shield therefore against the effects of an explosive charge, a shiftable latching means between the cover and the fixed one of the sleeves, and so constructed and arranged that the pressure developed behind the projectile within a gun will effect the actuation and release of said latching means from the cover.

5. A drag preventing means for a projectile, comprising a flat unit disposed at the rear end of the projectile and formed of a plurality of elements which are constructed and arranged to shift axially from the projectile to form a rearwardly tapering body, one of said elements comprising a centrally positioned core having a passage extending axially therethrough and leading at the inner end of the core into a chamber, said passage and chamber containing an explosive charge, a removable cover means for said elements, and means for effecting the ignition of said explosive charge through the cover means, said explosive charge when ignited effecting removal of said cover and the axial movement of the unit elements to form said rearwardly tapering body.

6. A drag preventing means for a projectile, comprising a fixed sleeve extending from the rear end of the projectile, a plurality of relatively shiftable sleeves arranged in concentric relation and within the fixed sleeve, said sleeves being of equal height and normally lying in nested relation upon the end of the projectile, a flanged cap covering said sleeves and having the flange portion thereof encircling a portion of the fixed sleeve, a shiftable latch member normally securing the fixed sleeve to said flange, and said flange having a bore formed transversely therethrough from its outer surface, the bore being covered at its inner end by said latch means and admitting pressure from an explosive charge which effects the shifting of the latch for the release of the cap from the fixed sleeve.

7. A drag preventing device for a projectile, comprising a plurality of concentrically related sleeves disposed at the rear end of the projectile and concentric therewith, the outermost one of the sleeves being fixed to the projectile, the sleeves being relatively movable to form a rearwardly extending cone-like body, a cap disposed over the sleeves when the same are in nested relation and having a flange portion encircling the fixed sleeve, said flange portion having a bore formed transversely therethrough from its outer surface, the inner end of the bore being enlarged, a latch member formed to position partly within the enlarged end of the bore and to partially engage in a corresponding bore in the fixed sleeve, resilient means normally urging the latch into the bore of the flange, and means for securing the latch against reverse movement when it has been shifted into the bore of the fixed sleeve against the resilient means.

8. A drag preventing means for a projectile, comprising a plurality of concentrically related nested sleeves disposed at the rear end of the projectile and concentric therewith, the outermost one of the sleeves being integral with the projectile and the remaining sleeves being axially movable to form a rearwardly tapering body, a core member within the innermost one of the sleeves, said core having an axial passage therethrough terminating in an enlarged chamber at its inner end, an explosive charge within the passage and chamber, a cap constructed to overlie the nested sleeves, means maintaining the cap upon and concentric with the fixed sleeve, the cap having an explosive charge containing passage formed axially therethrough and connecting with the passage in the core, the explosive charge in the said passage and chamber of the core, when ignited, effecting removal of the cap and the axial movement of all but the outermost one of said sleeves to form a rearwardly tapering body.

RAYMOND E. BOMAR.