United States Patent

Hoyer

[15] **3,699,576**

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[54] COLLAPSIBLE REFLECTOR

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[73] Assignee: **Fairchild Industries, Inc.**

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[52] **U.S. Cl.** .....**343/18 B,** 343/915

[51] **Int. Cl.** **H01q 15/16**

[58] **Field of Search** .....343/18 B, 915

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Primary Examiner—T. H. Tubbesing

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[57] **ABSTRACT**

A collapsible dished paraboloid reflector having an array of petals that surround and have petals that are rotatably connected at their inner ends to a reflector hub. The array of petals comprises a series of substantially spear tip shaped or lanceolate shaped petals that alternate between semi-hour glass shaped petals. Substantially wedge shaped petals are located between and have lateral edges that are rotatably connected in edge to edge relationship to each lanceolate shaped petal and semi-hour glass shaped petal. The edges of the petals when viewed from the focal point of the fully deployed reflector substantially approximates the parabolic radial curvature of the fully deployed reflector. The lanceolate shaped petals and the semi-hour glass shaped petals are of rigid construction lengthwise so that they are not capable of flexing in a lengthwise direction whereas the wedge shaped petals are of relatively flexible construction lengthwise so that they are capable of flexing lengthwise as the reflector assembly is being deployed or collapsed. The construction of the collapsible reflector permits it to be collapsed into a compact package and permits the reflector to be deployed to present a dished rigid paraboloid shaped surface.

10 Claims, 16 Drawing Figures

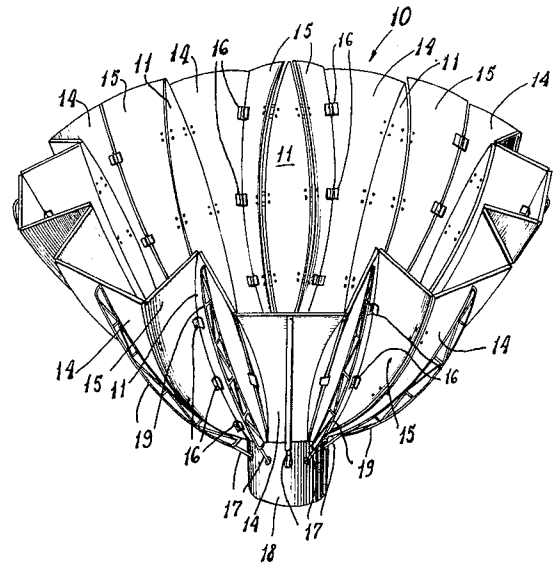


Fig. 1

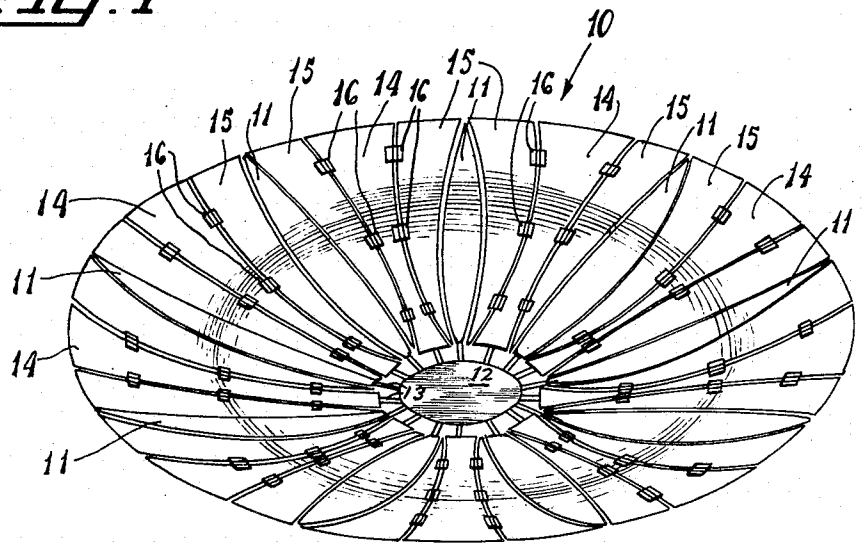
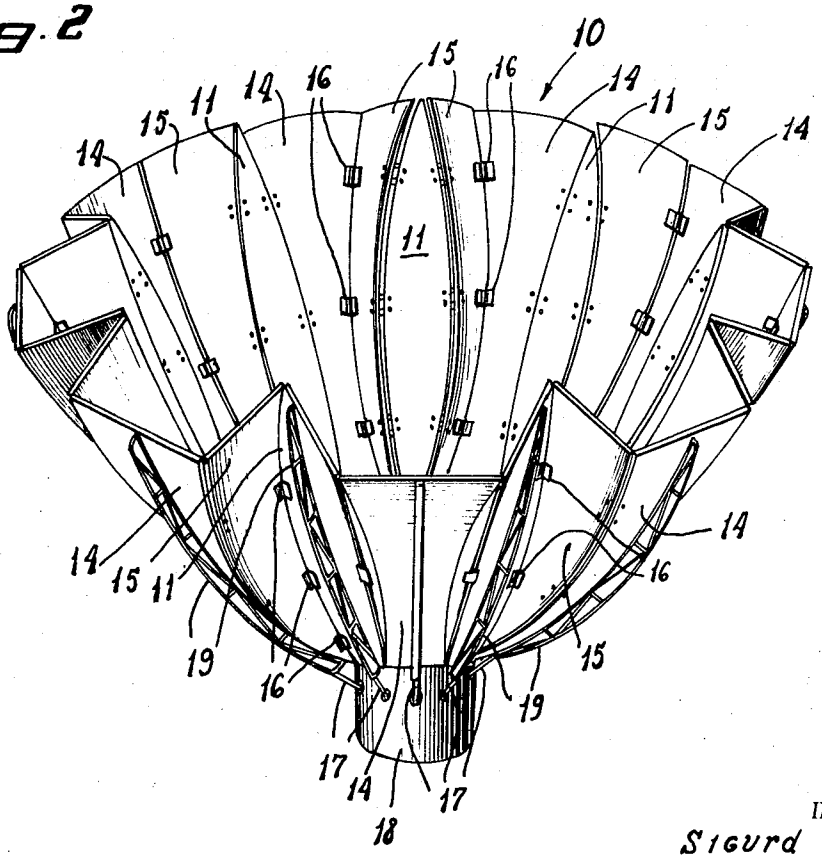


Fig. 2



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Fig. 3

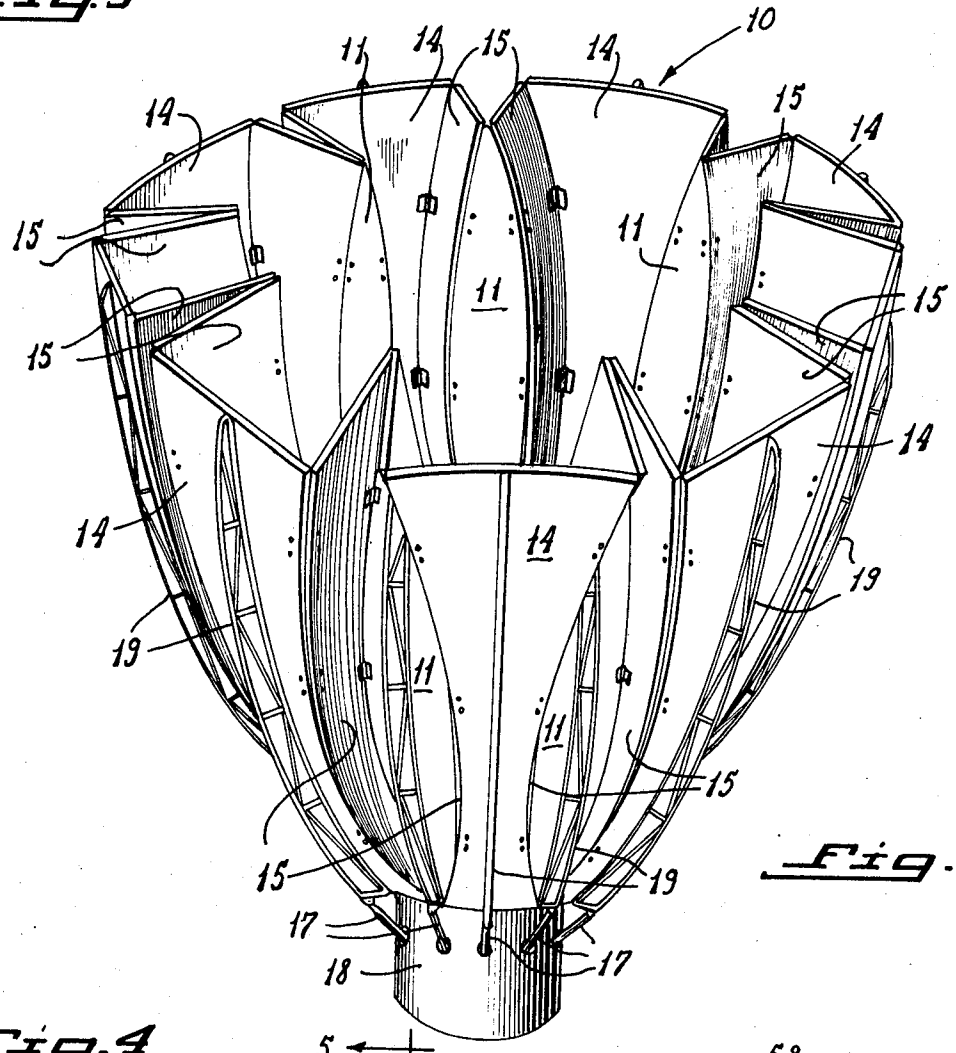


Fig. 16

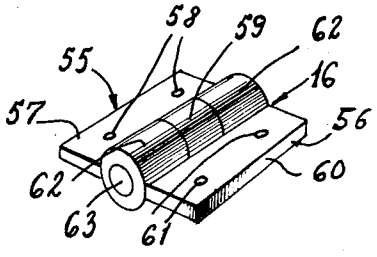
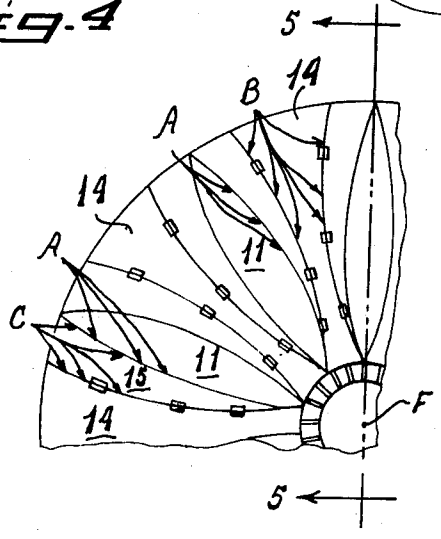


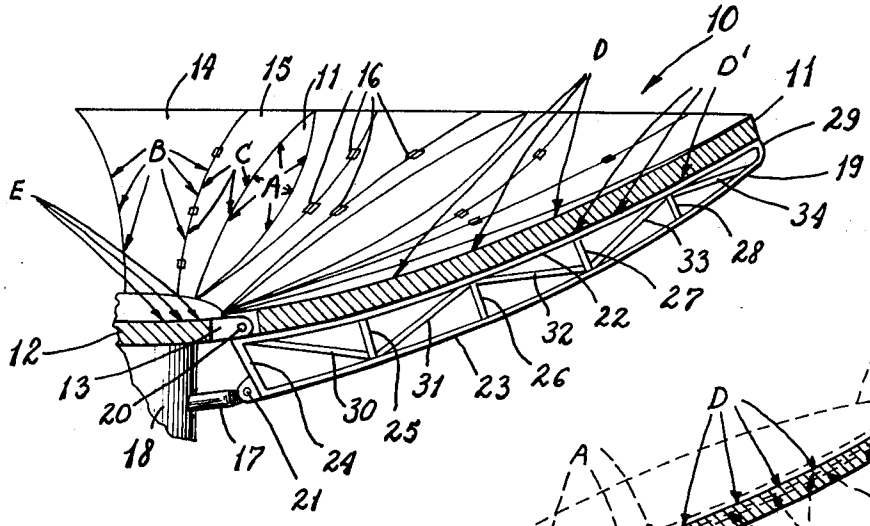
Fig. 4



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Fig. 5



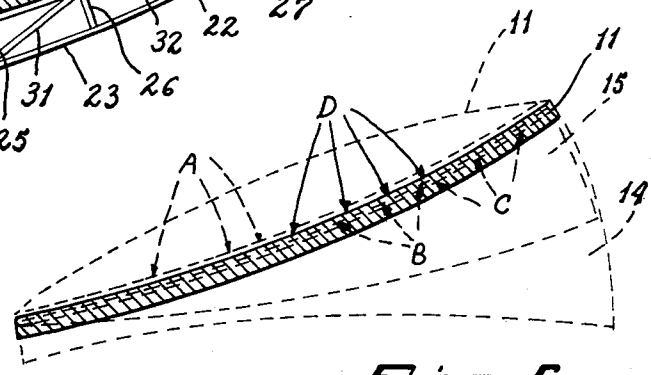


Fig. 6

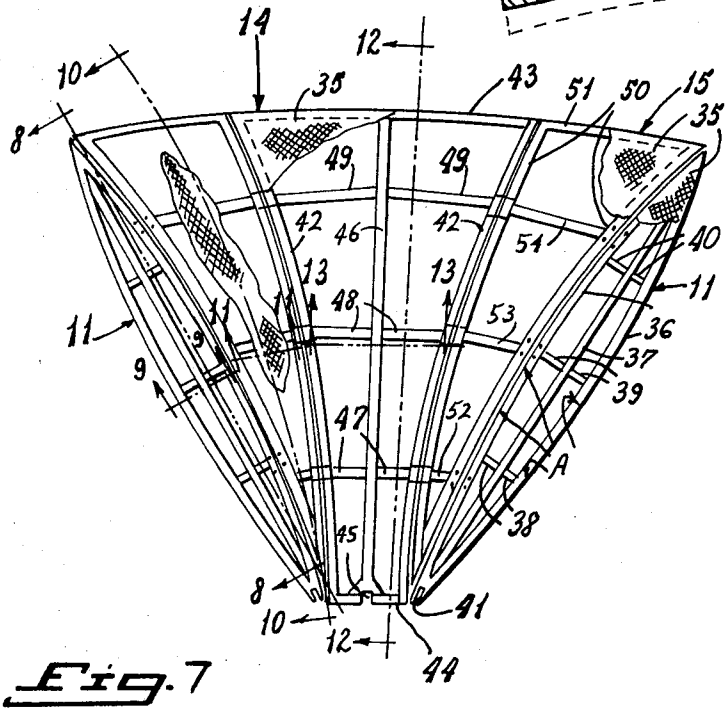


Fig. 7

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Fig. 6

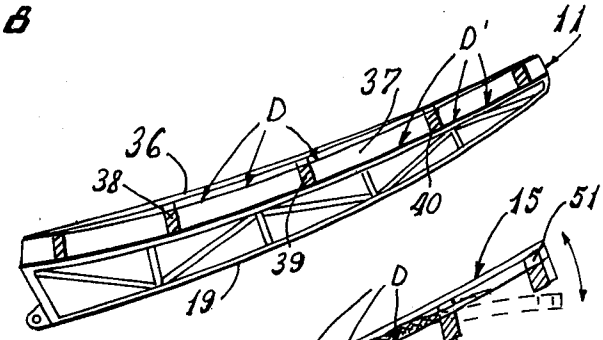


Fig. 9

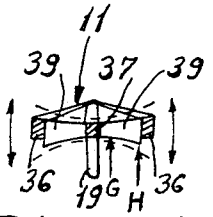


Fig. 11

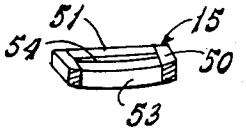


Fig. 10

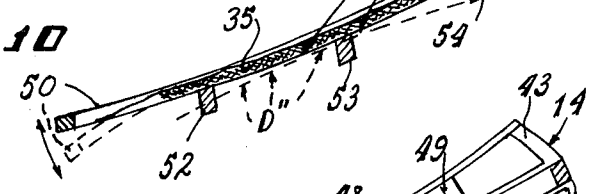


Fig. 13

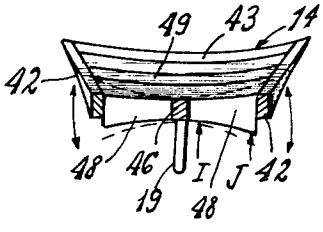
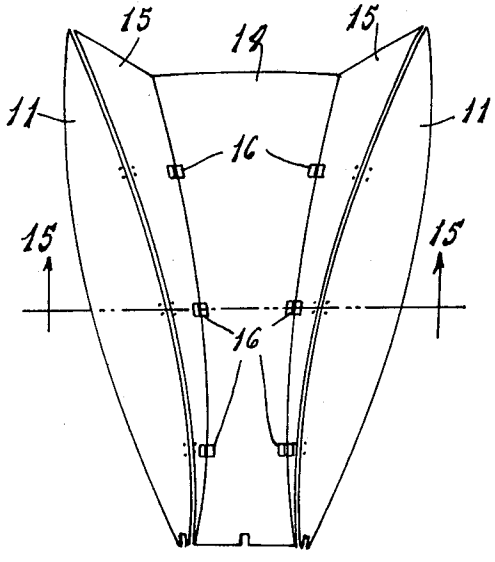


Fig. 12

Fig. 14



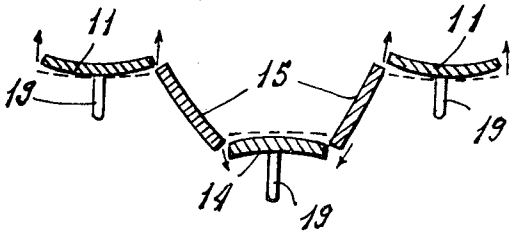


Fig 15

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COLLAPSIBLE REFLECTOR

BACKGROUND OF THE INVENTION

Collapsible reflectors have many uses. Collapsible reflectors are generally small in size in their collapsed state compared to their size when fully deployed. This ability to be collapsed into a small size allows collapsible reflectors to be employed in many situations where the use of corresponding rigid reflectors would be impossible. Collapsible reflectors have been used in situations where it was necessary to transport the reflector in a small container such as the type that are required to transport and place a reflector in space. Collapsible reflectors can also be used with or without containers on trucks, trailers, and other vehicles and they can also be used on watercraft.

Although there are many uses for collapsible reflectors and there have been numerous prior designs, most prior art reflectors have several disadvantages that limit their use. Many prior art reflectors, particularly those for use in space, lack sufficient rigidity to be capable of being folded back up once they have been fully deployed. Another serious disadvantage that many previous reflector designs possess is a lack of rigidity in the deployed state. This lack of rigidity has in part been due to a comparatively low percentage of fixed or rigid structure in the reflector. This low percentage of rigid structure was required in prior designs to permit collapsing of the reflector. This lack of rigidity can result in distortions of the shape of the reflector when it is deployed which could result in a loss in the performance and reliability of the reflectors. This lack of rigidity has more serious consequences in the case of large reflectors that are designed for use in space. With collapsible reflectors that are to be used in space, it is highly desirable from the standpoint of economy and reliability to test the performance of the reflector in its deployed condition prior to sending it into space. Unfortunately, previous large surface reflectors designed to retain their geometric configuration in the zero gravity environment of space will not retain their shape when subjected to gravitational forces on earth. This has previously prevented proper performance and reliability testing of large collapsible reflectors prior to placing them in space.

SUMMARY OF THE INVENTION

This invention relates to collapsible reflectors and more particularly to a collapsible reflector that has a rigid dished reflective surface when it is fully deployed.

It is accordingly an object of the present invention to provide a collapsible reflector that is capable of presenting a dished reflective surface that possesses a high degree of rigidity and resists distortion when the reflector is fully deployed.

It is an object of the present invention to provide a collapsible reflector that is capable of being collapsed into a compact package.

It is an object of the present invention to provide a collapsible reflector that is easy to collapse and deploy.

It is also an object of the present invention to provide a collapsible reflector that is capable of presenting a large reflective surface when the collapsible reflector is fully deployed.

The present invention provides a collapsible and deployable reflector having a plurality of petals surrounding a hub. The petals are adapted to present a dished substantially symmetrical reflective surface upon deployment of the reflector and they have lateral edges that have a curvature when viewed from the focus of the deployed reflector that substantially approximates the radial curvature of the surface of the petals of the fully deployed reflector. Interconnecting means are provided that are connected to the lateral adjacent edges of the petals for pivotally connecting the petals together in edge to edge relationship and means are connected to the hub and at least some of the petals for pivotally connecting the petals to the hub.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be hereinafter more fully described with reference to the accompanying drawings in which:

FIG. **1** is a perspective view of the collapsible reflector of this invention in the fully deployed state;

FIG. **2** is a perspective view of the collapsible reflector illustrated in FIG. **1** illustrating the reflector as the reflector is undergoing deployment or is in the process of being collapsed;

FIG. **3** is a perspective view of the collapsible reflector illustrated in FIGS. **1** and **2** when the reflector is in the fully collapsed state;

FIG. **4** is a plan view of part of the fully deployed collapsible reflector illustrated in FIG. **1**;

FIG. **5** is a cross sectional view of part of the fully deployed collapsible reflector taken on the line **5—5** of FIG. **4**;

FIG. **6** is a view of a portion of the structure illustrated in FIG. **5** showing the edge of the reflector;

FIG. **7** is an enlarged view of part of the deployable reflector illustrated in FIG. **4** with certain parts broken away to illustrate the interior construction of the reflector;

FIG. **8** is a sectional view of a lanceolate shaped petal taken on the line **8—8** of FIG. **7**;

FIG. **9** is a sectional view of a lanceolate shaped petal taken on the line **9—9** of FIG. **7**;

FIG. **10** is a sectional view of a wedge shaped petal taken on the line **10—10** of FIG. **7**;

FIG. **11** is a sectional view of a wedge shaped petal taken on the line **11—11** of FIG. **7**;

FIG. **12** is a sectional view of a semi-hour glass shaped petal taken on the line **12—12** of FIG. **7**;

FIG. **13** is a sectional view of a semi-hour glass shaped petal taken on the line **13—13** in FIG. **7**;

FIG. **14** is an enlarged view of part of the collapsible reflector illustrated in FIG. **2**;

FIG. **15** is a sectional view taken on the line **15—15** of FIG. **14**; and

FIG. **16** is a perspective view of the interconnecting means that can be utilized with the collapsible reflector of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. **1** the collapsible reflector **10** of the invention is illustrated in its fully open or deployed configuration. The reflector **10** comprises an array or plurality of substantially spear tiped shaped or lanceolate shaped petals **11** that come to a point at each end that are located around and are pivotally

mounted on a centrally located hub **12** by means of mounting struts **13** that are rigidly connected to the outer periphery of the hub and whose outer ends are pinned to the inner ends of the lanceolate shaped petals so that the lanceolate shaped petals are free to rotate in an upward direction about the pins as will be described hereinafter in greater detail. The reflector **10** also comprises an array or plurality of semi-hour glass shaped petals **14** that are located alternately between the lanceolate shaped petals **11** and are located around and pivotally mounted on the centrally located hub **12** by means of the mounting struts **13** that are rigidly connected to the outer periphery of the hub and whose outer ends are pinned to the inner ends of the hour glass shaped petals in a manner similar to that for the lanceolate shaped petals. The reflector assembly **10** also comprises an array or plurality of substantially wedge shaped petals **15** that are located around the centrally located hub **12** and between each lanceolate shaped petal **11** and the hour glass shaped petal **14**. The hour glass shaped petals **14** are pivotally connected to the adjacent wedge shaped petals **15** by interconnecting means **16** that comprise hinge members that are connected to the lateral adjacent edges of the hour glass shaped and wedge shaped petals. The lanceolate shaped petals **11** are pivotally connected to the adjacent wedge shaped petals **15** by similar interconnecting means **16** that comprise hinge members that are connected to the lateral adjacent edges of the lanceolate shaped petals and the wedge shaped petals on the underside of the reflector **10**, as illustrated in FIG. **2**. The upper surfaces of the lanceolate shaped petals **11**, hour glass shaped petals **14**, and the wedge shaped petals **15** are appropriately compound curved or dished slightly so that the fully deployed reflector **10** presents a reflector having a dished paraboloid that is substantially symetrical about its axis that passes through the center of the hub **12** and the focus of the paraboloid that is suitable for use in reflecting electromagnetic radiation.

In FIG. **2** the reflector **10** is illustrated in its partially collapsed or partially open configuration. As illustrated in FIG. **2** the lanceolate shaped petals **11** are shown as being rotated upward and inward about the hub **12** from their positions indicated in FIG. **1** due to the movement of actuating members or arms **17** that form part of a hydraulic activating unit **18** that is connected to the underside of the hub and whose outer ends are rotatably connected to the lower end of support trusses **19** that are rigidly secured to the back side of the lanceolate shaped petals along the central axis of the lanceolate shaped petals. The hour glass shaped petals **14** are also shown as being rotated upward and inward about the hub **12** from their positions indicated in FIG. **1** due to the action of other activating members or arms **17** that form part of the hydraulic activating unit **18** and whose upper ends are pivotally connected to the lower ends of support trusses **19** that are rigidly connected to the back of the hour glass petals along the central axis of the hour glass petals. The wedge shaped petals **15** that are located between and pivotally connected in edge to edge relationship to the adjacent lateral edges of the lanceolate shaped petals **11** and the hour glass shaped petals **14** by the hinge members **16** on the upper and lower sides of the reflector have pivoted about the edges of the lanceolate shaped and hour glass shaped petals when the reflector assembly is in its partially open or partially closed configuration. It should be noted that when the reflector assembly **10** is in its partially open or partially closed configuration the lanceolate shaped petals **11** are located toward the center of the assembly whereas the hour glass shaped petals **14** are located on the exterior of the assembly and the hydraulic unit **18** must be properly programmed to accomplish this to insure proper operation of the reflector assembly when the assembly is being closed or undergoing deployment.

The fully collapsed reflector assembly **10** is illustrated in FIG. **3**. In FIG. **3** it can be seen that the hour glass shaped petals **14** have been rotated upwardly and inwardly by the action of the activating members **17** of the hydraulic activating unit **18** so that they are located on the exterior of the assembly **10**. The lanceolate shaped petals **11** have also been rotated upwardly and inwardly by the action of the activating members **17** of the hydraulic activating unit **18** so that they are located in the interior of the collapsed assembly **10**. The wedge shaped petals **15** have been forced to pivot towards each other about the lateral edges of the lanceolate shaped petals and the hour glass petals **14**. Since the wedge shaped petals **15** have pivoted towards each other and the lanceolate shaped petals **11** have pivoted upwardly and inwardly so that they are located on the interior of the assembly and since the hour glass shaped petals have pivoted upwardly and inwardly so that they are located on the exterior of the assembly, the reflector **10** forms a very compact package when it is in its collapsed state.

As indicated in FIGS. **4** through **6** the curvature A of the lateral edges of the lanceolate shaped petals **11**, the curvature B of the lateral edges of the semi-hour glass shaped petals **14**, and the curvature C of the lateral edges of the wedge shaped petals **15** when viewed from the focus or focal point F of the fully deployed reflector must substantially approximate the radial curvature D of the surface of the fully deployed reflector when it is viewed in cross section as illustrated in FIG. **5**. In view of this requirement related to the curvature of the lateral edges of the various petals, if a lanceolate shaped petal **11** is rotated 90° about its long axis when in the fully deployed state and its lateral edge is placed against the corresponding surface of the fully deployed reflector the edge A will substantially conform to the curvature D as illustrated in FIG. **6**. In a similar manner if the hour glass shaped petal **14** or the wedge shaped petal **15** is rotated 90° about its long axis when in the fully deployed configuration and if their lateral edges were placed against the corresponding surface of a cross section of the fully deployed reflector **10**, the edges B and C would substantially conform to the curvature D as illustrated in FIG. **6**. This requirement related to the curvature of the petals is important since this permits the reflector to possess comparatively rigid petals that provide a rather large relatively rigid paraboloid reflective surface in the fully deployed state and yet be capable of being folded into a very compact package. In order to appreciate the importance of the curvature of the edges of the petals reference should first be made to FIG. **1** that illustrates the fully deployed reflector **10**. From FIG. **1** it is apparent that a

solid paraboloid is capable of being cut into a series of lanceolate shaped petals **11**, wedge shaped petals **15** and semi-hour glass shaped petals **14** around a central hub **12** in the manner illustrated. It is also apparent that if the lateral edges of these petals are flexibly or rotatably connected the petals can be folded inwardly as illustrated in FIG. **3** so that one edge of each wedge shaped petal **15** is pointing toward the center of the collapsed **10** and the wedge shaped petals form substantially 90° angles with the attached lanceolate shaped petals **11** and hour glass shaped petals **14** and thus the reflector **10** forms a very compact assembly in the collapsed configuration. If the edges of the petals did not substantially correspond to the curvature D of the deployed reflector assembly then the wedge shaped petals could not form the 90° relationships with the lanceolate shaped petals **11** and the hour glass shaped petals **14** since these petals are connected and when the wedge shaped petals are rotated into the 90° relationship their edges must conform to the radial curvature of the reflector that the hour glass shaped petals and the lanceolate shaped petals possess since binding between the petals or a separation or distortion of the petals would otherwise tend to occur.

The means for mounting the lanceolate shaped petals **11** and the hour glass shaped petals **14** to the hub **12** are illustrated in greater detail in FIG. **5**. The mounting means comprises the strut **13** whose inner end is rigidly connected to the outer edge of the dish shaped hub **12** and whose outer end is connected to the lower end of the lanceolate shaped petal **11** by means of the pin **20** so that the lanceolate shaped petal is free to rotate in an upward direction. It should be noted that the hub **12** is dished so that it forms a curvature E when seen in cross section that is an extension of the radial parabolic curvature D of the rest of the deployed reflector **10**. It can also be seen that the activating member or arm **17** of the activating unit **18** extends outward from the activating unit and has an outer end that is pivotally connected to the lower end of the truss member **19** by means of the pin **21**. The truss **19** is of rigid construction and has an upper tubular strut **22** that is bent to conform to the curvature D' of the underside of the lanceolate shaped petal **11** which when viewed in cross section has substantially the same curvature as the upper surface D. The upper tubular strut **22** is rigidly connected to a lower tubular strut **23** by means of tubular cross or connecting struts **24, 25, 26, 27, 28** and **29**, and these cross struts are reinforced by the diagonal tubular struts **30, 31, 32, 33** and **34** whose ends are respectively connected to the junctions of the upper strut **22** and the strut **24**, the lower strut **23** and the strut **25**; the lower strut **23** and the strut **25**; the upper strut **22** and the strut **26**; the upper strut **22** and the strut **26**; the lower strut **23** and the strut **27**; the lower strut **23** and the strut **27**; the upper strut **22** and the strut **28**; the upper strut **22** and the strut **28**; and the lower strut **23** and the strut **29**. The same type of truss construction is used for the trusses **19** that reinforce the hour glass petals **14**.

The construction of the lanceolate shaped petals **11**, the hour glass shaped petals **14** and the wedge shaped petals **15** are illustrated in greater detail in FIGS. **7** through **13**. In FIG. **7** a portion of the fully deployed reflector assembly is illustrated with the major portion of a wire mesh electromagnetically reflective screen covering **35** removed so that the internal construction of the lanceolate shaped petals **11**, the hour glass shaped petals **14** and the wedge shaped petals **15** is clearly visible. The lanceolate shaped petal **11** comprises two frame members or struts **36** that are joined at their ends and are curved so that their outer edges give the required curvature A when viewed from the focal point of the fully deployed reflector. These struts are reinforced in a radial direction by a reinforcing member or strut **37** that extends along the long central axis of the lanceolate shaped petal and whose ends are joined to the junction of the ends of the frame members **36**. Reinforcing struts **38, 39** and **40** extend outwardly in a direction transverse to the long axis of the reinforcing strut **37** and they are connected to the reinforcing strut and the frame struts **36**. A groove **41** is provided in the lower junction of the frame members **36** that is designed to accept the outer end of one of the mounting struts **13**. The hour glass shaped petal **14** comprises two frame members or struts **42** that are curved so that their outer edges give the required curvature B when viewed from the focal point of the fully deployed reflector assembly **10**. These frame members **42** are connected at their outer ends by an outer frame member **43** that is slightly curved in an outward direction so that it can form part of the rim of the fully deployed reflector **10**. The frame members **42** are connected at their inner ends by an inner frame member or strut **44** that is curved outwardly slightly. This inner frame member **44** has a slot **45** that is designed to accommodate the outer end of a mounting strut **13**. Located along the central axis of the hour glass shaped petal **14** is a radial reinforcing member or strut **46** whose ends are connected to the center of the outer frame member **43** and the inner frame member **44**. Reinforcing struts **47, 48** and **49** are located in a direction generally transverse to the long axis of the reinforcing member **46** and the ends of these struts are connected to the reinforcing member and the frame members **42**.

The wedge shaped petal comprises two outer frame members or struts **50** that are connected together at their inner ends to form a point and are connected at their outer ends by a frame member or strut **51** that is slightly curved in an outward direction so that it can form part of the rim of the fully deployed reflector assembly **10**. The outer frame members **50** are curved so that their outer edges give the required curvature C when viewed from the focal point of the fully deployed reflector. Reinforcing members or struts **52, 53** and **54** extend across the width of the wedge shaped petal and their ends are connected to outer frame members **50**. The wedge shaped petal **15** has no radial reinforcing strut such as the radial reinforcing strut **37** of the lanceolate shaped petal **11** and the radial reinforcing strut **46** of the hour glass shaped petal **14** and consequently the wedge shaped petal is comparatively flexible in a lengthwise direction whereas the lanceolate shaped petals and the hour glass petals are of substantially rigid lengthwise construction and are not flexible in the lengthwise direction in view of their reinforcing struts.

As illustrated in FIGS. **8** and **9** the reinforcing member **37** of the lanceolate shaped petal **11** is of substantially uniform thickness throughout its length and is

curved so that its upper surface corresponds to the curvature D and its lower surface corresponds to the curvature D' when viewed from the side. The truss **19** is connected to the lower surface of the reinforcing member **37** to give the supporting member additional strength and to prevent it from flexing. It can also be seen that the upper surfaces of the reinforcing struts **38, 39** and **40** are curved inward or dished so that the lanceolate shaped petal **11** can form part of a paraboloid when the reflector assembly is fully deployed. In FIG. **9** as indicated for one of the reinforcing struts **39**, the reinforcing struts **38, 39** and **40** are thinner at G near the reinforcing member **37** than they are at H near the frame member **36** and thus the reinforcing struts **38, 39** and **40** can bend or flex and this permits the lanceolate shaped petal **11** to bend elastically slightly up and down in a direction that is transverse to the long axis of the reinforcing member **37** as indicated by the broken lines and the arrows.

The outer frame member **50**, the reinforcing struts **52, 53** and **54**, and the frame member **51** of the wedge shaped petal **15** are also dished or curved as illustrated in FIGS. **10** and **11** so that when the wedge shaped petal is covered with wire mesh and viewed in section from the side it has a curvature D and the surface of the wedge shaped petal can form a part of a parabolic shaped surface of the reflector assembly **10** when the reflector assembly is fully deployed. It should be noted, however, that since the wedge shaped petal **15** has no radial reinforcing member such as that at **37** in FIG. **8**, the wedge shaped petal is free to flex as indicated by the arrows and the broken lines so that the underside of the petal when viewed in cross section from the side it presents the inverted curvature indicated by D'' and the dotted lines that is substantially equivalent to the curvature D. As illustrated for the reinforcing member **53** in FIG. **11** the reinforcing members **52, 53** and **54** and the frame member **51** are substantially of uniform thickness throughout their lengths so that they will not tend to bend in the manner described previously for the leaf shaped petal and thus the wedge shaped petal is resistant to bending in a direction transverse to its long axis.

As illustrated in FIGS. **12** and **13** the frame members **42**, the reinforcing member **46**, the reinforcing struts **47, 48, 49**, the outer frame member **43** and the inner frame member **44** of the hour glass shaped petal **14** are dished or curved so that when the hour glass petal is viewed in cross section from the side it has a curvature D and the surface of the hour glass shaped petal can form a part of a parabolic shaped surface of the reflector assembly when the reflector assembly is fully deployed. The underside of the reinforcing member **46** is also connected to the truss **19** to give the reinforcing member additional strength and to prevent it from flexing.

In FIG. **13** as indicated for one of the reinforcing struts **48**, the inner frame member **44**, the reinforcing struts **47, 48** and **49** and the outer frame member **43** are thinner at I near the reinforcing member **46** than they are at J near the frame member **42** and thus the inner frame member **44**, the reinforcing struts **47, 48** and **49** and the outer frame member **43** can bend or flex and this permits the hour glass shaped petal **14** to bend elastically slightly up and down in a direction that is transverse to the long axis of the reinforcing member **46** as indicated by the broken lines and the arrows.

The various frame members and reinforcing struts of the lanceolate shaped petals **11**, the semi-hour glass shaped petals **14** and the wedge shaped petals **15** may be constructed from various types of honeycomb materials that are familiar to those skilled in the art. It will also be appreciated that various types of wire mesh screen coverings and that reflect electromagnetic radiation that are familiar in the art can be used to cover the semi-hour glass shaped petals **11**, the hour glass shaped petals **14** and the wedge shaped petals **15**. Generally the selection of the type of screen covering that is to be used will be governed by the type of electromagnetic radiation that is to be reflected. In addition, a metalized mylar sheet covering may be substituted for the wire mesh screen covering in order to permit the reflector to be used to reflect electromagnetic radiation in the infrared and visible spectrum.

A portion of the partially deployed or partially collapsed reflector **10** is illustrated in FIGS. **14** and **15**. As illustrated in FIG. **15** as the reflector is undergoing deployment or being collapsed the edges of the lanceolate shaped petals **11** bend inwardly elastically toward the center of the assembly from their normal positions indicated by the appropriate broken lines and the edges of the hour glass shaped petals **14** bend elastically outwardly and away from the center of the assembly and from their normal positions indicated by the appropriate broken lines. It should also be appreciated that bending of the lanceolate shaped petals **11** and the hour glass shaped petals **14** can occur during certain phases of the deployment or closing of the reflector that is reverse to that indicated in FIG. **15**. This bending of the lanceolate shaped petals **11** and the hour glass shaped petals **14** permits the reflector to be readily deployed and closed without causing any binding between the various petals. However, when the reflector assembly is fully deployed the lanceolate shaped petals **11** and the hour glass shaped petals **14** have resumed their original shape and are no longer subject to elastic deformation and thus the reflector has a rigid reflective surface.

FIG. **16** illustrates in greater detail the type of interconnecting means **16** that can be utilized with this invention. The interconnecting means comprise a hinge member **16** that is similar in construction to the familiar common door hinge and comprises a left hinge member **55** and a right hinge member **56**. The left hinge member **55** has an outer flange **57** that has holes **58** in it for bolts or the like that can be used to attach the flange to the edge of the appropriate petal. The flange **57** has a cylindrical projection **59** that is located on its inner edge and this cylindrical projection has a hole through it along its long axis that is capable of accepting a pin. The right hinge member **56** also has a flange **60** that has holes **61** in it for bolts or the like that can be used to attach the flange to the edge of the appropriate petal. The flange **60** has two cylindrical projections **62** located on its inner edge that are separated to form a gap that accommodates the cylindrical projection **59**. The cylindrical projections **62** have holes in them along their long cylindrical axis that accept a pin **63** that also passes through the hole in the cylindrical projection **59** so that the two hinge members **55** and **56**

are rotatably connected to each other and are free to rotate about the pin.

In order to practice the invention, the collapsible reflector **10** is assembled in its fully deployed configuration as illustrated in FIG. **1** on a suitable jig. After the reflector is assembled and tested the hydraulic unit **18** is activated and this causes the activating arms **17** whose ends are pivotally connected to the lower ends of the trusses **19** to push outward and upward against the trusses that are connected to the backs of the lanceolate shaped petals **11** and the hour glass petals **14** so that the lanceolate shaped petals and the hour glass shaped petals are pushed upward and inwardly toward the center of the assembly. The upward and inward movement of the lanceolate shaped petals and the hour glass shaped petals also causes the wedge shaped petals **15** that are rotatably connected to the lateral edges of the lanceolate shaped petals **11** and hour glass shaped petals **14** to begin to rotate towards each other about the edges of the lanceolate shaped petals as illustrated in FIG. **2**. As the lanceolate shaped petals **11** and the hour glass shaped petals **14** move toward the center of the assembly they flex in the manner indicated in FIG. **15** so that binding does not occur between the edges of the petals. As the lanceolate shaped petals **11** and the hour glass shaped petals **14** begin to move into their final closed positions the wedge shaped petals **15** are forced to bend backward as illustrated by the broken lines in FIG. **10** since the lateral edges of the wedge shaped petals are connected to the edges of the adjacent lateral edges of the hour glass petals **14** and lanceolate shaped petals **11** and the edges of the wedge shaped reflector are forced to conform to curvature of the edges of these lanceolate shaped and hour glass shaped petals.

If the reflector **10** is to be used in space after the reflector has been collapsed it is then packaged in a suitable space launching vehicle and launched into space. When the space launch vehicle is at the desired location in space the collapsible reflector **10** is ejected from the launch vehicle and the hydraulic unit **18** is activated to cause the activating arms **17** to be pulled inward so that the connected trusses **19** and the attached lanceolate shaped petals **11** and hour glass shaped petals **14** are pulled outward and downward as indicated in FIG. **2**. As the lanceolate shaped petals **11** and the hour glass shaped petals **14** are pulled outward and downward this causes the wedge shaped petals **15** that are rotatably connected to the adjacent lanceolate shaped and hour glass shaped petals to rotate away from each other about the edges of the lanceolate shaped petals. As the collapsed reflector assembly **10** is undergoing deployment the wedge shaped petals **15** are pulled from their backward bent position illustrated in FIG. **10** to their normal configuration due to the shape of the lateral edges of the attached lanceolate shaped petals **11** and hour glass shaped petals **14**. It will be appreciated that as the collapsible reflector **10** is undergoing deployment the lanceolate shaped petals **11** and the hour glass shaped petals **14** bend from their bent positions to their normal positions indicated in dotted lines in FIG. **15**. When the lanceolate shaped petals **11** and the hour glass shaped petals **14** have been pulled to their fully open positions by the action of the hydraulic unit **18** the connected wedge shaped petals have rotated almost 90° about their long axis and thus the wedge shaped petals, the lanceolate shaped petals and the hour glass shaped petals provide the dished paraboloid illustrated in FIG. **1**.

Although the invention has been described in considerable detail with reference to certain preferred embodiments, it will be understood that variations and modifications may be made within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A collapsible and deployable reflector comprising:
a reflector hub;
a plurality of petals surrounding said reflector hub and being adapted to present a dished substantially symetrical reflective surface upon deployment of said reflector, said petals having lateral edges that have a curvature when viewed from the focus of the deployed reflector that substantially approximates the radial curvature of the surface of the petals of the fully deployed reflector;
interconnecting means connected to the lateral adjacent edges of said petals for pivotally connecting said petals together in edge to edge relationship; and
means connected to said hub and at least some of said petals for pivotally connecting said petals to said hub.

2. The collapsible and deployable reflector of claim **1** wherein said plurality of petals comprise petals being of substantially rigid lengthwise construction and petals being of comparatively flexible lengthwise construction alternately located between said lengthwise rigid petals.

3. The collapsible and deployable reflector of claim **2** wherein said lengthwise rigid petals comprise substantially lanceolate shaped petals alternating with semi-hour glass shaped petals.

4. The collapsible and deployable reflector of claim **2** including reinforcing means connected to the back of each of said lengthwise rigid petals for reinforcing said rigid petals.

5. The collapsible and deployable reflector of claim **4** wherein said reinforcing means comprises a truss member.

6. The collapsible and deployable reflector of claim **1** including means operatively connected to at least some of said petals for collapsing and deploying said petals.

7. The collapsible and deployable reflector of claim **6** wherein said collapsing and deploying means comprises a hydraulic activating unit.

8. The collapsible and deployable reflector of claim **1** wherein said petals are adapted to present a paraboloid and the radial curvature of the surface of the petals of the fully deployed reflector is substantially parabolic.

9. The collapsible and deployable reflector of claim **1** wherein said petals have an electromagnetically reflective wire mesh surface.

10. The collapsible and deployable reflector of claim **1** wherein said interconnecting means comprises hinge members.

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