Jan. 31, 1956 H. K. EPPLE 2,733,028

PARACHUTE CANOPY CONSTRUCTION

Filed May 17, 1954 2 Sheets-Sheet 1

FIG. 1

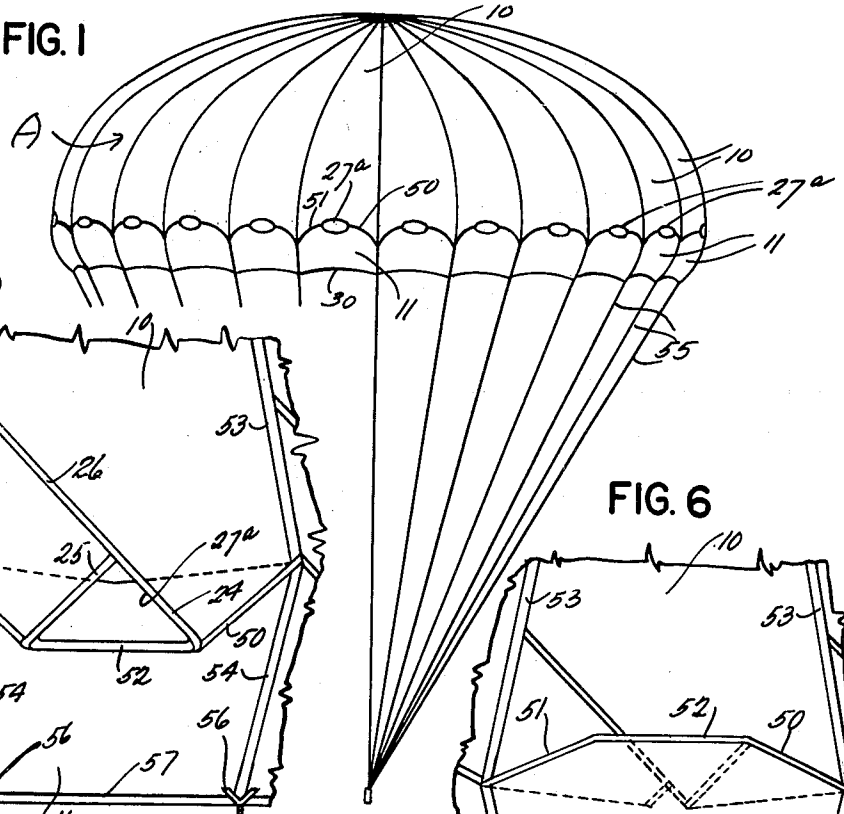

FIG. 5

FIG. 6

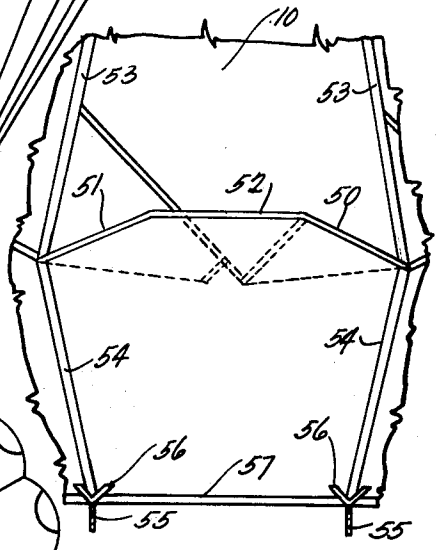

FIG. 2

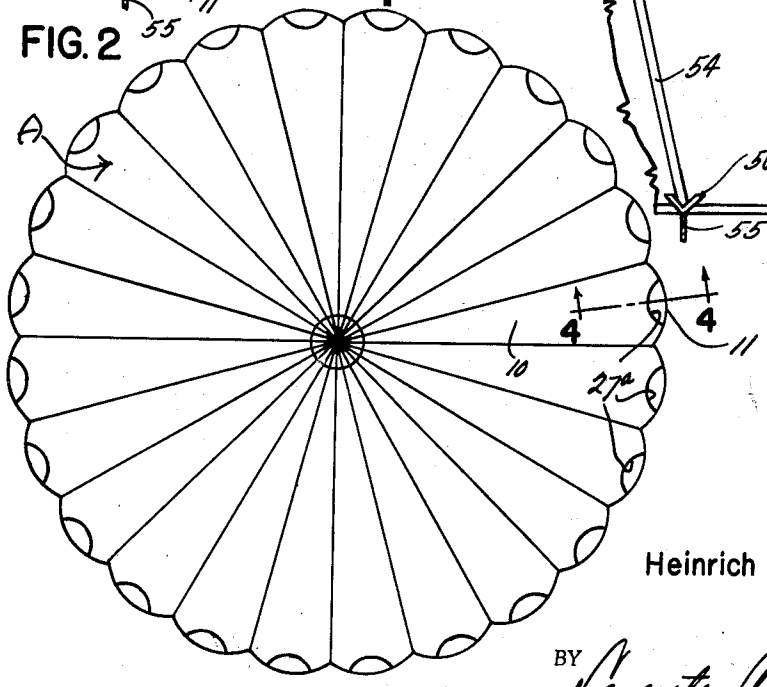

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FIG. 3

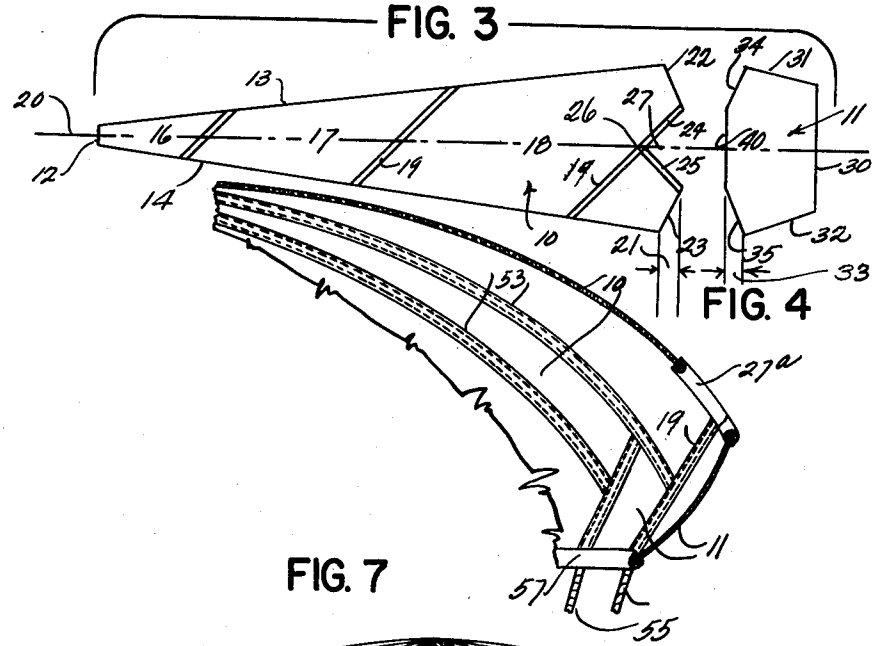
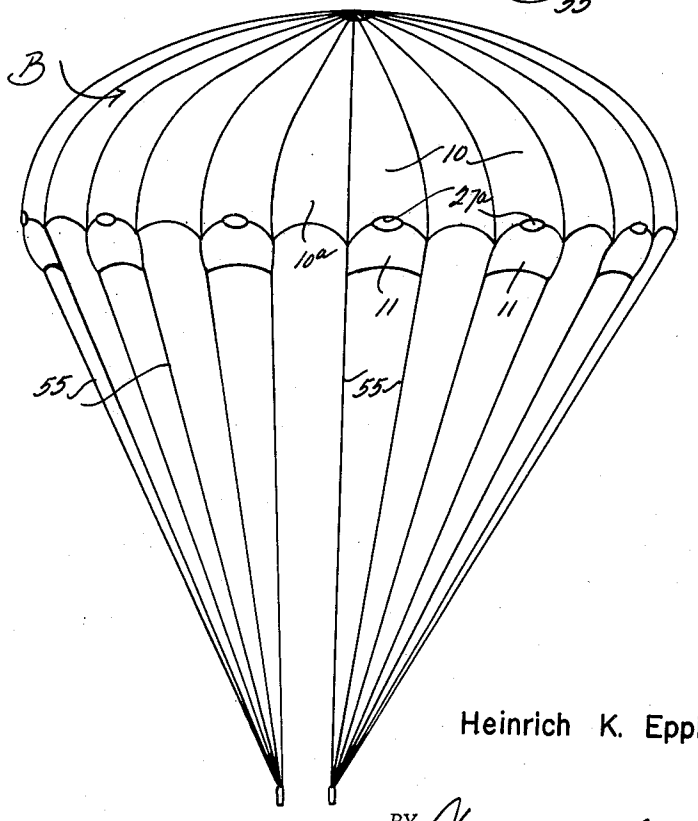


FIG. 4

FIG. 7



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PARACHUTE CANOPY CONSTRUCTION

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Application May 17, 1954, Serial No. 430,182

10 Claims. (Cl. 244—145)

This invention relates to improvements in parachute canopy constructions.

The primary purpose of this invention is the provision of a parachute canopy construction adapted to be used in connection with high speed aircraft, embodying means to quickly stabilize the canopy under descent with a load.

A further object of this invention is the provision of an improved parachute canopy construction provided with an improved extended skirt construction and air vent means for quickly damping oscillation during descent, and to lessen the load shock.

It is known in the art, such as set forth in the H. G. Heinrich Patent 2,462,864, to provide a canopy construction designed for the purpose of reducing oscillation. It includes peripherally located convergent air deflecting surfaces provided with vent means for increasing air turbulence at the outer peripheral portion of the canopy. It is a purpose of the present invention to provide a canopy having the gores or panels provided with extended deflecting surfaces at the peripheral portion thereof which have a convergent slope in the direction of the load, and which are so constructed as to provide for a more efficient pocketing of the panels at the lower periphery of the canopy. Furthermore, the panel is provided at the roof or top portion thereof immediately above the convergent air deflecting surfaces with vent means to provide for a very efficient jet discharge of air from the canopy at a location where the canopy, when inflated, has the air in greater volume and under greater pressure than within the medial area of the deflecting surface.

Other objects and advantages of the invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views:

Fig. 1 is a fragmentary, rather diagrammatic view of the improved parachute canopy showing it divided into an upper roof or top portion and a lower skirt portion having air deflecting surfaces at the lower end of each gore or panel.

Fig. 2 is a plan view of the inflated canopy of Fig. 1, more particularly showing the peripheral vents which definitely face upwardly.

Fig. 3 is a view showing the detailed construction of one of the panels of the parachute, and its deflecting surface; the latter, in this view, not being attached to the main or top portion of the panel.

Fig. 4 is a fragmentary cross sectional view taken radially through the central portion of one of the panels, substantially on the line 4—4 of Fig. 2, showing the inflated structural arrangement, and also showing the downwardly divergent pocketed air deflecting surface.

Fig. 5 is a fragmentary view showing a panel of the canopy flattened and folded over the flattened complementary air deflecting surface or skirt; this view illustrating the bottom fullness of the panel portion so as to enable

pocketing of the canopy at the juncture of both the top panel portion and its air deflecting skirt or surface.

Fig. 6 is a view similar to Fig. 5, but with the deflecting surface flattened over the lower portion of the top panel in order to demonstrate the degree of fullness of the lower deflecting surface or skirt of one of the panels, to provide for a pocketing arrangement at the maximum diameter portion of the inflated canopy, and at which location the air jet spill vent is provided.

Fig. 7 is a side elevation of an inflated modified form of canopy in which the improved deflecting skirt or surface portion is provided upon alternate panels, similar to the conventional modern United States Air Force personnel canopy.

In the drawings, wherein for the purpose of illustration are shown preferred and modified forms of canopies, the letters A and B generally designate the canopies shown respectively in Figs. 1 and 7. These canopies are identical, except Fig. 7 shows only alternate or recurring panels having the improved air deflecting surfaces or skirts; the other panels being of conventional construction.

The improved panel construction for canopies is shown in developed form in Fig. 3, wherein the top or roof portion 10 is in flattened position and the air deflecting surface or skirt portion 11 is also flattened but unattached to the top portion 10.

The top or roof portion 10 of the panel or gore has an upper straight edge 12 adapted to be located at the top vent portion of the canopy, if a top vent is desired. From this edge 12 extend relative divergent side edges 13 and 14 which are disposed at uniform angles with respect to a medial axial line 20 longitudinally provided through the panel. The panel portion 10 may have a biased weave, in accordance with conventional practice, and it may be made of a plurality of segments 16, 17 and 18, connected on biased seam lines 19 in accordance with conventional parachute canopy panel fabrication. The number of biased segments will depend upon the diametrical size of the parachute canopy.

The roof or top panel portion 10 has an added fullness over conventional panel construction, designated by the numeral 21 in Fig. 3. This fullness is provided in order to pocket the lower portion of the portion 10, and also to provide a vent recess or opening. It is shaped by providing relatively convergent straight edges 22 and 23 at the lower end of the portion 10, which respectively start at the side edges 13 and 14 and are located at an obtuse angle with respect thereto. The edges 22 and 23 terminate short of the medial axial line 20 of the panel. From their lowermost ends the edges 22 and 23 intersect with downwardly divergent edges 24 and 25 respectively. These edges 24 and 25 intersect at a location 26 on the medial line 20 of the panel and preferably they are in right angled relation to provide a recess 27 which ultimately results in a vent opening 27^a in the lower portion of the canopy. The edges 24 and 25 need not necessarily be in right angled relation.

The so-called air deflecting or guide surface or skirt portion 1 is provided with a lower straight edge 30. It normally parallels the top edge 12 of the panel and is located in right angled relation with respect to the panel axis 20. The side edges 31 and 32 of the portion 11 extend divergently upward from the edge 30, each at the same angle with respect to the line 30, and which angle is greater than 90°, as will be noted from Fig. 3. The top edging of the surface or skirt 11 has a fullness area designated at 33 in Fig. 3. It is formed by providing convergent straight edges 34 and 35 leading off in about right angled relation from the edges 31 and 32 respectively. The edges 34 and 35 extend for about the same lengths as the complementary edges 22 and 23 of the top panel portion 10, and they intersect with the top

straight edge **40** of the skirt portion **11**. The edge **40** is parallel with the edge **30** and in length is about the same as the width of the bottom portion of the recess **27**. It will be noted that the edges **22** and **34** are relatively divergent from the longitudinal axis of the panel construction sidewise and that is also true with respect to the edges **23—35**.

Referring to the shape and attachement of the panels of the canopy, the edges **22** and **34** are joined at a seam **50**, shown best in Figs. 5 and 6, and the edges **23** and **35** are joined at a seam **51**. The edge **40** taped at **52** is a continuation of the seams **50** and **51**, and joins with them. The edges **24** and **25** of the recess **27** are also taped, as shown in the drawings, for reinforcing purposes. The top panel portions **10** of the canopy are sidewise joined together with conventional seams **53**, shown in Figs. 5 and 6, and the edges **31** and **32** of the skirt or air deflecting surfaces **11** are relatively joined together by seams **54**, designated in Figs. 5 and 6 of the drawings. The shroud lines **55** are preferably connected by reinforcing portions **56** to the skirt edge tape **57** which is provided along the edge **30** of the deflecting surfaces. These shroud lines **55** may be continued upwardly through and attached in the seams **53** and **54**, similar to conventional canopy structure. The shroud lines may be conventionally continued across the top vent if so desired.

In event the deflecting surfaces or skirt portions **11** are to be provided at the bottom edges of recurrent or alternate panels the intermediate panels **10a**, shown in Fig. 6, may have straight lower edges, without vent recesses or openings.

It will be noted from Figs. 5 and 6 that a pocketing fullness exists at the lower end of the roof or top panel portion **10** and at the upper portion of the deflecting skirt or surface **11**. In Fig. 5 it is shown that the top panel portion **10** is extended and folded flat upon the upper under folded portion of the skirt **11** in order to better designate the pocketing effect. Likewise, in Fig. 6 the skirt or deflecting surface **11** is extended and folded flat, with the lower end of the top canopy portion **10** folded under the top edge of the skirt. With this arrangement, when the canopy is inflated, as shown in the fragmentary sectional view of Fig. 4, there are provided air filled pockets at the juncture of the panel portions **10** and **11**, and the vent opening **27a** opens upwardly and laterally at a location directly at the outermost peripheral edging of the inflated canopy, where air pressure within the canopy is greater than at the medial portion of the downwardly divergent surfaces **11**, whereby a stronger air jet is discharged for the creation of such turbulence at the outer peripheral edging of the canopy as will result in creating stability of the parachute during descent.

It is to be noted that all edges of the gore or panel portions **10** and **11** are straight.

The canopy when inflated will have a scalloped shape at the outer peripheral edging, as will be noted from the drawings.

The location of the air vents substantially lessens shock loads at the time of inflation. The location of the vents **27** is very important because they are best positioned for taking advantage of the fact that air at the time of inflation is more compacted at the lower edge of the roof portion of the gore than at any location within the area of the skirt extension. The skirt at initial opening of the canopy is not at all filled with air exerting any considerable pressure at its medial area.

It is intended to use the improved lower roof panel and skirt construction upon a canopy shaped with a flat camber of the roof portion or one having a more spherical shape.

Various changes in the shape, size and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or scope of the claims.

What is claimed is:

1. A canopy construction for parachutes comprising a main inflatable canopy portion having at the outer peripheral portion thereof a downwardly convergent air deflecting skirt, the air opening of said skirt being less in diameter than the outer peripheral diameter of the main canopy portion when inflated, the said canopy at the lower outermost peripheral edging thereof being provided with air vents facing upwardly.

2. A canopy construction as defined in claim 1 in which said air vents when the canopy is inflated also face laterally.

3. A parachute canopy comprising a plurality of panels which individually have side edges divergent downwardly from the central portion of the canopy in the direction of the lower peripheral portion thereof, said panels at the peripheral portions thereof having air deflecting portions connected to their lower ends in a transverse pocketed relation, the panels along their longitudinal central axes having vent openings disposed in upwardly facing relation when the canopy is inflated and located in the panels above the deflecting portions and being each relatively short radially of the panels.

4. A panel construction for parachute canopies comprising an elongated roof panel portion having downwardly divergent side edges from the peak thereof to the lower end thereof, said roof portion at the lower end thereof being provided with inwardly extending relatively convergent edges obtusely located with respect to the adjacent respective side edges, and which lower end edges terminate short of the longitudinal axis of the panel, the lower end of said panel roof portion having at the inner ends of the said lower convergent edges other edges which extend upwardly in relative convergent relation toward the longitudinal axis of the said roof panel portion to define an air vent recess, and an air deflecting skirt connected to the lowermost relatively convergent edges of the roof panel, said skirt having an upper edge facing the vent recess to define therewith an air vent opening.

5. A parachute panel construction as defined in claim 4 in which said air deflecting skirt portion is shaped to provide side edges which converge to the outermost edge thereof, the top edging of the skirt adjacent to the roof panel portion comprising a short central edge in substantial parallelism with the outermost edge of the said skirt portion and outer downwardly divergent edges connected to the said lowermost relatively convergent edges of the roof panel.

6. A canopy construction for parachutes comprising a main inflatable canopy portion constructed of a plurality of seam connected substantially triangular shaped roof panels, said roof panels at the lowermost ends thereof being provided with skirt extensions the side edges of which converge downwardly, shroud lines connected to said skirt extensions in the line of extension of the convergent side edges of the skirt extensions when the canopy and skirt extensions are inflated whereby the skirt extensions will be positioned in a downwardly convergent relation when supporting a load beneath the inflated canopy, said roof panel portions at the extreme lower ends thereof above the skirt extensions being provided with air vent openings which face upwardly when the canopy is inflated.

7. A canopy construction as defined in claim 6 wherein said skirt extensions are provided only at the lower edges of recurring main roof panel portions.

8. In a parachute construction a canopy having a cambered main canopy portion terminating at its outer periphery in an air spoiler edge, and an air deflecting skirt connected to said edge and extending convergently downward when the canopy is inflated, the said canopy directly at the juncture of the skirt with the main canopy portion having a series of non-communicating air jet discharge vents, each extending radially of the main can-

opy portion for only a short distance and which air vents each face upwardly and also laterally when the canopy construction and skirt are inflated.

9. In a parachute construction the combination of a cambered flexible canopy comprising a plurality of radial panels, recurrent panels at the lower edges thereof having skirt extensions and shroud lines connected thereto, the shroud lines having means at the load attaching ends thereof to position the shroud lines in a downwardly convergent relation whereby to position said air deflecting skirt portions in a downwardly convergent relation, the panel and skirt portions being provided with air vent openings directly at the extreme outermost peripheral juncture edges thereof, said air vent openings being appreciably narrow in width circumferentially of the canopy than the lengths of the respective juncture edges at which positioned and which air vent openings when the canopy is inflated open upwardly and laterally for turbulent jet discharge of air streams upwardly and laterally.

10. A canopy construction for parachutes comprising a main inflatable canopy portion constructed of a plurality of seam connected substantially triangular shaped

roof panels, said roof panels at the lowermost ends thereof being provided with fixedly attached skirt extensions, shroud lines connected to said skirt extensions having means at the load attaching ends thereof to position the shroud lines in a downwardly convergent relation when the canopy is inflated and hold said air deflecting skirt extensions at an obtuse angle with respect to the respective connected panels, the canopy at the juncture of the panels and skirt extensions being provided with non communicating air vent openings which face and open upwardly and also laterally when the canopy is inflated.

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