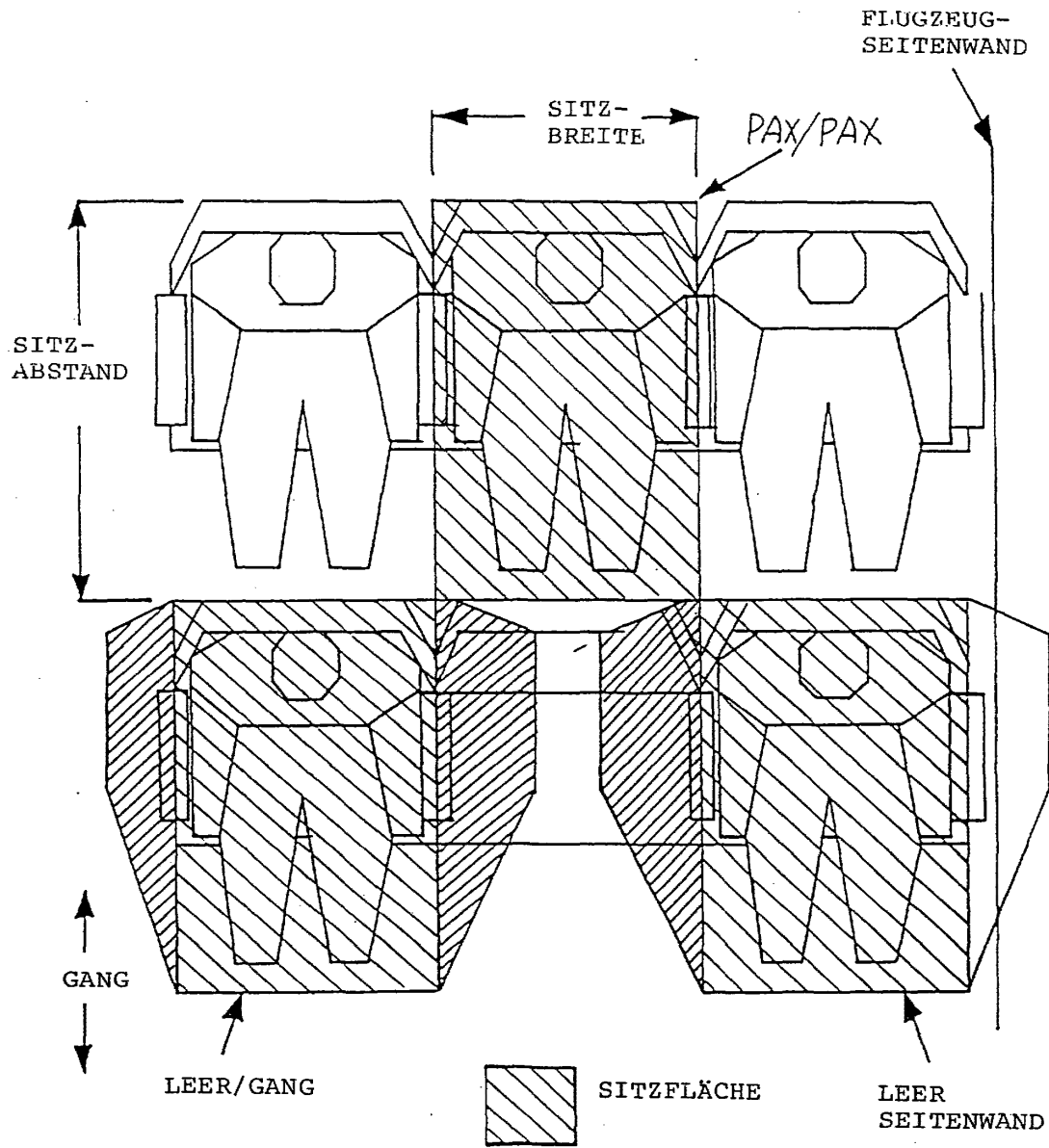


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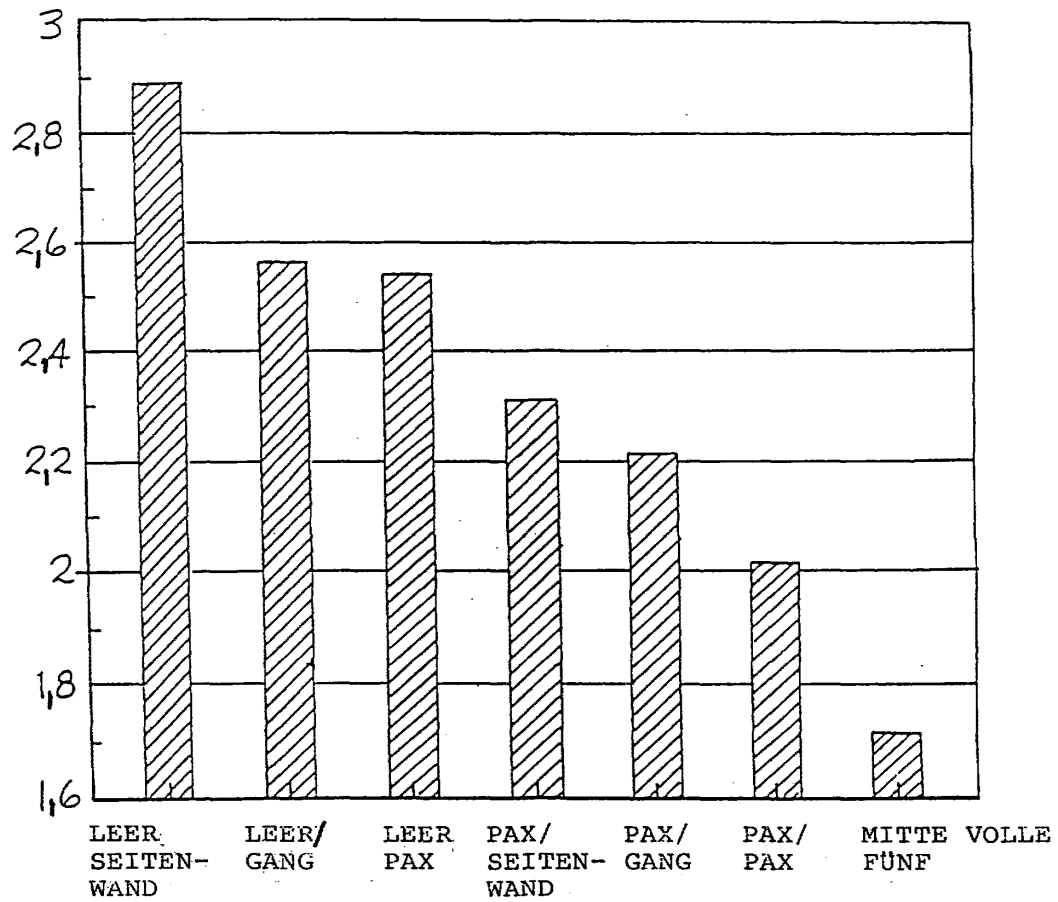


*Fig. 3*

BRAUCHBARE  
ZUSÄTZLICHE  
FLÄCHE

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MITTLERER KOMFORTNENNWERT



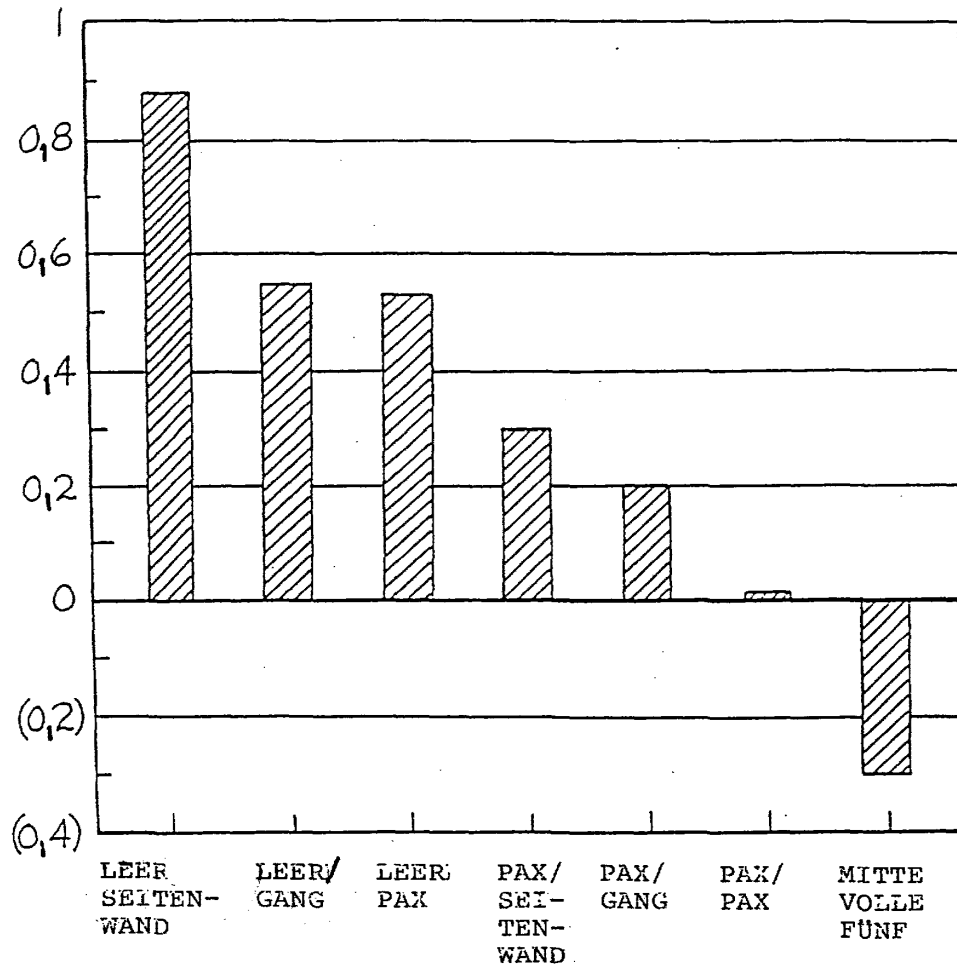
PASSAGIERE GESETZT ZWISCHEN

*Fig. 4*

4/14

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MITTLERER KOMFORTNENNWERT

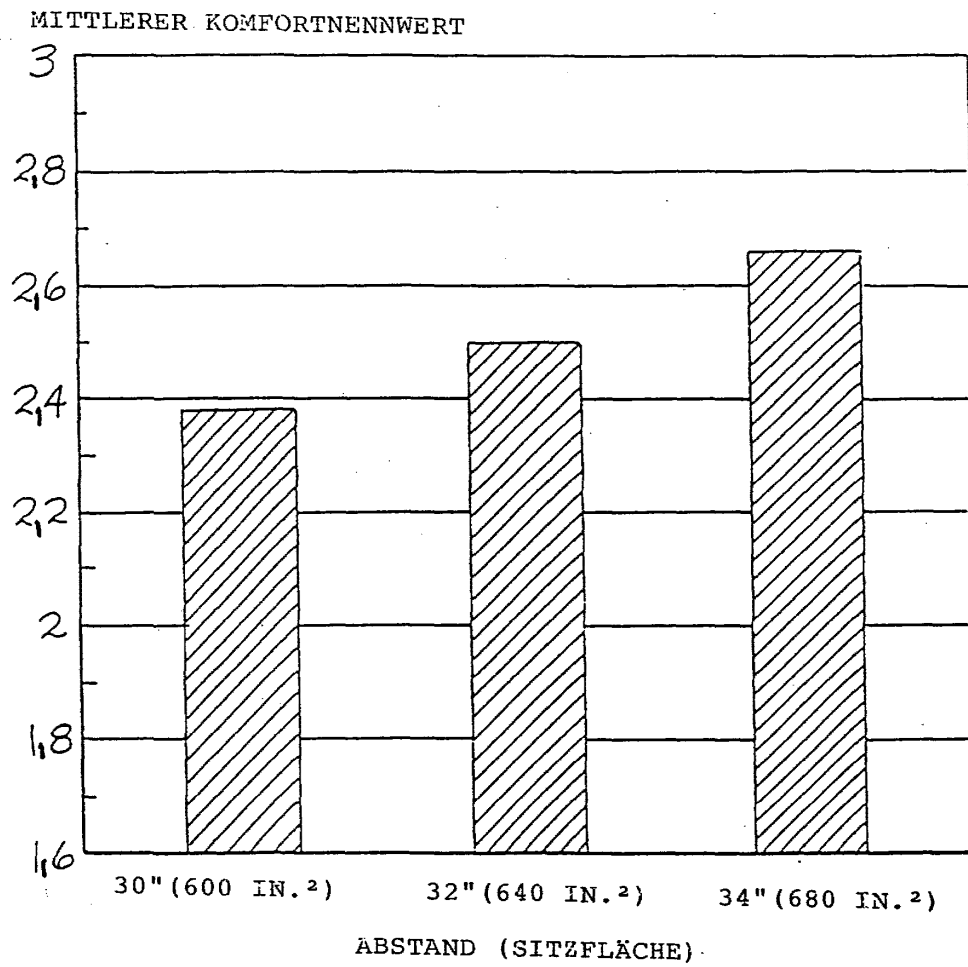


PASSAGIERE GESETZT ZWISCHEN

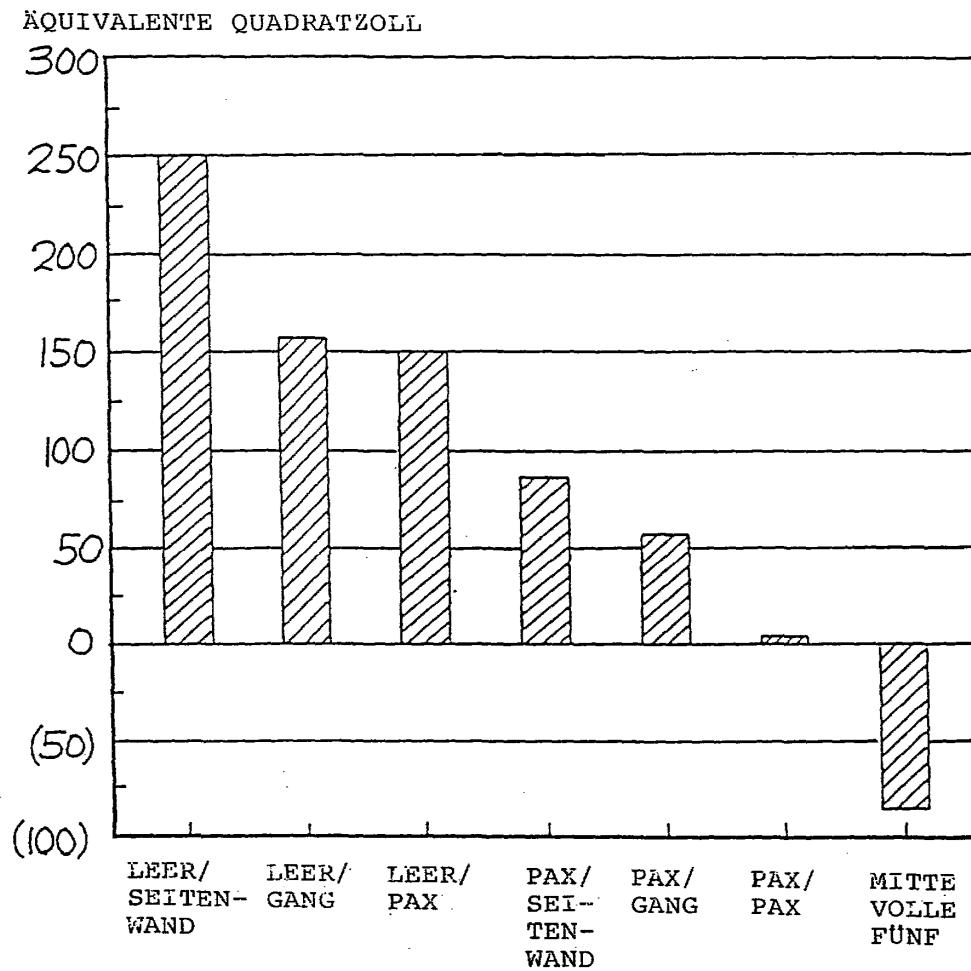
*Fig. 5*

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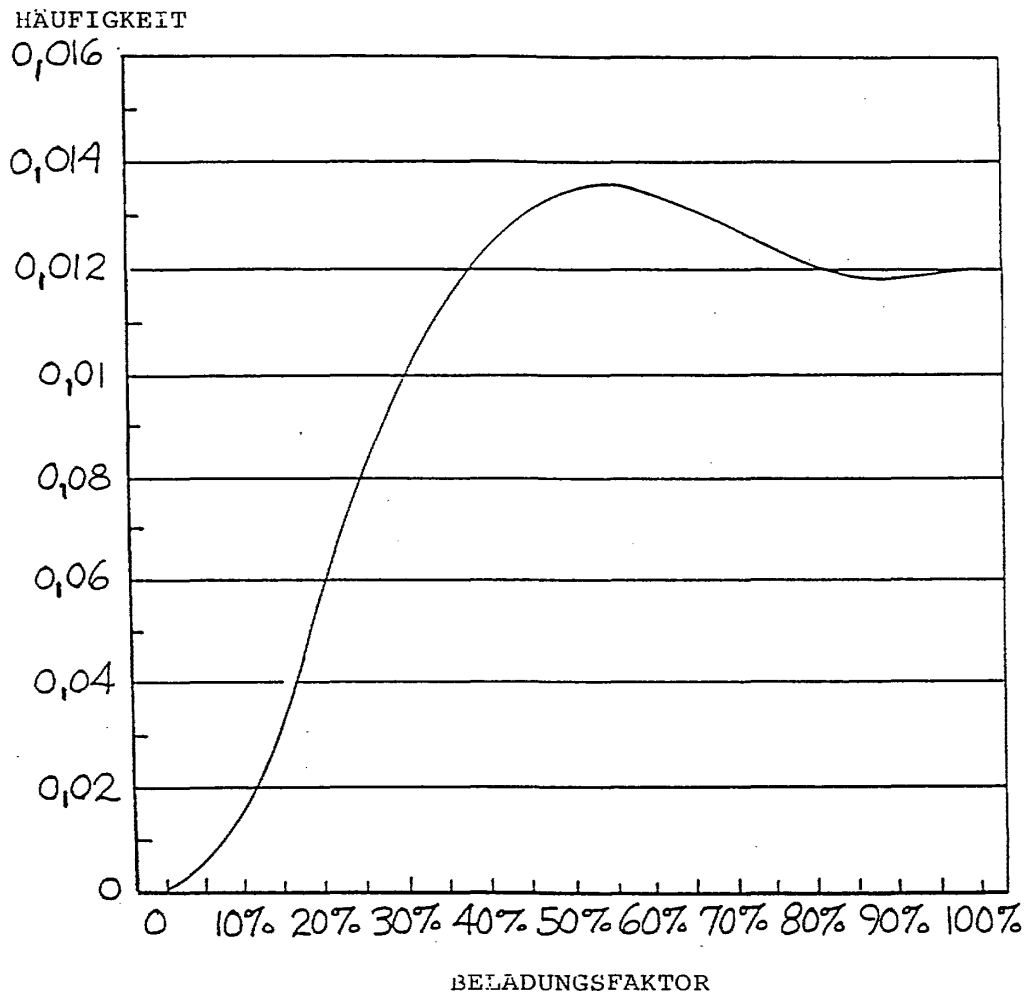
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PASSAGIERE GESETZT ZWISCHEN:

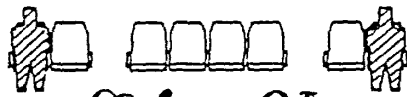
*Fig. 7*

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*Fig. 8*

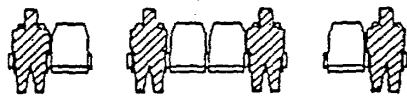
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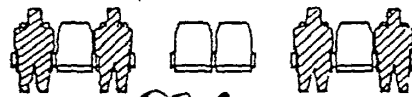
*Fig. 9A*



*Fig. 10A*



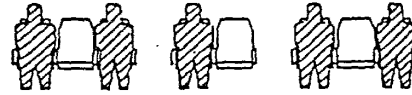
*Fig. 9B*



*Fig. 10B*



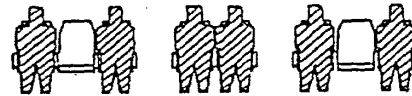
*Fig. 9C*



*Fig. 10C*



*Fig. 9D*



*Fig. 10D*



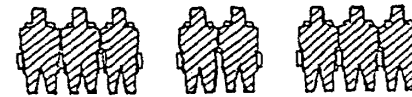
*Fig. 9E*



*Fig. 10E*

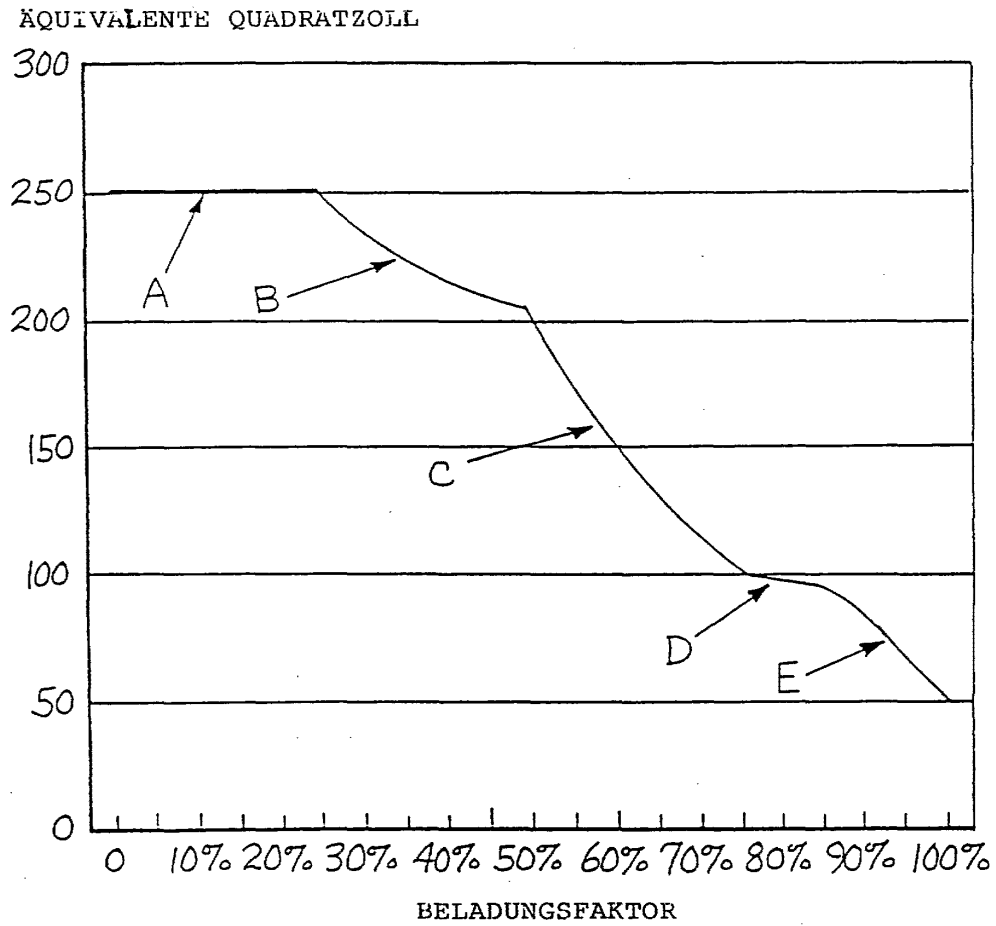


*Fig. 9F*



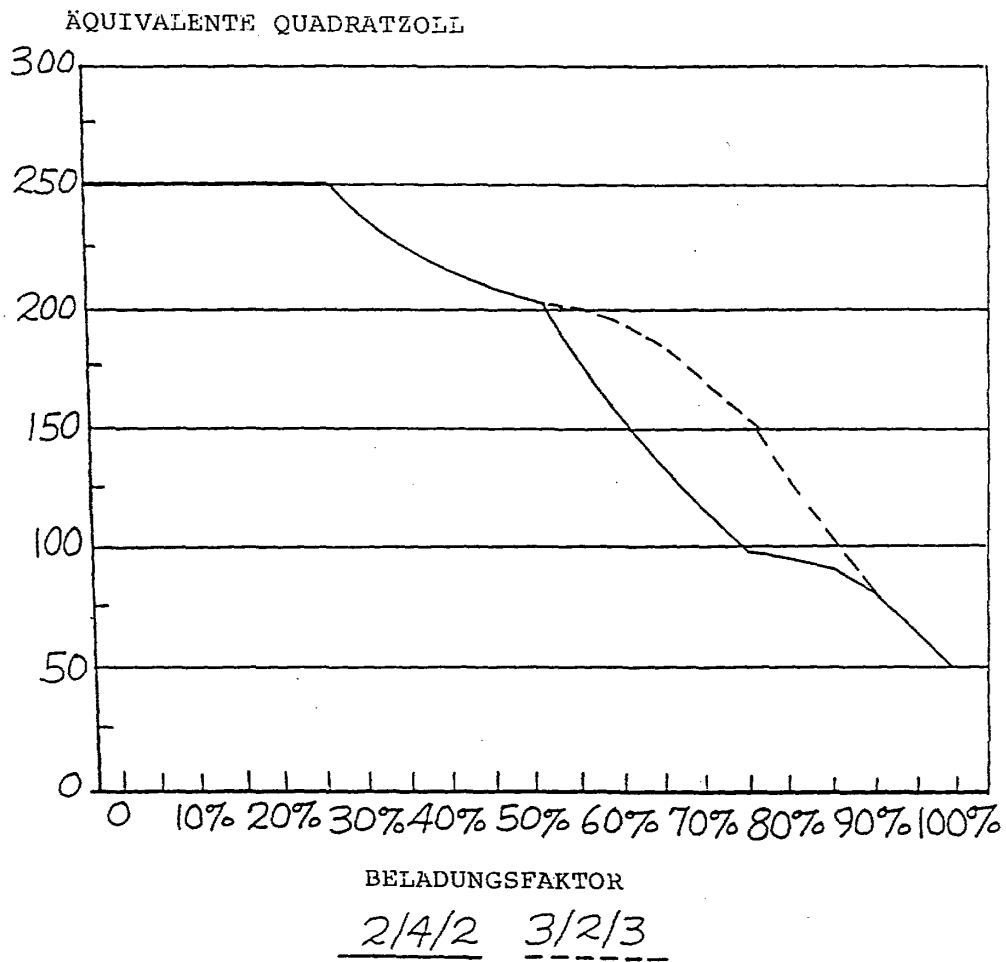
*Fig. 10F*

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*Fig.11*

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*Fig. 12*

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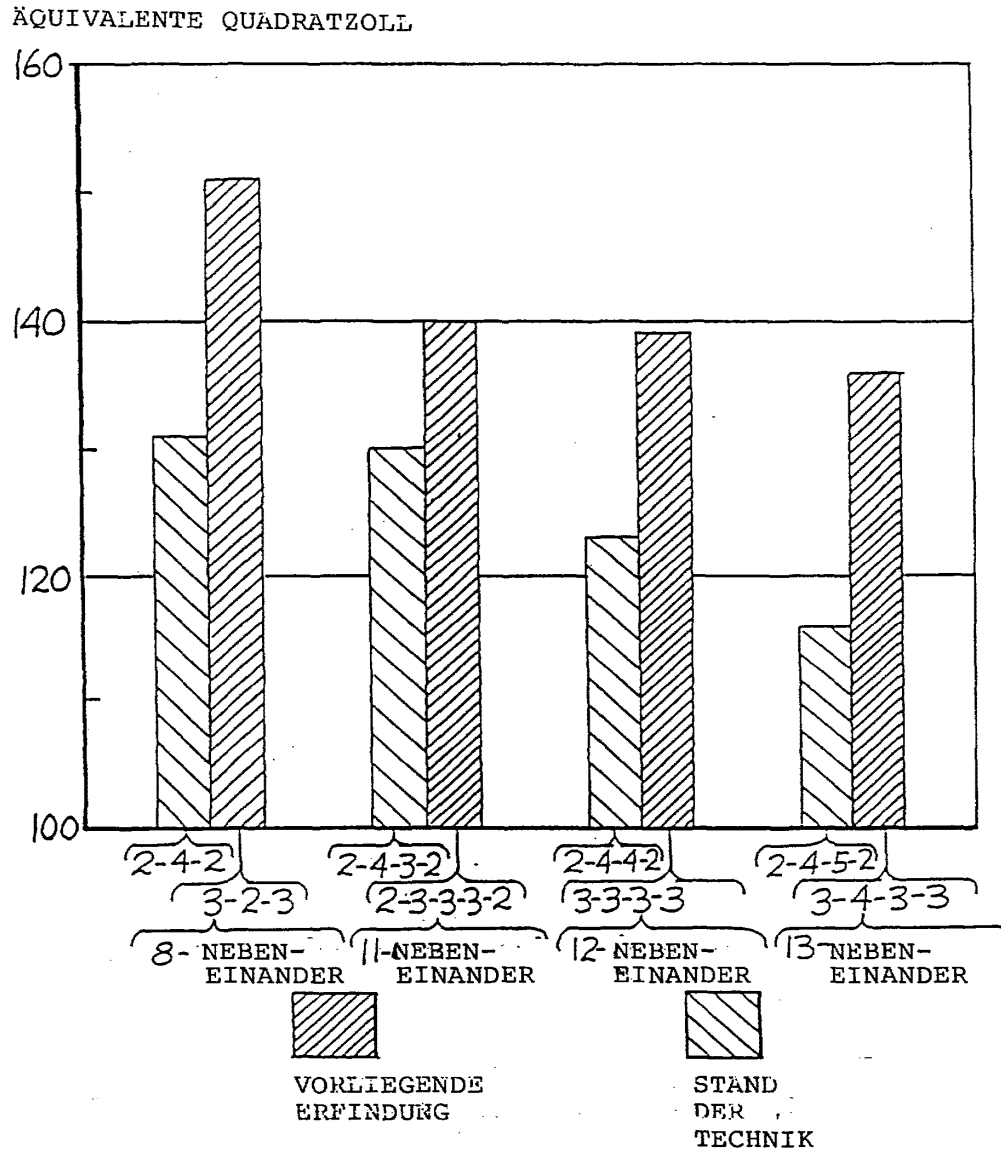
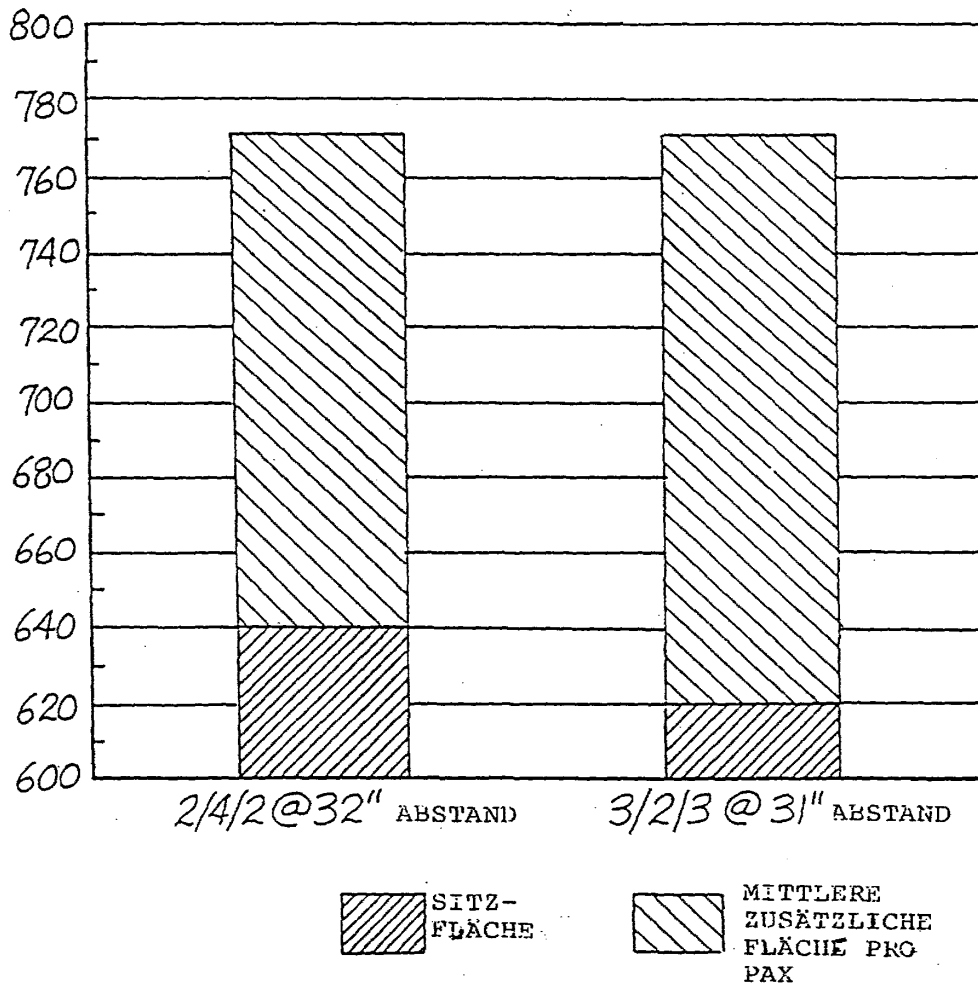


Fig.13

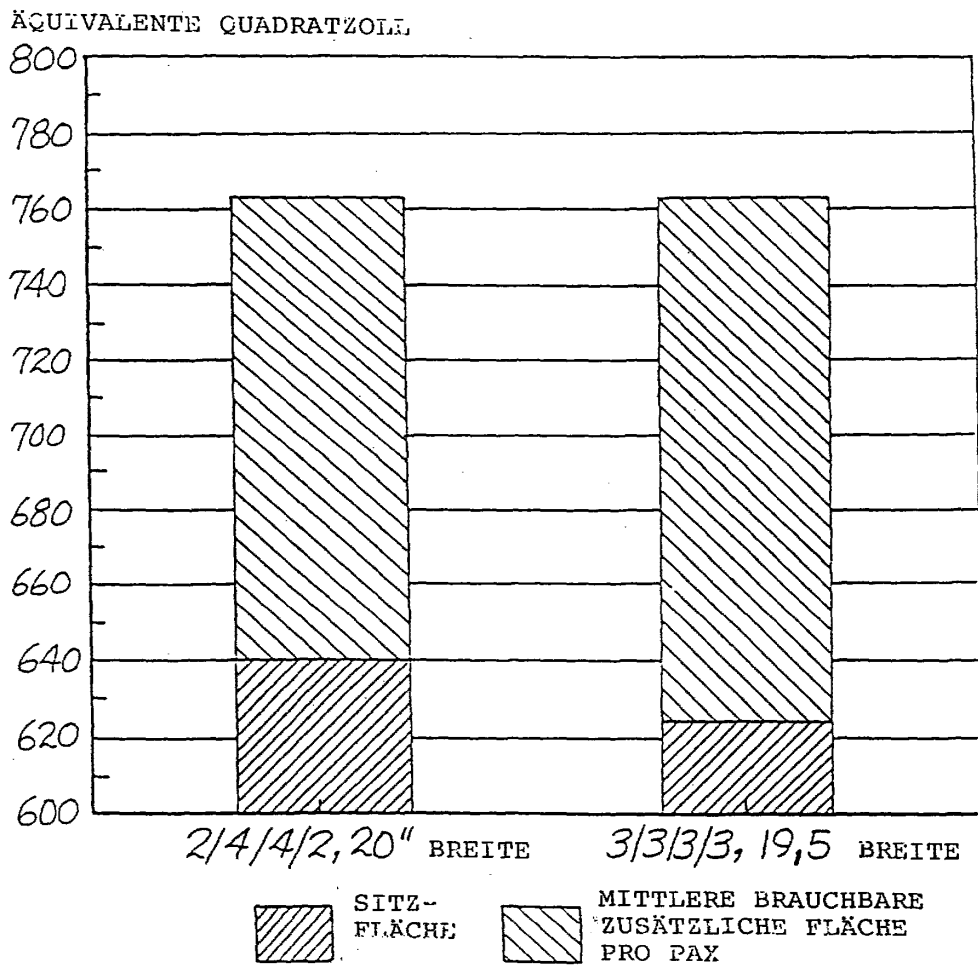
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AQUIVALENTE QUADRATZOLL



*Fig. 14*

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*Fig. 15*



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(54) Bezeichnung: **Fluggastsitz, drehbar und veränderbar in ein Bett**

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## Beschreibung

### Bereich der Erfindung

[0001] Diese Erfindung betrifft Flugzeugpassagiersitze: Insbesondere betrifft die vorliegende Erfindung zurücklegbare Sitze, wodurch Passagiere in einer normaleren horizontalen Lage schlafen können. Noch genauer betrifft die vorliegende Erfindung vollständig zurücklegbare Flugzeugpassagiersitze, welche den Mittelgangplatz ausnutzen können, während sich das Flugzeug im Flug befindet.

[0002] Die US-A-4,834,452 offenbart einen Wirbelsitz und Rahmen, auf welchem der Sitzrahmen für einen einzelnen Sitz gleitbar und drehbar an der Basis angebracht ist.

### Hintergrund der Erfindung

[0003] Da handelsübliche Flugzeuge größere Reichweiten erreichen und die Flugpläne der Fluggesellschaften mehr lang dauernde Flüge ohne Zwischenstopp enthalten, gibt es eine ansteigende Nachfrage bzgl. einer Bestuhlung in einer hochwertigen Klasse, wodurch Passagiere vollständig zurückliegend schlafen können, d. h. in einer normaleren entspannenden horizontalen Lage. Das Bereitstellen einer herkömmlichen nach vorn gerichteten Bestuhlung, welche in eine vollständig zurückgelegte Lage zurückgelegt wird, besitzt bestimmte offensichtliche Nachteile. Z. B. müssen die Sitze mit einem Abstand montiert sein, d. h. einer Entfernung zwischen entsprechenden Punkten an den Sitzen, welche die Länge eines wahrscheinlich anzutreffenden größten Passagiers übersteigt und genug Platz für am Fenster sitzende Passagiere bietet, um Zugang zu dem Mittelgang zu ermöglichen, wenn der am nächsten an dem Mittelgang befindliche Sitz, d. h. der Mittelgangssitz, vollständig zurückgelegt ist. Sitzabstände in der Größe von 80 Inch sind für diesen Einsatz gängig. Solche Sitzabstände reduzieren die Sitzkapazität oder die Anzahl der Sitze des Flugzeuges dramatisch und vermindern deshalb den Ertrag, welcher durch das Flugzeug erzielt werden kann.

[0004] Das Problem solch ineffizienter Platzausnutzung wird durch die Tatsache verschlimmert, dass die Passagiere nur in einigen Flugphasen oder Abschnitten und nicht während aller Teile dieser Abschnitte schlafen wollen. Zum Beispiel fliegen nach Osten gehende Transatlantikflüge typischerweise bei Nacht und die meisten Passagiere wollen schlafen, wenn der Essbetrieb abgeschlossen ist. Im Gegensatz dazu fliegen nach Westen gehende Transatlantikflüge bei Tageslicht, wobei nur eine geringe Nachfrage nach Schlafmöglichkeiten besteht. Es wurde kein betriebsfähiges Konzept gefunden, Flugzeuge für solche nach Westen und nach Osten gehenden Flüge unterschiedlich auszugestalten.

[0005] Verschiedene Konzepte sind beschrieben worden oder sind im Einsatz, um den Verlust bzgl.

der Sitzanzahl, welcher auf Grund der vollständig zurücklegbaren Bestuhlung erfolgt, zu minimieren. Zum Beispiel haben einige Fluggesellschaften die Sitze in der Art eines Fischgrätenmusters oder einer Staffe-lung in dem vorderen Bereich des Boeing-Modells **747** angeordnet (Ref.ritisches Patent GB 2,295,962, welches Dryburgh und anderen zuerkannt ist). Diese Anordnung hat zu einer bescheidenen Verminderung des Verlustes bzgl. der Sitzanzahl, welcher auf Grund der Montage der vollständig zurücklegbaren Sitze erfolgte, geführt.

[0006] Ein anderes Beispiel ist die Bereitstellung von alternativen Schlafmöglichkeiten in Abschnitten des Flugzeuges, welche typischerweise nicht für eine Passagierbestuhlung verwendet werden, z. B. in dem unteren Frachtraum oder über der Passagierkabineendecke. Jedoch haben sich diese Bereitstellungen aus verschiedenen Gründen nicht als beliebt erwiesen. Einbauten im unteren Frachtraum kann Einkommen erzeugende Fracht verdrängen und besitzt somit, allgemein gesprochen, keine erwiesene Attraktivität. Bei den meisten handelsüblichen Flugzeugen gibt es keinen benutzbaren Platz über der Passagierdecke. Bei solchen Flugzeugen, bei welchen Platz verfügbar ist, ist er von begrenzter Größe – insbesondere Höhe. Der Zugang zu Bereichen oberhalb der Decke wie auch des unteren Frachtraumes ist auch schwierig. Letztendlich glaubt man, dass Passagiere es nicht mögen, physisch von ihrem zugewiesenen Sitz getrennt zu sein, während die persönlichen Sachen dort verstaut sind, während sie schlafen.

[0007] Breite Mittelgänge, welche merklich breiter als solche sind, welche für eine Notfall-evakuierung benötigt werden, sind typischer Weise in Passagierkabinen der ersten Klasse und der Business-Class ("hoher Ertrag") bei interkontinentalen Flügen vorhanden. Die breiten Mittelgänge sorgen für eine Erleichterung des Einsteigens und der Beweglichkeit des Passagiers in der Kabine während der Essbetrie-b stattfindet. Insbesondere die Federal Aviation Administration fordert ein Minimum von 15 Inch breiten Mittelgängen für eine Passagiernotfall-evakuierung. Im Gegensatz dazu sind Mittelgänge in der ersten Klasse bei dem Boeing-Modell **747** typischerweise 34 Inch breit. Sowohl in der ersten Klasse des Boeing-Modells **777** als auch in der Business-Class im Oberdeck des Boeing-Modells **747** sind die Mittelgänge 29 Inch breit. In der Zeit vom Abschluss des Abendessbetriebes bis das Frühstück serviert wird, also zu der Zeit, wenn die Schlafmöglichkeiten am meisten benötigt werden ("Nachtzeit"), sind solche breiten Mittelgänge unnötig. Dieser Platzverwendungszyklus sorgt somit für eine Geschäftsgelegenheit für Fluggesellschaftseigentümer und Betreiber, um die Einkommen erzeugende Leistung und somit den Wert ihrer handelsüblichen Flugzeuge zu steigern. Die Passagiersitzanordnungen der vorliegenden Erfindung erfüllen diesen Bedarf der Fluggesellschaftseigentümer und Betreiber vollständig.

[0008] Zusätzlich besitzt das einzigartige Oberdeck

des Boeing-Modells **747** schräge Seitenwände, was den Platz neben den Seitenwänden des Innenraumes des Flugzeuges unbenutzbar für ein aufrechtes Sitzen macht. Die Passagiersitzanordnungen der vorliegenden Erfindung verwenden den Raum unterhalb der Seitenwand zusätzlich zu dem Raum des Mittelganges, um für Schlafunterbringungen zu sorgen.

#### Zusammenfassung der Erfindung

[0009] Eine Aufgabe der vorliegenden Erfindung ist, die Bereitstellung eines Verfahrens und einer Vorrichtung zur Verbesserung der Einkommen erzeugenden Eigenschaft eines Fahrzeuges, wie z. B. eines herkömmlichen Flugzeuges.

[0010] Eine andere Aufgabe dieser Erfindung ist, eine Flugzeugpassagiersitzanordnung bereitzustellen, welche von den Flugzeugpassagieren während aller Phasen eines Flugzeugfluges verwendet werden kann.

[0011] Noch eine andere Aufgabe der momentanen Erfindung ist, eine vollständig zurücklegbare Sitzanordnung bereitzustellen, welche einen entspannungsvollen Schlaf eines Passagiers der Fluggesellschaft während der Nachtphase eines Flugzeugfluges erlaubt.

[0012] Noch eine andere Aufgabe der vorliegenden Erfindung ist, die Bereitstellung einer Bestuhlungsanordnung, welche das Mehr an Breite des Mittelganges während der Nachtzeit und anderen Platz, welcher in bestimmten Flugzeugen verfügbar ist, vorteilhaft ausnutzt, um für Schlafunterbringungen zu sorgen, wenn sie am meisten von Passagieren der Fluggesellschaft gewünscht werden.

[0013] Eine zusätzliche Aufgabe der vorliegenden Erfindung ist die Bereitstellung einer vereinfachten Bestuhlungsanordnung, welche das Mehr an Breite des Mittelganges während der Nachtzeit und anderen Platz, welcher in bestimmten Flugzeugen verfügbar ist, vorteilhaft ausnutzt, um für Schlafunterbringungen zu sorgen, wenn sie am meisten von Passagieren der Fluggesellschaft gewünscht werden.

[0014] Eine andere zusätzliche Aufgabe der vorliegenden Erfindung ist die Bereitstellung eines Verfahrens zum Aufstellen eines Flugzeugpassagiersitzes aus einer Tagposition in eine Nachtposition.

[0015] Die vorliegende Erfindung ist in den beigefügten Ansprüchen definiert.

#### Kurze Beschreibung der Zeichnungen

[0016] Die vorhergehenden und andere Merkmale und Vorteile der vorliegenden Erfindung sind mit Bezug auf die folgende detaillierte Beschreibung einer Ausführungsform der Erfindung und durch die beigefügten Zeichnungen besser zu verstehen, wobei gleiche Bezugszeichen dieselben oder ähnliche Teile bezeichnen und wobei gilt:

[0017] **Fig. 1** ist eine Vorderansicht des Oberdecks

eines Boeing-Modells **747** und stellt Passagiersitze sowohl in einer Tagals auch in einer Nachtposition dar.

[0018] **Fig. 2** ist eine Draufsicht des Oberdecks von **Fig. 1** und stellt erstklassige Passagiersitze in der Tag-, einer Zwischen- und der Nachtposition dar.

[0019] **Fig. 3** ist eine isometrische Explosionsansicht der vollständig zurücklegbaren, drehbaren Flugzeugpassagier-Schlafsitzeanordnung der vorliegenden Erfindung.

[0020] **Fig. 4** ist eine isolierte Draufsicht der Untersitz-Unteranordnung der erfindungsgemäßen Sitzanordnung.

[0021] **Fig. 5** ist eine Seitenansicht der Untersitz-Unteranordnung entlang der Linie 5-5 in **Fig. 4**.

[0022] **Fig. 6** ist eine isolierte Draufsicht der gleitenden Karussell-Unteranordnung der vorliegenden Sitzanordnung.

[0023] **Fig. 7** ist eine Seitenansicht der gleitenden Karussell-Unteranordnung entlang der Linie 7-7 in **Fig. 6**.

[0024] **Fig. 8** ist eine isolierte Draufsicht der oberen Sitzbasis-Unteranordnung der vorliegenden Erfindung.

[0025] **Fig. 9** ist eine Seitenansicht der oberen Sitzbasis-Unteranordnung entlang der Linie 9-9 in **Fig. 8**.

[0026] **Fig. 10** ist eine Draufsicht der erfindungsgemäßen Sitzbasis-Anordnung in der Tagposition.

[0027] **Fig. 11** ist eine Seitenansicht der Sitzbasis-Anordnung entlang der Linie 11-11 in **Fig. 10**.

[0028] **Fig. 12** ist eine Draufsicht der vorliegenden Sitzbasis-Anordnung in einem ersten Zwischenzustand, wenn die Sitzanordnung aus einer Tagposition in eine Nachtposition umgesetzt wird.

[0029] **Fig. 13** ist eine Draufsicht der momentanen Sitzbasis-Anordnung in einem zweiten Zwischenzustand, wobei die Anordnung in die Nachtposition geschwenkt wird.

[0030] **Fig. 14** ist eine Draufsicht der erfindungsgemäßen Sitzbasis-Anordnung, wobei sich die Anordnung in einem dritten Zwischenzustand befindet, kurz bevor sie in die Nachtposition arretiert wird.

[0031] **Fig. 15** ist eine Draufsicht der Sitzbasis-Anordnung, wobei die Anordnung in einem Endzustand oder in der Nachtposition arretiert dargestellt ist.

[0032] **Fig. 16** ist eine Draufsicht der vereinfachten Sitzbasis-Anordnung der vorliegenden Erfindung in der Tagposition.

[0033] **Fig. 17** ist eine Seitenansicht der vereinfachten Sitzbasis-Anordnung entlang der Linie 17-17 in **Fig. 16**.

[0034] **Fig. 18** ist eine isometrische Explosionsansicht der vereinfachten Sitzbasis-Anordnung der vorliegenden Erfindung.

#### Detaillierte Beschreibung der bevorzugten Ausführungsform

[0035] Nun wird mit Bezug auf **Fig. 1** die Vorderansicht des Oberdecks **10** eines Boeing-Modells **747**

dargestellt. Diese Sektion des Flugzeug-Modells **747** wird von den Fluggesellschaften am häufigsten für den Passagierbetrieb der ersten Klasse oder Business Class eingesetzt. Überall in dem Oberdeck sind eine Mehrzahl von erfindungsgemäßen Passagiersitzen **15** herkömmlich an Sitzschienen **20** und benachbart zu auf dem Boden angebrachten Ladungskästen **25**, welche in der Nähe der Oberdeck-Seitenwände **30** positioniert sind, angebracht. Auf der linken Seite der **Fig. 1** ist ein schwenkbarer, vollständig zurücklegbarer Passagiersitz der vorliegenden Erfindung dargestellt, welcher nach vorn gerichtet und in einer Position ausgerichtet ist, welche während des Einsteigens, des normalen Fluges (einschließlich des Essbetriebes) und des Aussteigens, d. h. die so genannte "Tag"-Position **35**, verwendet wird. Der Passagiersitz ist der Einfachheit halber in **Fig. 1** als eine Zweisitzereinheit oder ein "Doppel" dargestellt, obwohl die vorliegende Erfindung nicht notwendigerweise auf Doppel beschränkt ist. Diese Doppelsitze umfassen Stützbeine **40**, welche an den Sitzschienen **20** angebracht sind, zwei Sitzbodenpolster **50**, eine Mittelarmlehne **55**, zwei Außenarmlehnen **60**, ein Paar Rückenlehnen **65** und ein Paar Beinlehnen **70**.

[0036] Die rechte Seite der **Fig. 1** offenbart eine Seitenansicht des Doppels in einer vollständig zurückgelegten oder einer "Nacht"-Position **75**. Die Nachposition erlaubt Passagieren, einen gemütlichen Schlaf in einer normaleren horizontalen Ebene zu genießen. Wie es im folgenden besser verstanden wird, können die erfindungsgemäßen Sitzeinheiten von der Seitenwand zu dem Mitteldurchgang versetzt und in die Nachposition geschwenkt werden, wie es auf der rechten Seite der **Fig. 1** dargestellt ist.

[0037] Wie es genauer in dem oberen Teil der Draufsicht der **Fig. 2** dargestellt ist, wobei die erstklassigen Sitze nach vorn gerichtet in einer Tagposition **35**, d. h. zum Einsteigen, Essbetrieb und Aussteigen nach vorn gerichtet, dargestellt sind. Nachdem der Essbetrieb abgeschlossen ist, nach welchem die Passagiere gewöhnlich wünschen, sich für die Nachtphase des Fluges zurückzuziehen, werden die Sitze aus der Tagposition, dargestellt mit **35**, in eine Zwischenposition, dargestellt mit **80**, und dann in einer Endposition gedreht, dargestellt mit **85**. Die untere rechte Seite der **Fig. 2** stellt die Rückenlehnen und Beinlehnen der erfindungsgemäßen Schlafpassagiersitze vollständig zurückgelegt bzw. verlängert **75** dar.

[0038] Der vollständig zurücklegbare schwenkende Flugzeugpassagiersitz der vorliegenden Erfindung ist genauer in **Fig. 3–15** dargestellt. Insbesondere umfasst die Passagiersitzanordnung eine Untersitz-Unteranordnung **90**, eine gleitende Karussell-Unteranordnung **95**, eine obere Sitzbasis-Unteranordnung **100** und eine herkömmliche obere Sitz-Unteranordnung **105** (in **Fig. 4–15** zur Übersichtlichkeit und Einfachheit nicht dargestellt).

[0039] Wie es am besten in **Fig. 4** und **5** zu sehen ist, umfasst die Untersitz-Unteranordnung einen In-

nen- und einen Außenrahmen **110**, **115**. Jeder Rahmen umfasst herkömmliche Sitzbeine, welche an ein horizontales Rahmenteil angebracht sind. Die Sitzbeine sind jeder herkömmlich an den Befestigungsschienen **20** befestigt, welche in dem Boden des Flugzeuges angeordnet sind. Das horizontale Innenrahmenteil ist typischerweise durch zwei Querkoppelrohre **120** mit dem horizontalen Außenrahmen verbunden, wie es momentan Praxis ist.

[0040] Ein erster elektrischer, pneumatischer oder hydraulischer Motor **125** ist an dem horizontalen Außenrahmenteil befestigt und dreht im Einsatz eine erste Antriebsschraube **130**, welche sich von dem Außenrahmen zu dem Innenrahmen erstreckt. Das distale Ende **135** der ersten Antriebsschraube wird in einem Lager gehalten, welches mit dem horizontalen Innenrahmenteil verbunden ist und in einer hexagonalen Form abgeschlossen ist, um für das Anbringen einer Handkurbel oder eines Schraubenschlüssels für den Fall eines Energie- oder Motorausfalls zu sorgen. Ein erstes Paar Verriegelungsstifte **140** sind an dem horizontalen Teil des Innenrahmens **110** angebracht oder daran ausgebildet und erstrecken sich von der Untersitz-Unteranordnung nach außen. Ein zweites Paar Verriegelungsstifte **145** sind an dem horizontalen Teil des Außenrahmens **115** angebracht oder daran ausgebildet und erstrecken sich nach innen zu dem Innenrahmen. Wie es im Folgenden besser verstanden wird, befinden sich das erste Paar Stifte und das zweite Paar Stifte parallel zu den Querkoppelrohren und verriegeln die erfindungsgemäße Passagiersitzanordnung entweder in einer Tag- oder in einer Nachtposition. Wie es in **Fig. 5** gesehen werden kann und im Folgenden besser verstanden wird, ist das zweite Paar Verriegelungsstifte **145** in einer horizontalen Ebene oberhalb derjenigen der Querkoppelrohre **120** angeordnet, damit sich ein Flansch, welcher Buchsen enthält, welche das zweite Paar Verriegelungsstifte aufnehmen, in einer horizontalen Ebene über den Querkoppelrohren und in den Anschluss mit dem zweiten Paar Verriegelungsstifte drehen kann.

[0041] Die gleitende Karussell-Unteranordnung ist in **Fig. 6** und **7** dargestellt, und ist, wie es besser verstanden wird, gleitbar an den Querrohren angebracht und stellt einen Halt für die obere Sitzbasis-Unteranordnung bereit. Die Karussell-Unteranordnung ist aus einer ersten flachen mittigen Platte **150** zusammengesetzt, welche mit zwei Innenarmen **155**, zwei Außenarmen **160**, einem in der ersten mittigen Platte an der Verbindungsstelle der Außenrahmen ausgebildeten Gewindeloch **165** ausgebildet ist. Ein unterer Abschnitt eines herkömmlichen Lagers **170** vom Typ "lazy Susan" ist mit der oberen Oberfläche der ersten flachen mittigen Platte zum Halten der oberen Sitzbasis-Unteranordnung befestigt und ermöglicht dieser, sich zu drehen. Ein zweiter elektrischer, pneumatischer oder hydraulischer Motor **175**, welcher schwenkbar an der oberen Oberfläche der ersten flachen mittigen Platte angebracht ist, treibt eine zweite Antriebsschraube **180** an. Jeder der Außenarme **160**

ist mit einer glatten Zylinderbohrung **185** genau wie jeder der Innenarme **155** versehen. Die Zylinderbohrungen in den Außen- und Innenarmen sind derart ausgerichtet und derart groß, dass sie den ungehinderten Durchgang eines der Querrohre **120** ermöglichen. Im Einsatz passen die Drehrohre ungehindert durch die ausgerichteten Lager **185** in den Innen- und Außenarmen, wodurch die Karussell-Unteranordnung leicht entlang der Querrohre zwischen dem Außen- und Innenrahmen gleiten kann. Wie es vielleicht besser in **Fig. 10–12** zu sehen ist, kann die erste Antriebsschraube **130** mittels Gewinde mit dem in der ersten mittigen Platte ausgebildeten Gewindeloch **165** gekoppelt sein, wobei im Einsatz, wenn der erste Motor **125** die erste Antriebsschraube in eine vorbestimmte Richtung im Uhrzeigersinn oder entgegen des Uhrzeigersinnes dreht, die Karussell-Unteranordnung entlang der Querrohre weg von oder zu der Seitenwand **30** des Flugzeuges gleitet oder umgesetzt wird.

[0042] Wie es besser in **Fig. 10–12** zu sehen ist, ist der untere Abschnitt des Lazy-Susan-Lagers **170**, welcher mit der ersten flachen mittigen Platte der Karussell-Unteranordnung befestigt ist, mit dem oberen Abschnitt des Lazy-Susan-Lagers **190** gekoppelt, welcher mit einer zweiten flachen mittigen Platte **195**, welche einen Teil der oberen Sitzbasis-Unteranordnung umfasst, befestigt ist. Im Einsatz halten der obere und der untere Abschnitt des Lazy-Susan-Lagers die obere Sitzbasis-Unteranordnung schwenkbar, und sind derart entworfen, dass die obere Sitzbasis-Unteranordnung um eine senkrechte Achse drehen kann während sie nach unten gerichtete Belastungen, welche, z. B. durch Passagiere, auf die Sitzanordnung wirken, tragen.

[0043] Genauer umfasst, wie in **Fig. 8** und **9** dargestellt, die obere Sitzbasis-Unteranordnung **100** den oberen Abschnitt des Lazy-Susan-Lagers **190**, welcher auf der unteren Oberfläche einer zweiten flachen mittigen Platte **195** angebracht ist, und einen schwenkbaren Zylinderblock **200**. Der Zylinderblock ist mit einem Gewindeloch versehen, dessen Achse parallel zu der Ebene der zweiten flachen mittigen Platte verläuft, und ist schwenkbar durch die zweite mittige Platte von der Unterseite her befestigt und wird durch eine Federklemme **205** auf der oberen Oberfläche der zweiten flachen mittigen Platte zurückgehalten. Im Einsatz befindet sich der Zylinderblock mittels Gewinde in Eingriff mit der zweiten Antriebsschraube **180**.

[0044] Wie in **Fig. 8** dargestellt umfasst der Sitzbasisrahmen, welcher die obere Sitzbasis-Anordnung abschließt, ein erstes und ein zweites Längsrohr **210**, **215**, ein erstes und ein zweites Innenquerrohr **220**, **225**, welche an Zwischenpunkten an die Längsrohre angebracht sind, und zwei Außenquerrohre **230**, welche an die distalen Enden der Längsrohre angebracht sind. Wie es im Folgenden besser verstanden wird, sind das erste und zweite Innenquerrohr **220**, **225** so nah wie praktisch möglich an den senkrechten

Ebenen positioniert, welche durch die Flugzeugssitzschienen in der Tagposition beschrieben sind, um so für einen direkten nach unten gerichteten Belastungspfad von der oberen Sitz-Unteranordnung zu den Flugzeugssitzschienen zu sorgen. Die Längsrohre, Innenquerrohre und Außenquerrohre können jeden geeigneten Querschnitt besitzen. Der Sitzbasisrahmen trägt die obere Sitz-Unteranordnung, welche, wie in **Fig. 1 & 3** dargestellt, herkömmliche Sitzkissen **50**, Armlehnen **55 & 60**, Rückenlehnen **65**, verlängerbare Beinlehnen **70** (zur Übersichtlichkeit in **Fig. 3** nicht dargestellt), eine Lebensrettungswesten-Aufbewahrung (nicht dargestellt), eine Unterhaltungsvorrichtung (nicht dargestellt) und verbundene Unterstützungsstrukturen (auch nicht dargestellt) umfasst. [0045] Wie in **Fig. 8** und **9** dargestellt sind das erste und das zweite Innenquerrohr mit einem ersten und zweiten Paar Tag-Buchsen **235**, **240** versehen, welche in einem ersten beziehungsweise einem zweiten Flansch **245**, **250** ausgebildet sind. Der erste und der zweite Flansch sind nach unten gerichtet an das erste beziehungsweise das zweite Innenquerrohr gebunden, wobei im Einsatz das erste und das zweite Paar Tag-Buchsen das erste und das zweite Paar Verriegelungsstifte aufnehmen beziehungsweise in Eingriff damit befindlich sein können. Ein Paar Nacht-Buchsen **255** sind in einem dritten Flansch **260** ausgebildet, welcher an das zweite Längsrohr **215** angebracht ist und davon nach unten gebunden ist. Im Einsatz kann das erste Paar Verriegelungsstifte **140** in den Nacht-Buchsen aufgenommen werden und sich mit diesen in Eingriff befinden.

[0046] Wie in **Fig. 10** und **11** dargestellt ist es vorgesehen, um für ein unfallsicheres Halteverfahren für die obere Sitzanordnung in der Tagposition zu sorgen, dass sich das erste und das zweite Paar Verriegelungsstifte **140**, **145** in Eingriff mit dem ersten und zweiten Paar Tag-Buchsen **235**, **240** befinden, welche in die obere Sitzbasis-Unteranordnung **100** gebohrt sind. Wie es im Folgenden besser verstanden wird, führt die letzte Querbewegung der oberen Sitzbasis-Unteranordnung (zu der Seitenwand hin gerichtet) bei dem Übergang zu der Tagposition aus einer Nachtposition diese Verriegelungsstifte in die Buchsen in der oberen Sitzbasis-Unteranordnung. Der Eingriff der Verriegelungsstifte und Buchsen ist vorzugsweise derart entworfen, um die Belastungen von **9G** oder **16G** zu tragen, welche von den Regulierungsbehörden für Unfallsicherheit gefordert werden.

[0047] In der Nachtposition (**Fig. 15**) befindet sich das erste Paar Verriegelungsstifte **140**, welches auf der Untersitz-Unteranordnung angebracht ist, in Verbindung mit der Lagereigenschaft der Karussell-Unteranordnung **95** für eine nach unten gerichtete Belastung in Eingriff mit dem Paar Nacht-Buchsen **255**. Wie zu sehen ist, wird das erste Paar Verriegelungsstifte durch eine letzte seitliche Bewegung (zu der Seitenwand hin gerichtet) in die Nacht-Buchsen eingeführt, wenn der Passagiersitz **15** in die Nachtposition umgesetzt wird.

[0048] Wie es in **Fig. 10, 12, 13, 14** und **15** der Reihe nach dargestellt ist, wird die obere Sitzbasis-Unteranordnung im Einsatz aus ihrer Tagposition durch die seitliche Umsetzung weg von der Seitenwand des Flugzeuges entriegelt, in eine Position parallel zu dem benachbarten Mittelgang geschwenkt und durch eine seitliche Umsetzung zu der Seitenwand hin in der Nachtposition verriegelt. Einmal in der Nachtposition befindlich kann die Rückenlehne **65** in eine vollständig unten befindliche Position zurückgelegt und die Beinlehnen **70** können in den unbenutzten Raum des Mittelganges verlängert werden. Dieses Verfahren ist auch in Verbindung mit den **Fig. 1** und **2** beschrieben worden.

[0049] Genauer und mit Bezug auf **Fig. 10–15** sind das erste und das zweite Paar Verriegelungsstifte **140, 145** in der Tagbetriebsart mit dem ersten beziehungsweise zweiten Paar Buchsen **235, 240** befestigt. Wenn jeglicher Essbetrieb abgeschlossen ist und sich die Passagiere zurückziehen wollen, kann ein Besatzungsmitglied für eine Antriebsleistung für die Sitzanordnung **15** sorgen, um eine Umsetzung aus einer Tagposition (**Fig. 10**) in eine Nachtposition (**Fig. 15**) zu ermöglichen. Eine seitliche (**Fig. 12**) und eine drehende oder schwenkende (**Fig. 13**) Bewegung der oberen Sitzbasis-Unteranordnung ist erforderlich, um die Sitzanordnung aus der Tagposition in die Nachtposition (und umgekehrt) zu bewegen. Dies kann manuell bewerkstelligt werden. Um jedoch in Übereinstimmung mit dem erwünschten Ambiente bei einer erstklassigen Reise zu sein, ist ein angetriebenes System, wie z. B. ein elektrisches, pneumatisches oder hydraulisches System vorgesehen.

[0050] Wie vorab beschrieben ist solch ein angetriebenes System bei der vorliegenden Erfindung vorgesehen worden, indem die erste und die zweite motorisierte Antriebsschraube verwendet wird. Die erste Antriebsschraube **130** wird parallel zu den Querrohren der Untersitz-Unteranordnung derart angebracht, um die Karussell-Unteranordnung entlang der Querrohre gleiten zu lassen. Die zweite Antriebsschraube **180** verbindet die Karussell-Unteranordnung derart mit der Sitzbasis-Unteranordnung, um die Sitzbasis-Unteranordnung im Wesentlichen um  $90^\circ$  relativ zu der Karussell-Unteranordnung zu drehen, obwohl kleinere Winkel möglich sind.

[0051] Der erste und der zweite Antriebsschraubenmotor kann am besten durch einen Satz von Endbegrenzungsschaltern **265** gesteuert werden, welche derart angeordnet sind, dass sie das erste Innenquerrohr **22** des Sitzbasisrahmens, die erste flache mittige Platte **150** oder Fühlerflansche **270** berühren, wobei diese nach unten gerichtet an dem Sitzbasisrahmen gebunden sind, um so die Bewegungen in der folgenden Weise abfolgen zu lassen. Wenn das System durch ein Besatzungsmitglied aktiviert wird, arbeitet somit im Einsatz die erste Antriebsschraube **130**, um die Karussell-Unteranordnung **95** seitlich entlang der Querrohre von der in **Fig. 10** dargestellten Position ausreichend zu bewegen oder umzusetzen,

um beide Paare von Verriegelungsstiften **140, 145** in einen ersten Zwischenzustand, die in **Fig. 12** dargestellte Position, zurückzuziehen. Zweitens arbeitet die zweite Antriebsschraube **180**, um die obere Sitzanordnung **105** durch den in **Fig. 13** dargestellten zweiten Zwischenzustand zu drehen. Wenn sich die obere Sitz-Unteranordnung einmal in einem in **Fig. 14** dargestellten dritten Zwischenzustand befindet, kurz bevor die obere Sitzanordnung **105** an dieser Stelle verriegelt wird, wird der erste Antriebsschraubenmotor aktiviert, um die umsetzende Bewegung der Karussell-Unteranordnung **95** umzukehren und um das erste Paar Verriegelungsstifte **140** in die Nacht-Buchsen **255** für die in **Fig. 15** dargestellte Nachtposition einzuführen.

[0052] Um den Sitz für den Fall eines Systemfehlers in die Tagposition zurückzuholen, kann eine Handkurbel oder ein Schraubenschlüssel (nicht dargestellt), welcher sich in Eingriff mit dem hexagonalen innen liegenden Ende der ersten Antriebsschraube **130** befindet, eingesetzt werden, um die erste Antriebsschraube **130** zu drehen und die obere Sitzbasis **100** in die in **Fig. 14** dargestellte Position umzusetzen. Nachdem die erste Antriebsschraube ausreichend gedreht wurde, wobei die Handkurbel oder der Schraubenschlüssel eingesetzt wird, um das erste Paar Verriegelungsstifte **140** aus den Nacht-Buchsen **255** zu lösen, wird die Federklemme **205**, welche den schwenkenden Zylinderblock **200** an der Sitzbasis-Unteranordnung befestigt, aus dem oberen Ende des Zylinderblockes herausgezogen, damit der Zylinderblock aus dem Eingriff mit der Sitzbasis-Unteranordnung herausfallen kann, wobei dadurch die obere Sitzanordnung **105** freigegeben wird, um manuell in die in **Fig. 12** angedeutete Position geschwenkt zu werden. Schließlich kann die umsetzende Bewegung (einschließlich dem Einführen der beiden Paare von Verriegelungsstiften **140, 145** in das erste **235** und das zweite **240** Paar Buchsen) durch eine Handkurbel betriebene erste Antriebsschraube **130** bewerkstelligt werden.

[0053] Da der erforderliche Aufwand, um die obere Sitzanordnung zu drehen, merklich geringer sein kann als derjenige, welcher erforderlich ist, um die obere Sitzanordnung **105** in der Querrichtung zu verschieben, kann eine Entfernung des zweiten Motors **175**, der zweiten Antriebsschraube **180** und anderer Komponenten, welche erforderlich sind, um die obere Sitzanordnung automatisch angetrieben zu drehen, als eine wünschenswerte Vereinfachung der vorab beschriebenen Realisierung der vorliegenden Erfindung betrachtet werden. Es ist auch vorgesehen, dass, unter gewissen Umständen die Entfernung beider Antriebsmotoren und Antriebsschrauben und der zugehörigen Komponenten als eine erstrebenswerte Vereinfachung der vorab beschriebenen Realisierung der vorliegenden Erfindung betrachtet werden kann.

[0054] Das bevorzugte Verfahren, um einen Vorteil aus dem Mittelgang und dem Platz unter der Seiten-

wand zur Bereitstellung von Schlafunterkünften zu ziehen, ist, zweiseitige Einheiten herzustellen und zu montieren, welche ähnliche Abmessungen wie die momentan im Einsatz befindlichen besitzen (eine Gesamtbreite von 53 Inch bis 57 Inch und eine Gesamtlänge von 70 Inch, wenn Sie vollständig zurückgelegt sind). Diese Sitzeinheiten, welche aus der nach vorn gerichteten Einstiegs- und Essbetriebs-"Tag"-Position **35** in **Fig. 2** dargestellt sind, schwenken derart um eine senkrechte Achse herum, dass sie dem Mittelgang gegenüberliegen und ausreichend zu dem Mittelgang hin umgesetzt sind, damit die Sitzrückenlehnen in die horizontale Position **75** zurückgelegt werden können.

[0055] Die Geometrie einiger Einbauten, wie z. B. des Oberdecks der **747**, ermöglicht es, die Umstellung des vorliegenden Sitzes zu bewerkstelligen, ohne die obere Sitzanordnung **105** weg von der Seitenwand umsetzen zu müssen. Solch eine Geometrie ermöglicht es, die erfindungsgemäße in **Fig. 16–18** dargestellte vereinfachte Sitzanordnung einzusetzen. Bei dieser vereinfachten Anwendung ist der untere Abschnitt des Lazy-Susan-Lagers **275** mit einer unteren Platte **280** befestigt, welche den Innenrahmen **285** und den Außenrahmen **290** der Untersitz-Unteranordnung verbindet. Verriegelungsstifte **295** sind vorhanden, welche sich ungehindert in den glatten Bohrungen **300** in dem Innen- und Außenrahmen der Untersitz-Unteranordnung bewegen. Ein Lösegriff **305** ist vorhanden, welcher die innen liegenden Verriegelungsstifte direkt und die außen liegenden Verriegelungsstifte mit Hilfe von Hebeln **310** aus dem Eingriff mit den Buchsen **315** herauszieht, welche in halbkreisförmige Flansche **320** gebohrt sind, welche nach unten gerichtet von an dem Sitzbasisrahmen gebunden sind. Der Lösegriff kann derart entworfen sein, dass seine Funktion für die Ungeübten nicht offensichtlich ist oder er kann mit einer angemessenen Verriegelung gesichert sein, um zu verhindern, dass Unautorisierte den Sitz schwenken. Eine Umsetzung des Sitzes aus der Tagposition in die Nachtposition umfasst ein Ziehen des Lösegriffes, ein Drehen des oberen Sitzes in die gewünschte Position und ein Drücken des Lösegriffes, um die Verriegelungsstifte in Eingriff mit den Nacht-Buchsen **325** zu bringen. Wenn ein Verriegelungsmechanismus vorhanden ist, geht ein Entriegeln des Lösegriffes der Umsetzung voraus und ein erneutes Verriegeln des Lösegriffes folgt.

[0056] Das Eindringen um 13 Inch in den normalen "Tag"-Mittelgang, welches sich aus dem Schwenken und Zurücklegen der Sitze ergibt, lässt für die Bewegung der Passagiere während der Schlafperioden einen Mittelgang von 21 Inch in dem Hauptdeck der **747** und einen Mittelgang von 16 Inch in der **777**. Bei dem Oberdeck der **747** sorgt ein Eindringen von 5,5 Inch in den Mittelgang (wenn typischerweise mit Einheiten einer Gesamtsitzbreite von 54 Inch ausgestattet) zusammen mit einem Überhang der Ladungskästen von 10,5 Inch für Platz für den Sitz mit 70 Inch.

Diese Sitze können in einem Abstand von (z. B.) 60 Inch montiert sein, womit es möglich ist, vier Reihen der Sitze eher als drei Reihen der Sitze mit einem Abstand von 80 Inch bei einer Länge der Kabine von 240 Inch zu montieren. Da alle Sitze in der Nachtposition dem Mittelgang gegenüberliegen, ist die Schwierigkeit der Passagiere am Fensterplatz, den Mittelgang zu erreichen, beseitigt. Zusätzlich zu der Angelegenheit des Mittelgangzuganges werden Sitze, welche eine Länge von 70 Inch in dieser Querposition bereitstellen gegenüber Sitzen, welche eine Länge von 80 Inch in der seitlichen Position bereitstellen, bevorzugt angenommen, da sich der Fußüberhang von der Querausrichtung in den Mittelgang erstreckt während sich der Fußüberhang bei der seitlichen Ausrichtung bis zu dem Kopf eines anderen Passagiers erstreckt.

[0057] Der Bereich zwischen zwei Mittelgängen bei Konfigurationen mit Doppelmittelgängen kann entweder mit einer Bordküche und mit Toiletteneinbauten oder mit Schlafsitzen ausgestaltet sein, welche mit ausreichend Abstand montiert sind, um sie vollständig zurücklegen zu können.

[0058] Die Geometrie des oberen Decks der **747** ist beschrieben worden, obwohl der momentane Sitz in jedem Fahrzeug mit vergleichbaren Raumdimensionen betriebsfähig ist. Wie vorab angemerkt wird bei Anwendungen im Oberdeck, weil eine größere seitliche Umsetzung weg von der Seitenwand erforderlich ist, bei der seitlichen Umsetzung eine Drehung des Sitzes in eine Zwischenposition bewerkstelligt und die Nacht-Verriegelungsstifte (ausgerichtet in die entgegengesetzte Richtung der Tag-Verriegelungsstifte) werden in Eingriff gebracht, wenn die seitliche Umsetzung abgeschlossen ist.

[0059] Um für einen einfachen Zugang zu den Sitzen in der Nachtposition zu sorgen, hat die vorab stehende Beschreibung einheitlich beschrieben, die Passagiersitze zu dem Mittelgang zu schwenken. Unter gewissen Umständen, unter denen ein Notausgangsweg oder ein anderes Konfigurationsdetail für einen angemessenen Zugang sorgen würde, wäre es annehmbar oder sogar bevorzugt, die Passagiersitze weg von dem Mittelgang zu der Seitenwand zu schwenken. Solch eine Verwendung ist durch die vorliegende Erfindung vorgesehen und die hier beschriebenen Prinzipien, Strukturen und Verfahren sind gleichfalls geeignet, um die Passagiere weg von einem Mittelgang hin zu einer Seitenwand auszurichten.

[0060] Die vorab stehende Beschreibung der vorliegenden Erfindung hat im Allgemeinen die Verwendung von Doppelsitzen beschrieben, welche in eine Nachtposition gedreht werden, welche im Wesentlichen senkrecht zu dem Mittelgang ist. Die Prinzipien, Strukturen und Verfahren der vorliegenden Erfindung können auch bei anderen Sitzeinheiten eingesetzt werden, welche mit kleineren Winkeln relativ zu dem Mittelgang gedreht werden. Zum Beispiel werden die Vorteile der vorliegenden Erfindung mit einer ersten

einzelnen Sitzeinheit erreicht, welche nur ausreichend dreht, damit sich die Beinlehnen des ersten Sitzes oder die Beine eines in dem ersten Sitz sitzenden Passagiers in den Mittelgang entlang der Seite eines vor dem ersten Sitzes befindlichen zweiten Sitzes erstrecken können. Solch eine Verschiebung ähnelt der in dem vorab erwähnten britischen Patent von Dryburgh und anderen dargestellten Staffelungsposition. Die vorliegende Erfindung bietet jedoch die Verbesserungen, zusätzlichen Mittelgangsplatz zu besitzen, welcher verfügbar ist, um die Beweglichkeit der Passagiere während des Einsteigens, des Aussteigens und des Essbetriebs zu begünstigen. Diese Vorteile wurden von Dryburgh und anderen nicht vorhergesehen.

[0061] Es wird oft als wünschenswert angesehen, die Sitzbodenpolster zu kippen oder zu "neigen", so dass sie vorn oder an der Vorderkante höher als hinten oder an der Hinterkante sind. Jedoch wird ein Neigungswinkel des Sitzbodens als unerwünscht betrachtet, wenn ein Sitz vollständig zurückgelegt ist. Fachleute bezüglich des Entwurfs von zurücklegbaren Sitzen sind mit Entwurfsmethoden vertraut, welche einen Neigungswinkel vermeiden, wenn die Sitze zurückgelegt sind. Der Aspekt bezüglich der Schwenkung der vorliegenden Erfindung bietet jedoch ein einfaches und daher bevorzugtes Verfahren zur Vermeidung des Neigungswinkels bei dem Umsetzen von der Tag- in die Nachtausrichtung. Das Ausmaß des Kipp- oder Neigungswinkels vom vorderen Teil zum hinteren Teil des Sitzbodens während des Tages wird im Folgenden als der Neigungswinkel bezeichnet. Wenn das erfindungsgemäße Lazy-Susan-Lager derart ausgerichtet ist, dass sowohl die vordere als auch die äußere Kante des Lagers um die Hälfte des gewünschten Neigungswinkels angehoben sind, d. h. das Lazy-Susan-Lager ist in einer Ebene ausgerichtet, welche sich horizontal auf einer Achse befindet, welche von 45 Grad nach innen vorn bis 45 Grad nach außen hinten verläuft, und auf einer Achse, welche von 45 Grad nach innen hinten bis 45 Grad nach außen vorn verläuft, um einen Winkel geneigt ist, welcher gleich der Hälfte des gewünschten Neigungswinkels multipliziert mit der Quadratwurzel von zwei ist, und die obere Sitzbasis und die obere Sitz-Unteranordnungen sind derart entworfen und angebracht, dass der Sitzboden den gewünschten Neigungswinkel in der nach vorn ausgerichteten Tagposition besitzt, wobei der Sitzboden keinen Neigungswinkel besitzt, wenn er in die nach innen gerichtete Nachtposition geschwenkt ist.

[0062] Während die Prinzipien dieser Erfindung in Verbindung mit bestimmten Ausführungsformen beschrieben worden sind, sollte klar sein, dass diese Beschreibungen nur in Form eines Beispiels gemacht sind und nicht den Umfang der angefügten Ansprüche einschränken sollen.

## Patentansprüche

1. Doppelpassagier-Schlafsitzanordnung zum Einsatz in einem Fahrzeug mit einer Mehrzahl von durch zumindest einen Mittelgang getrennten Sitzen, wobei jeder der Sitze eine schwenkbare Rückenlehne und eine verlängerbare Beinlehne besitzt, wobei die Anordnung umfasst:

- eine erste Basisunteranordnung (90), welche entlang des Mittelganges an dem Fahrzeug befestigt werden kann;
- eine zweite Unteranordnung (95), um jede der Rückenlehnen und jede der Beinlehnen zu halten, wobei die zweite Unteranordnung drehbar auf der ersten Unteranordnung gehalten wird;
- Mittel (120–135) zum Umsetzen der zweiten Unteranordnung bezüglich der ersten Unteranordnung aus einer ersten Position in eine zweite Position in den Mittelgang;
- Mittel (100–180) zum Drehen der zweiten Unteranordnung bezüglich der ersten Unteranordnung, wobei jede der Rückenlehnen und der Beinlehnen in eine im Wesentlichen horizontale Position angeordnet werden kann und jede der Beinlehnen in den Mittelgang verlängerbar ist.

2. Schlafsitzanordnung nach Anspruch 1, weiter Mittel umfassend, um automatisch angetrieben die zweite Unteranordnung bezüglich der ersten Unteranordnung umsetzen zu können.

3. Schlafsitzanordnung nach Anspruch 1, weiter Mittel umfassend, um automatisch angetrieben die zweite Unteranordnung bezüglich der ersten Unteranordnung drehen zu können.

4. Schlafsitzanordnung nach Anspruch 1, weiter umfassend:

- (a) Mittel (140), um die zweite Unteranordnung in der ersten Position zu verriegeln, und
- (b) Mittel (145), um die zweite Unteranordnung in der zweiten Position zu verriegeln.

5. Schlafsitzanordnung nach Anspruch 1, wobei die nach vorn ausgerichtete Richtung der Sitze in der zweiten Position senkrecht zu dem Mittelgang ist.

6. Schlafsitzanordnung nach einem der Ansprüche 1–5, wobei die Umsetzungsmittel eine an der ersten Basisunteranordnung angebrachte Antriebsschraube umfassen, wobei die Antriebsschraube parallel zu der Achse der Umsetzung der zweiten Unteranordnung ausgerichtet ist.

7. Schlafsitzanordnung nach einem der Ansprüche 1–6, wobei die aufgerichteten Sitze in der zweiten Position in eine Richtung senkrecht zu dem Mittelgang ausgerichtet sind, wobei die Rückenlehne geschwenkt werden kann und die Beinlehne in eine horizontale Position verlängert werden kann.

8. Verfahren zum Bereitstellen einer vollständig zurücklegbaren Passagiersitzanordnung in einem Flugzeug, indem die Ausnutzung von Platz in dem Fahrzeug maximiert wird, wobei die Anordnung eine Mehrzahl von Doppelsitzeinheiten aufweist, welche durch einen Mittelgang getrennt sind, welcher in dem Flugzeug angeordnet ist, wobei jeder der Sitze eine schwenkbare Rückenlehne und eine verlängerbare Beinlehne besitzt, wobei das Verfahren umfasst:

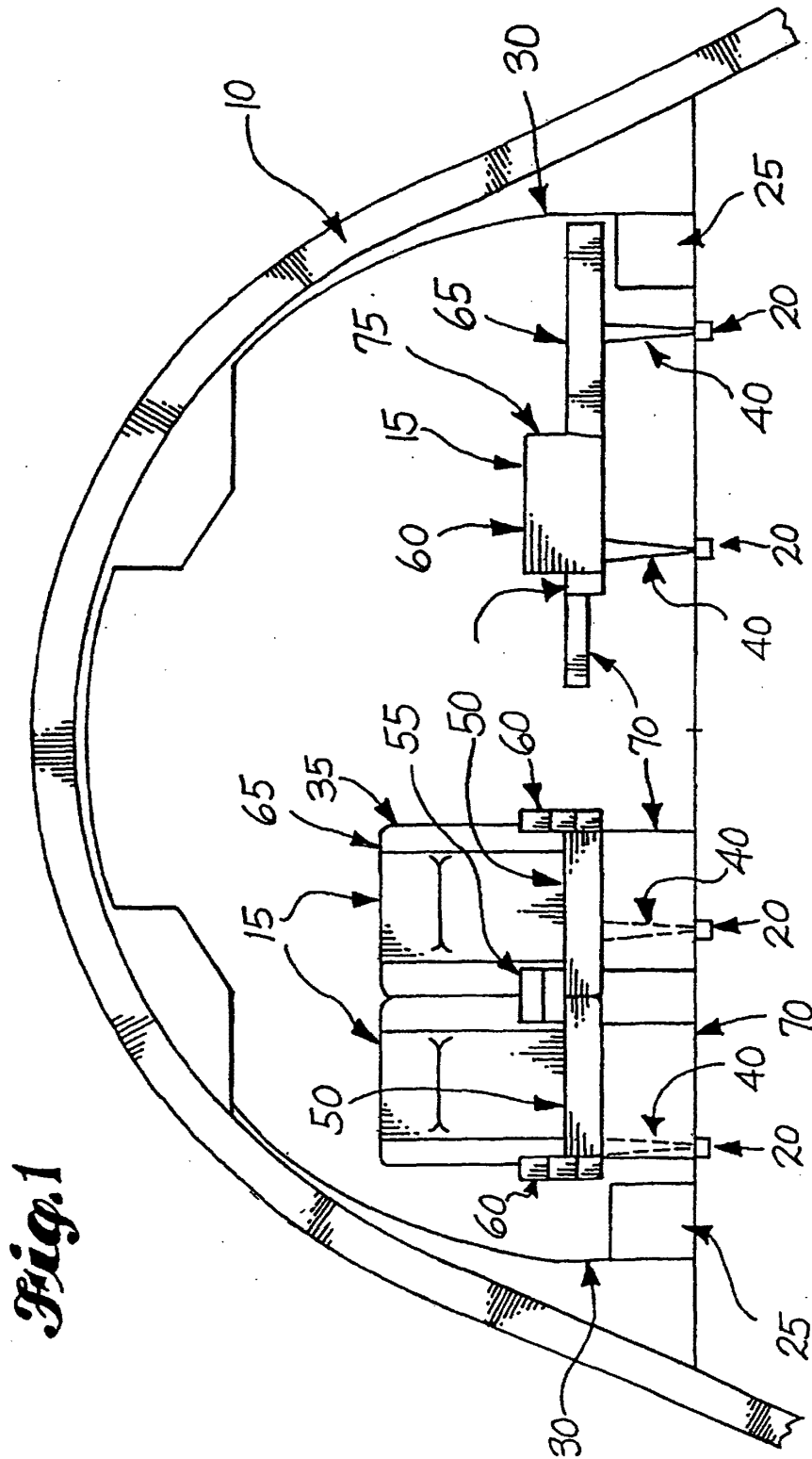
- Befestigen einer ersten Basisunteranordnung (**90**) an dem Flugzeug entlang des Mittelganges;
- drehbares Halten einer zweiten Unteranordnung (**95**) auf der ersten Basisunteranordnung, wobei die zweite Unteranordnung die Rückenlehne und die Beinlehne hält;
- Umsetzen der zweiten Unteranordnung bezüglich der ersten Basisunteranordnung aus einer ersten Position in eine zweite Position näher zu dem Mittelgang;
- Drehen der zweiten Unteranordnung bezüglich der ersten Basisunteranordnung;
- Anordnen zumindest einer der Rückenlehnen und zumindest einer der Beinlehnen in eine im Wesentlichen horizontale Position, und
- Verlängern zumindest eine Beinlehne in den Mittelgang.

9. Verfahren nach Anspruch 8, umfassend:

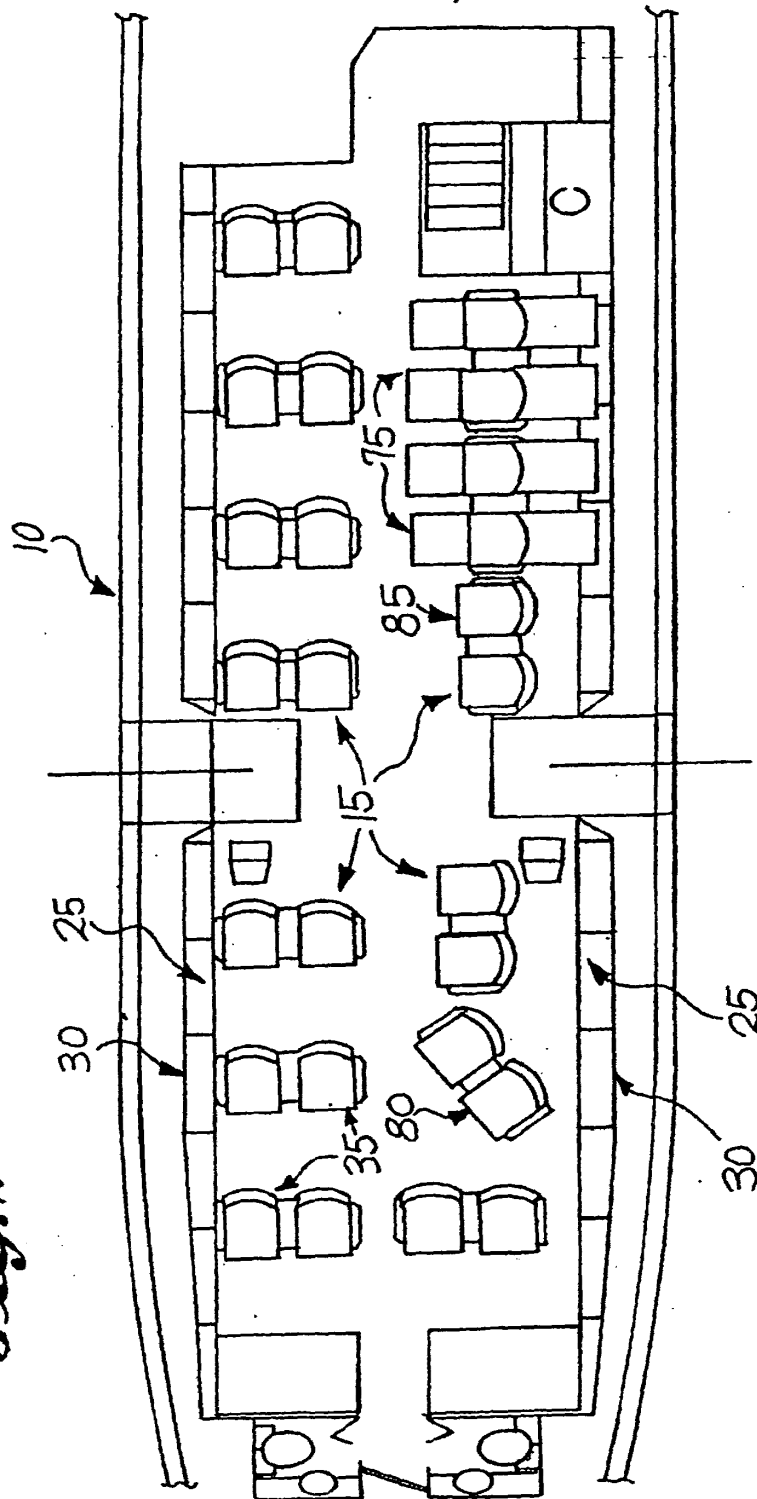
- Bereitstellen der zweiten Unteranordnung mit einer ersten Buchse (**235**) und einer zweiten Buchse (**240**);
- Ausrichten der ersten Buchse im Wesentlichen senkrecht zu der zweiten Buchse;
- gleitbares Halten zumindest eines Verriegelungsstiftes (**140**, **145**) in der ersten Unteranordnung;
- Bereitstellen eines Lösegriffes (**305**);
- Verbinden des Lösegriffes mit dem Verriegelungsstift;
- Einführen des Verriegelungsstiftes in die erste Buchse, wenn sich die zweite Unteranordnung in der ersten Position befindet, wobei der Lösegriff verwendet wird;
- Einführen des Verriegelungsstiftes in die zweite Buchse, wenn sich die zweite Unteranordnung in der zweiten Position befindet, wobei der Lösegriff verwendet wird, und
- Drehen der zweiten Unteranordnung bezüglich der ersten Basisunteranordnung und herausragen Lassen der zweiten Unteranordnung in den Mittelgang.

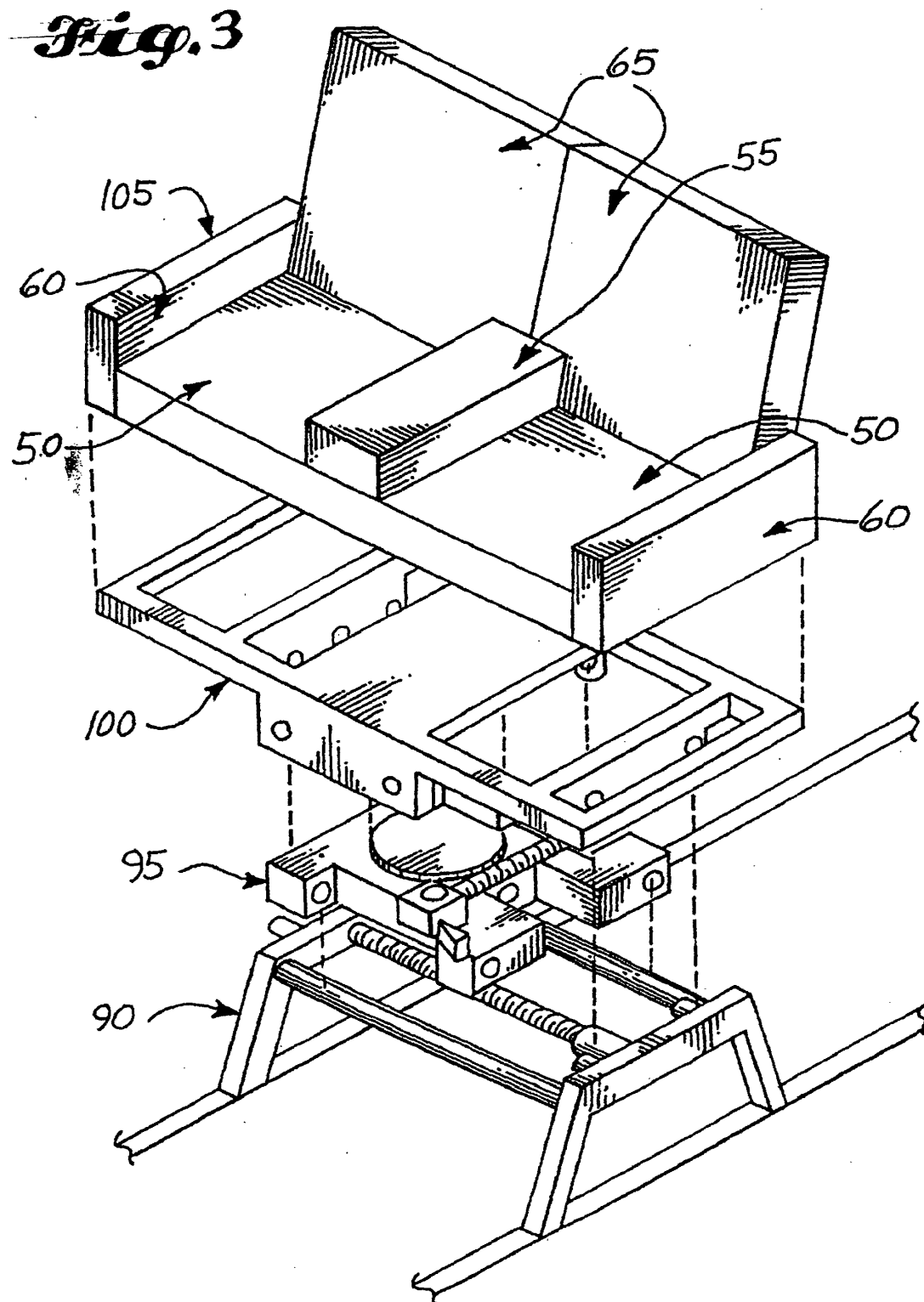
10. Flugzeug versehen mit einer Anordnung nach einem der Ansprüche 1–7.

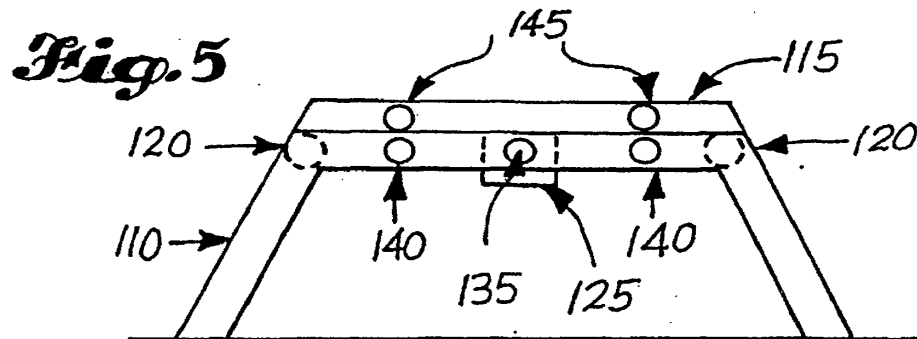
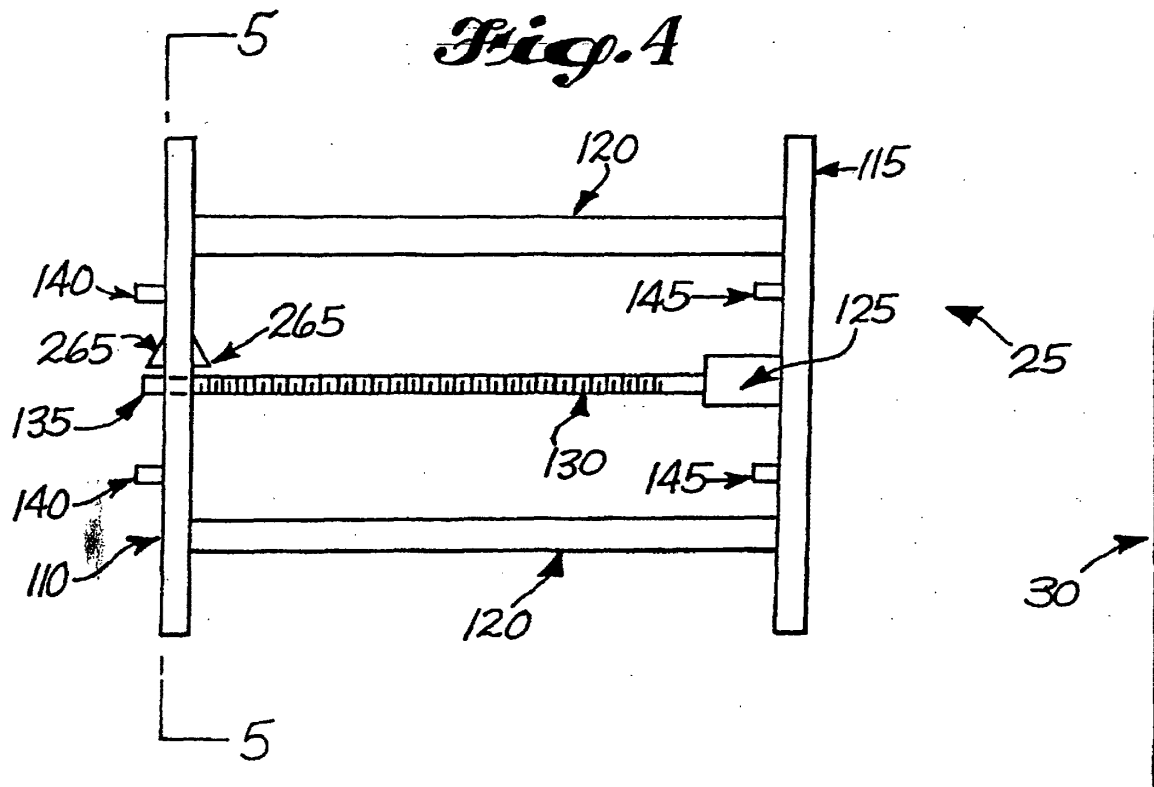
Es folgen 12 Blatt Zeichnungen

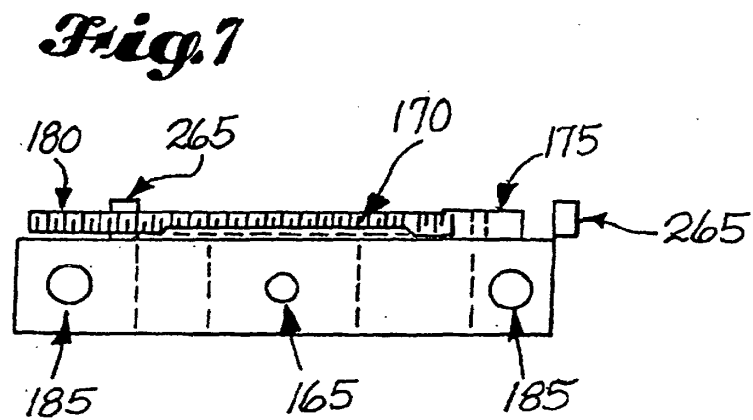
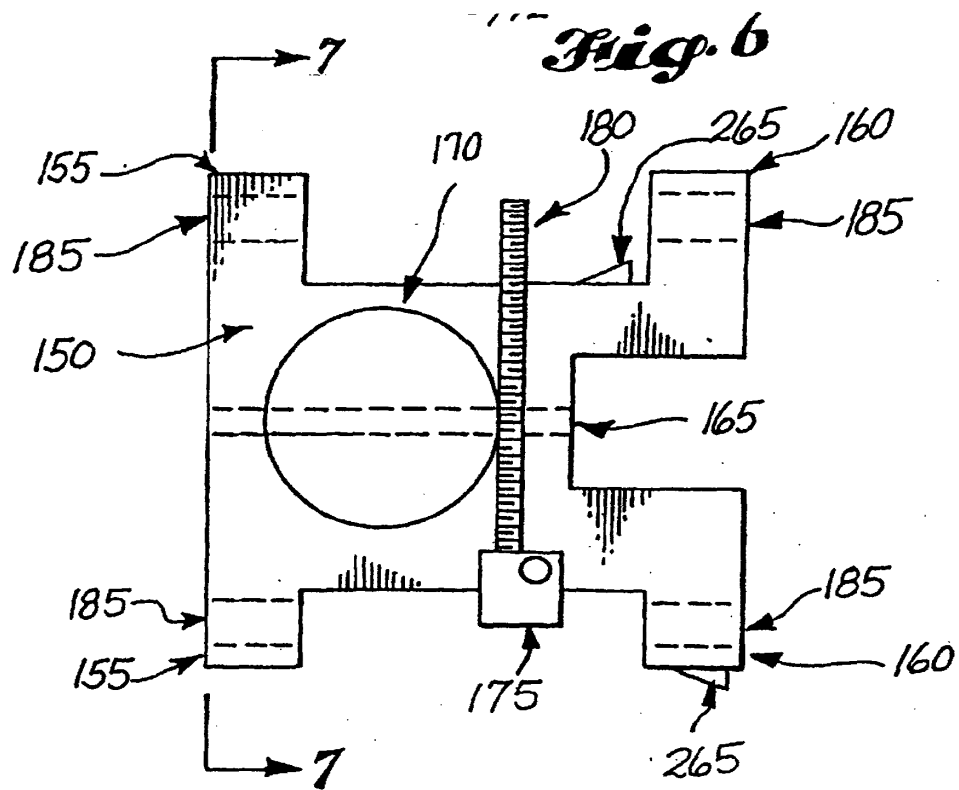


**Fig. 2**

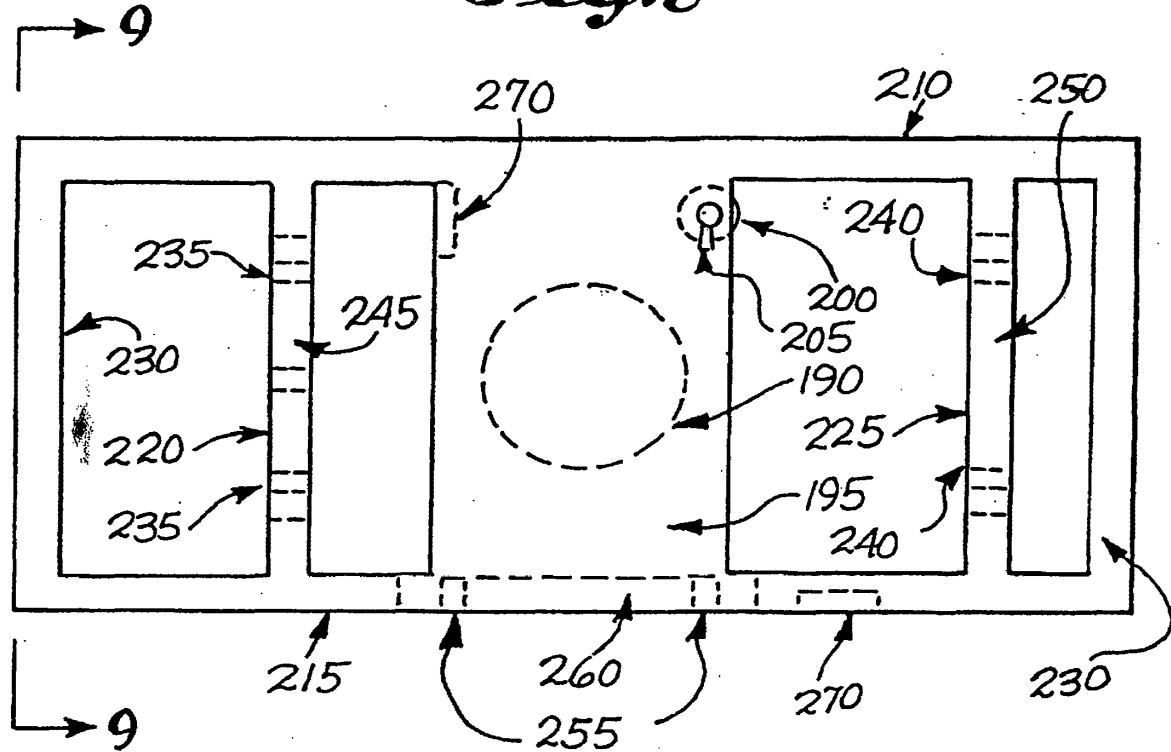




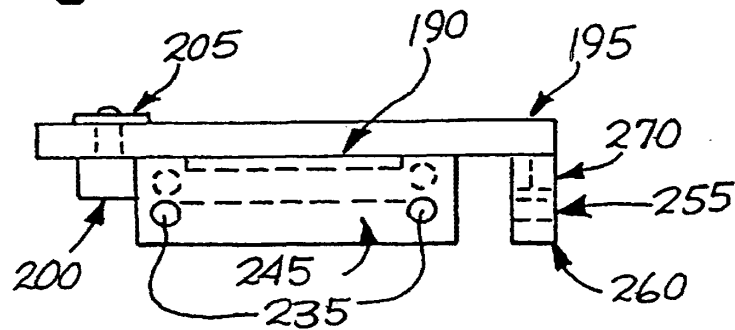




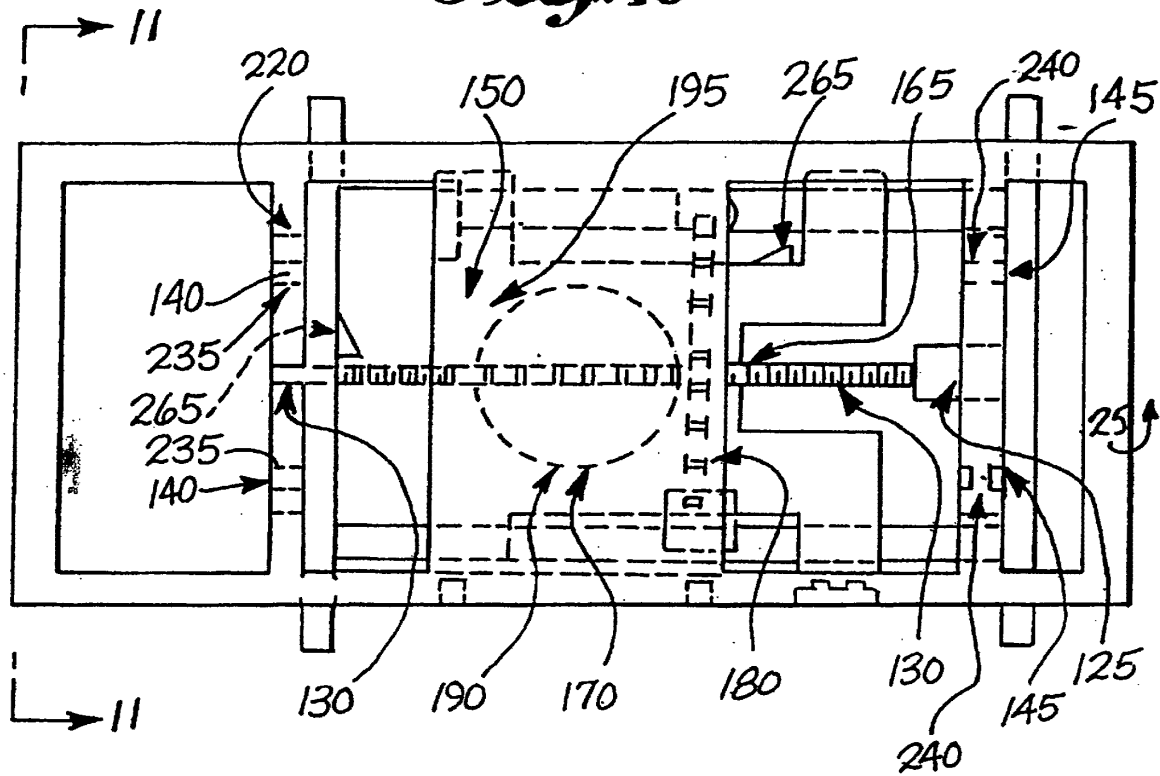
**Fig. 8**



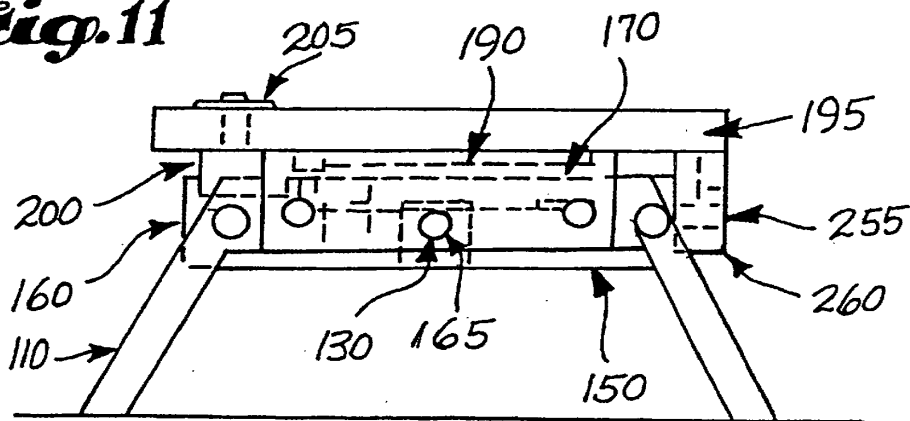
**Fig. 9**

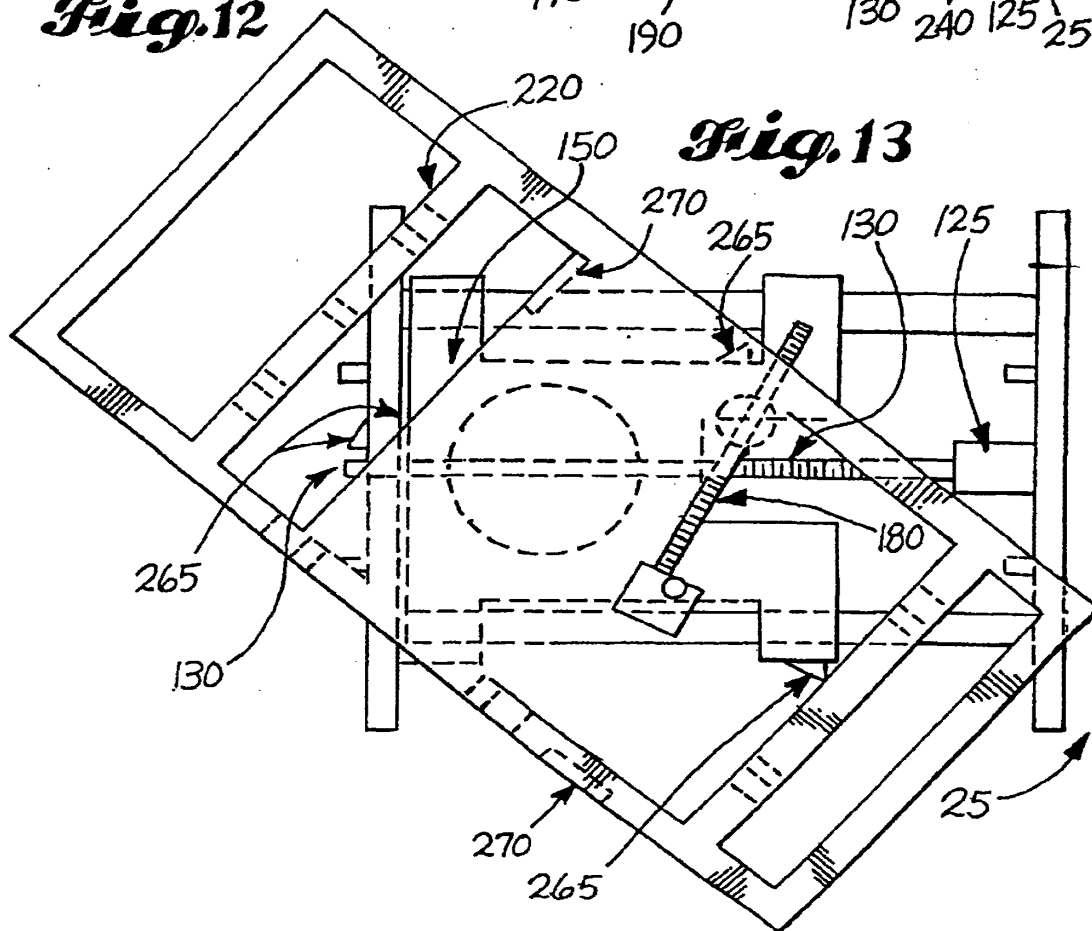
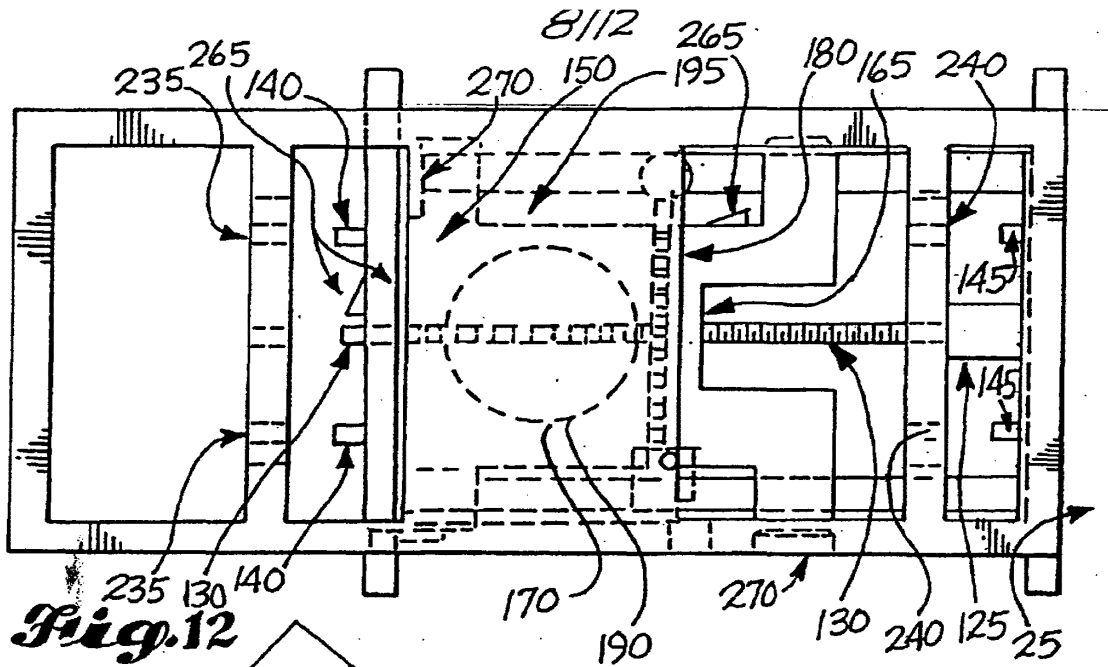


**Fig. 10**

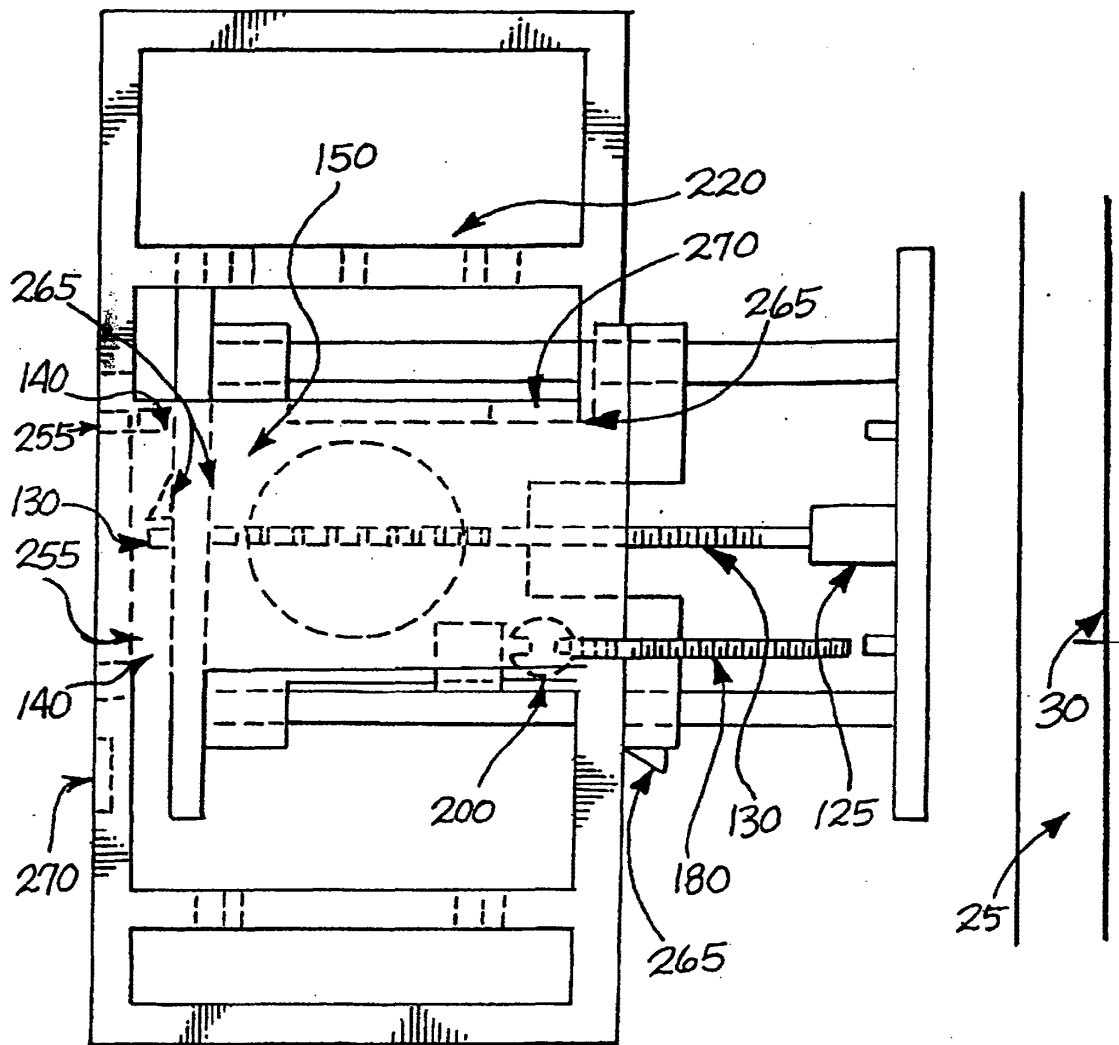


**Fig. 11**

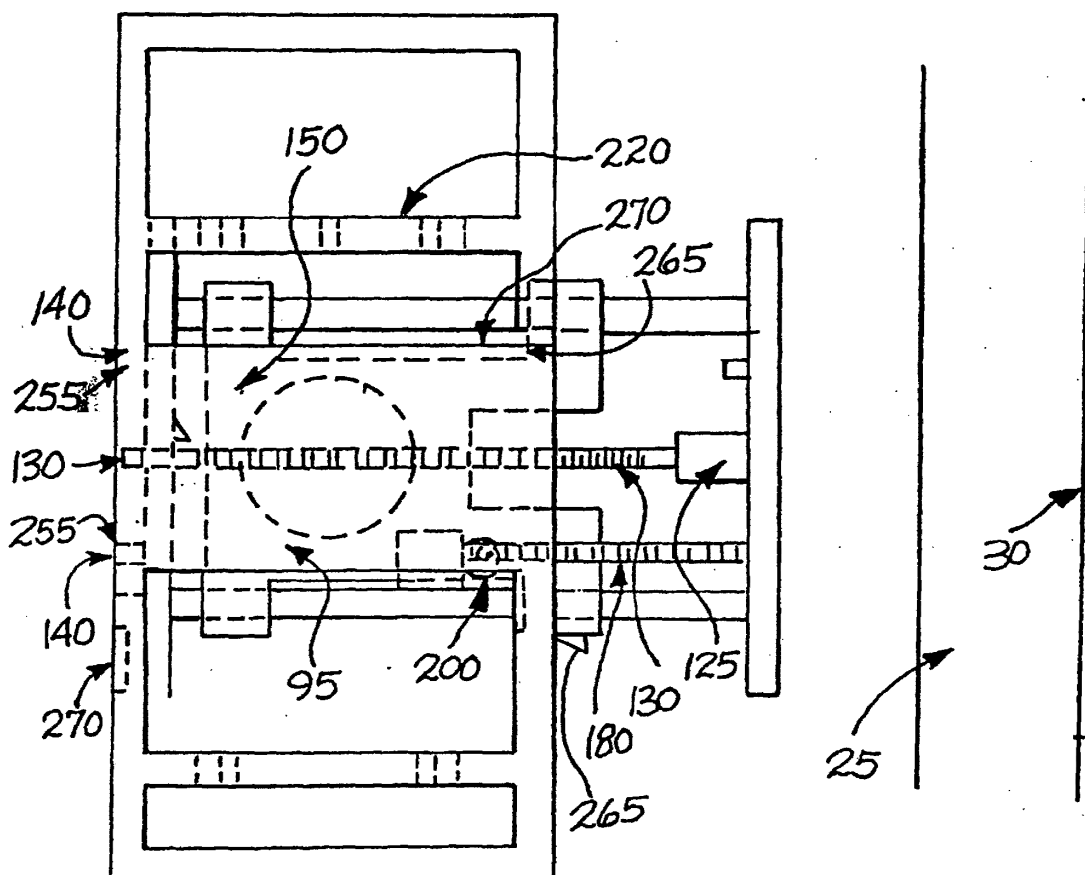




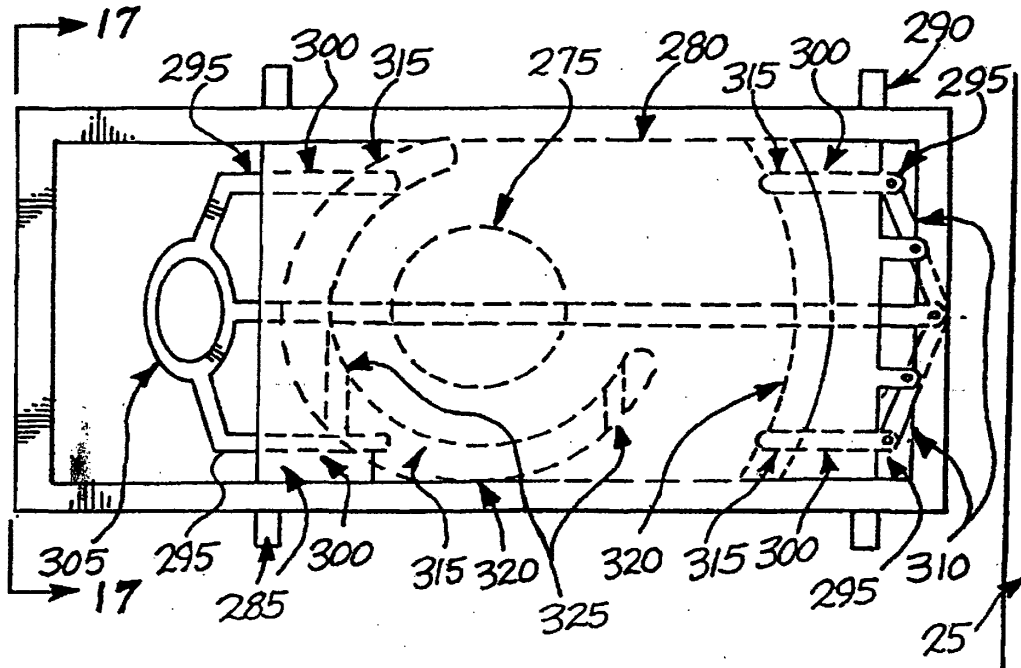
*Fig. 14*



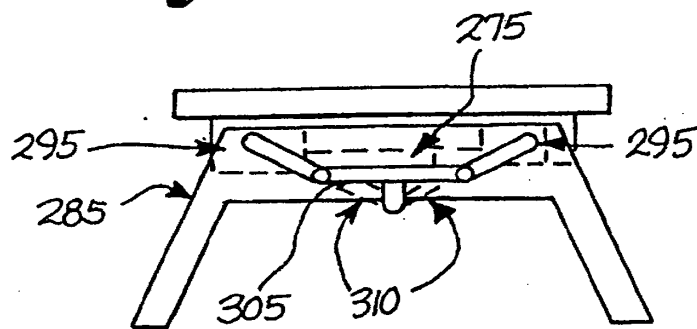
*Fig. 15*

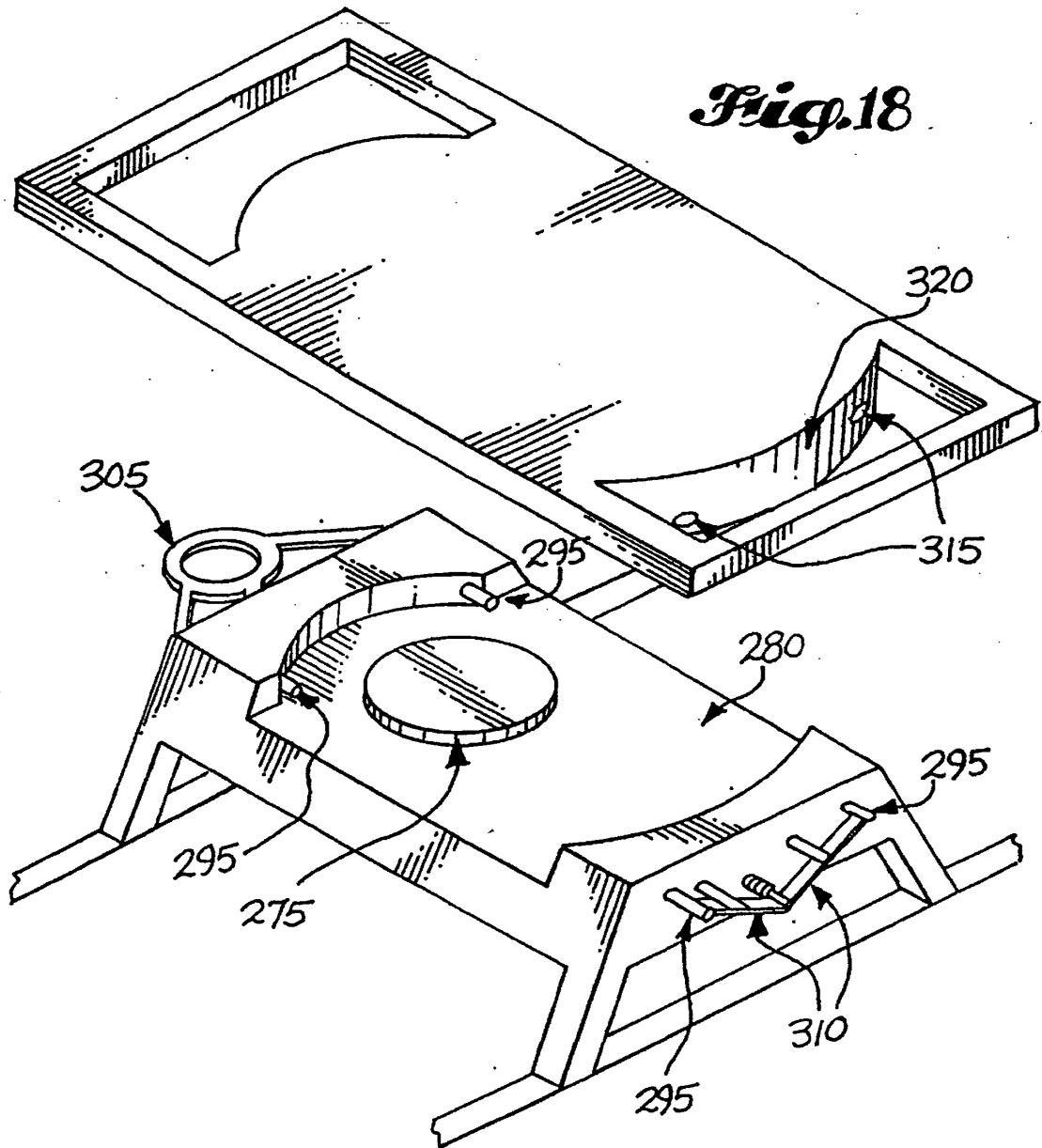


**Fig.16**



**Fig.17**





(19)



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(11)

**EP 0 722 404 B1**

(12)

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**(54) OPTIMAL AIRPLANE PASSENGER SEATING CONFIGURATIONS AND METHODS THEREFOR**

**OPTIMALE FAHRGASTSITZANORDNUNG IM FLUGZEUG UND VERFAHREN DAFÜR**

**CONFIGURATIONS OPTIMALES DE PLACEMENT DES PASSAGERS DANS UN AVION ET  
PROCEDES ASSOCIES**

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**DE-A- 4 209 037 US-A- 5 180 120**

Remarks:

The file contains technical information submitted  
after the application was filed and not included in  
this specification

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**EP 0 722 404 B1**

**Description****FIELD OF THE INVENTION**

5 [0001] The present invention generally relates to the arrangement of passenger seats in an airplane. More particularly, this invention relates to passenger seating configurations and methods for determining such seating configurations that at typical occupancy levels maximize passenger comfort in seats of any given dimensions. Even more particularly, this invention provides methods that either (i) increase passenger seating comfort levels in an airplane of fixed dimensions and number and type of seats, (ii) maximize the number of passenger seats in an airplane of fixed dimensions and seat type while maintaining original passenger comfort levels, or (iii) decrease airplane dimensions for substantially the same number of passengers at substantially the same original comfort levels with the same seat type.

**BACKGROUND OF THE INVENTION**

15 [0002] Commercial airlines and airplane manufacturers seek to arrange passenger seats in ways that maximize the revenue-earning potential of airplanes while minimizing operating costs per passenger seat. For existing airplane models, seats are arranged with the objective of maximizing passenger comfort without reducing the number of seats, or of maximizing the number of seats at a given level of passenger comfort. In designing new airplanes seating arrangements ideally should minimize the dimensions of the airplane (and the resulting weight and aerodynamic drag) to accommodate a given number of seats at a given comfort level.

20 [0003] Payloads engineers are normally responsible for designing seating configurations in modern airplanes and to achieve the above goals. With respect to the arrangement of seats in each row, payloads engineers assume that overall passenger comfort is maximized by minimizing the number of seats between any passenger and the nearest aisle. Among practical configurations, those in which no passenger is more than one seat away from the nearest aisle are chosen since they are considered ideal.

25 [0004] For existing eight-abreast configurations having two aisles, this rule has resulted in the use of a 2¼/2 seating configuration (where a backslash (\) represents the position of an aisle and numerals are used to indicate the number of seats (not necessarily occupied by passengers) in each seating unit). The seating arrangements of U.S. Patent Nos. 4,066,227, issued January 3, 1978, to Buchsel; 4,881,702, issued November 21, 1989, to Slettebak; 4,936,620, issued June 26, 1990, to Francois et al.; 5,178,345, issued January 12, 1993, issued to Peltola et al., and 5,180,120, issued January 19, 1993, to Simpson, et al., observe these principles.

30 [0005] US-A-4 936 620 discloses a number of seating arrangements in which the passenger seats are arranged in curved or circle-segment units of two or three seats each, rather than side-by-side and in-line like conventional aircraft passenger seats. In this document both eight-abreast and nine-abreast twin aisle configurations are shown, with the eight seats being arranged in the familiar 2¼/2 pattern and the nine seats in a 3¼/3 configuration. However, this disclosure relates to very specific non-standard seat units for which different design considerations would seem to apply, and is concerned with optimizing the shape of the seat units, rather than the number of seats per unit.

35 [0006] However, in contrast with the present invention, conventional configurations have failed to either maximize passenger comfort in seats of any given dimensions, maximize passenger comfort in an airplane of fixed dimensions and number and type of seats, maximize the number of passenger seats in an airplane of fixed dimensions and seat type while maintaining original passenger comfort levels, or minimize airplane dimensions for substantially the same number of passengers at substantially the same original comfort levels.

40 [0007] These objectives have not been achieved by the prior art because neither the percentage of available seats which are typically filled (load factor) in airline service, nor the specific seats which are filled in each possible configuration at various load factors, nor the different levels of comfort experienced by passengers seated in the different seating environments created by adjacent occupied seats, empty seats, sidewalls and aisles, have been taken into account.

45 [0008] In contrast, the present invention provides a unique process for determining and maximizing the additional comfort enjoyed by passengers as a result of being seated beside occupied seats, empty seats, sidewalls and/or aisles under realistic load conditions using conventional seat assignment procedures.

**SUMMARY OF THE INVENTION**

50 [0009] It is therefore an object of the present invention to provide a method for optimizing passenger seating configurations within an airplane. In accordance with a first aspect of the invention this object is achieved by a method comprising the steps of:

- (a) identifying the row configurations that can be reasonably accommodated by said airplane;
- (b) determining the level of comfort enjoyed by passengers seated in different seating environments within said air-

plane created by adjacent occupied seats, empty seats, sidewalls and aisles (environment comfort level),  
(c) determining the frequency of occurrence of possible load factor increments,  
(d) calculating the average passenger comfort level in said row configurations, using said environment comfort levels, weighted by the portion of passengers that would be seated in each of said seating environments at each said  
5 load factor increment, each said load factor increment being weighted by the frequency of occurrence of said load factor increment, and  
(e) installing seats in said airplane in accordance with the seating configuration shown by step (d) to provide the highest average passenger comfort level.

10 **[0010]** It is also an object of this invention to provide specific seating configurations that increase passenger seating comfort at typical load factors in an airplane with a fixed number of seats and aisles per row.

**[0011]** According to a second aspect of the invention, this object is achieved by a process for maximizing passenger comfort in an airplane having a fixed number of seats and aisles per row comprising:

- 15 (a) identifying the possible row configurations for a given number of seats and aisles;
- (b) determining the frequency of occurrence of possible load factor increments;
- (c) calculating the portion of passenger who can be seated alongside an empty seat in said row configuration in said load factor increments; and
- (d) selecting the row configuration allowing the greatest number of passengers to be seated next to an empty seat  
20 at typical load factors; and;
- (e) installing seats in said airplane in accordance with said selected row configurations.

**[0012]** In the processes of the present application which provide more comfort, passengers provided seats with dimensions substantially equal to those used with configurations determined by conventional methods may enjoy the  
25 additional comfort represented by the higher average passenger comfort level or greater chance of being seated next to an empty seat relative to configurations identified by the current art.

**[0013]** The invention further has for its object to provide various seating arrangements which have been found to provide maximum passenger comfort.

**[0014]** According to the invention, one such seating configuration for an airplane of fixed dimensions, having standard  
30 seats, two aisles and eight abreast seating comprises a two-seat unit and two three-seat units.

**[0015]** Another seating configuration in accordance with the invention, which is designed for an airplane of fixed dimensions, having standard seats, three aisles and eleven abreast seating comprises a two-seat unit and three three-seat units.

**[0016]** The invention further provides a seating configuration for an airplane of fixed dimensions, having standard  
35 seats, three aisles and twelve abreast seating comprising four three-seat units separated by the aisles in a 3\3\3\3 arrangement and a seating configuration for an airplane of fixed dimensions, having standard seats, three aisles and thirteen abreast seating comprising three three-seat units and a four-seat unit separated by the aisles in a 3\4\3\3 arrangement.

**[0017]** These and other advantages of the present invention will become more apparent from the following description  
40 of the preferred embodiments presented with reference to the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0018]**

45 FIG. 1 is a schematic of a modern twin-aisle airplane cut away to illustrate a contemporary 2\4\2 seating arrangement.

FIG. 2 shows the interior of the airplane of FIG. 1 looking towards the forward compartment.

50 FIG. 3 qualitatively shows, viewed from overhead, the seat area, and useful additional area enjoyed by passengers in selected seating environments.

FIG. 4 quantifies the average comfort reported by passengers in various seating environments.

55 FIG. 5 quantifies the comfort reported by passengers in various seating environments relative to that reported by a passenger seated between two other passengers.

## EP 0 722 404 B1

FIG. 6 quantifies the average comfort of passengers in various seat pitches.

FIG. 7 quantitatively portrays the useful additional area enjoyed by passengers in different seating environments occurring in airline service.

FIG. 8 shows a typical distribution of actual airline load factors.

FIG. 9A symbolically depicts an 8-abreast,  $2\frac{1}{4}\frac{1}{2}$ , conventional seating configuration when two seats per row are occupied.

FIG. 9B symbolically depicts a  $2\frac{1}{4}\frac{1}{2}$  seating configuration when four seats per row are occupied.

FIG. 9C symbolically depicts a  $2\frac{1}{4}\frac{1}{2}$  seating configuration when five seats per row are occupied.

FIG. 9D symbolically depicts a  $2\frac{1}{4}\frac{1}{2}$  seating configuration when six seats per row are occupied.

FIG. 9E symbolically depicts a  $2\frac{1}{4}\frac{1}{2}$  seating configuration when seven seats per row are occupied.

FIG. 9F symbolically depicts a  $2\frac{1}{4}\frac{1}{2}$  seating configuration when all eight seats per row are occupied.

FIG. 10A symbolically depicts an 8-abreast,  $3\frac{1}{2}\frac{1}{3}$  seating configuration of the present invention when two seats per row are occupied.

FIG. 10B symbolically depicts a  $3\frac{1}{2}\frac{1}{3}$  seating configuration when four seats per row are occupied.

FIG. 10C symbolically depicts a  $3\frac{1}{2}\frac{1}{3}$  seating configuration when five seats per row are occupied.

FIG. 10D symbolically depicts a  $3\frac{1}{2}\frac{1}{3}$  seating configuration when six seats per row are occupied.

FIG. 10E symbolically depicts a  $3\frac{1}{2}\frac{1}{3}$  seating configuration when seven seats per row are occupied.

FIG. 10F symbolically depicts a  $3\frac{1}{2}\frac{1}{3}$  seating configuration when all eight seats per row are occupied.

FIG. 11 illustrates useful additional area per passenger at each load factor in the  $2\frac{1}{4}\frac{1}{2}$  seating configuration of FIGS. 9 using the values of useful additional area shown in FIG. 7.

FIG. 12 illustrates useful additional area per passenger at each load factor in the  $2\frac{1}{4}\frac{1}{2}$  seating configuration illustrated in FIGS. 9 and the  $3\frac{1}{2}\frac{1}{3}$  seating configuration illustrated in FIGS. 10 using the values of useful additional area shown in FIG. 7.

FIG. 13 plots the average useful additional area per passenger, AUAAP, for various configurations calculated using the values of useful additional area shown in FIG. 7, and the distribution of load factors shown in FIG. 8.

FIG. 14 plots the total useful area per passenger, the sum of the seat area and the AUAAP, for a  $2\frac{1}{4}\frac{1}{2}$  configuration at 32 inches of pitch and a  $3\frac{1}{2}\frac{1}{3}$  configuration at 31 inches of pitch.

FIG. 15 plots the total useful area per passenger for a  $2\frac{1}{4}\frac{1}{2}$  configuration with 20 inch wide seats and a  $3\frac{1}{2}\frac{1}{3}$  configuration with 19.5 inch wide seats.

### BEST MODES OF CARRYING OUT THE INVENTION

[0019] The passenger compartment 10 of an airplane 20 is shown in schematic in FIGS. 1 and 2. In those pictorial views, there is a pair of seats 30 adjacent the airplane sidewalls and spaced from a plurality of center seats 40 by aisles 50 and 60. The seats 30, 40 are in the form of economy-class seats and each seat bottom and back have the same widths. This  $2\frac{1}{4}\frac{1}{2}$  arrangement is consistent with the industry practice described earlier. However, as will be better understood hereinafter, in contrast with the present invention, this seating configuration, and others which are obtainable using standard industry practices, do not provide the most comfort for passengers in airplanes of fixed dimensions, a fixed number of passenger seats, and seat type under the load factor conditions actually encountered in airline oper-

ations.

[0020] The following steps (a) through (e) correspond to those outlined in the summary of the invention as involved in achieving all of the objectives of the invention:

5 (a) Identifying potential row configurations:

[0021] The width of a passenger seat manufactured in accordance with industry standards for the selected level of service and accepted aisle widths for the selected level of service must be accounted for in determining all possible seat row configurations. For example, a standard economy-class seat is typically between seventeen (17) and eighteen (18) inches wide between a pair of two (2) inch wide armrests. Standard economy-class aisles are typically between seven-

teen (17) and twenty (20) inches wide. Therefore the process of identifying all possible row configurations for a given class of service is limited to identifying the possible candidates for a limited number of seats and aisles.  
[0022] The regulatory requirements of the Federal Aviation Administration (FAA) and other airworthiness authorities stipulate that a passenger may not be seated more than two seats away from the nearest aisle. This results in a limitation on the number of seats in units used in specific locations within the passenger compartment. For example, only units with three or fewer seats may be used adjacent to a sidewall and units located between two aisles may have no more than six seats.

[0023] No six-seat units are known to be in service and, as a result, there is no reported passenger comfort data for any unique seating environments that may exist in them. Furthermore, when the process of the present invention is expanded to evaluate six-seat units, no merit is shown for their use. As a result, the present invention ignores the use of six-seat units.

[0024] In view of the above constraints, all possible row configurations for a given number of seats and aisles can be identified. The following analysis can be extrapolated to any number of aisles. However, for purposes of clarity, the discussion is limited to airplanes with up to three-aisles.

25

For single-aisle airplanes:

[0025]

30 4 to 5 seats per row:  $2 \setminus (s-2)$   
6 seats per row:  $3 \setminus 3$

For two-aisle airplanes:

35 [0026]

6 to 9 seats per row:  $2 \setminus (s-4) \setminus 2$   
7 to 10 seats per row:  $2 \setminus (s-5) \setminus 3$ , or  $3 \setminus (s-5) \setminus 2$   
8 to 11 seats per row:  $3 \setminus (s-6) \setminus 3$

40

Where "s" = total number of seats per row

[0027] Example: for eight abreast seating ( $s=8$ ), two-aisle seating configurations consist of the following possible seating configurations:  $2 \setminus 4 \setminus 2$ ,  $2 \setminus 3 \setminus 3$ ,  $3 \setminus 3 \setminus 2$ , and  $3 \setminus 2 \setminus 3$ . As mentioned above, one such seating configuration, i.e.,  $2 \setminus 4 \setminus 2$ , is in use today in more than six hundred (600) commercial airplanes. None of the others,  $2 \setminus 3 \setminus 3$ ,  $3 \setminus 3 \setminus 2$  or  $3 \setminus 2 \setminus 3$ , is known to be, or to have been, in use in more than a single row in any commercial airplane cabin. For example the  $3 \setminus 2 \setminus 3$  configuration has been used in a single row in a specially configured Boeing model 747 to accommodate the airplane's  $3 \setminus 4 \setminus 3$  configuration to the tapered nose section of the airplane. Because only a very small portion of the airplane's seats are configured in the  $3 \setminus 2 \setminus 3$  arrangement the benefits of the present invention can not be realized.

50 For three-aisle airplanes:

[0028]

4 to 7 seats per half row:  $2 \setminus (h-2)$   
55 5 to 8 seats per half row:  $3 \setminus (h-3)$

Where "h" = a half row, i.e., the number of seats from either sidewall of the airplane to the center or middle aisle.

[0029] Although combinations of all the half rows identified above are possible, no potential merit has been demon-

strated for seating configurations with more asymmetry than necessary to accommodate an odd number of seats per row. More desirable configurations have equal numbers of seats per half row or, for odd numbers of seats per row, one more seat in one half row than in the other. When the total number of seats in a row is even,  $h=s/2$ . When the total number of seats is odd,  $h=(s/2) + .5$  for one half row whereas  $h=(s/2) - .5$  for the other half row.

- 5 **[0030]** Example: for twelve abreast seating ( $s=12$ ), six seats per half row ( $h=6$ ), the possible seating configurations with potential merit consist of:  $2\backslash4\backslash4\backslash2$  and  $3\backslash3\backslash3\backslash3$ .

(b) Determining the level of comfort enjoyed by passengers in each seating environment:

- 10 **[0031]** Referring to FIG. 3, seat width is defined as the distance between the centers of the armrests on each side of a passenger seat.

- [0032]** Seat pitch is defined as the distance between the same feature on seats positioned in alignment in immediately adjacent rows. As an example, referring to FIG. 3, between the back edge of the upright seat back of a first seat and the back edge of the upright seat back of a second seat positioned in alignment with the first seat in an immediately adjacent row.

15 **[0033]** Seat area is defined to equal seat width times seat pitch.

- [0034]** While some objectives of the present invention can be achieved employing abstract measures of passenger comfort, measures which are readily related to the physical dimensions of seating have been found to be most useful because they relate directly to the parameters that industry managers are accustomed to using to influence passenger comfort, i.e., seat pitch and seat width. A particularly useful spatial measure of comfort is the total amount of useful additional area enjoyed by passengers in a horizontal plane. This horizontal plane is best visualized at the shoulder level of seated passengers because anthropometric data show that passengers are typically widest at the shoulder and, as a result, interference between adjacent passengers, sidewalls and objects in the aisle most often occurs at seated shoulder level. This total useful area has been broken down into two components illustrated in FIG. 3: seat area and the useful additional area (UAA) made available to passengers by adjacent empty seats, aisles and sidewalls. The specific shape of UAA has been arbitrarily shown in the darker shaded portion of FIG. 3. Seat area is shown in the lighter shaded area of that drawing.

- [0035]** Not all available area is useful in improving passenger comfort. As an example, although the entire seat area of an empty seat may be available to the passengers seated on either side, passenger surveys reveal that the comfort of passengers seated beside empty seats is improved by a smaller amount than would be expected if the passengers' seat area had been increased by fifty (50) percent (each adjacent passengers' share of the empty seat between them).

- [0036]** Passengers seated beside sidewalls report average comfort levels higher than would be expected if their seat area had simply been increased by the area available between their seat and the sidewall. In this case the privacy and physical support afforded by the sidewall is interpreted as providing the comfort equivalent of more useful additional area.

- [0037]** Because not all available area is useful in improving comfort and because sidewalls provide more comfort than can be accounted for by the area available between the passengers seat and the sidewall, it is impractical to measure UAA directly. As a result, UAA is defined to equal the amount of additional seat area that would produce a comparable increase in passenger comfort. The UAA enjoyed by passengers seated in the various seating environments created by adjacent occupied seats, empty seats, sidewalls and aisles can be derived using the following procedure:

- [0038]** Passengers report different levels of comfort depending upon whether they are seated (e.g.) between an empty seat and a sidewall (Empty/Sidewall), between a passenger and an aisle (Pax/Aisle), or between two other passengers (Pax/Pax). Typical results for economy-class passengers are summarized in FIG. 4.

- [0039]** Survey results are preferably taken from passengers in airplanes capable of producing data for all seating environments occurring in economy-class service, including the center seat in a full 5-seat unit (Ctr., full quint). A McDonnell Douglas model DC-10, in which all such seating environments can be studied, has been found to be a good survey vehicle. Surveys conducted aboard other airplane types have consistently revealed the same relationships among the seating environments present. In FIG. 4 a constant has been subtracted from each comfort score to obscure data that are proprietary to the airlines surveyed. However this does not influence the results because, as will be shown, these data are used to establish comfort relative to a selected reference rather than absolute comfort.

- [0040]** It should be noted that there are no data for the seating environments of a sidewall on one side and an aisle on the other, and of an aisle on both sides, that would only be encountered with single-seat units. Single seats are only desirable under limited conditions in which current practice provides optimal comfort results, as a result the current invention does not address itself to the use of single seats.

- 55 **[0041]** It should also be noted that there are no data for seating environments created by features other than occupied seats, empty seats, sidewalls and aisles. Such other features, e.g., galley walls, may create unusual environments. However because so few passenger seats are positioned adjacent such features, the sample sizes present in available passenger survey data are not adequate to establish a statistically reliable estimate of the average comfort level expe-

rienced by passengers in such unusual environments. As a further result of such a small portion of total passengers being seated in such unusual environments, the impact of such environments on the average comfort of all passengers in an airplane is insignificant. For this reason, the present invention considers that adequate precision is achieved by considering the average comfort of passengers in such unusual seating environments as equal to the comfort of passengers seated in the most analogous usual environment, e.g., the average comfort of passengers seated between an occupied seat and a galley wall can be considered as being equal to the average comfort of passengers seated between an occupied seat and a sidewall. If any additional seating environment becomes sufficiently common that a reliable measure of average passenger comfort in such an environment can be readily obtained, the methods of the present invention are easily extended to include the additional environment.

[0042] All of the passengers surveyed in the study whose results are portrayed in FIG. 4 were seated in seats of substantially equal dimensions. The differences in passenger comfort quantified in FIG. 4 can therefore be attributed to the UAA of the various seating environments.

[0043] As can be seen in FIG. 3, the total area available to a passenger seated between two other passengers (Pax/Pax) is limited by the presence of the adjacent passengers solely to the seat area. As a result, passengers seated between two other passengers can be considered as having no useful additional area, and therefore, the average comfort rating for passengers seated between two other passengers (Pax/Pax) illustrated in FIG. 4 can be equated to the comfort resulting from the seat area of the airplane under study.

[0044] The portion of the average comfort rating resulting from the UAA enjoyed by passengers in other seating environments can, therefore, be calculated by subtracting the comfort rating illustrated in FIG. 4 of passengers seated between two other passengers (Pax/Pax) from the comfort rating of passengers in other seating environments. As an example, the average comfort reported by Pax/Pax passengers of 2.01 subtracted from the 2.31 average comfort reported by Pax/Sidewall passengers equals .30. These average comfort ratings, representative of the comfort resulting from the UAA of the various seating environments, are quantified in FIG. 5.

[0045] Passengers seated in the center seat of a full five-seat unit are shown as reporting average comfort levels indicative of negative UAA. This is interpreted as the spatial equivalent of the discomfort resulting from being seated in this undesirable environment. This discomfort is generally regarded as the result of being seated two seats away from an aisle.

[0046] Passenger comfort surveys have been conducted aboard airplane types such as the McDonnell Douglas model MD-80 and Fokker model F28 in which two seat units are positioned against one sidewall and three seat units are positioned against the opposite sidewall. In these surveys the average comfort reported by passengers seated (in the three-seat units) between a sidewall and an occupied seat two seats away from an aisle is not significantly different from that reported by passengers seated (in the two-seat units) between a sidewall and an occupied seat only one seat away from an aisle. As a result, unlike passengers seated between two other passengers in the center of a five-seat unit, the comfort of passengers seated between a sidewall and an occupied seat is considered not to be influenced by the number of seats between the passenger and the nearest aisle.

[0047] This finding is in direct conflict with the assumption that guides the current art, i.e., passenger comfort is maximized by minimizing the number of seats between any passenger and the nearest aisle. However, diligent analysis of the available data, which is adequate to establish these relationships in accordance with standard practices, shows that the number of seats between a passenger in a sidewall seat and an aisle does not have a significant effect on the comfort of passengers in sidewall seats when adjacent seats are occupied.

[0048] Many in-flight surveys asking the same question about passenger comfort, using the same scale, have been conducted aboard airplanes with economy-class seats installed at a variety of different seat pitches in different rows. The results of one such survey of economy class passengers are shown in FIG. 6. A constant has been subtracted from each comfort score in FIG. 6 to obscure data that are proprietary to the airlines surveyed.

[0049] It is generally accepted that increases in seat width, as well as increases in seat pitch, improve passenger comfort. Furthermore, it is known that, within practical limits, increases in seat pitch and seat width that result in comparable increases in seat area result in comparable improvements in passenger comfort. As a result, square inches of seat area are a useful measure of the passenger comfort resulting from the physical dimensions of passenger seats.

[0050] The survey data presented in FIG. 6 show that a four (4) inch increase in seat pitch results in a 0.28 point increase in the reported average comfort level in the study airplane. The study airplane had passenger seats that were twenty (20) inches wide (eighteen (18) inch wide cushions between two (2) inch wide armrests). As a result, a four (4) inch increase in pitch resulted in an eighty ( $4 \times 20 = 80$ ) square inch increase in seat area. As a further result, an eighty (80) square inch increase in seat area results in a 0.28 point increase in reported average comfort level or a one (1) square inch increase in seat area results in a 0.0035 point increase in reported average comfort level ( $0.28/80 = .0035$ ). This relationship, or a similarly calculated one, can be used in the present invention to convert the values for reported comfort resulting from UAA shown in FIG. 5 into square inch (or similar) values of UAA. As an example, as indicated in FIG. 5, passengers seated between another passenger and a sidewall (Pax/Sidewall) report comfort 0.30 points higher than passengers seated between two other passengers (Pax/Pax). That difference divided by the 0.0035 points per

# EP 0 722 404 B1

square inch relationship established above results in a UAA value of 85.7 square inches for passengers seated between another passenger and a sidewall.

[0051] The foregoing calculation of the UAA enjoyed by passengers in any particular seating environment can be generalized into the following formula:

5

$$UAA_X = B_X \cdot C + \frac{D-E}{F-G}$$

Where:

- 10 UAA<sub>X</sub> = useful additional area in seating environment X  
 and from a survey of passengers with identical seat area:  
 B<sub>X</sub> = average comfort level of passengers in seating environment X  
 C = average comfort level of passengers seated between two other passengers  
 and from a survey of passengers with different amounts of seat area (seat width x seat pitch):  
 15 D = average comfort level of passengers with most seat area  
 E = average comfort level of passengers with least seat area  
 F = seat area of passengers with most seat area  
 G = seat area of passengers with least seat area

- 20 [0052] The UAA enjoyed by passengers in the various seating environments, calculated using the above formula, is quantified in equivalent square inches in FIG. 7.

(c) Determining the frequency of occurrence of load factor increments:

- 25 [0053] Because the demand for travel on individual routes varies considerably, airlines typically operate airplanes which are sufficiently large to provide extra capacity to accommodate above average demand. As a result, an average of only sixty (60) to seventy (70) percent of airplane seats are typically occupied in airline service, i.e., thirty (30) to forty (40) percent remain empty.

- 30 [0054] Reflecting the variation in demand, load factors vary considerably around the average. A typical distribution of the frequency of occurrence of individual load factors is shown in FIG. 8. Such a distribution is easily constructed based on airline boarding records.

(d) Calculating average passenger comfort level:

- 35 [0055] An optimum order for assigning seats has been devised by most airlines based upon their perception of what seating environments are most comfortable. Typically, sidewall seats are filled first (phase A, FIGS. 9A and 10A); aisle seats next to unoccupied seats, second (phase B, FIGS. 9B, 10B and 10C); remaining aisle seats, third (phase C, FIGS. 9C, 9D and 10D); seats between an empty seat and an occupied seat, fourth (phase D, FIG. 9E), and finally, any remaining seats (phase E, FIGS. 9F, 10E and 10F). Having a measure for the UAA of each seating environment and  
 40 knowing what seats are occupied at what load factors, the average amount of UAA per passenger, UAAP, can be calculated for all passengers at each load factor using a standard arithmetic procedure (i.e. by summing the UAA of each passenger on board at the selected load factor and dividing by the number of passengers).

- [0056] FIG 11 illustrates the UAAP available at each load factor in the conventional 2¼/2 seating configuration described earlier. The seat assignment phases A through E described previously and illustrated in FIGS 9A through 9F are indicated by the letters A through E in FIG. 11. As is clearly shown, UAAP declines as load factor increases. However, applicant has discovered that UAAP declines at different rates for different seating configurations. This is illustrated in FIG. 12 using 2¼/2, and 3¼/3 seating configurations and is in largest part a result of the fact that all passengers can be seated beside an empty seat up to a 62.5% load factor in a 3¼/3 configuration, but only to a 50% load factor in a 2¼/2 configuration (see FIGS. 10C and 9B). Indeed, in the 3¼/3 configuration more passengers are  
 50 seated beside an empty seat at all load factors between 50% and 87.5%. Thus as is seen in FIG 12, UAAP declines at different rates for different seating configurations as load factor increases.

- [0057] The average amount of UAAP enjoyed by passengers in a given configuration under varying load factor conditions, AUAAP, is equal to the UAAP at each possible load factor weighted by the frequency of occurrence of that load factor and the number of passengers on board at that load factor. AUAAP can be stated algebraically as the integrated  
 55 product from zero (0) to one hundred (100) percent of the frequency of occurrence of each load factor, the load factor itself and the UAAP at each load factor, all divided by the average load factor:

$$AUAAP = \frac{1}{M} \left[ \int_0^{100\%} P(f) (f) UAAP_f df \right]$$

5

Where:

AUAAP = average useful additional area per passenger

M = average load factor

10 f = load factor

P(f) = frequency of occurrence of load factor f

UAAP<sub>f</sub> = useful additional area per passenger at load factor f

[0058] By replacing the terms (f) UAAP<sub>f</sub> in the foregoing equation by an algebraic calculation of UAAP<sub>f</sub> which embodies the conventional seat assignment priorities described earlier and the values for the UAA for each seating environment which were developed earlier, a generalized equation for the AUAAP in configurations composed of any combination of 2-, 3-, 4-, and 5-seat units compliant with FAA regulations can be stated. In the following formula, the integration limits are the load factors at which the seat assignment process completes the assignment of seats in a particular category (e.g., seats adjacent sidewalls for A, aisle seats adjacent empty seats for B, and so on). Within each integration interval the algebra describes the product of the frequency of occurrence of the load factor and the sum of the products of the portion of available seats occupied by passengers in each seating environment and the UAA of the corresponding seating environment.

$$\begin{aligned} AUAAP = & \frac{1}{M} \left[ \int_0^A P(f) (f) (WE) df + \int_A^B P(f) [(A) (WE) + (f - A) AE] df \right. \\ & + \int_B^C P(f) (A) (WE) + (B - A) AE + (f - B) (2AP - AE) df \\ & + \int_C^D P(f) [A^*WE + (B - A)AE + (C - B) (2AP - AE) + (f - C) (AP + WP - WE)] df \\ & + \int_D^E P(f) [A^*WE + (B - A)AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) + (f - D) (AP + PE - AE)] df \\ & + \int_E^G P(f) [A^*WE + (B - A)AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) \\ & + (E - D) (AP + PE - AE) + (f - E) (2PP + AP - PE - AE)] df \\ & + \int_G^H P(f) [A^*WE + (B - A)AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) \\ & + (E - D) (AP + PE - AE) + (G - E) (2PP + AP - PE - AE) + (f - G) (PP + 2AP - 2AE)] df \\ & + \int_H^K P(f) [A^*WE + (B - A)AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) \\ & + (E - D) (AP + PE - AE) + (G - E) (2PP + AP - PE - AE) + (H - G) (PP + 2AP - 2AE) + (f - H) (AP + PP + WP - AE - WE)] df \\ & + \int_K^1 P(f) [A^*WE + (B - A)AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) \\ & + (E - D) (AP + PE - AE) + (G - E) (2PP + AP - PE - AE) \\ & + (H - G) (PP + 2AP - 2AE) + (K - H) (AP + PP + WP - AE - WE) + (f - K) (CQ + 2PP - 2PE)] df \left. \right] \end{aligned}$$

55

Where:

# EP 0 722 404 B1

|    |       |                                                                                                        |
|----|-------|--------------------------------------------------------------------------------------------------------|
|    | AUAAP | = average useful additional area per passenger                                                         |
|    | M     | = average load factor                                                                                  |
|    | f     | = specific load factor                                                                                 |
|    | P(f)  | = frequency of occurrence of load factor f                                                             |
| 5  | WE    | = UAA enjoyed by passengers seated between a sidewall and an empty seat                                |
|    | AE    | = UAA enjoyed by passengers seated between an aisle and an empty seat                                  |
|    | WP    | = UAA enjoyed by passengers seated between a sidewall and another passenger                            |
|    | AP    | = UAA enjoyed by passengers seated between an aisle and another passenger                              |
|    | PE    | = UAA enjoyed by passengers seated between an empty seat and another passenger                         |
| 10 | PP    | = UAA enjoyed by passengers seated between two other passengers                                        |
|    | CQ    | = UAA enjoyed by passengers seated in the center seat of a full five-seat unit                         |
|    | WZ    | = the total number of outboard (positioned against a sidewall) two-seat units per row (or airplane*)   |
|    | WD    | = the total number of outboard (positioned against a sidewall) three-seat units per row (or airplane*) |
|    | CZ    | = the total number of inboard (positioned between two aisles) two-seat units per row (or airplane*)    |
| 15 | CD    | = the total number of inboard (positioned between two aisles) three-seat units per row (or airplane*)  |
|    | CV    | = the total number of inboard (positioned between two aisles) four-seat units per row (or airplane*)   |
|    | CF    | = the total number of inboard (positioned between two aisles) five-seat units per row (or airplane*)   |
|    | s     | = the total number of seats per row (or airplane*)                                                     |
|    | A     | = (WZ + WD)/s                                                                                          |
| 20 | B     | = A + [CZ + 2(CD + CV + CF) + WD]/s                                                                    |
|    | C     | = B + CZ/s                                                                                             |
|    | D     | = C + WZ/s                                                                                             |
|    | E     | = D + (CV + 2CF)/s                                                                                     |
|    | G     | = E + CV/s                                                                                             |
| 25 | H     | = G + CD/s                                                                                             |
|    | K     | = H + WD/s                                                                                             |

[0059] Other mathematical approaches can be taken to describe the same phenomenon. As an example, it may prove desirable to conduct the integration as summation of incremental load factor steps if the available load factor data is in such a form, or for ease of solution by computer. Such alternative approaches may also employ the same logical elements in a different sequence, e.g., first calculating the fraction of total passengers who are seated in each environment in a given configuration under given load factor conditions and subsequently using those fractions as weighting coefficients in the calculation of a weighted average of the UAA enjoyed by passengers in all seating environments. Such alternative approaches would use seat assignment logic and load factor weighting like those fundamental to the preceding formula to calculate the fraction of passengers in each seating environment and standard arithmetic techniques for calculating AUAAP.

## (e) Installing seats:

[0060] The last step comprises installing seats using the candidate configuration with the highest value of AUAAP, whereby passenger comfort in seats of any given dimensions may be maximized.

[0061] The present invention also contemplates a method for increasing passenger comfort relative to that achieved with the current art in an airplane of fixed dimensions and substantially equal number and type of seats. As is obvious, improving the comfort enjoyed by passengers is highly desirable. Greater comfort has been shown to attract passengers willing to pay higher fares as well as a greater share of passengers in a competitive environment.

[0062] Installing seats of the same dimensions as those employed with the current art using the configuration with the highest value of AUAAP maximizes passenger comfort while maintaining a substantially equal number of passenger seats in an airplane of fixed dimensions.

[0063] As an example, if seats of identical width are employed at identical pitch, the possible alternative configurations are reduced to those with the same number of seats and aisles per row. AUAAP for possible alternatives of 8-abreast two-aisle, and 11-, 12-, and 13-abreast three-aisle configurations are displayed in FIG. 13. Configurations obtainable with the present invention provide up to twenty (20) square inches more AUAAP than those obtainable with the current art. This is a comfort advantage substantially equal to that resulting from a one (1) inch increase in seat pitch (20 in. seat width x 1 in. seat pitch = 20 square inches).

\* while calculating the AUAAP for a typical row generally provides adequate precision, because the presence of lavatories, galleys or similar installations often results in some incomplete rows, it may be considered desirable to specify the configuration in terms of every seat unit in the cabin. The preceding formula is suitable for either approach.

**[0064]** It is also significant to note that the prior art teaches away from the selection of the seating configurations suggested by the present invention. In each of the instant configurations a number of passengers will be seated more than one seat away from the nearest aisle. Such configurations are not typically chosen because conventional wisdom deems them less than ideal as mentioned above.

5 **[0065]** The present invention also comprises a method of increasing the number of passenger seats while maintaining substantially the same comfort levels offered within the same airplane carrying fewer passengers when configured in accordance with current practice. In this discussion, it is assumed that the airplane is of fixed dimensions with the same floor space available for positioning the same type of passenger seats as in the previous discussion. As is obvious, adding revenue producing passenger seats to the airplane is highly desirable. Each additional seat potentially represents

10 as much as several hundreds of thousands of dollars in sales per year to a commercial airline.  
**[0066]** When installing seats in an airplane using a configuration which provides more AUAAP than a configuration identified using current practice, the seat area can be reduced by an amount equal to the AUAAP advantage. Thus, the greater comfort resulting from the greater AUAAP may be exchanged for the lesser comfort resulting from the smaller seat area. The reduction in seat area makes area within the airplane available for additional seats.

15 **[0067]** As an example, under typical load factor conditions,  $3\frac{1}{2}\frac{1}{3}$  configurations provide approximately 20 square inches more AUAAP than  $2\frac{1}{4}\frac{1}{2}$  configurations. Reducing the pitch of standard twenty (20) inch wide seats by one (1) inch will result in an offsetting twenty (20) square inch reduction in seat area ( $20 \times 1 = 20$ ). As a result, an airplane configured according to current practice containing 31 rows of 20 inch wide seats in a  $2\frac{1}{4}\frac{1}{2}$  arrangement at 32 inches of pitch can be reconfigured in a  $3\frac{1}{2}\frac{1}{3}$  arrangement at 31 inches of pitch providing equal amounts of total useful area per passenger (the sum of seat area and AUAAP), and therefore equivalent comfort. However, the one (1) inch of pitch gained from each of the 31 rows makes 31 inches of pitch available for one additional row of eight (8) revenue producing seats. The total useful area per passenger for a  $2\frac{1}{4}\frac{1}{2}$  configuration at 32 inches of pitch and a  $3\frac{1}{2}\frac{1}{3}$  configuration at 31 inches of pitch is quantified in FIG. 14 using the UAA data portrayed in FIG. 7 and the load factor distribution illustrated in FIG. 8. Thus, passengers may experience substantially the same comfort in either configuration.

25 **[0068]** The present invention further comprises a method of decreasing airplane dimensions for substantially the same number of passengers at substantially the same original comfort levels with the same seat type. In this discussion it is assumed that the airplane passenger capacity and desired comfort level are essentially fixed while, as is the case early in the airplane design process, the dimensions of the airplane can be changed.

30 **[0069]** Reducing the dimensions of an airplane reduces the structural weight and aerodynamic drag of the airplane resulting in lower operating costs. Reducing operating costs while holding passenger capacity and comfort levels essentially constant is obviously desirable because reducing costs, without changing the capacity and comfort qualities that determine revenue, results in higher operating profit for the airline.

35 **[0070]** As shown above, when installing seats in an airplane using a configuration which provides more AUAAP than a configuration identified using current practice, the seat area can be reduced by an amount equal to the AUAAP advantage. In this manner the greater comfort resulting from the greater AUAAP may be exchanged for the lesser comfort resulting from the smaller seat area. The reduction in seat area accomplished through the use of narrower seats and/or shorter seat pitch makes it possible to make the airplane itself narrower and/or shorter resulting in less structural weight and aerodynamic drag.

40 **[0071]** As an example, current efforts to design a very large commercial airplane with a capacity of approximately 600 to 800 seats have resulted in possible designs for airplane fuselages that could accommodate twelve-seat, three-aisle row configurations on the main deck. Current practice determines the  $2\frac{1}{4}\frac{1}{4}\frac{1}{2}$  configuration to be the ideal such seating configuration since no passenger is more than one seat from the nearest aisle. Using the first procedure of the present invention described earlier,  $3\frac{1}{3}\frac{1}{3}\frac{1}{3}$  can also be identified as a possible twelve-abreast, three-aisle configuration. When the AUAAP of  $2\frac{1}{4}\frac{1}{4}\frac{1}{2}$  and  $3\frac{1}{3}\frac{1}{3}\frac{1}{3}$  configurations are calculated as described previously,  $3\frac{1}{3}\frac{1}{3}\frac{1}{3}$  is found to provide passengers approximately sixteen (16) square inches more AUAAP than the  $2\frac{1}{4}\frac{1}{4}\frac{1}{2}$  configuration. As a result, to offer the same total useful area per passenger, if seat pitch is assumed to be thirty-two (32) inches, the seats in the  $3\frac{1}{3}\frac{1}{3}\frac{1}{3}$  configuration can be made one half (0.5) inch narrower, relative to those in the  $2\frac{1}{4}\frac{1}{4}\frac{1}{2}$  configuration, resulting in an offsetting sixteen (16) square inch decrease in seat area ( $32 \text{ in. pitch} \times 0.5 \text{ in. width} = 16 \text{ square inches}$ ). The airplane itself can therefore be made six (6) inches narrower ( $12 \text{ seats} \times 0.5 \text{ inches per seat} = 6 \text{ inches}$ ) than an airplane configured according to current practice while offering equal total useful area per passenger and therefore equivalent comfort. The total useful area per passenger for a  $2\frac{1}{4}\frac{1}{4}\frac{1}{2}$  configuration with twenty (20) inch wide seats (18 inch wide seat cushions with 2 inch wide armrests) and a  $3\frac{1}{3}\frac{1}{3}\frac{1}{3}$  configuration with 19.5 inch wide seats (17.5 inch wide seat cushions with 2 inch wide armrests) is quantified in FIG. 15 using thirty-two (32) inches of seat pitch, the UAA data portrayed in FIG. 7 and the load factor distribution illustrated in FIG. 8.

55 **[0072]** The present invention also comprises a simplification of the above method for increasing passenger comfort relative to that achieved with the current art with a fixed number of seats and aisles per row in an airplane of fixed dimensions and substantially equal number and type of seats.

**[0073]** The number of seats adjacent to sidewalls and aisles is identical for all possible seat row configurations of a

given number of aisles assuming aisles are not positioned adjacent to sidewalls. Thus, as a general rule, in addition to two sidewall seats per row, there are two aisle seats per row for each aisle. In single-aisle airplanes there are two aisle seats per row, in two-aisle airplanes there are four aisle seats per row, in three-aisle airplanes there are six aisle seats per row, and so on.

5 **[0074]** Positioning aisles adjacent to sidewalls reduces the total number of seats per row adjacent to sidewalls and aisles and is, therefore, avoided. However, where for some reason it is necessary to position an aisle adjacent a sidewall (such as to provide an emergency evacuation path), the methods of the present invention are readily applicable and achieve the objectives of the present invention while the current practice of payloads engineers teaches away from the optimal solution proposed by the present invention.

10 **[0075]** It has been shown earlier that sidewall and aisle seats adjacent an empty seat are assigned first. All remaining seat assignments are made to seats adjacent other passengers. Thus, with the portion of seats adjacent to a sidewall or aisle in a row with a given number of aisles being a constant for all practical purposes, the portion of passengers in each configuration who will be seated adjacent an empty seat under realistic load factor conditions can be used as a measure of average passenger comfort.

15 **[0076]** The number of passengers who can be seated beside an empty seat is a function of the arrangement of the seats. This can best be illustrated by way of example. Referring again to FIGS. 9-10, wherein two possible configurations for two-aisle, eight-abreast seating are shown. In particular, FIGS. 9-10 are intended in this discussion to exemplify the effect of configuration on the number of passengers who may be seated beside an empty seat at various load factors. FIGS. 9A & 10A represents a load factor of 25%, whereas FIGS. 9F & 10F represent the condition when all seats are filled, i.e., a load factor of 100%. FIGS. 9B-9E and FIGS. 10B-10E represent equivalent intermediate load factors.

20 **[0077]** For purposes of comparison, a seating configuration determined in accordance with conventional techniques (2\4\2) is contrasted with a seating configuration obtainable with the method of the present invention, i.e., a 3\2\3 seating configuration. Thus, the conventional configuration is shown in FIGS. 9A, 9B, 9C, 9D, 9E, and 9F and one of the configurations obtainable with the process of the present invention is portrayed in FIGS. 10A, 10B, 10C, 10D, 10E, and 10F.

25 **[0078]** When four or fewer seats per row are occupied (FIGS. 9A, 9B, 10A and 10B), all passengers can be seated adjacent to an empty seat in the 2\4\2 and 3\2\3 configurations. As the load factor increases (see FIGS. 9C and 10C) and five seats per row are occupied, only three passengers remain seated adjacent to empty seats in the conventional 2\4\2 configuration. In contrast, five passengers are seated next to an empty seat in the 3\2\3 configuration of the present invention. As load factor increases in FIGS. 9D and 10D (six passengers per row), only two passengers can be seated adjacent to an empty seat in the conventional 2\4\2 configuration whereas four passengers can enjoy maximum comfort in the 3\2\3 configuration. When seven passengers are seated per row (FIGS. 9E and 10E), the conventional configuration (2\4\2) and the configuration of the present invention (3\2\3), allow only two passengers to enjoy an empty seat alongside them. When all seats are filled (FIGS. 9F and 10F), no passengers are seated adjacent to empty seats in either configuration.

30 **[0079]** Thus, while at certain load factors (FIGS. 9A & 10A, 9B & 10B, 9E & 10E and 9F & 10F) both seat configurations provide equal passenger comfort (as measured by an empty seat), the present invention provides superior comfort to passengers flying in the airplane at realistic occupancy conditions, i.e., average load factors. As can be seen from these illustrations, the 3\2\3 configuration obtained using the process of the present invention enjoys an advantage over the conventional 2\4\2 configuration in terms of the number of passengers who are seated beside an empty seat when 5 or 6 seats in an 8 seat row are occupied. This represents load factors of 62.5% and 75%. Other desirable configurations obtainable using the present invention include permutations of the 3\2\3 seating arrangement, i.e., a 3\3\2 and a 2\3\3 seating configuration.

40 **[0080]** The portion of passengers who can be seated adjacent an empty seat in any configuration can be ascertained using the following formula which takes into account the seat assignment process described earlier and the frequency of occurrence of each load factor.

$$50 \quad E = \frac{1}{M} \left[ \int_0^{a/s} P(f)(f) df + \int_{a/s}^{b/s} P(f)(a/s - (f-a/s)) df + \int_{b/s}^{c/s} P(f)(g/s) df + \int_{c/s}^1 P(f)(g/s - 2(f-c/s)) df \right]$$

where:

55  $E$  = portion of occupied seats which have an empty seat alongside  
 $M$  = average load factor  
 $f$  = specific load factor

EP 0 722 404 B1

$P(f)$  = frequency of occurrence of load factor  $f$   
 $s$  = number of seats per row  
 $z$  = the number of two-seat units per row  
 $d$  = the number of three-seat units per row  
 $v$  = the number of four-seat units per row  
 $q$  = the number of five-seat units per row  
 $a$  =  $z + 2(d + v + q)$ ; the number of sidewall and aisle seats that can be occupied without seating passengers side by side.  
 $b$  =  $a + z$ ; the total number of sidewall and aisle seats  
 $c$  =  $b + v + 2(q)$ ; the total number of seats that can be filled leaving one empty seat in each 3-, 4-, and 5-seat unit  
 $g$  =  $2(d + v + q)$ ; the total number of passengers who are seated beside empty seats when (only) all sidewall and aisle seats are filled

**[0081]** The value of  $E$  for  $3\frac{1}{2} \times 3$ ,  $3\frac{1}{2} \times 2$  and  $2\frac{1}{2} \times 3$  configurations, is greater than  $E$  calculated for  $2\frac{1}{2} \times 2$  configurations for all distributions of load factors,  $P(f)$ , including positive values for load factors between .5 and .875. Since average load factors in the commercial aviation industry typically fall between .6 and .7, all realistic load factor distributions include positive values between .5 and .875.

**[0082]** The following Chart A illustrates some of the seating configurations attainable using the prior art and the present invention. The present seating configurations shown in Chart A were attained using the above simplified process. These configurations had the higher value for  $E$  and can also be shown to have the higher value of  $AUAAP$ .

| Chart A       |                                                                          |                                 |                                                   |                                 |
|---------------|--------------------------------------------------------------------------|---------------------------------|---------------------------------------------------|---------------------------------|
| seats per row | current practice                                                         | passengers two seats from aisle | present invention                                 | passengers two seats from aisle |
| 8             | $2\frac{1}{4} \times 2$                                                  | 0                               | $2\frac{1}{2} \times 3$ , $3\frac{1}{2} \times 2$ | 1,1                             |
| 11            | $2\frac{1}{4} \times 3\frac{1}{2}$<br>$2\frac{1}{2} \times 4\frac{1}{2}$ | 0                               | $3\frac{1}{2} \times 3$                           | 2                               |
|               |                                                                          | 0                               | $2\frac{1}{2} \times 3\frac{1}{2}$                | 1                               |
|               |                                                                          |                                 | $3\frac{1}{2} \times 3\frac{1}{2}$                | 1                               |
|               |                                                                          |                                 | $3\frac{1}{2} \times 2\frac{1}{2}$                | 2                               |
| 12            | $2\frac{1}{4} \times 4\frac{1}{2}$<br>$2\frac{1}{4} \times 5\frac{1}{2}$ | 0                               | $3\frac{1}{2} \times 3\frac{1}{2}$                | 2                               |
|               |                                                                          | 1                               | $3\frac{1}{4} \times 3\frac{1}{2}$                | 2                               |
|               |                                                                          | 1                               | $3\frac{1}{2} \times 4\frac{1}{2}$                | 2                               |
|               |                                                                          | 1                               |                                                   |                                 |
| 13            | $2\frac{1}{4} \times 4\frac{1}{2}$<br>$2\frac{1}{4} \times 5\frac{1}{2}$ | 1                               |                                                   |                                 |
|               |                                                                          | 1                               |                                                   |                                 |

**[0083]** As can clearly be seen from an examination of Chart A above, conventional payload techniques, which require passengers to be a minimum number of seats away from an aisle (preferably one), teach away from the process of the present invention. In stark contrast to what one would expect to do using conventional techniques, the present invention does not minimize the number of seats between a passenger and the nearest aisle. The present process, however, produces seating configurations fully compliant with applicable FAA regulations. And, as explained above, the seating arrangements contemplated by the present invention are more comfortable for passengers in an airplane of fixed dimensions and seat type at the typical load factors experienced by the airline industry because more passengers are seated next to an empty seat at these load factors.

**[0084]** The seating configurations determined in accordance with the above described process should preferably be applied to a sufficiently large portion of the passenger seats in a particular service class. In doing so the number of passengers who may be seated adjacent an empty seat may be significantly increased. As an example, using the formula for  $E$  above it can be determined that thirty (30) percent more passengers can be seated adjacent empty seats when the present  $3\frac{1}{2} \times 3$  configuration is used throughout the passenger seating area as compared to a conventional  $2\frac{1}{2} \times 2$  configuration. The superior seating environment of a  $3\frac{1}{2} \times 3$  configuration can obviously improve the service image of an

airline employing the present configuration.

[0085] By contrast, for the above Boeing model 747 which has a single row of 3\2\3 seating, only one tenth (0.1) of one percent more passengers can be seated adjacent an empty seat as compared to using the conventional 2\4\2 configuration for that single row. Since this is an insignificant increase, the specially configured Boeing model 747 could not enjoy the useful benefit of the present invention.

# Claims

1. A process for optimizing passenger seating configurations within an airplane, comprising:

- a - identifying the row configurations that can be reasonably accommodated by said airplane;
- b - determining the level of comfort enjoyed by passengers seated in different seating environments within said airplane created by adjacent empty seats, occupied seats, sidewalls, and aisles (environment comfort level);
- c - determining the frequency of occurrence of possible load factor increments;
- d - calculating the average passenger comfort level in said row configurations, using said environment comfort levels, weighted by the portion of passengers that would be seated in each of said seating environments at each said load factor increment each said load factor increment being weighted by the frequency of occurrence of said load factor increment; and
- e - installing seats in said airplane in accordance with the seating configuration shown by step (d) to provide the highest average passenger comfort level.

2. The process of claim 1, wherein said environment comfort levels in step (b) are calculated in accordance with the following formula;

$$ESE_x = B_x - C + \frac{D - E}{F - G}$$

Where:

- $ESE_x$  = environment spatial equivalent for seating environment X  
and from a survey of passengers with identical seat area (seat width x seat pitch)
- $B_x$  = average reported comfort of passengers in seating environment X
- $C$  = average reported comfort of passengers seated between two other passengers  
and from a survey of passengers with different amounts of seat area:
- $D$  = average reported comfort of passengers with most seat area
- $E$  = average reported comfort of passengers with least area
- $F$  = seat area of passengers with most seat area
- $G$  = seat area of passengers with least seat area

3. The process of claim 1 or 2, wherein said average passenger comfort level (APCL) is determined in accordance with the following formula:

EP 0 722 404 B1

$$\begin{aligned}
 \text{APCL} = \frac{1}{M} & \left[ \int_0^A P(f) \text{WE}(f) df + \int_A^B P(f) (A)^* \text{WE} + (f - A) \text{AE} df \right. \\
 & + \int_B^C P(f) [A^* \text{WE} + (B-A) \text{AE} + (f-B) (2\text{AP}-\text{AE})] df \\
 & + \int_C^D P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (f-C) (\text{AP}+\text{WP}-\text{WE})] df \\
 & + \int_D^E P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) + (f-D) (\text{AP}+\text{PE}-\text{AE})] df \\
 & + \int_E^G P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) - (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (f-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE})] df \\
 & + \int_G^H P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (G-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE}) + (f-G) (\text{PP}+2\text{AP}-2\text{AE})] df \\
 & + \int_H^K P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (G-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE}) + (H-G) (\text{PP}+2\text{AP}-2\text{AE}) + (f-H) (\text{AP}+\text{PP}+\text{WP}-\text{AE}-\text{WE})] df \\
 & + \int_K^1 P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (G-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE}) \\
 & \quad + (H-G) (\text{PP}+2\text{AP}-2\text{AE}) + (K-H) (\text{AP}+\text{PP}+\text{WP}-\text{AE}-\text{WE}) + (f-K) (\text{CQ}+2\text{PP}-2\text{PE})] df ]
 \end{aligned}$$

Where:

- 35 ACPL = average passenger comfort level  
 M = average load factor  
 f = specific load factor  
 P(f) = frequency of occurrence of load factor f  
 WE = environment comfort level for passengers seated between a sidewall and an empty seat  
 40 AE = environment comfort level for passengers seated between an aisle and an empty seat  
 WP = environment comfort level for passengers seated between a sidewall and another passenger  
 AP = environment comfort level for passengers seated between an aisle and another passenger  
 PE = environment comfort level for passengers seated between an empty seat and another passenger  
 PP = environment comfort level for passengers seated between two other passengers  
 45 CQ = environment comfort level for passengers seated in the center of a full five-seat unit  
 WZ = the total number of outboard (positioned against a sidewall) two-seat units per row (or airplane)  
 WD = the total number of outboard (positioned against a sidewall) three-seat units per row (or airplane)  
 CZ = the total number of inboard (positioned between two aisles) two-seat units per row (or airplane)  
 CD = the total number of inboard (positioned between two aisles) three-seat units per row (or airplane)  
 50 CV = the total number of inboard (positioned between two aisles) four-seat units per row (or airplane)  
 CF = the total number of inboard (positioned between two aisles) five-seat units per row (or airplane)  
 s = the total number of seats per row (or airplane)  
 A = (WZ + WD)/s  
 B = A + [CZ + 2(CD + CV + CF) + WD]/s  
 55 C = B + CZ/s  
 D = C + WZ/s  
 E = D + (CV + 2CF)/s  
 G = E + CV/s

$$H = G + CD/s$$

$$K = H + WD/s$$

- 5 4. A process for maximizing passenger comfort in an airplane having a fixed number of seats and aisles per row comprising:

- (a) identifying the possible row configurations for a given number of seats and aisles;  
 (b) determining the frequency of occurrence of possible load factor increments;  
 (c) calculating the portion of passenger who can be seated alongside an empty seat in said row configuration  
 10 in said load factor increments; and  
 (d) selecting the row configuration allowing the greatest number of passengers to be seated next to an empty seat at typical load factors, and;  
 (e) installing seats in said airplane in accordance with said selected row configurations.

- 15 5. The process of claim 4, wherein said portion of passengers is determined in accordance with the following formula:

$$E = \frac{1}{M} \left[ \int_0^{a/s} P(f)(f) df + \int_{a/s}^{b/s} P(f)(a/s - (f-a/s)) df + \int_{b/s}^{c/s} P(f)(g/s) df + \int_{c/s}^1 P(f)(g/s - 2(f-c/s)) df \right]$$

20

where

- E = portions of passengers who can be seated alongside an empty seat  
 25 M = average load factor  
 f = specific load factor  
 P(f) = frequency of occurrence of load factor f  
 s = number of seats per row  
 z = the number of two-seat-units per row  
 30 d = the number of three-seat-units per row  
 v = the number of four-seat-units per row  
 q = the number of five-seat-units per row  
 a = z + 2 (d + v + q) ; the number of sidewall and aisle seats that can be occupied without seating passengers side by side  
 35 b = a + z; the total number of sidewall and aisle seats  
 c = b + v + 2 (g) ; the total number of seats that can be filled leaving one empty seat in each 3-, 4-, 5-seat unit  
 g = 2 (d + v + q); the total number of passengers who are seated beside empty seats when (only) all sidewall and aisle seats are filled

- 40 6. In an airplane of fixed dimensions, having standard seats, two aisles and eight abreast seating the seating configuration comprising a two-seat unit and two three-seat units.

7. The airplane of claim 6, wherein said two-seat unit is positioned between a side wall of the airplane and a first aisle closest to said side wall.

- 45 8. The airplane of claim 6, wherein said two-seat unit is positioned between said two aisles.

9. In an airplane of fixed dimensions, having standard seats, three aisles and eleven abreast seating, the seating configuration comprising a two-seat unit and three three-seat units.

- 50 10. The airplane of claim 9, wherein said two-seat unit is positioned between a side wall of the airplane and a first aisle closest to said side wall.

11. The airplane of claim 9, wherein said two-seat unit is positioned between two of said aisles.

- 55 12. In an airplane of fixed dimensions, having standard seats, three aisles and twelve abreast seating, the seating configuration comprising:

- (a) a first three-seat unit positioned between a side wall of the airplane and a first aisle closest to said side wall,
- (b) a second three-seat unit positioned between said first aisle and the second aisle,
- (c) a third three-seat unit positioned between said second aisle and the third aisle, and
- (d) a fourth three-seat unit positioned between said third aisle and the other side wall of said airplane.

13. In an airplane of fixed dimensions, having standard seats, three aisles and thirteen abreast seating, the seating configuration comprising:

- (a) a first three-seat unit positioned between a side wall of the airplane and a first aisle closest to said side wall,
- (b) a four-seat unit positioned between said first aisle and the second aisle,
- (c) a second three-seat unit positioned between said second aisle and the third aisle, and
- (d) a third three seat unit positioned between said third aisle and the other side wall of said airplane.

#### Patentansprüche

1. Verfahren zum Optimieren der Passagiersitzgelegenheitskonfigurationen innerhalb eines Flugzeugs, umfassend:

- a - Identifizieren der Reihenkonfigurationen, die vernünftigerweise von dem Flugzeug aufgenommen werden können;
- b - Bestimmen des Komfortniveaus, das von Passagieren genossen wird, die in unterschiedlichen Sitzgelegenheitsumgebungen innerhalb des Flugzeugs sitzen, welche durch benachbarte leere Sitze, besetzte Sitze, Seitenwände und Gänge erzeugt werden (Umgebungskomfortniveau);
- c - Bestimmen der Häufigkeit des Auftretens von möglichen Belastungsfaktorzunahmen;
- d - Berechnen des mittleren Passagierkomfortniveaus in den Reihenkonfigurationen unter Verwendung der Umgebungskomfortniveaus, gewichtet durch den Teil von Passagieren, der in jeder der Sitzgelegenheitsumgebungen bei jeder genannten Belastungsfaktorzunahme sitzen würde, wobei jede Belastungsfaktorzunahme durch die Häufigkeit des Auftretens der Belastungsfaktorzunahme gewichtet wird; und
- e - Installieren von Sitzen in dem Flugzeug gemäß der durch den Schritt (d) gezeigten Sitzgelegenheitskonfiguration, um das höchste mittlere Passagierkomfortniveau vorzusehen.

2. Verfahren nach Anspruch 1, worin die Umgebungskomfortniveaus im Schritt (b) gemäß der folgenden Formel berechnet werden;

$$ESE_x = B_x - C \div \frac{D - E}{F - G}$$

worin:

$ESE_x$  = umgebungsräumliches Umgebungsäquivalent für die Sitzgelegenheitsumgebung X und von einer Schätzung der Passagiere mit identischer Sitzfläche (Sitzbreite x Sitzabstand)

$B_x$  = mittlerer berichteter Komfort der Passagiere in der Sitzgelegenheitsumgebung X

C = mittlerer berichteter Komfort der Passagiere, die zwischen zwei anderen Passagieren sitzen und von einer Schätzung der Passagiere mit unterschiedlichen Beträgen an Sitzfläche:

D = mittlerer berichteter Komfort der Passagiere mit der meisten Sitzfläche

E = mittlerer berichteter Komfort der Passagiere mit der wenigsten Sitzfläche

F = Sitzfläche der Passagiere mit der meisten Sitzfläche

G = Sitzfläche der Passagiere mit der wenigsten Sitzfläche

EP 0 722 404 B1

3. Verfahren nach Anspruch 1 oder 2, worin das mittlere Passagierkomfortniveau (APCL) gemäß der folgenden Formel bestimmt wird:

$$\begin{aligned}
 \text{APCL} = \frac{1}{M} & \left[ \int_0^A P(f) \text{WE}(f) df + \int_A^B P(f) (A^* \text{WE} + (f - A) \text{AE}) df \right. \\
 & + \int_B^C P(f) [A^* \text{WE} + (B-A) \text{AE} + (f-B) (2\text{AP}-\text{AE})] df \\
 & + \int_C^D P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (f-C) (\text{AP}+\text{WP}-\text{WE})] df \\
 & + \int_D^E P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) + (f-D) (\text{AP}+\text{PE}-\text{AE})] df \\
 & + \int_E^G P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) - (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (f-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE})] df \\
 & + \int_G^H P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (G-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE}) + (f-G) (\text{PP}+2\text{AP}-2\text{AE})] df \\
 & + \int_H^K P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (G-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE}) + (H-G) (\text{PP}+2\text{AP}-2\text{AE}) + (f-H) (\text{AP}+\text{PP}+\text{WP}-\text{AE}-\text{WE})] df \\
 & + \int_K^1 P(f) [A^* \text{WE} + (B-A) \text{AE} + (C-B) (2\text{AP}-\text{AE}) + (D-C) (\text{AP}+\text{WP}-\text{WE}) \\
 & \quad + (E-D) (\text{AP}+\text{PE}-\text{AE}) + (G-E) (2\text{PP}+\text{AP}-\text{PE}-\text{AE}) \\
 & \quad + (H-G) (\text{PP}+2\text{AP}-2\text{AE}) + (K-H) (\text{AP}+\text{PP}+\text{WP}-\text{AE}-\text{WE}) + (f-K) (\text{CQ}+2\text{PP}-2\text{PE})] df \left. \right]
 \end{aligned}$$

worin:

- (ACPL) = mittleres Passagierkomfortniveau  
M = mittlerer Belastungsfaktor  
f = spezifischer Belastungsfaktor  
P(f) = Häufigkeit des Auftretens des Belastungsfaktors f  
WE = Umgebungskomfortniveau für Passagiere, die zwischen einer Seitenwand und einem leeren Sitz sitzen  
AE = Umgebungskomfortniveau für Passagiere, die zwischen einem Gang und einem leeren Sitz sitzen  
WP = Umgebungskomfortniveau für Passagiere, die zwischen einer Seitenwand und einem anderen Passagier sitzen  
AP = Umgebungskomfortniveau für Passagiere, die zwischen einem Gang und einem anderen Passagier sitzen  
PE = Umgebungskomfortniveau für Passagiere, die zwischen einem leeren Sitz und einem anderen Passagier sitzen  
PP = Umgebungskomfortniveau für Passagiere, die zwischen zwei anderen Passagieren sitzen  
CQ = Umgebungskomfortniveau für Passagiere, die in der Mitte einer vollen 5-Sitz-Einheit sitzen  
WZ = Gesamtzahl von Außenbord- (positioniert an einer Seitenwand) 2-Sitz-Einheiten pro Reihe (oder Flugzeug)  
WD = Gesamtzahl von Außenbord- (positioniert an einer Seitenwand) 3-Sitz-Einheiten pro Reihe (oder Flugzeug)  
CZ = Gesamtzahl von Innenbord- (positioniert zwischen zwei Gängen) 2-Sitz-Einheiten pro Reihe (oder Flugzeug)

# EP 0 722 404 B1

|    |      |                                                                                                          |
|----|------|----------------------------------------------------------------------------------------------------------|
|    | CD = | Gesamtzahl von Innenbord- (positioniert zwischen zwei Gängen) 3-Sitz-Einheiten pro Reihe (oder Flugzeug) |
|    | CV = | Gesamtzahl von Innenbord- (positioniert zwischen zwei Gängen) 4-Sitz-Einheiten pro Reihe (oder Flugzeug) |
| 5  | CF = | Gesamtzahl von Innenbord- (positioniert zwischen zwei Gängen) 5-Sitz-Einheiten pro Reihe (oder Flugzeug) |
|    | s =  | Gesamtzahl von Sitzen pro Reihe (oder Flugzeug)                                                          |
|    | A =  | (WZ + WD)/s                                                                                              |
|    | B =  | A + [CZ + 2(CD + CV + CF) + WD]/s                                                                        |
| 10 | C =  | B + CZ/s                                                                                                 |
|    | D =  | C + WZ/s                                                                                                 |
|    | E =  | D + (CV + 2CF)/s                                                                                         |
|    | G =  | E + CV/s                                                                                                 |
|    | H =  | G + CD/s                                                                                                 |
| 15 | K =  | H + WD/s                                                                                                 |

4. Verfahren zum Maximieren des Passierkomforts in einem Flugzeug, das eine feste Anzahl von Sitzen und Gängen pro Reihe hat, umfassend:

- (a) Identifizieren der möglichen Reihenkonfigurationen für eine gegebene Anzahl von Sitzen und Gängen;  
 (b) Bestimmen der Häufigkeit des Auftretens von möglichen Belastungsfaktorzunahmen;  
 (c) Berechnen des Teils von Passagieren, der neben einem leeren Sitz in der Reihenkonfiguration in den Belastungsfaktorzunahmen sitzen kann; und  
 (d) Auswählen der Reihenkonfiguration, die es der größten Anzahl von Passagieren ermöglicht, gleich neben einem leeren Sitz bei typischen Belastungsfaktoren zu sitzen, und  
 (e) Installieren von Sitzen in dem Flugzeug gemäß den ausgewählten Reihenkonfigurationen.

5. Verfahren nach Anspruch 4, worin der genannte Teil der Passagiere gemäß der folgenden Formel bestimmt wird:

$$E = \frac{1}{M} \left[ \int_0^{a/s} P(f)(f) df + \int_{a/s}^{b/s} P(f)(a/s - (f-a/s)) df + \int_{b/s}^{c/s} P(f)(g/s) df + \int_{c/s}^1 P(f)(g/s - 2(f-c/s)) df \right]$$

worin

- E = Teile von Passagieren, die neben einem leeren Sitz sitzen können  
 M = mittlerer Belastungsfaktor  
 f = spezifischer Belastungsfaktor  
 P(f) = Häufigkeit des Auftretens des Belastungsfaktors f  
 s = Anzahl von Sitzen pro Reihe  
 z = Anzahl von 2-Sitz-Einheiten pro Reihe  
 d = Anzahl von 3-Sitz-Einheiten pro Reihe  
 v = Anzahl von 4-Sitz-Einheiten pro Reihe  
 q = Anzahl von 5-Sitz-Einheiten pro Reihe  
 a = z + 2 (d + v + q); die Anzahl der Seitenwand- und Gangsitze, die besetzt werden kann, ohne Passagiere nebeneinander zu setzen  
 b = a + z; die Gesamtzahl von Seitenwand- und Gangsitzen  
 c = b + v + 2 (q); die Gesamtzahl von Sitzen, die gefüllt werden kann, wobei ein leerer Sitz in jeder 3-, 4-, 5-Sitz-Einheit bleibt  
 g = 2 (d + v + q); die Gesamtzahl von Passagieren, die neben leeren Sitzen sitzen, wenn (nur) alle Seitenwand- und Gangsitze gefüllt sind

6. In einem Flugzeug von festen Dimensionen, das Standardsitze, zwei Gänge und acht Nebeneinandersitzgelegenheiten hat, die Sitzgelegenheitskonfiguration, welche eine 2-Sitz-Einheit und zwei 3-Sitz-Einheiten umfaßt.

7. Flugzeug nach Anspruch 6, worin die 2-Sitz-Einheit zwischen einer Seitenwand des Flugzeugs und einem ersten Gang, welcher der genannten Seitenwand am nächsten ist, positioniert ist.

8. Flugzeug nach Anspruch 6, worin die 2-Sitz-Einheit zwischen den beiden Gängen positioniert ist.
9. In einem Flugzeug von festen Dimensionen, das Standardsitze, drei Gänge und elf Nebeneinandersitzgelegenheiten hat, die Sitzgelegenheitskonfiguration, welche eine 2-Sitz-Einheit und drei 3-Sitz-Einheiten umfaßt.
10. Flugzeug nach Anspruch 9, worin die genannte 2-Sitz-Einheit zwischen einer Seitenwand des Flugzeugs und einem ersten Gang, welcher der genannten Seitenwand am nächsten ist, positioniert ist.
11. Flugzeug nach Anspruch 9, worin die genannte 2-Sitz-Einheit zwischen zwei der Gänge positioniert ist.
12. In einem Flugzeug von festen Dimensionen, das Standardsitze, drei Gänge und zwölf Nebeneinandersitzgelegenheiten hat, die Sitzgelegenheitskonfiguration, die folgendes umfaßt:
  - (a) eine erste 3-Sitz-Einheit, die zwischen einer Seitenwand des Flugzeugs und einem ersten Gang, welcher der genannten Seitenwand am nächsten ist, positioniert ist,
  - (b) eine zweite 3-Sitz-Einheit, die zwischen dem ersten Gang und dem zweiten Gang positioniert ist,
  - (c) eine dritte 3-Sitz-Einheit, die zwischen dem zweiten Gang und dem dritten Gang positioniert ist, und
  - (d) eine vierte 3-Sitz-Einheit, die zwischen dem dritten Gang und der anderen Seitenwand des Flugzeugs positioniert ist.
13. In einem Flugzeug von festen Dimensionen, das Standardsitze, drei Gänge und dreizehn Nebeneinandersitzgelegenheiten hat, die Sitzgelegenheitskonfiguration, die folgendes umfaßt:
  - (a) eine erste 3-Sitz-Einheit, die zwischen einer Seitenwand des Flugzeugs und einem ersten Gang, der der genannten Seitenwand am nächsten ist, positioniert ist,
  - (b) eine 4-Sitz-Einheit, die zwischen dem ersten Gang und dem zweiten Gang positioniert ist,
  - (c) eine zweite 3-Sitz-Einheit, die zwischen dem zweiten Gang und dem dritten Gang positioniert ist, und
  - (d) eine dritte 3-Sitz-Einheit, die zwischen dem dritten Gang und der anderen Seitenwand des Flugzeugs positioniert ist.

#### Revendications

1. Procédé d'optimisation des configurations de disposition des sièges pour passagers dans un avion, comprenant :
  - a) l'identification des configurations de rangées qui peuvent être raisonnablement logées dans l'avion,
  - b) la détermination du niveau de confort dont jouissent les passagers assis dans différents environnements de disposition des sièges dans l'avion créés par des sièges vides adjacents, des sièges occupés, des parois latérales et des allées (niveau de confort d'environnement),
  - c) la détermination de la fréquence d'apparition d'incrémentes possibles du facteur de charge,
  - d) le calcul du niveau de confort moyen des passagers dans ces configurations de rangées, à l'aide des niveaux de confort d'environnement pondérés par la fraction de passagers qui seraient assis dans chacun des environnements de disposition des sièges pour chaque incrément du facteur de charge, chaque incrément du facteur de charge étant pondéré par la fréquence d'apparition de cet incrément du facteur de charge, et
  - e) l'installation de sièges dans l'avion d'après la configuration de disposition des sièges représentée par l'étape (d) pour l'obtention du niveau de confort moyen le plus élevé pour les passagers.
2. Procédé selon la revendication 1, dans lequel les niveaux de confort d'environnement dans l'étape (b) sont calculés d'après la formule suivante :

$$ESE_x = B_x - C \div \frac{D - E}{F - G}$$

avec

$ESE_x$  = surface supplémentaire utile dans l'environnement X de disposition des sièges et, d'après une étude des passagers ayant une surface identique de siège :  
 $B_x$  = confort moyen indiqué par les passagers dans l'environnement X de disposition des sièges,

# EP 0 722 404 B1

- C = confort moyen indiqué par les passagers assis entre deux autres passagers, et, d'après une étude de passagers ayant des valeurs différentes de surface de siège (largeur par pas de siège), on a
- D = confort moyen indiqué par les passagers ayant plus de surface de siège
- E = confort moyen indiqué par les passagers ayant moins de surface de siège
- F = surface de siège des passagers ayant plus de surface de siège
- G = surface de siège de passagers ayant moins de surface de siège.

3. Procédé selon la revendication 1 ou 2, dans lequel le niveau de confort moyen des passagers (APCL) est déterminé d'après la formule suivante :

$$APCL = \frac{1}{M} \left[ \int_0^A P(f) WE(f) df + \int_A^B P(f) (A^* WE + (f - A) AE) df + \int_B^C P(f) [A^* WE + (B - A) AE + (f - B) (2AP - AE)] df + \int_C^D P(f) [A^* WE + (B - A) AE + (C - B) (2AP - AE) + (f - C) (AP + WP - WE)] df + \int_D^E P(f) [A^* WE + (B - A) AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) + (f - D) (AP + PE - AE)] df + \int_E^G P(f) [A^* WE + (B - A) AE + (C - B) (2AP - AE) - (D - C) (AP + WP - WE) + (E - D) (AP + PE - AE) + (f - E) (2PP + AP - PE - AE)] df + \int_G^H P(f) [A^* WE + (B - A) AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) + (E - D) (AP + PE - AE) + (G - E) (2PP + AP - PE - AE) + (f - G) (PP + 2AP - 2AE)] df + \int_H^K P(f) [A^* WE + (B - A) AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) + (E - D) (AP + PE - AE) + (G - E) (2PP + AP - PE - AE) + (H - G) (PP + 2AP - 2AE) + (f - H) (AP + PP + WP - AE - WE)] df + \int_K^1 P(f) [A^* WE + (B - A) AE + (C - B) (2AP - AE) + (D - C) (AP + WP - WE) + (E - D) (AP + PE - AE) + (G - E) (2PP + AP - PE - AE) + (H - G) (PP + 2AP - 2AE) + (K - H) (AP + PP + WP - AE - WE) + (f - K) (CQ + 2PP - 2PE)] df \right]$$

avec

- APCL = niveau de confort moyen des passagers
- M = facteur de charge moyen
- f = facteur de charge spécifique
- P(f) = fréquence d'apparition du facteur de charge f
- WE = niveau de confort d'environnement dont jouissent les passagers assis entre une paroi latérale et un siège vide
- AE = niveau de confort d'environnement dont jouissent les passagers assis entre une allée et un siège vide
- WP = niveau de confort d'environnement dont jouissent les passagers assis entre une paroi latérale et un autre passager
- AP = niveau de confort d'environnement dont jouissent les passagers assis entre une allée et un autre passager
- PE = niveau de confort d'environnement dont jouissent les passagers assis entre un siège vide et un autre passager

# EP 0 722 404 B1

- PP = niveau de confort d'environnement dont jouissent les passagers assis entre deux autres passagers  
 CQ = niveau de confort d'environnement dont jouissent les passagers assis dans le siège central d'une unité complète à cinq sièges  
 WZ = nombre total d'unités externes à deux sièges (placées contre une paroi latérale) par rangée (ou avion)  
 5 WD = nombre total d'unités externes à trois sièges (placées contre une paroi latérale) par rangée (ou avion)  
 CZ = nombre total d'unités externes à deux sièges (placées entre deux allées) par rangée (ou avion)  
 CD = nombre total d'unités externes à trois sièges (placées entre deux allées) par rangée (ou avion)  
 CV = nombre total d'unités externes à quatre sièges (placées entre deux allées) par rangée (ou avion)  
 CF = nombre total d'unités externes à cinq sièges (placées entre deux allées) par rangée (ou avion)  
 10 s = nombre total de sièges par rangée (ou avion)  
 A = (WZ + WD)/s  
 B = A + [CZ + 2(CD + CV + CF) + WD]/s  
 C = B + CZ/s  
 D = C + WZ/s  
 15 E = D + (CV + 2CF)/s  
 G = E + CV/s  
 H = G + CD/s  
 K = H + WD/s

- 20 4. Procédé d'augmentation au maximum du confort des passagers dans un avion ayant un nombre fixe de sièges et d'allées par rangée, comprenant :

- a) l'identification des configurations possibles de rangées pour un nombre déterminé de sièges et d'allées,  
 b) la détermination de la fréquence d'apparition des incréments possibles du facteur de charge,  
 25 c) le calcul de la fraction des passagers qui peuvent être assis à côté d'un siège vide dans la configuration de rangées pour ces incréments du facteur de charge,  
 d) la sélection de la configuration de rangées donnant le plus grand nombre de passagers qui peuvent être assis à côté d'un siège vide pour les facteurs de charge considérés, et  
 e) l'installation des sièges dans l'avion d'après les configurations choisies de rangées.

- 30 5. Procédé selon la revendication 4, dans lequel la partie des passagers est déterminée d'après la formule suivante :

$$E = \frac{1}{M} \left[ \int_0^{a/s} P(f)(f)df + \int_{a/s}^{b/s} P(f)a/s - (f - a/s)df + \int_{b/s}^{c/s} P(f)(g/s)df + \int_{c/s}^1 P(f)(g/s - 2(f - c/s))df \right]$$

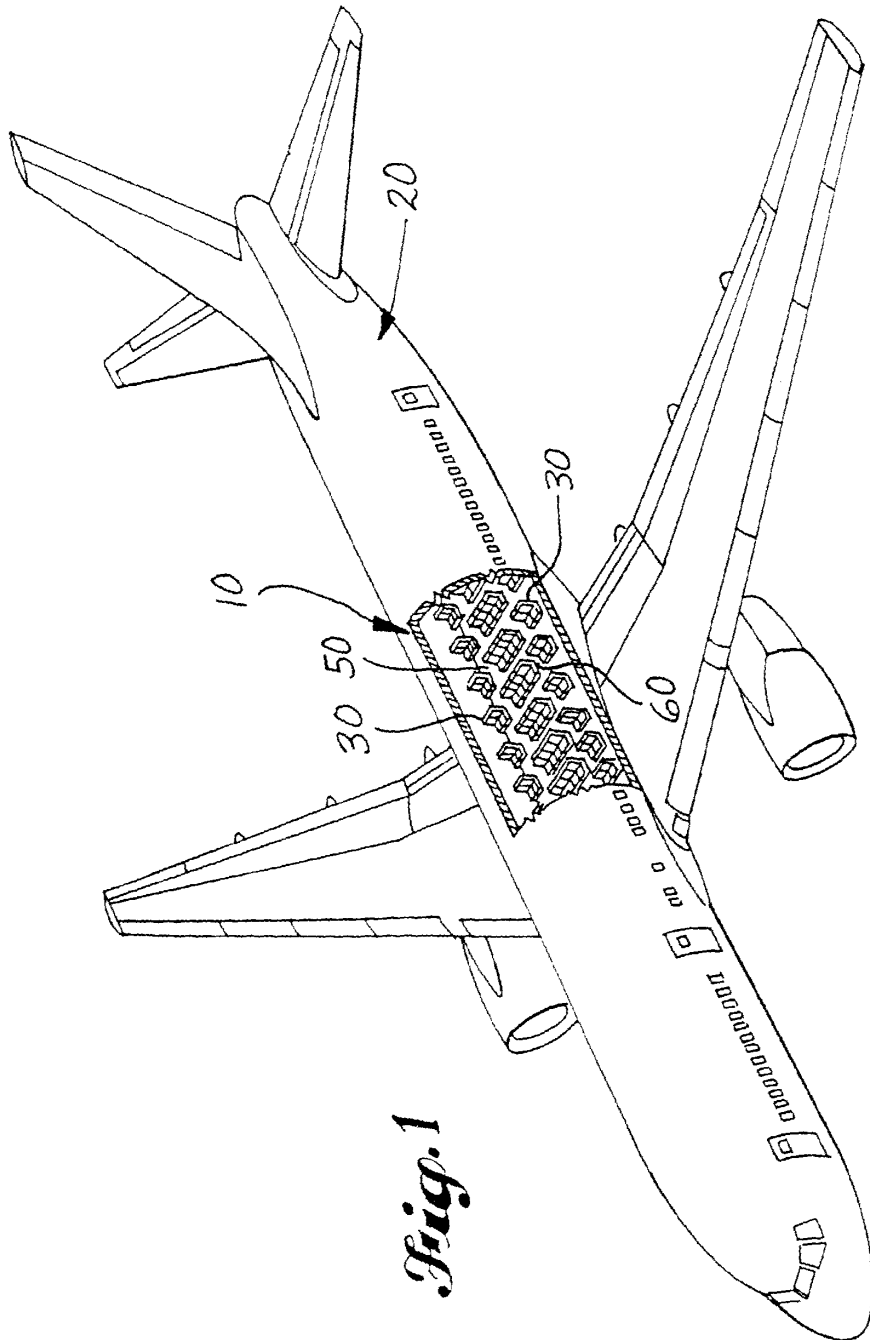
avec

- 40 E = fraction de passagers qui peuvent être assis à côté d'un siège vide  
 M = facteur moyen de charge  
 f = facteur spécifique de charge  
 P(f) = fréquence d'apparition du facteur de charge f  
 s = nombre de sièges par rangée  
 45 z = nombre d'unités à deux sièges par rangée  
 d = nombre d'unités à trois sièges par rangée  
 v = nombre d'unités à quatre sièges par rangée  
 q = nombre d'unités à cinq sièges par rangée  
 a = z + 2 (d + v + q), nombre de sièges de paroi et d'allée pouvant être occupés sans que des passagers ne  
 50 soient assis côte-à-côte  
 b = a + z, nombre total des sièges de paroi et d'allée  
 c = b + v + 2q, nombre total de sièges pouvant être occupés afin qu'il reste un siège vide dans chacune des  
 unités à trois, quatre et cinq sièges,  
 g = 2 (d + v + q), nombre total de passagers assis à côté de sièges vides lorsque tous les sièges de paroi  
 55 et d'allée (seulement) sont occupés.

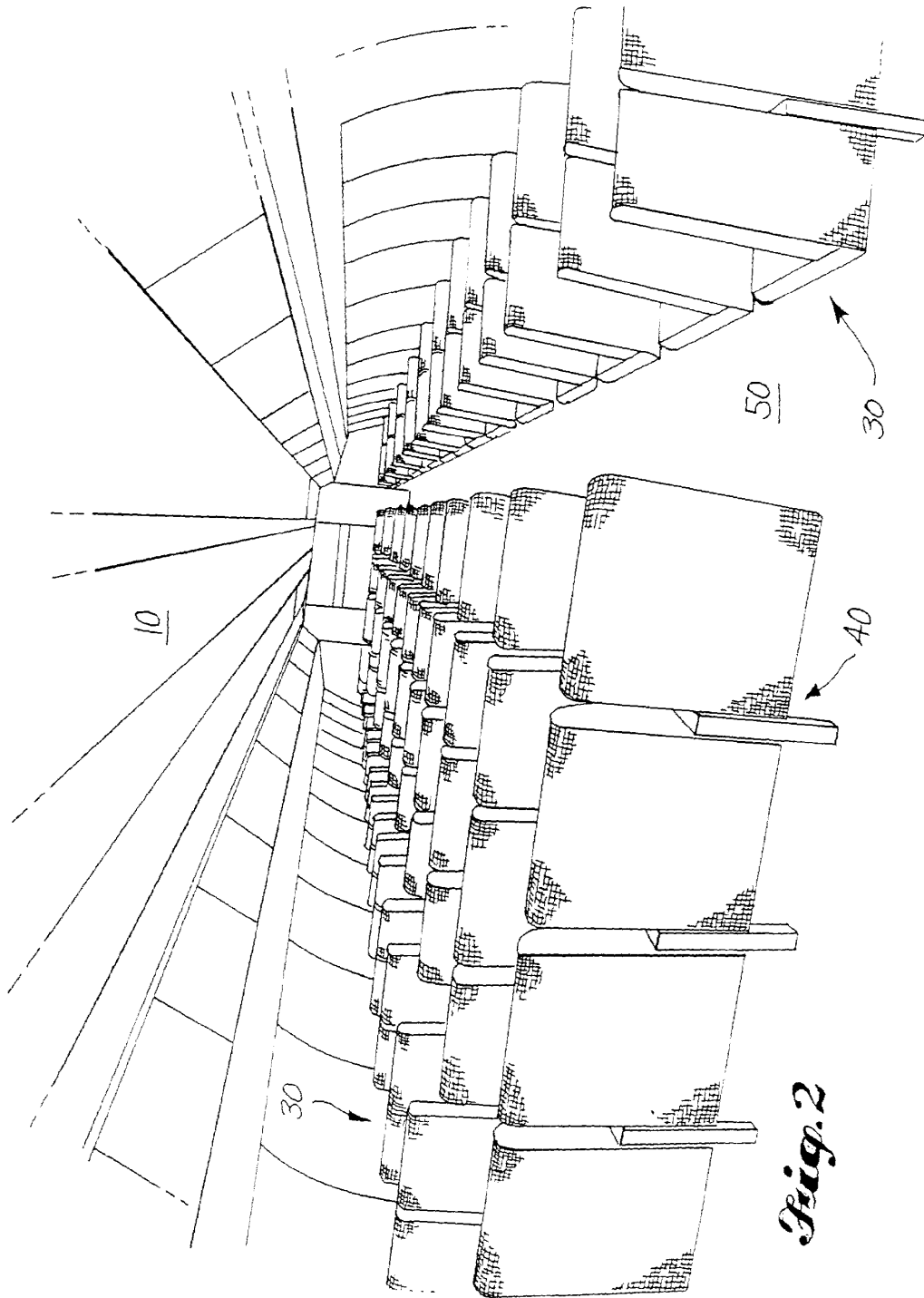
6. Dans un avion de dimensions fixes ayant des sièges normaux, deux allées et huit sièges par rangée, la configuration de disposition des sièges comprenant une unité à deux sièges et deux unités à trois sièges.

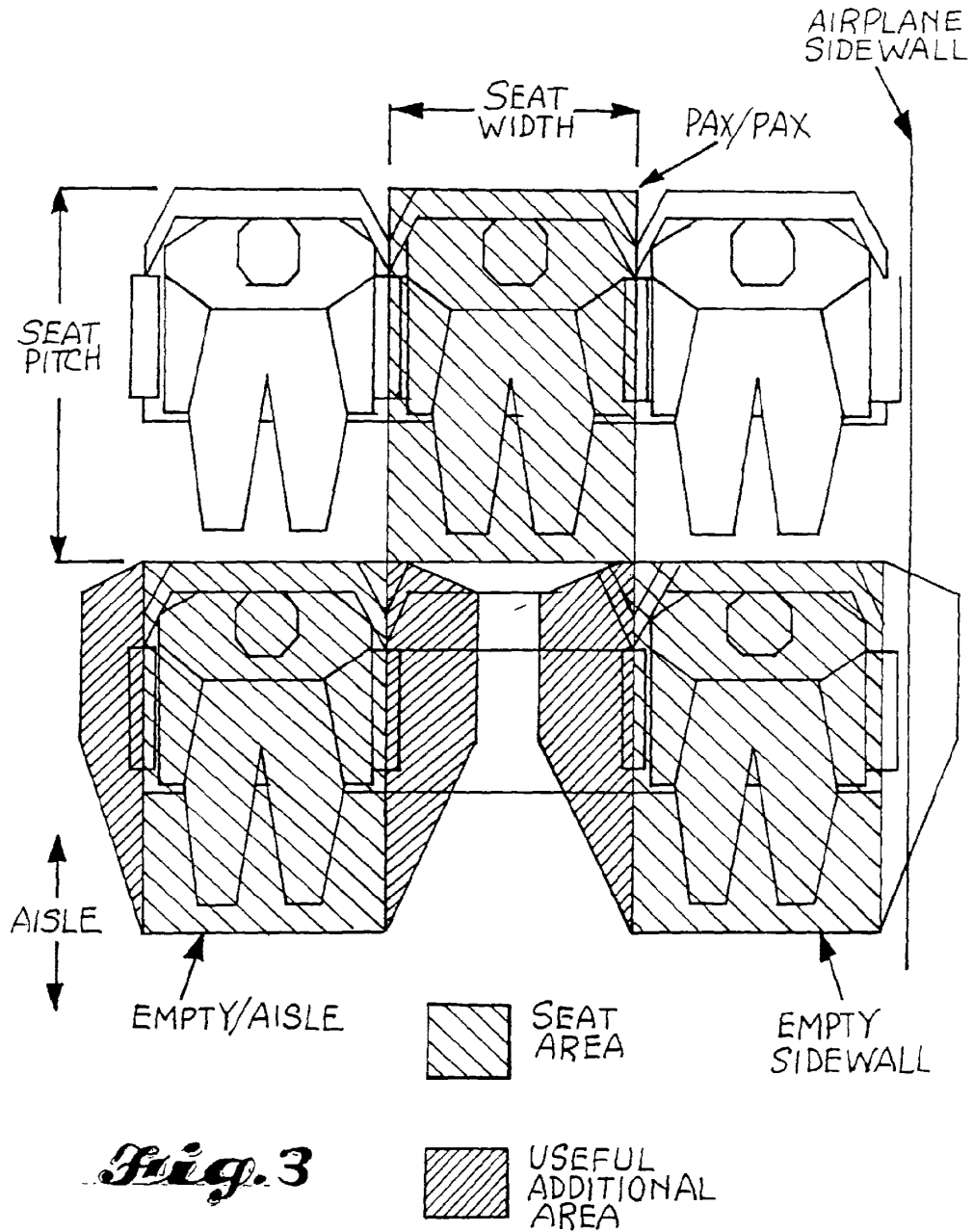
**EP 0 722 404 B1**

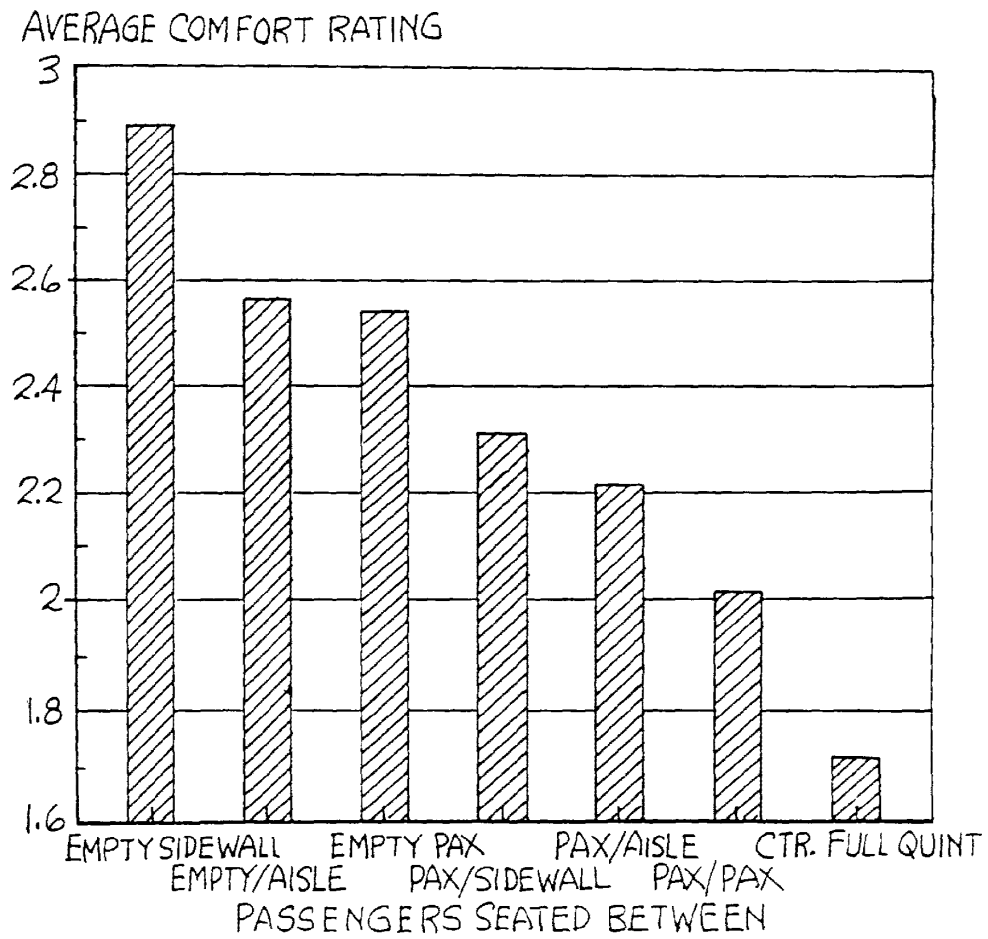
7. Avion selon la revendication 6, dans lequel l'unité à deux sièges est placée entre une paroi latérale de l'avion et une première allée la plus proche de la paroi latérale.
8. Avion selon la revendication 6, dans lequel l'unité à deux sièges est placée entre les deux allées.
9. Dans un avion de dimensions fixes, ayant des sièges normaux, trois allées et onze sièges par rangée, la configuration de disposition des sièges comprenant une unité à deux sièges et trois unités à trois sièges.
10. Avion selon la revendication 9, dans lequel l'unité à deux sièges est disposée entre une paroi latérale de l'avion et une première allée la plus proche de la paroi latérale.
11. Avion selon la revendication 9, dans lequel l'unité à deux sièges est positionnée entre deux des allées.
12. Dans un avion de dimensions fixes, ayant des sièges normaux, trois allées et douze sièges par rangée, la configuration de disposition des sièges qui comprend :
- a) une première unité à trois sièges placée entre une paroi latérale de l'avion et une première allée la plus proche de la paroi latérale,
  - b) une seconde unité à trois sièges placée entre la première allée et la seconde allée,
  - c) une troisième unité à trois sièges placée entre la seconde allée et la troisième allée, et
  - d) une quatrième unité à trois sièges placée entre la troisième allée et l'autre paroi latérale de l'avion.
13. Dans un avion de dimensions fixes ayant des sièges normaux, trois allées et treize sièges par rangée, la configuration de disposition des sièges comprenant :
- a) une première unité à trois sièges placée entre une paroi latérale de l'avion et une première allée la plus proche de la paroi latérale,
  - b) une unité à quatre sièges positionnée entre la première allée et la seconde allée,
  - c) une seconde unité à trois sièges placée entre la seconde allée et la troisième allée, et
  - d) une troisième unité à trois sièges placée entre la troisième allée et l'autre paroi latérale de l'avion.



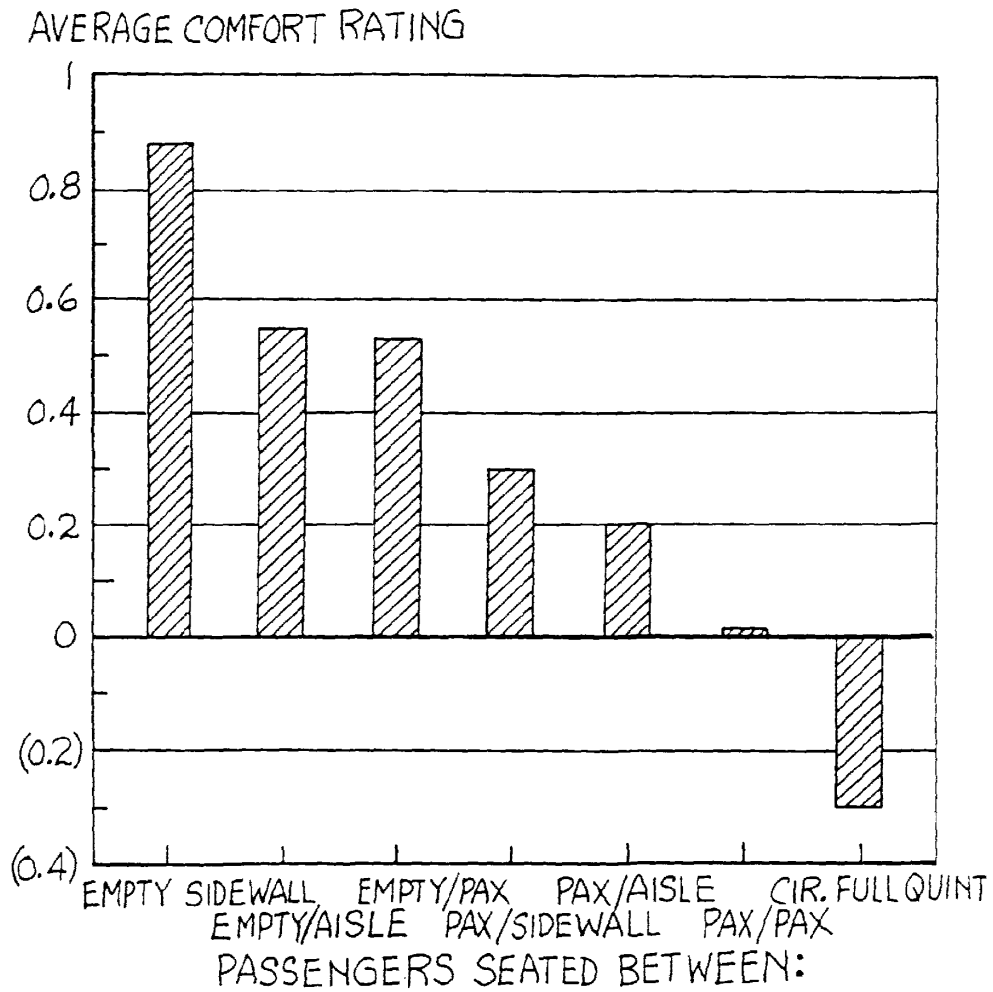
*Fig. 1*



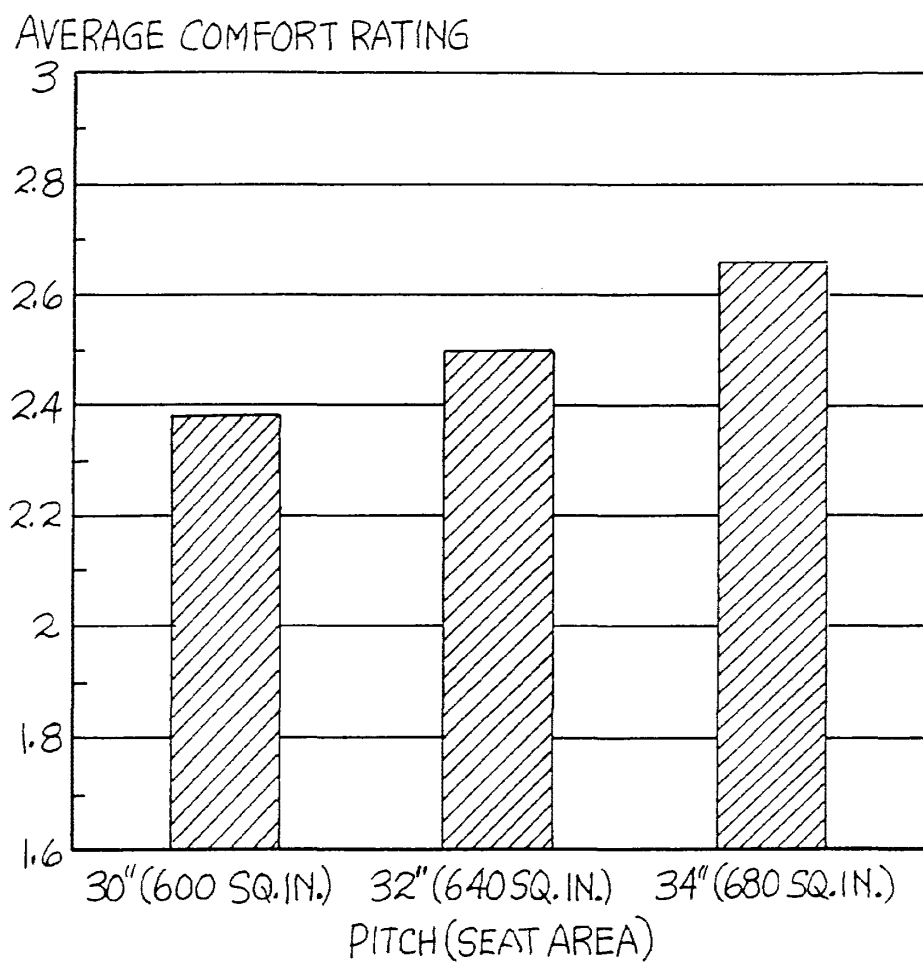




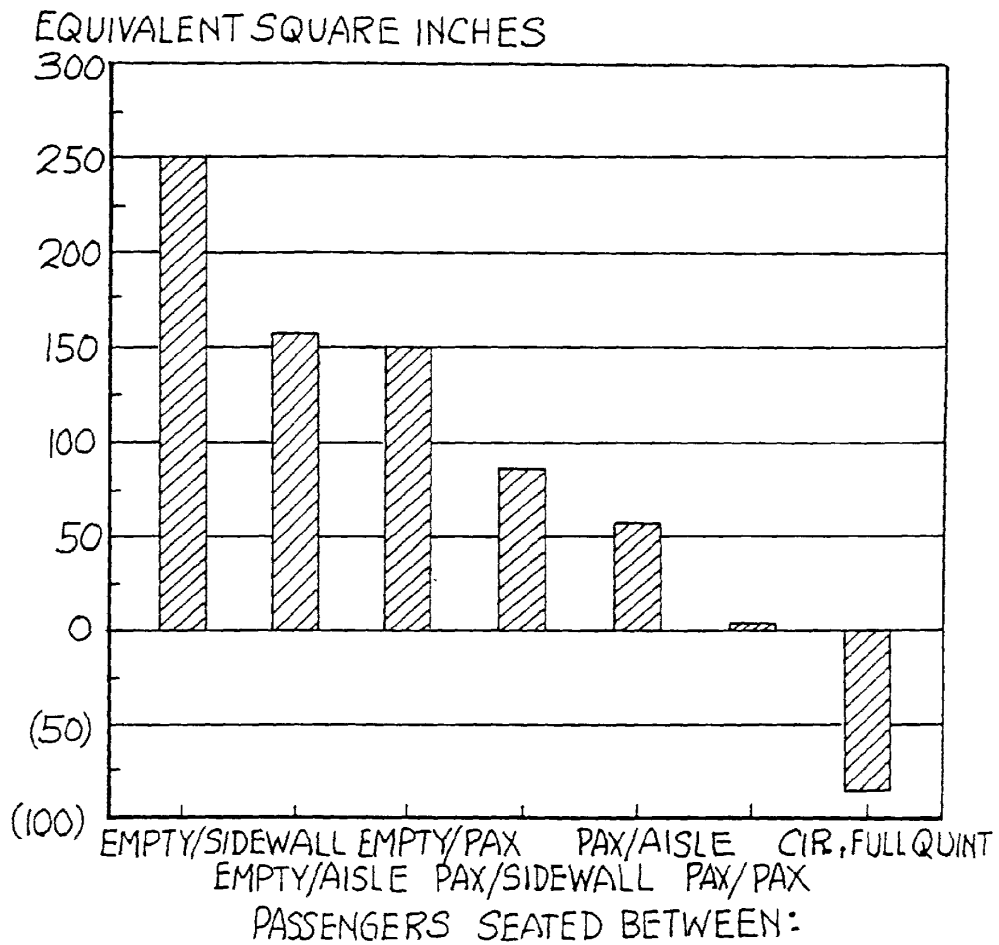
*Fig. 4*



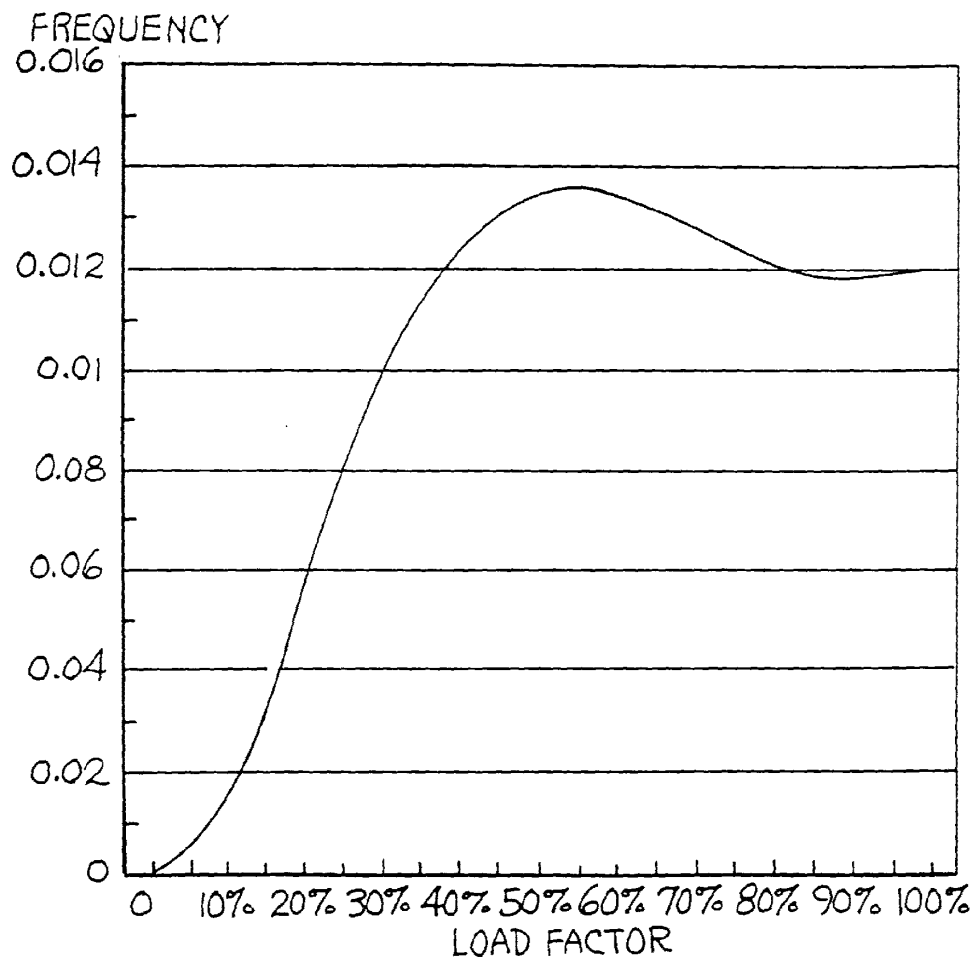
**Fig. 5**



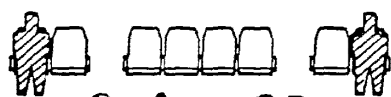
**Fig. 6**



**Fig. 7**



**Fig. 8**



*Fig. 9A*



*Fig. 10A*



*Fig. 9B*



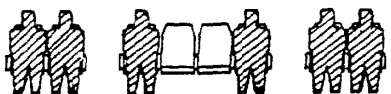
*Fig. 10B*



*Fig. 9C*



*Fig. 10C*



*Fig. 9D*



*Fig. 10D*



*Fig. 9E*



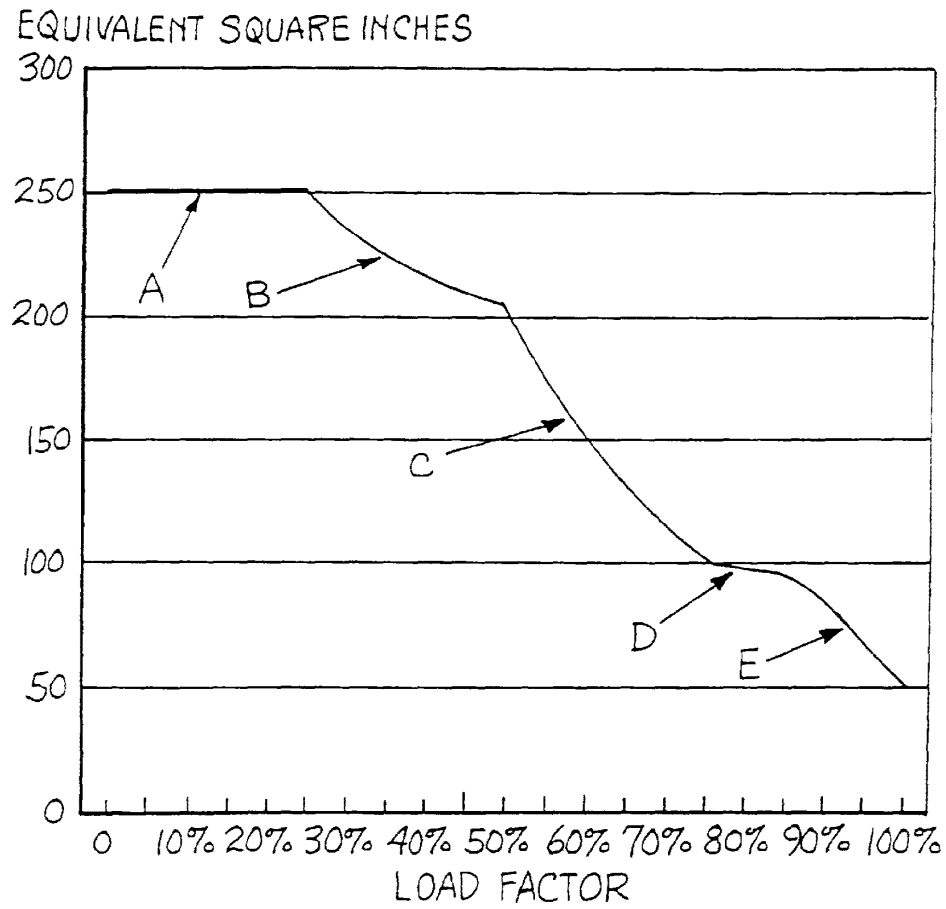
*Fig. 10E*



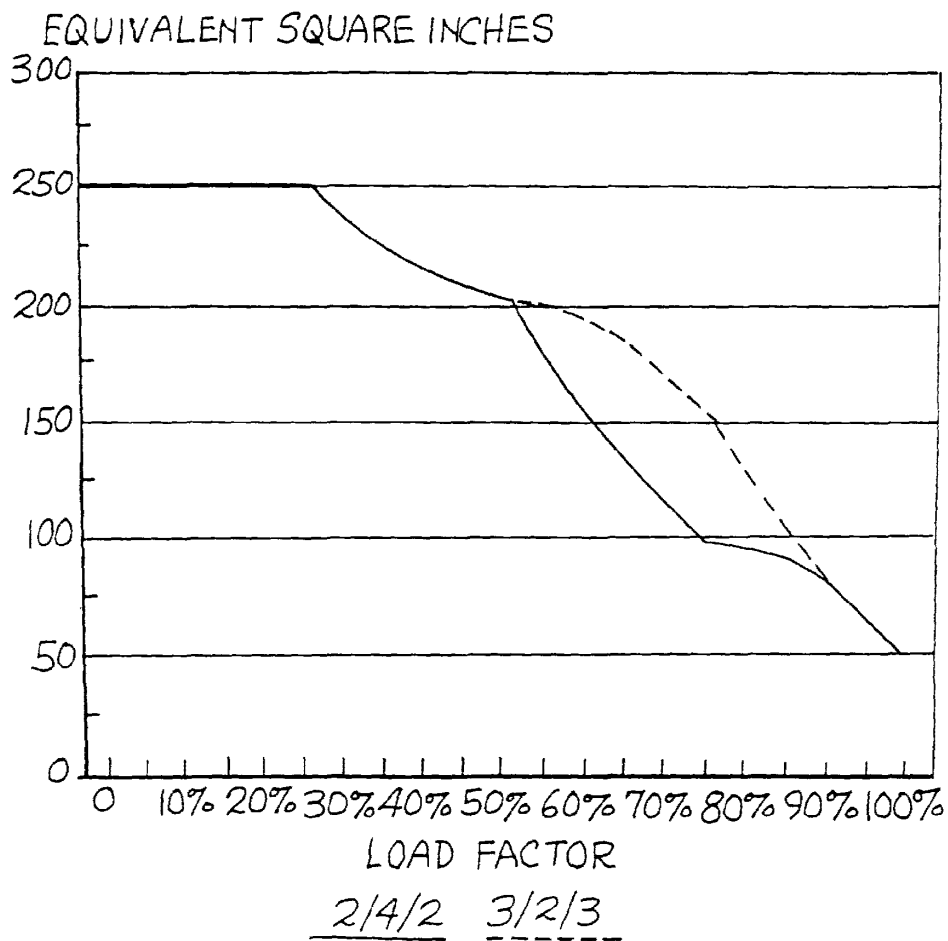
*Fig. 9F*



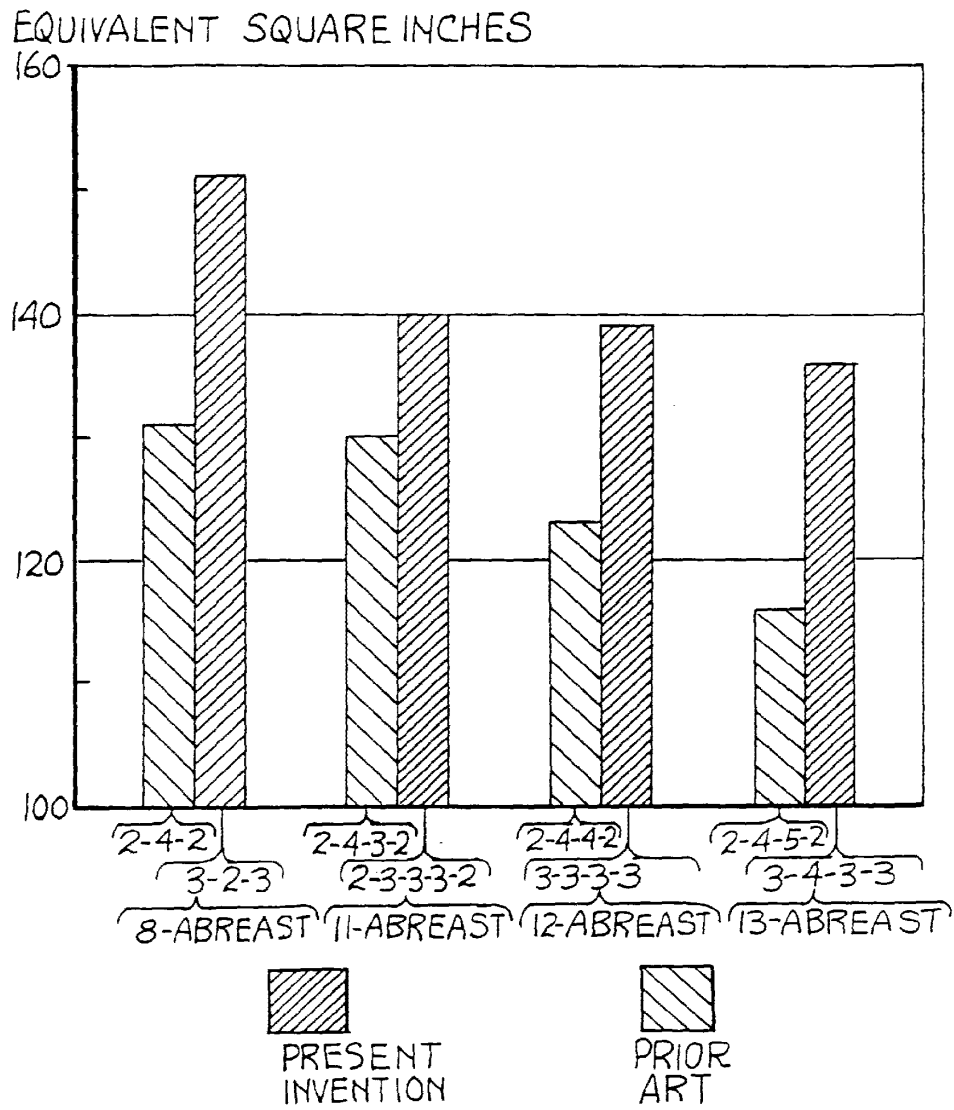
*Fig. 10F*



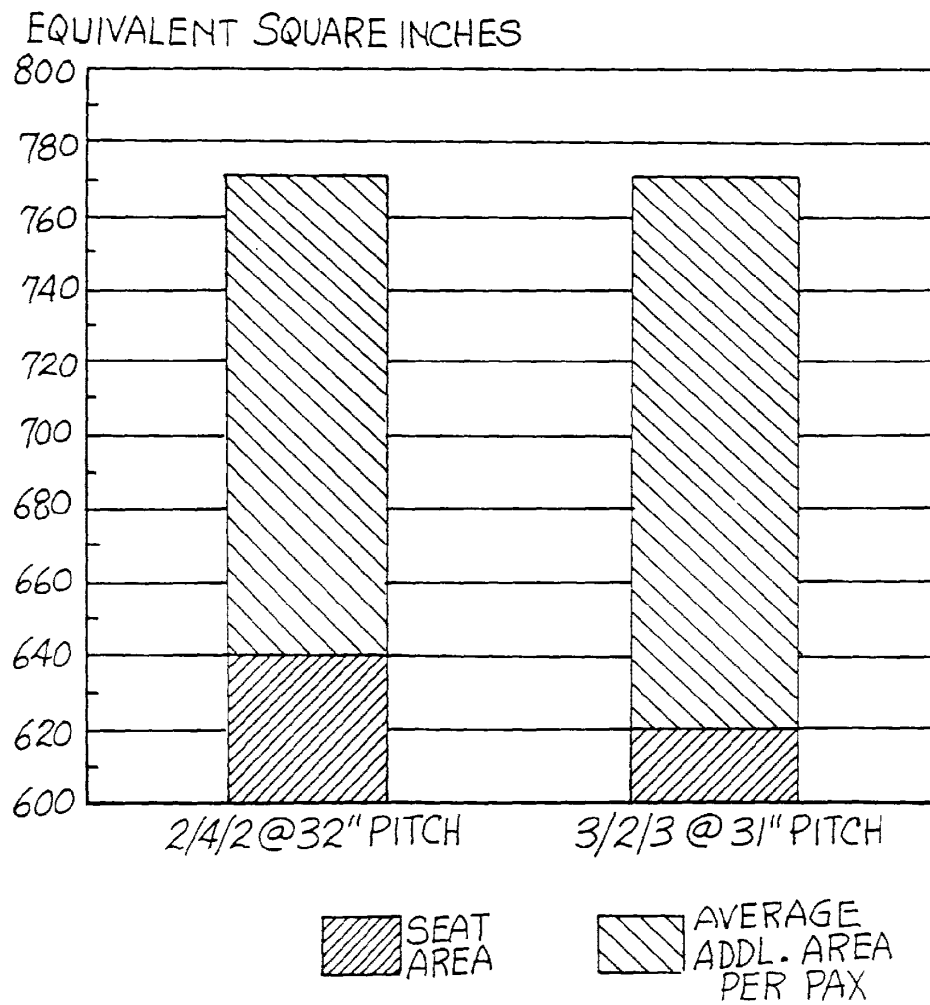
*Fig.11*



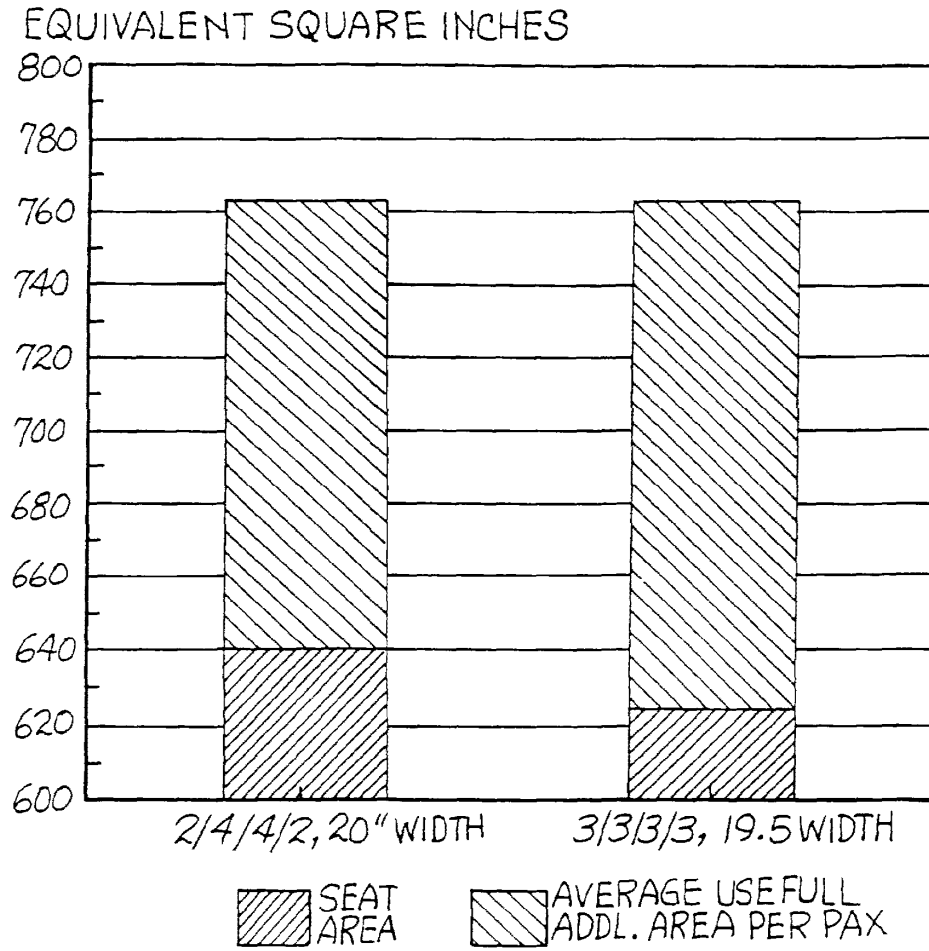
**Fig. 12**



*Fig.13*



**Fig.14**



**Fig. 15**

(19)



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**EP 0 850 834 A1**

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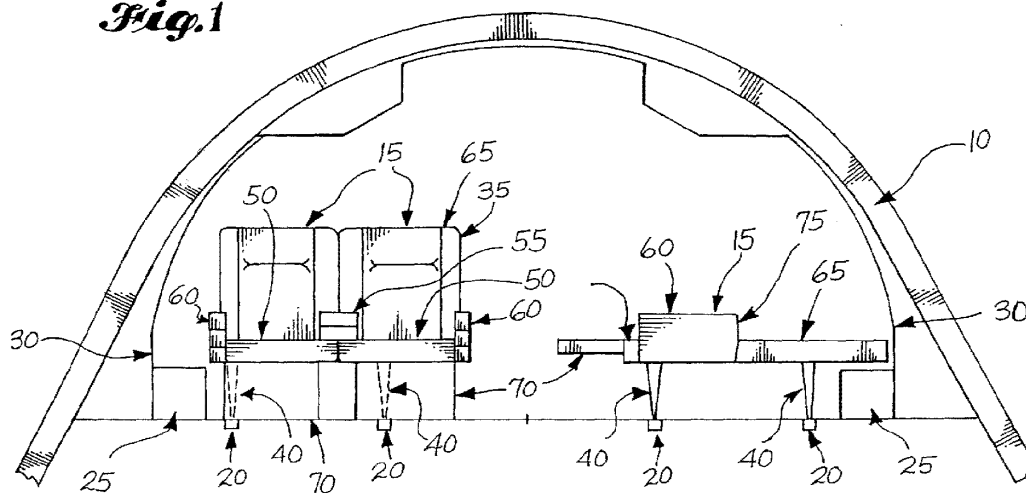
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**(54) Fully reclinable, pivotable airplane passenger sleeper seat assemblies**

(57) A fully reclinable pivotable airplane premium passenger seat. The seat can be translated and/or pivoted from a daytime position to a nighttime position. In the nighttime position, the seat can be fully extended

into unused aisle space. In its fully extended position, the seat back may be placed in a horizontal mode and the leg rest fully extended to permit more restful sleep for passengers in a horizontal position.

**Fig.1**



**EP 0 850 834 A1**

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## Description

### FIELD OF THE INVENTION

This invention relates to airplane passenger seats. More particularly, the present invention relates to reclinable passenger seats allowing passengers to sleep in a more normal horizontal position. Still more particularly, the instant invention pertains to fully reclinable airplane passenger seats capable of using aisle space while the airplane is in flight.

### BACKGROUND OF THE INVENTION

As commercial airplanes gain greater range capability and airlines schedule more long duration non-stop flights, there is an increasing demand for premium-class seating that allows passengers to sleep fully reclined, i. e., in a more normal, relaxing, horizontal position. Providing conventional forward-facing seating that reclines to a fully reclined position has certain obvious disadvantages. For example, the seats must be installed at a pitch, i.e., distance between corresponding points on the seats, exceeding the length of the tallest passenger likely encountered plus enough space for window seat passengers to gain access to the aisle when the seat closest to the aisle, i.e., the aisle seat, is fully reclined. Seat pitches on the order of 80 inches are becoming common for this use. Such seat pitches dramatically reduce seating capacity or seat count of the airplane and therefore reduce the revenue that may be generated by the airplane.

The problem of such inefficient space utilization is exacerbated by the fact that passengers are only interested in sleeping on some flight phases or segments and not during all portions of these segments. As an example, eastbound transatlantic flights are typically flown at night and most passengers are interested in sleeping once the meal service is completed. Westbound transatlantic flights by contrast are typically flown during daylight hours with little demand for sleeping facilities. No workable concept has been seen to configure airplanes differently for such westbound and eastbound flights.

Several concepts have been described or are in use to minimize the seat count loss resulting from fully reclinable seating. For example, some airlines have arranged seats in a herringbone or echelon fashion in the forward zone of the Boeing Model 747 (ref. British Patent GB 2,295,962 awarded to Dryburgh, et al.) This arrangement has resulted in a modest reduction of the seat count loss resulting from the installation of fully reclinable seats.

Another example is the provision of alternate sleeping facilities in portions of the airplane not typically used for passenger seating, e.g., in the lower (cargo) hold or above the passenger cabin ceiling. However, these provisions have not proven popular for several reasons. Lower hold installations may displace revenue-generat-

ing cargo and thus, have not, generally speaking, proven attractive. In most commercial airplanes there is no usable space above the passenger ceiling. In those airplanes in which space is available, it is of limited size - particularly height. Access to over-ceiling, as well as lower-hold, areas is also difficult. Finally it is believed that passengers do not like to be physically separated from their assigned seat, and the belongings stowed there, while sleeping.

Wide aisles, considerably wider than those required for emergency evacuation, are typically provided in intercontinental first and business-class ("high-yield") passenger cabins. The wider aisles provide ease of boarding and passenger mobility within the cabin while the meal service is in progress. More particularly, the Federal Aviation Administration requires a minimum of 15 inch aisles for passenger emergency evacuation. In contrast, typical first-class aisles in the Boeing Model 747 are 34 inches wide. In both the Boeing Model 777 first-class and in the Boeing Model 747 upper-deck business-class, aisles are 29 inches wide. From the time the dinner service is concluded until breakfast is served, the time when sleeping facilities are most needed ("night-time"), such wide aisles are unnecessary. This space utilization cycle thus provides a business opportunity for airline owners and operators to increase the revenue generating capacity, and thus value, of their commercial airplanes. The passenger seat assemblies of the present invention completely satisfy this need of airline owners and operators.

In addition, the unique upper deck of the Boeing Model 747 has sloping sidewalls which render the space adjacent to the sidewalls of the interior of the airplane unusable for upright seating. The passenger seat assemblies of the present invention utilize under sidewall space in addition to aisle space to provide sleeping accommodations.

### SUMMARY OF THE INVENTION

An object of the present invention is the provision of a method and an apparatus for enhancing the revenue generating capability of a vehicle, such as a commercial airplane.

Another object of this invention is to provide a airplane passenger seat assembly that may be used by airplane passengers during all phases of an airplane flight.

Still another object of the instant invention is to provide a fully reclinable seat assembly permitting relaxful sleep by an airline passenger during the nighttime phase of an airplane flight.

Yet another object of the present invention is the provision of a seating assembly that takes advantage of excess nighttime aisle width and other space available within certain airplanes to provide sleeping accommodations when they are most desired by airline passengers.

An additional object of the present invention is the provision of a simplified seating assembly that takes advantage of excess nighttime aisle width and other space available within certain airplanes to provide sleeping accommodations when they are most desired by airline passengers.

Another additional object of the present invention is the provision of a process for deploying an airplane passenger seat from a daytime position to a nighttime position.

The present invention achieves these and other objects through the provision of an airplane passenger seat assembly capable of rotating about an axis whereby the seat assembly may pivot from a daytime position facing forward in the airplane to a nighttime position. In the nighttime position, the seat back of the seat assembly can, e.g., be fully reclined and the leg rest fully extended into unused aisle space.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will become more readily appreciated by reference to the following detailed description of an embodiment of the invention and the accompanying drawings wherein like numbers refer to the same or similar parts and wherein:

FIG. 1 is a front view of the upper deck of a Boeing Model 747 and illustrates passenger seats disposed in both a daytime and a nighttime position.

FIG. 2 is a plan view of the upper deck of FIG. 1 and depicts premium passenger seats in daytime, intermediate and nighttime positions.

FIG. 3 is an exploded isometric view of the fully reclinable, pivotable, airplane passenger sleeper seat assembly of the present invention.

FIG. 4 is an isolated plan view of the underseat subassembly of the seating assembly of the present invention.

FIG. 5 is a side view of the underseat subassembly, taken along lines 5-5 in FIG. 4.

FIG. 6 is an isolated plan view of the sliding carousel subassembly of the present seating assembly.

FIG. 7 is a side view of the sliding carousel subassembly, taken along lines 7-7 in FIG. 6.

FIG. 8 is an isolated plan view of the upper seat base subassembly of the present invention.

FIG. 9 is a side view of the upper seat base subassembly, taken along lines 9-9 in FIG. 8.

FIG. 10 is a plan view of the seat base assembly of the present invention in the daytime position.

FIG. 11 is a side view of the seat base assembly, taken along lines 11-11 in FIG. 10.

FIG. 12 is a plan view of the present seat base assembly in a first intermediate stage as the seat assembly translates from a daytime position towards a nighttime position.

FIG. 13 is a plan view of the instant seat base as-

sembly in a second intermediate stage wherein the assembly pivots toward the nighttime position.

FIG. 14 is a plan view of the seat base assembly of the present invention wherein the assembly is in a third intermediate stage just prior to being locked in the nighttime position.

FIG. 15 is a plan view of the seat base assembly showing the assembly in a final stage or locked in the nighttime position.

FIG. 16 is a plan view of the simplified seat base assembly of present invention in the daytime position.

FIG. 17 is a side view of the simplified seat base assembly, taken along lines 17-17 in FIG. 16.

FIG. 18 is an exploded isometric view of the simplified seat base assembly of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown the front view of the upper deck 10 of a Boeing Model 747. This section of the Model 747 airplane is most frequently used by airlines for first-class or business-class passenger service. Disposed throughout the upper deck are a plurality of passenger seats 15 of the present invention conventionally mounted to seat tracks 20 and proximate floor-mounted stowage bins 25 positioned near the upper deck side walls 30. The left hand side of FIG. 1 shows a pivotable, fully reclinable passenger seat of the present invention facing forward and oriented in a position used during boarding, normal flight (including meal service), and deplaning, i.e. the so-called "daytime" position 35. The passenger seat is illustrated for convenience in FIG. 1 as a two-seat unit or "double" although the present invention is not necessarily limited to doubles. These double seats comprise support legs 40 attached to the seat tracks 20, two seat bottom cushions 50, a center arm rest 55, two outer arm rests 60, a pair of back rests 65 and a pair of leg rests 70.

The right hand side of FIG. 1 discloses a side view of the double in a fully reclined or a "nighttime" position 75. The nighttime position allows passengers to enjoy restful sleep in a more normal horizontal plane. As will be better understood hereinafter, the seating units of the present invention may be translated away from the side wall toward the center aisle and pivoted to the nighttime position shown in the right hand side of FIG. 1.

More particularly, as shown in upper part of the plan view of FIG. 2, the premium seats are shown facing forward in a daytime position 35, i.e., facing forward for boarding, meal service, and deplaning. After meal service is completed after which passengers usually wish to retire for the nighttime phase of the flight, the seats are pivoted from the daytime position, shown at 35, to an intermediate position, shown at 80, and then rotated to a final position shown at 85. The lower right hand side of FIG. 2 shows the seat backs and leg rests of the sleeper passenger seats of the present invention fully

reclined and extended, respectively 75.

The fully reclinable pivoting airplane passenger seat of the present invention is shown more particularly in FIGS. 3-15. In particular, the passenger seat assembly comprises an underseat subassembly 90, a sliding carousel subassembly 95, an upper seat base subassembly 100 and a conventional upper seat subassembly 105 (not shown in FIGS. 4-15 for clarity and convenience).

As best shown in FIGS. 4 and 5, the underseat subassembly comprises an inboard and an outboard frame 110, 115. Each frame comprises conventional seat legs attached to a horizontal frame member. The seat legs are each conventionally affixed to mounting tracks 20 disposed in the floor of the airplane. The inboard horizontal frame member is typically connected to the outboard horizontal frame by two transverse coupling tubes 120 as is current practice.

A first electric, pneumatic or hydraulic motor 125 is affixed to the outboard horizontal frame member and, in use, rotates a first drive screw 130 which extends from the outboard frame to the inboard frame. The distal end 135 of the first drive screw is supported in a bearing connected to the inboard horizontal frame member and is finished in a hexagonal shape to provide for the attachment of a hand crank or wrench in the event of power or motor failure. A first pair of locking pins 140 are attached to or formed on the horizontal member of the inboard frame 110 and extend outwardly from the underseat subassembly. A second pair of locking pins 145 are attached to or formed on the horizontal member of the outboard frame 115 and extend inwardly towards the inboard frame. As will better understood hereinafter, the first pair of pins and the second pair of pins are parallel to the transverse coupling tubes and lock the passenger seat assembly of the present invention either in a daytime or a nighttime position. As can be seen in FIG. 5 and will be better understood hereinafter the second pair of locking pins 145 are located in a horizontal plane above that of the transverse connecting tubes 120 to allow a flange containing receptacles which receive this second pair of locking pins to swing through a horizontal plane over the transverse connecting tubes and into alignment with the second pair of locking pins.

The sliding carousel subassembly is shown in FIGS. 6 and 7 and, as will be better understood, is slidably mounted on the transverse tubes, and provides support for the upper seat base subassembly. The carousel subassembly is composed of a first flat central plate 150 formed with two inboard arms 155, two outboard arms 160, a threaded hole 165 formed in the first central plate at the juncture of the outboard arms. A lower portion of a conventional "lazy susan" type bearing 170 is fastened to upper surface of the first flat central plate for supporting the upper seat base subassembly and permitting it to rotate. A second electric, pneumatic or hydraulic motor 175, pivotably mounted on the upper surface of the first flat central plate drives a second drive

screw 180. Each of the outboard arms 160 is provided with a smooth cylindrical bore 185 as is each of the inboard arms 155. The cylindrical bores in the outboard and inboard arms are aligned and sized to permit the free passage of one of the transverse tubes 120. In use, the transverse tubes freely pass through the aligned bearings 185 in the inboard and the outboard arms, whereby the carousel subassembly may easily slide along the transverse tubes between the outboard and the inboard frames. As is perhaps better seen in FIGS. 10-12, the first drive screw 130 may be threadably coupled to the threaded hole 165 formed in the first central plate, whereby in use, when the first motor 125 rotates the first drive screw in a predetermined clockwise or counterclockwise direction, the carousel subassembly slides or translates along the transverse tubes away from or towards the side wall 30 of the airplane.

As may be better seen in FIGS. 10-12, the lower portion of the lazy susan bearing 170 fastened to the first flat central plate of the carousel subassembly is coupled to the upper portion of the lazy susan bearing 190 fastened to a second flat central plate 195 comprising part of the upper seat base subassembly. In use, the upper and lower portion of the lazy susan bearing pivotably supports the upper seat base subassembly and is designed to allow the upper seat base subassembly to rotate about a vertical axis while sustaining downward loads imposed on the seating assembly by, e.g. passengers.

More particularly, as shown in FIGS. 8 and 9, the upper seat base subassembly 100 comprises the upper portion of the lazy susan bearing 190, which is mounted on the undersurface of a second flat central plate 195, and a pivotable cylindrical block 200. The cylindrical block is provided with a threaded hole, whose axis is parallel to the plane of the second flat central plate, and is pivotably attached through the second central plate from the underside and retained by a spring clip 205 on the upper surface of the second flat central plate. In use, the cylindrical block threadingly engages the second drive screw 180.

As shown in FIG. 8, the seat base frame which completes the upper seat base assembly comprises a first and second longitudinal tube 210, 215, a first and a second interior transverse tube 220, 225 attached to intermediate points on the longitudinal tubes, and two exterior transverse tubes 230 attached to the distal ends of the longitudinal tubes. As will be better understood hereinafter, the first and second interior transverse tubes 220, 225 are positioned as near as practical to the vertical planes described by the aircraft seat tracks in the daytime position so as to provide a direct downward load path from the upper seat subassembly to the aircraft seat tracks. The longitudinal tubes, interior transverse tubes and exterior transverse tubes may be of any appropriate cross-section. The seat base frame supports the upper seat subassembly which as shown in FIGS. 1 & 3, comprises conventional seat cushions 50, arm-

rests 55 & 60, back rests 65, extendible leg rests 70 (not shown for clarity in FIG. 3), life jacket stowage (not shown), entertainment equipment (not shown) and associated support structures (also not shown).

As shown in FIGS. 8 and 9, the first and the second interior transverse tubes are provided with a first and a second pair of daytime receptacles 235, 240 formed in a first and a second flange 245, 250, respectively. The first and the second flanges downwardly depend from the first and the second interior transverse tubes, respectively, whereby in use, the first and the second pair of daytime receptacles may receive and engage the first and the second pair of locking pins, respectively. A pair of nighttime receptacles 255 are formed in a third flange 260 which is attached to and depends downwardly from the second longitudinal tube 215. In use, the first pair of locking pins 140 may be received within and engage the nighttime receptacles.

As shown in FIGS. 10 and 11, to provide a crash-worthy method of supporting the upper seat assembly in the daytime position, it is envisioned that the first and the second pair of locking pins 140, 145 engage the first and second pair of daytime receptacles 235, 240 bored in the upper seat base subassembly 100. As will be better understood hereinafter, the final transverse motion of the upper seat base subassembly (toward the side-wall) in the transition to the daytime position from a nighttime position inserts these locking pins into the receptacles in the upper seat base subassembly. The engagement of the locking pins and receptacles is preferably designed to carry the 9 G or 16 G loads required by regulatory authorities for crashworthiness.

In the nighttime position (FIG. 15), in combination with the downward-load-bearing capacity of the carousel subassembly 95, the first pair of locking pins 140 mounted on the underseat subassembly engage the pair of nighttime receptacles 255. As will be seen, the first pair of locking pins are inserted into the nighttime receptacles by a final lateral motion (toward the side wall) as the passenger seat 15 is converted to the nighttime position.

As seen in FIGS. 10, 12, 13, 14 and 15 in sequence, in use, the upper seat base subassembly is unlocked from its daytime position by the lateral translation away from the side wall of the airplane, pivoted to a position parallel to the adjacent aisle, and locked in the nighttime position by a lateral translation toward the side wall. Once in the nighttime position the back rest 65 can be reclined to a full down position and the leg rests 70 extended into the unused space of the aisle. This process has also been described in connection with FIGS. 1 and 2.

More particularly and with reference to FIGS. 10-15, in daytime mode use, the first and second pairs of locking pins 140, 145 are secured within the first and second pairs of receptacles 235, 240, respectively. When all meal service is complete and passengers wish to retire, a crew member can provide power to the seat assembly

15 to facilitate transition from a daytime position (FIG. 10) to a nighttime position (FIG. 15). A lateral (FIG. 12) and turning or pivoting (FIG. 13) motion of the upper seat base subassembly is required to move the seat assembly from the daytime position to the nighttime position (and vice versa). This can be accomplished manually. However, to be consistent with the ambiance desired in premium travel, a powered system such as an electrical, pneumatic or hydraulic system, is foreseen.

As described above, such a powered system has been provided in the present invention using the first and the second motorized drive screws. The first drive screw 130 is mounted parallel to the transverse tubes in the underseat subassembly so as to slide the carousel subassembly along the transverse tubes. The second drive screw 180 connects the carousel subassembly to the seat base subassembly in such a way as to turn the seat base subassembly substantially 90° relative to the carousel subassembly, although lesser angles are possible.

The first and the second drive screw motors can best be controlled by a set of limit switches 265 arranged so as to contact the first interior transverse tube 220 of the seat base frame, the first flat central plate 150 or feeler flanges 270 depending downwardly from the seat base frame so as to sequence motions in the following way. Thus, in use, when the system is activated by a crew member, the first drive screw 130 operates to move or translate the carousel subassembly 95 laterally along the transverse tubes from the position shown in FIG. 10 sufficiently to withdraw both pairs of locking pins 140, 145 to a first intermediate stage, the position shown in FIG. 12. Second, the second drive screw 180 operates to rotate the upper seat assembly 105 through the second intermediate stage shown in FIG. 13. Once the upper seat subassembly is in a third intermediate stage shown in FIG. 14, just prior to locking the upper seat assembly 105 in place, the first drive screw motor is activated to reverse the transverse motion of the carousel subassembly 95 and insert the first pair of locking pins 140 into the nighttime receptacles 255 for the nighttime position illustrated in FIG. 15.

To return the seat to the daytime position in the event of a system failure, a hand crank or wrench (not shown) engaged with the hexagonal inboard end of the first drive screw 130 may be employed to turn the first drive screw 130 and translate the upper seat base 100 into the position shown in FIG. 14. After the first drive screw is turned sufficiently using the hand crank or wrench to disengage the first pair of locking pins 140 from the nighttime receptacles 255, the spring clip 205 securing the pivoting cylindrical block 200 to the seat base subassembly is pulled out of the upper end of the cylindrical block allowing the cylindrical block to fall out of engagement with the seat base subassembly thereby freeing the upper seat assembly 105 to be pivoted manually to the position indicated in FIG. 12. Finally, the transverse motion (including the insertion of both pairs

of locking pins 140, 145 into the first 235 and second 240 pairs of receptacles) may be effected with the hand cranked first drive screw 130.

Because the effort required to rotate the upper seat assembly may be considerably less than that required to displace the upper seat assembly 105 in the transverse direction, elimination of the second motor 175, the second drive screw 180 and other components required to powerably rotate the upper seat assembly may be considered a desirable simplification of the previously described implementation of the present invention. It is also foreseen that under some circumstances the elimination of both drive motors and drive screws and related components may be considered a desirable simplification of the previously described implementation of the present invention.

The preferred method of taking advantage of aisle and under-sidewall space for providing sleeping accommodations is to manufacture and install two-seat units of similar dimensions to those currently in use (53 inch to 57 inch total width and 70 inch total length when fully reclined.) These seating units, from the forward-facing boarding and meal service "daytime" position 35 shown in FIG 2, pivot around a vertical axis so as to face the aisle and translate toward the aisle sufficiently to allow the seat backs to recline to the horizontal position 75.

The geometry of some installations such as the upper deck of the 747 make it possible to accomplish the reorientation of the present seat without the need to translate the upper seat assembly 105 away from the sidewall. Such a geometry makes it possible to employ the simplified seating assembly of the present invention shown in FIGS. 16-18. In this simplified application, the lower portion of the lazy susan bearing 275 is fastened to a lower plate 280 which connects the inboard 285 and outboard 290 frames of the underseat subassembly. Locking pins 295 are provided which move freely in smooth bores 300 in the inboard and outboard frames of the underseat subassembly. A release handle 305 is provided which directly, in the case of the inboard locking pins, and by means of levers 310, in the case of the outboard locking pins, pulls the locking pins out of engagement with the receptacles 315 bored in semi-circular flanges 320 which downwardly depend from the seat base frame. The release handle can be designed so that its function is unobvious to the untrained or it can be secured with a lock adequate to prevent unauthorized pivoting of the seat. Conversion of the seat from the daytime position to the nighttime position involves pulling the release handle, turning the upper seat to the desired position and pushing the release handle to engage locking pins in the nighttime receptacles 325. If a locking mechanism is provided, conversion is preceded by unlocking the release handle and followed by relocking the release handle.

The 13 inch incursion into the standard "daytime" aisle that results from pivoting and reclining the seats leaves a 21 inch aisle in the 747 main deck and a 16

inch aisle in the 777 for passenger movement during sleeping periods. In the case of the 747 upper deck a 5.5 inch incursion into the aisle (as typically configured with 54 inch total seat width units) coupled with a 10.5 inch overhang of the stow bins provides space for the 70 inch seat. These seats could be installed at (e.g.) 60 inch pitch making it possible to install four rows of seats rather than three rows of seats at 80 inch pitch in a 240 inch length of cabin. Since all seats face the aisle in the nighttime position, the difficulty of window seat passengers accessing the aisle is eliminated. In addition to this issue of aisle access, seats providing a 70 inch length in this transverse position are acceptable in preference to seats providing 80 inch length in the lateral position because foot overhang from the transverse orientation extends into the aisle while foot overhang in the lateral orientation extends into the head of another passenger.

The area between the two aisles in twin-aisle configurations can either be configured with galley and lavatory installations or sleeper seats installed with sufficient pitch to enable them to be fully reclined.

The 747 upper deck geometry has been described although the instant seat is workable in any vehicle with comparable dimensional space. As noted earlier, in main deck applications, because a greater lateral translation away from the sidewall is required, seat rotation will be accomplished in an intermediate position in the lateral translation and nighttime locking pins (oriented in the opposite direction of the daytime locking pins) engaged by completing the lateral translation.

To provide for easy access to seats in the nighttime position the foregoing description has consistently described pivoting the passenger seats toward the aisle. Under certain circumstances, as where an emergency exit path or other configuration detail would provide adequate access, it may be acceptable or even preferred to pivot the passenger seats away from the aisle toward the side wall. Such a use is foreseen by the present invention and the principles, structures and methods described herein are equally suitable for orienting passengers away from an aisle toward a sidewall.

The foregoing description of the present invention has generally described the use of double seats rotating toward a nighttime position that is substantially perpendicular to the aisle. The principles, structures and methods of the present invention can also be employed with other seating units rotated to lesser angles relative to the aisle. As an example, the advantages of the present invention will be gained by a first single seat unit rotated only sufficiently to allow the leg rests of said first seat or the legs of a passenger seated in said first seat to be extended into the aisle alongside a second seat positioned forward of said first seat. Such a displacement resembles the fixed echelon position shown in the aforementioned British patent to Dryburgh, et al. However the present invention offers the improvements of having additional aisle space available to aid passenger mobility during boarding, deplaning and meal service. These ad-

vantages are not foreseen by Dryburgh, et al.

It is often considered desirable to tilt or "rake" seat bottom cushions such that they are higher at the front or leading edge than at the back or rear edge. However seat bottom rake may be considered undesirable when a seat is fully reclined. Persons of ordinary skill in the art of designing reclinable seats are familiar with design approaches that eliminate rake when seats are reclined. The pivoting aspect of the present invention, however, offers a simple and therefore preferred method of eliminating rake in the transition from the daytime to the nighttime orientation. The degree of front to back seat bottom tilt or rake in the daytime will be referred to hereinafter as the rake angle. If the lazy susan bearing of the present invention is oriented such that both the forward and the outboard edge of the bearing are raised by one half of the desired rake angle, i.e., the lazy susan bearing is oriented in a plane which is horizontal on an axis running 45 degrees inboard of forward to 45 degrees outboard of aft, and inclined by an angle equal to one half the desired rake angle times the square root of two on an axis running from 45 degrees inboard of aft to 45 degrees outboard of forward, and the upper seat base and upper seat subassemblies are designed and installed such that the seat bottom has the desired degree of rake in the forward-facing daytime position, the seat bottom will have no rake when pivoted to the inboard-facing nighttime position.

While the principles of this invention have been described in connection with specific embodiments, it should be understood clearly that these descriptions are made only by way of example and are not intended to limit the scope of the invention.

#### Claims

1. A passenger sleeper seat assembly for use in a vehicle having a plurality of seats separated by at least one aisle, each of said seats having a pivotable seat back and an extendible leg rest, said assembly comprising:

(a) a first base subassembly affixed to said vehicle along said aisle;  
 (b) a second subassembly for supporting said seat back and said leg rest, said second subassembly being rotatably supported on said first subassembly;  
 (c) means for translating said second subassembly with respect to said first subassembly from a first position to a second position;  
 (d) means for rotating said second subassembly with respect to said first subassembly whereby said second subassembly may be projected into said aisle.

2. The sleeper seat assembly of claim 1, further com-

prising means for powerably translating said second assembly with respect to said first subassembly.

3. The sleeper seat assembly of claim 1, further comprising means for powerably rotating said second assembly with respect to said first subassembly.

4. The sleeper seat assembly of claim 1, further comprising:

(a) means for locking said second subassembly in said first position, and  
 (b) means for locking said second subassembly in said second position.

5. The sleeper seat assembly of claim 1, wherein said second position is perpendicular to said aisle, whereby said seat back may be pivoted and said leg rest may be extended into a horizontal position.

6. A passenger sleeper seat assembly for use in a vehicle having a plurality of seats separated by at least one aisle, each of said seats having a pivotable seat back and an extendible leg rest, said assembly comprising:

(a) a first base subassembly affixed to said vehicle along said aisle;  
 (b) a second subassembly for supporting said seat back and said leg rest, said second subassembly being rotatably supported on said first subassembly from a first position to a second position;  
 (c) means for rotating said second subassembly with respect to said first subassembly whereby said second subassembly may be projected into said aisle.

7. The sleeper seat assembly of claim 6, further comprising means for powerably rotating said second assembly with respect to said first subassembly.

8. The sleeper seat assembly of claim 6, further comprising:

(a) means for locking said second subassembly in said first position, and  
 (b) means for locking said second subassembly in said second position.

9. The sleeper seat assembly of claim 6, wherein said second position is perpendicular to said aisle, whereby said seat backs may be pivoted and said leg rests may be extended into a horizontal position.

10. A process for increasing the revenue generating capability of a vehicle, said vehicle including a plurality

of seats separated by an aisle, said process comprising:

- (a) affixing a first base subassembly to said vehicle along said aisle; 5
- (b) rotatably supporting a second subassembly on said first subassembly, said second subassembly supporting said seat back and said leg; 10
- (c) translating said second subassembly with respect to said first subassembly from a first position to a second position; 15
- (d) rotating said second subassembly with respect to said first subassembly and projecting said second subassembly into said aisle. 15

11. A process for increasing the revenue generating capability of a vehicle, said vehicle including a plurality of seats separated by at least one aisle, said process comprising: 20

- (a) affixing a first base subassembly to said vehicle along said aisle;
- (b) rotatably supporting a second subassembly on said first subassembly from a first to a second position; 25
- (c) rotating said second subassembly with respect to said first subassembly and projecting said second subassembly into said aisle. 30

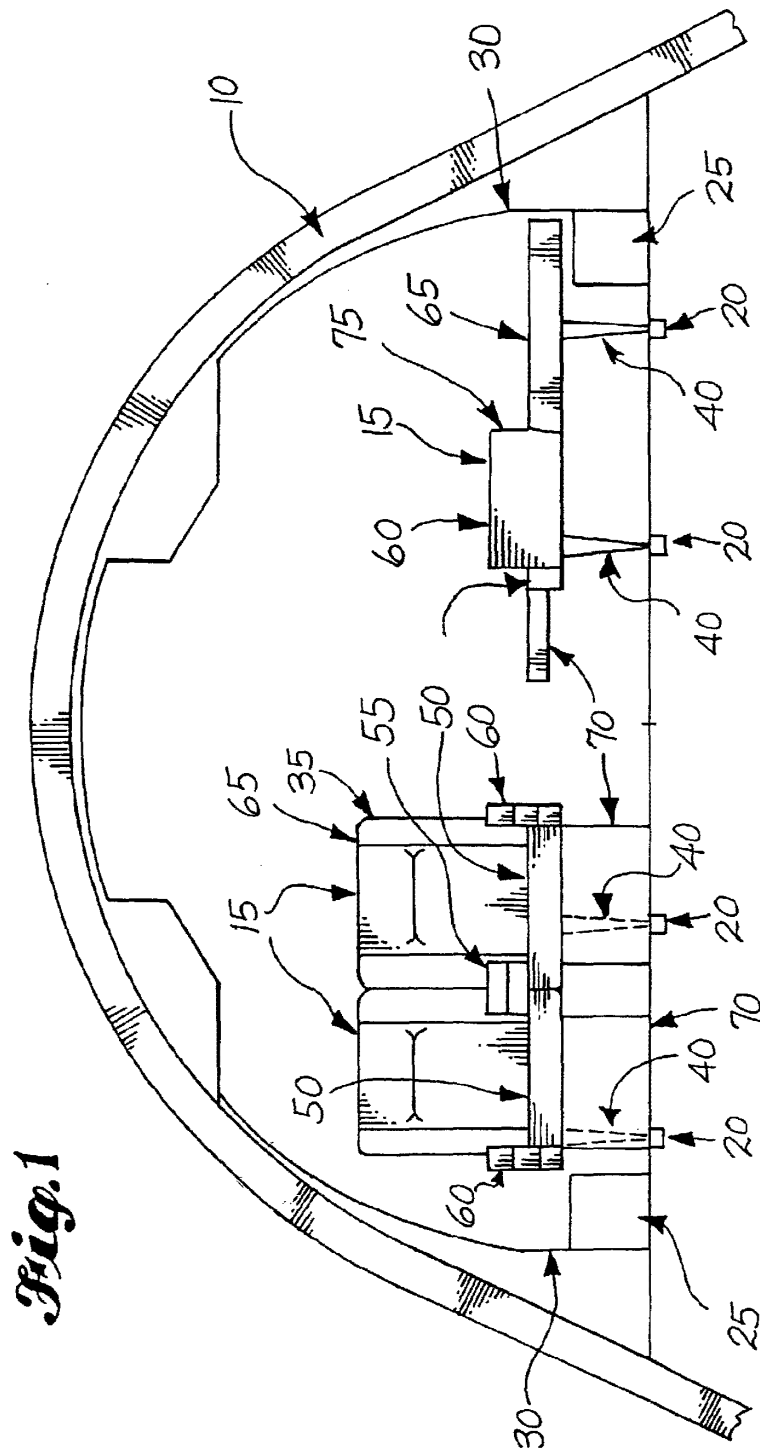
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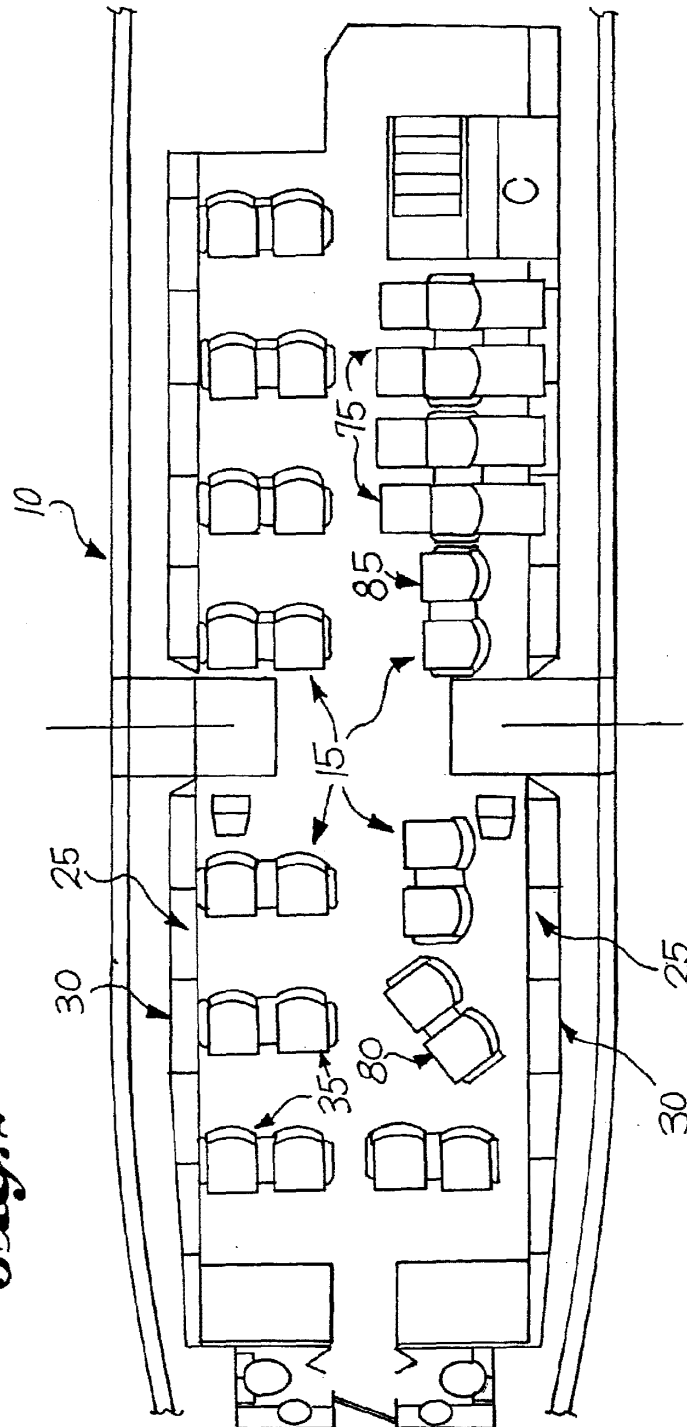
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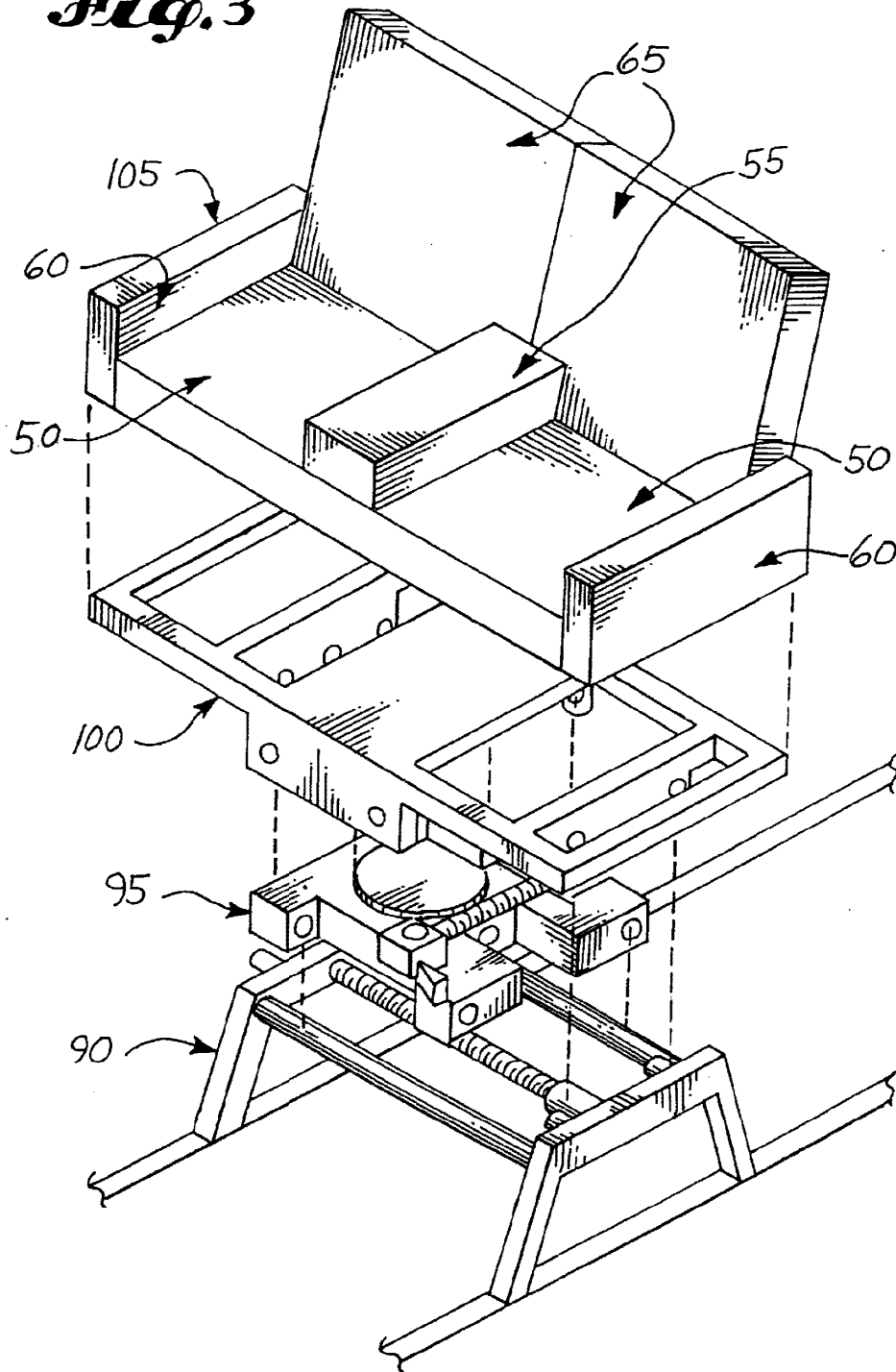


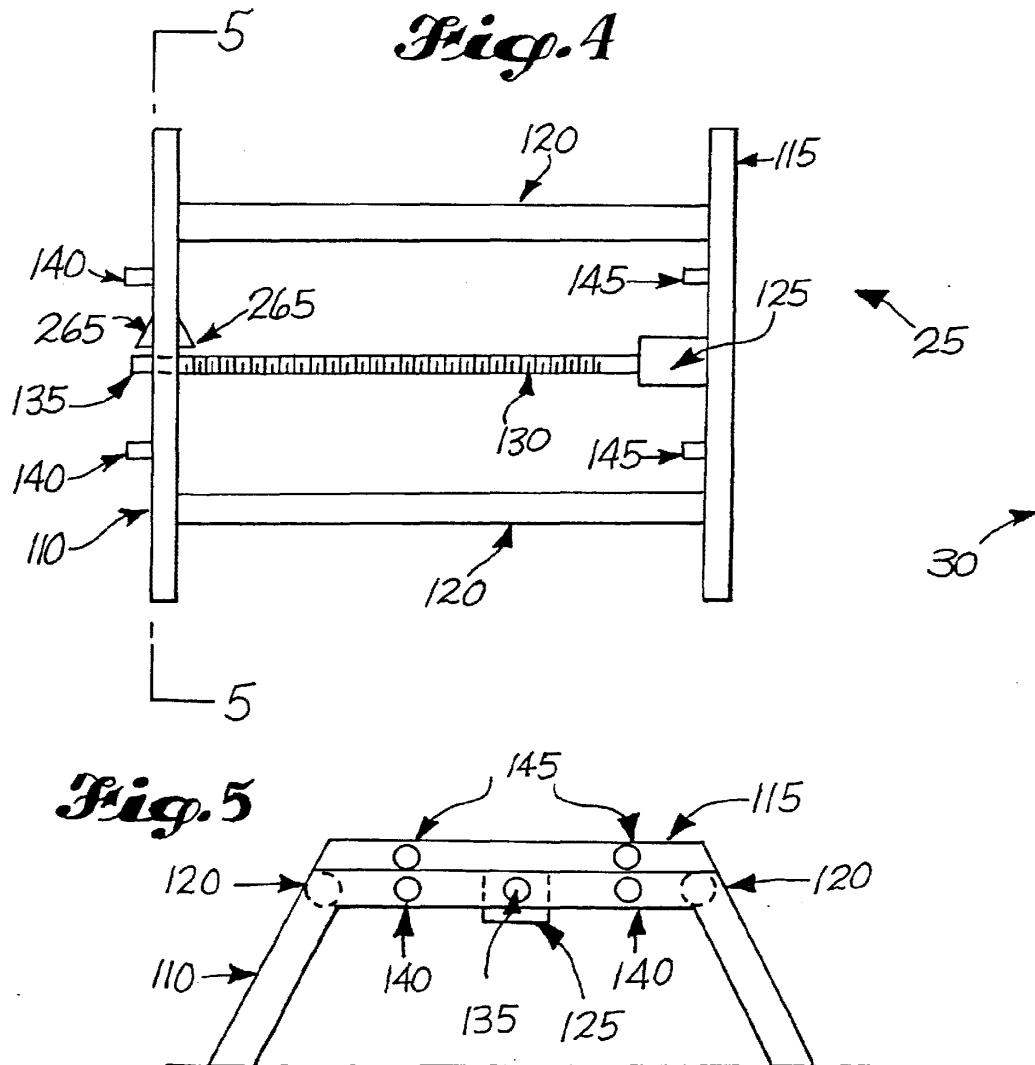
**Fig. 1**

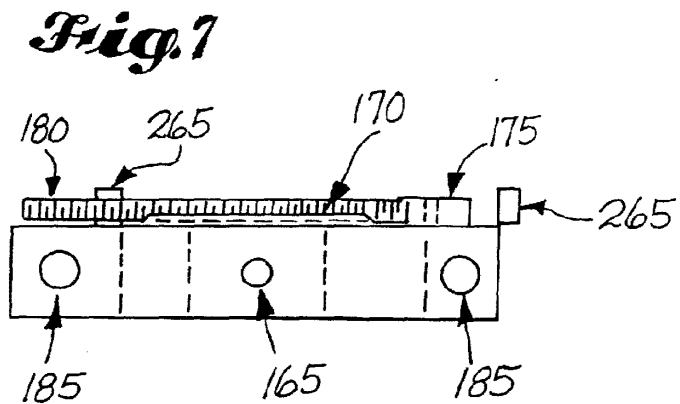
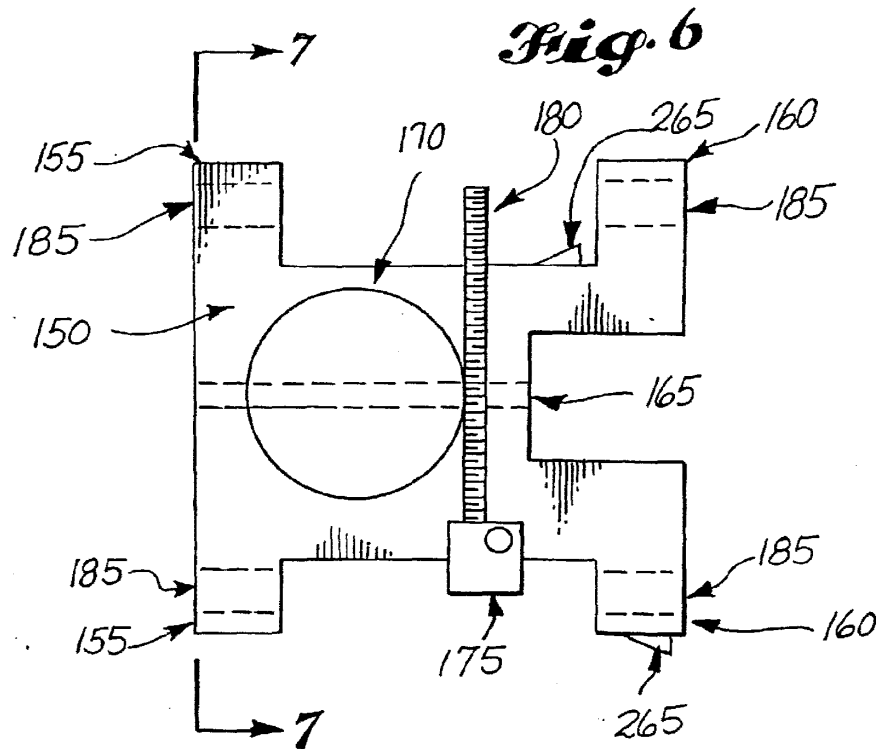
**Fig. 2**



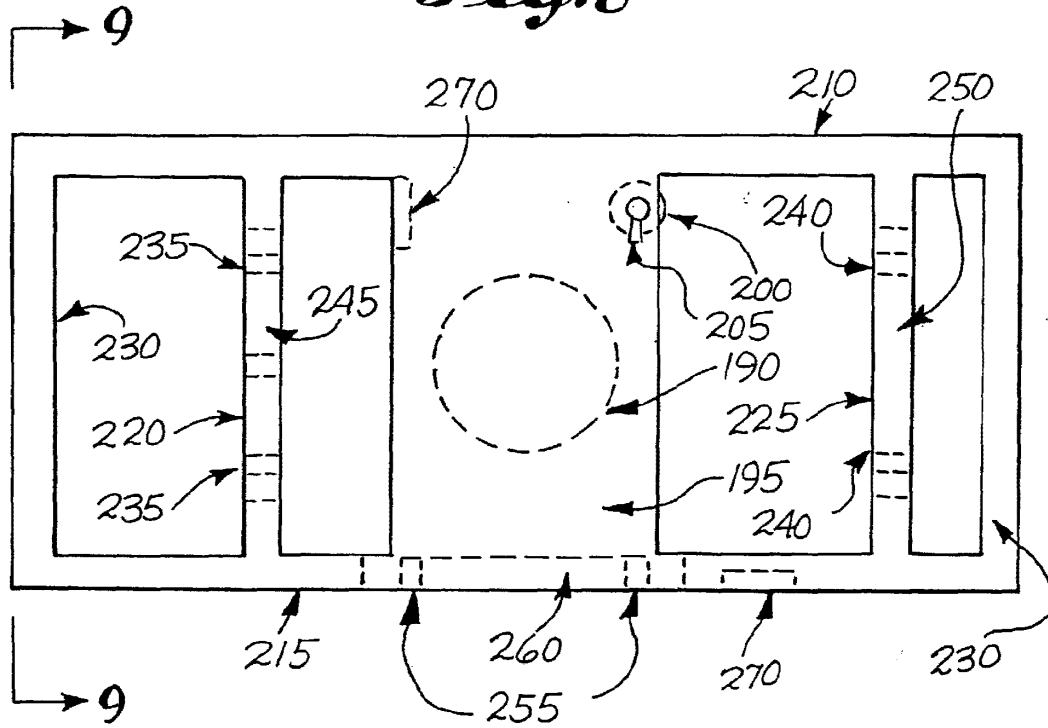
**Fig. 3**



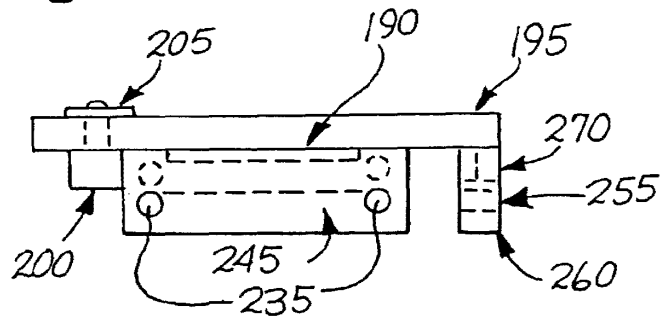




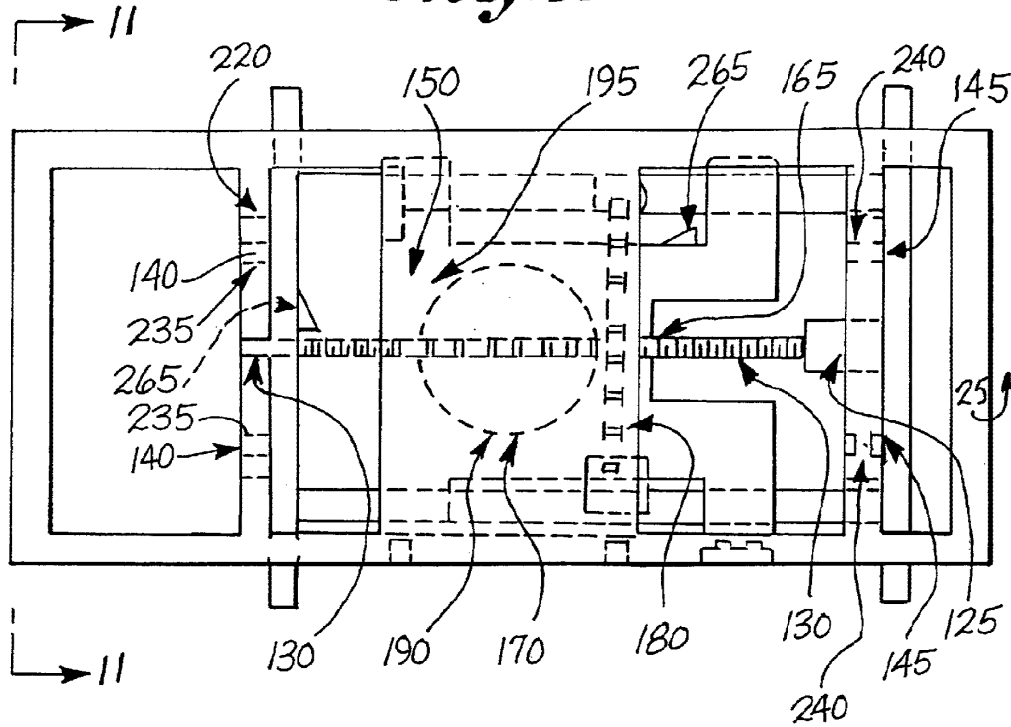
**Fig. 8**



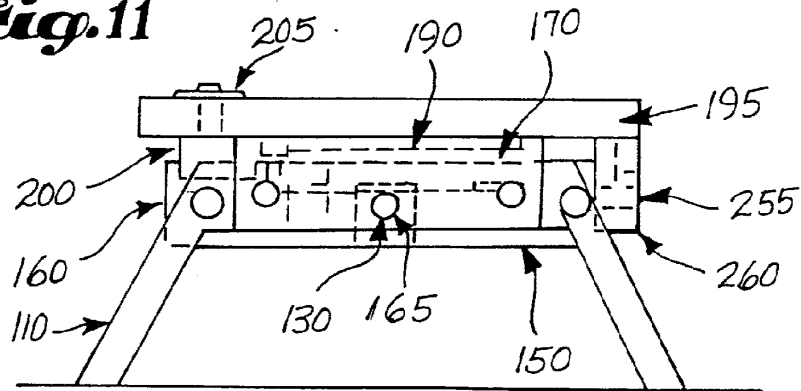
**Fig. 9**

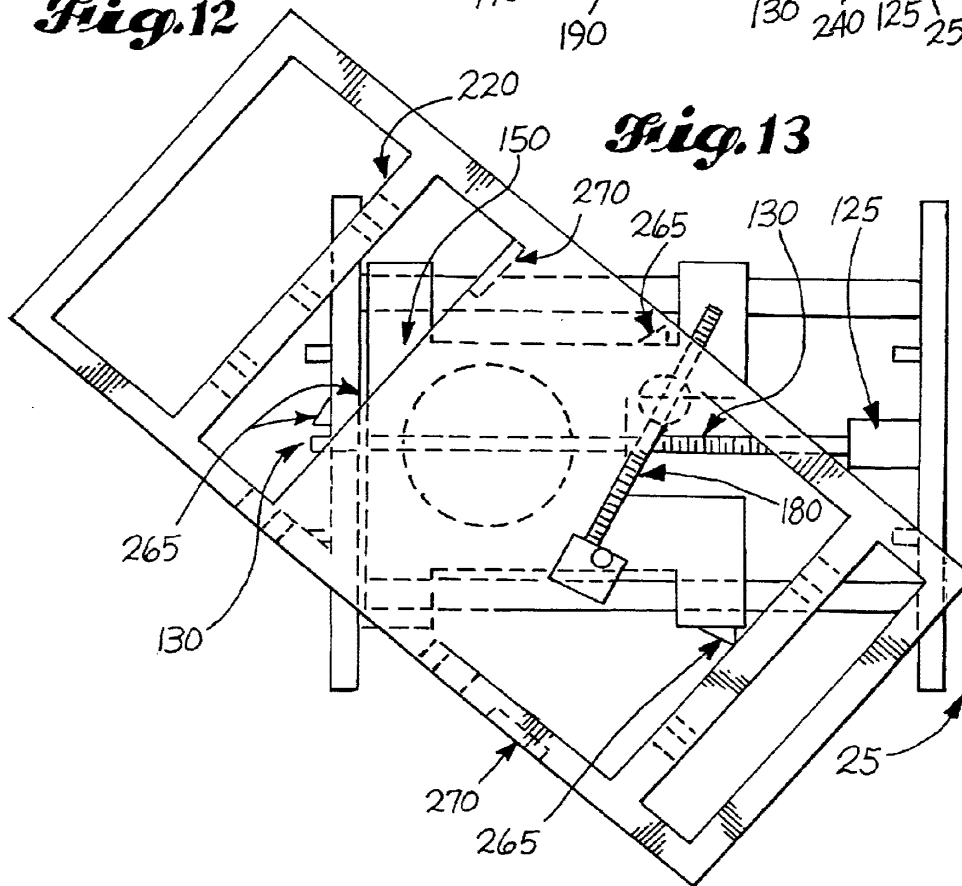
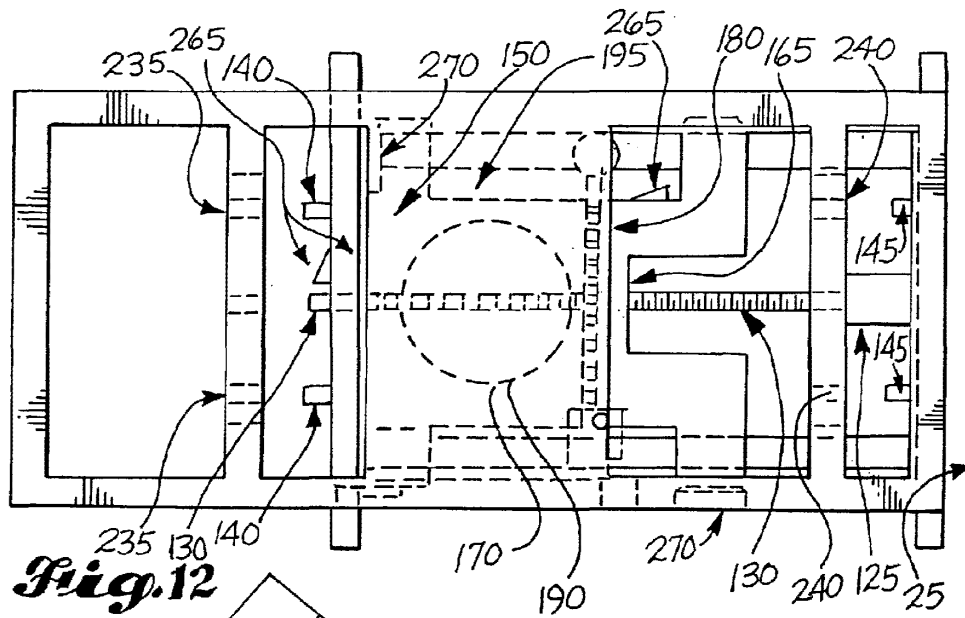


**Fig. 10**

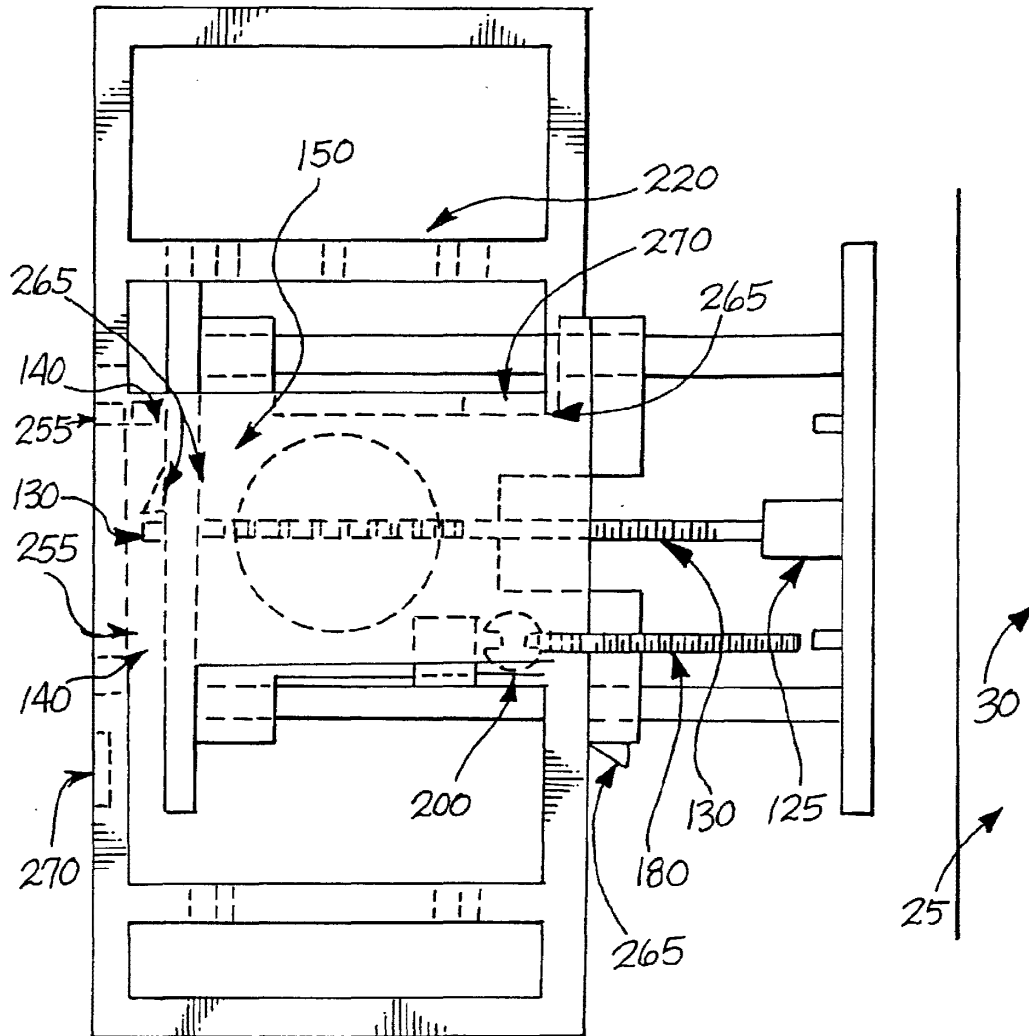


**Fig. 11**

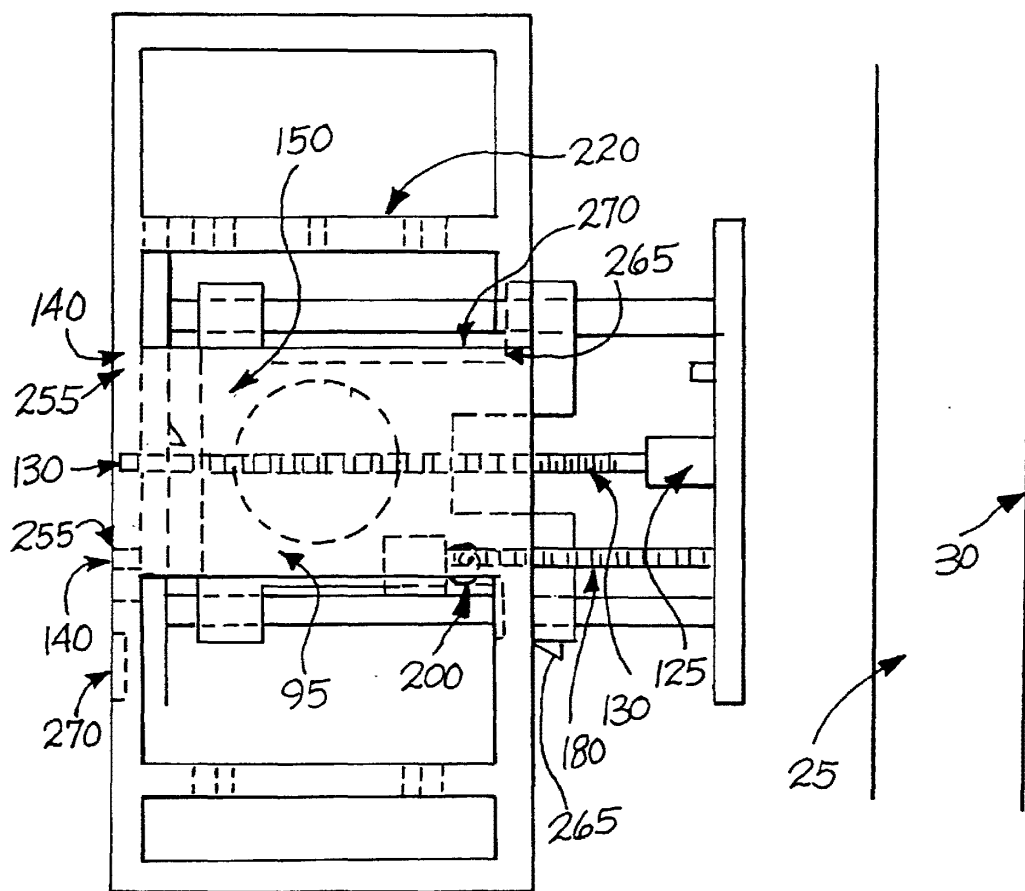




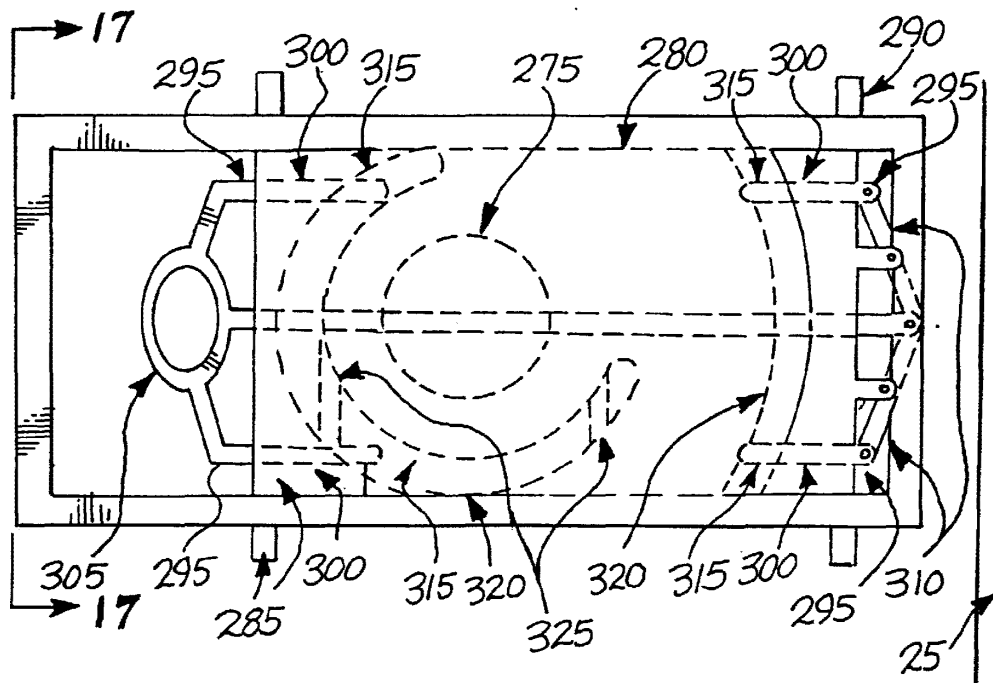
*Fig. 14*



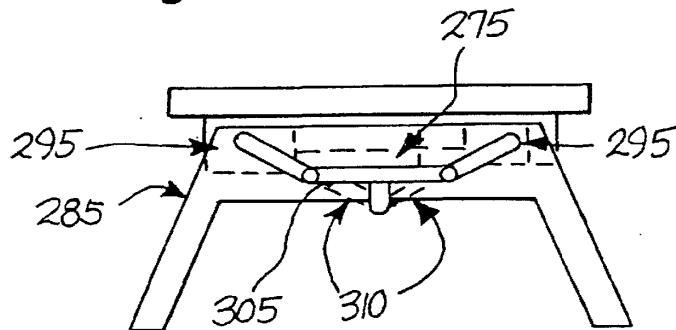
*Fig. 15*

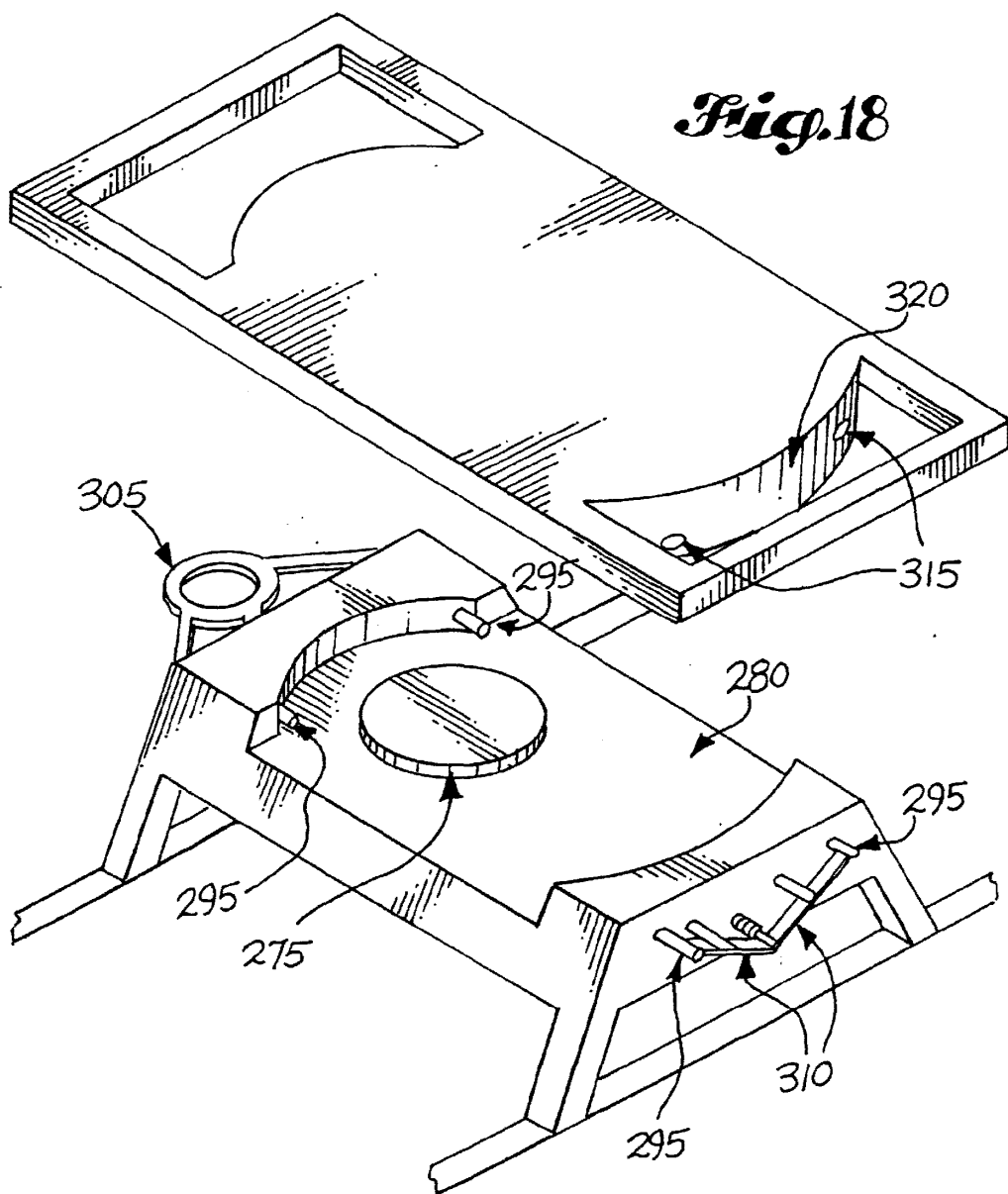


**Fig.16**



**Fig.17**







European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 97 20 3949

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                               |                                                   |                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim                                 | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US 4 834 452 A (GOODRICH GROVER G)<br>* column 1, line 25 - line 37 *<br>---  | 1, 6, 10, 11                                      | B64D11/06<br>B60N2/34                        |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EP 0 747 256 A (AEROSPATIALE)<br>* column 1, line 15 - line 25 *<br>---       | 1                                                 |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | FR 350 043 A (SELMERSHEIM)<br>* the whole document *<br>-----                 | 1                                                 |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                               |                                                   | TECHNICAL FIELDS SEARCHED (Int.Cl.6)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                               |                                                   | B64D<br>B60N<br>B61D                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                                                   |                                              |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                               | Date of completion of the search<br>10 March 1998 | Examiner<br>Hauglustaine, H                  |
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(54) **ARCHITECTURAL ARCHWAY FOR AN AIRCRAFT**  
**ARCHITEKTONISCHER TORBOGEN FÜR EIN FLUGZEUG**  
**ARCHITECTURE D'UN ARC D'UN AERONEF**

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**US-B1- 6 491 254**

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**Description****TECHNICAL FIELD**

[0001] The present invention relates to architectural structures for aircraft and more particularly to improved structures, cabin furnishing, accessories and auxiliary equipment for aircraft.

**BACKGROUND OF THE INVENTION**

[0002] The interior configuration and architecture of aircraft have become relatively standardized today. The arrangements of the passenger seats, bulkheads, lavatories, serving areas, and crew spaces have been developed for convenience and accommodation of both passengers and crew. The passenger compartments are typically divided into two or more sections with bulkheads and lavatories being positioned accordingly. Aisles and passageway spaces are left between sets of seats and at the access doors.

FR-A-2303711 discloses a way of transforming an aircraft from having a single cabin to having a number of different compartments. The different compartments can be provided as prefabricated "igloos".

[0003] The support lines and conduits for the accessory and auxiliary systems, such as conditioned air, water, hydraulics and electrical systems, are typically positioned in the lower bay below the passenger compartment (cabin) or in the crown or space above the passenger cabin. For some of these accessory systems, such as conditioned air and electrical systems, the wires and lines are passed between the lower bay and crown, or between one of those areas and the passenger cabins through the sidewalls or support members adjacent the exterior of the aircraft.

[0004] The installation, repair, and modification of the accessory and auxiliary systems, as well as the cabin furnishings, is a considerable expense to aircraft owners and users. There is a need for improved interior systems and for more efficient design and use of cabin furnishings and associated systems.

[0005] Often, the design and installation of cabin furnishing and auxiliary systems result in modification to the system transport elements, such as electrical wiring, fluid lines, and environmental control system ducts, which result in an increased cost and lead time for delivery of the desired aircraft. The problem is amplified for those transport systems that pass between the crown and lower bay of the aircraft since this may result in the loss of windows and sidewalls or longer than desired runs to fixed monuments at bulkheads.

[0006] There is a need in the aircraft industry for improved, more efficient, less complex, and less costly configurations for cabin furnishings and associated auxiliary systems in order to obviate the afore-mentioned problems.

**SUMMARY OF THE INVENTION**

[0007] According to the present invention there is provided an aircraft as claimed in claim 1. Advantageously additional features as claimed in claims 2 to 10 are also present.

[0008] One or more arch-type members ("archways") are positioned in the cabin of the aircraft. The archways preferably are inverted generally "U-shaped" structures which extend along the inside surfaces of the passenger cabins and have hollow interiors for placement and passage of electrical wires, air conditioning ducts, water lines and the like. The archways are preferably placed at stable locations within the cabin, such as at fixed door locations, so that they will reduce potential impact on seat configurations. The archways provide a path or raceway for the system transport elements particularly between the crown and lower bays of the aircraft.

[0009] The archways also can be positioned at architectural points of interest in the aircraft to help define and establish cabin proportions and also provide logical locations for passage of auxiliary system components. Placement of the archways at door locations provides a passage to run systems at each doorway without interfering with structural intercoastals located between framed bays at the door locations. The archways allow penetration through the floor of the cabin which can be standardized, reducing the variation in floor panel design. In addition, the archways can serve as receptacles for lavatory and gallery monuments, further reducing the complexity associated with integrating those elements into the interior of the aircraft. The archways further can eliminate the need for design close-out seals for outboard monuments.

[0010] The present invention simplifies the installation complexity and eliminates the installation variability associated with installing and running transport elements between the crown and lower bays of the aircraft.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0011] FIGURE 1 illustrates an aircraft in which the present invention can be utilized.

[0012] FIGURE 2 is a cross-section through the aircraft as shown in Figure 1 and depicting use of the present invention.

[0013] FIGURE 3 is a perspective view of an aircraft cabin interior, illustrating the use of the present invention.

[0014] FIGURE 4 is a perspective view illustrating the use of a plurality of archways in an aircraft in accordance with the present invention.

[0015] FIGURE 5 depicts the use of a pair of inventive archways at an exterior door to the passenger compartment.

[0016] FIGURE 6 is a cross-sectional view of the archways as shown in Figure 2.

[0017] FIGURE 7 is a cross-section of an alternate embodiment of an archway in accordance with the present

invention.

**[0018]** FIGURE 8 is a cross-section of still another alternate embodiment of an archway in accordance with the present invention.

**[0019]** FIGURE 9 illustrates use of the present invention for lavatories and other accessory systems.

**[0020]** FIGURE 10 depicts a cross-section of still another alternate embodiment of an archway in accordance with the present invention.

#### DESCRIPTION OF PREFERRED EMBODIMENTS

**[0021]** Efficient interior configuration and modification of airplanes and other aircraft is of value to airline companies and customers by reducing the costs associated with designing and installing cabin furnishings and auxiliary and support systems. Often, these activities will result in modifications to system transport elements, such as electrical wiring, water lines, or environment control system ducts resulting in increased costs and lead time for delivery of the desired aircraft. This problem is amplified for those transport elements that must run or be passed between the airplane crown and the lower lobe or bay, since current design practices result in loss of windows in the sidewalls, or longer than desired runs to fixed monuments at the fore or aft bulkheads.

**[0022]** The complexity and costs associated with providing for system runs between the crown and lower bays of airplanes and other aircraft has a significant impact on interior architecture, interior flexibility, body structure at doorways and manufacturing installation time. The present invention simplifies the installation complexity and eliminates the installation variability associated with running transport elements between the crown and lower bay areas.

**[0023]** In particular, the present invention uses architectural arches or archways at one or more locations along the length of the aircraft. The archways provide raceways or passageways for system transport elements, particularly for those which need to be passed from the crown to the lower bay of the aircraft. The archways also can be placed at stable locations within the fuselage or cabin of the aircraft, such as at fixed door locations which reduce the potential impact on seat configuration and provide improved cabin configurations.

**[0024]** Archways located on either side of a doorway will enable a number of different functions, such as architectural delineation of cabin volumes that are properly proportioned, and enclosure of system transport elements, including, but not limited to, electrical power and signal, water and conditioned air. The architectural archways also can incorporate a stable floor coupling in order to pass system transporting elements through the floor while meeting existing requirements for floor penetrations.

**[0025]** The inventive archways further will provide accommodation for items, including, but not limited to, system control panels, lavatories, emergency equipment

and flight attendant seats. When properly sized and configured, the archways will have the ability to provide for retractable features or otherwise hide these elements within the archway when not in use.

**[0026]** With the present invention, an altered method for interior cabin lighting via recessed task lighting can result, particularly through the use of luminescent cover panels or wash lighting from within the archways. The present invention will also provide a way to more efficiently create and control air temperature zones within the cabin by using an archway located air curtain to prevent air draft from moving fore and aft between cabins.

**[0027]** The present invention further can reduce the impact of external temperature extremes on cabin interior temperatures while in the boarding or deplaning processes.

**[0028]** With the present invention, various stations or zones within the cabin can be designated where passengers can experience a local enhanced air environment contained within a station or zone. This could include local humidification, increased air mixing, or ionized/purified air.

**[0029]** Finally, the present invention can provide a more integrated look for outboard lavatories or gallery monuments by designing the archways to accept the modules without the use of closeout seals or foams. In this regard, system connections servicing these monuments can be readily accessible.

**[0030]** The use of archways located at doorways can serve as a system, plenum to connect the systems that run between the crown of the airplane, the lower lobe or bay, and the main passenger cabin. The archways can assist in defining and establishing cabin proportions and also provide logical locations for system runs associated with water, power, and conditioned air. The placement at door locations provides a way to run systems at each doorway without having to interfere with the structural intercostals located between frame bays typically positioned at door locations.

**[0031]** With the present invention, the penetration through the floor can be standardized which will reduce the variation in floor panel designs.

**[0032]** If the archways are used for lavatory and galley monuments, this can reduce the complexity associated with integrating these elements into the interior, as well as eliminating the need for designed closeout seals for outboard monuments.

**[0033]** Figure 1 is a perspective view of an airplane or aircraft according to the present invention. The airplane is referred to generally by the reference numeral 20.

**[0034]** Figure 2 is a representative cross-section 2-2 taken at a location along the length of the fuselage or cabin of the airplane 20. As indicated, the aircraft includes a main passenger cabin 24, an upper crown area 26 and a lower lobe or bay 28, all positioned with an outer skin or exterior 30 of the airplane. The lower bay 28 typically is utilized for transporting luggage and other material. The passenger cabin or compartment 24 includes a number

of passenger seats 32 which are positioned on a floor member 34 that extends across the width of the airplane 20. Also, as conventional in airplanes today, a number of luggage or storage bins 36A, 36B, and 36C are provided on the upper portion of the passenger cabin 24.

[0035] An architectural arch or archway 40 is shown in its representative position within the airplane 20. The archway has a semi-circular or curved configuration as shown and is attached to the floor member 34 at its two lower ends 40A and 40B. The archway can be attached to the floor member in any conventional manner. The archway 40 preferably has a V-shaped cross-section as shown in Figure 6. Although a V-shaped cross-section is preferred, it is also possible within the scope of the present invention for the archway 40 to have other cross-sectional sizes and shapes. For example, the archway 140, as shown in Figure 8, has an expanded U-shaped cross-sectional configuration and shape, while the archway 240 as shown in Figure 10 has a semi-circular or curved cross-sectional shape and configuration.

[0036] As shown in Figure 2, an aircraft, such as airplane 20, has a number of control, auxiliary and support systems which have wires and conduits which need to be passed or run along the length of the aircraft and to be utilized at various positions along the length of the aircraft. These lines and conduits also need to be passed at some locations between the crown and lower bay areas of the aircraft. The conduits for these systems are shown in Figure 2 and are represented generally by reference numerals 42, 44, 46, 48, and 50. The conduits and systems mentioned and shown are only representative of the known and conventional systems used in aircraft today, such as electrical wiring, control wiring, water lines, air ducts, environment control system ducts, etc.

[0037] With the configuration shown, the system wires and conduits 42, 44, and 46 are positioned in the upper portion or crown 26 of the fuselage of the aircraft. In addition, other systems and conduits, such as 48 and 50 shown in Figure 2, are positioned in the lower lobe or bay of the aircraft. In order to utilize these systems, the archways 40 of the present invention allow or act as passageways or chaseways for the electrical lines and other conduits, such as 42A, 44A, and 46A, 48A and 50A. As shown in the cross-sectional view in Figure 6, the conduits are positioned in the interior open space of the archway 40. Some of these same conduits and wires are also shown in Figures 8 and 10.

[0038] In accordance with the present invention, it is also possible to have one or more of the conduits or ducts be molded or provided as part of the archway itself. This is shown in Figure 7, where archway 40' has a cross member 54 which forms an enclosed plenum or chamber 56. It is also to be understood, of course, that any number of interior conduits and plenums can be provided in the archways in accordance with the present invention and thus the invention is not limited to a structure having at least one plenum or any number thereof.

[0039] It is to be understood that the various cross-sectional sizes and shapes of the archways 40, 140, and 240 are only illustrative of the various cross-sectional sizes and shapes of archways that can be utilized in accordance with the present invention. Thus, the present invention is not limited to any particular size or shape of cross-section.

[0040] It is also possible to provide more than one integral or "built-in" conduit or passageway in the archway. Also, the integral conduits or passageways do not have to extend the full length of the archway, but can be positioned only in one or more portions thereof, such as in the portions which are positioned along the inner sides of the aircraft fuselage. It is further possible to provide one or more archways for the aircraft which are not hollow at all, or are only hollow along portions thereof.

[0041] In accordance with one embodiment of the present invention, pairs of arches or archways 40 can be positioned at various locations along the length of the aircraft or airplane. This is shown in Figures 3-5. First, as shown in Figure 4, two sets A, B of pairs of archways 40 are shown located at two positions in the fuselage of airplane 120. An interior view of the fuselage 60 in the direction of the length of the fuselage is shown in Figure 3. The archways 40 are used to separate the fuselage into various cabins C1, C2, and C3 along the length of the airplane.

[0042] A side elevational view illustrating one of the pairs of archways 40A is shown in Figure 5. The pair of archways 40A are also used to frame a door member 62. In this regard, as shown in Figures 3 and 5, various partitions 64 and 66 can be positioned in or adjacent to the archways 40, 40A in order to assist in separating the interior cabins, such as C1, C2 and C3, from one another.

[0043] It is to be understood in accordance with the present invention, that any number of archways can be provided along the length of the fuselage of an airplane or aircraft. It is also understood that any number of pairs or sets of archways can be provided at various locations along the length of the aircraft.

[0044] As shown in Figure 9, archways in accordance with the present invention can also be used to house or accommodate various accessories or auxiliary systems which are common in passenger airplanes today. In this regard, archways 80 and 82 are used to frame or flank a door member 62' at a location along the length of the airplane. Archway 80 is sufficiently wide to incorporate a lavatory 90, while archway 82 has a size sufficient to incorporate a jump seat 92 for one of the flight attendants. Also, as shown in Figure 9, an archway can be modified to incorporate various other items and systems, such as telephone 94 and electronic controls 96 for other systems on the airplane.

[0045] While the invention has been described in connection with one or more embodiments, it is to be understood that the specific mechanisms, processes and procedures which have been described are merely illustrative of the principles of the invention, numerous modifi-

cations may be made to the methods and apparatus described without departing from the scope of the invention as defined by the appended claims.

#### Claims

1. An aircraft (20) having an elongated fuselage with an upper crown portion (26), a floor member (34) and a lower lobe portion (28);  
at least one architectural archway (40) positioned inside the fuselage, said at least one archway (40) comprising a curved inverted loop-like structure with two spaced apart end members (40A, 40B), the end members positioned on the floor member (34), and wherein said archway (40) defines an interior open space;  
at least one system component (42, 44, 46, 48, 50) selected from the list of electrical wires, water lines, control wiring and environmental control system ducts, the at least one system component running between said upper crown portion (26) and said lower lobe portion (28) and being positioned in the interior open space of said archway (40) .
2. The aircraft (20) as claimed in claim 1 wherein said archway (40) has a cross-sectional shape selected from the group comprising V-shaped, U-shaped and semi-circular shaped.
3. The aircraft (20) as claimed in claims 1 or 2 further comprising at least one integral passageway (56) in said archway (40) structure for passage of at least one system component.
4. The aircraft (20) as claimed in any of claims 1-3 further comprising a lavatory (90) positioned in said archway structure adjacent one of said end members (40A, 40B) .
5. The aircraft (20) as claimed in any of claims 1-4 further comprising a seat member (92) positioned in said archway structure.
6. The aircraft (20) as claimed in any preceding claim, further comprising a door member (62) and two said archways positioned inside the fuselage, said pair of archways (40A) positioned in the aircraft (20) adjacent to and framing the door member (62).
7. The aircraft (20) as claimed in claim 6 wherein said end members (40A, 40B) of each of said archways are positioned on the floor member (34) on opposite sides of the fuselage.
8. The aircraft (20) as described in any preceding claim, wherein at least two sets (A, B) of archways (40) are positioned in a passenger portion (24) of the aircraft,

each set (A, B) comprising a pair of said archways (40) positioned closely adjacent each other.

9. The aircraft (20) as described in any preceding claim, wherein said archway (40) is utilized as a divider to separate a passenger portion of the aircraft into two separate sections (C1, C2).
10. The aircraft (20) as described in any preceding claim wherein said archway (40) is utilized as a divider to separate a passenger portion of the aircraft from at least one flight service portion of the aircraft.

#### Patentansprüche

1. Luftfahrzeug (20), das einen langgestreckten Rumpf mit einem oberen Bogenscheitelabschnitt (26), einem Bodenelement (34) und einem unteren Lobusabschnitt (28) aufweist;  
zumindest ein architektonischer Torbogen (40), angeordnet innerhalb des Rumpfes, wobei dieser zumindest eine Torbogen (40) eine gewölbte Struktur ähnlich einer umgekehrten Rinne mit zwei einander beabstandenden Endelementen (40A, 40B) umfasst, die Endelemente auf dem Bodenelement (34) angeordnet sind, und wobei der Torbogen (40) einen inneren offenen Raum definiert;  
zumindest eine Systemkomponente (42, 44, 46, 48, 50) aus der Liste der elektrischen Leitungen, Wasserleitungen, Steuerungsverkabelung und Lüftungskanäle für das Umweltkontrollsystem, wobei die zumindest eine Systemkomponente zwischen dem oberen Bogenscheitelabschnitt (26) und dem unteren Lobusabschnitt (28) verläuft und in dem inneren offenen Raum des Torbogens (40) angeordnet ist.
2. Luftfahrzeug (20) nach Anspruch 1, wobei der Torbogen (40) eine Querschnittsform aus der Gruppe der V-förmigen, U-förmigen und Halbkreisförmigen aufweist.
3. Luftfahrzeug (20) nach Anspruch 1 oder 2, weiterhin umfassend zumindest einen integralen Durchgang (56) in der Torbogenstruktur (40) zum Durchführen von zumindest einer Systemkomponente.
4. Luftfahrzeug (20) nach einem der Ansprüche 1-3, weiterhin umfassend einen Wasorraum (90), der in der Torbogenstruktur angrenzend an eines der Endelemente (40A, 40B) angeordnet ist.
5. Luftfahrzeug (20) nach einem der Ansprüche 1-4, weiterhin umfassend ein Sitzelement (92), angeordnet in der Torbogenstruktur.
6. Luftfahrzeug (20) nach einem vorhergehenden Anspruch, weiterhin umfassend ein Türelement (62)

und zwei Torbögen, angeordnet im Inneren des Rumpfes, wobei dieses Torbogenpaar (40A) benachbart zu dem Türelement (62) und dieses umrahmend in dem Luftfahrzeug (20) angeordnet ist.

7. Luftfahrzeug (20) nach Anspruch 6, wobei die Endelemente (40A, 40B) jedes Torbogens auf dem Bodenelement (34) an gegenüberliegenden Seiten des Rumpfes angeordnet sind.

8. Luftfahrzeug (20) nach einem vorhergehenden Anspruch, in welchem zumindest zwei Sätze (A, B) von Torbögen (40) in einem Fluggastabschnitt (24) des Luftfahrzeugs angeordnet sind, wobei jeder Satz (A, B) ein Paar der Torbögen (40), dicht nebeneinander angeordnet, umfasst.

9. Luftfahrzeug (20) nach einem vorhergehenden Anspruch, wobei der Torbogen (40) als Trennelement dient, um einen Fluggastabschnitt des Luftfahrzeugs in zwei getrennte Sektionen (C1, C2) zu unterteilen.

10. Luftfahrzeug (20) nach einem vorhergehenden Anspruch, wobei der Torbogen (40) als Trennelement dient, um einen Fluggastabschnitt des Luftfahrzeugs von zumindest einem Bordserviceabschnitt des Luftfahrzeugs abzutrennen.

#### Revendications

1. Aéronef (20) comportant un fuselage oblong avec une portion de couronne supérieure (26), un élément de plancher (34) et une portion de lobe inférieure (28) ;

Au moins une arcade architecturale (40) positionnée à l'intérieur du fuselage, ladite au moins une arcade (40) comprenant une structure courbée, inversée, semblable à une boucle avec deux éléments d'extrémité espacés (40A, 40B), les éléments d'extrémité étant positionnés sur l'élément de plancher (34), et où ladite arcade (40) définit un espace intérieur ouvert ;

Au moins un composant de système (42, 44, 46, 48, 50) sélectionné dans la liste de fils électriques, conduites d'eaux, câblages de commande et conduits du système de commande environnemental, au moins un composant de système s'étendant entre ladite portion de couronne supérieure (26) et ladite portion de lobe inférieure (28) et étant positionnée dans l'espace intérieur ouvert de ladite arcade (40).

2. Aéronef (20) selon la revendication 1, où ladite arcade (40) présente une forme en section transversale sélectionnée dans le groupe comprenant une forme en V, une forme en U et une forme semi-circulaire.

3. Aéronef (20) selon l'une des revendications 1 ou 2, comprenant en outre au moins un passage intégral (56) dans ladite structure d'arcade (40) pour le passage d'au moins un composant de système.

4. Aéronef (20) selon l'une des revendications 1 à 3, comprenant en outre des toilettes (90) positionnées dans ladite structure d'arcade d'une manière adjacente à l'un desdits éléments d'extrémité (40A, 40B).

5. Aéronef (20) selon l'une des revendications 1 à 4, comprenant en outre un élément de siège (92) positionné dans ladite structure d'arcade.

6. Aéronef (20) selon l'une des revendications précédentes, comprenant en outre un élément de porte (62) et deux arcades précitées positionnées à l'intérieur du fuselage, les deux arcades (40A) étant positionnées dans l'aéronef (20) d'une manière adjacente à et encadrant l'élément de porte (62).

7. Aéronef (20) selon la revendication 6, où lesdits éléments d'extrémité (40A, 40B) de chacune desdites arcades sont positionnés sur l'élément de plancher (34) sur des côtés opposés du fuselage.

8. Aéronef (20) selon l'une des revendications précédentes, où au moins deux ensembles (A, B) d'arcades (40) sont positionnés dans une portion de passagers (24) de l'aéronef, chaque ensemble (A, B) comprenant une paire desdites arcades (40) positionnée d'une manière étroitement adjacente l'une à l'autre.

9. Aéronef (20) selon l'une des revendications précédentes, où ladite arcade (40) est utilisée comme une division pour séparer une portion de passagers de l'aéronef en deux sections séparées (C1, C2).

10. Aéronef (20) selon l'une des revendications précédentes, où ladite arcade (40) est utilisée comme une division pour séparer une portion de passagers de l'aéronef d'au moins une portion de service de vol de l'aéronef.

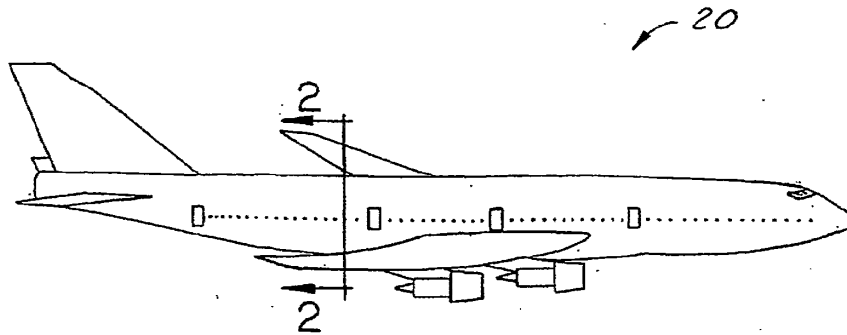


FIG. 1

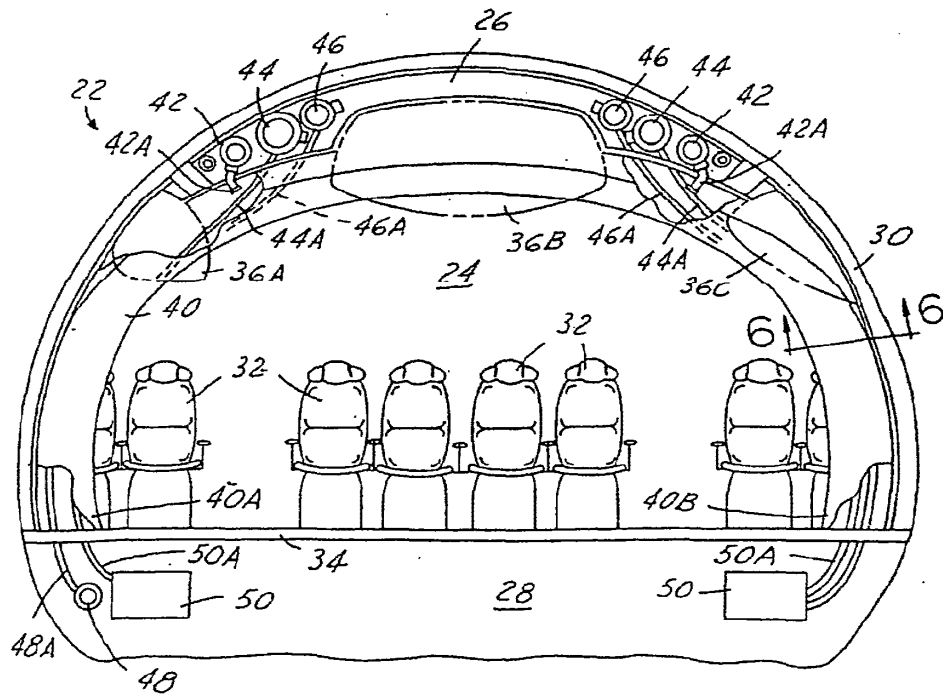


FIG. 2

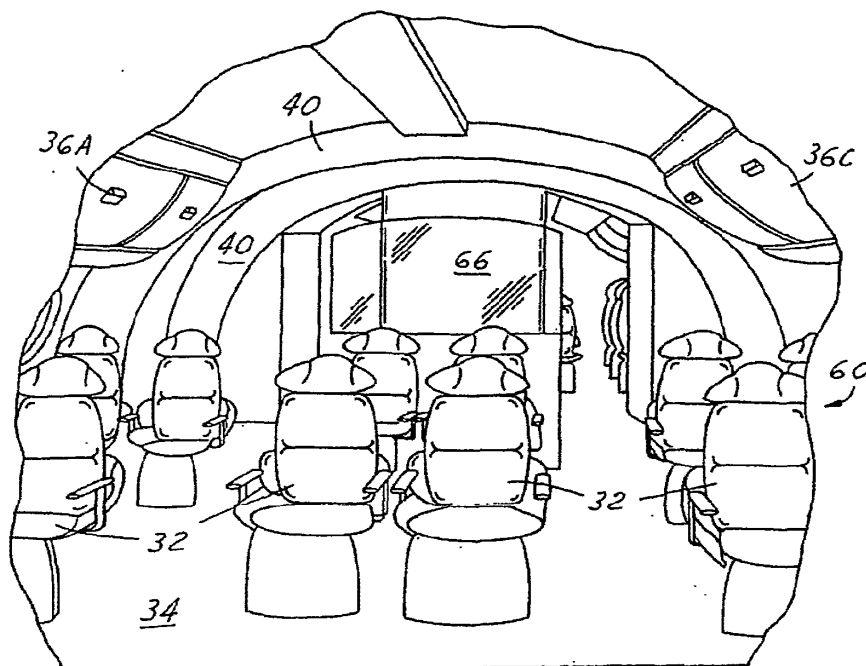


FIG. 3

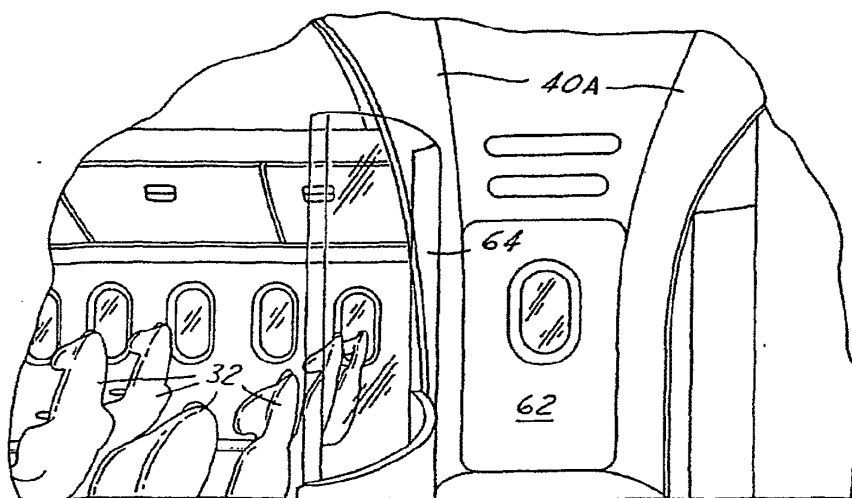
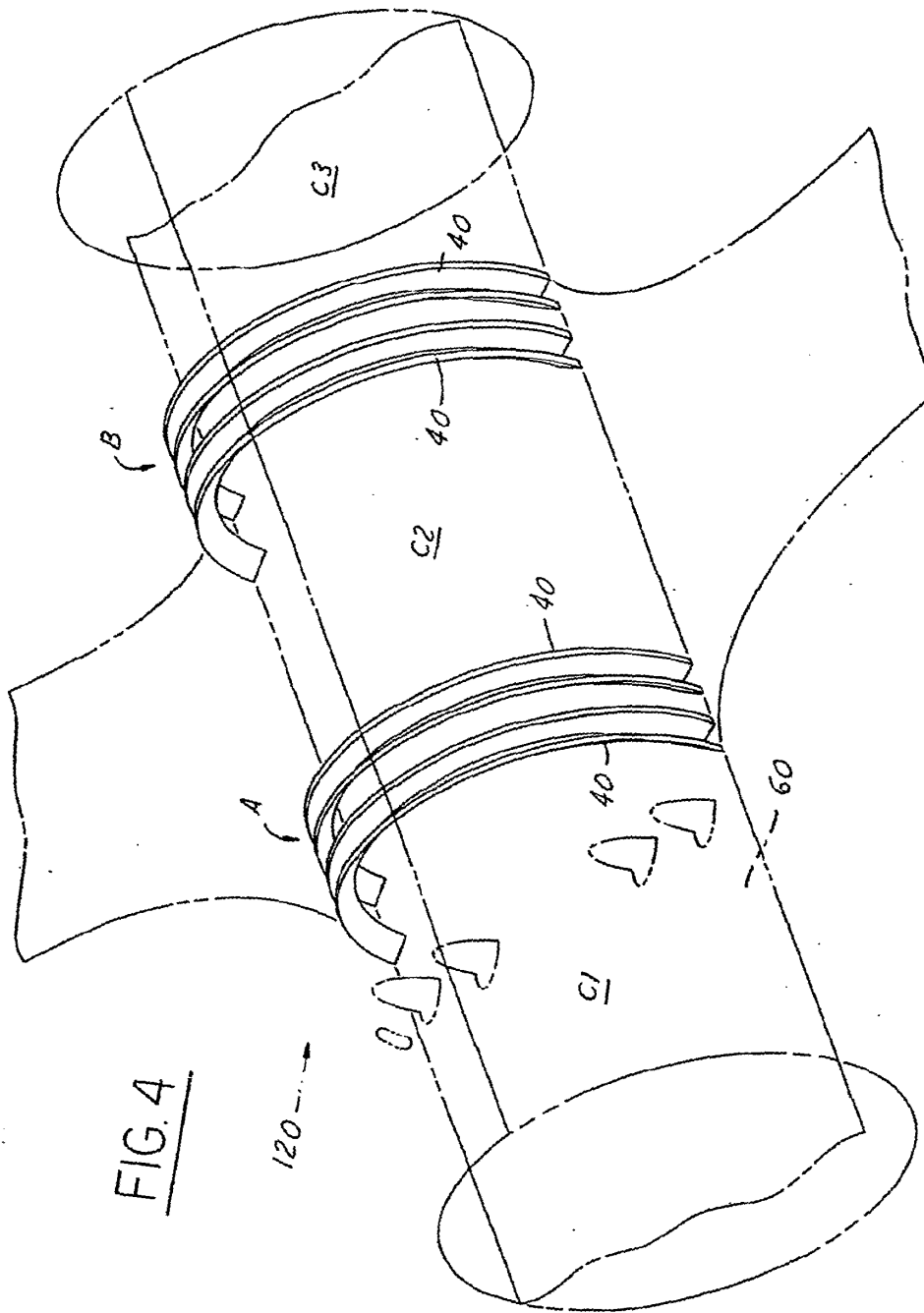


FIG. 5



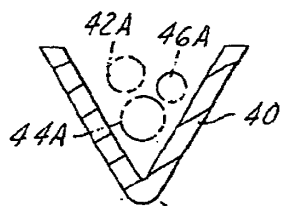


FIG. 6

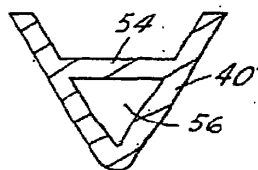


FIG. 7

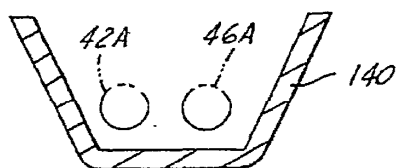


FIG. 8

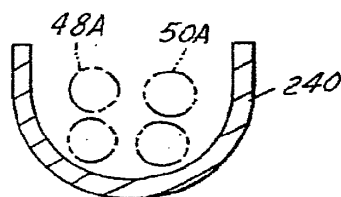


FIG. 10

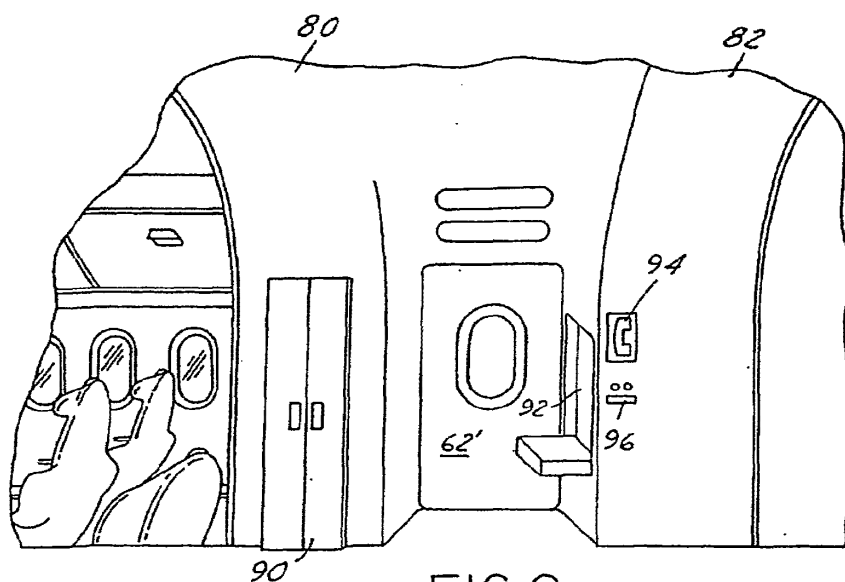


FIG. 9

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- FR 2303711 A [0002]

| Electronic Acknowledgement Receipt          |                                      |
|---------------------------------------------|--------------------------------------|
| <b>EFS ID:</b>                              | 25478931                             |
| <b>Application Number:</b>                  | 14709409                             |
| <b>International Application Number:</b>    |                                      |
| <b>Confirmation Number:</b>                 | 1803                                 |
| <b>Title of Invention:</b>                  | AIRCRAFT INTERIOR LAVATORY           |
| <b>First Named Inventor/Applicant Name:</b> | Donald F. Cook                       |
| <b>Customer Number:</b>                     | 22850                                |
| <b>Filer:</b>                               | Bradley Davis Lytle/Dara Del Rosario |
| <b>Filer Authorized By:</b>                 | Bradley Davis Lytle                  |
| <b>Attorney Docket Number:</b>              | 466860US110CONT                      |
| <b>Receipt Date:</b>                        | 13-APR-2016                          |
| <b>Filing Date:</b>                         | 11-MAY-2015                          |
| <b>Time Stamp:</b>                          | 14:16:14                             |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)          |

**Payment information:**

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

**File Listing:**

| Document Number | Document Description | File Name        | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|------------------|------------------------------------------|------------------|------------------|
| 1               |                      | 466860US_IDS.pdf | 128461                                   | yes              | 2                |
|                 |                      |                  | 3938bd3f9eac2ddac5cbde9af9661845e1823302 |                  |                  |

|                              | Multipart Description/PDF files in .zip description |                |                                          |     |    |
|------------------------------|-----------------------------------------------------|----------------|------------------------------------------|-----|----|
|                              | Document Description                                |                | Start                                    | End |    |
|                              | Transmittal Letter                                  |                | 1                                        | 1   |    |
|                              | Information Disclosure Statement (IDS) Form (SB08)  |                | 2                                        | 2   |    |
| Warnings:                    |                                                     |                |                                          |     |    |
| Information:                 |                                                     |                |                                          |     |    |
| 2                            | Foreign Reference                                   | DE69422723.pdf | 2430468                                  | no  | 61 |
|                              |                                                     |                | 62c8c86b2fe27003681a020fcc72f7cb34ee2d0e |     |    |
| Warnings:                    |                                                     |                |                                          |     |    |
| Information:                 |                                                     |                |                                          |     |    |
| 3                            | Foreign Reference                                   | DE69725542.pdf | 1084701                                  | no  | 21 |
|                              |                                                     |                | d5179129b76028751403abee4134dd6713a840f0 |     |    |
| Warnings:                    |                                                     |                |                                          |     |    |
| Information:                 |                                                     |                |                                          |     |    |
| 4                            | Foreign Reference                                   | EP0722404.pdf  | 1745213                                  | no  | 37 |
|                              |                                                     |                | 7b43ccf4cb5f076c1942281e7e229962d1d0a95e |     |    |
| Warnings:                    |                                                     |                |                                          |     |    |
| Information:                 |                                                     |                |                                          |     |    |
| 5                            | Foreign Reference                                   | EP0850834.pdf  | 918272                                   | no  | 21 |
|                              |                                                     |                | 21b6c814fe88e6f72f6aee2ebce335f515a41fcd |     |    |
| Warnings:                    |                                                     |                |                                          |     |    |
| Information:                 |                                                     |                |                                          |     |    |
| 6                            | Foreign Reference                                   | EP1685023.pdf  | 579058                                   | no  | 11 |
|                              |                                                     |                | bea302798656e465f67db449b3ff9f110d038025 |     |    |
| Warnings:                    |                                                     |                |                                          |     |    |
| Information:                 |                                                     |                |                                          |     |    |
| Total Files Size (in bytes): |                                                     |                | 6886173                                  |     |    |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

Docket No. 466860US110CONT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

IN RE APPLICATION OF: Donald F. COOK, et al.

SERIAL NO: 14/709,409

GAU: 3641

FILED: May 11, 2015

EXAMINER: LEE, BENJAMIN P.

FOR: AIRCRAFT INTERIOR LAVATORY

**INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR 1.97**

COMMISSIONER FOR PATENTS  
ALEXANDRIA, VIRGINIA 22313

Commissioner:

Applicant(s) wish to disclose the following information.

**REFERENCES**

- ☒ The applicant(s) wish to make of record the reference(s) listed on the attached form PTO-1449 and/or accompanying documents from a corresponding foreign application. Copies of the listed reference(s) are attached, where required, as are either statements of relevancy or any readily available partial or full English translations of pertinent portions of any non-English language reference(s).
- ☐ Credit card payment is being made online (if electronically filed), or is attached hereto (if paper filed), in the amount required under 37 CFR §1.17(p).

**CERTIFICATION**

- ☐ Each item of information contained in this information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this statement.
- ☒ No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the undersigned, having made reasonable inquiry, was known to any individual designated in 37 CFR §1.56(c) more than three months prior to the filing of this statement.

**DEPOSIT ACCOUNT**

- ☒ Please charge any additional fees for the papers being filed herewith and for which no payment is enclosed herewith, or credit any overpayment to deposit account number **15-0030**.

Respectfully submitted,

OBLON, McCLELLAND,  
MAIER & NEUSTADT, L.L.P.

/Greg H. Gardella/

Greg H. Gardella

Registration No. 46,045

Customer Number

**22850**

Tel. (703) 413-3000  
Fax. (703) 413-2220  
(OMMN 02/12)

Natalie J. Grace

Registration No. 65,803



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

## NOTICE OF ALLOWANCE AND FEE(S) DUE

22850 7590 04/26/2016  
OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P.  
1940 DUKE STREET  
ALEXANDRIA, VA 22314

EXAMINER

LEE, BENJAMIN P

ART UNIT

PAPER NUMBER

3641

DATE MAILED: 04/26/2016

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/709,409      | 05/11/2015  | Donald F. Cook       | 466860US110CONT     | 1803             |

TITLE OF INVENTION: AIRCRAFT INTERIOR LAVATORY

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 07/26/2016 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

**PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

22850 7590 04/26/2016  
OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P.  
1940 DUKE STREET  
ALEXANDRIA, VA 22314

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/709,409      | 05/11/2015  | Donald F. Cook       | 466860US110CONT     | 1803             |

TITLE OF INVENTION: AIRCRAFT INTERIOR LAVATORY

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 07/26/2016 |

| EXAMINER        | ART UNIT | CLASS-SUBCLASS |
|-----------------|----------|----------------|
| LEE, BENJAMIN P | 3641     | 244-118600     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_



# UNITED STATES PATENT AND TRADEMARK OFFICE

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|                                                                                                                  |             |                      |                             |                  |
|------------------------------------------------------------------------------------------------------------------|-------------|----------------------|-----------------------------|------------------|
| APPLICATION NO.                                                                                                  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.         | CONFIRMATION NO. |
| 14/709,409                                                                                                       | 05/11/2015  | Donald F. Cook       | 466860US110CONT             | 1803             |
| 22850 7590 04/26/2016<br>OBLOM, MCCLELLAND, MAIER & NEUSTADT, L.L.P.<br>1940 DUKE STREET<br>ALEXANDRIA, VA 22314 |             |                      | EXAMINER<br>LEE, BENJAMIN P |                  |
|                                                                                                                  |             |                      | ART UNIT                    | PAPER NUMBER     |

3641

DATE MAILED: 04/26/2016

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

|                               |                                      |                                    |                                                  |
|-------------------------------|--------------------------------------|------------------------------------|--------------------------------------------------|
| <b>Notice of Allowability</b> | <b>Application No.</b><br>14/709,409 | <b>Applicant(s)</b><br>COOK ET AL. |                                                  |
|                               | <b>Examiner</b><br>BENJAMIN P. LEE   | <b>Art Unit</b><br>3641            | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/30/2016.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-6. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☐ All    b) ☐ Some    \*c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.  
**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |                                                                                                                               |                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)                                                              | 5. <input type="checkbox"/> Examiner's Amendment/Comment                                 |
| 2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date <u>3/30/2016</u> | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance     |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material                       | 7. <input checked="" type="checkbox"/> Other <u>Third Party Submission (2/26/2016)</u> . |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____.                                        |                                                                                          |

/BENJAMIN P LEE/  
Primary Examiner, Art Unit 3641

The present application is being examined under the pre-AIA first to invent provisions.

### **DETAILED ACTION**

#### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/30/2016 has been entered.

#### **Declaration Under 37 CFR 1.132**

2. Applicant filed a declaration dated 3/30/2016, but failed to file under a specific rule. After review, it appears that the Declaration falls under the 37 CFR 1.132 rule.

The declaration under 37 CFR 1.132 filed 3/30/2016, along with the amendments to the claims, is sufficient to overcome the rejection of all claims.

#### ***Allowable Subject Matter***

3. Claims 1-6 are allowed.

4. The following is an examiner's statement of reasons for allowance: With respect to claim 1, the closest prior art fails to teach or make obvious, including all the limitations of claim 1, that the forward wall is adapted to provide more space forward of the enclosure unit such that the seat support can be positioned further aft in the cabin than if the cabin included another enclosure unit having a substantially flat front wall located in substantially the same position in the cabin as the forward wall and positioning said seat support further aft in said aircraft cabin than said seat support could have been positioned prior to retrofitting said aircraft, whereby a portion of the exterior aft surface of said passenger seat back in the unreclined seat position is received by said forward wall. With respect to claim 2, the closest prior art fails to teach or make obvious, including all the limitations of claim 2, that the forward wall is adapted to provide more space forward of the enclosure unit such that the seat support can be positioned further aft in the cabin than if the cabin included another enclosure unit having a front wall that is substantially flat and is located in substantially the same position in the cabin as the forward wall. Examiner notes that the indication of allowable subject matter is assumed to indicate that the seat support is movable to a different position further aft in the cabin and is capable of doing so because the forward wall of the enclosure unit is adapted to provide more space.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Benjamin P. Lee whose telephone number is 571-272-8968. The examiner can normally be reached between the hours of 8:30am and 5:00pm on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Troy Chambers can be reached on 571-272-6874. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/BENJAMIN P LEE/

Primary Examiner, Art Unit 3641

Receipt date: 02/26/2016

14709409 -- GAU: 3641

Doc Code:IDS.3P

PTO/SB/429(08-12)

Document Description: Third-Party Submission Under 37 CFR 1.290

Approved for use through 07/31/2015. OMB 0651-0031

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|----------------------------------------------------------|--------------------|----------|
| <b>THIRD-PARTY<br/>SUBMISSION<br/>UNDER 37 CFR 1.290</b> | Application Number | 14709409 |
|                                                          |                    |          |

| U.S. PATENTS                                                   |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------|-------------------------------|---------------------------------------------|--------------------------|
| Cite No                                                        | Patent Number                                                                                                                                              | Kind Code <sup>1</sup>    | Issue Date (YYYY-MM-DD)       | First Named Inventor          |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| U.S. PATENT APPLICATION PUBLICATIONS                           |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Publication Number                                                                                                                                         | Kind Code <sup>1</sup>    | Publication Date (YYYY-MM-DD) | First Named Inventor          |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS      |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Foreign Document Number <sup>3</sup>                                                                                                                       | Country Code <sup>2</sup> | Kind Code <sup>1</sup>        | Publication Date (YYYY-MM-DD) | Applicant, Patentee or First Named Inventor | T <sup>5</sup>           |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             | <input type="checkbox"/> |
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| NON-PATENT PUBLICATIONS (e.g., journal article, Office action) |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), place of publication (where available). |                           |                               |                               | T <sup>5</sup>                              | E <sup>6</sup>           |

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| THIRD-PARTY<br>SUBMISSION<br>UNDER 37 CFR 1.290 | Application Number | 14709409 |
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| 2 | Air France Letter                | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3 | 2007 Startup Boeing Presentation | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

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14709409 - GAU. 3641

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| THIRD-PARTY<br>SUBMISSION<br>UNDER 37 CFR 1.290 | Application Number | 14709409 |
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| 4 | Final Written Decision IPR 2014-00727, October 26, 2015 | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
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## STATEMENTS

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

☒ The fee set forth in 37 CFR 1.290(f) has been submitted herewith.

☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and the only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

☐ This resubmission is being made responsive to a notification of non-compliance issued for an earlier filed third-party submission. The corrections in this resubmission are limited to addressing the non-compliance. As such, the party making this resubmission: (1) requests that the Office apply the previously-paid fee set forth in 37 CFR 1.290(f), or (2) states that no fee is required to accompany this resubmission as the undersigned is again making the fee exemption statement set forth in 37 CFR 1.290(g).

|            |                    |                                        |       |
|------------|--------------------|----------------------------------------|-------|
| Signature  | /John C. Alemanni/ |                                        |       |
| Name/Print | John C. Alemanni   | Registration Number<br>(if applicable) | 47384 |

|                    |                  |                 |            |
|--------------------|------------------|-----------------|------------|
| Examiner Signature | /BENJAMIN P LEE/ | Date Considered | 04/04/2016 |
|--------------------|------------------|-----------------|------------|

\*EXAMINER: Signature indicates all documents listed above have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant. 1. If known, enter kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document, by two-letter code under WIPO standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter the kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 5. Check mark indicates translation attached. 6. Check mark indicates evidence of publication attached.

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.P.L./

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| Form PTO 1449<br>(Modified)                                                                                                                                                                                                                  |                  | U.S. DEPARTMENT OF COMMERCE<br>PATENT AND TRADEMARK OFFICE                                       |      | ATTY DOCKET NO.<br>466860US110CONT  |                       | SERIAL NO.<br>14709,409                                          |                               |
| LIST OF REFERENCES CITED BY APPLICANT                                                                                                                                                                                                        |                  |                                                                                                  |      | APPLICANT<br>Donald F. COOK, et al. |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              |                  |                                                                                                  |      | FILING DATE<br>May 11, 2015         |                       | GROUP<br>3641                                                    |                               |
| <b>U.S. PATENT DOCUMENTS</b>                                                                                                                                                                                                                 |                  |                                                                                                  |      |                                     |                       |                                                                  |                               |
| EXAMINER<br>INITIAL                                                                                                                                                                                                                          |                  | DOCUMENT<br>NUMBER                                                                               | DATE | NAME                                | CLASS                 | SUB<br>CLASS                                                     | FILING DATE<br>IF APPROPRIATE |
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| <b>FOREIGN PATENT DOCUMENTS</b>                                                                                                                                                                                                              |                  |                                                                                                  |      |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              |                  | DOCUMENT<br>NUMBER                                                                               | DATE | COUNTRY                             | TRANSLATION<br>YES NO |                                                                  |                               |
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| <b>OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)</b>                                                                                                                                                               |                  |                                                                                                  |      |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AW               | Slide Deck, B/E Aerospace, Spacewall Technology, Examiner Interview, February 24, 2016, 53 pages |      |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AX               |                                                                                                  |      |                                     |                       |                                                                  |                               |
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|                                                                                                                                                                                                                                              | AZ               |                                                                                                  |      |                                     |                       | <input type="checkbox"/> Additional References sheet(s) attached |                               |
| Examiner                                                                                                                                                                                                                                     | /BENJAMIN P LEE/ |                                                                                                  |      |                                     | Date considered       | 04/04/2016                                                       |                               |
| *Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. |                  |                                                                                                  |      |                                     |                       |                                                                  |                               |

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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14709409 | <b>Applicant(s)/Patent Under Reexamination</b><br>COOK ET AL. |  |
|                                                                                                                  | <b>Examiner</b><br>BENJAMIN P LEE          | <b>Art Unit</b><br>3641                                       |  |

| CPC    |  |    |  |    |      |            |
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| B64D   |  | 11 |  | 02 | F    | 2013-01-01 |
| Y02T   |  | 50 |  | 46 | A    | 2013-01-01 |
| B64C   |  | 1  |  | 10 | I    | 2013-01-01 |
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| NONE                                               |          | <b>Total Claims Allowed:</b> |                   |
| (Assistant Examiner)                               | (Date)   | 6                            |                   |
| /BENJAMIN P LEE/<br>Primary Examiner.Art Unit 3641 | 4/4/2016 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                 | (Date)   | 1                            | 2                 |

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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14709409 | <b>Applicant(s)/Patent Under Reexamination</b><br>COOK ET AL. |
|                                                                                                                  | <b>Examiner</b><br>BENJAMIN P LEE          | <b>Art Unit</b><br>3641                                       |

| US ORIGINAL CLASSIFICATION |                                   |  |          |  |  | INTERNATIONAL CLASSIFICATION |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
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| CLASS                      |                                   |  | SUBCLASS |  |  | CLAIMED                      |   |   |   |                      | NON-CLAIMED |  |  |  |  |  |  |  |  |  |
| 244                        |                                   |  | 118.6    |  |  | B                            | 6 | 4 | D | 11 / 06 (2006.01.01) |             |  |  |  |  |  |  |  |  |  |
| CROSS REFERENCE(S)         |                                   |  |          |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
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|--------------------------------|----------|------------------------------|-------------------|
| NONE                           |          | <b>Total Claims Allowed:</b> |                   |
|                                |          | 6                            |                   |
| (Assistant Examiner)           | (Date)   |                              |                   |
| /BENJAMIN P LEE/               | 4/4/2016 | O.G. Print Claim(s)          | O.G. Print Figure |
| Primary Examiner.Art Unit 3641 |          | 1                            | 2                 |
| (Primary Examiner)             | (Date)   |                              |                   |

|                                                                                                                  |                                            |                                                               |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14709409 | <b>Applicant(s)/Patent Under Reexamination</b><br>COOK ET AL. |
|                                                                                                                  | <b>Examiner</b><br>BENJAMIN P LEE          | <b>Art Unit</b><br>3641                                       |

| <input type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b> <input type="checkbox"/> <b>CPA</b> <input type="checkbox"/> <b>T.D.</b> <input type="checkbox"/> <b>R.1.47</b> |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|
| Final                                                                                                                                                                                                         | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
| 1                                                                                                                                                                                                             | 1        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 2                                                                                                                                                                                                             | 2        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 3                                                                                                                                                                                                             | 3        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 4                                                                                                                                                                                                             | 4        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 5                                                                                                                                                                                                             | 5        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 6                                                                                                                                                                                                             | 6        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                               |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |

|                                                    |          |                              |                   |
|----------------------------------------------------|----------|------------------------------|-------------------|
| NONE                                               |          | <b>Total Claims Allowed:</b> |                   |
|                                                    |          | 6                            |                   |
| (Assistant Examiner)                               | (Date)   |                              |                   |
| /BENJAMIN P LEE/<br>Primary Examiner.Art Unit 3641 | 4/4/2016 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                 | (Date)   | 1                            | 2                 |

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|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>14709409 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>COOK ET AL. |
|                                                                                                              | <b>Examiner</b><br><br>BENJAMIN P LEE          | <b>Art Unit</b><br><br>3641                                       |

| CPC- SEARCHED                                                                                                                                                                                  |          |          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|
| Symbol                                                                                                                                                                                         | Date     | Examiner |
| b64d11/00.cpc. or b64d2011/0046.cpc. or b64d11/0023.cpc. or b64d11/06.cpc. or b64d2011/0617.cpc. or b64d2011/0665.cpc. or b63b11/00.cpc. or b63b11/02.cpc. or b63b29/00.cpc. or b63b29/02.cpc. | 6/5/2015 | LEE      |

| CPC COMBINATION SETS - SEARCHED |      |          |
|---------------------------------|------|----------|
| Symbol                          | Date | Examiner |
|                                 |      |          |

| US CLASSIFICATION SEARCHED |                           |          |          |
|----------------------------|---------------------------|----------|----------|
| Class                      | Subclass                  | Date     | Examiner |
| 244                        | 1r,118.5,118.6,129.1,117r | 6/5/2015 | LEE      |
| 114                        | 116                       | 6/5/2015 | LEE      |

| SEARCH NOTES    |          |          |
|-----------------|----------|----------|
| Search Notes    | Date     | Examiner |
| Text search     | 6/5/2015 | LEE      |
| Inventor search | 6/5/2015 | LEE      |

| INTERFERENCE SEARCH     |                           |          |          |
|-------------------------|---------------------------|----------|----------|
| US Class/<br>CPC Symbol | US Subclass / CPC Group   | Date     | Examiner |
| 244                     | 1r,118.5,118.6,129.1,117r | 4/4/2016 | LEE      |
| 114                     | 116                       | 4/4/2016 | LEE      |

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**EAST Search History****EAST Search History (Interference)**

| Ref # | Hits | Search Query                                         | DBs   | Default Operator | Plurals | Time Stamp       |
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| L1    | 3224 | ((244/1r,118.5,118.6,129.1,117r) or (114/116)).CCLS. | USPAT | OR               | OFF     | 2016/04/04 10:29 |

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# **PART B - FEE(S) TRANSMITTAL**

Complete and send this form, together with applicable fee(s), to: **Mail Stop ISSUE FEE**  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

**CUSTOMER NUMBER**  
**22850**

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/709,409      | 05/11/2015  | Donald F. Cook       | 466860US110CONT     | 1803             |

TITLE OF INVENTION: AIRCRAFT INTERIOR LAVATORY

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 07/26/2016 |

| EXAMINER        | ART UNIT | CLASS-SUBCLASS |
|-----------------|----------|----------------|
| LEE, BENJAMIN P | 3641     | 244-118600     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

- 1 Oblon, McClelland,
- 2 Maier & Neustadt, L.L.P
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

**B/E AEROSPACE, INC.**

**Wellington, FLORIDA**

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
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- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 15-0030 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Greg H. Gardella/

Date April 27, 2016

Typed or printed name Greg H. Gardella

Registration No. 46,045

| Electronic Patent Application Fee Transmittal      |                 |                                       |               |                             |
|----------------------------------------------------|-----------------|---------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                         |                 | 14709409                              |               |                             |
| <b>Filing Date:</b>                                |                 | 11-May-2015                           |               |                             |
| <b>Title of Invention:</b>                         |                 | AIRCRAFT INTERIOR LAVATORY            |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        |                 | Donald F. Cook                        |               |                             |
| <b>Filer:</b>                                      |                 | Bradley Davis Lytle/Mimi Chanthaphone |               |                             |
| <b>Attorney Docket Number:</b>                     |                 | 466860US110CONT                       |               |                             |
| Filed as Large Entity                              |                 |                                       |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                 |                                       |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b> | <b>Quantity</b>                       | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                 |                                       |               |                             |
| <b>Pages:</b>                                      |                 |                                       |               |                             |
| <b>Claims:</b>                                     |                 |                                       |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                 |                                       |               |                             |
| <b>Petition:</b>                                   |                 |                                       |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                 |                                       |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                 |                                       |               |                             |
| Utility Appl Issue Fee                             | 1501            | 1                                     | 960           | 960                         |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 960                  |

| Electronic Acknowledgement Receipt          |                                       |
|---------------------------------------------|---------------------------------------|
| <b>EFS ID:</b>                              | 25613374                              |
| <b>Application Number:</b>                  | 14709409                              |
| <b>International Application Number:</b>    |                                       |
| <b>Confirmation Number:</b>                 | 1803                                  |
| <b>Title of Invention:</b>                  | AIRCRAFT INTERIOR LAVATORY            |
| <b>First Named Inventor/Applicant Name:</b> | Donald F. Cook                        |
| <b>Customer Number:</b>                     | 22850                                 |
| <b>Filer:</b>                               | Bradley Davis Lytle/Mimi Chanthaphone |
| <b>Filer Authorized By:</b>                 | Bradley Davis Lytle                   |
| <b>Attorney Docket Number:</b>              | 466860US110CONT                       |
| <b>Receipt Date:</b>                        | 27-APR-2016                           |
| <b>Filing Date:</b>                         | 11-MAY-2015                           |
| <b>Time Stamp:</b>                          | 15:40:02                              |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)           |

**Payment information:**

|                                                                                                                |             |
|----------------------------------------------------------------------------------------------------------------|-------------|
| Submitted with Payment                                                                                         | yes         |
| Payment Type                                                                                                   | Credit Card |
| Payment was successfully received in RAM                                                                       | \$960       |
| RAM confirmation Number                                                                                        | 2118        |
| Deposit Account                                                                                                |             |
| Authorized User                                                                                                |             |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: |             |

| <b>File Listing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |              |                                          |                  |                  |
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| Document Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Document Description        | File Name    | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Issue Fee Payment (PTO-85B) | 466860us.pdf | 1129105                                  | no               | 1                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |              | 29dbab4b753c6b79cdef574b07144614fd50a042 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |              |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |              |                                          |                  |                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Fee Worksheet (SB06)        | fee-info.pdf | 30501                                    | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |              | e14d83ce279351513f550af83b65ba2180bf6500 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |              |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |              |                                          |                  |                  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |              | 1159606                                  |                  |                  |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                             |              |                                          |                  |                  |



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Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/709,409      | 05/11/2015  | Donald F. Cook       | 466860US110CONT     | 1803             |

|                                             |      |            |
|---------------------------------------------|------|------------|
| 22850                                       | 7590 | 05/12/2016 |
| OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P. |      |            |
| 1940 DUKE STREET                            |      |            |
| ALEXANDRIA, VA 22314                        |      |            |

|                 |  |
|-----------------|--|
| EXAMINER        |  |
| LEE, BENJAMIN P |  |

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
| 3641     |              |

|                   |               |
|-------------------|---------------|
| NOTIFICATION DATE | DELIVERY MODE |
| 05/12/2016        | ELECTRONIC    |

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The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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oblonpat@oblon.com  
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Alexandria, Virginia 22313-1450

| APPLICATION NO./<br>CONTROL NO. | FILING DATE  | FIRST NAMED INVENTOR /<br>PATENT IN REEXAMINATION | ATTORNEY DOCKET NO. |
|---------------------------------|--------------|---------------------------------------------------|---------------------|
| 14/709,409                      | 11 May, 2015 | COOK ET AL.                                       | 466860US110CONT     |

|                                                                                         |  |                 |          |
|-----------------------------------------------------------------------------------------|--|-----------------|----------|
| OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P.<br>1940 DUKE STREET<br>ALEXANDRIA, VA 22314 |  | EXAMINER        |          |
|                                                                                         |  | BENJAMIN P. LEE |          |
|                                                                                         |  | ART UNIT        | PAPER    |
|                                                                                         |  | 3641            | 20160505 |

DATE MAILED:

**Please find below and/or attached an Office communication concerning this application or proceeding.**

Commissioner for Patents

IDS dated 4/13/2016 and Third Party Submission dated 2/26/2016

/BENJAMIN P LEE/  
Primary Examiner, Art Unit 3641

PTO-90C (Rev.04-03)

Receipt date: 04/13/2016

14709409 - GAU: 3641

SHEET 1 OF 1

|                                                                                                                                                                                                                                              |                  |                                                            |            |                                     |                       |                                                                  |                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------|------------|-------------------------------------|-----------------------|------------------------------------------------------------------|-------------------------------|
| Form PTO 1449<br>(Modified)                                                                                                                                                                                                                  |                  | U.S. DEPARTMENT OF COMMERCE<br>PATENT AND TRADEMARK OFFICE |            | ATTY DOCKET NO.<br>466860US110CONT  |                       | SERIAL NO.<br>14/709,409                                         |                               |
| LIST OF REFERENCES CITED BY APPLICANT                                                                                                                                                                                                        |                  |                                                            |            | APPLICANT<br>Donald F. COOK, et al. |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              |                  |                                                            |            | FILING DATE<br>May 11, 2015         |                       | GROUP<br>3641                                                    |                               |
| <b>U.S. PATENT DOCUMENTS</b>                                                                                                                                                                                                                 |                  |                                                            |            |                                     |                       |                                                                  |                               |
| EXAMINER<br>INITIAL                                                                                                                                                                                                                          |                  | DOCUMENT<br>NUMBER                                         | DATE       | NAME                                | CLASS                 | SUB<br>CLASS                                                     | FILING DATE<br>IF APPROPRIATE |
|                                                                                                                                                                                                                                              | AA               | 5,611,503                                                  | 03/18/1997 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AB               | 6,000,659                                                  | 12/14/1999 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AC               | 6,822,812                                                  | 11/23/2004 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AD               | 6,874,731                                                  | 04/05/2005 | Brauer, et al.                      |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AE               | 7,156,345                                                  | 01/02/2007 | Brauer, et al.                      |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AF               | 7,252,267                                                  | 08/07/2007 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AG               | 7,331,545                                                  | 02/19/2008 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AH               | 7,469,860                                                  | 12/30/2008 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AI               | 7,448,574                                                  | 11/11/2008 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AJ               | 7,516,919                                                  | 04/14/2009 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AK               | 7,871,039                                                  | 01/18/2011 | Fullerton, et al.                   |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AL               | 8,087,613                                                  | 01/03/2012 | Fullerton, et al.                   |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AM               | D508,173                                                   | 08/09/2005 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AN               | D516,496                                                   | 03/07/2006 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AO               | D533,129                                                   | 12/05/2006 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AP               | D606,923                                                   | 12/29/2009 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AQ               | D617,254                                                   | 06/08/2010 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AR               | 2012/0253752                                               | 10/04/2012 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AS               | 2015/0363656                                               | 12/17/2015 | Brauer                              |                       |                                                                  |                               |
| <b>FOREIGN PATENT DOCUMENTS</b>                                                                                                                                                                                                              |                  |                                                            |            |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              |                  | DOCUMENT<br>NUMBER                                         | DATE       | COUNTRY                             | TRANSLATION<br>YES NO |                                                                  |                               |
|                                                                                                                                                                                                                                              | AT               | 694 22 723                                                 | 06/21/2000 | DE (corresponds to U.S. 5,611,503)  |                       |                                                                  | X                             |
|                                                                                                                                                                                                                                              | AU               | 697 25 542                                                 | 04/29/2004 | DE (corresponds to U.S. 6,000,659)  |                       |                                                                  | X                             |
|                                                                                                                                                                                                                                              | AV               | 0 722 404                                                  | 07/24/1996 | EP                                  |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AW               | 0 850 834                                                  | 07/01/1998 | EP                                  |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AX               | 1 685 023                                                  | 08/02/2006 | EP                                  |                       |                                                                  |                               |
| <b>OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)</b>                                                                                                                                                               |                  |                                                            |            |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AY               |                                                            |            |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AZ               |                                                            |            |                                     |                       | <input type="checkbox"/> Additional References sheet(s) attached |                               |
| Examiner                                                                                                                                                                                                                                     | /BENJAMIN P LEE/ |                                                            |            |                                     | Date considered       | 05/05/2016                                                       |                               |
| *Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. |                  |                                                            |            |                                     |                       |                                                                  |                               |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.P.L./

Receipt date: 02/26/2016

14709409 - GAU: 3641

Doc Code: IDS.3P

Document Description: Information Disclosure Statement Filed

PTO/SB/429 (03-13)

Approved for use through 07/31/2015. OMB 0651-0062

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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**THIRD-PARTY SUBMISSION  
UNDER 37 CFR 1.290**

Application Number (required): 14/709,409

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**U.S. PATENTS AND U.S. PATENT APPLICATION PUBLICATIONS**

| Cite No. | Document Number               | Issue Date or Publication Date | First Named Inventor |
|----------|-------------------------------|--------------------------------|----------------------|
|          | Number-Kind Code <sup>1</sup> | MM/DD/YYYY                     |                      |
|          | US-                           |                                |                      |
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**FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS**

| Cite No. | Country or Patent Office and Document Number                           | Publication Date | Applicant, Patentee or First Named Inventor | Translation Attached     |
|----------|------------------------------------------------------------------------|------------------|---------------------------------------------|--------------------------|
|          | Country Code <sup>2</sup> -Number <sup>3</sup> -Kind Code <sup>4</sup> | MM/DD/YYYY       |                                             |                          |
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1. If known, enter kind of document by the appropriate symbols indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document by two-letter country code under WIPO Standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter kind of document by the appropriate symbols indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a).

This collection of information is required by 35 U.S.C. 122(e) and 37 CFR 1.290. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 10 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.P.L/

Doc Code: IDS.3P

Document Description: Information Disclosure Statement Filed

PTO/SB/429 (03-13)

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**THIRD-PARTY SUBMISSION  
UNDER 37 CFR 1.290**

(Page 2 of 2)

Application Number (required): 14/709,409

**NON-PATENT PUBLICATIONS (e.g., journal article, Office action)**

| Cite No. | Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), and place of publication (where available) | Translation Attached     | Evidence of Publication Attached |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------|
| 1        | Final Written Decision, Case IPR2014-00727, Paper No. 65 (PTAB Oct. 26, 2015)                                                                                 | <input type="checkbox"/> | <input type="checkbox"/>         |
| 2        | StartupBoeing, DC-10 presentation, copyright 2007                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/>         |
| 3        | Letter from Flight Structures, Inc. to Air France, Aug. 3, 1994, re "B747-400M Door 4 Crew Rest", and enclosures                                              | <input type="checkbox"/> | <input type="checkbox"/>         |
| 4        | Flight Structures, Inc., 747 Door 4 Overhead Crew Rest rendering                                                                                              | <input type="checkbox"/> | <input type="checkbox"/>         |
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**STATEMENTS**

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

- ☒ The following fee set forth in 37 CFR 1.290(f) is submitted herewith: ☒ regular undiscounted ☐ small entity\*
- ☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

|                      |                      |                         |           |
|----------------------|----------------------|-------------------------|-----------|
| Signature            | /s/ John C. Alemanni | Date                    | 2/26/2016 |
| Name (Printed/Typed) | John C. Alemanni     | Reg. No., if applicable | 47,384    |

|                      |                  |                 |            |
|----------------------|------------------|-----------------|------------|
| Examiner Signature** | /BENJAMIN P LEE/ | Date Considered | 04/04/2016 |
|----------------------|------------------|-----------------|------------|

\*SUBMITTER: By selecting the "small entity" box and paying the applicable small entity fee, the party making the submission asserts that the party qualifies as a small entity. A third party is not eligible for the micro entity discount.

\*\*EXAMINER: Signature indicates all items listed have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.P.L/

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Receipt date: 02/26/2016

14709409 -- GAU: 3641

Doc Code:IDS.3P

PTO/SB/429(08-12)

Document Description: Third-Party Submission Under 37 CFR 1.290

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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| <b>THIRD-PARTY<br/>SUBMISSION<br/>UNDER 37 CFR 1.290</b> | Application Number | 14709409 |
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| U.S. PATENTS                                                   |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------|-------------------------------|---------------------------------------------|--------------------------|
| Cite No                                                        | Patent Number                                                                                                                                              | Kind Code <sup>1</sup>    | Issue Date (YYYY-MM-DD)       | First Named Inventor          |                                             |                          |
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| U.S. PATENT APPLICATION PUBLICATIONS                           |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Publication Number                                                                                                                                         | Kind Code <sup>1</sup>    | Publication Date (YYYY-MM-DD) | First Named Inventor          |                                             |                          |
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| FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS      |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Foreign Document Number <sup>3</sup>                                                                                                                       | Country Code <sup>2</sup> | Kind Code <sup>1</sup>        | Publication Date (YYYY-MM-DD) | Applicant, Patentee or First Named Inventor | T <sup>5</sup>           |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             | <input type="checkbox"/> |
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| NON-PATENT PUBLICATIONS (e.g., journal article, Office action) |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), place of publication (where available). |                           |                               |                               | T <sup>5</sup>                              | E <sup>6</sup>           |

Receipt date: 02/26/2016

14709409 - GAU: 3641

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| THIRD-PARTY<br>SUBMISSION<br>UNDER 37 CFR 1.290 | Application Number | 14709409 |
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|---|----------------------------------|--------------------------|-------------------------------------|
| 1 | FSI Crew Rest Rendering          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2 | Air France Letter                | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3 | 2007 Startup Boeing Presentation | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Receipt date: 02/26/2016

14709409 - GAU. 3641

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| THIRD-PARTY<br>SUBMISSION<br>UNDER 37 CFR 1.290 | Application Number | 14709409 |
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|---|---------------------------------------------------------|--------------------------|-------------------------------------|
| 4 | Final Written Decision IPR 2014-00727, October 26, 2015 | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
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## STATEMENTS

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

☒ The fee set forth in 37 CFR 1.290(f) has been submitted herewith.

☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and the only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

☐ This resubmission is being made responsive to a notification of non-compliance issued for an earlier filed third-party submission. The corrections in this resubmission are limited to addressing the non-compliance. As such, the party making this resubmission: (1) requests that the Office apply the previously-paid fee set forth in 37 CFR 1.290(f), or (2) states that no fee is required to accompany this resubmission as the undersigned is again making the fee exemption statement set forth in 37 CFR 1.290(g).

|            |                    |                                        |       |
|------------|--------------------|----------------------------------------|-------|
| Signature  | /John C. Alemanni/ |                                        |       |
| Name/Print | John C. Alemanni   | Registration Number<br>(if applicable) | 47384 |

|                    |                  |                 |            |
|--------------------|------------------|-----------------|------------|
| Examiner Signature | /BENJAMIN P LEE/ | Date Considered | 04/04/2016 |
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\*EXAMINER: Signature indicates all documents listed above have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant. 1. If known, enter kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document, by two-letter code under WIPO standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter the kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 5. Check mark indicates translation attached. 6. Check mark indicates evidence of publication attached.

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14709409 - GAU: 3641

Doc Code: IDS.3P

Document Description: Information Disclosure Statement Filed

PTO/SB/429 (03-13)

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| <b>THIRD-PARTY SUBMISSION<br/>UNDER 37 CFR 1.290</b><br><br>(Do <u>not</u> submit this form electronically via EFS-Web) | Application Number (required): <b>14/709,409</b> |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|

| U.S. PATENTS AND U.S. PATENT APPLICATION PUBLICATIONS |                               |                                |                      |  |
|-------------------------------------------------------|-------------------------------|--------------------------------|----------------------|--|
| Cite No.                                              | Document Number               | Issue Date or Publication Date | First Named Inventor |  |
|                                                       | Number-Kind Code <sup>1</sup> | MM/DD/YYYY                     |                      |  |
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| FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS |                                                                        |                  |                                             |                          |
|-----------------------------------------------------------|------------------------------------------------------------------------|------------------|---------------------------------------------|--------------------------|
| Cite No.                                                  | Country or Patent Office and Document Number                           | Publication Date | Applicant, Patentee or First Named Inventor | Translation Attached     |
|                                                           | Country Code <sup>2</sup> -Number <sup>3</sup> -Kind Code <sup>4</sup> | MM/DD/YYYY       |                                             |                          |
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1. If known, enter kind of document by the appropriate symbols indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document by two-letter country code under WIPO Standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter kind of document by the appropriate symbols indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a).

This collection of information is required by 35 U.S.C. 122(e) and 37 CFR 1.290. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 10 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Doc Code: IDS.3P

Document Description: Information Disclosure Statement Filed

PTO/SB/429 (03-13)

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**THIRD-PARTY SUBMISSION  
UNDER 37 CFR 1.290**

(Page 2 of 2)

Application Number (required): 14/709,409

**NON-PATENT PUBLICATIONS (e.g., journal article, Office action)**

| Cite No. | Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), and place of publication (where available) | Translation Attached     | Evidence of Publication Attached |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------|
| 1        | Final Written Decision, Case IPR2014-00727, Paper No. 65 (PTAB Oct. 26, 2015)                                                                                 | <input type="checkbox"/> | <input type="checkbox"/>         |
| 2        | StartupBoeing, DC-10 presentation, copyright 2007                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/>         |
| 3        | Letter from Flight Structures, Inc. to Air France, Aug. 3, 1994, re "B747-400M Door 4 Crew Rest", and enclosures                                              | <input type="checkbox"/> | <input type="checkbox"/>         |
| 4        | Flight Structures, Inc., 747 Door 4 Overhead Crew Rest rendering                                                                                              | <input type="checkbox"/> | <input type="checkbox"/>         |
|          |                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/>         |
|          |                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/>         |
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|          |                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/>         |
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**STATEMENTS**

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

- ☒ The following fee set forth in 37 CFR 1.290(f) is submitted herewith: ☒ regular undiscounted ☐ small entity\*
- ☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

|                      |                      |                         |           |
|----------------------|----------------------|-------------------------|-----------|
| Signature            | /s/ John C. Alemanni | Date                    | 2/26/2016 |
| Name (Printed/Typed) | John C. Alemanni     | Reg. No., if applicable | 47,384    |

|                      |                  |                 |            |
|----------------------|------------------|-----------------|------------|
| Examiner Signature** | /BENJAMIN P LEE/ | Date Considered | 04/04/2016 |
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14709409 – GAU: 3641

Doc code: IDS

PTO/SB/08a (01-10)

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| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br>( Not for submission under 37 CFR 1.99) | Application Number     |                 | 14709409   |  |
|                                                                                                     | Filing Date            |                 | 2015-05-11 |  |
|                                                                                                     | First Named Inventor   | Donald F. Cook  |            |  |
|                                                                                                     | Art Unit               | 3641            |            |  |
|                                                                                                     | Examiner Name          | LEE, BENJAMIN P |            |  |
|                                                                                                     | Attorney Docket Number | BEALCI-94515    |            |  |

| U.S.PATENTS       |         |               |                        |            |                                                 | Remove                                                                 |
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| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|                   | 1       | D 705909      | S                      | 2014-05-27 | Koyama et al.                                   |                                                                        |
|                   | 2       | 2650368       | A                      | 1953-09-01 | EVANS RANDOLPH                                  |                                                                        |
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|                   | 4       | 2914001       | A                      | 1959-11-24 | MURPHY GOODRICH K.                              |                                                                        |
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|                   | 8       | 5150863       | A                      | 1992-09-29 | HOZUMI; HIROYUKI et al.                         |                                                                        |

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| Examiner Name          | LEE, BENJAMIN P |
| Attorney Docket Number | BEALCI-94515    |

|    |         |    |            |                                                 |  |
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| 9  | 5333416 | A  | 1994-08-02 | HARRIS; EDWARD D. - ;<br>SCHIMMELPFENNIG et al. |  |
| 10 | 5340059 | A  | 1994-08-23 | Kanigowski                                      |  |
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| Attorney Docket Number | BEALCI-94515    |

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|----|---------|----|------------|-------------------|--|
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|                   | 1       | 20060192050        | A1                     | 2006-08-31       | Cheung et al.                                   |                                                                          |

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| Attorney Docket Number | BEALCI-94515    |

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| 3  | 20070170310 | A1 | 2007-07-26 | Bock et al.         |  |
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14709409 -- GAU: 3641

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|  |    |             |    |            |                      |  |
|--|----|-------------|----|------------|----------------------|--|
|  | 13 | 20110121134 | A1 | 2011-05-26 | Schotte et al.       |  |
|  | 14 | 20110139930 | A1 | 2011-06-16 | S&uuml;tthoff et al. |  |
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| Attorney Docket Number | BEALCI-94515    |

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|-------------------|---------|--------------------------------------|-----------------------------|------------------------|------------------|-------------------------------------------------|--------------------------------------------------------------------------|--------------------------|
|                   | 1       | 1281614                              | EP                          | A1                     | 2005-03-30       | Farnsworth                                      |                                                                          | <input type="checkbox"/> |
|                   | 2       | WO2003026495                         | WO                          | A2                     | 2003-04-03       | Marvin Keogh                                    |                                                                          | <input type="checkbox"/> |
|                   | 3       | 2005014395                           | WO                          | A1                     | 2005-02-17       | THOMPSON                                        |                                                                          | <input type="checkbox"/> |
|                   | 4       | 2005080196                           | WO                          | A1                     | 2005-09-01       | BOCK                                            |                                                                          | <input type="checkbox"/> |
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|--------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|                    | 1       | International Search Report, September 15, 2011, 8 pages                                                                                                                                                                                                        | <input type="checkbox"/> |
|                    | 2       | MCDONNELL DOUGLAS, DC-10 Customer Configuration, October 1978, 177 pages                                                                                                                                                                                        | <input type="checkbox"/> |
|                    | 3       | C&D Zodiac, Inc.'s proposal to Scandinavian Airlines System to manufacture S4 Storage Unit, August 23, 2001, 17 pages                                                                                                                                           | <input type="checkbox"/> |

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|    |                                                                                                                                        |                          |
|----|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 4  | C&D Zodiac, Inc.'s drawings with a leading page entitled "MD90," 27 pages                                                              | <input type="checkbox"/> |
| 5  | Photographs of C&D Zodiac, Inc.'s S4 storage unit, 5 pages                                                                             | <input type="checkbox"/> |
| 6  | C&D Zodiac, Inc.'s Petition for Inter Partes Review of U.S. Patent No. 8,590,838 (including Exhibits tabs 1-9), May 2, 2014, 856 pages | <input type="checkbox"/> |
| 7  | Technical Proposal by FSI to Air France regarding a Door 4 overhead crew rest station for the Boeing 747, August 3, 1994, 10 pages     | <input type="checkbox"/> |
| 8  | Rendering and photographs of Boeing 747 overhead crew rest station, 3 pages                                                            | <input type="checkbox"/> |
| 9  | B/E Aerospace, Inc.'s Motion for Preliminary Injunction, May 16, 2014, 25 pages                                                        | <input type="checkbox"/> |
| 10 | Greg Chamitoff Declaration in support of B/E Aerospace, Inc.'s Motion for Preliminary Injunction, May 14, 2014, 39 pages               | <input type="checkbox"/> |
| 11 | International Search Report, January 27, 2015, 5 pages, from PCT/US2013/050342 published as WO 2014/014780 on January 23, 2014         | <input type="checkbox"/> |

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<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

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|                        |                 |
|------------------------|-----------------|
| Application Number     | 14709409        |
| Filing Date            | 2015-05-11      |
| First Named Inventor   | Donald F. Cook  |
| Art Unit               | 3641            |
| Examiner Name          | LEE, BENJAMIN P |
| Attorney Docket Number | BEALCI-94515    |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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**SIGNATURE**

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|            |                 |                     |            |
|------------|-----------------|---------------------|------------|
| Signature  | /JAMES W. PAUL/ | Date (YYYY-MM-DD)   | 2015-06-10 |
| Name/Print | James W. Paul   | Registration Number | 29,967     |

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Receipt date: 02/26/2016

14709409 -- GAU: 3641

Doc Code:IDS.3P

PTO/SB/429(08-12)

Document Description: Third-Party Submission Under 37 CFR 1.290

Approved for use through 07/31/2015. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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|                                                          |                    |          |
|----------------------------------------------------------|--------------------|----------|
| <b>THIRD-PARTY<br/>SUBMISSION<br/>UNDER 37 CFR 1.290</b> | Application Number | 14709409 |
|                                                          |                    |          |

| U.S. PATENTS                                                   |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------|-------------------------------|---------------------------------------------|--------------------------|
| Cite No                                                        | Patent Number                                                                                                                                              | Kind Code <sup>1</sup>    | Issue Date (YYYY-MM-DD)       | First Named Inventor          |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| U.S. PATENT APPLICATION PUBLICATIONS                           |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Publication Number                                                                                                                                         | Kind Code <sup>1</sup>    | Publication Date (YYYY-MM-DD) | First Named Inventor          |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| FOREIGN PATENTS AND PUBLISHED FOREIGN PATENT APPLICATIONS      |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Foreign Document Number <sup>3</sup>                                                                                                                       | Country Code <sup>2</sup> | Kind Code <sup>1</sup>        | Publication Date (YYYY-MM-DD) | Applicant, Patentee or First Named Inventor | T <sup>5</sup>           |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             | <input type="checkbox"/> |
|                                                                |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| NON-PATENT PUBLICATIONS (e.g., journal article, Office action) |                                                                                                                                                            |                           |                               |                               |                                             |                          |
| Cite No                                                        | Author (if any), title of the publication, page(s) being submitted, publication date, publisher (where available), place of publication (where available). |                           |                               |                               | T <sup>5</sup>                              | E <sup>6</sup>           |

Receipt date: 02/26/2016

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|-------------------------------------------------|--------------------|----------|
| THIRD-PARTY<br>SUBMISSION<br>UNDER 37 CFR 1.290 | Application Number | 14709409 |
|                                                 |                    |          |

|   |                                  |                          |                                     |
|---|----------------------------------|--------------------------|-------------------------------------|
| 1 | FSI Crew Rest Rendering          | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2 | Air France Letter                | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3 | 2007 Startup Boeing Presentation | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Receipt date: 02/26/2016

14709409 - GAU. 3641

|                                                 |                    |          |
|-------------------------------------------------|--------------------|----------|
| THIRD-PARTY<br>SUBMISSION<br>UNDER 37 CFR 1.290 | Application Number | 14709409 |
|                                                 |                    |          |

|   |                                                         |                          |                                     |
|---|---------------------------------------------------------|--------------------------|-------------------------------------|
| 4 | Final Written Decision IPR 2014-00727, October 26, 2015 | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
|---|---------------------------------------------------------|--------------------------|-------------------------------------|

## STATEMENTS

The party making the submission is not an individual who has a duty to disclose information with respect to the above-identified application under 37 CFR 1.56.

This submission complies with the requirements of 35 U.S.C. 122(e) and 37 CFR 1.290.

☒ The fee set forth in 37 CFR 1.290(f) has been submitted herewith.

☐ The fee set forth in 37 CFR 1.290(f) is not required because this submission lists three or fewer total items and, to the knowledge of the person signing the statement after making reasonable inquiry, this submission is the first and the only submission under 35 U.S.C. 122(e) filed in the above-identified application by the party making the submission or by a party in privity with the party.

☐ This resubmission is being made responsive to a notification of non-compliance issued for an earlier filed third-party submission. The corrections in this resubmission are limited to addressing the non-compliance. As such, the party making this resubmission: (1) requests that the Office apply the previously-paid fee set forth in 37 CFR 1.290(f), or (2) states that no fee is required to accompany this resubmission as the undersigned is again making the fee exemption statement set forth in 37 CFR 1.290(g).

|            |                    |                                        |       |
|------------|--------------------|----------------------------------------|-------|
| Signature  | /John C. Alemanni/ |                                        |       |
| Name/Print | John C. Alemanni   | Registration Number<br>(if applicable) | 47384 |

|                    |                  |                 |            |
|--------------------|------------------|-----------------|------------|
| Examiner Signature | /BENJAMIN P LEE/ | Date Considered | 04/04/2016 |
|--------------------|------------------|-----------------|------------|

\*EXAMINER: Signature indicates all documents listed above have been considered, except for citations through which a line is drawn. Draw line through citation if not considered. Include a copy of this form with next communication to applicant. 1. If known, enter kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 2. Enter the country or patent office that issued the document, by two-letter code under WIPO standard ST.3. See MPEP 1851. 3. For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 4. If known, enter the kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16. See MPEP 901.04(a). 5. Check mark indicates translation attached. 6. Check mark indicates evidence of publication attached.

EFS Web 2.1.17

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/709,409      | 05/11/2015  | Donald F. Cook       | 466860US110CONT     | 1803             |

|                                             |      |            |
|---------------------------------------------|------|------------|
| 22850                                       | 7590 | 08/04/2016 |
| OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P. |      |            |
| 1940 DUKE STREET                            |      |            |
| ALEXANDRIA, VA 22314                        |      |            |

|                 |  |
|-----------------|--|
| EXAMINER        |  |
| LEE, BENJAMIN P |  |

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
| 3641     |              |

|                   |               |
|-------------------|---------------|
| NOTIFICATION DATE | DELIVERY MODE |
| 08/04/2016        | ELECTRONIC    |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com  
oblonpat@oblon.com  
ahudgens@oblon.com



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| APPLICATION NO./<br>CONTROL NO. | FILING DATE  | FIRST NAMED INVENTOR /<br>PATENT IN REEXAMINATION | ATTORNEY DOCKET NO. |
|---------------------------------|--------------|---------------------------------------------------|---------------------|
| 14/709,409                      | 11 May, 2015 | COOK ET AL.                                       | 466860US110CONT     |

|                                                                                         |  |                 |          |
|-----------------------------------------------------------------------------------------|--|-----------------|----------|
| OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P.<br>1940 DUKE STREET<br>ALEXANDRIA, VA 22314 |  | EXAMINER        |          |
|                                                                                         |  | BENJAMIN P. LEE |          |
|                                                                                         |  | ART UNIT        | PAPER    |
|                                                                                         |  | 3641            | 20160607 |

DATE MAILED:

**Please find below and/or attached an Office communication concerning this application or proceeding.**

Commissioner for Patents

All IDS submissions for this case have been considered. The document dates are: 6/10/2015, 2/26/2016(2), 3/30/2016, 4/13/2016

There are 5 IDS submissions including 2 Third Party submissions.

/BENJAMIN P LEE/  
Primary Examiner, Art Unit 3641

PTO-90C (Rev.04-03)

Receipt date: 03/30/2016

14709409 - GAU: 3641

SHEET 1 OF 1

|                                                                                                                                                                                                                                                             |                         |                                                                                                  |      |                                            |                       |                                                                  |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------|------|--------------------------------------------|-----------------------|------------------------------------------------------------------|-------------------------------|
| Form PTO 1449<br>(Modified)                                                                                                                                                                                                                                 |                         | U.S. DEPARTMENT OF COMMERCE<br>PATENT AND TRADEMARK OFFICE                                       |      | ATTY DOCKET NO.<br><b>466860US110CONT</b>  |                       | SERIAL NO.<br><b>14/709,409</b>                                  |                               |
| LIST OF REFERENCES CITED BY APPLICANT                                                                                                                                                                                                                       |                         |                                                                                                  |      | APPLICANT<br><b>Donald F. COOK, et al.</b> |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             |                         |                                                                                                  |      | FILING DATE<br><b>May 11, 2015</b>         |                       | GROUP<br><b>3641</b>                                             |                               |
| <b>U.S. PATENT DOCUMENTS</b>                                                                                                                                                                                                                                |                         |                                                                                                  |      |                                            |                       |                                                                  |                               |
| EXAMINER<br>INITIAL                                                                                                                                                                                                                                         |                         | DOCUMENT<br>NUMBER                                                                               | DATE | NAME                                       | CLASS                 | SUB<br>CLASS                                                     | FILING DATE<br>IF APPROPRIATE |
|                                                                                                                                                                                                                                                             | AA                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AB                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AC                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AD                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AE                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AF                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AG                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AH                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AI                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AJ                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AK                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AL                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AM                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AN                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
| <b>FOREIGN PATENT DOCUMENTS</b>                                                                                                                                                                                                                             |                         |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             |                         | DOCUMENT<br>NUMBER                                                                               | DATE | COUNTRY                                    | TRANSLATION<br>YES NO |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AO                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AP                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AQ                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AR                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AS                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AT                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AU                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AV                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
| <b>OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)</b>                                                                                                                                                                              |                         |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AW                      | Slide Deck, B/E Aerospace, Spacewall Technology, Examiner Interview, February 24, 2016, 53 pages |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AX                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AY                      |                                                                                                  |      |                                            |                       |                                                                  |                               |
|                                                                                                                                                                                                                                                             | AZ                      |                                                                                                  |      |                                            |                       | <input type="checkbox"/> Additional References sheet(s) attached |                               |
| Examiner                                                                                                                                                                                                                                                    | <b>/BENJAMIN P LEE/</b> |                                                                                                  |      |                                            | Date considered       | <b>04/04/2016</b>                                                |                               |
| <small>*Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.</small> |                         |                                                                                                  |      |                                            |                       |                                                                  |                               |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.P.L./

Receipt date: 04/13/2016

14709409 - GAU: 3641

SHEET 1 OF 1

| Form PTO 1449<br>(Modified)                                                                                                                                                                                                                  |                  | U.S. DEPARTMENT OF COMMERCE<br>PATENT AND TRADEMARK OFFICE |            | ATTY DOCKET NO.<br>466860US110CONT  |                       | SERIAL NO.<br>14/709,409                                         |                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------|------------|-------------------------------------|-----------------------|------------------------------------------------------------------|-------------------------------|
| LIST OF REFERENCES CITED BY APPLICANT                                                                                                                                                                                                        |                  |                                                            |            | APPLICANT<br>Donald F. COOK, et al. |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              |                  |                                                            |            | FILING DATE<br>May 11, 2015         |                       | GROUP<br>3641                                                    |                               |
| <b>U.S. PATENT DOCUMENTS</b>                                                                                                                                                                                                                 |                  |                                                            |            |                                     |                       |                                                                  |                               |
| EXAMINER<br>INITIAL                                                                                                                                                                                                                          |                  | DOCUMENT<br>NUMBER                                         | DATE       | NAME                                | CLASS                 | SUB<br>CLASS                                                     | FILING DATE<br>IF APPROPRIATE |
|                                                                                                                                                                                                                                              | AA               | 5,611,503                                                  | 03/18/1997 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AB               | 6,000,659                                                  | 12/14/1999 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AC               | 6,822,812                                                  | 11/23/2004 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AD               | 6,874,731                                                  | 04/05/2005 | Brauer, et al.                      |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AE               | 7,156,345                                                  | 01/02/2007 | Brauer, et al.                      |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AF               | 7,252,267                                                  | 08/07/2007 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AG               | 7,331,545                                                  | 02/19/2008 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AH               | 7,469,860                                                  | 12/30/2008 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AI               | 7,448,574                                                  | 11/11/2008 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AJ               | 7,516,919                                                  | 04/14/2009 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AK               | 7,871,039                                                  | 01/18/2011 | Fullerton, et al.                   |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AL               | 8,087,613                                                  | 01/03/2012 | Fullerton, et al.                   |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AM               | D508,173                                                   | 08/09/2005 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AN               | D516,496                                                   | 03/07/2006 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AO               | D533,129                                                   | 12/05/2006 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AP               | D606,923                                                   | 12/29/2009 | Young, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AQ               | D617,254                                                   | 06/08/2010 | Guard, et al.                       |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AR               | 2012/0253752                                               | 10/04/2012 | Brauer                              |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AS               | 2015/0363656                                               | 12/17/2015 | Brauer                              |                       |                                                                  |                               |
| <b>FOREIGN PATENT DOCUMENTS</b>                                                                                                                                                                                                              |                  |                                                            |            |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              |                  | DOCUMENT<br>NUMBER                                         | DATE       | COUNTRY                             | TRANSLATION<br>YES NO |                                                                  |                               |
|                                                                                                                                                                                                                                              | AT               | 694 22 723                                                 | 06/21/2000 | DE (corresponds to U.S. 5,611,503)  |                       |                                                                  | X                             |
|                                                                                                                                                                                                                                              | AU               | 697 25 542                                                 | 04/29/2004 | DE (corresponds to U.S. 6,000,659)  |                       |                                                                  | X                             |
|                                                                                                                                                                                                                                              | AV               | 0 722 404                                                  | 07/24/1996 | EP                                  |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AW               | 0 850 834                                                  | 07/01/1998 | EP                                  |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AX               | 1 685 023                                                  | 08/02/2006 | EP                                  |                       |                                                                  |                               |
| <b>OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, etc.)</b>                                                                                                                                                               |                  |                                                            |            |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AY               |                                                            |            |                                     |                       |                                                                  |                               |
|                                                                                                                                                                                                                                              | AZ               |                                                            |            |                                     |                       | <input type="checkbox"/> Additional References sheet(s) attached |                               |
| Examiner                                                                                                                                                                                                                                     | /BENJAMIN P LEE/ |                                                            |            |                                     | Date considered       | 5/5/2016 05/05/2016                                              |                               |
| *Examiner: Initial if reference is considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. |                  |                                                            |            |                                     |                       |                                                                  |                               |

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| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 14/709,409      | 09/06/2016 | 9434476    | 466860US110CONT     | 1803             |

22850 7590 08/17/2016  
OBLON, MCCLELLAND, MAIER & NEUSTADT, L.L.P.  
1940 DUKE STREET  
ALEXANDRIA, VA 22314

## ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Donald F. Cook, Arlington, WA;  
B/E Aerospace, Inc., Wellington, FL;  
Liberty Harrington, Seattle, WA;  
Philipp Steiner, Seattle, WA;  
Robert K. Brauer, Seattle, WA;  
Trevor Skelly, Mercer Island, WA;

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