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(54) **CARGO AIRCRAFT**

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(74) Representative: **Viering, Jentschura & Partner**
Patent- und Rechtsanwälte
Grillparzerstrasse 14
81675 München (DE)

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(73) Proprietor: **Biosphere Aerospace LLC**
Carpinteria, CA 93013 (US)

(72) Inventor: **Helou, Elie Jr.**
Carpinteria, CA 93013 (US)

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Description

BACKGROUND OF THE INVENTION

[0001] The field of the present invention is cargo aircraft for transporting modular containers.

[0002] The basic unit for transporting goods has been the truck. Being the basic unit, the truck has defined limitations on intermodal containers that can typically be transported by ships, trains and trucks. Much of commerce today for which intermodal containers are most convenient are high volume, low weight products, computers being one example. Thus, volume instead of weight creates the limiting factor in the design of intermodal containers. As such, containers have grown to the maximum volume capacity of the basic unit, the truck. As such, intermodal containers are limited by the dimensions allowed by highway infrastructures.

[0003] The aforementioned intermodal containers have greatly facilitated and lowered the cost of cargo transportation. However, air cargo has generally been excluded from participation in intermodal cargo systems. Aircraft of a size capable of carrying substantial cargo have typically been designed first as passenger aircraft. Cylindrical fuselages and lack of large access ports thereto in such passenger aircraft limit the use of such aircraft for truly intermodal cargo systems. Rather, the aircraft must become the basic unit with odd shaped and smaller sized containers. As a result, even with containerized cargo, a truck must be loaded with multiple individual containers for efficient distribution of air cargo. Such aircraft are also designed to be efficient at high speeds which is costly. Military transports are also not particularly compatible with intermodal cargo systems as they are designed for oversized cargo such as rolling equipment, e.g., tanks and trucks, and palletized, irregularly shaped cargo. Most aircraft specifically designed for the military also are mission directed and overall efficiency for competitive cargo transportation is not a first priority.

[0004] The inability of aircraft to participate in intermodal container cargo systems has been disadvantageous to international commerce. Business principals such as just-in-time supply and changing business environments including rapid global internet communication have created a demand for much more rapid international shipping than can be provided by conventional ships. However, air cargo systems remain both expensive and inconvenient to intermodal shipping.

[0005] US 2004/0135031 A1 discloses a modular automated air transport system comprising an unmanned aircraft wherein a structural frame portion contains an interior cargo hold and wherein said system contains a computer.

[0006] US 2 387 527 discloses a cargo airplane having a lower opening for receiving a cargo container providing an outer surface of the aircraft.

[0007] US 4 379 533 discloses a transport airplane.

[0008] US 6 363 586 B1 discloses a kit for rigidly connecting two containers.

[0009] US 2003/0214143 discloses a system for unlocking a container from a base.

SUMMARY OF THE INVENTION

[0010] According to the present invention, an aircraft for carrying at least one container as claimed in claim 1 is provided. The dependent claims define some examples of such an aircraft.

[0011] The present invention is directed to an aircraft having a beam structure to receive at least one rigid cargo container with mounts detachably integrating the at least one rigid cargo container as part of the beam structure to provide structural rigidity to the aircraft in flight.

[0012] In a first separate aspect of the present invention, the aircraft includes a forward fuselage and an empennage attached to either end of the beam structure. Wings and engines are also provided.

[0013] In a second separate aspect of the present invention, the mounts associated with the beam structure are located on the top side of the beam structure to detachably support at least one rigid container thereon.

[0014] In a third separate aspect of the present invention, the mounts are on the underside of the beam structure to detachably suspend at least one rigid cargo container therefrom.

[0015] In a fourth separate aspect of the present invention, the at least one rigid cargo container is the size of an intermodal container and is of a composite lightweight structure.

[0016] In a fifth separate aspect of the present invention, multiple containers and orientations thereof are contemplated.

[0017] In a sixth separate aspect of the present invention, an empennage is constructed to provide direct access longitudinally to the beam from the back of the aircraft.

[0018] In a seventh separate aspect of the present invention, a forward fuselage is pivotally associated relative to the beam to allow full access to the forward end of the beam.

[0019] In an eighth separate aspect of the present invention, the aircraft is a drone. As a drone, efficient low speed and, correspondingly, longer flights without crew are cost effective and advantageous.

[0020] In a ninth separate aspect of the present invention, a forward fuselage, an empennage, wings and engines are each removable as separate units from association with the beam.

[0021] In a tenth separate aspect of the present invention, any of the foregoing separate aspects are contemplated to be combined to greater advantage.

[0022] Accordingly, it is an object of the present invention to provide an improved cargo aircraft. Other and further objects and advantages will appear hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Figure 1 is a perspective view of a first embodiment of an aircraft.

Figure 2 is a partial perspective view with portions broken away for clarity of the aircraft of Figure 1.

Figure 3 is a cross-sectional view taken transversely through the fuselage of the aircraft of Figure 1.

Figure 4 is a perspective view of a cargo bay and combinations of containers.

Figure 5 is a partial exploded perspective view of the aircraft of Figure 1.

Figure 6 is a detailed perspective of the fuselage of the aircraft of Figure 5.

Figure 7 is a side view of a fairing frame for the aircraft of Figure 1 with a container in place.

Figure 8 is a perspective view of the aircraft of Figure 1 being loaded or unloaded.

Figure 9 is a perspective view of the aircraft of Figure 1 with the forward fuselage raised.

Figure 10 is a perspective view of a frame structure of a cargo container.

Figure 11 is a perspective view of a longer frame structure of a cargo container.

Figure 12 is a perspective view of an exploded assembly of a cargo container.

Figure 13 is a partial cross-sectional view of a panel illustrated in Figure 12.

Figure 14 is a detail cross-sectional view of an assembled panel on a cargo container.

Figure 15 is a cross-sectional view of a mount between the beam structure and a container.

Figure 16 is an exploded perspective view of corner attachments and couplers.

Figure 17 is a perspective view of a second embodiment of an aircraft.

Figure 18 is a partial perspective view of the aircraft of Figure 17 with portions broken away for clarity.

Figure 19 is a cross-sectional view taken transversely of the fuselage of the aircraft of Figure 17.

Figure 20 is a perspective view of an aircraft with cargo containers side by side.

Figure 21 is a cross-sectional view of the fuselage of the aircraft of Figure 20.

Figure 22 is a cross-sectional view as in Figure 21 with an amended beam configuration.

Figure 23 is a partial perspective view of the aircraft of Figure 20 with portions broken away for clarity.

Figure 24 is a perspective view of a fourth embodiment of an aircraft.

Figure 25 is a partial perspective view of the aircraft of Figure 24 with portions broken away for clarity.

Figure 26 is a cross-sectional view of the fuselage of the aircraft of Figure 24.

Figure 27 is a cross-sectional view of the fuselage of yet another embodiment.

Figure 28 is a perspective view of an aircraft of a further embodiment.

Figure 29 is a partial side view of the fairing frame of Figure 7 with a first attachment rail system.

Figure 30 is a partial side view of the fairing frame of Figure 7 with a second attachment rail system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] Figure 1 illustrates a first aircraft design with an integrating and supporting beam structure 30 having two ends. The details of the beam structure 30 are better illustrated in Figures 2 and 3. The beam structure 30 includes a floor 32 which may include rollers and/or anti-friction devices to facilitate longitudinal movement of a cargo container along the surface of the floor 32. Restraining flanges 33 run along each longitudinal side of the floor 32. In addition to the floor 32, the beam structure 30 includes I-beams 34 with bulkheads 36, 38 positioned periodically along the beam structure 30 and affixed to the floor 32 and the I-beams 34. The beam structure 30 becomes a rigid structure which is preferably sufficient to support the aircraft in flight when empty but cannot support the aircraft in flight when loaded.

[0025] A forward fuselage 40 is located at one end of the beam structure 30. The forward fuselage 40 is shown to be that of a drone with no cockpit. Since the Shuttle SRTM mapping mission, it has been possible to have extended commercial flights without human intervention. A cargo drone can fly at low speeds for long distances without concern for crew time and passenger fatigue. The aircraft can therefore be designed for highly efficient flight profiles without accommodation for crew and passengers.

[0026] As illustrated in Figure 9, the forward fuselage 40 is pivotally mounted relative to the beam structure 30 to fully expose the interior cavity above the beam structure 30 from the forward end of the aircraft for loading of cargo containers. The guidance and control for the aircraft may be located in the forward fuselage 40; but, given the lack of a cockpit, can be located elsewhere with equal facility. The forward fuselage 40 may be removed from association with the beam as a unit.

[0027] An empennage 42 is attached to the other end of the beam structure 30. The empennage 42 includes laterally extending horizontal stabilizers 44 with twin vertical stabilizers 46 positioned at the outer ends of the horizontal stabilizers 44. As illustrated in Figure 8, the rear fuselage 48 forming part of the empennage 42 may be split vertically and pivotally mounted to either side of the main fuselage. In this way, access is provided to the rear end of the beam structure 30 across the ramp defined by the empennage 42 including the horizontal stabilizers 44. The empennage 42 may be removed from association with the beam as a unit.

[0028] Wings 50 are also structurally associated with the beam structure 30. The wings 50 as well as the beam

structure 30 may contain fuel tanks. Landing gear 52 are provided under the wings 50; and a forward gear 54 is provided under the beam structure 30. The wings 50 may be removed from association with the beam as a unit.

[0029] Engines 56 are shown in the embodiment of Figure 1 to be directly mounted to the beam structure 30. An engine on each side, symmetrically mounted, is contemplated. Alternatively, as illustrated in Figure 28, the engines 56 are mounted atop the wings 50. This arrangement is understood to add to the efficiency of the aircraft. The engines 56 may each be removed from association with the beam as a unit.

[0030] Figures 5 and 6 illustrate framing to support aerodynamic panels. The frame includes vertical elements 58 and horizontal elements 60 with corner elements 62 lying in transverse planes of the aircraft. One such frame 63 is illustrated in greater detail in Figures 7, 29 and 30. These elements 58, 60 are typically of I-beam cross section with lightening holes as in conventional aircraft construction. Corner elements 64 extend longitudinally at the intersections of the vertical elements 58 and horizontal elements 60. These corner elements 64 may provide structural rigidity to augment the strength of the beam structure 30 and certainly provide sufficient rigidity to retain fairing components in place on the frame 62. In Figure 5, a top fairing panel 66 and a side fairing panel 68 are shown. Of course, a second side fairing panel 68 is also deployed on the other side of the aircraft.

[0031] The aircraft thus defined provides a cargo bay which is designed and sized to closely receive rigid cargo containers 70 forming right parallelepipeds which are the sizes of intermodal containers. Such intermodal containers are typically of a given height and width and varying incrementally in length. An alternative, not covered by the present invention, to the construction of a fairing to define a cargo bay between the forward fuselage 40 and the empennage 42 would be to define the intermodal containers with aerodynamic surfaces. The forward fuselage 40 and the empennage 42 would transition to create an aerodynamic surface with the forward fuselage 40 and the empennage 42. The containers 70 would be designed to be compatible with truck transportation whether or not they have aerodynamic surfaces.

[0032] In the embodiments, the rigid cargo containers 70 provide strength to the beam structure 30. The beam structure 30 is designed to be as light as possible. As such, the beam structure 30 is capable of supporting takeoff loads, flight loads and landing loads of the aircraft when free of cargo. Additionally, the beam structure 30 must be sufficient to support compression loads upon landing even when fully loaded. However, the beam structure 30 is not required to fully sustain bending and torsional loads in flight, landing and takeoff when a rigid cargo container or multiple such containers are in place in the aircraft. The additional rigidity required is supplied by the rigid cargo containers 70. To this end, the containers 70 are constructed with sufficient structure and rigidity and are securely mounted to the beam structure 30 such

that bending and torsional forces experienced by the beam structure 30 are imposed upon the securely mounted container or containers 70.

[0033] Mounts 72 are provided on the beam structure 30. These mounts may be bolted or otherwise retained on the floor 32. Further, incremental adjustments are preferably provided in order that the mounts 72 can attach to the container or containers 70 while accommodating variations in container length and placement. Such incremental adjustment may be provided by patterns of attachment holes in the floor 32 to allow for lateral or longitudinal repositioning of the mounts 72 once the container or containers 72 are in place. A mount 72 is illustrated in Figure 15 as a shoulder bolt 72 which extends between the beam structure 30 and a container 70. Such a bolt 72 provides substantial shear resistance as well as tension loading. The mounts 72 may be located or positionable along the full length of the floor 32 or at incremental positions reflecting standard container sizes. The mounts may face inwardly from the sides of the floor 32. Access ports through the fairings may be provided to allow access to the mounts 72. Alternatively, mechanisms may be employed which are automatic or remotely actuated.

[0034] Attachments 74 are illustrated in Figure 16 as formed boxes 76 through which slots 78 extend. By employing the formed boxes 76, the slots 78 terminate to provide an inner face. The attachments 74 are located in the structure of the rigid container or containers 70. As such, the attachments 74 cooperate with the formed boxes 76 with slots 78 through the walls thereof. The formed boxes 76 may include thick walls on one outer side or bottom to receive the mounts 72.

[0035] To fix the attachments 74 to one another, couplers 84 are employed. Each coupler 84 includes two heads 86 extending in opposite directions from a coupler body 88. The heads 86 are undercut between the body 88 and each of the heads 86 to form opposed engaging surfaces on the inner sides of the heads 86. The heads 86 also fit within the slots 76 in one orientation. The heads 86 have a convex surface for easier placement in the associated slots 76.

[0036] The couplers 84 may be formed such that the heads 86 are on a shaft rotatable within the body 88. A collar 90 is separated from each of the heads 86 by substantially the thickness of the walls of the formed boxes 76 with the collar 90 being of sufficient diameter that the collar 90 cannot fit within the slots 78. The collar 90 also provides access once the heads 86 are positioned in the slots 78 for rotation of the heads 86 into a locked orientation with the slots 78. The body 88 is of sufficient size and includes flat sides 92 such that it is prevented from rotating by the floor 32. Once the head 86 have been properly located, a set screw 94 can be placed to insure that the heads 86 will not rotate relative to the attachments 74. The same mechanisms are employed between attachments 74 on adjacent containers 70.

[0037] The mounts 72 may correspond to the attach-

ments 74 and employ the same mechanisms as shown in Figure 16. Identical slots 78 in the floor 32 or the restraining flanges 33 can cooperate with the slots 78 in the containers 70 and couplers 84 to restrain the containers 70 and integrate the structures thereof with the beam structure 30.

[0038] Each rigid cargo container 70 is constructed as shown in Figures 10 through 16. A first internal structure of a container is illustrated in Figure 10. This structure includes four columns 96 and eight beams 98 fixed together by corner attachments 74 as illustrated in Figure 10 to form a right parallelepiped. Panels 100 are then assembled with longerons 102 to form a top, a bottom and sides of the cargo container 70. A representative panel 100 is illustrated in Figure 13. The panel 100 is formed of lightweight material. In this embodiment the panel 100 is defined by two thin sheets 104, 106 separated by honeycomb 108. Inner longerons 110 are also placed between the sheets 104, 106 and attached thereto. About the periphery of each of the panels 100, the sheets 104, 106 come together to form an attachment flange 112. Each of these panels 100 may be of composite material or a mixture of aluminum sheets 104, 106 and formed honeycomb 108.

[0039] Figure 13 illustrates the sides, top and bottom of the completed cargo container 70 in association with the structure defined by the four columns 96 and eight beams 98. Two panels 100 are associated together with longerons 102 positioned therebetween. The attachment flanges 112 are fixed to the corner columns 96 and beams 98 which include parallel flanges 114 for that purpose.

[0040] Where longer containers are contemplated, intermediary columns 96 and beams 98 may additionally be employed. In this way, all panels 100 may be of the same size through appropriate location of the columns 96 with the overall lengths of the containers being multiples of the container illustrated in Figure 10. Multiple containers of varying length may be employed to create an overall payload for an aircraft of a given length. Figure 4 illustrates such arrangements with a sixty-foot long cargo area and containers 70 broken into various multiples of ten-foot lengths.

[0041] Figure 8 illustrates employment of the first embodiment through the placement of a cargo container 70. A truck 116 is shown aligned with the cargo area of the aircraft. In this case, the rear fuselage 48 is defined by doors which extend in an aerodynamic form and can also open to fully expose the interior of the fairing for insertion or removal of the rigid cargo container 70. This container 70 may be, as illustrated in Figure 4, one single container or a preassembled group of containers 70. Winches and other mechanisms may be employed to assist in the repositioning of the container or containers 70 either in the aircraft or on the truck 116. Alternatively, the forward fuselage 40 may be pivoted out of the way as illustrated in Figure 9 and the container 70 loaded from or unloaded to the truck 116 from the front of the aircraft. The landing gear 52 and/or forward gear 54 may be additionally ex-

endable or retractable or the mounts thereof may be able to move up and down to accommodate the level of the bed of a truck 116.

[0042] The general principles described herein with regard to the first embodiment also apply to the several other embodiments which are presented. A second embodiment is illustrated in Figures 17 through 19. In this embodiment, the beam structure 30 is arranged at the top of the aircraft with the rigid cargo container or containers 70 suspended thereunder through attachments to the underside of the beam structure 30. In this second embodiment, the beam structure is effectively inverted and is formed of a very similar structure to that of the first embodiment. The wings 50 are correspondingly associated with the top of the aircraft to be at the beam structure for support. Further, the engines 56 are also so located.

[0043] This repositioning of the beam structure 30 makes the loading and unloading of containers through the empennage 42 more difficult. However, the forward fuselage 40 continues to provide loading capability through rotation of the forward fuselage 40 out of the way. Alternatively, cargo bay doors 118, as illustrated in Figure 19, may provide access for loading of the container or containers 70 from below. To accommodate this overhead placement of the beam structure 30, the landing gear 52 must be supported at a greater distance than as required in the first embodiment. Either the gear 52, 54 itself or structure 119 may extend within additional fairings 120 to either side of the fuselage.

[0044] Figures 20 through 23 illustrate another configuration having a double-wide beam structure 30 to accommodate side-by-side rigid cargo containers 70. But for the dimensional changes and required additional structural rigidity within the beam structure 30, the foregoing discussion applies to this embodiment. Figures 21 and 22 show two different configurations of the I-beams 34 to support different expected weight requirements. These figures also illustrate a central column disposed between the side by side containers which can be a bulkhead or a series of independent columns. Alternatively, the side by side containers 70 can be linked together as discussed above and the containers 70 at or adjacent that joint also attached to mounts associated with the central corner element 64 with no central column present.

[0045] Figures 24 through 26 illustrate yet another embodiment designed to accommodate a different arrangement of rigid cargo containers 70. In this embodiment, two-high sets of containers are placed side by side to achieve four times the cross-sectional area for container cargo as in the first embodiment. The same comments applied to Figures 21 and 22 regarding the central column, illustrated between the containers 70 in Figure 26, apply to this embodiment.

[0046] Figure 27 provides a hybrid between the first and second embodiments. Two sets of side-by-side cargo containers 70 are positioned above and below the beam structure 30. The same comments applied to Figures 21 and 22 regarding the central column, illustrated

between the containers 70 in Figure 27, apply to this embodiment.

[0047] Figures 29 and 30 illustrate yet another feature which can augment the structure of the system. A rail 122 is associated with the frame 62 in two locations as illustrated in the two figures. A corresponding channel 124 is shown located in the container 70. The channel 124 may be an interlocking fit as shown only at the corners of the container 70 or fully through the container with additional support provided therealong. The rail mechanism is shown in association with the fairing but may be associated with the beam structure 30 as well.

Claims

1. An aircraft for carrying at least one rigid cargo container (70), comprising a forward fuselage (40); an empennage (42); wings (50); a beam structure (30) including a first end to which the forward fuselage (40) is attached, a second end to which the empennage (42) is attached, and mounts (72) to structurally engage the at least one rigid cargo container (70) in juxtaposition with the beam structure (30) between the first and second ends, the wings (50) being mounted to the beam structure (30); engines (56) fixed relative to the beam structure (30); and a frame for supporting aerodynamic fairing panels (66, 68) attached to the beam structure, which frame includes vertical elements (58) and horizontal elements (60), thereby including an interior cavity to receive the at least one rigid cargo container; wherein the mounts (72) detachably integrate the at least one rigid cargo container (70) as part of the beam structure (30) to provide structural rigidity to the beam structure (30) in flight.
2. The aircraft of claim 1, the mounts (72) being on the underside of the beam structure (30) to detachably suspend the at least one rigid cargo container (70) therefrom.
3. The aircraft of claim 1, the mounts (72) being on the top side of the beam structure (30) to detachably support the at least one rigid cargo container (70) thereon.
4. The aircraft of claim 1, the engines (56) being mounted to the upper side of the wings (50).
5. The aircraft of claim 1 further comprising the at least one rigid container (70) attached to the mounts (72).
6. The aircraft of claim 5, the rigid container (70) further including four columns (96) and eight beams (98) forming the edges and corners of a structurally unitary parallelepiped with at least two side panels (100), a top panel (100) and a bottom panel (100).
7. The aircraft of claim 6, the side panels (100) being a composite with thin skin surfaces (104, 106) with a honeycomb structure (108) therebetween and periodic longerons extending thereacross.
8. The aircraft of claim 5, the at least one rigid container (70) being multiple containers (70), the container (70) including attachments (74) to structurally engage one another, the attachments (74) being rigidly fixed to the corners.
9. The aircraft of claim 8, the containers (70) being the size of intermodal containers of one or more incremental lengths.
10. The aircraft of claim 8 further comprising couplers (84), the attachments (74) on the ends of the containers (70) employing the couplers (84) for universal engagement with one another.
11. The aircraft of claim 10, the attachments (74) and mounts (72) being universally engageable with one another including undercut slots (78) and locking pins (72, 86) having opposed engaging surfaces engageable with the undercut slots (78) in adjacent attachments (74) and mounts (72).
12. The aircraft of claim 8, the containers (70) each extending longitudinally on the beam structure (30), arranged side by side and engaging the mounts (72).
13. The aircraft of claim 8, the containers (70) arranged end to end extending longitudinally on the beam structure (30) and including attachments (74) to structurally engage one another, the containers being attached to the beam structure (30) by the mounts (72).
14. The aircraft of claim 1, wherein the interior cavity closely receives the at least one rigid cargo container (70).
15. The aircraft of claim 5, the at least one rigid container (70) being at least four containers (70), two of the at least four rigid containers (70) each extending longitudinally on top of the beam structure (30) and arranged side by side, and two of the at least four rigid containers (70) each extending longitudinally and depending from the beam structure (30) and arranged side by side, the at least four rigid containers (70) being engaged by the mounts (72).
16. The aircraft of claim 5, the at least one rigid container

(70) being at least four containers(70), a first two of the at least four rigid containers (70) each extending longitudinally on top of and engaging the beam structure (30) and arranged side by side, and a second two of the at least four rigid containers (70) each extending longitudinally on top of the first two rigid containers (70), the at least four containers (70) including attachments (74), the second two of the at least four rigid containers (70) being arranged side by side and being attached by the attachments (70) to the first two of the at least four rigid containers (70).

17. The aircraft of claim 1, the empennage (42) including a ramp (44) extending substantially level with the upper surface of the beam structure (30), horizontal stabilizers (44) extending outwardly from the ramp (44) and twin vertical stabilizers (46) displaced laterally from the ramp (44).
18. The aircraft of claim 17, the empennage (42) further including doors (48) extending in an aerodynamic form rearwardly over the ramp and being mounted to selectively provide full access to the ramp(44).
19. The aircraft of claim 1, the aircraft being a drone.
20. The aircraft of claim 1, the forward fuselage (40) being pivotally mounted relative to the beam structure (30) to selectively provide full access to the beam structure (30).
21. The aircraft of claim 1, the forward fuselage (40), the empennage (42), the wings (50) and the engines (56) each being removable as a unit from association with the beam structure (30).

Patentansprüche

1. Ein Flugzeug zum Befördern von mindestens einem steifen Frachtcontainer (70), aufweisend:
 - einen vorderen Flugzeugrumpf (40),
 - ein Leitwerk (42),
 - Flügel (50),
 - eine Trägerstruktur (30), aufweisend ein erstes Ende, an dem der vordere Flugzeugrumpf (40) angebracht ist, ein zweites Ende, an dem das Leitwerk (42) angebracht ist, und Befestigungen (72), um den mindestens einen steifen Frachtcontainer (70) neben der Trägerstruktur (30) zwischen dem ersten und dem zweiten Ende in strukturellen Eingriff zu bringen, wobei die Flügel (50) an der Trägerstruktur (30) montiert sind, Triebwerke (56), die bezüglich der Trägerstruktur (30) befestigt sind, und
 - einen Rahmen zum Abstützen von aerodynamischen Verkleidungspaneelen (66, 68), der an

der Trägerstruktur angebracht ist, wobei der Rahmen vertikale Elemente (58) und horizontale Elemente (60) aufweist, wodurch er einen inneren Hohlraum aufweist, um den mindestens einen steifen Frachtcontainer aufzunehmen, wobei die Befestigungen (72) den mindestens einen steifen Frachtcontainer (70) als Teil der Trägerstruktur (30) lösbar integrieren, um der Trägerstruktur (30) beim Flug eine strukturelle Steifigkeit zu verleihen.

2. Das Flugzeug gemäß Anspruch 1, wobei sich die Befestigungen (72) an der Unterseite der Trägerstruktur (30) befinden, um den mindestens einen steifen Frachtcontainer (70) lösbar daran aufzuhängen.
3. Das Flugzeug gemäß Anspruch 1, wobei sich die Befestigungen (72) an der Oberseite der Trägerstruktur (30) befinden, um den mindestens einen steifen Frachtcontainer (70) lösbar daran abzustützen.
4. Das Flugzeug gemäß Anspruch 1, wobei die Triebwerke (56) an der Oberseite der Flügel (50) montiert sind.
5. Das Flugzeug gemäß Anspruch 1, ferner den mindestens einen steifen Container (70) an den Befestigungen (72) angebracht aufweisend.
6. Das Flugzeug gemäß Anspruch 5, wobei der steife Container (70) ferner aufweist: vier Pfeiler (96) und acht Träger (98), die die Kanten und Ecken eines strukturell einheitlichen Parallelepipeds mit mindestens zwei Seitenpaneelen (100), einem oberen Paneel (100) und einem unteren Paneel (100) bilden.
7. Das Flugzeug gemäß Anspruch 6, wobei die Seitenpaneel (100) ein Schichtkörper mit dünnen Außenhaufflächen (104, 106) mit einer Wabenstruktur (198) dazwischen und periodischen Längsträgern, die sich quer dadurch erstrecken, sind.
8. Das Flugzeug gemäß Anspruch 5, wobei der mindestens eine steife Container (70) mehrere Container (70) sind, wobei der Container (70) Halterungen (74) aufweist, um strukturell ineinanderzugreifen, wobei die Halterungen (74) steif an den Ecken befestigt sind.
9. Das Flugzeug gemäß Anspruch 8, wobei die Container (70) die Größe von Containern für den kombinierten Verkehr mit einer oder mehr inkrementellen Längen haben.
10. Das Flugzeug gemäß Anspruch 8, ferner aufweisend Kupplungen (84), wobei die Halterungen (74)

an den Enden der Container (70) die Kupplungen (84) für einen universellen Eingriff miteinander einsetzen.

11. Das Flugzeug gemäß Anspruch 10, wobei die Halterungen (74) und Befestigungen (72), die universell miteinander in Eingriff gebracht werden können, hinterschnittene Schlitze (78) und Verriegelungsstifte (72, 86) aufweisen, die entgegengesetzte Eingriffsflächen haben, die mit den hinterschnittenen Schlitzen (78) in benachbarten Halterungen (74) und Befestigungen (72) in Eingriff bringbar sind. 5
12. Das Flugzeug gemäß Anspruch 8, wobei die Container (70) sich jeweils in Längsrichtung an der Trägerstruktur (30) erstrecken, Seite an Seite angeordnet sind und mit den Befestigungen in Eingriff sind. 10
13. Das Flugzeug gemäß Anspruch 8, wobei sich die Endezu-Ende angeordneten Container (70) in Längsrichtung an der Trägerstruktur (30) erstrecken und Halterungen (74) aufweisen, um strukturell ineinanderzugreifen, wobei die Container mittels der Befestigungen (72) an der Trägerstruktur (30) angebracht sind. 20
14. Das Flugzeug gemäß Anspruch 1, wobei der innere Hohlraum den mindestens einen steifen Frachtcontainer (70) eng aufnimmt. 25
15. Das Flugzeug gemäß Anspruch 5, wobei der mindestens eine steife Container (70) mindestens vier Container (70) sind, zwei der mindestens vier steifen Container sich jeweils oben an der Trägerstruktur (30) in Längsrichtung erstrecken und Seite an Seite angeordnet sind, und zwei der mindestens vier Container (70) sich jeweils in Längsrichtung erstrecken und von der Trägerstruktur (30) abhängen und Seite an Seite angeordnet sind, wobei die mindestens vier steifen Container (70) mit den Befestigungen (72) in Eingriff sind. 30
16. Das Flugzeug gemäß Anspruch 5, wobei der mindestens eine steife Container (70) mindestens vier Container (70) sind, wobei sich erste zwei der mindestens vier steifen Container (70) jeweils in Längsrichtung oben an der Trägerstruktur (30) erstrecken und mit dieser in Eingriff sind und Seite an Seite angeordnet sind, und wobei sich zweite zwei der mindestens vier steifen Container (70) jeweils in Längsrichtung oben an den ersten zwei steifen Containern (70) erstrecken, wobei die mindestens vier Container (70) Halterungen (74) aufweisen, wobei die zweiten zwei der mindestens vier steifen Container (70) Seite an Seite angeordnet sind und mittels der Halterungen (74) an den ersten zwei der mindestens vier steifen Container (70) angebracht sind. 40
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17. Das Flugzeug gemäß Anspruch 1, wobei das Leitwerk (42) aufweist: eine Rampe (44), die sich im Wesentlichen auf einer Höhe mit der oberen Fläche der Trägerstruktur (30) erstreckt, Höhenflossen (44), die sich von der Rampe (44) aus nach außen erstrecken, und Doppelseitenflossen (46), die zu der Rampe (44) lateral versetzt sind.

18. Das Flugzeug gemäß Anspruch 17, wobei das Leitwerk (42) ferner Türen (48) aufweist, die sich in einer aerodynamischen Form nach hinten über der Rampe erstrecken und montiert sind, um wahlweise vollen Zugang zu der Rampe (44) bereitzustellen.

19. Das Flugzeug gemäß Anspruch 1, wobei das Flugzeug eine Drohne ist. 15

20. Das Flugzeug gemäß Anspruch 1, wobei der vordere Flugzeugrumpf (40) bezüglich der Trägerstruktur (30) gelenkig gelagert ist, um wahlweise vollen Zugang zu der Trägerstruktur (30) bereitzustellen. 20

21. Das Flugzeug gemäß Anspruch 1, wobei der vordere Flugzeugrumpf (40), das Leitwerk (42), die Flügel (50) und die Triebwerke (56) jeweils als eine Einheit von der Verbindung mit der Trägerstruktur (30) lösbar sind. 25

30 Revendications

1. Un avion pour transporter au moins un conteneur de fret rigide (70), comprenant
un fuselage avant (40),
un empennage (42),
des ailes (50),
une structure de poutre (30) ayant une première extrémité à laquelle le fuselage avant (40) est attaché, une deuxième extrémité à laquelle l'empennage (42) est attaché, et des fixations (72) pour engrener de façon structurelle l'au moins un conteneur de fret rigide (70) en juxtaposition avec la structure de poutre (30) entre la première et deuxième extrémités, les ailes (50) étant montées sur la structure de poutre (30),
des moteurs (56) fixés relativement à la structure de poutre (30), et
un cadre pour supporter des panneaux d'habillage aérodynamiques (66, 68) attaché à la structure de poutre, le cadre comportant des éléments verticaux (58) et des éléments horizontaux (60), ainsi comportant une cavité intérieure pour recevoir l'au moins un conteneur de fret rigide,
dans lequel les fixations (72) intègrent l'au moins un conteneur de fret rigide (70) de façon amovible comme partie de la structure de poutre (30) pour apporter une rigidité structurelle à la structure de poutre (30) pendant le vol. 35
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2. L'avion selon la revendication 1, les fixations (72) étant à la face inférieure de la structure de poutre (30) afin de suspendre l'au moins un conteneur de fret rigide (70) de façon amovible à celle-ci.
3. L'avion selon la revendication 1, les fixations (72) étant à la face supérieure de la structure de poutre (30) afin de supporter l'au moins un conteneur de fret rigide (70) de façon amovible sur celle-ci.
4. L'avion selon la revendication 1, les moteurs (56) étant montés sur la face supérieure des ailes (50).
5. L'avion selon la revendication 1, comportant en outre l'au moins un conteneur rigide (70) attaché aux fixations (72).
6. L'avion selon la revendication 5, le conteneur rigide (70) comprenant en outre quatre piliers (96) et huit poutres (98) formant les angles et les arêtes d'un parallélépipède structurellement unitaire avec au moins deux panneaux latéraux (100), un panneau supérieur (100) et un panneau inférieur (100).
7. L'avion selon la revendication 6, les panneaux latéraux (100) étant un composite avec des surfaces de revêtement fines (104, 106) avec une structure alvéolée (108) entre celles-ci et des longerons périodiques s'étendant au travers de celles-ci.
8. L'avion selon la revendication 5, l'au moins un conteneur rigide (70) étant des conteneurs multiples (70), le conteneur (70) ayant des attaches (74) pour s'engrener mutuellement, les attaches (74) étant fixées de façon rigide aux angles.
9. L'avion selon la revendication 8, les conteneurs (70) ayant la taille de conteneurs pour le transport intermodal d'une ou de plusieurs longueurs incrémentielles.
10. L'avion selon la revendication 8, comportant en outre des coupleurs (84), les attaches (74) aux extrémités des conteneurs (70) employant les coupleurs (84) pour un engrenage mutuel universel.
11. L'avion selon la revendication 10, les attaches (74) et les fixations (72) pouvant s'engrener mutuellement de façon universelle ayant des fentes à contre-dépouille (78) et des goupilles de verrouillage (72, 86) ayant des surfaces d'engrenage opposées pouvant s'engrener dans les fentes à contre-dépouille (78) dans des attaches (74) et fixations (72) adjacentes.
12. L'avion selon la revendication 8, les conteneurs (70) s'étendant chacun longitudinalement sur la structure de poutre (30), étant disposés les uns à côté des autres et étant en prise des fixations (72).
13. L'avion selon la revendication 8, dans lequel les conteneurs (70) disposés de bout en bout s'étendent longitudinalement sur la structure de poutre (30) et ont des attaches (74) pour s'engrener mutuellement, les conteneurs étant attachés à la structure de poutre (30) moyennant les fixations (72).
14. L'avion selon la revendication 1, dans lequel la cavité intérieure reçoit étroitement l'au moins un conteneur de fret rigide (70).
15. L'avion selon la revendication 5, l'au moins un conteneur rigide (70) étant au moins quatre conteneurs (70), deux des au moins quatre conteneurs rigides (70) s'étendant chacun longitudinalement au-dessus de la structure de poutre (30) et étant disposés l'un à côté de l'autre, et deux des au moins quatre conteneurs rigides (70) s'étendant chacun longitudinalement et pendant de la structure de poutre (30) et étant disposés l'un à côté de l'autre, les au moins quatre conteneurs rigides (70) étant en prise des fixations (72).
16. L'avion selon la revendication 5, l'au moins un conteneur rigide (70) étant au moins quatre conteneurs (70), des premiers deux des au moins quatre conteneurs rigides (70) s'étendant chacun longitudinalement au-dessus de la structure de poutre (30) et étant en prise de celle-ci et disposés l'un à côté de l'autre, et des deuxièmes deux des au moins quatre conteneurs rigides (70) s'étendant chacun longitudinalement au-dessus des premiers deux conteneurs rigides (70), les au moins quatre conteneurs (70) ayant des attaches (74), les deuxièmes deux des au moins quatre conteneurs rigides (70) étant disposés l'un à côté de l'autre et étant attachés par les attaches (74) aux premiers deux des au moins quatre conteneurs rigides (70).
17. L'avion selon la revendication 1, l'empennage (42) comprenant une rampe (44) s'étendant essentiellement au niveau de la surface supérieure de la structure de poutre (30), des stabilisateurs horizontaux (44) s'étendant vers l'extérieur à partir de la rampe (44) et des stabilisateurs verticaux jumeaux (46) étant décalés latéralement par rapport à la rampe (44).
18. L'avion selon la revendication 17, l'empennage (42) comportant en outre des portes (48) s'étendant d'une forme aérodynamique vers l'arrière au-dessus de la rampe et étant montées afin de fournir sélectivement accès complet à la rampe (44).
19. L'avion selon la revendication 1, l'avion étant un drone.

20. L'avion selon la revendication 1, le fuselage avant (40) étant monté de façon pivotante relativement à la structure de poutre (30) afin de fournir sélectivement accès complet à la structure de poutre (30).

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21. L'avion selon la revendication 1, le fuselage avant (40), l'empennage (42), les ailes (50) et les moteurs (56) pouvant chacun être détaché comme unité d'une association avec la structure de poutre (30).

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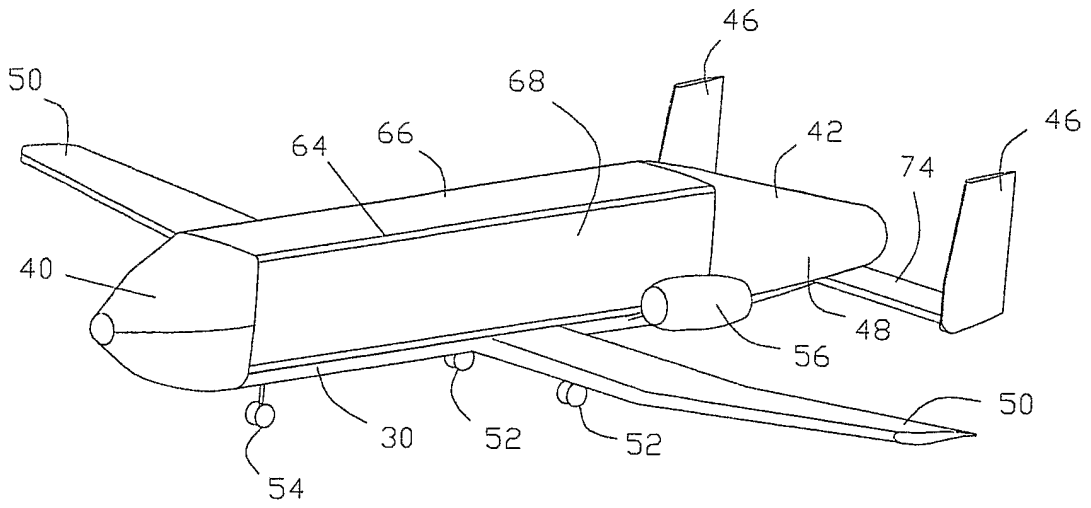


Fig. 1

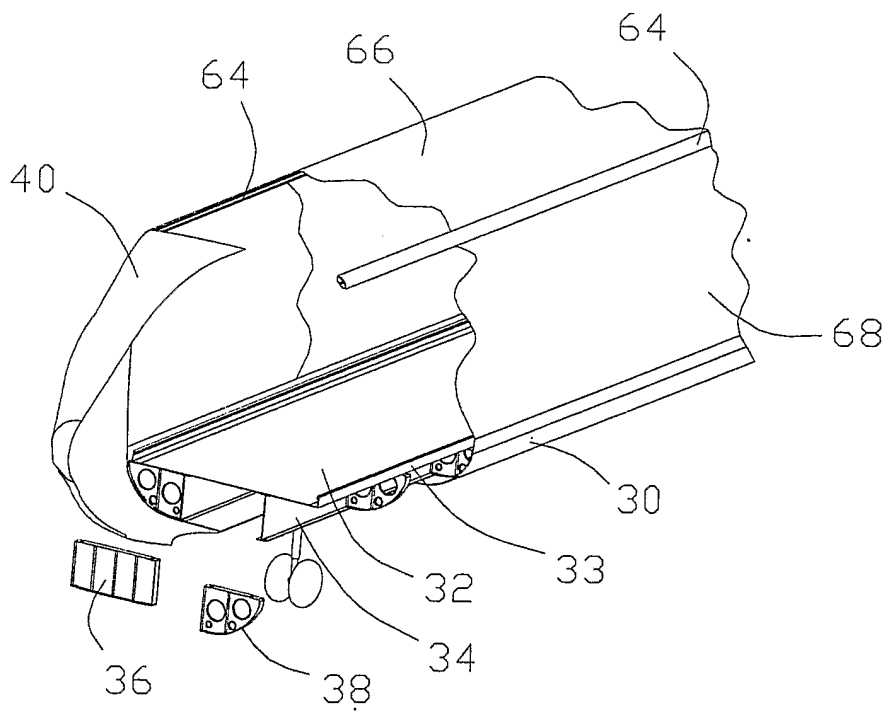


Fig. 2

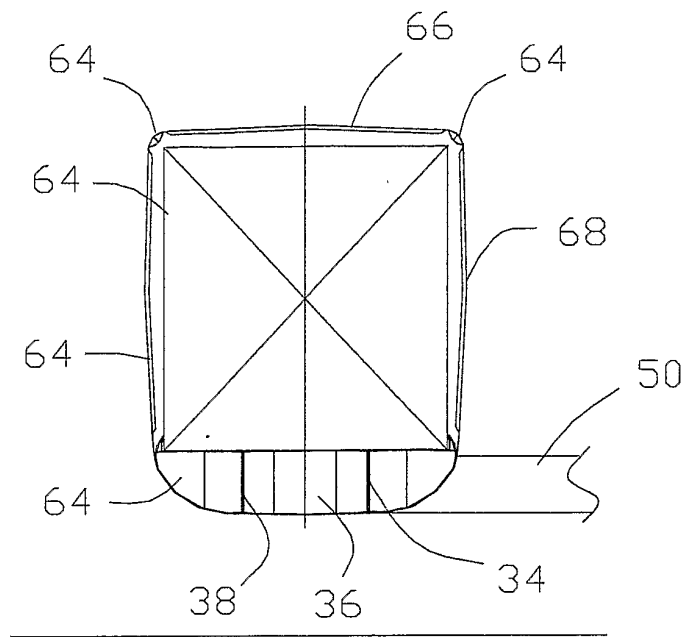


Fig. 3

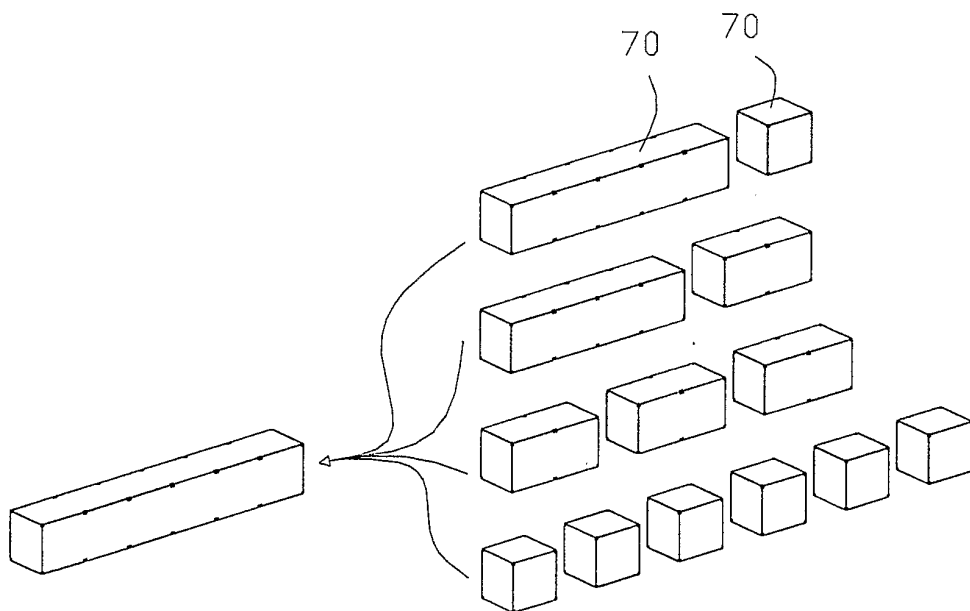


Fig. 4

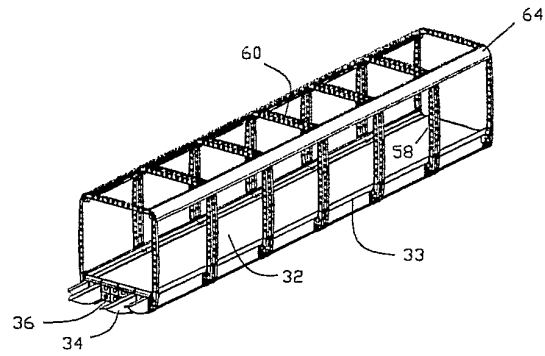


Fig. 6

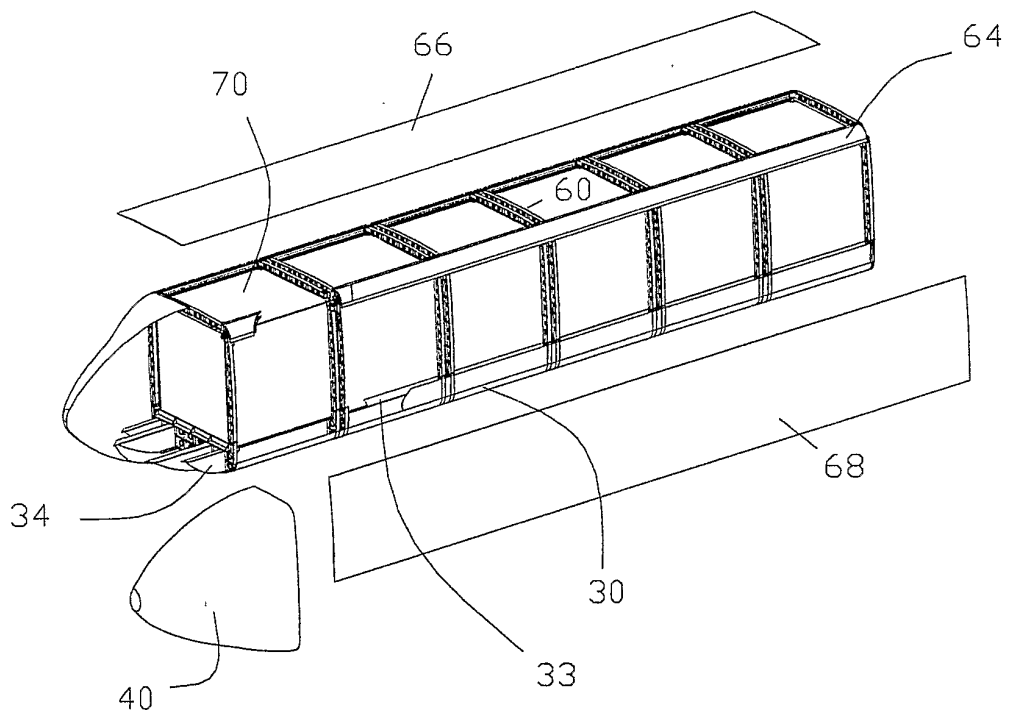


Fig. 5

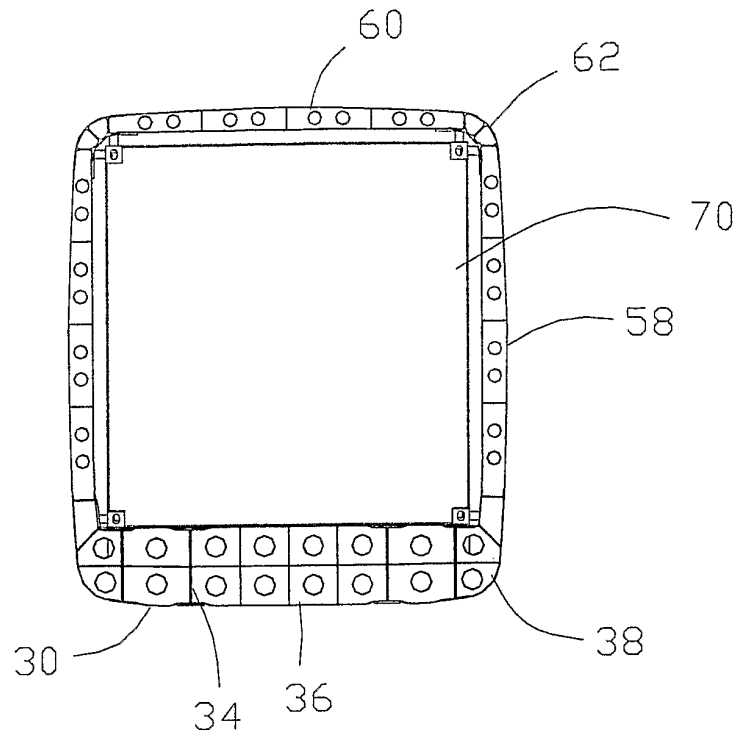


Fig. 7

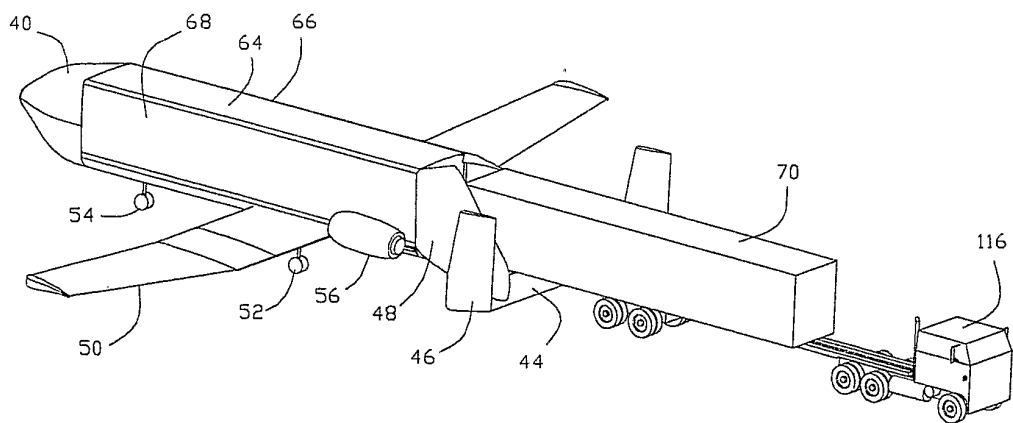


Fig. 8

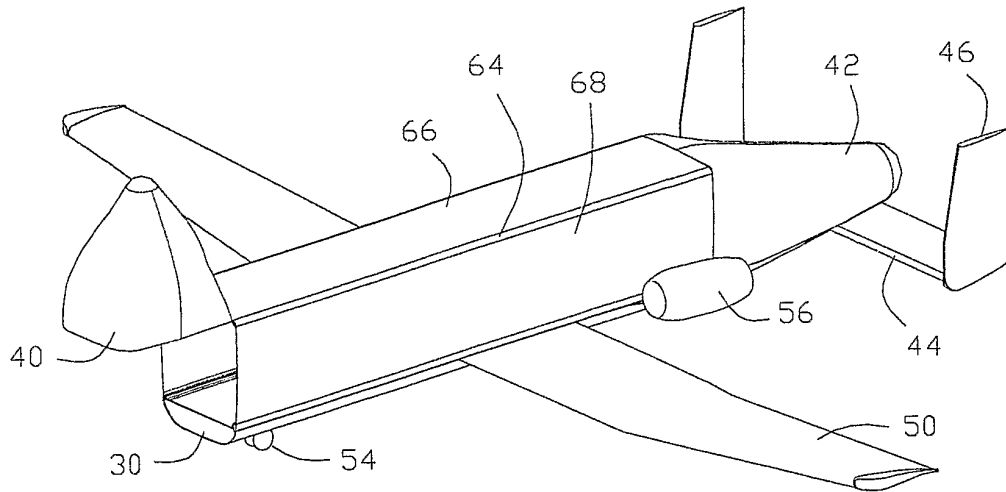


Fig. 9

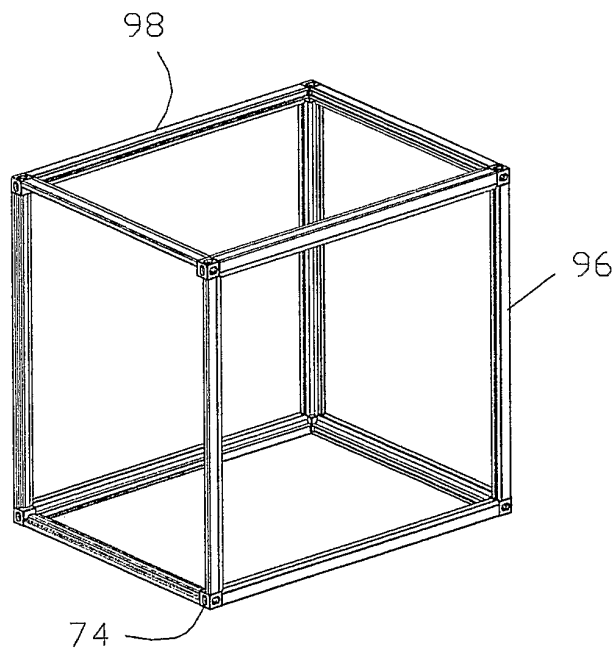


Fig. 10

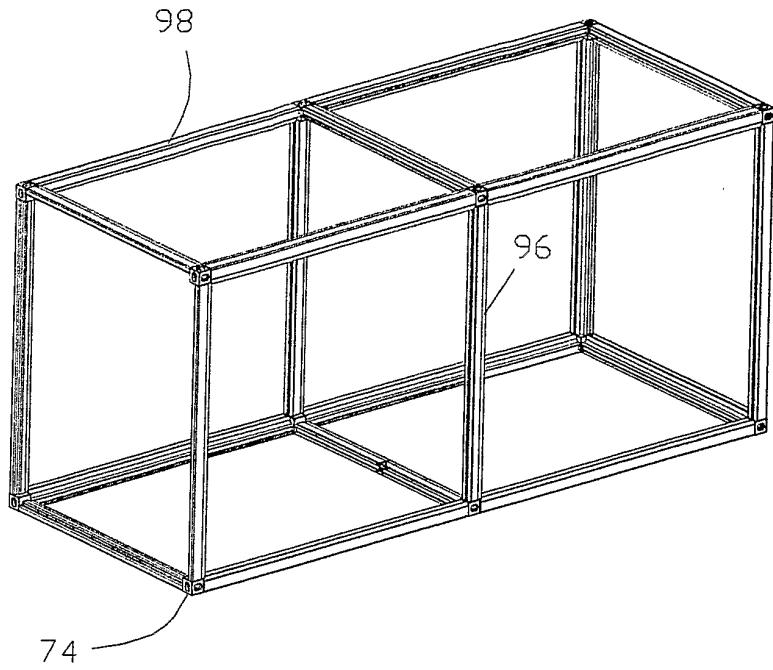


Fig. 11

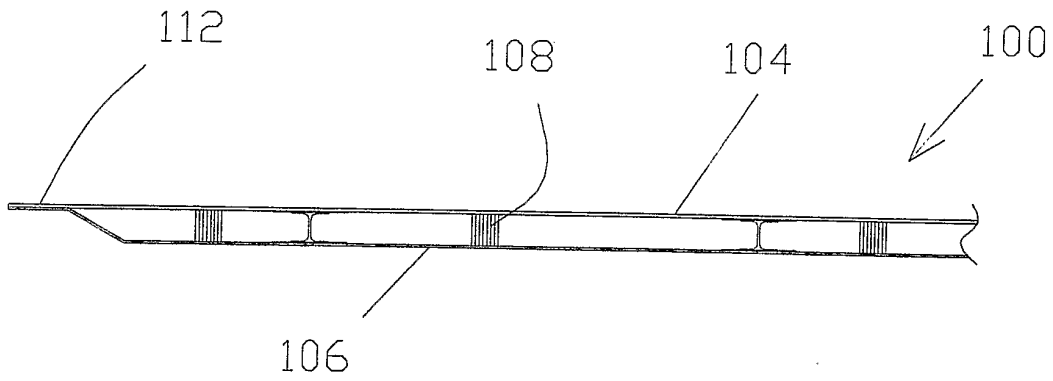


Fig. 13

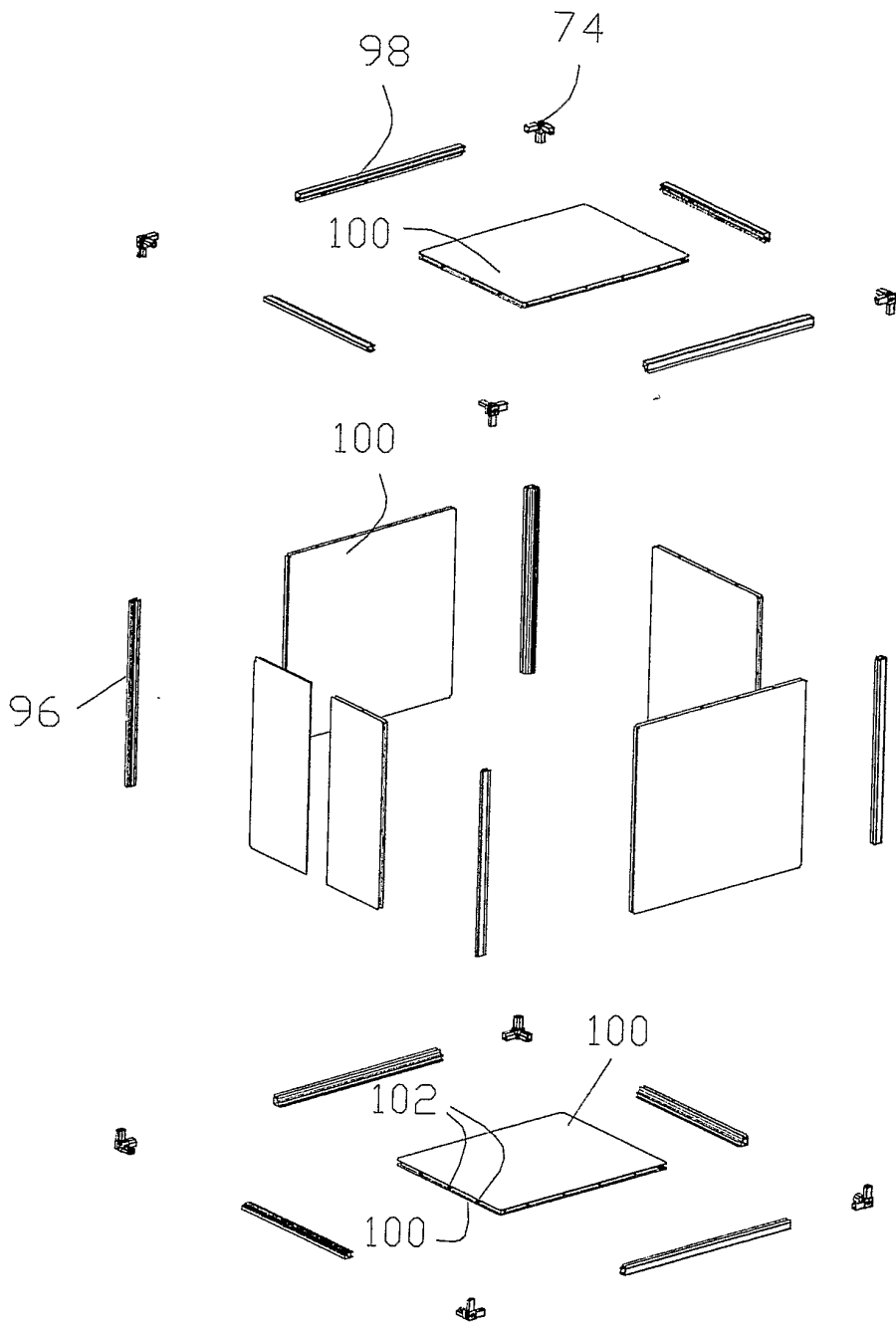


Fig 12

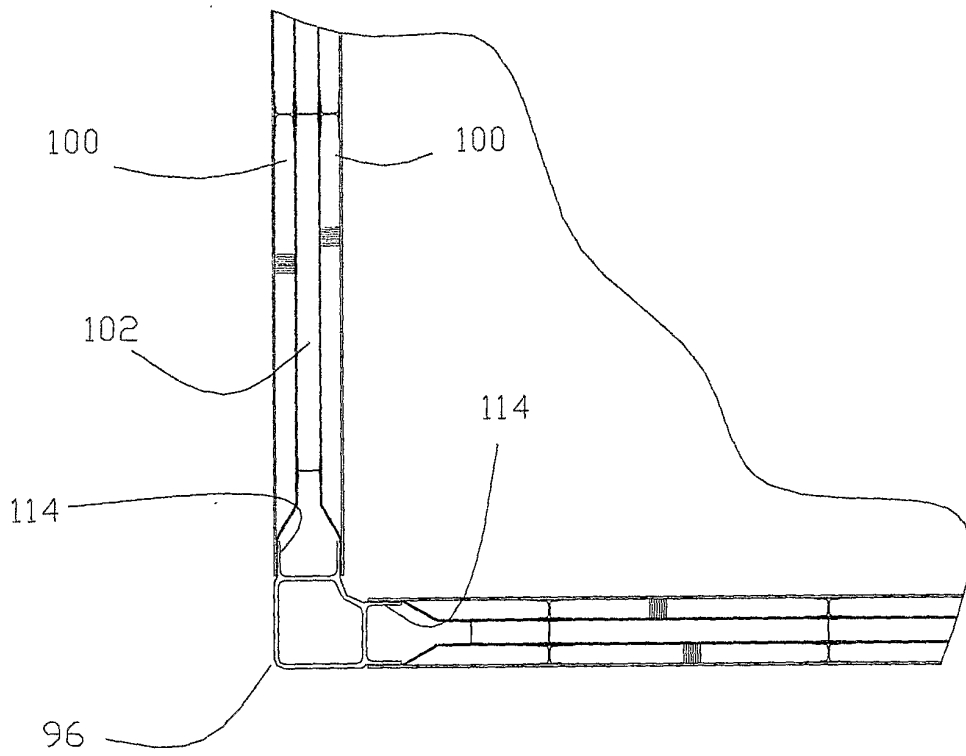


Fig. 14

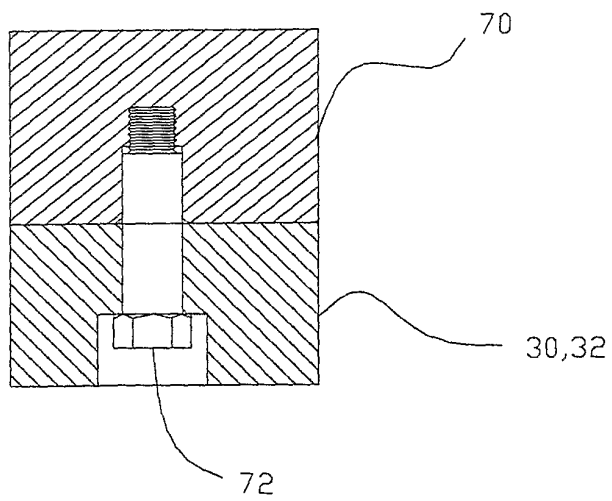


Fig. 15

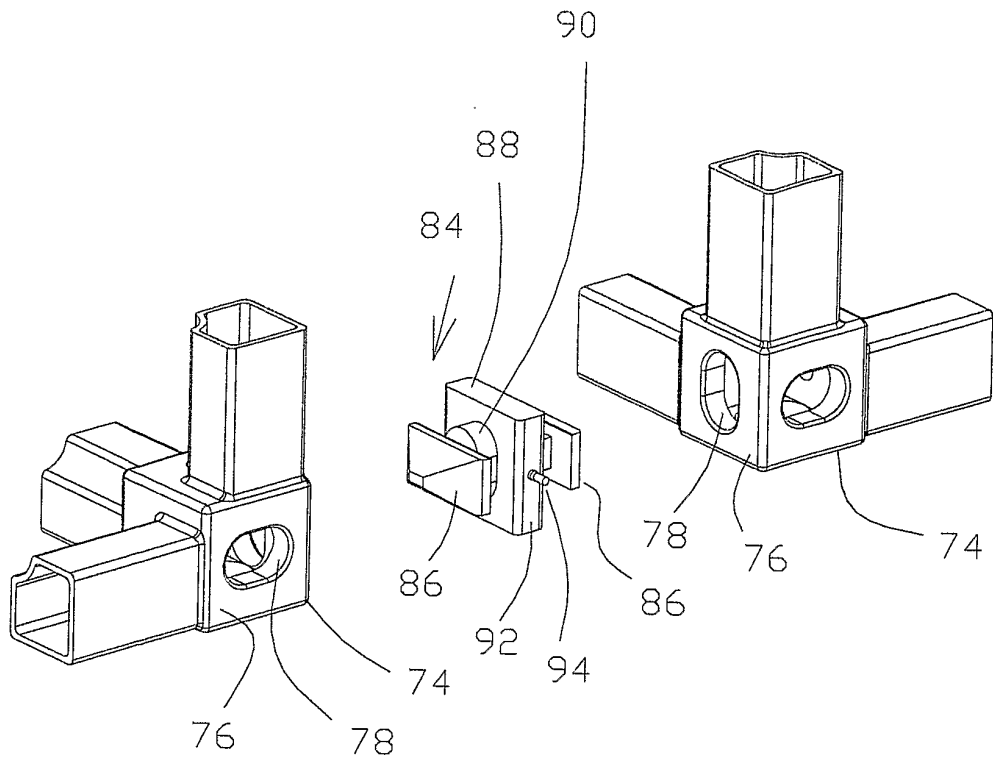


Fig. 16

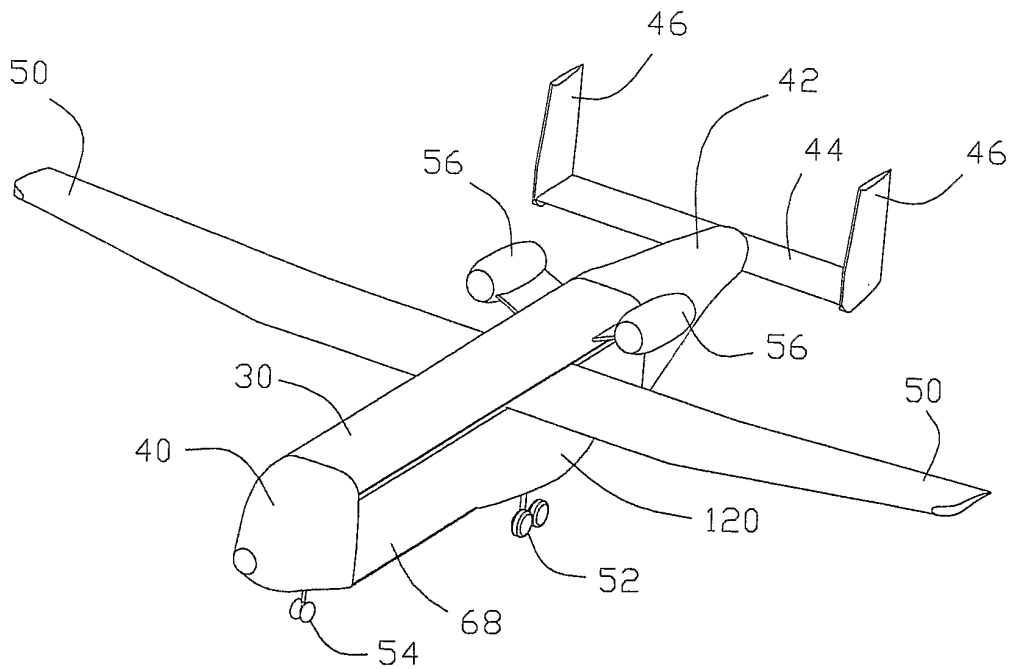


Fig. 17

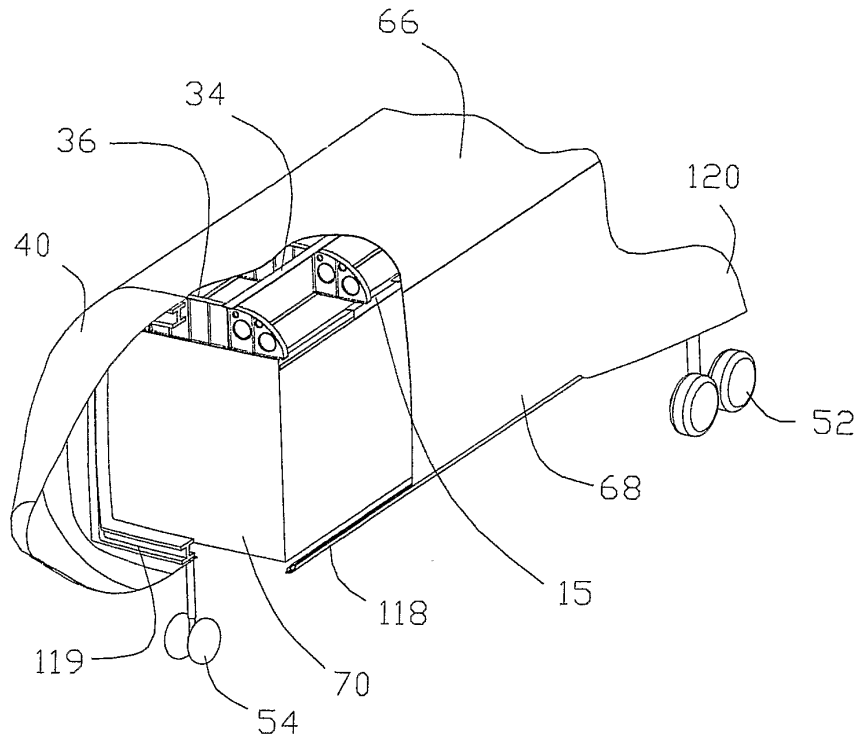


Fig. 18

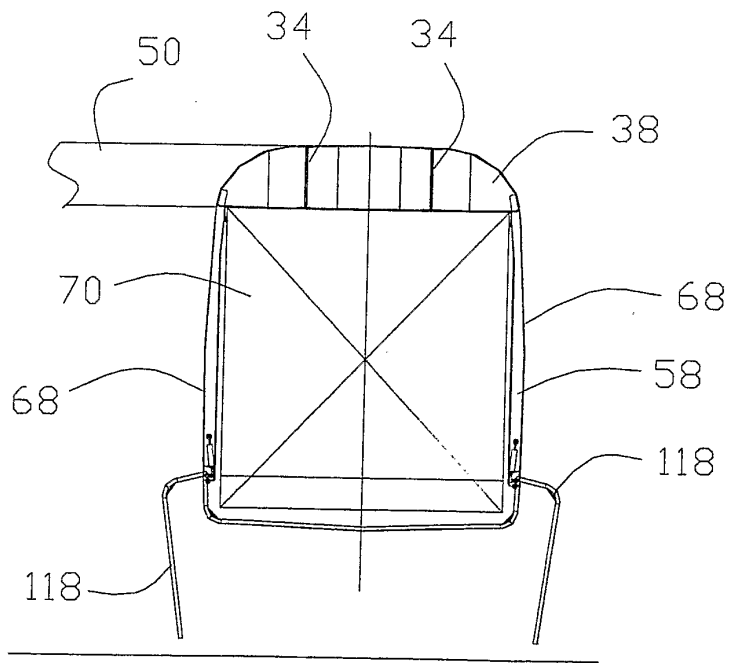


Fig. 19

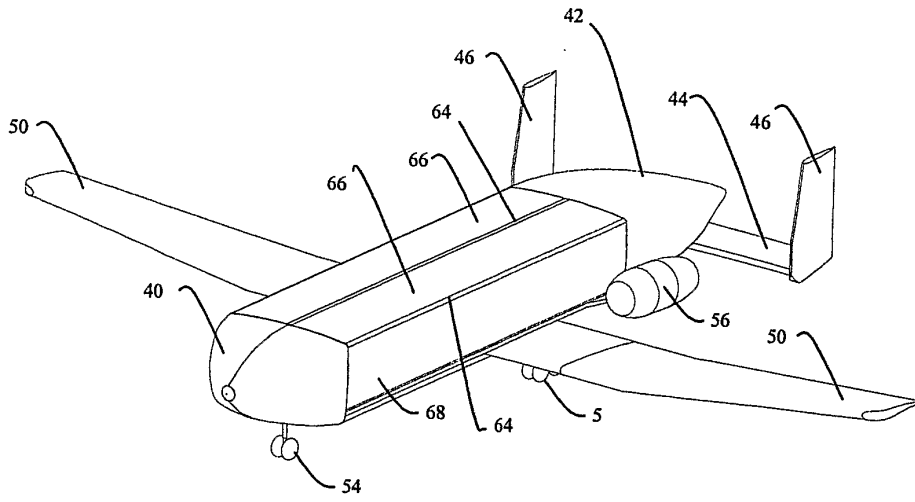


Fig. 20

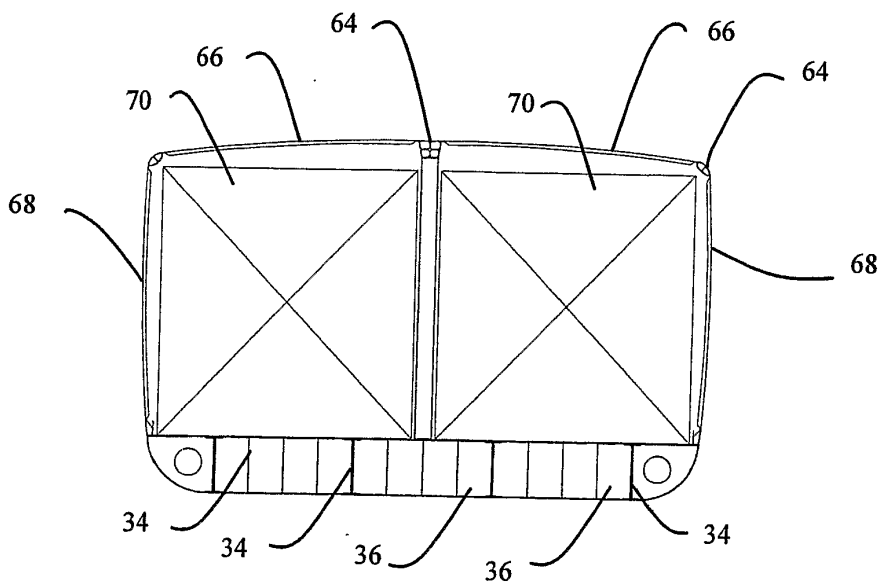


Fig. 21

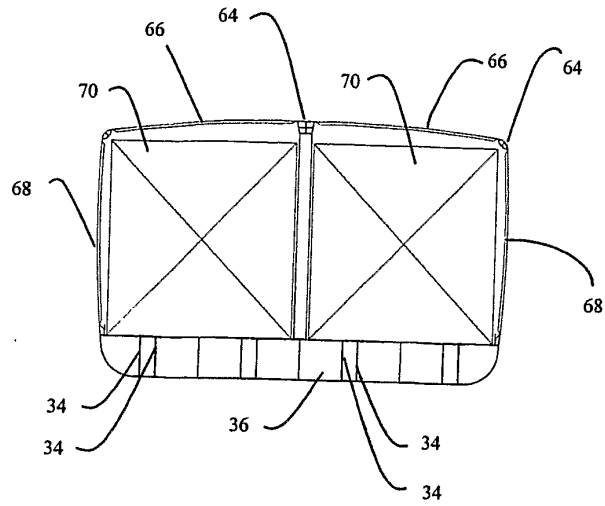


Fig. 22

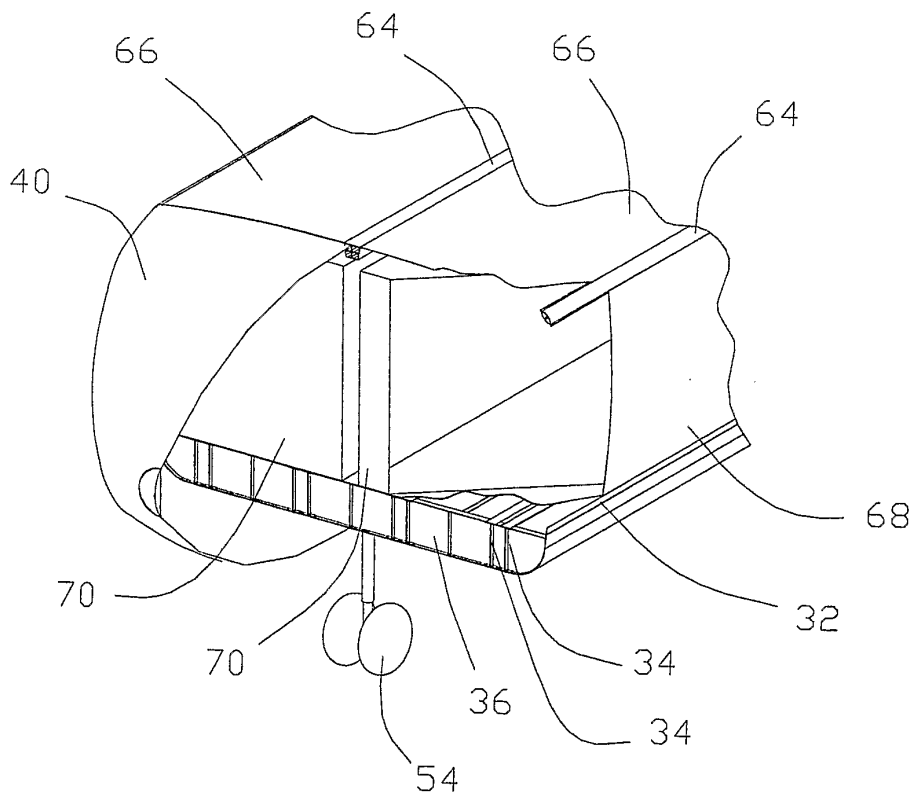


Fig. 23

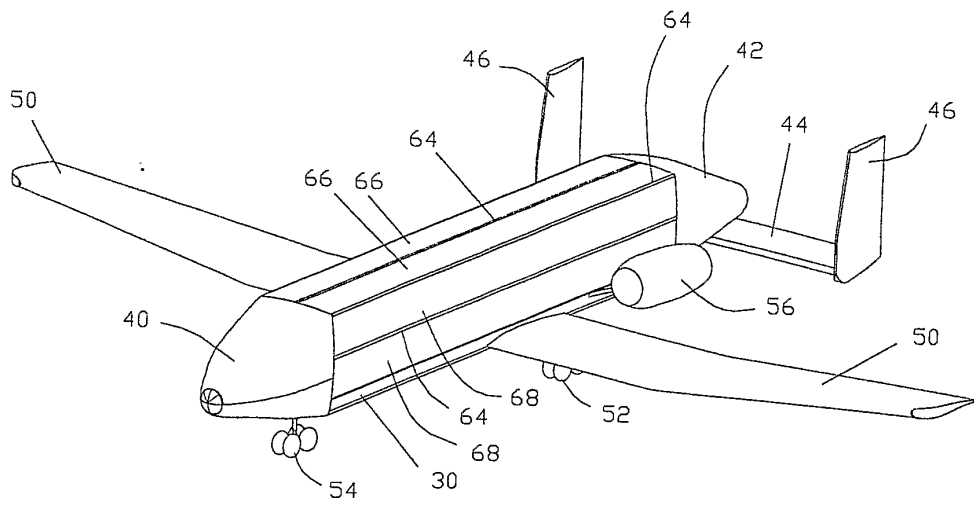


Fig. 24

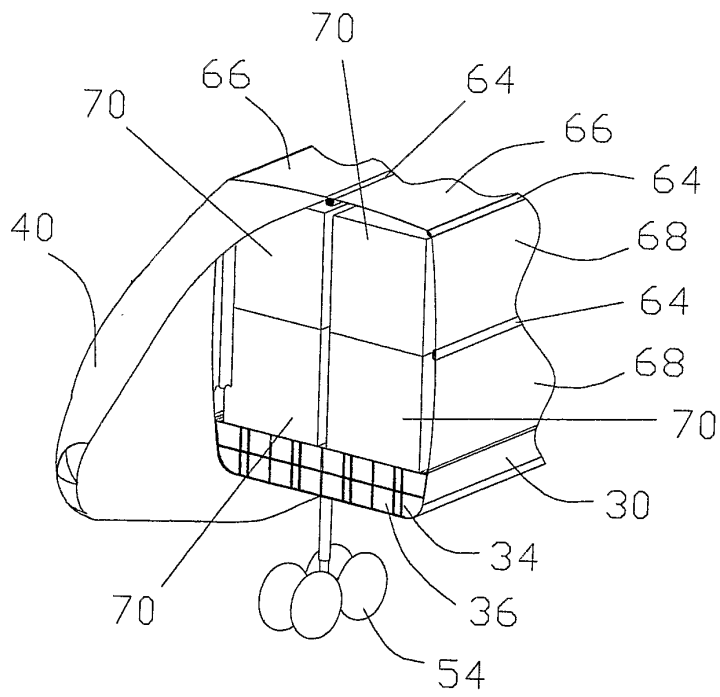


Fig. 25

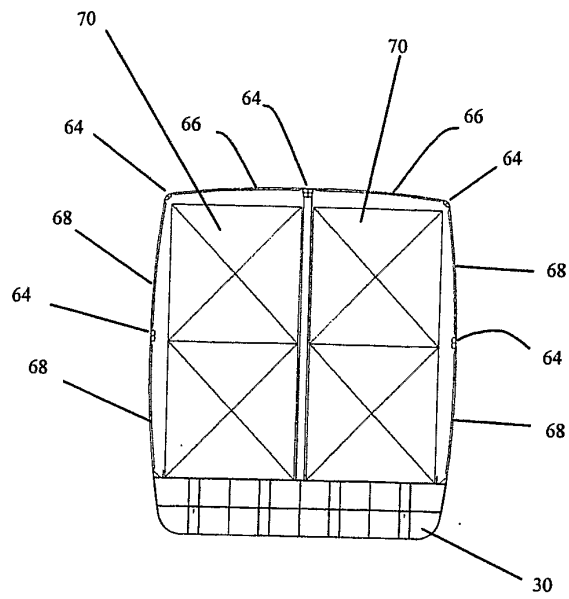


FIG. 26

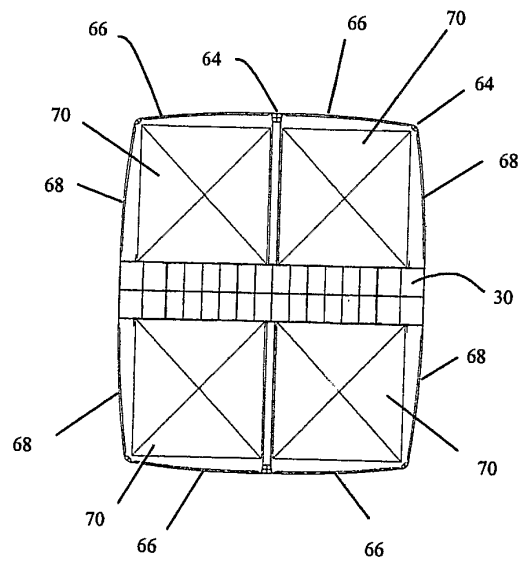


FIG. 27

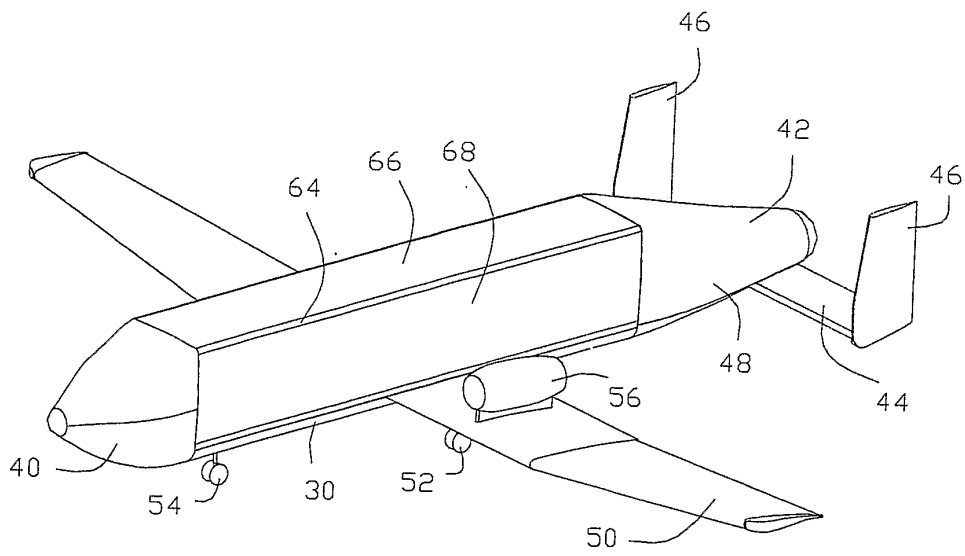


Fig. 28

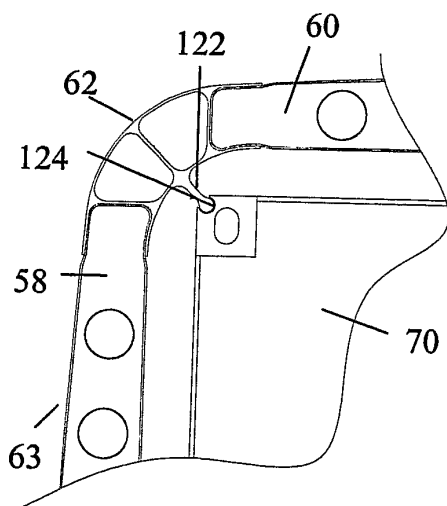


FIG. 29

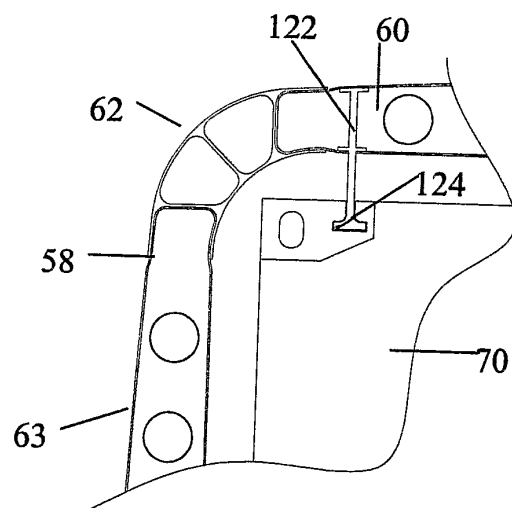


FIG. 30

REFERENCES CITED IN THE DESCRIPTION

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