Mar. 13, 1923. 1,448,166.

W. J. H. STRONG.

PROJECTILE.

FILED MAY 15, 1918. 4 SHEETS—SHEET 1.

Fig. 1.

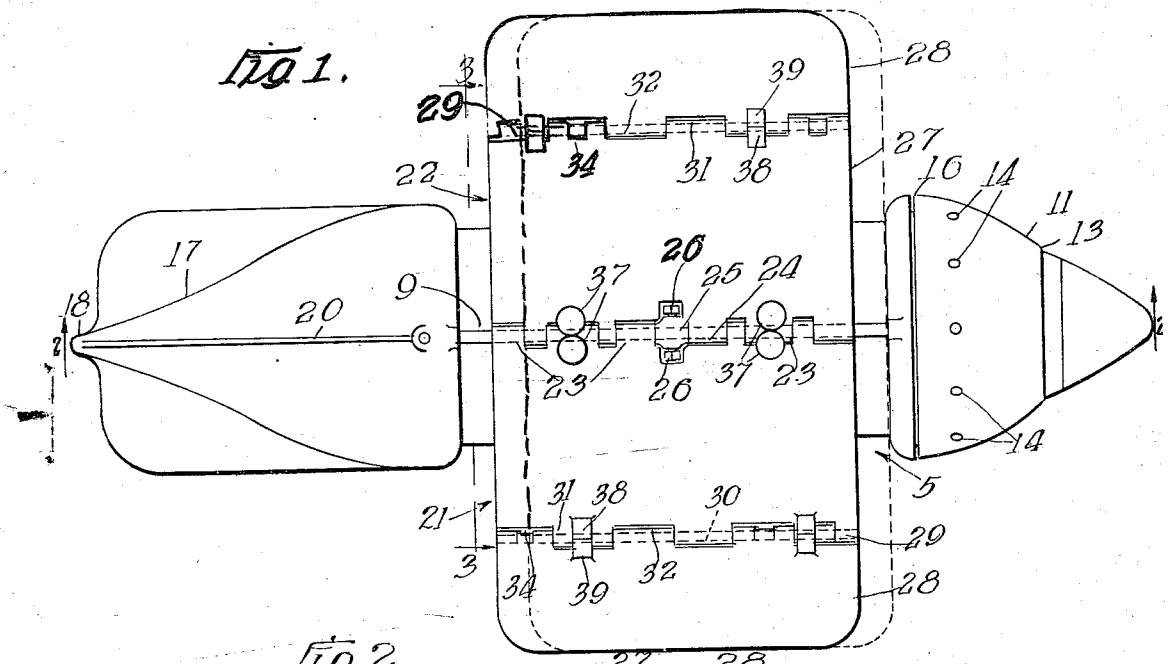


Fig. 2.

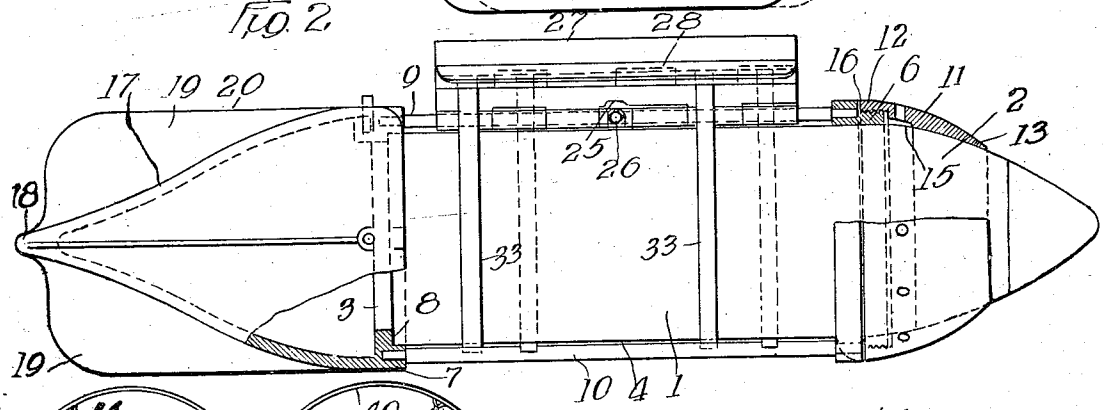


Fig. 4.

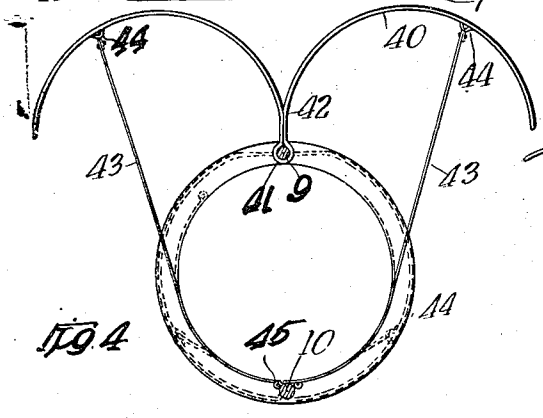
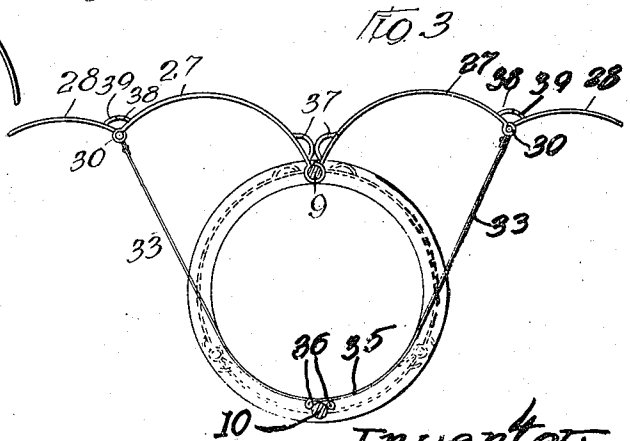


Fig. 3.



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PROJECTILE.

FILED MAY 15, 1918. 4 SHEETS—SHEET 2.

FIG. 5

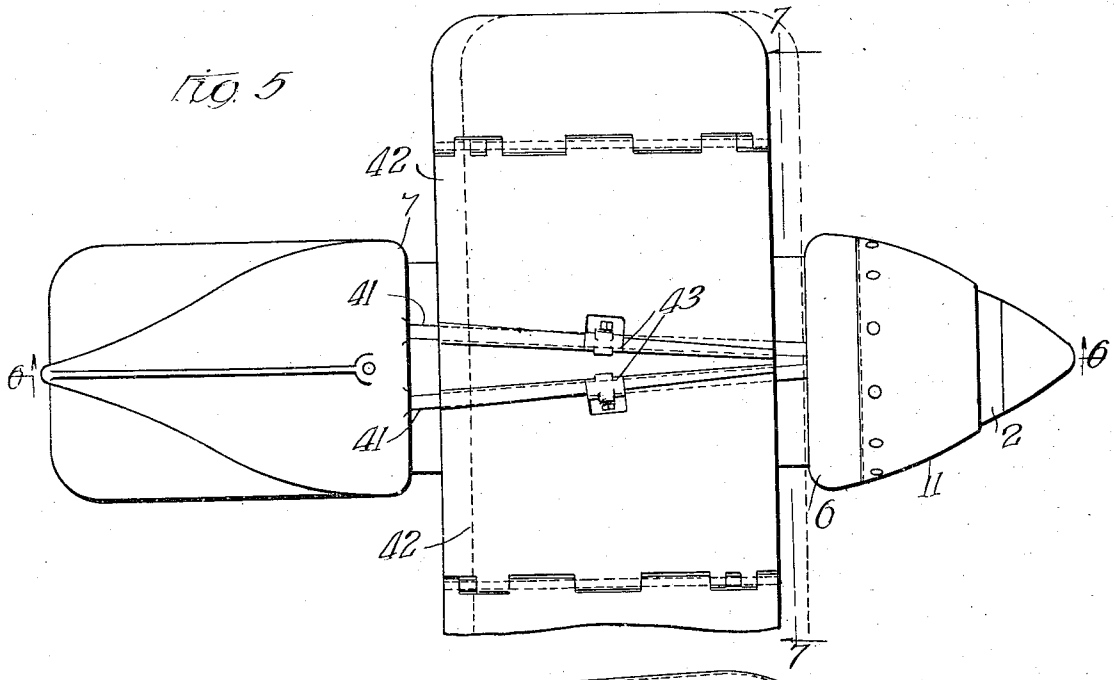


FIG. 6

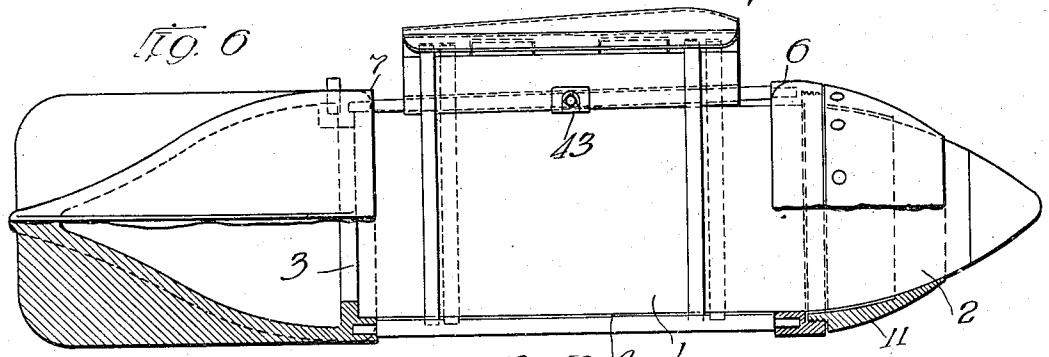


FIG. 8

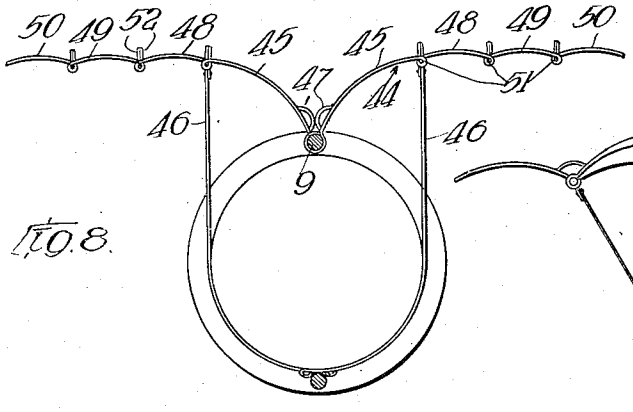
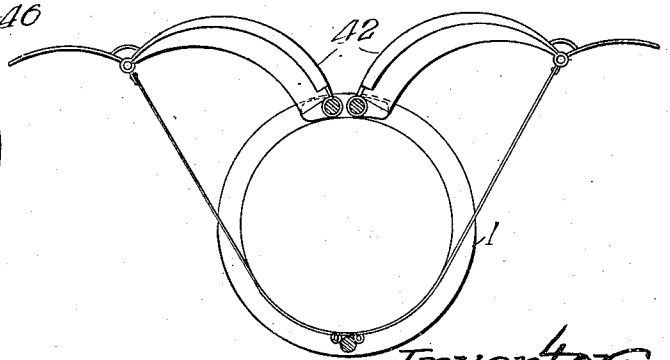


FIG. 7



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Mar. 13, 1923. 1,448,166.

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PROJECTILE.

FILED MAY 15, 1918. 4 SHEETS—SHEET 3.

FIG. 10

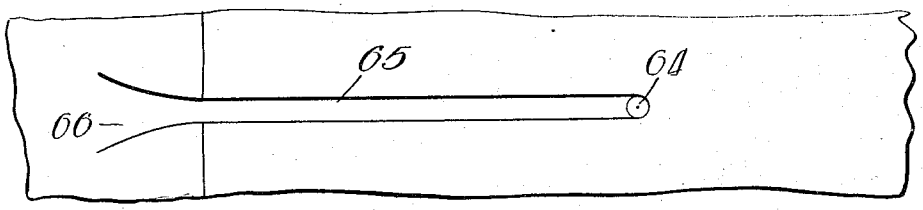


FIG. 9

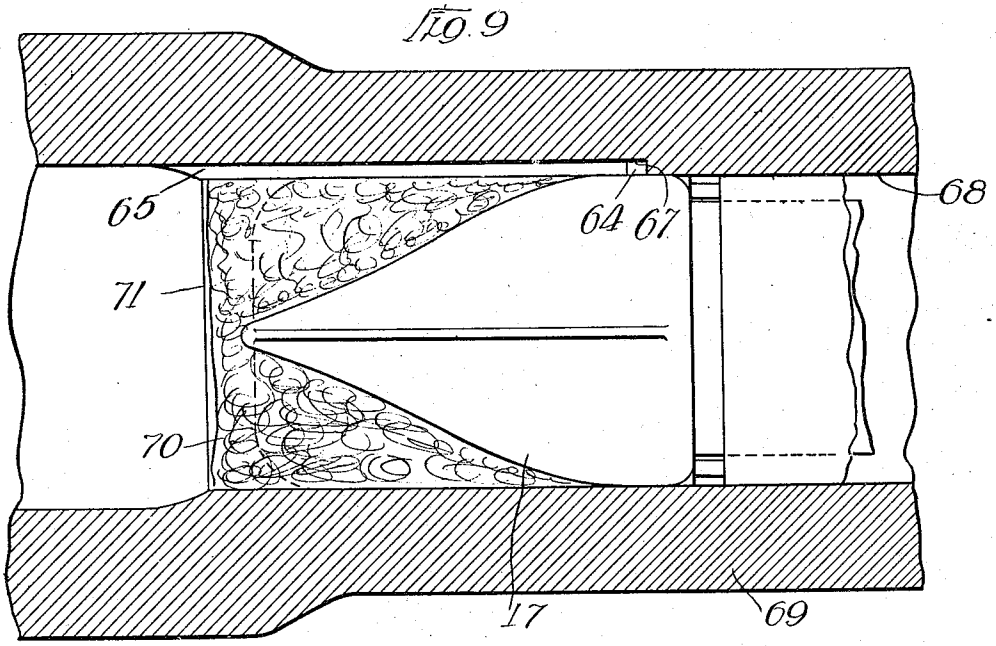
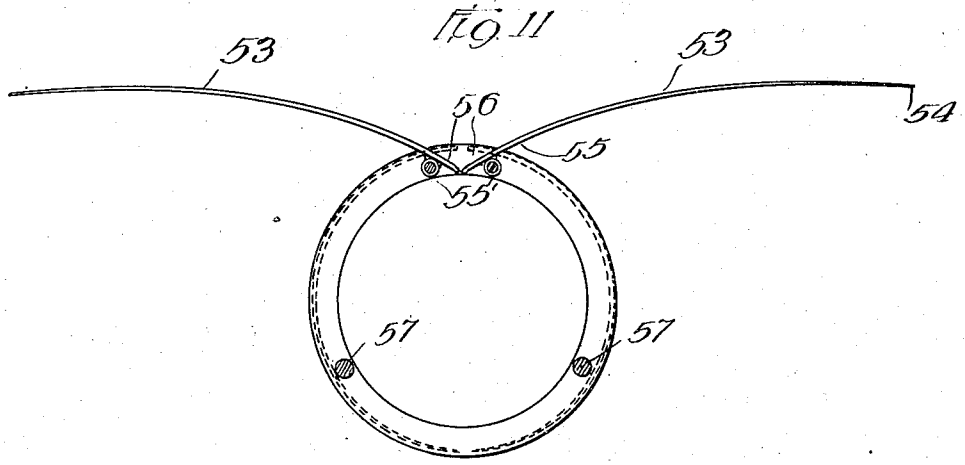


FIG. 11



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1,448,166.

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PROJECTILE.

FILED MAY 15, 1918.

4 SHEETS—SHEET 4.

Fig. 12

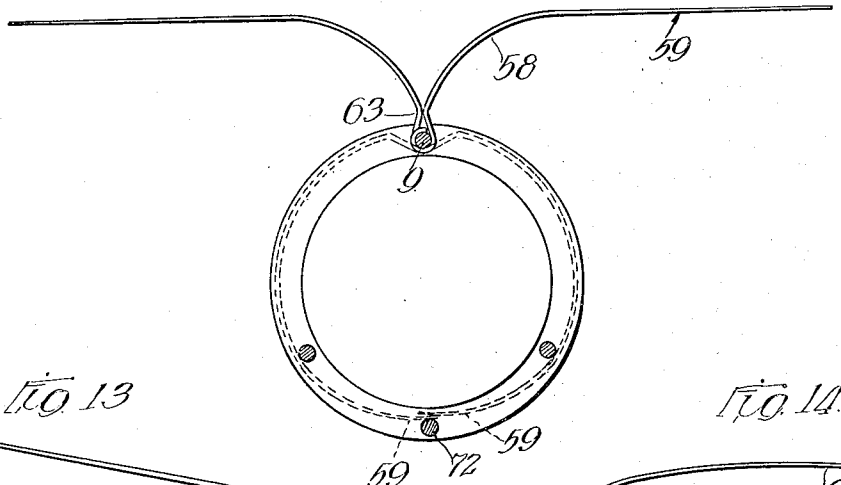


Fig. 13

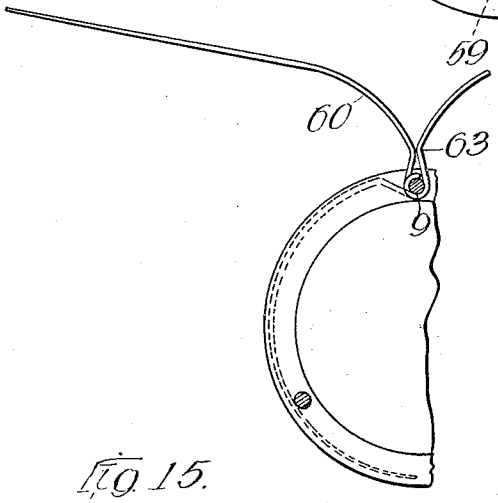


Fig. 14.

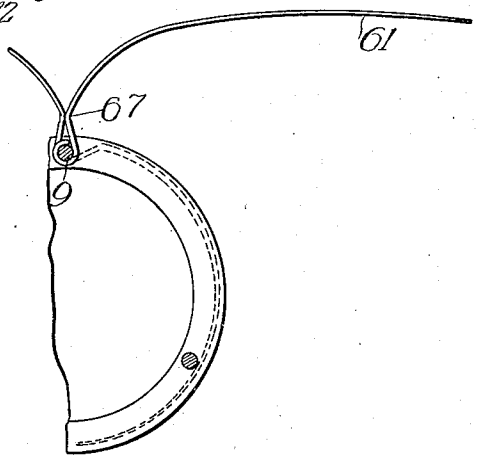


Fig. 15.

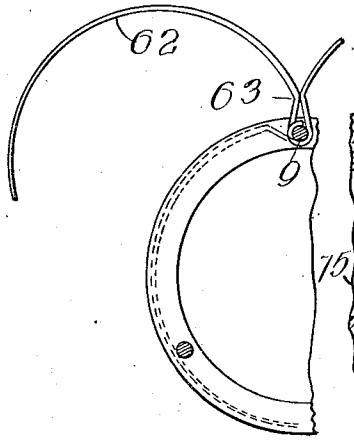
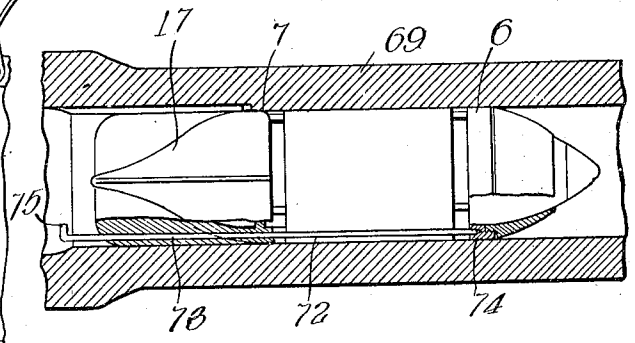


Fig. 16.



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By

Patented Mar. 13, 1923. 1,448,166

UNITED STATES PATENT OFFICE.

WILLIAM J. H. STRONG, OF CHICAGO, ILLINOIS, ASSIGNOR TO EDW. FAY WILSON, TRUSTEE.

PROJECTILE.

Application filed May 15, 1918. Serial No. 234,595.

To all whom it may concern:

Be it known that I, WILLIAM J. H. STRONG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Projectiles, of which the following is a specification.

My invention relates to improvements in shells for use in guns, my object being to provide a shell which shall travel farther than an ordinary shell when driven by an equal quantity of explosive, or which can be thrown to an equal distance with the use of a smaller quantity of explosive. In other words, it is my object to provide a shell which can be thrown much farther than has hitherto been possible, and to conserve the explosive under ordinary conditions by reason of the fact that my improved shell requires the application of less force to project it a distance equal to the projection of an ordinary shell.

A further object of my invention is to provide means for quickly and easily converting the standard shells now in use into shells of the new type, in other words, to provide a winged cradle for application to standard shells now in use by which such shells can be quickly converted into flying shells.

My invention consists of a shell provided on its rear end with an outer surface which effectually destroys the retarding vacuum which is inherent in the use of the ordinary flat bottom shell.

My invention also consists in providing a shell with what I term stream lines of least resistance on its rear end whereby the retarding vacuum action is not only destroyed, but a positive propelling force is made effective to assist in the projection of the shell.

My invention also consists in a cradle or framework adapted to be secured to an ordinary shell and provided with wings or supporting planes which are adapted to be folded into compact relation around the body of the shell for placement in the bore of the cannon and adapted to be spread automatically when the shell is shot out of the bore.

My invention also comprises various other features and combinations and relations of parts and features of construction which will all be made clear in the following description and as particularly pointed out in the appended claims.

I have discovered that if the forward end of a shell is made somewhat tapered as in the ordinary standard ordnance shell, the air will pack against the forward end by reason of the speed of the shell and will produce flow lines or surfaces within the air itself adjacent to the front end of the shell which will be lines or surfaces of least resistance and which surfaces would not be much more effective in the reduction of resistance should such surfaces be reproduced or formed by shaping the forward end of the shell in accordance therewith. Even if there is a projecting ring on the forward end of the shell, this will not materially affect the speed of the shell as the air will pack against the ring and produce an effective point or forward end on the shell having lines of least resistance.

On the other hand, the shape of the rear end of the shell is of the very highest importance, for it is well known that as the speed of the shell is increased the necessary explosive charge to produce the increased speed must be increased out of all proportion to the kinetic energy of the speeding shell and the surface air friction. I have determined that this detrimental feature is due to the high vacuum which is produced at the rear end or base of an ordinary shell by reason of the spreading or rarification of the air in the path of and surrounding the immediate path of the shell. The higher the speed of the shell the larger the base of the compacted cone of air whose center is the center line of the travel of the shell and whose base extends in conical form around the forward end of the shell. This compacted cone of air in effect enlarges the spreading action of the shell, probably to two or three diameters, with the result that there is produced within the base of this cone of air and at the base of the shell probably nearly a perfect vacuum, which of course holds back on the shell in proportion to its negative pressure, the maximum

being equal to the atmospheric pressure at the point of flight.

By means of my invention I am enabled to attain a very flat and low trajectory and thus conserve explosive, while at the same time obtaining long distance flight. I have made beneficial use in the propulsion of the shell of the vacuum formed ordinarily at the base of the shell, in that I have provided the base of the shell with such a conical surface tapering off to nothing at its extreme rear end, that the air which is pushed out laterally by the moving shell, in returning to the shell path behind the shell produces a pressure on the rear portion of the shell that is, on the conical surface which I have provided, which causes or produces a forward pushing resultant force or pressure.

In other words, I have obtained an effect similar to the projecting pressure on the rear end of a water melon seed or similar projectile, when the same is squeezed between the fingers for the purpose of projecting it through the air in a manner well known.

This effective resultant forward pushing pressure may be as high or 8 or 10 lbs. per square inch of effect in area, but whatever it is it destroys the drag of the vacuum and provides in its place a positive propelling pressure, and if I am enabled to attain a propelling force of but a few pounds, I have, in consequence of destroying the vacuum, added from 16 to 30 pounds to the effective propelling pressure related to the condition of an ordinary shell.

My invention contemplates the use of old discarded rifled cannon as smooth bores, for the reason that I do not permit my shell to rotate, but on the other hand hold it against rotation until fired from the cannon. I provide means at the base of the shell and co-operating means in the bore for placing the shell in what might be termed a level-keel position and retain it in such position until the gun is fired. As soon as the shell emerges, the wings spread and the shell is not rotating, the wings immediately act to steady the shell, prevent its rotation, and serve as floating planes similar to the planes in other aeronautical devices.

Furthermore, to assist in the guiding of the shell and to assist in preventing its rotation in the air, I provide the base of the shell with rigid lateral projecting fins or vanes, preferably 4 thereof, equally spaced around the base, and which have an effective outer diameter equal to that of the shell and assist in guiding the shell centrally through the bore of the gun.

Still another important feature of my invention is that the wings are adjustable longitudinally relatively to the longitudinal center of gravity of the shell and the attached cradle, so that after my improved shell is all assembled I can adjust the wings longitudinally relatively to the shell to support it on an even keel fore and aft, or to effect the elevation or depression of the point of the shell as desired.

My invention also readily lends itself to the production of a form in which the wings are actually tilted longitudinally of the shell whereby I am enabled to actually cause the shell to climb in the air in the manner of an upwardly tilted airplane, or at least to effect the holding up or sustaining the shell in its flight for distances far beyond the ordinary projection of shells.

My invention will be more readily understood by reference to the accompanying drawings forming a part of this specification and in which I have illustrated several typical forms in which my invention may be embodied, and in which drawings:—

Figure 1 is a top plan view of a shell embodying my invention in one form, the wings spread as in flight;

Figure 2 is a central longitudinal vertical section on the line 2—2 of Figure 1;

Figure 3 is a vertical transverse section of the cradle on the line 3—3 in Figure 1, the shell not being sectioned;

Figure 4 is a view similar to Figure 3 showing a modified form of wing;

Figure 5 is a view similar to Figure 1 illustrating a form which is adapted to tilt the wings upwardly at their forward ends;

Figure 6 is a central longitudinal vertical section on the line 6—6 of Figure 5;

Figure 7 is a vertical cross section similar to Figure 3 and taken on the line 7—7 of Figure 5;

Figure 8 is a cross section similar to Figure 7 showing the wings each articulated at more than one point;

Figure 9 is a vertical fragmentary longitudinal section of the breach portion of a cannon and the rear portion of one of my improved shells in firing position;

Figure 10 is a fragmentary inner plan view of the cannon breech shown in Figure 9;

Figures 11, 12, 13, 14 and 15 are views similar to Figure 3, particularly showing different forms of one piece wings and illustrating the effect of different degrees and relative proportions of tempering steel wings; and

Figure 16 is a fragmentary view similar to Figure 9, the wings being the self adjusting type.

Referring to said drawings, 1 indicates an ordinary shell having a tapered or coned forward end 2 and a flat base 3. The shell may have or carry soft metal rifling rings, although I have not thought it necessary to show such rings. The point 2 and the base 3 are joined by the elongated cylindrical body portion 4.

I provide a cradle or frame work which consists of a ring 6 fitting the forward end of the cylindrical part 4 of the shell and a somewhat similar ring 7, likewise fitting the cylindrical part 4 adjacent to the base 3.

I provide the base ring 7 with an inner annular shoulder 8 adapted to engage the base 3.

I join the two rings 6 and 7 by longitudinal rods or bars 9 and 10, the ends of the rods entering suitable openings in the rings 6 and 7 and being secured tightly therein. For securing the cradle upon the shell I provide a ring 11 fitting the forward end 2 of the shell adjacent to its base and adjustably secured to the forward ring 6 as by the co-operating annular screw threads 12 so that I can thereby draw and hold the base ring 7 against the base of the shell and the cradle longitudinally and circumferentially immovable relative to the shell. I preferably make the ring 11 coned on its inner surface to fit the adjacent coned surface of the point 2 and I make the forward edge 13 as thin as possible so as to minimize the air resistance at this point.

For placing the ring 11 in position I provide spanner holes 14 for screwing the ring into place in an obvious manner. I preferably counterbore the inner end of the ring 11 as shown at 15, and I purposely cut the inner end 16 of the ring 11 a trifle short so that I can properly draw the base ring 7 directly against the base 8.

As hereinbefore explained, I provide the base of the cradle with a coned or tapered rear end to eliminate the vacuum at the base of a speeding shell and for this reason I provide a coned or tapered base 17, preferably integral with the ring 7 and having an outer surface which is equal in diameter at its forward end to the outer diameter of the ring 7 and decreasing toward its rear end until it ends in a relatively small center point 18. Preferably I make the base 17 hollow to avoid waste and expense, making the walls merely thick enough to have sufficient strength to withstand the pressure of the explosion when the gun is fired. It should be understood that the outer diameters of the two rings 6 and 7 are equal to each other and are the maximum diameter of my cradled shell and they serve to guide the shell while in the bore of the gun.

I provide the base 17 with fixed wings or vanes 19 preferably as shown, providing 4 of them equally circumferentially spaced around the base 17. The outer edges 20 of the vanes 19 are parallel with the center line of the shell and they serve as guides for the shell as I make them equal in diameter with the outer diameter of the rings 6 and 7. These vanes not only serve as extended guides while the shell is within the bore, they also greatly increase the strength of the hollow base, allowing me to make the same of minimum weight and so cut down the cost, and they also serve, during flight, to steady and guide the shell, offering resistance to rotation of the shell and as I arrang one pair of the vanes on the plane of the horizontal center of the shell they add their quota of sustaining surface.

I make use of the upper tie rod 9 upon which to hingedly mount the wings 21 and 22, which, when extended, provide a gliding plane centrally disposed laterally relatively to the body of the shell and adapted to be adjusted longitudinally of the shell, in reference to the center of gravity thereof to sustain the shell, in its flight, as desired and as heretofore explained. The wings 21 and 22 are provided with interlocking hinge parts 23 and 24 respectively, adapted to encircle the tie rod 9, as shown, and permitting the wings to rotate about the tie rod or bar to extended position, as shown in Figure 3, in full lines, or to be folded in against the body of the shell between the rings 6 and 7 and within their outer diameter, as shown in Figure 3 in dotted lines. These wings are preferably made of sheet metal which is curved to fit the cylindrical contour of the shell, and as illustrated in Figures 3 and 4, may each consist of a single piece from base to tip or of more than one piece hinged together at their meeting lines or edges.

For the purpose of adjusting the wings longitudinally on the hinge rod 9 I provide a collar 25 on the rod 9 fitting within suitable openings provided in the wings. The collar can be adjusted longitudinally along the rod 9 and in turn places the wings longitudinally, as the ends of the openings in the wings contact with the ends of the collar. The collar may be held in adjusted position by set screws 26. Once having determined the relative position of the wings for a certain type and size of shell, I then manufacture the device ready to be applied to that particular type and size of shell with the wings properly positioned without the need of setting them for each particular shell, particularly as the standard shells do not vary as to diameter or center of gravity sufficient to militate against such practice. Consequently, my improvement could be manufactured and adjusted in large quantities and shipped in knock-down form separate from the shells to the field of action and there placed upon the ordinary shells shipped beforehand or separately.

As shown, I make the width of the wings, that is their dimension longitudinally of the shell, somewhat less, than the distance between the rings 6 and 7 to leave ample room for the adjustment of the wings above described, and also to permit a readjustment of the wings to correspond with

the desired results to be produced in the firing of the shell, should necessity arise.

The wings 21 and 22 shown in Figures 1, 2 and 3 are each made of two pieces, an inner member 27 hinged at its inner edge as described upon the rod 9, and an outer member or tip 28 similarly hinged at its inner edge upon the outer edge of the inner member as at 29. I provide hinge rods or pins 30 extending through the several hinged parts 31 and 32 of the wing members 27 and 28 respectively, the several hinge parts of the two parts of the wing being interlocked to prevent relative longitudinal movement of the same.

The wings can be limited in their rotative movement about the hinged pin or rod 9 in many ways, to cause them to be retained definitely in proper extended position once they are released from the bore of the gun.

In Figures 1, 2 and 3 I have shown tie straps 33 preferably made of flat spring steel, and having their outer ends 34 wrapped or formed around the hinge pins 30 and secured in such position. The inner ends 35 of the ties 33 are passed around the shell between the shell and the tie rod 8, and I form the free inner end of each tie strap 33 into a small coil 36 of a large enough size so that it cannot pass between the rod 8 and the shell body 4, and I make each tie strap 33 of such a length that when the end 36 contacts with the rod 8 upon the spreading of the wing, to which such tie is attached, the wing will be held in its best position for sustaining the shell in its flight.

As an additional means of bracing the wings I can, as best shown in Figure 3, provide humps or bumped-up portions 37 in the wing parts 27 adjacent to their inner edges and adapted to contact with each other to mutually brace the wings when they are in extended position. To retain the wing tips 28 in proper extended position, I provide them with tongues 38 at their inner edges and I provide co-operating tongues 39 on the outer edges of the inner wing members adapted to contact with the tongues 38 beyond the hinge pins 30 as best shown in Figure 3 to hold the wing parts 28 extended substantially horizontally during flight. When the wings are in folded position, as shown in Figure 3 in dotted lines, the tie strap of each wing is wound around the shell between the opposite wing and the surface of the shell and the bracing humps 37 and the projections 38 and 39 as well as the wings themselves all lie within the outer diameter of the rings 6 and 7, so that the wings in folded position may pass through any bore through which the rings 6 and 7 can pass.

In Figure 4 I have shown wings each made of a single piece 40 and each curved to fit the shell. Each wing is straight or flat adjacent to its inner edge 41 to provide a mutually bracing contact line 42 outside of the hinge pin or guide rod 9. While this contact will mutually brace the wings one against the other, it would not hold the wings as a whole relatively to the shell. For this purpose I provide tie straps 43 similar to the straps 33 shown in Figure 1 connected to the under side of the wings at 44 between the base and tip thereof and provided with enlarged inner ends 45 for contact with the lower tie rod 8 to set and hold the wings relatively to the shell. As shown in Figure 4, in dotted lines, the wings 40 and their tie straps can be folded in collapsed condition within the outer diameter of the rings 6 and 7.

In Figures 5, 6 and 7 I have illustrated the form which my invention takes when arranged to provide wings which are tilted on an angle to the direction of travel of the shell. In this form instead of hinging the two wings upon a central upper tie rod 9 I provide a pair of tie rods 41 their forward ends secured in the ring 6 close together and their rear ends secure in the ring 7 and spaced farther apart, whereby they are angularly disposed as best shown in Figure 5. As it is desirable that the wings 42 closely hug the shell when folded, it follows that they must be formed to lie substantially parallel with the cylindrical part 4 of the shell when in folded form. Due to the angular position of the rods upon which they are hingedly mounted the wings necessarily swing to an upwardly inclined relative position when extended, as shown in the drawings. They are each held against longitudinal movement on the hinge rods by set collars 43 similar to the set collar 25 shown in Figure 1. I preferably make these wings of inner and outer parts similar to those shown in Figure 1 and as best shown in Figure 7 I similarly tie and brace the wings.

In Figure 8 I have illustrated a form of wing 44 made up of a plurality of wing parts, the inner part 45 being hingedly mounted on the upper tie rod 9 and provided with tie straps 46 and mutually bracing humped-up projections 47 similar to those described with reference to Figure 3. I provide relatively narrow outer wing parts 48, 49 and 50 hinged together at their adjacent edges on pins 51 and the adjacent edges of the several parts provided with mutually co-operating projections 52 limiting the spreading of the wing parts in an obvious manner. The several parts of the wings are curved to fit against the shell and the projections 52 are short enough so that they will not project beyond the outer diameter of the rings 6 and 7 when the wings are folded.

It is not absolutely necessary that the wings shall have tie straps for the shell may

so hang from the wings that it will place itself by gravity centrally below the wings and it is well known, in the aviation art, that a plane once started through the air in an edgewise direction tends to hold its direction of movement, or in other words, it is difficult to rotate a plane out of its plane of movement when moving edgewise through the air. I take advantage of this in the construction of my flying shell as illustrated in Figures 11, 12, 13, 14 and 15.

The wings in all of these forms are single piece wings, and all of the forms shown except that shown in Figure 11, are hinged upon a single upper tie rod 9. To this extent they are similar to the single piece wing 40 shown in Figure 4. They are different in that they are self positioning or sustaining once they have been released.

As shown in said several figures I preferably make each wing thicker at its inner edge than at its outer edge and tapering or graduated in thickness between these two points. In other words, I graduate or proportion the thickness of the wings to the sustaining force demanded of it at the various distances from the hinge joint.

As shown in Figure 11 the wings 53 are relatively thinner at their outer edges 54 than at their inner edges 55. They are thus stronger or stiffer adjacent to their bases than at their tips. In this form of wing I prefer to support each wing upon a separate tie rod 55′, as shown, instead of a single upper tie rod as shown in Figure 1 and I provide the inner edges of each wing with projections 55 substantially in the plane of the wing and adapted to contact with the shell when the wing is fully extended to limit the rotation of the wing in an obvious manner.

In this instance also I have shown two lower tie rods 57 in place of the single tie rod shown in Figure 1.

The wings 57 are preferably made of spring sheet metal such as steel and it is obvious that they could be so tempered as to permit them to be wound against the shell for folding, as shown in dotted lines in Figure 11, and to assume different curves or relative forms when extended. In the form shown in Figure 11 the tip part of the wing is horizontal or level, and the body of the wing curves down gradually toward the hinge rod.

In the form shown in Figure 12 the base portion 58 of the wing 59 is curved substantially to the curvature of the shell and is so shaped that it does not change its curvature when extended, and in action. The outer part however is more pliable and adapted to assume a substantially horizontal position or condition as shown when extended and to be formed around the shell when folded, as shown in dotted lines.

In Figure 13 I have shown a form of wing in which the rigid base portion 60 is shorter than that shown in Figure 12 and consequently the outer part of the wing may take a position in an upper and outwardly inclined direction as shown.

In Figure 14 I have shown a wing similar to that shown in Figure 13 except that the stiffening of the wing may be considered to be so proportioned that its outer part 61 remains slightly curved downwardly which assists in preventing sidewise sliding the shell.

In Figure 15 I have shown a form of single piece wing 62 similar to that shown in Figure 4 but of the self supporting type, that is, without the tie straps shown in Figure 4 and so relatively rigid or stiff that it does not materially change its shape from unfolded to extended position.

In all of the forms shown in Figures 12, 13, 14 and 15 the wings are formed to have mutually contacting and supporting points or lines 63 adapted to contact beyond the supporting or hinge rod 9 and to mutually hold the wings against movement relative to each other when supporting the shell in flight.

It is obvious that in the use of my shell it is necessary to so place the shell in the cannon that when it emerges the wings will provide a substantially horizontal sustaining plane for the shell. For this purpose I provide, on the forward end of the base 17, a projection 64 which extends laterally or radially from the base and is preferably made of some soft metal such as copper, and I provide within the bore of the cannon a longitudinal guide groove 65 having an inner or base flared end 66 to guide the projection 64 into the groove as the shell is entered into the breach of the cannon. The groove 65 extends forward and ends at a point just forward of the position of the projection 64 when the shell is in loaded position best shown in Figure 9.

I make this projection 64 of soft metal so that it can be readily sheared off by the end 67 of the groove 65 when the shell is forced forwardly out of the cannon.

To provide a substantially tight joint between the shell and the smooth bore 68 of the cannon 69 I provide a relatively soft wadding or pad 70 formed to be placed within the bore of the cannon surrounding the coned end 17 of the shell and presenting a substantially flat rear end surface 71 to receive the pressure from the burning explosive. In other words, I provide a wadding similar to the wadding in a shotgun preferably making such wadding of felt or some similar material which will not burn easily or sustain combustion and consequently will not carry or scatter fire.

In placing my flying shells in the gun, the

forms shown in Figures 1 to 9 inclusive do not require any especial preparation as the wings thereof will readily stay in folded position around the shell, but with the spring wings shown in Figures 10 to 15 inclusive I have provided means to retain the wings in folded position until the shell is within the bore. When the shell has been placed within the bore the wings obviously cannot again expand until the shell emerges at the muzzle.

For the purpose of holding the spring wings in folded form I make the wings long enough from base to tip, as shown in dotted lines in Figure 12, so that their tips 59 overlap when the wings are wrapped around the shell and I hold the overlapped ends and consequently the wings in folded condition by means of a lock rod 72 which I project through a hole 73 provided for it in the shell base 17, its forward end entering a hole 74 which I provide in the forward ring 6. I provide the rear end of the rod 72 with a handle 75 by which the rod can be withdrawn through the breech of the gun after the shell has been placed in firing position.

It should be understood that the said several illustrations of my invention are typical merely of the many forms in which it can be embodied and consequently I do not limit or confine my invention to the specific structures herein shown and described except within the scope of the following claims.

I claim:

1. The improvement herein described, comprising a cradle or frame adapted to be removably secured upon a shell, which is adapted to be impelled from a gun, a longitudinally extending member holding said frame on the shell, a wing hinged to said member and adapted to be wrapped around the body of the shell for placement within the bore of a gun and to be automatically extended when the device is released from the gun, and means holding the wing in substantially horizontal position when extended.

2. The improvements herein described comprising an ordinary ordnance shell having a body of substantially uniform diameter from end to end, an enlarged removable head and tail piece, a wing support within the diameter of said head and tail piece and connecting them together, a wing hinged at one end to said support and arranged for limited rotation above said support, said wing being foldable within the diameter of the head and tail piece for placement within a gun barrel, and adapted to be automatically extended to shell supporting position when released from the barrel.

3. The improvement herein described, comprising a frame consisting of a ring adapted to engage the base of a shell, a second ring adapted to engage the forward end of a shell, tension rods extending between the two rings and holding them on the shell, a pair of wings hingedly mounted on one of the tension rods and adapted to be drawn in around the body of the shell between the rings and to be extended substantially in horizontal shell supporting position.

4. The improvement herein described, comprising a frame consisting of a ring adapted to engage the base of a shell, a second ring adapted to be placed upon the forward end of the shell, tension rods joining the two rings, means adapted to engage the coned forward end of the shell to hold said second ring in place, a pair of wings hingedly mounted on said frame and adapted to be drawn in around the body of the shell between the rings and to be extended in substantially horizontal shell supporting position.

5. The improvement herein described, comprising a frame consisting of a ring adapted to engage the base of a shell, a second ring secured upon the forward end of the shell, tension members joining the two rings, a pair of wings hingedly mounted on the frame and adapted to be drawn in around the body of the shell between the rings and to be extended in substantially horizontal shell supporting position, and stops limiting the outward movement of the wings.

6. The improvement herein described, comprising a frame work or cradle adapted to be movably mounted upon a shell, wings carried by said cradle and means for adjusting the wings longitudinally of the cradle.

7. The improvement herein described, comprising a frame or cradle adapted to be removably secured upon a shell, said frame having a ring at each end and a longitudinally extending member extending from ring to ring, wings mounted on the member between the rings and adapted to be folded against the shell within the outer diameter of the rings and also adapted to be extended in substantially horizontal shell supporting position.

8. In a device of the kind described, an ordinary ordnance shell having a forward conical end, a hollow conical base for mounting on said shell, a ring adapted to fit the forward conical end of the shell, and tension rods connecting the hollow base and the ring for holding same upon the shell.

9. The improvements herein described, comprising a hollow conical shell for attachment on the base of an ordnance shell, a ring adapted to receive the forward end of the ordnance shell, tension rods connecting the said hollow base with the rings and

wings hinged on the tension rods, and adjustable longitudinally thereon.

10. A frame or cradle adapted for attachment upon an ordnance shell, a longitudinally extending rod on said frame, wings hingedly mounted on said rod, a flexible tie strap attached to each wing and adapted to be wrapped around the shell beneath the opposite wing, the inner end of the strap adapted to engage a limit stop to limit the outward movement of the wings.

In witness whereof, I hereunto subscribe my name this 11th day of May, A. D. 1918.

WILLIAM J. H. STRONG.