United States Patent [19]

Hamy

[11] **3,903,825**

[45] **Sept. 9, 1975**

[54] **TRANSPORT SYSTEM**

[75] Inventor: **Norbert Hamy**, Beaconsfield, Canada

[73] Assignee: **Trebron Holdings Limited**, Regina, Canada

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[30] **Foreign Application Priority Data**

July 13, 1971 United Kingdom 32758/71

[52] **U.S. Cl.** .... **114/77 R**; 114/235 A; 114/16 R

[51] **Int. Cl.** **B63b 3/02**

[58] **Field of Search** .... 114/77 A, 77 R, 72, 16 R, 114/235 A, 235 B, 235 R; 115/6; 214/12–15; 220/1.5, 8, 17

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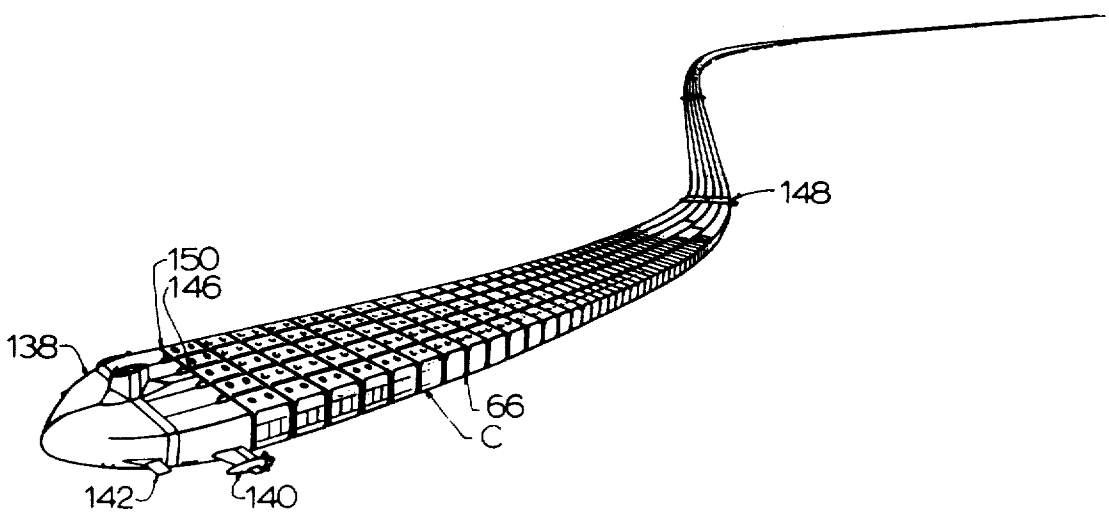
Primary Examiner—Trygve M. Blix
Assistant Examiner—Stuart M. Goldstein
Attorney, Agent, or Firm—Robert J. Schaap

[57] **ABSTRACT**

A transport system including a series of modular containers or so-called container modules which are connectable in a desired orientation to form a chain of these container modules. This chain of container modules is powered in overwater or underwater modes of operation by a lead power module and optionally intermediate power modules, and in some cases is adaptable for movement on land. The container modules are uniquely designed for rapid loading and unloading of bulk or discrete solids or liquids or other forms of cargo including pressurized cargo contents to thereby provide a system for transporting a variable cargo mix.

47 Claims, 42 Drawing Figures



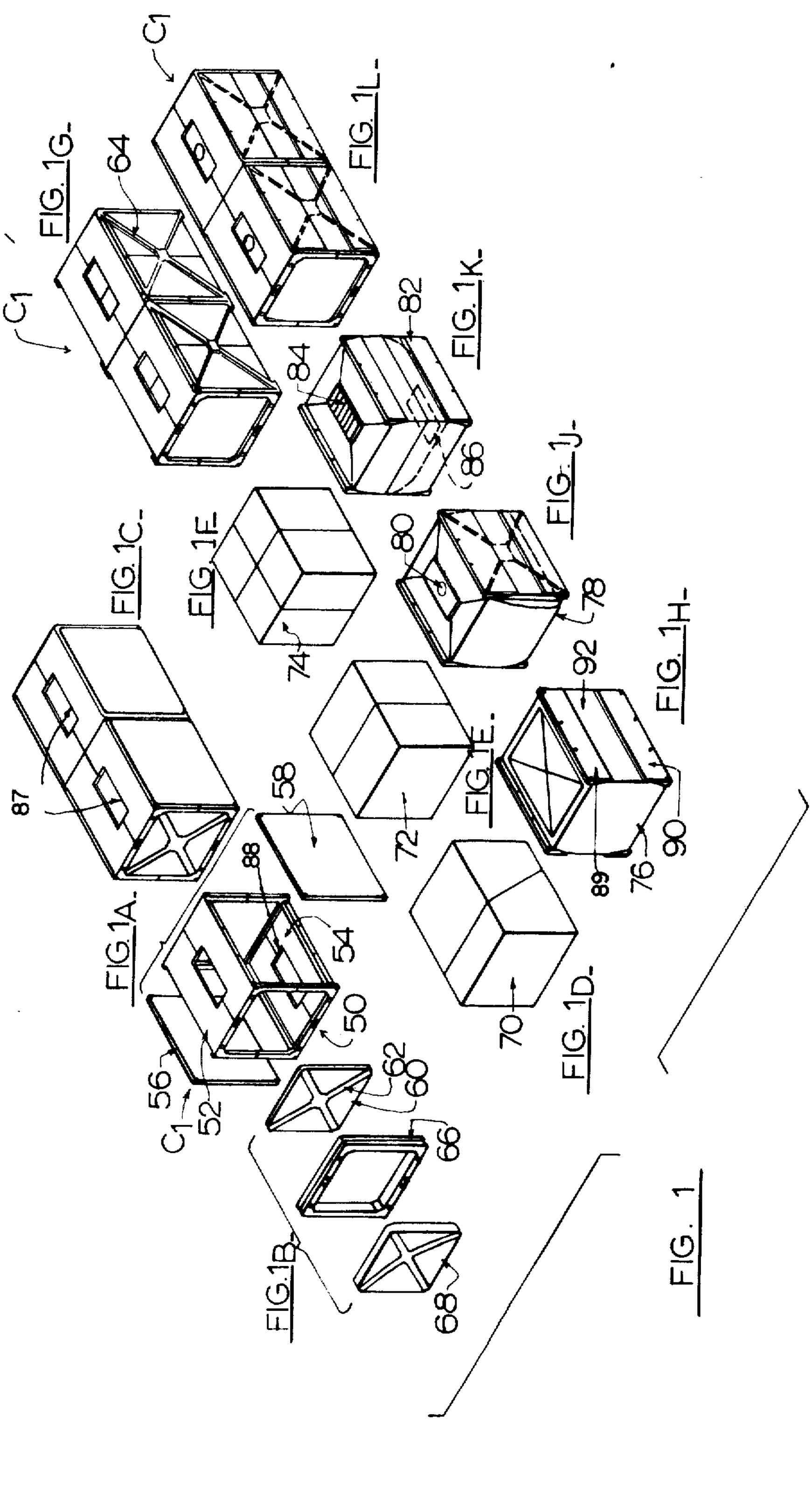


FIG. 1A.
FIG. 1B
FIG. 1C.
FIG. 1D.
FIG. 1E
FIG. 1E.
FIG. 1G.
FIG. 1H.
FIG. 1J.
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FIG. 1

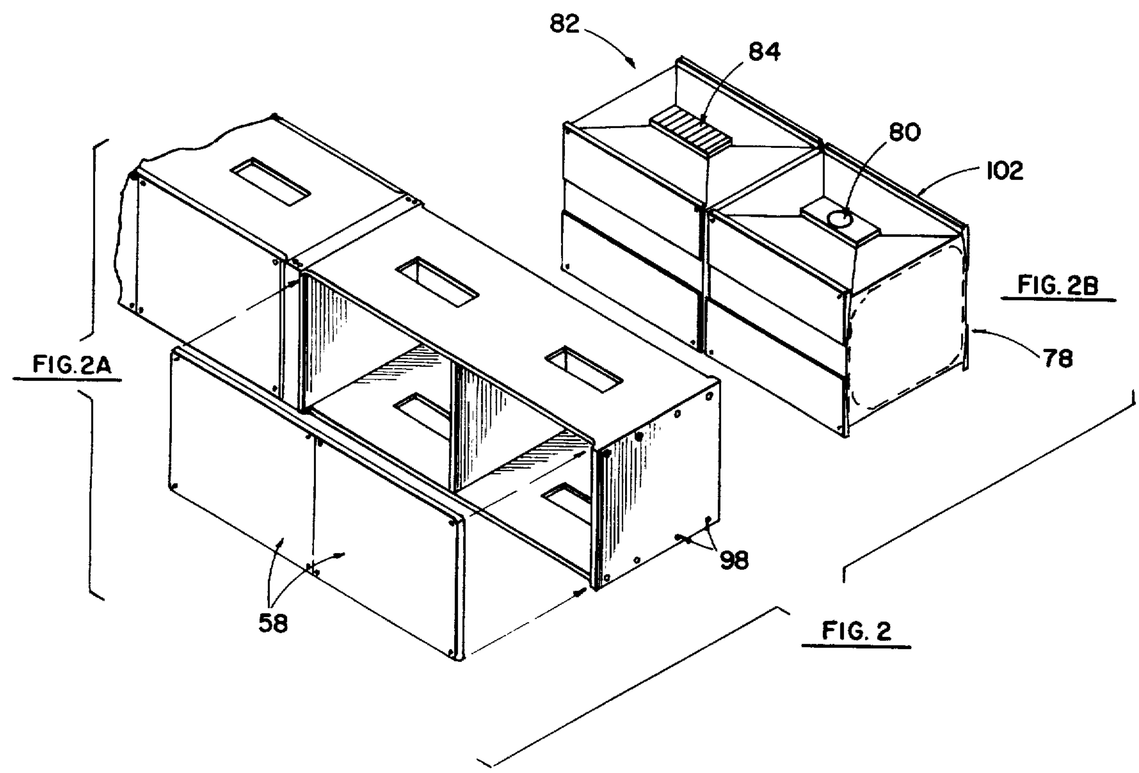


FIG. 2

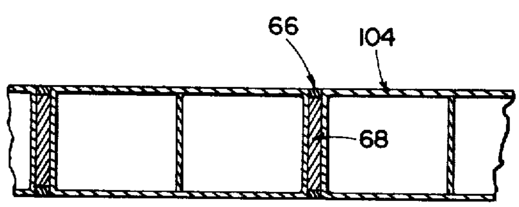


FIG. 6

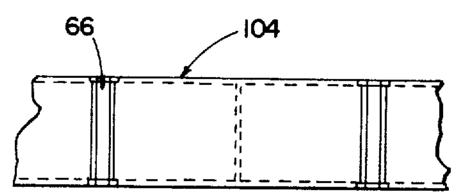


FIG. 7

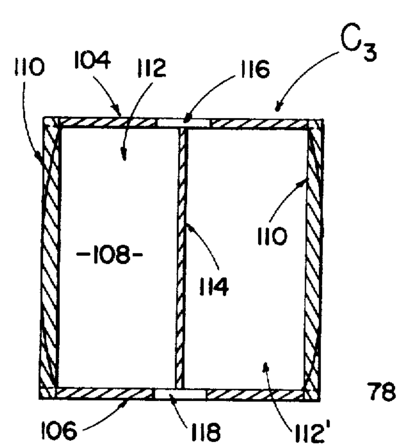


FIG. 3

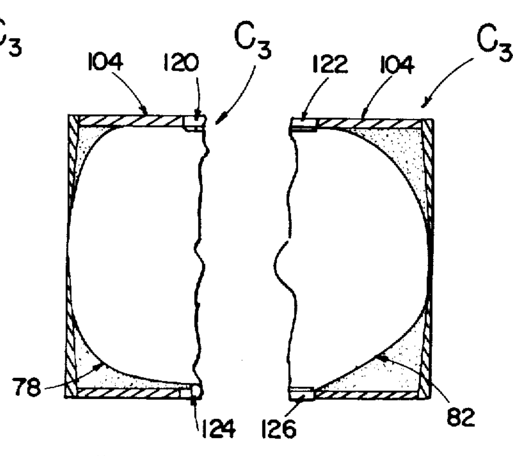


FIG. 4A FIG. 4B

FIG. 4

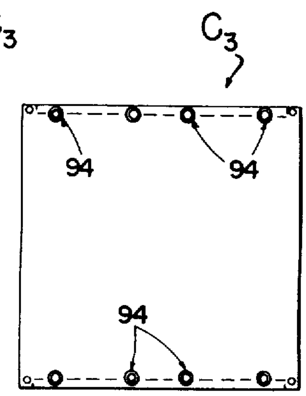


FIG. 5

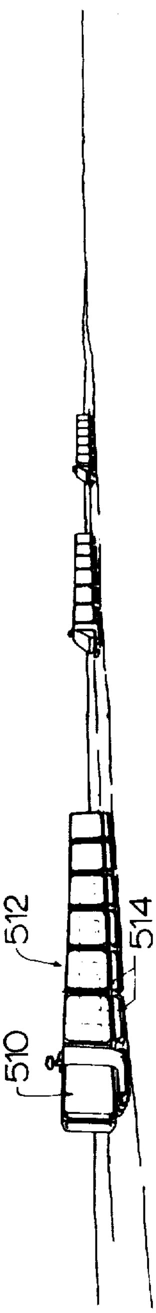


FIG. 20

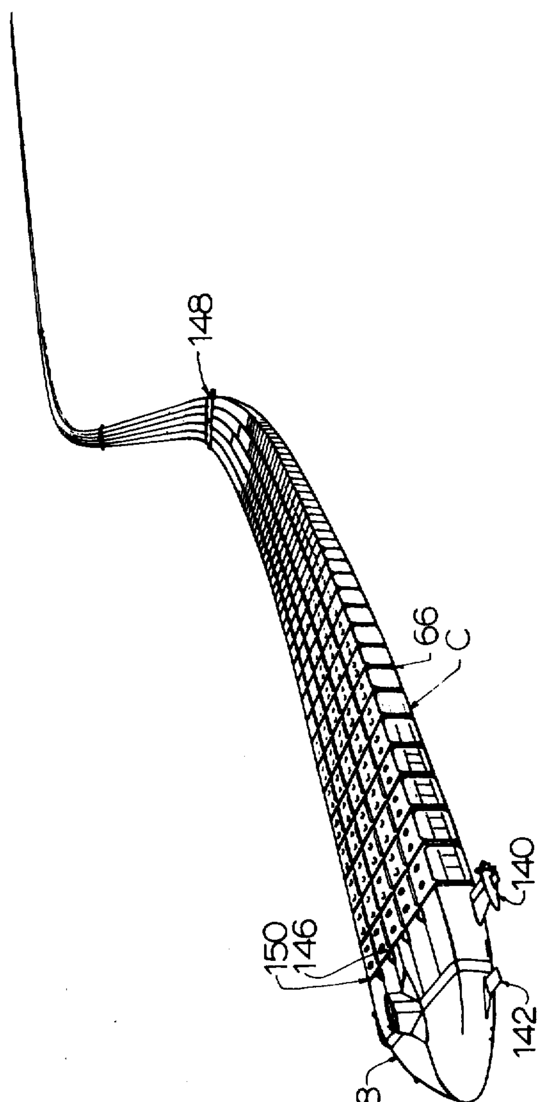
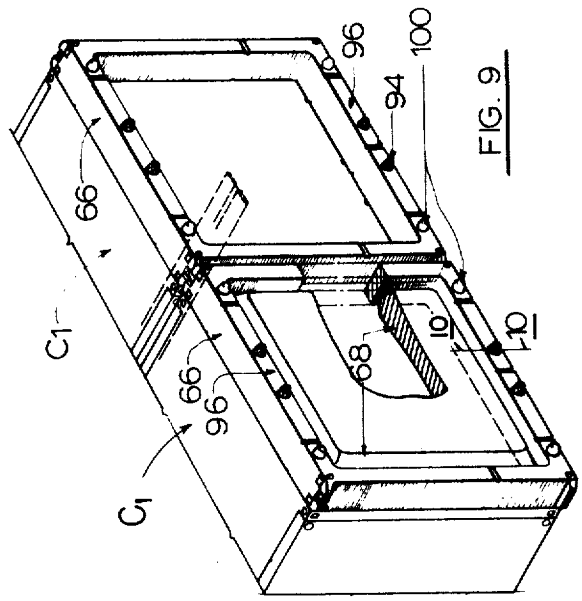


FIG. 8



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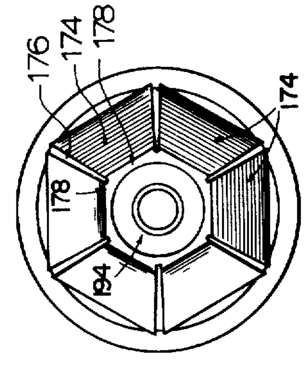


FIG. 11

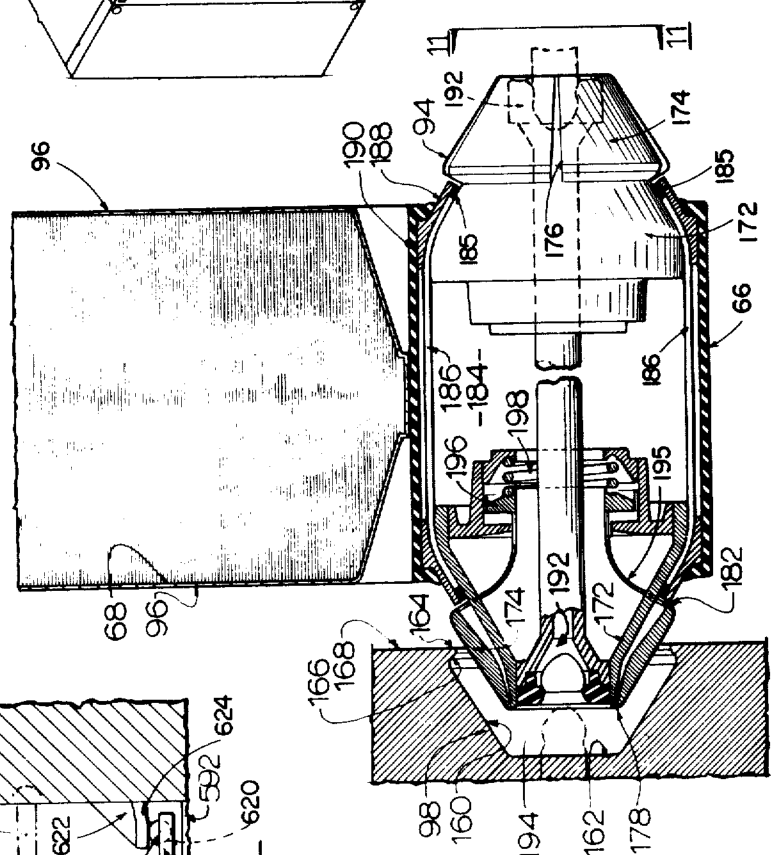
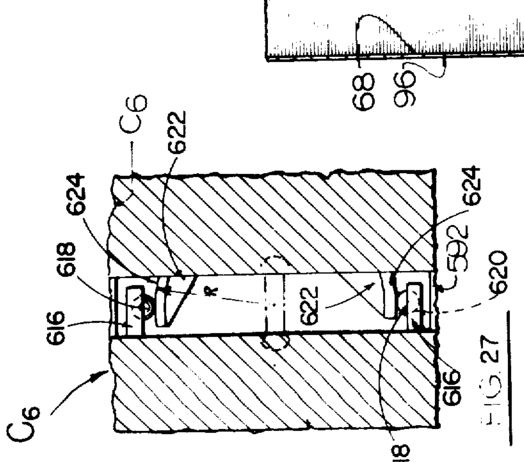


FIG. 10



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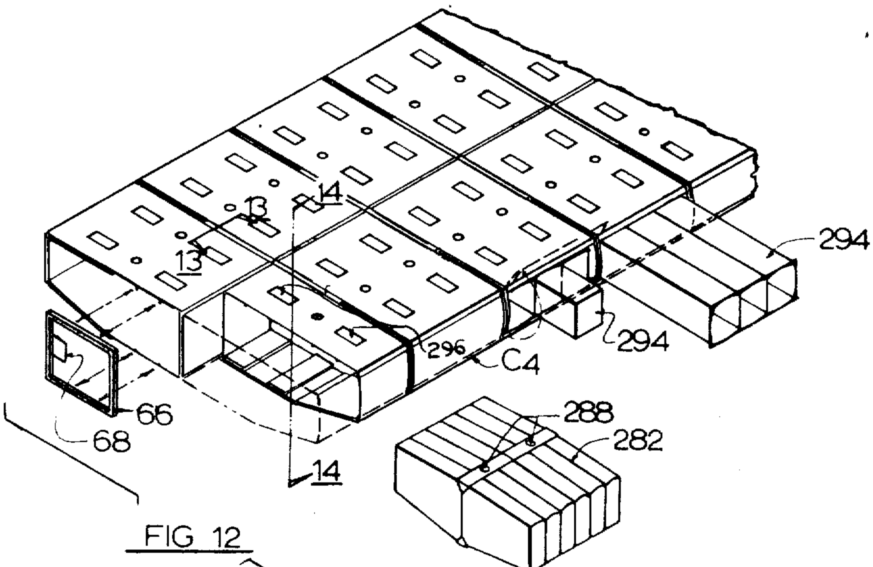
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FIG 12

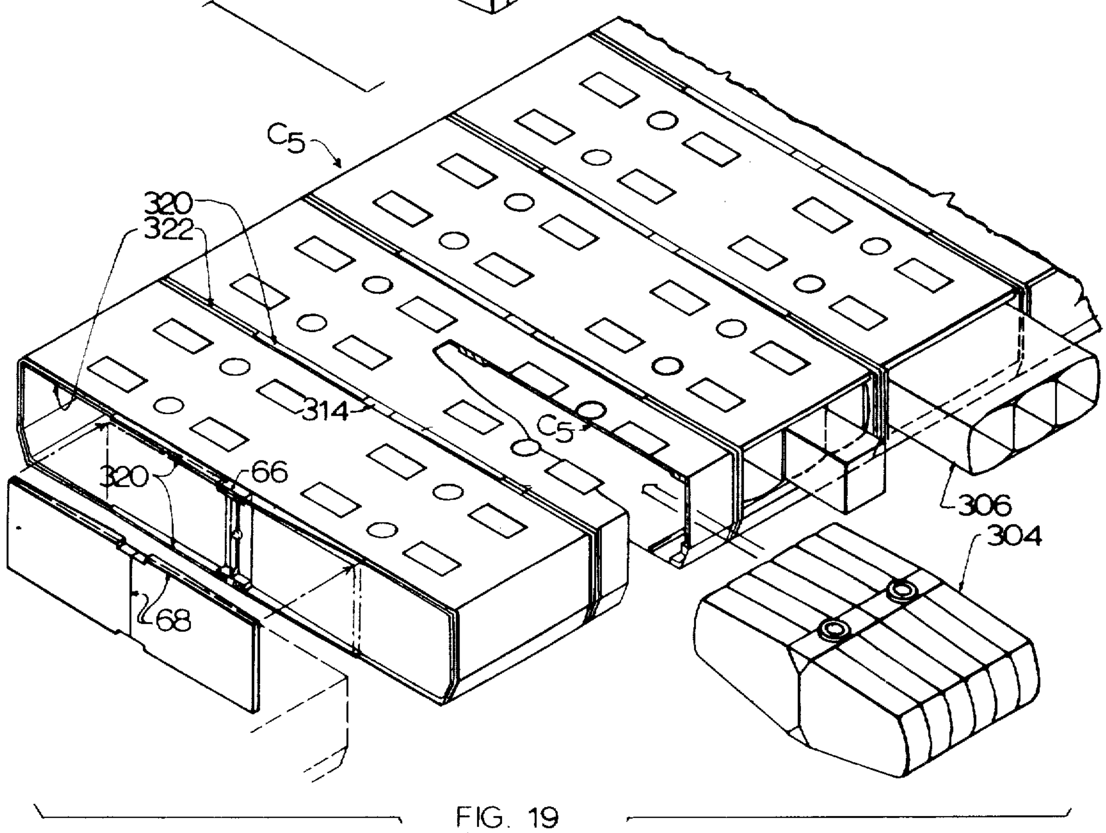
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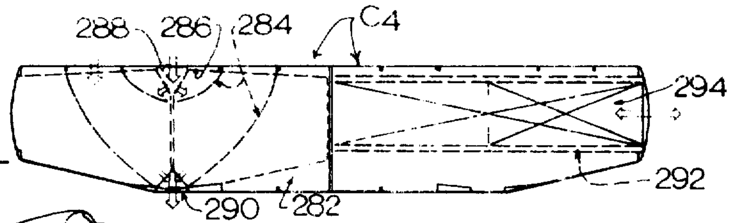
FIG. 19



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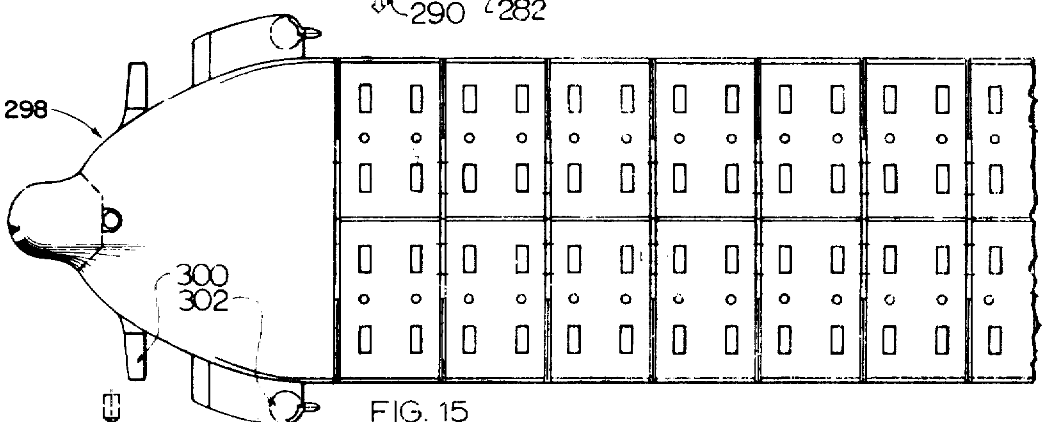

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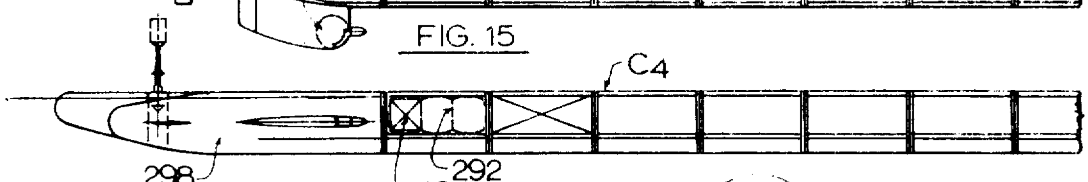

FIG. 16

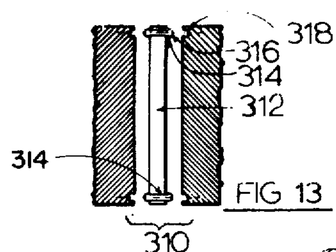

FIG 13

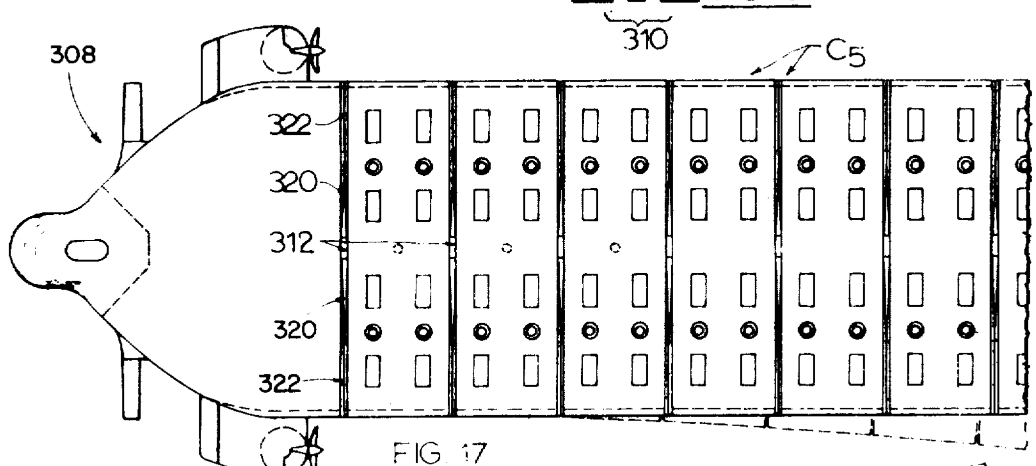

FIG 17

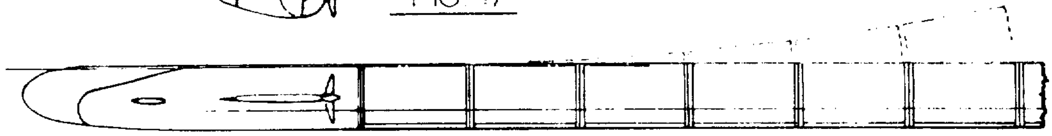

FIG 18

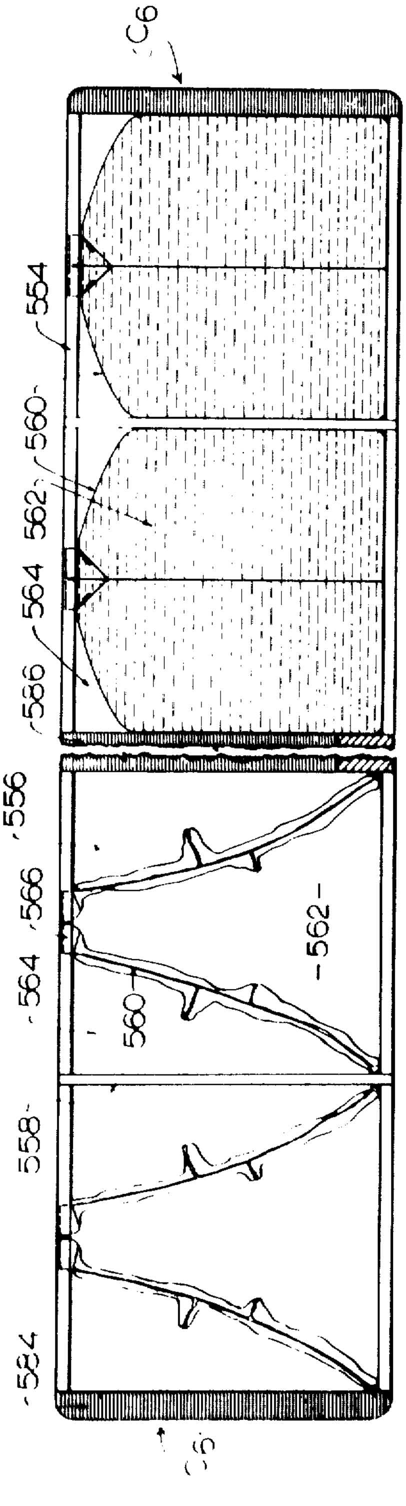
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FIG. 22

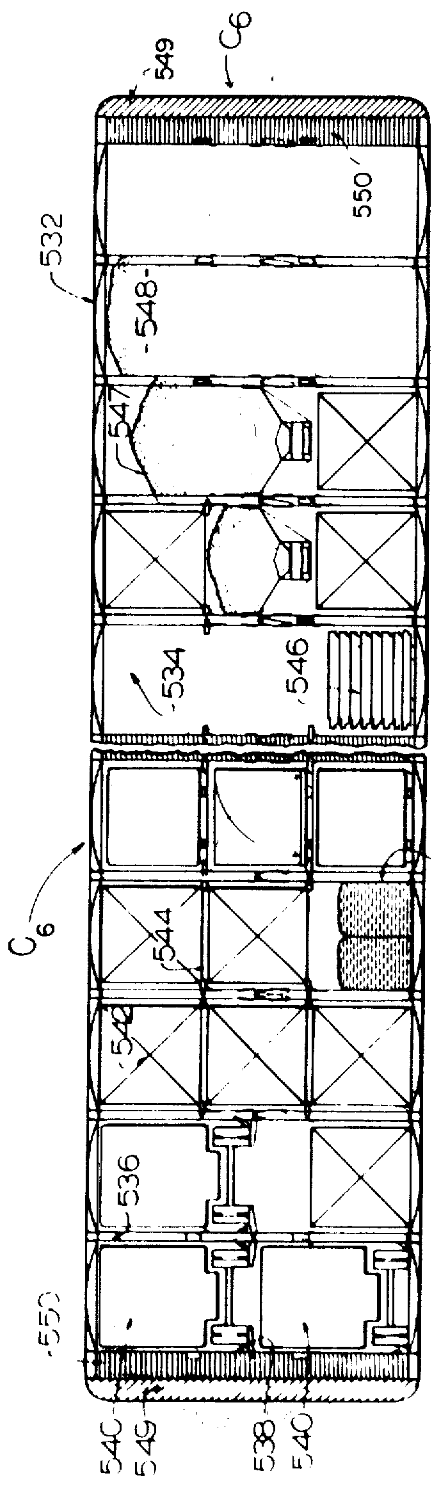
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FIG. 21

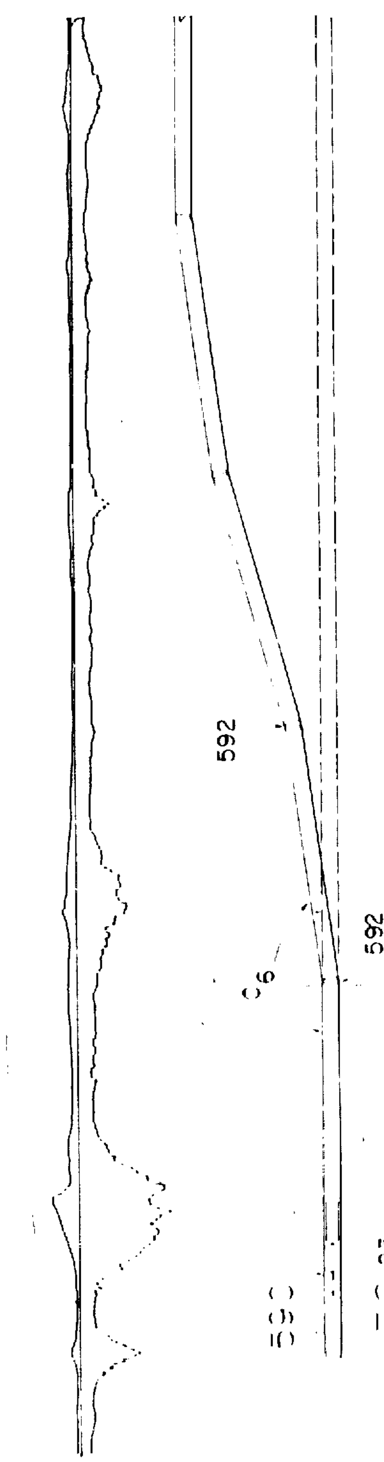

FIG. 23

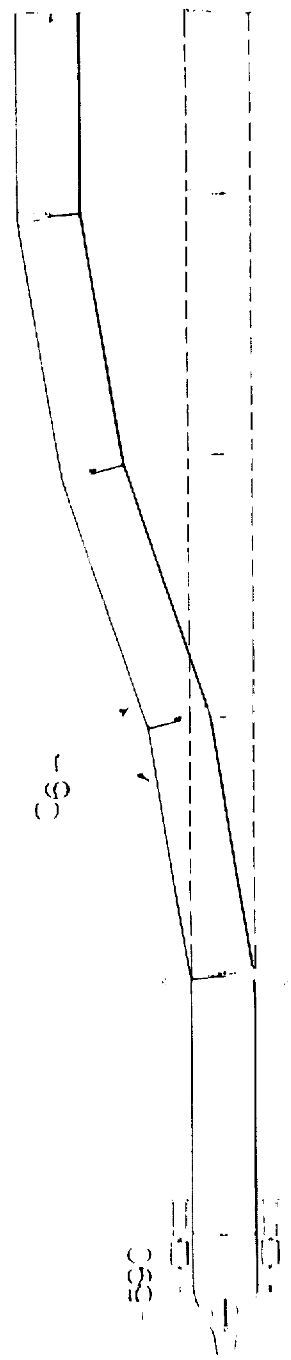

FIG. 24

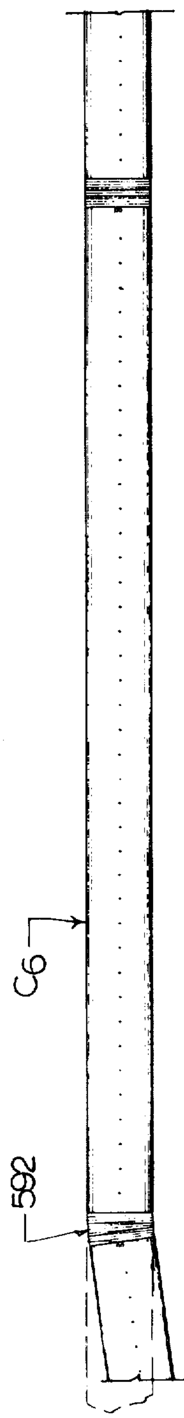

FIG. 26

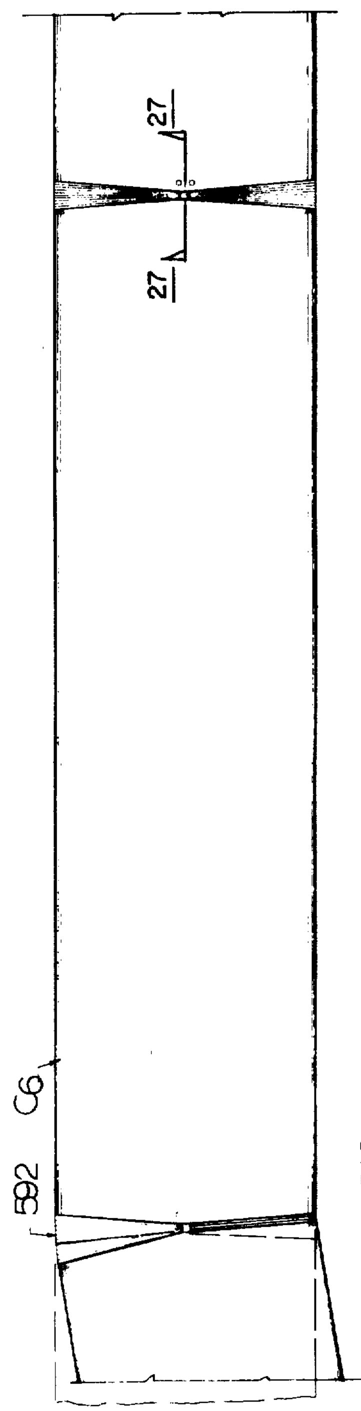

FIG. 25

TRANSPORT SYSTEM

BACKGROUND OF THE INVENTION

This invention relates in general to certain new and useful improvements in transport systems, and more particularly, to transport systems which employ a plurality of interconnectable container modules for land or sea operation when powered by one or more power modules and processing facilities therefor.

Since the beginning of trade and mercantile commerce, man has relied primarily upon waterways including the oceans and inland waterways for transporting freight, particularly over large distances. The ocean-going vessel was used as the primary source of transporting this cargo, particularly between two continents or between two bodies of land separated by an expanse of water. Interestingly, this state of art has remained relatively unchanged since the first initiation of ocean-going vessels except for improvements in the vessels giving rise to increased cargo capacity and speed, thereby increasing the economic advantage of sea transport of cargo.

In more recent years, utilization of barges powered by tug boats and the like has been made for transporting cargo over inland waterways. To some extent, the shipping of cargo by means of seagoing vessels and inland waterway vessels has been met with competition by land travel such as trains, trucks and the like and to some extent the intercontinental shipment of cargo has been met with competition by air freight. Nevertheless, the capacity of cargo which can be handled by airborne freight handling systems is severely limited and the same holds true with overland freight hauling units such as trucks, railcars and the like. Consequently, a large percentage of freight is still shipped by means of barges on inland waterways and by the ocean-going vessel for shipment across expanses of water.

In relatively recent years, military submarines have been used to transport military persons and a limited amount of cargo under frozen expanses of water. However, under the present state of technology, even with nuclear powered submarines, the type and amount of cargo which can be handled in any particualar submarine vessel is again severely limited. Accordingly, this mode of freight shipment has not been commercially adopted.

The present problems encountered with the use of waterways for transporting cargo are well known and include such problems as inefficiency and high cost. Generally, substantial time delays are encountered when shipping freight by ocean-going vessels or by inland waterway barges due to the relatively slow speeds of these vessels. In addition, overland transportation such as trains, trucks, or the like are then required at the point of imbarcation of the cargo from the particular vessel. While shipment of cargo by air freight does not generally encounter these time delays, the type of cargo which can be shipped by air freight is substantially limited, and furthermore, the high cost of air shipment renders this form of cargo movement relatively prohibitive for most types of cargo.

Notwithstanding, the practical problems of shipping cargo by means of sea-going vessels, these types of vessels have been subjected to other widespread criticism. One of the most common means of shipping bulk fluids such as oil from either drilling sites or oil processing sites is accomplished by the use of the ocean-going vessel. However, oil spills, that is the inadvertent leakage of the crude oil from the vessel, has contaminated the various shore areas and has presented substantial ecological problems. In addition, these ocean-going vessels generally burn diesel fuels for operation of the engines, giving rise to substantial air contaminates and which again adds to the present ecological problems.

The actual processing of the cargo on ocean-going vessels and inland waterway barges also presents substantial problems from the standpoint of loading and unloading the cargo. There are relatively few automated procedures for loading and unloading cargo from ocean-going vessels and consequently, substantial amounts of costly labor needed for this purpose. Therefore, the cost of shipping cargo by use of sea vessels has increased dramatically over recent years. Present large capacity vessels have severe geographical limitations due to excessive draft requirements in terms of routing and harbor locations. Thus, it can be realized that the general system for shipping of cargo by means of waterways has not materially changed since the earliest times of ocean-going vessels, except by means of improvements in the vessels including speed and cargo handling capabilities and payload capacities. Nevertheless, the other problems attendant to this form of transportation have not been substantially reduced.

The present invention obviates these and other problems by providing a transport system in the form of modular containers, often referred to as "container modules" and which are connectable in any desired orientation for movement over or in water bodies when powered by one or more power modules. In addition, the transport system of the present invention provides an improved facility for loading and unloading the container modules as well as a facility for storing and orienting the container modules in a desired chain for sea travel. Thus, the subject transport system enables fast and efficient transportation of cargo on both open seas and inland waterways and provides the additional unique advantage of submersible travel when desired. This submerged mode of travel facilitates new global polar routes through Arctic and Antarctic waters. Furthermore, the transport system is highly unique in that it enables sea-land transferability.

The present transport system also provides for mobile and stationary terminal facilities which are fully automated and thereby lends to significant reduction of costly labor necessary for loading and unloading of cargo. Furthermore, there is a high degree of flexibility in these transport systems due to the combined advantages of bulk shipping, containerization and barge systems. Relatively few, if any, geographic limitations for passage or freight processing are encountered with this type of transport system and relatively low capital investments are required for harbor installations.

OBJECTS

It is, therefore, the primary object of the present invention to provide a transportation system for the transporting and processing of bulk and discrete materials by means of interconnectable container modules.

It is another object of the present invention to provide a transport system of the type stated where the container modules can be interconnected in a desired fashion to form a chain of these container modules and provided with a power module for moving the chain on land, or in overwater or underwater modes of operation.

It is a further object of the present invention to provide a transport system of the type stated which is readily adaptable for the transporting of bulk solids, bulk liquids or other forms of fluid, discrete materials such as discrete solids and dry good materials in the same modular sea chain.

It is another object of the present invention to provide a transport system of the type stated which permits efficient and rapid surface or subsurface interlocking of container modules in essentially any orientation for forming sea chains of container modules by the provision of a coupling system associated with one or more of the container modules.

It is also an object of the present invention to provide a transport system of the type stated where the container modules and/or the coupling systems therebetween may be provided with ballast chambers or other weight control means for regulating depth control in either underwater or overwater operation in a sea chain.

It is an additional object of the present invention to provide a transport system of the type stated where a series of interconnectable container modules are provided with automatic valving and hopper mechanisms which may be operable from a lead power module for convenient loading and unloading of the modules.

It is yet another object of the present invention to provide a transport system of the type stated which includes provision for harbor processing facilities or offshore processing facilities to permit the convenient and efficient loading and unloading of the container modules and processing of the contents therein.

It is a salient object of the present invention to provide a transport system of the type stated which includes container module processing stations for rapidly and efficiently storing and processing of the module and which also permits the rapid, efficient and automatic orientation of various selected container modules for coupling to form sea chains of the container modules.

It is still another object of the present invention to provide a transport system of the type stated where seagoing chains of modular containers can be loaded, unloaded, stored and assembled automatically at either mobile or stationary processing facilities and which processing facilities may be located on land, on a body of water or submerged in a body of water.

It is yet another object of the present invention to provide a system of transporting cargo by use of modular container sea chains which presents little if any undesirable impact on environmental conditions by eliminating the previously required large and inefficient storage facilities at sites of loading and unloading, and by permitting the transporting of mixed cargoes within given operating cycles.

It is also an object of the present invention to provide a transport system of the type stated which permits the combined advantages of bulk shipping, containerization and barge systems, and which creates little, if any, geographic limitations for passage or freight process.

With the above and other objects in view, my invention resides in the novel features of form, construction, arrangement and combination of parts presently described and pointed out in the claims.

GENERAL DESCRIPTION

The present invention provides a transport system for highly rapid, efficient and economical processing of cargo and which includes a number of novel and unique sub-systems, such as a chain of disengageable container modules powered by a lead power module and optionally one or more intermediate power modules. In addition, the present invention provides a facility for storing and orienting these container modules in a desired pattern for ultimate coupling to form a sea chain. Furthermore, the present invention provides unique processing facilities for loading and unloading the contents of the container modules at harbor facilities and at offshore facilities.

The modular containers used in the formation of the sea chains are containers having interior cavities adapted to receive cargo and the like and these containers are often referred to herein as container modules since each of the containers have basic external dimensions or multiples thereof which are capable of being easily linked with similar modules of the same external dimension or multiples thereof to form a larger unit. Thus, these modules may be coupled in a desired orientation to form a composite chain thereof. These container modules are often referred to as "constant modules" inasmuch as in most cases the modules are of a relatively similar and constant size and shape. Smaller containers which are designed for removable disposition within the cavity of the container modules are referred to herein as "sub-modular" containers or "submodules." "ISO" containers refer to an international standard container size and generally two of the smaller constant container modules can be coupled to form a container equivalent to the standard ISO-container. Therefore, the terms "ISO-container" or "ISO-container module" will refer to one or more modules coupled together to form a container combination of the ISO-container size.

Several of the containers are of a substantially larger size and these containers, which are also modular in construction are referred to as "super constant modules" or "super constant container modules." When connected together any of these modules will form a chain and the term "chain" as used herein will refer to two or more of the modular containers connected together either laterally or longitudinally. Thus, a chain may consist of a plurality of endwise connected longitudinally located group of modules which are laterally connected to one or more like groups of modules.

The present invention also provides containers which are larger than the super constant modules and these larger containers are modular in construction and referred to as "magnum constant modules." These latter modules are of such size that they may be linked end-to-end to form a chain, but are not linked laterally to other chains thereof. These modules are of such size that they are capable of receiving truck trailers and the like.

The movable container portion of the transport system can be described in general terms as a transport system for travel in a water medium and comprising a plurality of modular containers having interior cavities adapted to receive a cargo. These modular containers are water-tight in that they are capable of travel on the surface of a body of water and submergible travel in the body of water. The containers are also sized for movement on land travel vehicles. This transport system also comprises coupling means for coupling each one of the modular containers to another of the modular containers to thereby form a chain of these containers. In addition, power means is operatively associated with the containers and adapted to transport the chain of modular containers through the water medium between any two or more geographic points.

Inasmuch as the container modules are sized for movement on land travel vehicles such as train cars, trucks or air cushion vehicles, etc. and as they can travel over a body of water or submerged travel in a body of water they are often referred to herein as "universal modular containers." Therefore, the term "universal" modular containers will refer to these containers in accordance with the present invention which are capable of being moved on such land based vehicles and which are also capable of movement through a body of water either for surface travel on and submergible travel in said body of water. Thus, the universal container modules will include the sub-modular container, the constant container modules and the super constant modules, including the ISO-modules formed of any one of more of the above, as well as the magnum constant modules.

In a preferred embodiment the transport system can be further characterized in that the coupling means comprises a coupling collar adapted for operative interposition between two of the modular containers. A lock means on the collar is cooperatively engageable with cooperating means on the containers for forming the chain of containers. This coupling collar is preferably a two-way coupling device and includes self activating expandible lock devices such as self activating mechanical lock devices with hydraulic release mechanisms. These lock devices are cooperatively engageable with coupling sleeves in the modular container. In some cases it is only necessary to employ a one-way coupling device, depending on the sea chain size and configuration. In most cases, however, the coupling device will be a two-way device and will allow angulated movement between two adjacent modules in at least horizontal and vertical planes. With most sea chains of container modules the coupling mechanism is designed to allow full omni-directional articulation. The coupling mechanisms also are relatively inextesible and therefore do not allow extensible movement between two adjacent modules, although they do permit limited rotation of one module with respect to another.

The present invention also relates to an improvement in modular containers of the type adapted to be removably connected to similar containers and which have interior chambers adapted to receive cargo therein. This improvement comprises the coupling mechanism which is interposable between two of the modular containers and which is provided with a locking means for cooperatively locking two of the containers on opposite sides of the coupling mechanism. This improvement is further characterized in that a ballast chamber may be formed in each of the modular containers and means may be associated with this ballast chamber for controlling water ballast levels in the ballast chambers. In addition, this improvement comprises a ballast chamber in each of the coupling mechanisms in addition to or in place of the ballast chambers in the modules, along with means to control the water ballast levels in the ballast chambers of the coupling mechanisms.

In a preferred mode of the transport system, submodular containers may be provided for removable insertion into the modular containers. These submodular containers are actually smaller modules each containing the same or different types of cargo and a plurality of these sub-modular containers may be introducable into a particular container module for storage and/or transport therein. In addition, an embodiment of the invention discloses the use of collapsible bag-like members which are mounted in or are provided for removable insertion into the modular containers and adapted to carry bulk materials. Certain of the modular containers may be adapted for presurization in order to retain certain types of cargo therein. Hopper means may be provided on certain of the modular containers for introduction into and removal of bulk material with respect to the chamber in the containers. In certain other modular containers, automatic valve means may be provided for the introduction or removal of fluids or other materials therein. The magnum constant modules may be provided with automated loading and unloading conveyor means, or pumping means for bulk liquids.

In many systems, it is desirable to use not only a lead power module which includes a control system and preferably, an automatic guidance system, but at least one or more intermediate power modules which are interposed between two of the modular containers in the chain. In a preferred aspect of the present invention, these intermediate power modules may receive power from the main power module. The present invention teaches the use of continuous power cables or power conducting means through the coupling mechanisms to transmit this power from the main power module to the intermediate power modules.

Processing facilities for handling the sea going chains of container modules may be located adjacent to or proximate a body of water to constitute a harbor facility or it may be located in the body of water to constitute an off-shore facility. The harbor facility arrangement is uniquely adapted to receive cargo from trucks, boats, rail traffic, or the like. Container modules having cargo previously introduced therein or the cargo in other forms moved by these modes of transportation can then be introduced into container modules at the storage and processing facility for ultimate formation of the container modules into sea chains. In the case of cargo in either bulk or liquid form, this cargo can then be loaded into the container modules for ultimate coupling of these modules to form the sea chains. Otherwise, with respect to the cargo previously loaded into container modules, these container modules can be stored until the desired time for shipping at which point the container modules would then be coupled in the desired arrangement and provided with a lead power module for transport to a desired geographic point.

The magnum constant modules of the present invention also exhibit the wide degree of utility present in the other modules previously described. In like manner, these modules can be formed into chains for seasurface, or underwater operation, and in many cases, are adaptable for land travel. These magnum modules are highly adaptable for the storage and transporting of large cargo and may include sub-modules such as the tank-bag sub-module, the bulk sub-module inserts and the like. In addition, these magnum modules are adaptable to carry a wide variety of cargo types in the same module. For example, these modules may be subdivided by various headers into various compartments so that each compartment may carry a different type of cargo. Furthermore, the magnum modules are sized so that they are capable of handling railroad cars, truck trailers and the like.

Due to the size of these magnum modules, they may include their own internal ballast chambers with their own internal automatic pumping controls. In addition, they may be adapted for air pressurization or the like for either underwater operation or submerged operation as aforesaid.

The present invention also provides a unique coupling means as aforesaid and which is used for coupling two structures together on impact. One of these structures is generally provided with a recess having a first abutment shoulder formed therein. The coupling assembly would then comprise a protruding locking head located on one surface of the other structure and having a second abutment shoulder which matches the first abutment shoulder and engages therewith when the head is inserted into the recess. Tension means are operatively connected to the locking head permitting slight angulated movement between the two structures while in the locked position. Furthermore, fluid actuable release means are operatively connected to the locking head for slightly reducing the size of the second abutment shoulder thereby permitting withdrawal of the head from the recess.

This coupling assembly may be further characterized in that another protruding locking head is located on the opposite surface of the structure carrying the first protruding locking head and this second locking head is also capable of fitting into a recess in a third structure. In this case, the first structure would normally be a container module and the second structure would normally be the coupling frame or the coupling bracket which holds the locking head. The third structure would normally be another container module located on the opposite side of the coupling frame or bracket. Each of the locking heads on the opposite sides of the second structure are operatively connected to this tension means and each would be provided with a bluid actuable release means, and preferably a hydraulically actuable release means.

The locking mechanism in a preferred aspect of the present invention comprises a cylindrical member which is capable of diametral contraction and expansion. A plurality of relatively unexpandable tensile elements are engageable with the cylindrical member and are also operatively connected to the locking heads. Thus, if the locking heads are subjected to tension on each of the opposite sides of the second structure, the tensile members will engage the cylindrical member and cause a slight contraction thereof. The fluid actuable release means preferably comprises a hydraulic ram which is operatively connected to the locking head for urging the same out of the recess. The locking head in this construction is provided with a plurality of leaf-like members on its outer surface for diametral constriction upon actuation of the hydraulic ram. Also in the preferred aspect of the present invention, the second abutment shoulder on the locking head is on the side thereof which faces the second structure and the first abutment shoulder faces away from the opening forming the recess in the first of the structures.

Having generally described the invention, reference will now be made to the accompanying drawings, in which:

FIG. 1 is a perspective view showing the various container modules, in which:

FIG. 1A is an exploded perspective view of a container module referred to as a constant module;

FIG. 1B is a perspective view of the end closure panel of the constant module of FIG. 1A, and a coupling frame and a ballast chamber frame;

FIG. 1C is a perspective view of two completely assembled constant modules to form an ISO-size container;

FIGS. 1D, 1E and 1F are perspective views of various forms of sub-modular containers;

FIG. 1G is a perspective view of a pair of constant modules connected together;

FIGS. 1H, 1J and 1K are perspective views of sub-modular container inserts;

FIG. 1L is a perspective view of two container modules connected together;

FIG. 2 is a partial perspective view of one type of module;

FIG. 2A is a side perspective view of one set of the closure panels for the module of FIG. 2;

FIG. 2B is a perspective view of a further type of module;

FIG. 3 is a vertical sectional view showing the interior of one form of container module;

FIG. 4 is a composite vertical sectional view of additional modules of which:

FIG. 4A is a vertical sectional view showing a container-bag module;

FIG. 4B is a vertical sectional view showing a bulk-solid module; container modules showing coupling sleeves thereon;

FIG. 6 is a vertical sectional view, in elevation, showing a series of endwise connected container modules with ballast chambers;

FIG. 7 is a side elevational view similar to FIG. 6;

FIG. 8 is a perspective view of a constant module sea chain;

FIG. 9 is a perspective view, partially broken away and in section and showing part of a two-way coupling system for securing two or more modular containers together;

FIG. 10 is a fragmentary vertical sectional view taken along line 10—10 of FIG. 9;

FIG. 11 is an end elevational view of the coupling substantially along line 11—11 of FIG. 10;

FIG. 12 illustrates larger modular containers with portions thereof being shown in exploded views;

FIG. 13 is a section taken along the line 13—13 of FIG. 12;

FIG. 14 is a vertical sectional view taken along line 14—14 of FIG. 12 and showing two laterally connected super constant modules, one of the modules having a tank-bag modular insert therein and the other sub-modular containers stored therein;

FIG. 15 is a top plan view of a chain of ½ width super constant modules, including a lead power module;

FIG. 16 is a side elevational view of the chain of super constant modules of FIG. 15;

FIG. 17 is a partial top plan view similar to FIG. 15 showing a modified sea chain;

FIG. 18 is a side elevational view of FIG. 17;

FIG. 19 is a perspective view partially broken away and in section of a portion of a modified container system, with certain parts shown in exploded view;

FIG. 20 is a perspective view showing the overland;

FIG. 21 is a vertical section view showing the interior of a pair of substantially larger modules (each of which is referred to as a magnum module);

FIG. 22 illustrates, pair of vertical sectional views showing the interior of a pair of magnum constant modules, the left-hand side of which illustrates tank bag-type modules, and the right-hand side of which illustrates filled bulk bag modules in containers;

FIG. 23 is a schematic side elevational view of a seagoing chain of magnum modules, and showing the underwater operation;

FIG. 24 is a top plan view similar to FIG. 23 illustrating the angular relationship between the modules during the lateral shifting thereof;

FIG. 25 is a top plan view of a chain of magnum modules and showing the angular relationship between the modules during a lateral shifting movement thereof;

FIG. 26 is a side elevational view of the chain of magnum modules of FIG. 25 and showing the angular relationship between the modules during a vertical shifting movement thereof;

FIG. 27 is a side elevational view of a coupling mechanism used for the magnum constant modules;

DETAILED DESCRIPTION

Referring now in more detail and by reference characters to the drawings which illustrate practical embodiments of the present invention, FIG. 1, including FIGS. 1A through 1L disclose a modular containerization system illustrating various forms of container modules C such as the container module C_1. All of these container modules in accordance with the present invention are "universal container modules" in the manner as described above.

The container module C_1 comprises a rectangular container frame 50 as illustrated in FIG. 1A having a top wall 52 and a bottom wall 54 secured thereto by any conventional means. Side closure panels or so-called "side walls" 56 and 58 are also secured to the longitudinal side margins of the frame 50 and enclosure panels or so-called "end walls" 60 are secured to the transverse ends of the frame 50 to form a completely enclosed container module. By reference to FIG. 1B, it can be observed that the end closure panels 60 are integrally provided with a bracing 62 in the form of diagonally located intersecting cross bars. In this connection, it should be observed that the side closure panels 58 may also be provided with a similar form of bracing to increase the structural rigidity of the container module.

The container module C_1 of the present invention may be constructed of any of a number of known materials of construction and include various metals such as iron, steel, aluminum, or the like, as well as other materials including wood or synthetic wood products. Furthermore, the containers and/or the various components thereof may be molded from any of a number of synthetic plastic materials such as polyethylene, a number of polyvinyl chlorides or other vinyl type material, polystyrene and the like. If the modular containers C_1 are fabricated from individual components which are formed in molding operations, these components may be assembled in any conventional manner such as heat welding or other known means for securing plastic components. The exact material of construction employed in any of the container modules in the present invention will depend primarily upon the end use. With respect to those containers to be used in sea chains, the containers may preferably, though not necessarily, be formed of any plastic material which is suitably sealed so that the interior portion of the container is watertight. Otherwise, the containers may be constructed with metal materials and welded or otherwise assembled in such fashion so that they are capable of movement through a body of water without encountering water leakage into the storage cavity formed by the container. In like manner, the bracing 62 may be integrally formed with the end closure panels 60 or the side closure panels 56 and 58 so they may be individual members which are secured thereto. By reference to FIG. 1G, it can be observed that struts 64 in the form of flexible bracing straps may also be secured to the frame of the containers. The sub-modular containers illustrated in FIGS. 1D through 1F and the modules of FIG. 1G are adapted primarily for land use, although they could be fluid sealed if desired for water surface or underwater operation.

A coupling means, preferably in the form of a coupling sleeve 66 may be secured to each of the opposite end closure panels 60 for purposes of securing two or more modular containers C in endwise abutting relationship. Two small container modules may be connected in the manner as illustrated in FIGS. 1C, 1G and 1L to form ISO-size container modules. In essence, a series of these container may be connected in endwise relationship and may be also connected laterally in order to form a chain of the containers. A ballast chamber plate 68 having an internally formed ballast chamber may then be secured to each of the coupling sleeves 66 on each of the opposite end walls of the containers C.

The coupling sleeve 66 may be provided with one or more flexible bumper pads or similar members to permit angulation or "fairing" in both horizontal and vertical planes. Thus, as the container modules move through the body of water during a turn, they will be angularly disposed to each other in a horizontal plane. In like manner, when the chain changes the draft or depth in the body of water, such as from a submerged to a surface position, the containers will be angulated with respect to each other in a vertical plane. The amount of flexible movement or angulation is predicated upon the length of the container modules, that is the size of the container modules in the direction of movement thereof. A greater degree of flexing would be required for longer container modules. Thus for the average sized container modules including the super constant modules, the average degree of angulation in a horizontal plane between two container modules will be about 1°. Furthermore, the average degree of angulation in a vertical plane between two container modules, that is the degree of flexing between two modules as the depth thereof changes, is about 2°, ranging to 10°. Various forms of coupling means in accordance with the present invention may be used and which permit the angulated movement are described and illustrated in more detail hereinafter.

A series of sub-modular containers, often referred to as sub-modules or sub-modular containers are also provided for removable disposition into any of the container modules of the present invention such as the container module C_1. Certain embodiments of these sub-modular containers are illustrated in FIGS. 1D through 1F and FIGS. 1H through 1K. FIG. 1D illustrates a pair of air containerization sub-modular containers 70 which are preferably constructed of the same materials used in the construction of the modular container C_1. FIG. 1E illustrates a pair of sub-modular containers which are not pressurized but which are capable of containing dry goods, bulk material or fluid material as desired. As illustrated, a pair of the sub-modular containers 72 are designed to be located in side-by-side relationship for removable insertion into the container C_1. FIG. 1F discloses another form of sub-modular containers 74 which are similar to the container 72 in construction. However, the sub-modular containers 74 are sized so that they are vertically disposed within the modular container C_1 and four of the sub-modular containers 74 are provided for simultaneous insertion into the modular container C_1. FIG. 1G discloses a pair of modular containers C_1 connected together in endwise relationship with a plurality of sub-modular containers rigidly retained therein after the end closure panels 60 and the side closure panels 56 and 58 are secured in place.

FIG. 1H illustrates another form of pressurized sub-modular container 76 which is semi-rigid in its construction, but is capable of being pressurized and is designed for the retention of dry goods material. FIG. 1J also discloses a sub-modular container 78 which includes a collapsible tank-bag for the retention of fluids. This type of sub-modular container is often referred to as a "tank-bag module." In this connection, it should be noted that the sub-modular container 78 is provided with a top and bottom automatic valve means 80 for access to the interior thereof. FIG. 1K discloses yet another form of sub-modular container 82 in collapsible form for the retention of bulk materials which may include for e.g. various forms of solids, such as ores, grains, or the like. This form of sub-modular container 82 is often referred to as a "bulk sub-module." The container 82 is also provided with a hopper plate 84 on its top wall and a discharge port having a hopper plate 86 thereover on the bottom wall thereof. These sub-modular containers 76, 78, and 82 are also sized for insertion into the modular containers C, such as the container modules. FIG. 1L illustrates a pair of the modular containers C_1 connected in endwise relationship to form one ISO-size with any of the sub-modular containers disposed therein. It should be observed in FIG. 1L that the sub-modular containers have access means exposed through elongated rectangularly shaped apertures 87 formed in the top wall of the modular containers C_1 and the closure plate 87 exposed through an elongated rectangularly shaped aperture 88 in the bottom wall of the modular container C_1.

The access means 84 which is employed in the sub-modular container 82 is more fully illustrated in FIG. 2B in disposition over a hopper. A similar hopper is again located on the bottom wall of this sub-modular container. The valve arrangement is used in the modular container 78 is an automatic valve which is again more fully illustrated in FIG. 2. In like manner an automatic valve 80 of this type would also be located in the bottom wall. Thus, the container 82 may be suitably designed for the retaining of the bulk solids in the manner as previously described and the container 78 would be designed for retention of bulk liquids featuring filling discharge by gravity. Furthermore, the tank-bag modular container 78 may be constructed in collapsible form.

It can be observed that each of these sub-modular containers when inserted in container modules C are included in the chains as the container modules can be connected together in endwise relationship as illustrated in FIG. 2. It should also be observed that these container modules are only some of the forms of containers which can be used and coupled to form a sea chain and in this sense are non-limiting embodiments. Furthermore, the sub-modular containers can be constructed of such size so that only one or otherwise a plurality of these sub-modular container may be removably disposed within a container module C. Each of the sub-modules 76, 78 and 82 are also provided with upper depending side flaps 89 and lower upstanding side flaps 90 on each of the opposite sides thereof for purposes of securing the sub-modules into the container modules such as the module C. Thus, a portion of the side walls of the sub-modules illustrated at 92 is of a flexible construction.

The coupling means are used to removably connect the container modules in two or more directions to form a chain of these container modules as illustrated in FIG. 9. An individual coupling sleeve 66 is illustrated as being secured to the transverse margins of each of a pair of longitudinally abutting container modules C_1. The coupling sleeve 66 on each of these container modules is provided with a plurality of outwardly projecting hydro-pneumatic coupling lock devices 94 on both of its opposite end faces 96. These lock devices 94 are sized to engage with and cooperatively lock with coupling collars 98 (FIG. 2) on the end closure panels, and in some cases the side closure panels of each of the modular containers C_1. Furthermore, these lock devices 94 are designed to react with the coupling collars 98 on the modules and lock automatically on impact. In this way, each of the lock devices 94 within one coupling sleeve 66 can also be released simultaneously through hydraulic releases. Coupling of the various container modules in a desired orientation is facilitated by means of alignment cones 100 also formed on the end face of the coupling collars 66. These coupling mechanisms are more fully illustrated in FIGS. 10 and 11 and as aforesaid, are described in more detail hereinafter.

The ballast chamber plate 68 is designed to be retained by the coupling sleeve 66 and internally includes a ballast chamber. Each ballast chamber would preferably, though not necessarily, contain its own electric evacuation pump (not shown) and also a rigid porous core 101 to prevent collapse of the interior chamber walls under evacuated conditions. In actual operation, the ballast chambers in each of these ballast chamber plates 68 for all of the container modules in a chain would be controlled from a computerized guidance system from a lead power module in a manner to be hereinafter described in more detail.

As stated previously, each of the sub-modular containers are insertable into container modules C_1 for transport thereby. In many cases, the sub-modular containers can be constructed of a size which is almost equivalent to the interior cavity of a modular container so that only one sub-modular container fits within the internal cavity of a container module C. This arrangement is more specifically illustrated in FIG. 2 showing modules C_2. In this connection, the submodular container would thereby be provided with extending guide flanges **102** which are adapted to locate the standard sub-modular containers into the cavities of container modules. In this arrangement, the sub-modular containers would be inserted into the container module C_2, and thereafter the side closure panels **58** would be secured to the container frame. FIG. **2** also illustrates a pair of container modules connected together by means of the coupling system previously described. In most cases, side panels are not attached to the container modules which are provided with the submodular inserts of FIGS. **1H** through **1K**, particularly when adapted for submarine use. However, in some cases, particularly when the modules may be also scheduled for overland travel as well, it may be desirable to attach the side panels. In this connection, it should be noted that the bag-like portion of the submodule or as it is often called "modular insert," is sufficiently thick and durable to withstand any abuse received in underwater operation.

Thus, when all of the container modules have been coupled both laterally and longitudinally, they can form a chain of these containers which are of ISO-size such as in the manner as illustrated in FIG. **8.** It should also be observed that the container modules are connected to each other both laterally and longitudinally so that the modular containers extend in a longitudinal direction with respect to the movement of the sea chain. However, it should also be understood that the container modules could be oriented in such manner that the longitudinal axis thereof is perpendicular to the direction of movement of the chain. For lateral coupling of two or more container modules coupling devices on the lateral margins of the coupling sleeve **66** may be optionally employed.

It should also be observed that certain of the container modules could be constructed of a size which are multiples of the modules C_1. Thus, for example, a container module having a size of twice the length of the module C_1 to form an ISO-sized module [such as the module C_2], could be employed, or twice the width, or any multiple thereof, could also be employed in the formation of the sea chain. It is generally desirable though not necessary to have any modular container with a size which constitutes a direct multiple of the normal modular container C_1. [Thus, while most of the constant modules including the super-constant modules are of multiple sizes, the magnum modules are not necessarily of this multiple size arrangement.]

Container modules can be constructed with a much larger size so that they serve as a pressure cell for retention of gases and other forms of fluids. When constructed as a pressure cell, typically, the container module will have a stressed skin steel exterior hull with a plastic interior core. It has been found that these types of gas pressure cells in just the super-constant modules can be constructed to hold approximately 1,425,000 cubic feet of a gas at approximately 600 pounds per square inch. Furthermore, the container modules can be designed so that they can carry other forms of cargo, other than bulk solids and fluids, discrete materials and the like. For example, the magnum constant modules hereinafter described in more detail can be designed with a floor or base plate for receiving truck trailers or other large load bearing structures. In this case, the modular container can be designed so that it is capable of receiving one or more of these truck trailers or similar vehicles, or other forms of freight for that matter. These modular containers would also be constructed with a stressed skin steel exterior hull having an interior plastic core structure. Furthermore, the container module would probably be formed with one end plate rigidly secured thereto and an opposite end closure panel which serves as a swingable end wall having a pressure cell lock. Typically, a pneumatic seal would be provided for releasibly locking the closure panel in place in a fluid type condition.

The modular containers used in the present invention can assume any of a variety of constructed forms. Thus, FIG. **3** discloses in vertical cross-section a modular container C_3 which is similar to the modular container C_1 or C_2 and having top and bottom walls **104, 106** respectively and end closure panels **108.** This module is also shown with side closure panels **100.** Furthermore, the modular container C_3 is divided into a pair of container chambers **112** and **112'** by means of a mobile bulkhead **114.** In some cases, the bulkheads **114** may be fixed or they may be shiftable to form individual internal chambers of varying sizes. The top wall **104** may be provided with an aperture for receiving the automatic valve arrangement or hopper arrangement on a sub-modular insert in the manner as illustrated in FIG. **4.**

FIG. **4A** illustrates in vertical cross-section the tank-bag modular container C_3 which is provided with a tank-bag sub-module insert similar to the tank-bag submodular container **78** illustrated in FIG. **1J.** In this case, the modular container C_3 also includes a top valve mechanism **120** on the tank-bag module insert. A top hopper mechanism **122** is located on the bulk module insert projecting through the aperture **116** in the manner as illustrated in **4B** of the drawings. A bottom valve **124** (FIG. **4A**) on the tank-bag module insert and a bottom hopper mechanism **126** (FIG. **4B**) on the bulk module insert project through the aperture **118** on the bottom wall **106.** The flexible bag-like portions which form each of the modular inserts are preferably formed of a plastic material such as a fairly durable synthetic rubber, polyethylene, polybutadine, polyvinyl chloride or similar forms of plastic material.

It has been found in connection with the present invention that the tank-bag modules of the type illustrated in FIGS. **3** and **4** can be designed to carry at least 100 barrels of crude oil which is approximately 560 cubic feet of oil. In addition, the tank-bag modules C_3 of the type illustrated in FIGS. **3** and **4** can be used for the transporting of ore materials and in this connection, it has been found that one individual modular container of this type can carry 226 cubic feet or approximately 37 tons of iron ore. These automatic valves **120** and **124** may be conventional in their construction, or the may be of the unique construction specifically designed for use herein and these unique valves are described in more detail hereinafter. It should be observed that the valves **120** and **124** could be automatically and/or remotely operable from a central control panel such as in a lead power module in a manner to be hereinafter described in more detail.

The present invention also contemplates the construction of modular containers which are subdivided into interior cells or chambers which are capable of carrying different forms of cargo. Thus, one chamber in a module container may carry one form of bulk liquid and another chamber in the same modular container may carry a different form of bulk liquid. In the case of the tank-bag modules, the bag may form an interior cell capable of retaining ore and the remaining portion of the cavity formed in the modular container can serve as a displacement cell or a pressure cell to receive air under pressure. Thus, the pressure cell can provide for the required amount of displacement.

Furthermore, it should be observed that the interior portions of the modular container can be designed with any type of storage mechanism including tracks for receiving railroad cars, strap type holdings for retaining truck trailers therein or essentially other forms of retaining mechanisms. In this connection, the modular containers can be provided with shelving structures or the like for retaining pallets having cargo mounter thereon and may even include provision on an interior sub-chamber portion permitting the storing of the empty stacked pallets. Thus, an individual modular container can be adapted for holding essentially any type of cargo combination.

Referring again to FIG. **8**, it can also be seen that the chain of modular containers is powered by a lead power module **138** which is preferably nuclear-powered and contains its own automatic guidance and control systems. Essentially any form of powered prime mover may be used, though it is envisioned that nuclear powered modules of this type would provide a greater degree of versatility including range, fuel requirement and the like over ice covered routes. The lead power module is provided on each side thereof with multi-directional water screws **140** which can be articulated through approximately 85° or more for lateral control. The water screws may also be fixed and separate lateral thrust systems can be provided if desired. Furthermore, the module **138** is provided with control fins **142** along with ballast chambers formed in the ballast chamber plates **68** to provide depth control for use in underwater operation. The lead power module **138** is unique in that it can be designed for surface operation on a body of water or for submarine form of operation or both.

Intermediate power modules may be located between one or more rows of modular containers along the length of the chain as required. For relatively short chains of containers, it is only necessary to employ a lead power module. However, where the chains of modular containers are relatively long, one or more stations of intermediate power modules may be required. Where intermediate power modules are required, a power strap **146** extends from the lead power module **138** to the intermediate power modules designated as **148** in FIG. **10**. The power strap **146** is preferably fed from a power strap spool **150** located within or by the lead power module **138** in the manner as illustrated in FIG. **8**. The power transfer may also be integral with the coupling means. When only a lead power module is used no power transfer is required. All systems along the chain are then controlled hydraulically. It should be understood that the lead power module **138** is a manned module whereas the intermediate power modules are preferably unmanned modules. The lead power module would also be provided with control systems to automatically control all of the functions in the coupling systems and the container modules such as ballast control, hopper and automatic valve control and the like. Control systems of this type are conventional in their construction and therefore neither illustrated nor described in any further detail herein.

These forms of sea chains have a wide utility and a wide degree of versatility in that they are capable of both underwater and water surface operation. In this way, the use of sea chains for hauling cargo provides a very significant advantage over any of the transportation means known in the prior art. This type of system is particularly unique in hauling cargo such as oil or other freight forms from areas containing frozen water masses such as the Arctic areas of the earth. In many cases, it is necessary to provide supplies to various outposts in these frozen Arctic areas. All major routes would be shortened by 50 percent through the Arctic polar route. Furthermore, the sea chain would then be independent of surface weather conditions or drag-producing wave action. Generally, the freight is hauled by means of freighters to destinations in bodies of water where the water remains relatively unfrozen. From this point, the freight must then be hauled either over land or by air, which is not only time consuming but highly costly. The transport system of the present invention is uniquely designed so that the modular containers can be pulled by the lead power module and/or the intermediate power modules in an underwater mode of operation. The sea chain can also operate in a surface mode in relatively calm waters such as coastal distribution routes.

The coupling arrangement which is used to connect two or more of the modules of the present invention to form a chain thereof is more fully illustrated in FIGS. **9-11**. FIG. **9** illustrates the coupling system in the form of a coupling frame **66** which may be locked or coupled to the one end wall of a particular container module. As indicated previously, this coupling frame is provided with locking heads **94** on each of the opposite end walls **96** thereof and are capable of being fitted into the recesses or so-called "coupling collars" **98** on the end closure panels of the container modules. The alignment cones **100** would also fit into slight recesses (not shown) on the end walls of the container modules and which would be sized and shaped to receive the alignment cones **100**, merely for permitting the alignment of the two container modules during the locking operation. These alignment columns are also effective in controlling rotation of the various modules during movement thereof in a body of water.

By reference to FIG. **10**, it can be seen that the coupling collar **98** is provided with a tapered annular side wall **160** which integrally merges into a relatively flat back wall **162**. At its outer end, the coupling sleeve **98** is provided with an inwardly projected annular lip **164** which forms with the tapered wall **160** a somewhat inclined annular abutment shoulder **166**. Thus, it can be observed that the abutment shoulder **166** is inclined inwardly and upwardly with respect to an outer wall **168**. This structure forming the coupling collar **98** may actually be in the form of an insert which fits into an aperture in the end wall of the container module, or it may be integrally formed in the end wall of the container module as desired.

The coupling system also comprises a locking mechanism **170** which includes the pair of locking heads **94** on opposite side walls **96** of the sleeve **66**. The locking heads **94** are more fully illustrated in FIGS. **10** and **11** and each generally include an outwardly and inwardly tapering support wall **172**. A plurality of outwardly extending angularly located leaves **174** which are somewhat trapezoidal in shape extend annularly around the support wall **172** in the manner as illustrated in FIG. **10.** These leaves **174** are separated by elongated slots **176** and are integrally formed at their outer ends with the support wall **172** at a hinge joint **178.** At the rearward ends, each of the leaves **174** are tapered inwardly to form an abutment wall **182** which is sized to engage the abutment wall **166** formed within the collar **98.** These locking heads **94** are preferably formed of a fairly hard durable material of construction such as steel or the like.

Thus, by reference to FIG. **10** it can be observed that as the locking head **94** is inserted into the collar **98,** the hinge joint **178** will engage the back wall **162** of the sleeve and the abutment shoulder **182** will engage the abutment shoulder **166** in the collar, thereby providing a locking action. In this connection, the leaves **174** are somewhat yieldable about the integral hinge joint **178** so that they will be biased inwardly toward the central axis of the head **94** as the head passes into the coupling collar **98.** It can be observed that the inner annular margin of the protruding lip **164** will engage the various leaves **174** thereby causing them to yield as the head passes through and into the collar **98.** After the head **94** has completely entered the locking collar **98** so that the hinge joint **178** engages the back wall **162,** the leaves **174** will pivot outwardly about the hinge joint **178** and expand, thereby permitting engagement of the shoulder **182** with the abutment shoulder **166.** It can be observed that this engagement generates a positive locking action so that if an axial tension were applied to the head **94,** the various leaves **174** would only yield radially outwardly thereby increasing the locking action. Furthermore, it can be observed that this construction enables an immediate locking upon impact.

The locking heads **94** are operable in conjunction with a central body portion illustrated in detail in FIG. **10.** An electrically conducted rod **180** which may be insulated extends axially through the hollow body portion **184** and into the locking head **94** for reasons which will presently more fully appear. The body portion has a collar or jacket member **190,** preferably formed of a relatively hard rubber material or like material which is fairly rigid in its construction but which is nevertheless somewhat compressible. In addition a plurality of axially extending (they may also be vertically extending) tensile strands **186** are circumferentially disposed interiorly about the jacket **190** which extend between the two locking heads **94** and are secured thereto at **185** in the manner as illustrated in FIG. **10.** These tensile strands are preferably formed of a high tensile steel material or like material and may alternately be formed of various known fiberous materials such as boron fiber, carbon fiber or the like. These strands are essentially inextensible so that they will not expand when an outward axial tensional force is applied to the locking heads **94.** Furthermore, it can be observed that this yieldable movement of the locking heads **94** will permit angulation between two structures, namely the coupling sleeves **66** and the container module having the coupling collar **98.** Thus, the container modules could pivot downwardly or upwardly through a vertically located arc with respect to the coupling sleeve **66.** The inward axial movement available for the locking heads **94** will permit this action without breaking the coupling between these two members. In addition, horizontal angulation with respect to these two structures can also be permitted through the same action.

A lock ring **188** is disposed about the tensile fibers **186** at locations near the opposite end walls **96** of the sleeve **66.** These tension rings are designed to maintain a locking contact between the tensile fibers **186** and the annular support wall **172.** In addition, the above described rubber jacket or collar **190** surrounds the entire structure in the manner as illustrated in FIG. **10** so that an air-tight pocket **184** may be formed therein, which may be pressurized with any suitable valve means being included (not shown).

Each of the locking heads **94** are provided at their outer ends with electrical conductor clips **192** which may be integrally formed with or otherwise connected to the rod **180.** The rod **180** may, in turn, be connected to any suitable source of electrical current, such as current from any of the power modules used in a sea chain. Furthermore, the conductor clip **192** is protected by an insulating jacket **194** at the outer end of the head **94** and essentially abuts against the connecting ring **178.** The support wall **172** also cooperates with a plurality of circumferentially spaced control webs **195** integrally formed at the rearward ends of the leaves **174** in the manner as illustrated in FIG. **10** for retaining a hydraulic ram **196** which operates against the action of a spring **198.** When the hydraulic rams **196** are actuated, they will cause an axially inward movement of the control webs **195** thereby pulling the leaves **174** inwardly. As this occurs, the overall diametral size of the abutment shoulder **182** will be reduced sufficiently to remove the locking head from the coupling collar **98.** Thus, it can be observed that the hydraulic ram could be connected to a suitable source of hydraulic fluid under pressure (not shown) and also operated remotely from a remote console, such as in the lead power module.

When the coupling sleeve **68** is aligned with a container module and the two are urged together on impact, the locking head **94** will immediately enter the coupling collar **98** and become permanently locked therein until actual release through actuation of the hydraulic ram **196.** As indicated previously, this form of coupling mechanism is unique in that it provides for angulation between two container modules in both the horizontal and vertical plane or any combinations thereof. Thus, if two container modules on opposite sides of the coupling sleeve **66** were subjected to a turning action in a body of water, they would be angulated with respect to each other on a horizontal plane. Since the locking heads **94** are capable of being angulated due to member **186,** this angulation is thereby permitted without breaking this coupling action. In the same manner, if the draft of level of the containers in the body of water is changed, such as from a submergible mode to a water surface mode, the containers would angulate with respect to each other on a vertical plane, also without breaking the coupling action.

As indicated previously, any form of valve arrangement, either a manually operable valve or a semiautomatic valve or fully automatic valve arrangement may be used in certain of the modules of the present invention, such as the bulk fluid container modules and bulk solid modules.

As indicated previously, the modular containers of the present invention may be formed of any multiple sizes. The present invention provides larger container modules or modular containers which are referred to as super constant modules C_4 as illustrated in FIG. **12.** These super constant modules C_4 are also designed for coupling to form sea chains in the same manner as the constant module containers were designed for coupling to form sea chains. FIG. **12** discloses one form of sea chain comprising two columns of these super constant modules laterally joined. These modules are often referred to as "half-width" super constant modules since two columns of endwise connected modules are used to make a chain thereof. Thus, each module is one-half the width of the chain and generally one-half the width of the lead power module as illustrated in FIG. **15.**

Each of the super constant modules is adapted to receive either a bulk liquid tank-bag insert module of the type described, or it may receive a bulk solid submodule, or it may be constructed in the form of a dry goods pressure cell designed to receive standard submodular containers of the type previously described. Furthermore, each of the sub-modular inserts for super constant modules C_4 may be provided with its own internal hopper system and/or valving system which extends through apertures formed in the top and bottom walls of the super constant modules C_4. FIG. **14** shows in vertical cross-section two super constant modules C_4 which are laterally joined. The left-hand module C_4 illustrates a bulk solid bag module which contains either an internal bulk solid type bag insert module **282** or a bulk liquid bag insert module **284** or a combination of both for easy switching between payload types. Furthermore, the top and bottom of the bulk solids bag **282** is provided with a hopper **286.** The bulk liquid bag module insert **282** is also provided with top and bottom valve systems **288** and **290** respectively to allow fill and discharge of the contents contained within the bulk liquid bag **282.** It should be observed that while the module C_4 may be provided with both of these bags **282** and **284**, that typically, the module would only be provided with either a solid material such as an ore in the bulk solid bag **282** or either a bulk liquid such as a crude oil or the like within the bulk liquid bag **284** at any point in time. These liquid bag insert modules **282** and bulk solid bag insert modules **284** would also preferably be formed of any of the aforementioned synthetic resinous materials.

The right-hand super constant module C_4 illustrated in FIG. **14** is designed to carry dry goods pressure cells **292** which receive standard containers **294** which may be the ISO-container or sub-modular container of the type previously described. Again, it can be observed that the pressure cell **76** and/or the standard submodular containers as illustrated in FIG. **1** may be removed from the super constant module C_4 by removal of the side closure panel forming part of the module. In this case, the side closure panel would probably be pneumatically sealed for water-tight operation. Furthermore, it can be observed that several standard submodular containers **294** may be introduced into the pressure cells **292** of the super constant module C_4.

It has been found in connection with the present invention that the super constant modules are capable of containing about 700 tons of ore in each individual super constant modular container. Furthermore, the tank-bag super constant module is designed to carry approximately 8,900 barrels or approximately 1,450 tons of oil. These super constant modules may be designed with their own internal buoyancy cell systems and ballast cells (not shown).

When forming chains of modules C from either the constant modules, such as the modules C_1 or the super constant modules, such as the modules C_4, or even the magnum constant modules, it is preferable to form a flexible coupling arrangement between each of the modules in the chain, in the manner as illustrated in FIG. **13.** By such a construction, in this manner, articulation of the various modules permits a depth control for changing the level of the sea chain in the body of water. Thus, for example, if it is desired to change from a sea surface mode of operation to a submarine mode of operation, the operator in the lead power module will direct the lead power module downwardly, such as under an ice pack, permitting all of the other container modules in the chain to follow. In this connection, the modules may be provided with buoyancy control valves and in many cases with directional water jets. The faired coupling space may be provided by means of spacer pads and bumper pads along with the coupling brackets mounted between each of the modules in the chain.

FIG. **12** illustrates a portion of a chain of half-width super constant modules C_4 in accordance with the present invention. It can be observed that one of the modules is provided with a bulk liquid tank-bag insert module **282** having standard valve arrangements **288** and the module is also provided on the opposite side thereof with another form of modular insert (not shown) and having either hopper or valve arrangements extending through apertures **296** on the top wall thereof. In addition, another one of the modules C_4 is designed to receive three aligned sub-modular inserts **294** which are capable of being introduced into and removed from the side wall of the container module in the manner as illustrated in FIG. **12.**

These chains of half-width super constant modules are also powered by a lead power module **298** which is similar to the previously described lead power module **138** and would include control fins **300** and screw drive means **302** in the manner as illustrated in FIG. **15.** In addition, this lead power module would contain its own internal control and guidance system and the chain of these super constant modules may also be provided with intermediate power modules and introduced between rows of container modules along the length of the chain.

The present invention also provides full-width super constant modules C_5 which are more fully illustrated in FIGS. **17–19** and these full-width super constant modules are similar in their construction to the half-width super constant modules C_4 except that they have a width approximately equal to the width of the chain. Thus, when a chain of these fullwidth super constant modules is formed only one module will exist is any lateral row thereof. Furthermore, these modules have a width which is substantially equal to the width of the lead power module.

The full-width super constant modules are also designed to retain the same forms of tank-bag insert module, bulk solid bag modules or the like and FIG. **19** illustrates one form of tank-bag module insert **304** which may be introduced into one of the super constant modules C_5. Another one of the super constant modules in the portion of the chain illustrated in FIG. **19** is designed to receive sub-modular containers **306.** It should be observed that these modular inserts only extend for half of the width of the full-width super constant modules and therefore, each super constant module C_5 will receive, for example, two tank-bag insert modules **304** or two rows of sub-modular containers **306** and where each of the rows contains approximately three sub-modular containers as illustrated in FIG. **19.** Again, it should also be recognized that the size of these modular containers can be altered and preferably, alteration of the size should occur in multiples of any of the modules hereinbefore illustrated and described. In this connection, it can be observed that the ISO-container modules are basically twice the size of the simple container module C_1 illustrated in FIG. **1.** Furthermore, the super constant modules are also multiples of these basic constant modules C_1. In like manner, the full-width super constant module is a multiple of the half-width super constant module.

The chain of full-width super constant modules is also provided with a lead power module **308** which is substantially identical to the lead power module **298** used in connection with the chain of half-width super constant modules. Furthermore, each of the modules C_4 in the chain thereof or the modules C_5 in a chain of similar modules are coupled in such a manner that fairing or articulation may exist between the various adjacent modules in the chain. Thus, by referring to FIG. **17,** it can be observed that various modules C_5 within the chain will articulate with respect to each other during a lateral shift, such as the type of shift which would occur during a turning movement in the water. Furthermore, articulation would also exist in a vertical direction which would result from a change in depth of the chain of modular containers, as illustrated in FIG. **18.**

A coupling system **310** which is similar to the previously described coupling system involving the coupling frame **66** is also employed for connecting the various full-width super constant modules C_5 or the various half-width super constant modules C_4 to form chains thereof. A coupling mechanism **310** comprises a coupling frame **312** and which is provided with locking mechanisms **314** which are substantially identical to the previously described locking mechanisms **170.** Furthermore, these locking mechanisms **314** have locking heads **316** protruding from each of the opposite end walls thereof and which are designed to mate and engage coupling sleeves **318** formed in the end walls of the container modules upon direct impact. These frames **312** are substantially narrower than the coupling sleeve **66** and do not extend for the full width of the module as illustrated in FIG. **13.** Disposed on each side of the locking frame **312** are vertically extending strips of a fairly durable but yet slightly compressible material **320** and which serve as spacer pads. Also located outwardly of the two spacer pads **320** are a pair of somewhat flexible strips of material which serve as bumper pads **322.** These spacer pads **320** and the bumper pads **322** preferably, though not necessarily, extend for the entire vertical dimension of the two container modules. Thus, by means of this construction, two adjacent container modules which are coupled endwise, may pivot slightly in either the vertical or the horizontal dimension or any complex plane thereof about the locking mechanism **310** in the same manner that two adjacent endwise coupled container modules could pivot about the coupling frame **66.** The spacer pads **320** somewhat limit the amount of fairing movement which is also allowed by the compressibility of the bumper pads **322.** This type of arrangement can be used in either of the half-width super constant modules C_4 or the full-width super constant modules C_5.

In many cases, such as in those areas which are covered with ice surfaces on the body of water, it may be desirable to move chains of modular containers or portions of these chains of modular containers over the ice pack for predetermined distances to a processing facility, for example. In these cases, a power module **510** which is capable of traveling over land may be used to shift a chain **512** of the container modules. Furthermore, the container modules may be loaded on rather large powered dollies or sleds of pneumatic transfer pads **514** which are adaptable for movement over an ice pack, as illustrated in FIG. **20.** The power module **510** would be adapted for movement under the control of an operator on the packed snow or ice cover as indicated and could pull several of the containers for a desired distance to a processing station or the like. These powered devices would normally include a source of power such as a hydrocarbon combustion engine or the like and would be provided with crawlers or other ground engaging device adapted for movement on the ground surface conditions. The dollies **514** may also be powered uner control of the lead power unit **510** if desired.

The magnum constant module are more fully illustrated in FIGS. **21–27** of the drawings. These magnum constant modules C_6 are in many respects similar to the other modules described above and can be constructed of a size where they are multiples of the previously described modules. The magnum constant modules of the present invention are nevertheless constructed of a substantially larger size than any of the previously described modules, including the super constant modules, and are specifically designed for retention of large quantities of cargo or large bulk cargo.

One of the magnum constant modules C_6 which is illustrated in FIG. **21** includes and outer housing **532** which is subdivided into a plurality of longitudinally spaced laterally extending chambers **534** by means of a plurality of laterally extending dividers or so-called "bulkheads" **536.** Some of these chambers **534** are provided with support racks **538** in order to support a truck trailer **540,** or a railroad car or the like. Thus, by further reference to FIG. **21,** it can be observed that a pair of vertically disposed truck trailers **540** may be disposed in one chamber **534** in accordance with this arrangement. In like manner, the other chambers **534** may be designed for the retention of various other modules such as some of the ISO-modules or other forms of constant container modules **542** in accordance with the present invention. In this connection, several of the chambers **534** may be provided with several levels of intermediate horizontally disposed support plates **544.** In this way it is possible to support loads of material on pallets **546** or the like. In yet other chambers, these chambers are provided with bulk-solid insert modules **547** for the retention of bulk liquids. In like manner, the entire chamber may be filled with a low density bulk solid material as illustrated at **548.**

Thus, it can be observed that the magnum constant modules C_6 of the present invention are highly versatile in that they can carry a wide variety of cargo options. It should be understood that each of these modules C_6 could carry only one form of cargo such as truck trailers or railroad cars or the like, or all bulk materials, or the like. Each of the modules are also provided with a primary ballast cell **549** at each transverse end of the module for depth control in a water medium. In addition, due to the variance in weight of the modules when in the loaded or unloaded condition, in many cases, it is desirable to provide a pair of secondary buoyancy cells **550** at each transverse end of the module and which are often referred to as "buoyancy control cells." The primary ballast cells **549** and the secondary ballast cells **550** would also be either individually controlled on each module or controlled in unison from a primary source such as the lead power module. In addition, due to the respective sizes of these magnum constant modules C_6, the modules are oftentimes provided with their own internal complimentary ballast cells **552** and these ballast cells may be individually controlled for each module or all ballast cells of all modules may be automatically controlled from a remote source, such as the lead power modules previously described.

FIG. **22** illustrates in vertical sectional view, the interior portions of a tank-bag magnum constant module C_6 and which also includes an outer housing **554** divided into a plurality of compartments **556** by internal dividers or in the form of transversely extending walls **558.** Each of these compartments **556** is designed to hold a flexible tank-bag **560** thereby dividing each individual compartment **556** into a pay-load chamber **562** as well as an internal void area **564.** When the modules C_6 are not being used for the transport of a pay-load, such as a bulk fluid, the pay-load chambers **562** are provided with a ballast water so that they assume the shape as illustrated in FIG. **22.** The void areas **564** could then be filled with sea water in order to maintain proper weight control of the module C_6.

FIG. **22** illustrates the form assumed by the tank-bags **560** when filled with a bulk fluid. It can be observed that the bags **560** essentially fill out the total area of the individual compartments **556** except for a small space **564** which may be again filled with a sea water or the like. In this case, it can be observed that the tank-bags **560** are essentially impervious to water and therefore contamination of the pay-load such as the bulk fluid will not be contaminated by the sea water. Furthermore, each of the compartments are provided with their own intake valve **556** on the top wall thereof for introduction or removal of the fluid contents in the tank-bag **560.** In this connection it should be observed that it is also possible to provide a discharge valve (not shown) on the bottom wall.

It should be observed in connection with the modules illustrated in FIG. **22** that the various compartments **556** and **568** could be provided with insert modules of the type previously described, except of a larger size to accommodate the various chambers **556** and **568.** In addition, each of the modules illustrated in FIG. **22** provided with primary ballast cells **584** which are substantially identical to the previously described primary ballast cells **550,** and they may also be provided with secondary ballast cells **586** which are similar to the previously described secondary ballast cells **552.**

It has been found in connection with the present invention that the modules C_6 illustrated in FIG. **22** are capable of holding approximately 166,000 barrels or approximately 27,080 tons of oil. And, therefore, a 14 module chain is capable of handling approximately 232,000,000 barrels. In like manner, the magnum constant modules previously described are capable of handling 28,670 tons of a solid bulk material.

Chains of these super constant modules can also be formed in the same manner that chains of the other container modules were formed in accordance with the present invention. Thus, referring to FIGS. **23** and **24,** it can be observed that a chain of super constant modules C_6 is powered by a lead power module **590** which is similar to any of the previously described lead power modules. In like manner it is also possible to use one or more intermediate power modules (not shown) and which also may be controlled under the guidance of the lead power module **590.** These modules are also capable of underwater or surface sea travel in the manner as illustrated in FIGS. **23** and **24.** In this case, each of the modules are provided with a faired coupling mechanism **592** which is more fully illustrated in FIGS. **25-27.** Thus, referring again to FIG. **23,** it can be observed that this faired coupling mechanism **592,** to be hereinafter described in more detail permits angulation between two magnum constant modules in a vertical plane to permit depth change as illustrated in FIG. **23,** or angulation between two adjacent container modules C_6 in a horizontal plane to permit directional changes, as illustrated in FIG. **24.**

The coupling mechanism for the modules is generally formed on each of the opposite end walls of the magnum constant modules, and may be constructed according to the above embodiments or by conventional technology.

FIG. **25** illustrates the exterior view of the coupling mechanism **592** when two container modules are angulated with respect to each other in a vertical plane. In like manner, FIG. **26** illustrates the exterior view of a coupling mechanism **592** when two magnum constant modules are angulated with respect to each other in a horizontal plane. Thus, it can be observed that the exterior appearance of the coupling mechanism is one of continuity in the form of a continuous wall between the two endwise located magnum constant modules.

In order to prevent uncontrolled rotation between the coupled magnum constant modules of the present invention, the end walls of one of the modules are provided with pairs of upper and lower outwardly extending brackets **616** which retain roller bearings **618** in inwardly presented arcuate recesses **620** formed therein. These roller bearings are designed to engage with outwardly extending guide flanges **622** on the end wall of an opposed magnum constant module. The guide flanges **622** are provided with arcuate guide faces **624** in the manner as illustrated in FIG. **27.** Thus, by means of this construction, two magnum constant modules are permitted to angulate with respect to each other in any of a plurality of complex planes including the horizontal and vertical planes. However, this bracket and guide flange arrangement will prevent rotation of the various magnum constant modules during angulation thereof or during movement through an aqueous medium.

The chains of magnum constant modules may be processed in the same manner as any of the other sea chain modules in the present invention. Thus, these modules are capable of being loaded and unloaded on barge type structures, or at harbor facilities and in both underwater and surface water operation. area **630** until the draft of the module was greater than the land shelf **632** beneath the surface of the water. At this point, a dock alignment slide track **634** which is located on an inclined ramp **636** will engage the rearward end of the module C_6 and pull the same upwardly above the water level **638**. The end closure panel of the magnum constant module C_6 may be removed for the ultimate removal of sub-modular containers **640** which also may take the form of ISO-modules or other forms of containerization.

It can be observed that the transport system of the present invention is highly unique and provides many distinct advantages over conventional transport systems. The transport system illustrated and described herein enables year-around Arctic access from essentially all markets. Because of the unique versatility of the chains of modular containers, numerable routes with time and distance savings can be achieved. In addition, the sea chains of these modular containers enable sea-land transferability with high efficiency. Furthermore, the sea chains of these modular containers permit unlimited cargo flexibility which is not otherwise attainable with the various prior art modes of transport. Because of the highly automated nature of handling the sea chains in the processing facilities, there is a significant reduction of labor. Furthermore, high capital investment is substantially reduced because the terminal facilities may be mobile thereby eliminating the need for large and expensive stationary installations. Due to the unique design of the processing facilities which may be used for these modular containers, even the permanent harbor installations only require low capital investment.

These sea chains provide the combined advantages of bulk shipping, containerization, and lash-type barge systems. Because of the means employed in the powering of these vehicles, there is an inherently high degree of pollution safety. Furthermore, pollution safety is achieved through the employment of modules with a high degree of compartmentation of bag inserts. In addition, the sea chains are not subject to the same dangers of collision and resulting break-up or sinking as conventional vessels. Furthermore, the systems of the present invention permit a wide range of failsafe characteristics on a continuous flow basis.

The transport system of the present invention also provides a great flexibility and security for resource flow. The flexible marine modes of operation are highly effective in specialized naval operations. In addition, these systems provide new options for logistics planning. Because of the great flexibility inherent in this type of transport system, these systems have long-range future advantages in providing new industrial and marketing patterns, new areas of urbanization and new options for coastal land development as well as new options for freight handling facilities. They provide the inherent significant annual savings in fuel costs and significant economics of loading and unloading at the various processing facilities.

Thus, there has been illustrated and described a unique transport system which fulfills all of the objects and advantages recited therefore. It should be understood that various changes and modifications can be made in the form, construction, arrangement and combination of parts presently described and pointed out without departing from the nature and principle of our invention. Therefore, any and all such changes and modifications which do not depart from the nature and principle of our invention are deemed to be covered by the invention which is limited only by the following claims.

Having thus described my invention, what I desire to claim and secure by Letters Patent is:

1. A transport system comprising a plurality of modular containers capable of being liquid sealed for travel on the surface of a water medium and submergible travel through a water medium, each said modular container having an interior cargo receiving cavity, means subdividing said cavity into a plurality of compartments adapted to receive various types of cargo, and at least one opening in a portion of each said modular container communicating with said cavity, at least one submodular container sized for disposition into each of said plurality of compartments, each of said submodular containers having an aperture therein for the introduction of cargo thereinto, a closure member disposable over said aperture for closing each said submodular container, closure means disposable over said opening in said modular containers in liquid sealingwise condition thereto, a two way coupling member adapted for operative interposition between two of said modular containers, fluid actuable lock devices associated with said coupling member and cooperatively engagable with coupling elements in said modular containers for coupling each one of said modular containers to another of said modular containers to form a chain of these containers, and power means operatively associated with said containers and adapted to transport said chain of modular containers in submergible travel through and on the surface of said water medium between two or more geopgraphic points.

2. The transport system of claim **1** further characterized in that said fluid actuable lock devices on said coupling member are mechanically expandable upon engaging with the coupling elements in said containers and are fluid retractable.

3. The transport system of claim **1** further characterized in that said coupling member is a collar which is provided with a ballast chamber, and means for controlling water level in said ballast chamber to thereby control the draft of a chain of modular containers.

4. The transport system of claim **1** further characterized in that each of said modular containers are provided with a ballast chamber, and means for controlling water level in said ballast chamber to thereby control the draft of said containers.

5. The transport system of claim **1** further characterized in that flexible bag-like sub-modular containers are provided for removable insertion into said modular containers.

6. The transport system of claim **1** further characterized in that flexible bag-like members which are collapsible are provided for removable insertion into said modular containers and adapted to carry bulk materials, and means on said flexible bag-like members for sealing same in an air-tight condition.

7. The transport system of claim **1** further characterized in that means is provided for pressurizing certain of said modular containers.

8. The transport system of claim **1** further characterized in that hopper means is provided on certain of said modular containers for introduction and removal of bulk material into at least one of the compartments therein.

9. The transport system of claim **1** further characterized in that automatic valve means is provided on certain of said modular containers for introduction of fluid material into at least one of the compartments therein.

10. The transport system of claim **1** further characterized in that said power means comprises a lead power module having a control system and at least one intermediate power module interposed between two of said modular containers in said chain.

11. The transport system of claim **10** further characterized in that said lead power module provides power to each of said intermediate power modules through said co upling means.

12. The transport system of claim **1** further characterized in that said modular containers are sized for movement on land travel vehicles.

13. A transport system for travel on the surface of a water medium and submergible travel through a water medium, said system comprising at least two laterally connected chains of modular containers, each of said chains including a plurality of endwise connected longitudinally extending modular containers having interior cavities adapted to receive cargo, a coupling collar adapted for operative interposition between two of said endwise connected modular containers in each of said chains, and lock means on said coupling collar cooparative by engaging with cooperating means on said containers for coupling each one of said modular containers to another of said modular containers in endwise longitudinally extending relationship to form said chains of these containers, means operatively associated with said coupling means to permit flexing between two associated endwise connected modular containers in each of said chains in both substantially horizontal and vertical planes, said coupling collar being provided with a ballast chamber to thereby control the draft of the chains of modular containers and power means operatively associated with said chains of modular containers and adapted to transport said chains of modular containers on or through said water medium between two or more geographic points.

14. The transport system of claim **13** further characterized in that the lock means comprises mechanically expanding fluid retractable lock devices associated with each of said coupling collars are cooperatively engagable with coupling elements in said modular containers.

15. A transport system comprising a plurality of modular containers capable of being liquid sealed for travel on the surface of a body of water or submergible travel in said body of water, said modular containers being adapted to be removably endwise connected to like modular containers to form a chain of said modular containers, at least certain of said modular containers having an interior chamber adapted to receive cargo therein, means operatively associated with each such container having an interior chamber for closing such chamber with a liquid tight seal, a coupling member interposable between each of said modular containers in said chain, expandable locking means on each said coupling member and projecting outwardly therefrom and extending toward a juxtaposed endwise located container, and a cooperating locking recess on each of said containers for cooperatively receiving the locking means on said coupling member and locking each of two containers on opposite sides of said coupling member, a first abutment shoulder surrounding each said locking recess, a second abutment shoulder associated with each said locking means which matches the first abutment shoulder and engages therewith when a container is locked to one side of the coupling member, means operatively associated with said locking means to permit flexible movement between each of said modular containers in at least two planes, and fluid operable lock release means operatively associated with said locking means for releasing said locking means from said locking recess.

16. The transport system of claim **15** further characterized in that said coupling member is a two-way coupling collar and that said expandable locking means comprises a fluid operable locking head which is cooperatively engagable with the locking recess in said modular containers.

17. The transport system of claim **15** further characterized in that a ballast chamber is included in each of said modular containers.

18. The transport system of claim **15** further characterized in that a ballast chamber is included in each of said modular containers, and means operatively associated with said modular containers to control water ballast levels in said ballast chambers.

19. The transport system of claim **15** further characterized in that said coupling member is a coupling sleeve and comprises a ballast chamber in each of said coupling sleeves, and means to control water ballast levels in said ballast chamber in each of said coupling sleeves.

20. In a modular container of the type capable of travel on a body of water or submergible travel in said body of water and which are adapted to be removably endwise connected to like modular containers, and at least certain of said modular containers having an interior chamber adapted to receive cargo therein; an improvement comprising a coupling member interposable between two endwise located container modules for operatively locking said two container modules together on impact and where one of said container modules has an end wall with a recess having a first abutment shoulder formed therein, a protruding locking head located on one surface of said coupling member and having a second abutment shoulder which matches the first abutment shoulder and engages therewith when the head is inserted into said recess, tension means operatively connected to said locking head permitting slight angulated movement between said two structures while in the locked position, said fluid actuable release means operatively connected to said locking head for slightly reducing the size of said second abutment shoulder thereby permitting withdrawal of said head from said recess.

21. The improvement in modular containers of claim **20** further characterized in that a protruding locking head is located on an opposite surface of said coupling member and is capable of fitting into a recess in an end wall of the other of said endwise located modular containers.

22. The improvement in modular containers of claim **20** further characterized in that a protruding locking head is located on the opposite surface of said coupling and is capable of being inserted into a recess in an end wall of the other of said endwise located modular containers, and where said last named protruding locking head is operatively connected to said tension means, and is also operatively connected to a fluid actuable release means.

23. The improvement in modular containers of claim 20 further characterized in that said tension means comprises a cylindrical member capable of diametrical contraction and expansion on a plurality of relatively unexpandable tensile elements engagable therewith and being operatively connected to said locking head.

24. The improvement in modular containers of claim 20 further characterized in that said fluid actuable release means comprises a hydraulic ram which is operatively connected to said locking head for urging same out of said recess.

25. The improvement in modular containers of claim 24 further characterized in that said locking head is provided with a plurality of leaf-like members on its outer surface for diametrical constriction upon actuation of said hydraulic ram.

26. The improvement in modular containers of claim 20 further characterized in that said second abutment shoulder is formed on a side of said head facing said coupling member and the first abutment shoulder faces away from the recess.

27. The transport system of claim 13 further characterized in that said modular containers in each of said chains are substantially the same size in both lateral and longitudinal dimensions.

28. The transport system of claim 13 further characterized in that at least one of the modular containers in one of said chains is laterally connected to a juxtaposed modular container in an adjacent chain.

29. The transport system of claim 13 further characterized in that the power means is a main power module located at one of the ends of said chains, and that an intermediate power module is disposed intermediate the ends of at least one of said chains for providing additional power to transport said chains of modular containers.

30. The transport system of claim 29 further characterized in that power strap means operatively connect said main power module to said intermediate power module.

31. The transport system of claim 29 further characterized in that means is operatively associated with said coupling member to operatively connect said main power module to said intermediate power module for power transferences.

32. A transport system comprising a plurality of endwise located longitudinally extending modular containers capable of being liquid sealed for travel on the surface of a water medium and submergible travel through a water medium, each said modular container having an interior cargo receiving cavity adapted to receive various types of cargo, and at least one opening in a portion of each said modular container communicating with said cavity for introducing cargo thereinto, closure means operable with respect to said opening in said modular containers for sealing said containers in liquid sealingwise condition, a separate coupling member interposed between each of said endwise located modular containers for coupling each one of said modular containers to another of said modular containers to form an individual chain of these containers, each of said coupling members comprising a frame which would be located between the juxtaposed ends of two endwise located modular containers, locking means on the frame of each said coupling means and projecting outwardly therefrom and extending toward a juxtaposed endwise located container, and a cooperating locking recess on said containers for cooperatively receiving the locking means on said coupling member and locking each of two containers on opposite sides of said coupling member, means operatively associated with said locking means to permit flexible movement between each of said two modular containers in at least two planes, and power means operatively associated with said containers and adapted to transport said chain of modular containers in submergible travel through and on the surface of said water medium between two or more geographic points.

33. The transport system of claim 32 further characterized in that the locking means is an expandable locking means.

34. The transport system of claim 32 further characterized in that fluid operable lock release means are operatively associated with said locking means for releasing said locking means from said locking recess.

35. The transport system of claim 32 further characterized in that said coupling member is a two-way coupling collar, and that said expandable locking means comprises a fluid operable locking head which is cooperatively engageable with a coupling recess in said modular containers.

36. The transport system of claim 32 further characterized in that said coupling member is a collar which is provided with a ballast chamber, and means for controlling water level in said ballast chamber to thereby control the draft of a chain of modular containers.

37. The transport system of claim 32 further characterized in that flexible bag-like sub-modular containers are provided for removable insertion into said modular containers.

38. The transport system of claim 32 further characterized in that flexible bag-like members which are collapsible are provided for removable insertion into said modular containers and adapted to carry bulk materials, and means on said flexible bag-like members for sealing same in an air-tight condition.

39. The transport system of claim 32 further characterized in that means is provided for pressurizing certain of said modular containers.

40. The transport system of claim 32 further characterized in that hopper means is provided on certain of said modular containers for introduction and removal of bulk material into at least one of the compartments therein.

41. The transport system of claim 32 further characterized in that automatic valve means is provided on certain of said modular containers for introduction of fluid material into at least one of the compartments therein.

42. The transport system of claim 32 further characterized in that said lead power module provides power to each of said intermediate power modules through said coupling means.

43. The transport system of claim 32 further characterized in that said modular containers are sized for movement on land travel vehicles.

44. A transport system comprising a plurality of endwise located longitudinally extending modular containers capable of being liquid sealed for travel on the surface of a water medium and submergible travel through a water medium, each said modular container having an interior cargo receiving cavity adapted to receive various types of cargo, and at least one opening in a portion of each said modular container communicating

with said cavity for introducing cargo thereinto, closure means operable with respect to said opening in said modular containers for sealing said containers in liquid sealingwise condition, a two-way coupling member adapted for operative interposition between each two of said endwise located longitudinally extending modular containers, fluid actuable locking members projecting outwardly from said coupling member and extending toward each of two juxtaposed endwise located modular containers, and a cooperating locking recess on said containers for cooperatively receiving the opposed locking members for coupling each one of said modular containers to another of said modular containers through said coupling member to form a chain of these containers, means operatively associated with said locking members to permit flexible movement between each of said two modular containers in at least two planes, and power means operatively associated with said containers and adapted to transport said chain of modular containers in submergible travel through and on the surface of said water medium between two or more geographic points.

45. A transport system comprising a plurality of modular containers capable of being liquid sealed for travel on the surface of a water medium and submergible travel through a water medium, each said modular container having an interior cargo receiving cavity, means subdividing said cavity into a plurality of compartments adapted to receive various types of cargo, and at least one opening in a portion of each said modular container communicating with said cavity, at least one submodular container sized for disposition into each of said plurality of compartments, each of said submodular containers having an aperture therein for the introduction of cargo thereinto, a closure member disposable over said aperture for closing each said submodular container, closure means disposable over said opening in said modular containers in liquid sealingwise condition thereto, coupling means for coupling each one of said modular containers to another of said modular containers to form a chain of these containers, a lead power module operatively associated with said containers and having a control system associated therewith, and at least one intermediate power module interposed between two of said modular containers in said chain, said lead power module and said intermediate power module being adapted to transport said chain of modular containers in submergible travel through and on the surface of said water medium between two or more geographic points.

46. In a modular container of the type capable of travel on the surface of a body of water or submergible travel in said body of water, and which are adapted to be removably endwise connected to like modular containers to form a chain of said modular containers, and at least certain of said modular containers having an interior chamber adapted to receive cargo therein; the improvement comprising a coupling member interposable between two of said modular containers, expandable locking means including an expandable locking head on said coupling member and projecting outwardly therefrom and extending toward a juxtaposed endwise located container, and a cooperating locking recess on said containers for cooperatively receiving the expandable locking head on said coupling member and locking each of two containers on opposite sides of said coupling member, a first abutment shoulder surrounding each of said locking recess, a second abutment shoulder associated with each said locking means which matches the first abutment shoulder and engages therewith when a container is locked to one side of the coupling member, means operatively associated with said locking means to permit flexible movement between each of said two modular containers in at least two planes, and fluid operable lock release means operatively associated with said locking means for slightly reducing the size of said second abutment shoulder and releasing said locking head from said locking recess.

47. A transport system comprising a plurality of endwise located longitudinally extending modular containers capable of being liquid sealed for travel on the surface of a water medium and submergible travel through a water medium, each said modular container having an interior cargo receiving cavity adapted to receive various types of cargo, and at least one opening in a portion of each said modular container communicating with said cavity for introducing cargo thereinto, closure means operable with respect to said opening in said modular containers for sealing said containers in liquid sealingwise condition, a coupling member interposed between each of said endwise located modular containers for coupling each one of said modular containers to another of said modular containers to form a chain of these containers, locking means on said coupling member and projecting outwardly therefrom and extending toward a juxtaposed endwise located container, and a cooperating locking recess on said containers for cooperatively receiving the locking means on said coupling member and locking each of two containers on opposite sides of said coupling member, means operatively associated with said locking means to permit flexible movement between each of said two modular containers in at least two planes, and a lead power module operatively associated with said containers and having a control system associated therewith, at least one intermediate power module interposed between two of said modular containers in said chain, said lead power module and said intermediate power module being adapted to transport said chain of modular containers in submergible travel through and on the surface of said water medium between two or more geographic points.

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