

AERODYNAMIC APPARATUS FOR SERIES 1 FREIGHT CONTAINERS

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Technical Field

My present disclosure is directed to standard ISO intermodal freight containers, train cars, and other cargo containers where aerodynamic improvements that reduce wind drag on the mode of transit are desired.

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Background Art

Series 1 Freight Containers:

15 Malcom McClean revolutionized global trade when he introduced the shipping container. The innovation was not immediately adopted, but in 1968, twelve years after he introduced the container, an international standard was finally agreed upon. It was known as an ISO 668 – *series 1 freight container*.

20 **Containers in Detail:**

The cargo container itself has not seen much inventive interest from those in the shipping industry since Malcom McClean revolutionized shipping with the Ideal-X inaugural container shipment (April 26, 1956) and then later standardized the industry (September 24, 1965).

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Since then, interest around the cargo container has lied substantially on the capacity of ships and port-side cranes, not on fuel savings.

The intermodal cargo container is ubiquitous, handy, and extremely useful. It is singularly
30 responsible for globalization.

One must marvel at the utility of a container through its spare use of material. The sidewalls and roof are made of a fluted steel deck. Its fluted shape achieves great strength with a minimal thickness of corten steel.

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This does not translate to a reduction in wind drag, however.

PRIOR ART DESCRIBED

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Containers:

US 2009/0230725 uses an applied, dimpled surface to reduce wind drag on an already smooth tractor trailer. The patent was not granted.

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US 10,745,066 adds radiused walls to an existing smooth tractor trailer. The added structure alters the shape of the trailer to improve aerodynamics. It does not anticipate working with cargo containers or the constraints of being tightly packed on a cargo ship.

50 **US 4,756,256** was designed to work with rail cars on a multi-unit railway car. Essentially, the apparatus smoothed out the gaps between the cars, reducing wind drag. This patent did not anticipate intermodal use.

In **US 2010/0116932** fairing panels on a cargo aircraft envelope one or more cargo
55 containers. The patent was not granted.

Similar to the '256 patent, **US 4,518,188** provides a side panel to prevent air turbulence from occurring between the tractor and the trailer. This does not apply to an intermodal cargo container.

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US 8,496,286 creates a rib-like protruding post for sidewall panels on a tractor trailer. It does not concern an intermodal cargo container.

WO 2021-124175 is a reflective film intended to emit and/or reduce heat passively from a building or vehicle. It primarily intends to mold or form to a shape. It does not intend to smooth out a shape—such as the deep flutes on a modular, intermodal cargo container.

US 2011/0181072 created separate wings intended to fly over the top of a vehicle, trailer or cargo box. While the patent was not granted, its attempt was admirable; wings for “reducing the effective weight,” presumably, would lift the cargo trailer off the ground leaving the truck down below but still attached at the hitch.

It would be a hazard to all who neared the traveling apparatus.

US 3,372,503 is a flat, rigid magnetic sign attached to a protruding strip structure behind the planar surface. The strip structure provides openings on the tailwind side of the sign to create a low-pressure condition aimed at preventing the sign from being sucked away from the trailer during transit. It is intended to attach to a metallic “flat” truck trailer wall, not a fluted metallic surface such as a cargo container.

<https://www.insofast.com/products/40-ft-shipping-container-insulation-9-ft-high-cube-sidewall-cx44-bundle.html> is an insulation meant to smooth out the flutes of a cargo container for the purposes of creating a living area. This product does not contemplate intermodal cargo transport.

<https://www.slideshare.net/BrandonHilliard6/an-aerodynamic-study-of-bulk-commodity-tractor-trailers> contemplates providing a protruding “nose-cone” at the upper portion of the front of a tractor trailer, such that the space above the rear wheels of the truck is filled with a shape to deflect wind and reduce wind drag. It is not contemplated for use on an intermodal cargo container.

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Summary

TECHNICAL PROBLEM

Series 1 freight containers are efficient apparatus for conveying freight.

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They were not designed to be aerodynamic.

The structural flutes used to form the walls of the *series 1 freight container* provide a substantial amount of drag when pulled by a tractor trailer.

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According to testing by Lawrence Livermore National Laboratory, containers with corrugated sides have a significantly higher aerodynamic drag that makes for a rather large fuel economy deficit. I was recently in a Department of Energy meeting where they reported about a 10% fuel economy loss when comparing these types of containers to a smooth sided 53 ft. dry van. (Fleetowner.com, 2015)

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The Executive Director of the North American Council for Freight Efficiency rightly observed the issue; yet, from my own personal research, as well as my patentability search firm, the industry did not provide a fix in the past seven years.

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How did this not attract entrepreneurial and inventive attention over the past 66 years?

I believe that it has not attracted such attention because of the brutal nature of how *series 1 freight containers* are treated. They are lifted, banged, dropped, and bumped about ports, ships, trucks, and trains. They need to be tough.

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While steel flutes are remarkably strong and efficient, they do not improve fuel efficiency.

It would be interesting to know how many billion gallons of diesel have been wasted since 1968 driving with the exposed flutes. With the national price of diesel at \$5.735 USD per gallon, I imagine logistics companies would be eager to save if they could (AAA, 2022).

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With the 2021 United Nations Climate Change Conference (COP26) having recently ended, and nation pledges made, carbon emission reduction is all the more important.

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130 **SOLUTION TO PROBLEM**

I can apply a pliable membrane over the flutes of *series 1 freight containers*. Applying a membrane that withstands 120 km per hour, or 75 mph, is challenging as the flutes do not provide a continuous surface to adhere to. This is why several vertical rows of magnet
135 anchors are required, as not all flutes will be perfectly aligned. Several vertical rows enable the pliable membrane to work on *series 1 freight containers* built from different manufacturers without customizing each and every pliable membrane.

To be absolutely sure the drag reduction would be valuable to trucking driving
140 professionals, I commissioned a computational fluid dynamics (CFD) study by Auto Research Center located in Indiana, USA.

The following is an exact printout of the report:

145 BidBird was interested in understanding the possible fuel economy improvements by installing smooth panels onto a 40-foot container trailer.

- _Baseline Case – 2016 International Prostar , 73” Sleeper Sky-Rise Cab
- _CFD conducted in accordance with GHG2 & California Air Resources Board protocols

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Overall Drag
CdA = 6.663
Cd = .625

155 Simulations carried out at wind 65 mph with +4.5 degrees of yaw. The wind is coming from the driver’s left side. This is customary as it simulates a realistic scenario for over the road trucking as most often there is some cross wind and these parameters have shown to correlate well to real world conditions.

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Overall Drag
CdA = 6.026
Cd = .565

165 For a large blunt object, much of the drag comes from the pressure difference
between the front and the back faces. Regions facing the wind tend to be high
pressure, shown in red, and cause drag. The picture below shows how each of the
flutes on the container adds to the drag ($C_p > 0$ in yellow).

170 (Unfortunately, I did not submit these color images due to PCT Rule 11.13. But
they are available upon request.)

The skinned container shows much less drag generated on the side

175 (Unfortunately, I did not submit these color images due to PCT Rule 11.13. But
they are available upon request.)

The below picture shows the iso-surfaces of total pressure equal to zero. These iso-
surfaces show large wake structures that are generated around the truck. These are
areas of large energy losses and contribute to drag. The structure seen behind the
180 truck causes a large portion of the drag. This is normal for semi-trucks; however,
what can also be seen is that each flute also has areas of energy loss.

(Unfortunately, I did not submit these color images due to PCT Rule 11.13. But
they are available upon request.)

185 Below is a comparison of the two wake structures.

(Unfortunately, I did not submit these color images due to PCT Rule 11.13. But
they are available upon request.)

190 Since it is difficult to clearly see the difference, the picture below shows the skinned
container with its wake structure in light blue overlaid with the standard container
in green. We can see that the structure behind the standard container is longer thus
causing more drag.

195 (Unfortunately, I did not submit these color images due to PCT Rule 11.13. But
they are available upon request.)

200 CFD gives us the ability to separate the drag contributions of each part of the tractor trailer combination. Although many times the interaction between parts makes it difficult to see where the drag reductions are generated, in this case we can clearly see the skinned container trailer contributes much less drag to the overall system.

		Overall Drag	Container Only
205	Drag Baseline	0.625	0.139
	Skinned Container	0.565	0.072
	Delta	0.0600	.067%
	Change	9.6%	48.4%
	estimated fuel savings	5.2%	

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ADVANTAGES

As Auto Research Center proved, estimated fuel savings of 5.2% is a handsome improvement.

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In addition to a pliable membrane that may be applied to existing containers, I also propose that newly constructed *series 1 freight containers* receive an outer, durable panel proud of the steel flutes. Such panels could be a thin layer of corten sheet steel, welded in place. Plastic panels would also work. Basically, anything that bridges the gaps of the steel flutes and is rigid.

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The embodiments are not limited to *series 1 freight containers*, when viewing a train drive by in Tucson, Arizona, I have seen thousands upon thousands of freight cars with protruding structure.

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I further propose *skinning* those apparatus.

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Brief Description of Drawings

- Fig. 1** A low aerial orthogonal view of a prior art *series 1 freight container*
- Fig. 2** A below eye-level perspective view of a prior art *series 1 freight container* where joists can be seen below
- 235 **Fig. 3** A table of the CFD results
- Fig. 4** A table of the CFD results
- Fig. 5** A view of a pliable membrane and how to arrange magnet anchors according to Figs. 3 and 4
- Fig. 6** An upper perspective view of a *magnet anchor* formed from a piece of pliable membrane which is heat welded
- 240 **Fig. 7** A lower perspective view of *magnet anchor* formed from a piece of pliable membrane which is heat welded
- Fig. 8** A plan view of how magnet anchors adhere to a steel flute
- Fig. 9** A perspective view of a pliable membrane with wind seal attached
- 245 **Fig. 10** A low aerial perspective view of a *skinned series 1 freight container*

Embodiments:

- Fig. 11** A top plan view of *magnet anchor* punched from a steel plate
- 250 **Fig. 12** A bottom plan view of *magnet anchor* punched from a steel plate
- Fig. 13** An elevation view of *magnet anchor* punched from a steel plate
- Fig. 14** A perspective view of a *magnet anchor* punched from a steel plate
- Fig. 15** A plan view of a pliable membrane with integrally formed protruding volumes of pliable membrane material which are sized, shaped and placed
- 255 to make contact with the *valley* of a steel flute

Best Mode for Carrying Out the Invention

265 **Fig. 1** shows a low-aerial perspective view of a prior art *series 1 freight container 10*. It is apparent from the flutes **54** on the container side wall **58** that the surface is rough and prone to aerodynamic drag.

Also shown are the flutes **54** on the top side **52** of a *series 1 freight container 10*.

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Fig. 2 shows an underside perspective view of a prior art *series 1 freight container 10* largely similar to Fig. 1. Bottom framing **56** on the underside of the container is also prone to aerodynamic drag.

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While it is possible to use a pliable membrane for the underside of the *series 1 freight container 10*, it seems more reasonable to use a rigid panel, such as sheet steel. The panel could be screwed or welded.

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Fig. 3 shows a table of the CFD results from Auto Research Center.

Fig. 4 shows a table of the CFD results from Auto Research Center.

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Fig. 5 shows a view of a pliable membrane and how to arrange magnet anchors according to Figs. 3 and 4.

290 To make this apparatus, place magnets in each section labeled T1 **12**, etc. per the strength indicated in the respective Fig. Because the flute arrangement is not called out in the specification ISO 668 – *Series 1 Freight Containers*, I recommend adding several vertical rows of magnets to ensure that the pliable membrane will adhere to a minimum number of flutes.

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At the sides of the membrane, wind seals 62 are shown. These are presently thought to use bent sheet metal with punches holes for threading a thread, or the punched holes themselves lock the edge of the membrane. See Fig. 10 for more information.

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Certainly, if you calculated the pulling forces needed for the center sections T5 20 and B5 40 and used a completely magnetized pliable membrane with suitable load resistance capability, it is possible that no magnet anchors are required. You could simply use a magnetized pliable membrane. This embodiment, while useful, comes at a higher price than that shown in this Fig.

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Fig. 6 shows an upper perspective view of a *magnet anchor* formed from a piece of pliable membrane 68 which is heat welded. A heat weld 66 is shown sandwiching a magnet which will be shown in the following Fig.

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Fig. 7 shows a lower perspective view of *magnet anchor* formed from a piece of pliable membrane 68 which is heat welded. A magnet 68 is shown. The heat weld will be applied to the main pliable membrane which covers a side of a *series 1 freight container*.

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Fig. 8 illustrates a plan view of how magnet anchors 62 adhere to a steel flute 54.

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Several vertical rows of magnets can prevent the unfortunate situation where no magnet anchors 62 align with a steel flute 54.

While the overall size of the pliable membrane 68 can be counted upon, as the overall shape of a *series 1 freight container* is prescribed in ISO 668, the flutes are not.

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Fig. 9 shows a perspective view of a pliable membrane 68 with wind seals 64 attached.

Punched spooling slots 86 enable a spooling machine to lock into the slot with rods and begin rolling the pliable membrane **68** for application and removal purposes.

330 Keeping a pliable membrane **68** attached to a *series 1 freight container 10* during transit has other advantages. The pliable membrane **68** provides a surface on which to place advertisements. As we have seen above, magnets must be placed at various quantities and strengths, in specific areas, along a side of *series 1 freight container 10*.

335 Not only will this apparatus save money on fuel, but it will also earn money for the truck driving professionals who use the pliable membrane. One last thought is that a GPS tracker may be added to the pliable membrane so that the advertisers may have a printout of where their advertisements were shown.

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Fig. 10 shows a low aerial perspective view of the top side **52** of a *skinned series 1 freight container 10*. Pliable membranes **68** are shown on both the side and top of the container.

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Description of Embodiments

Fig. 11 shows a top plan view of *magnet anchor 62* punched from a metal plate **70**.

While there is nothing special about the circle as a shape for a magnet anchor **62**, I do think that not having corners, or at least sharp corners, is practical.

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In this example, a circular metal plate **70** is punched with a series of holes **72** forming a circle. Likely, in the same punch four bent tabs **76** are formed. A magnet **78** is placed at the center of the bent tabs **76** where the final process of bending the remaining portion of tab around the magnet.

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The holes **72** may be threaded with twine or another commercial grade thread to the pliable membrane **68**.

360 **Fig. 12** shows a bottom plan view of a *magnet anchor 62* substantially similar to Fig. 11 other than you may see the back side of the anchor. It is clear here that the bent tabs 76 prevent the magnet anchor 62 from being released.

365 **Fig. 13** shows an elevation view of the *magnet anchor 62* of Fig. 11.

Fig. 14 shows a perspective view of a *magnet anchor 62* of Fig. 11. Here the slot 74 is more clear. It simply is the void of the punched bent tab 76.

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Fig. 15 shows a plan view of a pliable membrane with integrally formed protruding volumes of pliable membrane material which are sized, shaped, and placed to make contact with the *valley* of a steel flute.

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There are a number of other options such as accordion panels with hinges that smooth out the flutes of a *series 1 freight container 10*. Some magnets could be wider than the ones shown here in these Figs. In that manner, they will always make magnetic contact.

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REFERENCE SIGNS LIST (numbers are **bolded** in description)

	10	<i>series 1 freight container</i>
	12	T1 of Fig. 3
395	14	T2 of Fig. 3
	16	T3 of Fig. 3
	18	T4 of Fig. 3
	20	T5 of Fig. 3
	22	T6 of Fig. 3
400	24	T7 of Fig. 3
	26	T8 of Fig. 3
	28	T9 of Fig. 3
	30	T10 of Fig. 3
	32	B1 of Fig. 4
405	34	B2 of Fig. 4
	36	B3 of Fig. 4
	38	B4 of Fig. 4
	40	B5 of Fig. 4
	42	B6 of Fig. 4
410	44	B7 of Fig. 4
	46	B8 of Fig. 4
	48	B9 of Fig. 4
	50	B10 of Fig. 4
	52	top side (of <i>series 1 freight container</i>)
415	54	flutes
	56	bottom framing (of <i>series 1 freight container</i>)
	58	side wall (of <i>series 1 freight container</i>)
	60	entrance end wall (of <i>series 1 freight container</i>)
	62	<i>magnet anchor</i>
420	64	wind seal
	66	heat weld
	68	pliable membrane
	70	metal plate
	72	hole
425	74	slot

REFERENCE SIGNS LIST—continued (numbers are **bolded** in description)

	74	slot
	76	bent tab
	78	magnet
430	80	rigid sheet
	82	punched holes
	84	rigid panel
	86	<i>punched spooling slot</i>
	88	integrally formed protruding volumes
435	90	magnetic studs

CLAIMS GLOSSARY

440 (Specific claim terms are in *italics* throughout this disclosure. These claim terms represent an overview; for a richer understanding of these consistent terms consult the description and drawings.)

445 *magnet anchor* A single piece of flat material with cut and bent tab(s) which permanently wrap a magnet. The magnet backing is used to create resistance in a pliable membrane to prevent the magnet from being separated from the membrane.

plurality Two or more

450 *punched spooling slot (s)* A linear punched slot in a piece of sheet metal. The protruding slot provides a void for a spooling rod to enter and begin rolling a pliable membrane.

455 *series 1 freight* A freight container designed to the International *container* Organization for Standards ISO 668 specification.

skin (s, ned, ning) An article that smooths the gaps found in a steel flute.

460 A state where it can be said a container has had a skin applied to it.

The act to which an apparatus applies a pliable membrane to a side of a series one freight container.

465 **CITATION LIST**

The following is a tabulation of some prior art that presently appears relevant.

U.S. Patents

	Patent Number	Kind Code	Issue Date	Patentee
	US 10,745,066	B2	2020-08-18	Prakash et al.
470	US 4,756,256		1988-07-12	Rains et al.
	US 4,518,188		1985-05-21	Witten
	US 8,496,286	B1	2013-07-30	Katz et al.

US 3,372,503

1968-03-12

Weeks

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U.S. Patent Application Publications

Patent Number	Kind Code	Issue Date	Patentee
US 20090230725	A1	2009-09-17	Juieng
US 2010/0116932	A1	2010-05-13	Helou, Jr.
US 2011/0181072	A1	2011-07-28	Kempster

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Foreign Patent Documents

Foreign Doc. Num.	Kind Code	Issue Date	App or Patentee
WO 2021/124175	A1	2021-06-24	3M Innovative Properties Company

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Nonpatent Literature Documents

Levinson, Marc, *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*, (Princeton, NJ), pp. 68,191.

Sidewall (40' High Cube) CX44-Bundle | InSoFast Container Insulation. (n.d.). InSoFast.

490 <https://www.insofast.com/products/40-ft-shipping-container-insulation-9-ft-high-cube-sidewall-cx44-bundle.html>

Brandon Hilliard Follow. (n.d.). *An aerodynamic study of bulk commodity tractor trailers*. Share and Discover Knowledge on SlideShare.

<https://www.slideshare.net/BrandonHilliard6/an-aerodynamic-study-of-bulk-commodity-tractor-trailers>

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Roeth, M. (2015, July 17). *Miles to Go | Running Green content from Fleet Owner*. web.archive.org.

<https://web.archive.org/web/20150726054227/http://fleetowner.com/running-green/miles-go> *National Average Gas Prices*. AAA Gas Prices. (n.d.). Retrieved

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July 28, 2022, from <https://gasprices.aaa.com/>

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Claims

I claim:

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- 1) In the field of intermodal shipping where *series 1 freight containers* are employed in transit a manufacture for improved aerodynamics comprising:

515 a pliable membrane having a wind facing side and a *series 1 freight container* side, sized and shaped to substantially cover an exterior side of a *series 1 freight container* creating a substantially flat surface to reduce turbulence and drag caused by a plurality of structural steel flutes integral to said exterior side of said *series 1 freight container* while in transit;

520 a means to affix said pliable membrane on said exterior side of said *series 1 freight container* is oriented to and capable of withstanding real-world forces subject to said *series 1 freight container* in transit and remaining affixed to the exterior side of said *series 1 freight container* until it is desired to remove said pliable membrane.

525 2) The pliable membrane of claim 1 wherein said pliable membrane is sea-worthy.

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3) The pliable membrane of claim 1 wherein said pliable membrane is multi-layered.

530 4) The pliable membrane of claim 1 wherein said pliable membrane is multi-layered with at least one reinforcement layer.

5) The pliable membrane of claim 1 wherein said means to affix pliable membrane to said exterior side of said *series 1 freight container* are magnetic.

535 6) The pliable membrane of claim 1 wherein said means to affix pliable membrane to said exterior side of said *series 1 freight container* utilize a plurality of *magnet anchors*.

7) The pliable membrane of claim 1:

540 wherein said pliable membrane is integrally formed with a plurality of protruding volumes which are sized, shaped and placed to make contact with the valley of said plurality of structural steel flutes integral to said exterior side of said *series 1 freight container*;

545 further, wherein said means to affix said pliable membrane on said exterior side of said *series 1 freight container* are a plurality of *magnetic studs* wherein each of said plurality of *magnetic studs* have an enlarged end, a rod-like middle section and a magnetic end, said enlarged end and said rod-like middle section are integrally formed in one of said protruding volumes to resist pullout forces and said magnetic end is arranged so the magnetic

550 surface makes contact with said valley of one of said plurality of structural steel flutes.

8) The pliable membrane of claim 1 wherein at least one edge is formed with a wind seal to prevent air turbulence from getting between said exterior side of said *series 1 freight container* and said pliable membrane while in transit.

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9) The pliable membrane of claim 1 wherein said wind seal is separate from said pliable membrane and is mechanically fastened.

560 10) The pliable membrane of claim 1 wherein said wind seal is separate from said pliable membrane and is adhesively fastened.

11) The pliable membrane of claim 1 wherein said wind seal is integrally formed with said pliable membrane.

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12) The pliable membrane of claim 1 wherein said wind seal comprises:
a suitably sized piece of sheet metal bent to sandwich an end of said pliable membrane.

570 13) The pliable membrane of claim 1 wherein said wind seal comprises:
a suitably sized piece of sheet metal bent to sandwich an end of said pliable membrane;

575 said suitably sized piece of sheet metal is further bent to create an angled crimp which bridges a gap between said exterior side of *series 1 freight container* and said wind facing side of said pliable membrane, thereby creating an angled wind seal.

580 14) The pliable membrane of claim 1 wherein said wind seal comprises:
a suitably sized piece of sheet metal bent to sandwich an end of said pliable membrane;
a *plurality* of crimped holes in said suitably sized piece of sheet metal wherein said crimped holes punch through the pliable membrane and it can be said to be permanently fixed.

585 15) The pliable membrane of claim 1 wherein said wind seal comprises:
a suitably sized piece of sheet metal bent to sandwich an end of said pliable membrane;
a *plurality* of crimped holes in said suitably sized piece of sheet metal wherein said crimped holes punch through the pliable membrane and it can
590 be said to be permanently fixed;
a plurality of *punched spooling slots* wherein a spooling rod may enter said *punched spooling slots* and roll the pliable membrane.

595 16) The pliable membrane of claim 1 wherein said wind facing side may accept a printed advertising membrane and where said printed advertising membrane may remain affixed until it is desired to remove said printed advertising membrane.

600 17) The pliable membrane of claim 1 wherein said wind facing side is used in combination with an advertisement affixed to said wind facing side.

18) The pliable membrane of claim 1 wherein is used in combination with a global position satellite tracking device.

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19) In the field of intermodal shipping where *series 1 freight containers* are employed in transit a manufacture for improved aerodynamics comprising:

610 a panel sized and shaped to substantially cover an exterior side of a *series 1 freight container* creating a substantially flat surface to reduce turbulence and drag caused by a plurality of structural steel flutes integral to said exterior side of said *series 1 freight container* while in transit;

615 a means to affix said panel on said exterior side of said *series 1 freight container* is oriented to and capable of withstanding real-world forces subject to said *series 1 freight container* in transit and remaining affixed to said exterior side of said *series 1 freight container* until it is desired to remove said panel.

20) The panel of claim 19 wherein said panel is sea-worthy.

620 21) The panel of claim 19 wherein said means to affix said panel on said exterior side of said *series 1 freight container* are magnetic.

625 22) The panel of claim 19 wherein said means to affix said panel on said exterior side of said *series 1 freight container* is a magnet sized and arranged to bridge the gap of a plurality of valleys of said *structural steel flutes* such that no matter the arrangement of said structural steel flutes magnetic contact is made.

23) The panel of claim 19 wherein said panel is comprised of:

a plurality of hinges;

630 a plurality of sub-panels wherein said sub-panels fold up in an accordion-like fashion and are bound together with said plurality of hinges.

24) In the field of intermodal shipping where *series 1 freight containers* are employed in transit an aerodynamic improvement comprising:

635 a *series 1 freight container*;

a panel sized and shaped to substantially cover an exterior side of a *series 1 freight container* creating a substantially flat surface to reduce turbulence and drag caused by a plurality of structural steel flutes integral to said exterior side of said *series 1 freight container* while in transit;

640 a means to affix said panel on said exterior side of said *series 1 freight container* that is capable of withstanding real-world forces subject to said *series 1 freight container* in transit and remaining affixed to said exterior side of said *series 1 freight container*.

645 25) The panel of claim 24 wherein said panel is sea-worthy.

26) The panel of claim 24 wherein said means to affix said panel on said exterior side of said *series 1 freight container* is through welding.

650 27) The panel of claim 24 wherein said means to affix said panel on said exterior side of said *series 1 freight container* is mechanically fastened.

28) The panel of claim 24 wherein said means to affix said panel on said exterior side of said *series 1 freight container* is adhesively bonded.

655 29) The panel of claim 24 wherein said panel is comprised of a plurality of sub-panels.

30) In the field of intermodal shipping where *series 1 freight containers* are employed in transit an aerodynamic improvement comprising:

a *series 1 freight container*;

660 a panel sized and shaped to substantially cover a bottom side wherein a plurality of bottom framing on a *series 1 freight container* is located, creating a substantially flat surface to reduce turbulence and drag caused by said plurality of bottom framing integral to said bottom side of said *series 1 freight container* while in transit;

665 a means to affix said panel on said bottom side of said *series 1 freight container* that is capable of withstanding real-world forces subject to said *series 1 freight container* in transit and remaining affixed to said bottom side of said *series 1 freight container*.

670 31) The panel of claim 30 wherein said panel is sea-worthy.

32) The panel of claim 30 wherein said means to affix said panel on said bottom side of said *series 1 freight container* is through welding.

675 33) The panel of claim 30 wherein said means to affix said panel on said bottom side of said *series 1 freight container* is mechanically fastened.

34) The panel of claim 30 wherein said means to affix said panel on said bottom side of said *series 1 freight container* is adhesively bonded.

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35) The panel of claim 30 wherein said panel is comprised of a plurality of sub-panels.

36) In the field of intermodal shipping where freight train cars are employed in transit a manufacture for improved aerodynamics comprising:

685 a panel sized and shaped to substantially cover exterior sides of a freight train car creating a substantially flat surface to reduce turbulence and drag caused by a plurality of protruding structural steel members integral to said exterior sides of said freight train car while in transit;

690 a means to affix said panel on said exterior sides of said freight train car is oriented to and capable of withstanding real-world forces subject to said freight train car in transit and remaining affixed to said exterior sides of said freight train car until it is desired to remove said panel.

695 37) The panel of claim 36 wherein said means to affix said panel on said exterior sides of said freight train cars is through welding.

38) The panel of claim 36 wherein said means to affix said panel on said exterior side of said freight train cars is mechanically fastened.

700 39) The panel of claim 36 wherein said means to affix said panel on said exterior side of said freight train cars is adhesively bonded.

40) The panel of claim 36 wherein said panel is comprised of a plurality of sub-panels.

705 41) The panel of claim 36 wherein said panel is made of steel.

42) The panel of claim 36 wherein said panel is made of coreten steel.

43) The panel of claim 36 wherein said panel is made of aluminum.

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44) A *magnet anchor* comprising:

a magnet;

a single piece of flat material sized and shaped to provide an anchor backing for said magnet;

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a plurality of bent tabs cut from but still attached to said single piece of flat material wherein said bent tabs are sized to permanently wrap said magnet to prevent the magnet from being dislodged.

45) The *magnet anchor* of claim 44 wherein said anchor backing has a

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plurality of holes which provide a gripping mechanism when used in an integrally formed pliable membrane.

46) The *magnet anchor* of claim 44 wherein said anchor backing has a plurality

of punched tabs which provide a gripping mechanism when used in an integrally

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formed pliable membrane.

47) The *magnet anchor* of claim 44 wherein said single piece of flat material has a

single bent tab cut from but still attached to said single piece of flat material wherein

said bent tab is sized to permanently wrap said magnet to prevent the magnet from

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being dislodged.

48) The *magnet anchor* of claim 44 wherein said single piece of flat material is

shaped with a plurality of sides.

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49) The *magnet anchor* of claim 44 wherein said single piece of flat material is

circularly shaped.

50) A *magnet anchor* for a pliable membrane comprising:

a magnet;

740 an adhesive;
a single piece of pliable membrane sized and shaped to provide an anchor backing
for said magnet that extends beyond the edge of said magnet to provide an ample
area for said single piece of pliable membrane to receive a bed of said adhesive
surrounding said magnet and adhesively bonding to a pliable membrane sized to
745 permanently wrap said magnet to prevent the magnet from being dislodged during
intermodal transit.

51) A magnet anchor for a pliable membrane comprising:

a magnet;
750 a durable, industrial thread;
a single, separate piece of pliable membrane sized and shaped to permanently
sandwich said magnet between a pliable membrane wherein an outer edge extends
beyond an outer edge of said magnet providing an ample area for said single piece
of pliable membrane to receive a sewn stitch of said durable, industrial thread to
755 said pliable membrane to permanently wrap said magnet to prevent said magnet
from being dislodged during intermodal transit.

52) A magnet anchor for a pliable membrane comprising:

a magnet;
760 a single piece of pliable membrane sized and shaped to provide an anchor backing
for said magnet that extends beyond the edge of said magnet to provide an ample
area for said single piece of pliable membrane to receive a heat weld surrounding
said magnet, bonding to a pliable membrane and forming a weldment;
said weldment is sized to permanently wrap said magnet to prevent the magnet from
765 being dislodged during intermodal transit.

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