Jan. 28, 1947. H. C. WOLF 2,414,844

COLLAPSIBLE FIN ASSEMBLY

Filed July 5, 1943 3 Sheets-Sheet 1

Fig. 1.

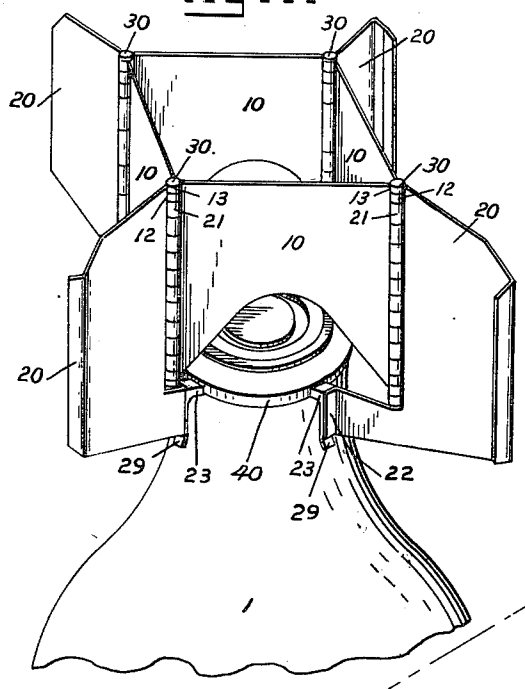


Fig. 6.

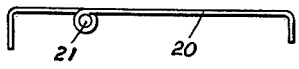


Fig. 5.

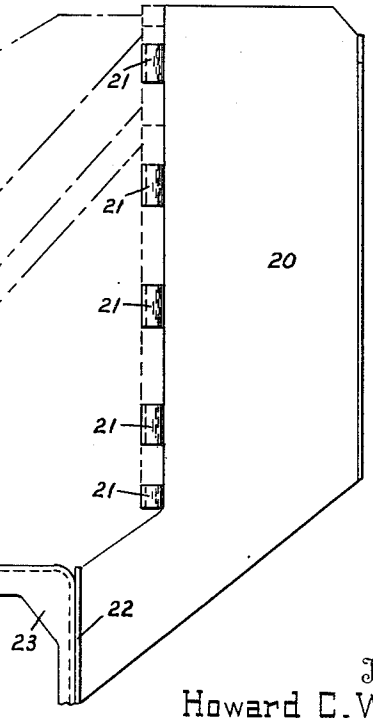


Fig. 3.

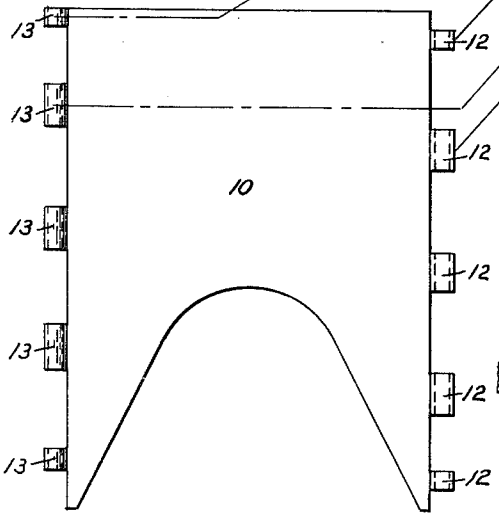
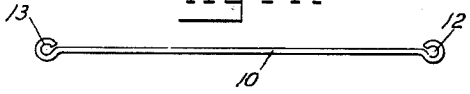


Fig. 4.



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Fig. 2.

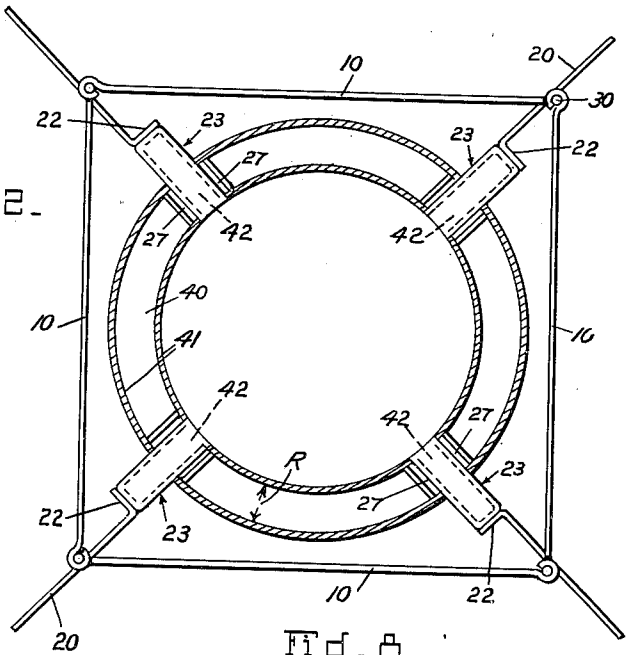


Fig. 8.

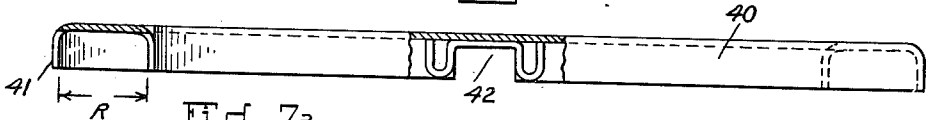


Fig. 7a.

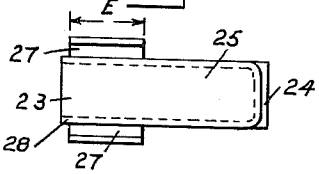


Fig. 7c.

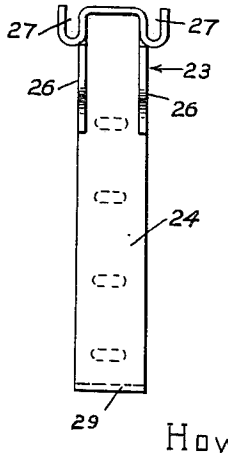
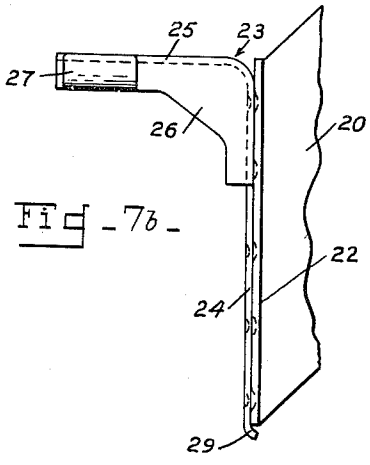


Fig. 7b.



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Fig. 9.

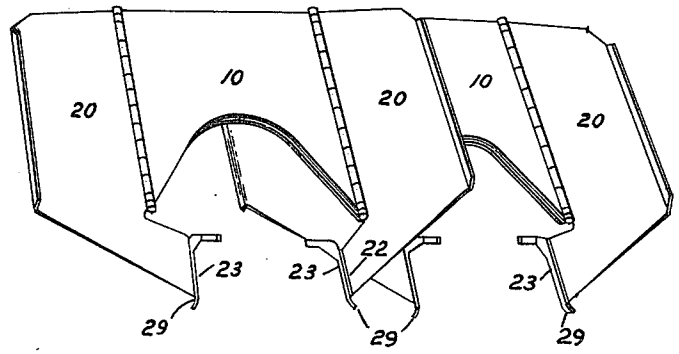


Fig. 8a.

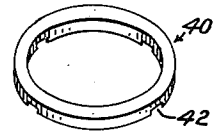
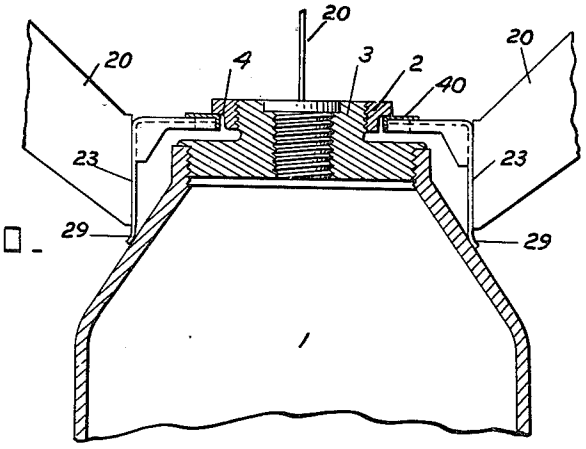


Fig. 10.



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Patented Jan. 28, 1947

2,414,844

UNITED STATES PATENT OFFICE

2,414,844

COLLAPSIBLE FIN ASSEMBLY

Howard C. Wolf, Cleveland, Ohio

Application July 5, 1943, Serial No. 493,503

11 Claims. (Cl. 102—2)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to bombs and other missiles, and more particularly to the fins or tail fins secured to them for the purpose of stabilizing their flight. The object of this invention is to devise a fin assembly which may be readily applied to the bomb or other missile at the time the bomb is to be released from aircraft or at the time of other discharge or firing. In present practice the fin assembly is shipped separately from the bomb and secured thereto at the place and time of use. The fin assemblies heretofore used occupied considerable storage space when crated for shipment. An important object of this invention is to devise a fin assembly which will occupy very considerably reduced space in crated condition and in shipping. Allied with this object, a further object is to device a fin assembly which is quickly and easily secured on the bomb without the use of any special tools and without any modification of the bomb.

For the attainment of these and such other objects as may appear or be pointed out I have shown an embodiment of my invention in the accompanying sheet of drawings wherein:

Fig. 1 is an isometric view of the improved fin assembly in position on a bomb.

Fig. 2 is a top view of the fin assembly, the distal ends of the vanes not being shown.

Figs. 3 and 4 are respectively, front view and top view of the side pieces of the improved assembly.

Figs. 5 and 6 are respectively, front view and top view of the vanes of the improved assembly.

Figs. 7*a*, 7*b*, and 7*c* are respectively, the top, side and front views of a bracket member employed in locking the fin assembly in open condition.

Fig. 8 is a front view of the ring member employed, in conjunction with the bracket member in locking the fin assembly in open condition.

Fig. 8*a* is a perspective view of the ring member.

Fig. 9 shows the improved fin assembly in folded condition.

Fig. 10 is a sectional view of the upper portion of the bomb and the lower portion of the fin assembly, showing the manner of attachment.

The improved fin assembly comprises four side pieces 10 and four vanes 20 which are located at the four corner edges presented by the four side pieces when assembled in the box-like formation

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shown in Figs. 1 and 2. At each of the said four corner edges two side pieces 10 and a single vane 20 are articulated or hinged together by a single pintle 30. For this purpose one edge of the vane 20 is provided with ears 21 conveniently made by bending the sheet metal of which the vanes are fabricated. Both edges of the side pieces 10 are provided with similarly formed ears 12 and 13. It will be observed from Fig. 3 that while the ears 12 and 13 on the two edges may be of substantially the same widths, the ears, e. g. 12 are not in alignment with the ears 13 of the other edge. This is to provide for the interlocking of the ears of the three meeting edges, namely the proximal edge of the vane, one edge of one side piece, and the opposite edge of an adjacent side piece. It will be observed from Fig. 5 that the ears of the two adjacent side pieces and the single vane follow one another in the following repeated sequence: an ear 13 of one edge of one of the adjacent side pieces, an ear 12 from the opposite edge of the other of the adjacent side pieces, and an ear 21 of the vane.

For the purpose of providing means enabling the improved fin assembly to be locked in open or operative position the lower portion of each vane 20 is provided with a bracket 23 which is conveniently spot-welded to turned edge 22 at the lower vane portion. A detail enlargement of bracket 23 is shown in Figs. 7*a*, 7*b*, and 7*c* where it will be seen that the bracket is stamped in the form of an inverted-L, the vertical leg 24 of which is considerably longer than the horizontal leg 25 and is the surface which is spot-welded to vane edge 22. As best seen in Fig. 7*c*, the horizontal leg 25 is stamped in the form of an inverted-U. A bracing web 26 is left between the two legs, Fig. 7*b*, or rather a pair of such webs, at the sides of the bracket, Fig. 7*c*. The distal edge of the horizontal leg 25 of the bracket is provided with a pair of ears 27, one on each side, which project laterally from the horizontal leg, as best seen in Fig. 7*a*. As the top view of Fig. 7*a* reveals, the horizontal leg 25 presents a T-formation with the ears 27 constituting the lateral projections and distally disposed. The horizontal leg 25 extends past the formation of the ears 27 to provide a slight extending portion 28.

The brackets 23, more particularly, the T-shaped horizontal leg 25, cooperate with a ring 40 having concentric edge flanges 41 so as to present an inverted-U cross-section. The ring, or rather its pair of concentric edge flanges 41, is provided with four notches 42 spaced 90° from each other. The width of the notches 42 is only

slightly greater than the width of the horizontal T-shaped leg 25 of the bracket 23 to allow the assembly of these two parts to form a tight fit, one with the other. The inside width of the ring, i. e., the inside distance between the concentric edge flanges 41 (dimension R, Figs. 8 and 2), is somewhat wider than the width of the ears 27 (dimension E, Fig. 7a).

The fin is assembled from the flat position shown in Fig. 9 so that the side pieces 10 form a square and the vanes 20 bisect the 90° angle formed by the sides. The ring 40 is snapped into position so that the ears 27 of the brackets 23 engage between the edge flanges 41 of the ring 40, and the extending portion 28 and the horizontal portion 25 in front of and to the rear of the ears 27, respectively, engage with the cut-out sections 42 on the edge flanges 41. The assembled fin is then placed over the tail of the bomb, as shown in Figure 10, so that the extremities 29 of the bracket 23 come in contact with the tapered portion of the bomb tail 1. The fin lock-nut 2 is then screwed onto the base plug 3 so that the guide lip 4 of the nut 2 centers the fin assembly by engaging the central portion of the locking ring 40. The fin lock-nut 2 tightens up the fin assembly by contacting the locking ring 40 which transmits the force to the extremities 29 of the brackets 23. Any looseness which may occur is compensated for by the wedging action which results in a self-tightening effect.

I claim:

1. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, each of the lower portions of the vanes having a downwardly directed inclined extension presenting an edge parallel to the hinge edge of the vane, brackets in the shape of an inverted-L, formed from sheet material in the form of a channel with inwardly-turned flanges along the edges, the longer vertical leg of the brackets being spot welded to the said edge of the vane extensions, the shorter horizontal leg of the bracket presenting its channel section as an inverted-U, the material of the said side flanges being enlarged between the said horizontal and vertical legs to form a reinforcing brace, the flange material being further enlarged at the distal end of the horizontal leg and formed as upturned lateral ear projections extending for a predetermined length along both sides of the horizontal leg, and a ring formed of sheet metal in the form of an inverted-U channel, the inside distance between the flanges thereof being somewhat greater than the said predetermined length of the distal ear projections of the horizontal leg of the bracket, the said channeled ring being provided with four equi-distanced cut-outs in both its said channel flanges, the said ring cut-outs being somewhat larger than the width of the said bracket whereby the ring may be slipped over the said four vanes when in their said opened position, the said lateral ear projections being received in the channel of the ring to lock the vanes and the said ring in the said open position of the assembly.

2. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, each of the lower portions of the vanes having a downwardly directed inclined extension presenting an edge parallel to the hinge edge of the vane, brackets in the shape of an inverted-L, formed from sheet material in the form of a channel with inwardly-turned flanges along the edges, the longer vertical leg of the brackets being secured to the said edge of the vane extensions, the shorter horizontal leg of the bracket presenting its channel section as an inverted-U, the material of the said side flanges being enlarged between the said horizontal and vertical legs to form a reinforcing brace, the flange material being further enlarged at the distal end of the horizontal leg and formed as upturned lateral ear projections extending for a predetermined length along both sides of the horizontal leg, and a ring formed of sheet metal in the form of an inverted-U channel, the inside distance between the flanges thereof being somewhat greater than the said predetermined length of the distal ear projections of the horizontal leg of the bracket, the said channeled ring being provided with four equi-distanced cut-outs in both its said channel flanges, the said ring cut-outs being somewhat larger than the width of the said bracket whereby the ring may be slipped over the said four vanes when in their said opened position, the said lateral ear projections being received in the channel of the ring to lock the vanes and the said ring in the said open position of the assembly.

3. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a sub-

stantially flat shape, brackets in the shape of an inverted-L, and formed from sheet material in the form of a channel with inwardly-turned flanges along the edges, the longer vertical leg of the bracket being secured to an edge of the said vanes, the shorter horizontal leg of the bracket presenting its channel section as an inverted-U, the material of the said side flanges being enlarged between the said horizontal and vertical legs to form a reinforcing brace, the flange material being further enlarged at the distal end of the horizontal leg and formed as upturned lateral ear projections extending for a predetermined length along both sides of the horizontal leg, and a ring formed of sheet metal in the form of an inverted-U channel, the inside distance between the flanges thereof being somewhat greater than the said predetermined length of the distal ear projections of the horizontal leg of the bracket, the said channeled ring being provided with four equidistanced cut-outs in both its said channel flanges, the said ring cut-outs being somewhat larger than the width of the said bracket whereby the ring may be slipped over the said four vanes when in their said opened position, the said lateral ear projections being received in the channel of the ring to lock the vanes and the said ring in the said open position of the assembly.

4. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, brackets in the shape of an inverted-L, and formed from sheet material in the form of a channel with inwardly-turned flanges along the edges, the longer vertical leg of the bracket being secured to an edge of the said vanes, the shorter horizontal leg of the bracket presenting its channel section as an inverted-U, the flange material being further enlarged at the distal end of the horizontal leg and formed as upturned lateral ear projections extending for a predetermined length along both sides of the horizontal leg, and a ring formed of sheet metal in the form of an inverted-U channel, the inside distance between the flanges thereof being somewhat greater than the said predetermined length of the distal ear projections of the horizontal leg of the bracket, the said channel ring being provided with four equi-distanced cut-outs in both its said channel flanges, the said ring cut-outs being somewhat larger than the width of the said bracket whereby the ring may be slipped over the said four vanes when in their said opened position, the said lateral ear projections being received in the channel of the ring to lock the vanes and the said ring in the said open position of the assembly.

5. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, each of the lower portions of the vanes having a downwardly directed inclined extension presenting an edge parallel to the hinge edge of the vane, brackets in the shape of an inverted-L, formed from sheet material in the form of a channel with inwardly-turned flanges along the edges, the longer vertical leg of the brackets being spot welded to the said edge of the vane extensions, the shorter horizontal leg of the bracket presenting its channel section as an inverted-U, the material of the said flanges being enlarged between the said horizontal and vertical legs to form a reinforcing brace, the flange material being further enlarged at the distal end of the horizontal leg and formed as upturned lateral ear projections extending for a predetermined length along both sides of the horizontal leg, and a ring formed of sheet metal in the form of an inverted-U channel, the inside distance between the flanges thereof being somewhat greater than the said predetermined length of the distal ear projections of the horizontal leg of the bracket, the said channeled ring being provided with four equi-distanced cut-outs in the outer channel flanges, the said ring cut-outs being somewhat larger than the width of the said bracket whereby the ring may be slipped over the said four vanes when in their said opened position, the said lateral ear projections being received in the channel of the ring to lock the vanes and the said ring in the said open position of the assembly.

6. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, each of the lower portions of the vanes having a downwardly directed extension presenting an edge parallel to the hinge edge of the vane, a bracket in the shape of an inverted-L, the longer vertical leg of the bracket being spot welded to the said edge of the vane extension, the horizontal leg of the bracket being enlarged at its distal end of the horizontal leg to form lateral projections extending for a pre-

determined length along both sides of the horizontal leg, and a ring formed of sheet metal in the form of an inverted-U channel, the inside distance between the flanges thereof being somewhat greater than the said predetermined length of the distal projections of the horizontal leg of the bracket, the said channeled ring being provided with four equi-distanced cut-outs, the said ring cut-outs being somewhat larger than the width of the said bracket whereby the ring may be slipped over the said four vanes when in their said opened position, the said lateral projections being received in the channel of the ring to lock the vanes and the said ring in the said open vane position.

7. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, and a ring adapted to be slipped over the bomb, the said ring and the said four vanes being provided with cooperative means to hold the vanes in their said opened position.

8. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners thereof in a direction to bisect the right-angle at the said corners of the square, each vane having a portion extending below its

hinge the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, and means cooperating with said extended vane portion for locking the vanes in their said open position.

9. A collapsible fin assembly for a bomb comprising four side-pieces formed of sheet material, the said material being bent along two parallel edges to form integral hinge ears, four vanes formed of sheet material, the said material being bent along one edge to form integral hinge ears, the said hinge ears of the two edges of the side-pieces and of the single edge of the vane being aligned relative to each other so that the ears of all three said edges will interlock to form a continuous hinge, and pintles therefor adapted to hold the said eight parts when opened up in the form of a square formed of the said four side-pieces with a vane projecting outwardly from each of the four corners of the square, each vane having a portion extending below its hinge, the said parts being adapted to fold at their said four hinges to be collapsed into a substantially flat shape, and means cooperating with said extended vane portion to lock the vanes in their open position.

10. A foldable fin assembly for a bomb having a tapered bomb tail and a fin lock nut, comprising a plurality of vanes, brackets in the shape of an inverted-L, the longer legs of which are secured to the lower portion of the vanes, a ring provided with means for engaging the horizontal legs of the said brackets, the said horizontal legs of the brackets having lower end extremities adapted to contact the said tapered tail of the bomb, and the said bracket engaging ring being adapted to underlie the said fin lock nut of the bomb whereby the screwing of the lock nut on the bomb will force the said bracket extremities to bear firmly against the said tapered tail of the bomb.

11. A collapsible fin assembly for attachment to the tail portion of a bomb, comprising plates hinged at their edges to form a square, and at least one outwardly extending vane hinged to each corner of the square and having a hinge line common with the hinge line of the intersecting plates forming the corner, said vanes each having a portion extended below its hinged edge, and a ring adapted to surround the tail of a bomb and provided with notches entered by said extended portions to lock said assembly in open position.

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