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(54) **LARGE-SCALE WATERCRAFT STORAGE FACILITY**

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(57) **ABSTRACT**

A warehousing and dry storage system and apparatus are directed to powerboats and yachts from about (30) to (80) feet in length. The basic units of the apparatus comprise at least one horizontally and vertically movable prime mover and a plurality of wheeled cradles or storage frames of very robust construction. The prime mover has a horizontal railed portion upon which rides a tow frame. The tow frame, in turn, is driven by a cable or chain to a reversible electric gear motor for movement of a cradle. The prime mover aligns with heavy structural horizontal frame members of the warehouse. These frame members serve as rails in supporting the wheeled cradles. The wheeled cradles are equipped with boat pads for direct supporting contact with a boat hull. Power yachts, each weighing many tons, can easily be supported in a stacked configuration in racks in an enclosed warehouse with the configuration of the invention.

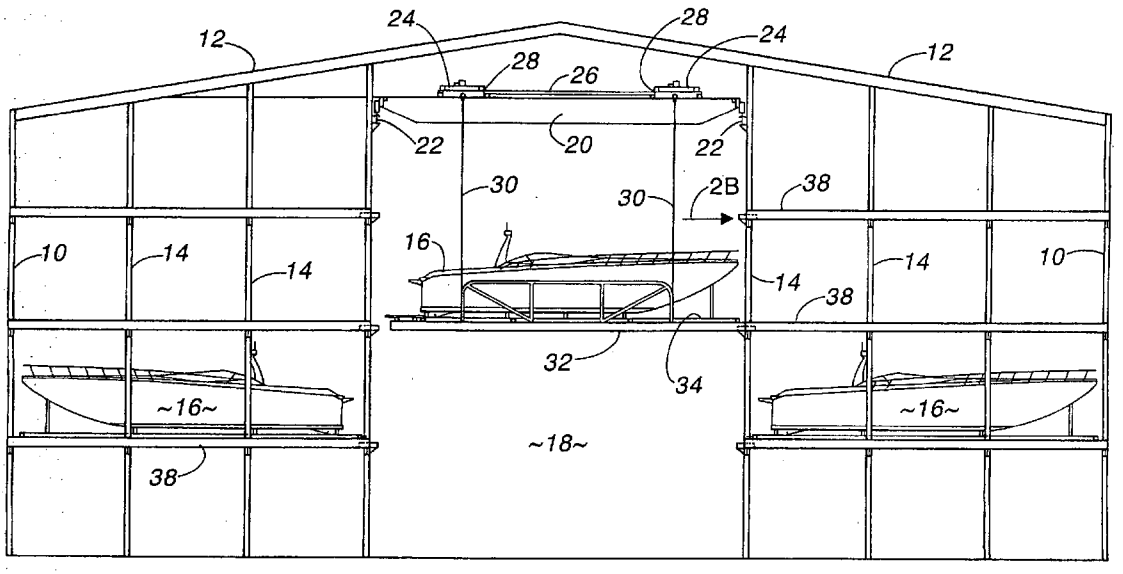


FIG 1

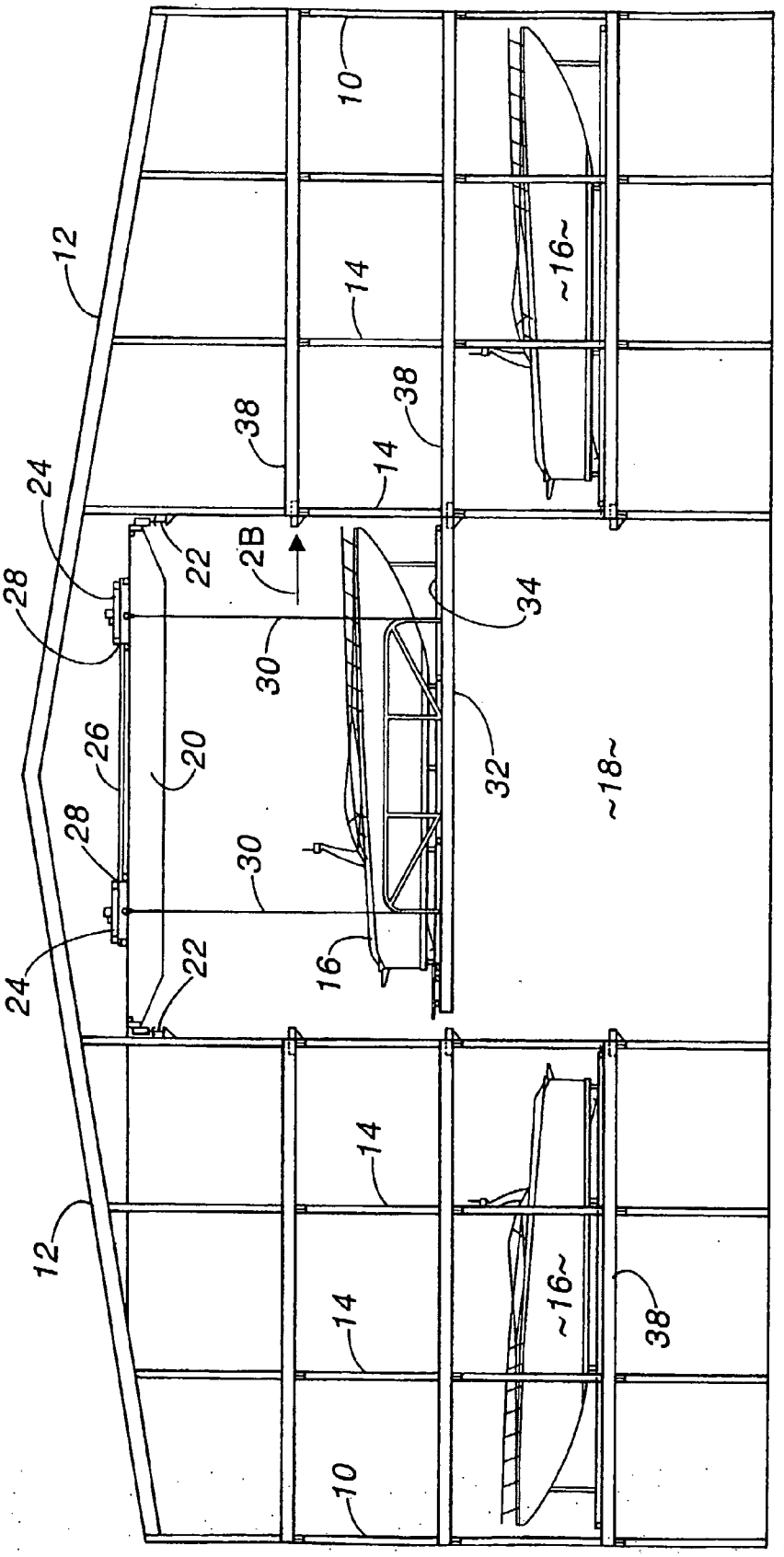


FIG 2

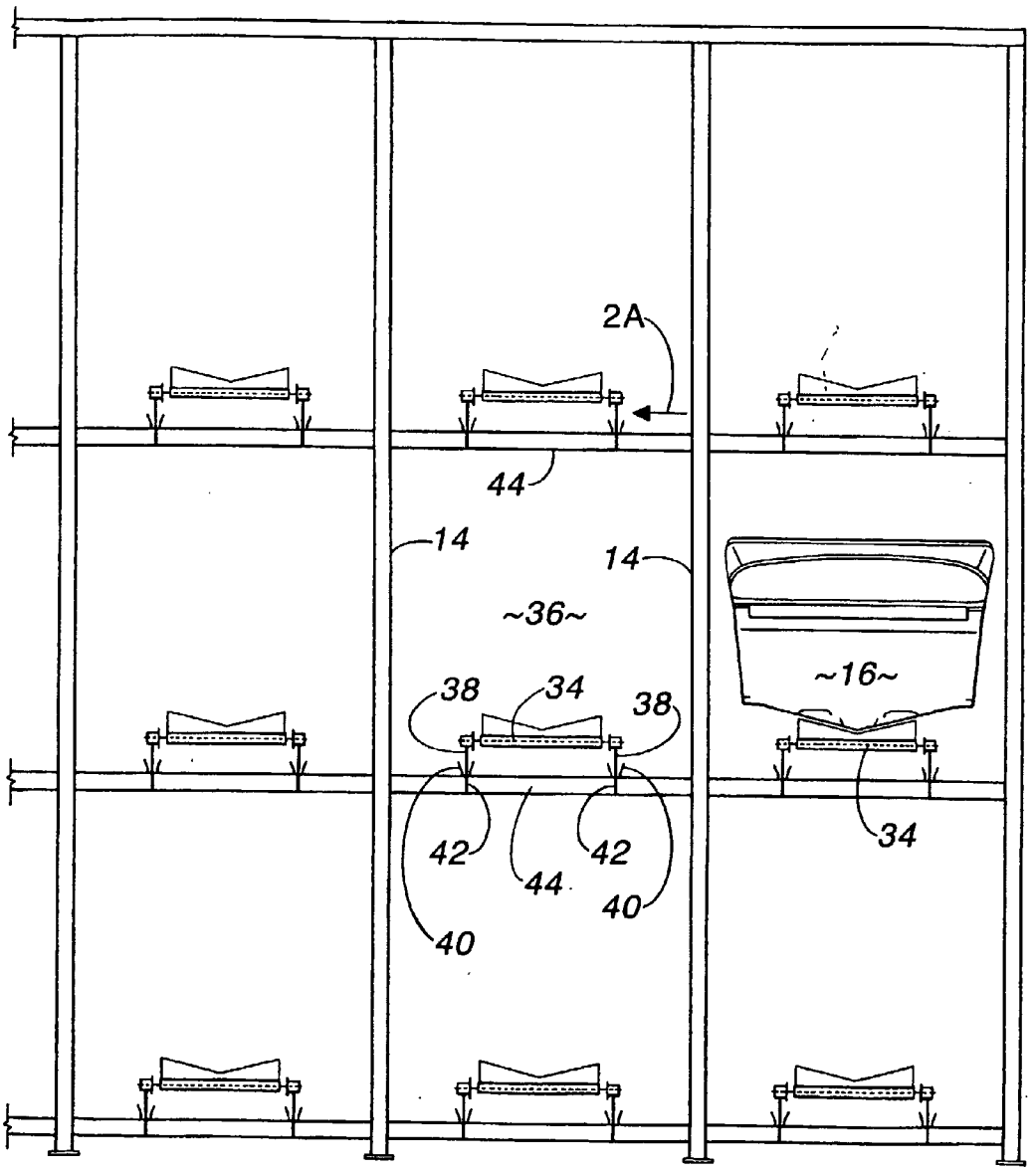


FIG 2A

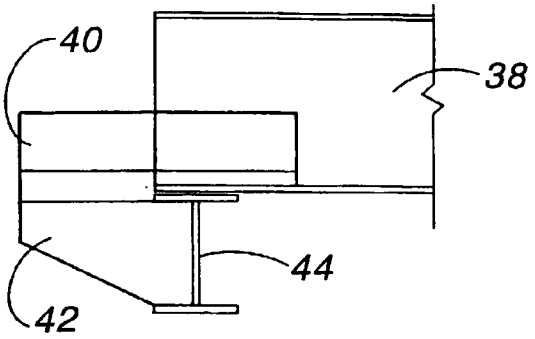


FIG 2B

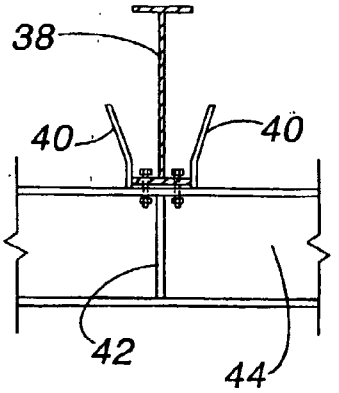
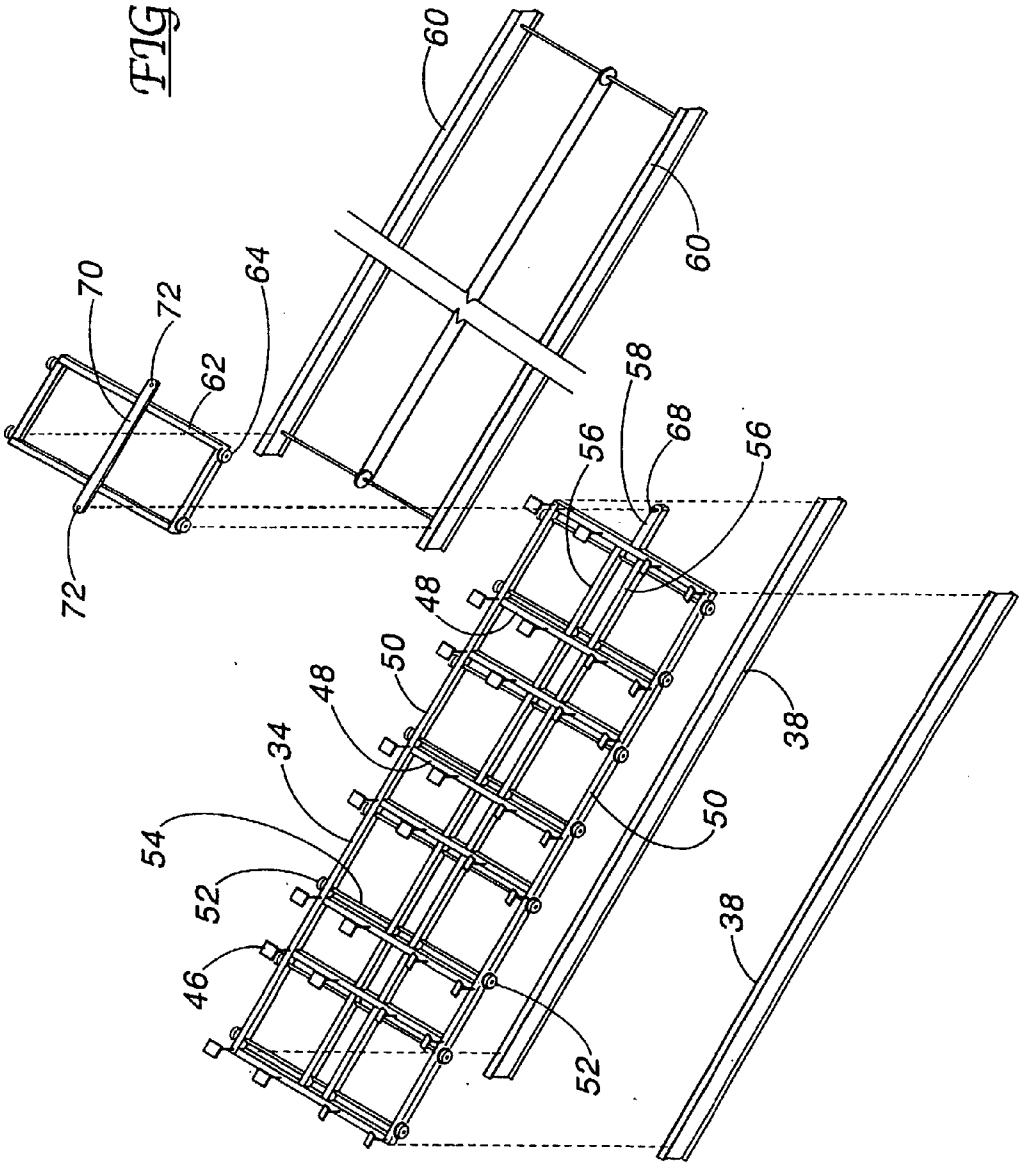


FIG 3



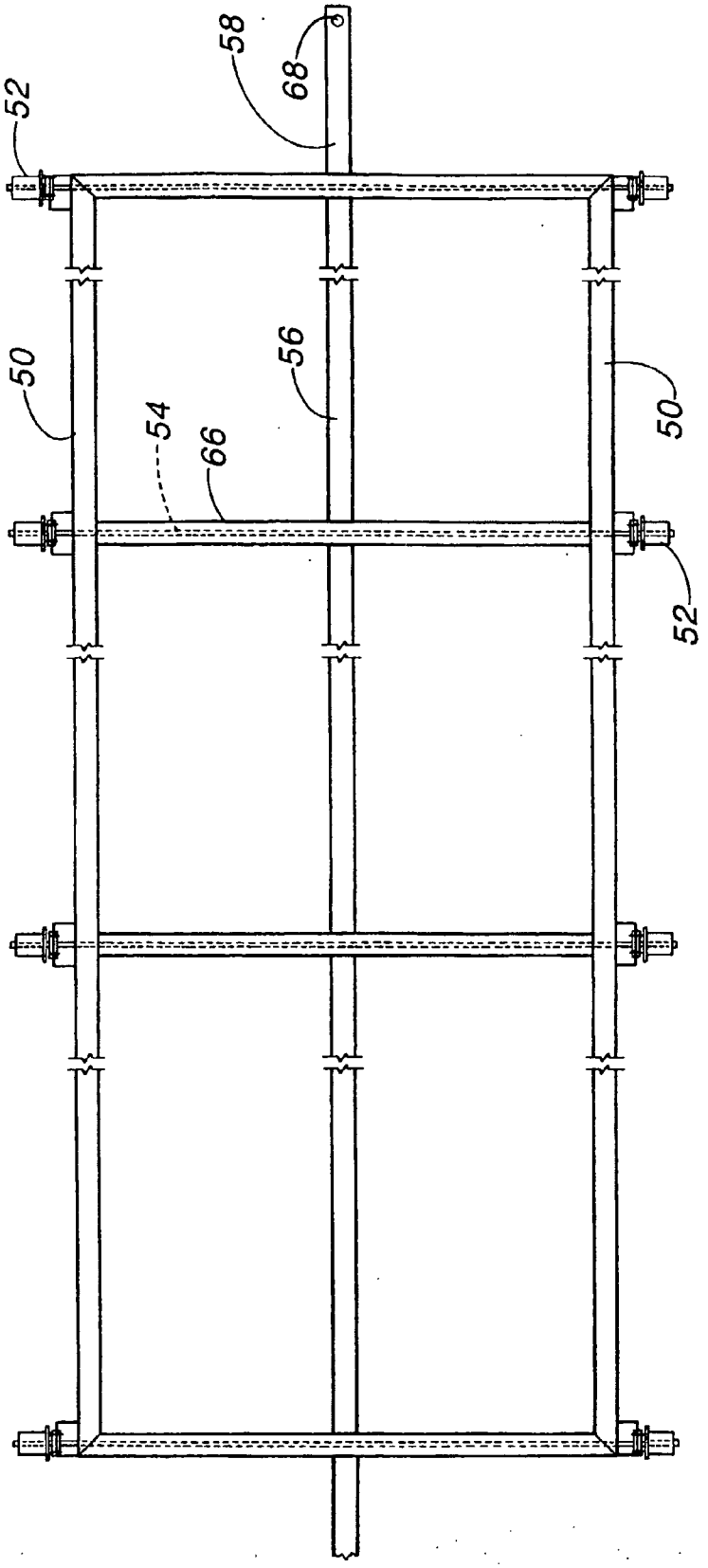


FIG 4A

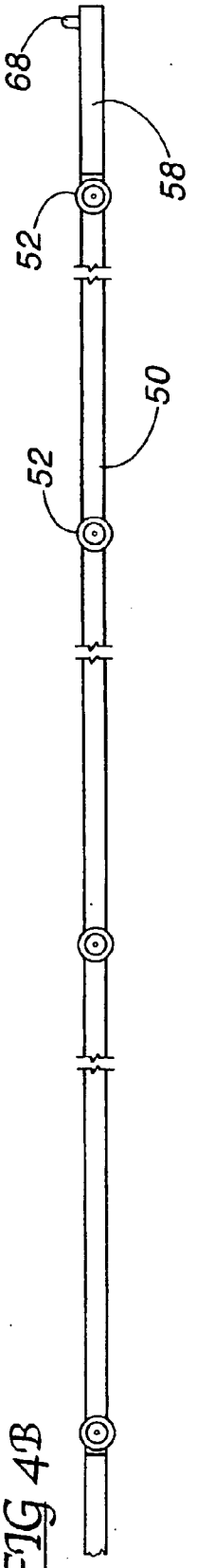
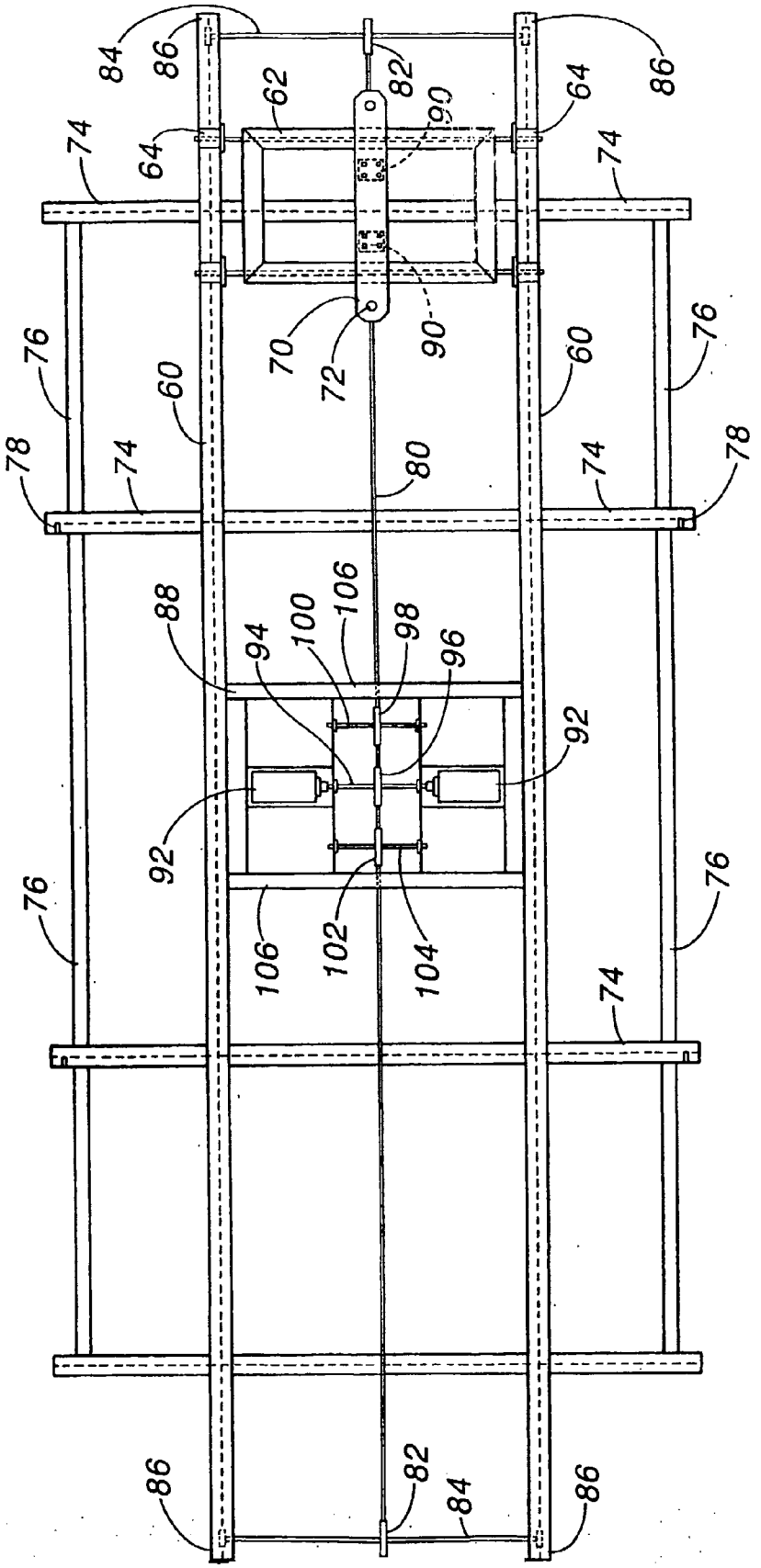


FIG 4B

FIG 5A


84
86
62
82
90
64
86
74
64
74
76
70
72
90
60
76
60
78
74
80
74
78
88
94
100
106
98
96
92
92
76
106
102
104
74
76
86
82
84
86

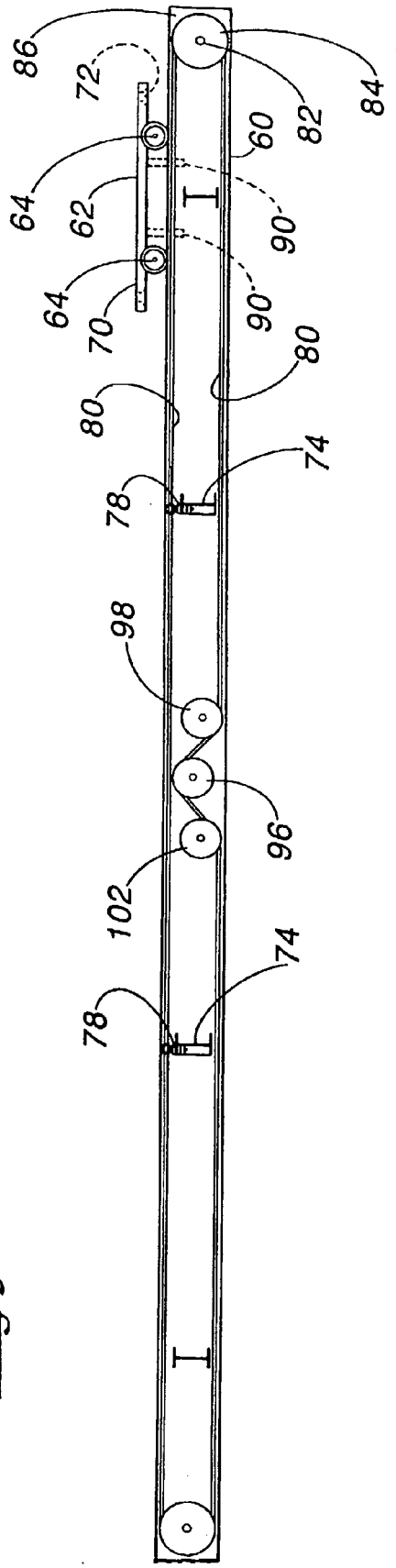

86
72
84
82
60
64
62
90
64
70
90
80
80
74
78
98
96
102
74
78

FIG 5B

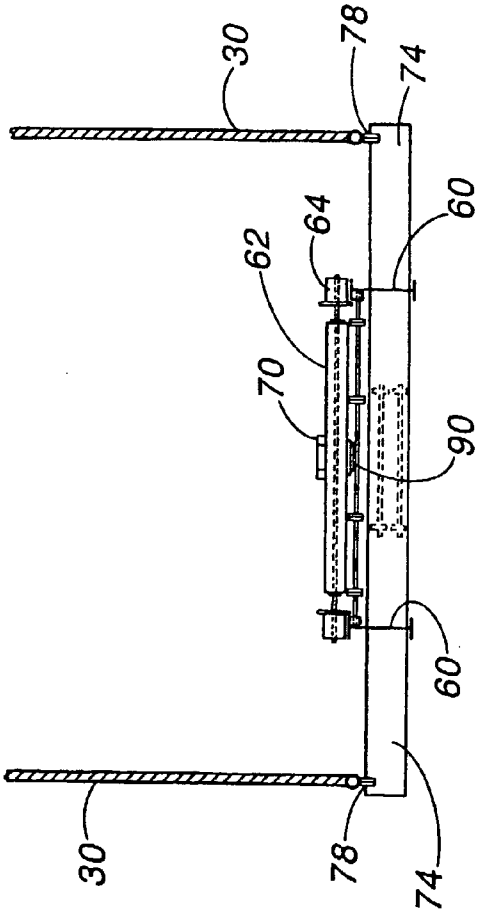

30
78
74
60
64
62
70
90
60
30
78
74

FIG 5C

FIG 6A

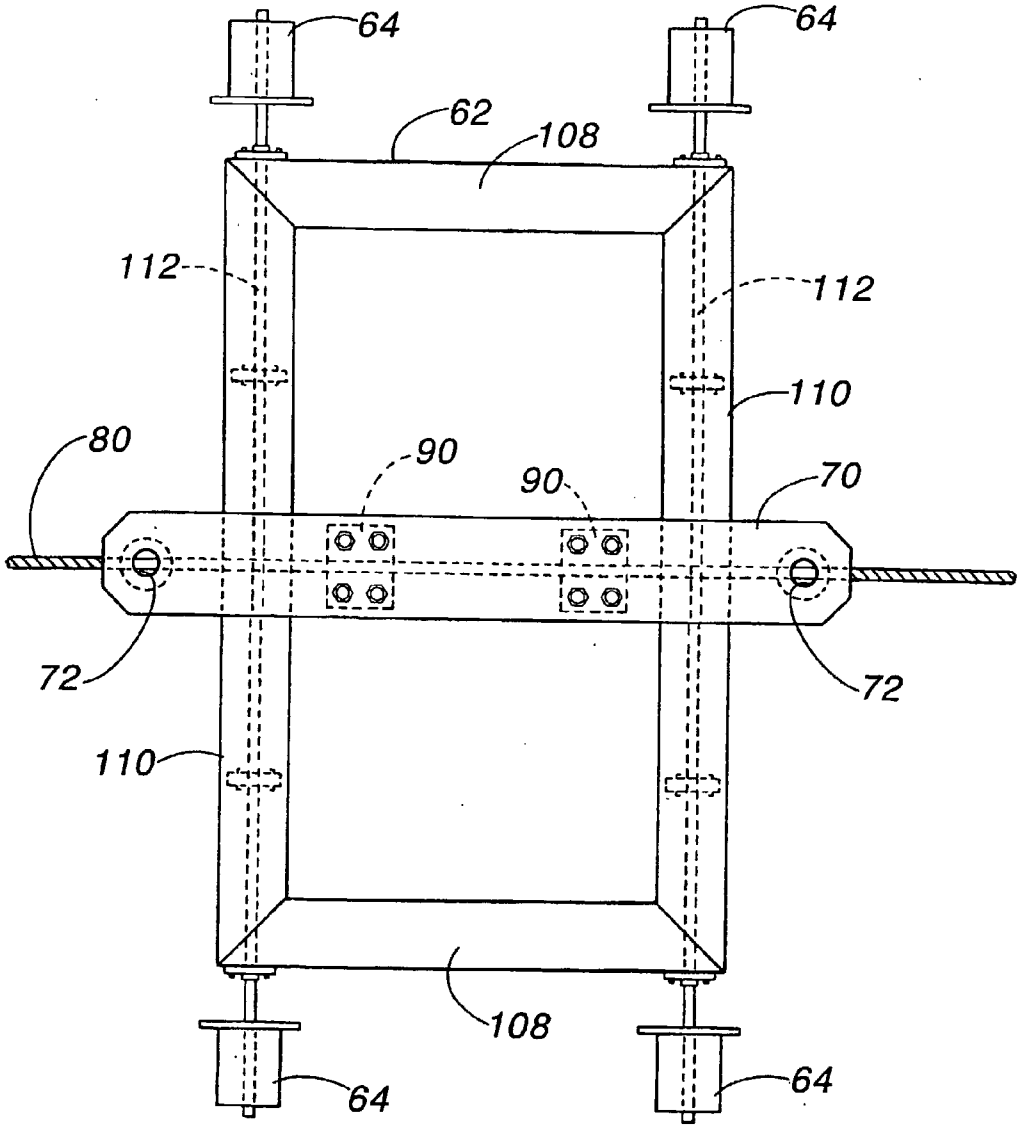


FIG 6B

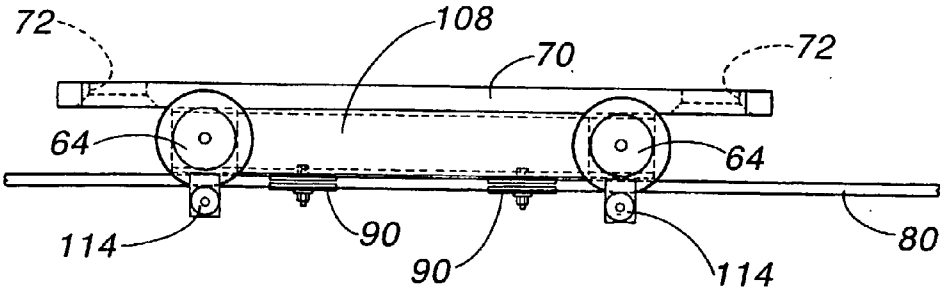
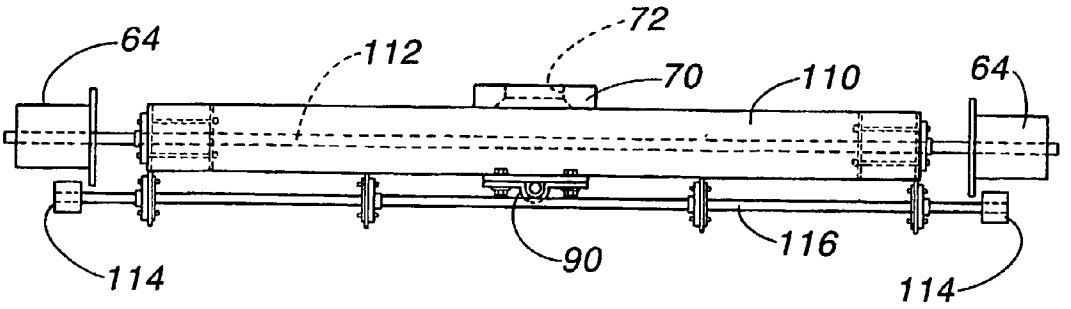

72
108
70
72
64
64
114
90
90
114
80

FIG 6C


64
112
72
70
110
64
114
90
116
114

LARGE-SCALE WATERCRAFT STORAGE FACILITY

BACKGROUND OF THE INVENTION

[0001] The field of the invention pertains to large-scale warehouse and boat storage facilities and, in particular, to the out-of-water storage of motor yachts.

[0002] For storage and repair, motor yachts of about 30 to 80 feet in length are typically hauled from the water in slings suspended from wheeled gantry cranes or in cradles riding on marine railways. Larger yachts require marine railways or dry docks. Smaller yachts utilize trailers towable behind vehicles—usually trucks.

[0003] Powerboats and yachts above about 25 feet in length typically are stored outdoors on trailers or cradles. On occasion, they are stored on wooden blocks and supports. Small boats below about 20 feet in length are now often stored in warehouses on racks. The small boats are placed in, or removed from, the racks with forklift trucks ("hi-lo's"). Such trucks are inadequate for larger boats and yachts for a variety of reasons.

[0004] Since indoor warehousing of a wide variety of other objects up to and including the size of automobiles has become common, there has been some development of more convenient and safer warehousing for small boats. Illustrative of such warehousing is U.S. Pat. No. 6,007,288 wherein the warehouse is equipped with a traveling overhead crane having a specialized cradle to lift a boat. The boat racks comprise frame assemblies to support rack assemblies having cantilever beams to support the boats. While practical for small boats, such a warehousing system is not practical for large powerboats and yachts.

[0005] U.S. Pat. No. 3,786,942 discloses an overhead traveling crane for carrying boats in suspended slings. The suspended slings descend from a first frame that is carried by a second frame in direct suspension from the traveling crane. The first frame is movable horizontally and remains with the stored boat in a rack.

[0006] U.S. Pat. Pub. No. 2002/0176767 discloses a rotatable forklift that travels on rails into and out of the storage area to place boats in storage racks. This design allows relatively low warehouses with low doors to be used.

[0007] Japanese Pat. Pub. No. 2-183055 and No. 2-241891 disclose a relatively low tower for lifting a boat from the water or a trailer and transferring the tower and boat to a second lift where the tower and boat are lifted to a storage location in a rack. The boat is supported on a frame that is moved into, or retrieved from, the storage location.

[0008] French Pat. Pub. No. 2552411 discloses an overhead traveling crane with a telescopic retrieval device for lifting boats from underneath and depositing them in racks for storage.

[0009] While suitable for small watercraft storage, the devices of the prior art are not practical for the storage and retrieval of large power yachts weighing many tons and worth hundreds of thousands, and sometimes millions, of dollars.

SUMMARY OF THE INVENTION

[0010] The new warehousing and dry storage system and apparatus are directed to powerboats and yachts from about 30 to 80 feet in length but are not limited to such sizes. The basic units comprise at least one horizontally and vertically movable prime mover and a plurality of wheeled cradles, both of very robust steel construction.

[0011] The prime mover has a horizontal railed portion upon which rides a tow frame and one of a plurality of wheeled cradles. The tow frame, in turn, is driven by a cable or chain to a reversible electric gear motor. The prime mover aligns with heavy structural horizontal steel frame members of the warehouse. These steel frame members serve as rails in supporting one or more wheeled cradles. The wheeled cradles are equipped with boat pads for direct supporting contact with a boat hull. Power yachts, each weighing many tons, can easily be supported in racks in a stacked configuration in an enclosed warehouse with the new configuration of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a cross-section through the new boat storage warehouse building;

[0013] FIG. **2** is a partial longitudinal section of the new boat storage warehouse taken perpendicular to the section in FIG. **1**;

[0014] FIG. **2**A is a detail taken in the direction of arrow **2**A in FIG. **2**;

[0015] FIG. **2**B is a detail taken in the direction of arrow **2**B in FIG. **1**;

[0016] FIG. **3** is a perspective exploded view of the typical storage frame rails, storage frame, tow frame and prime mover rails.

[0017] FIG. **4**A is a plan view of a typical boat storage frame;

[0018] FIG. **4**B is a side elevation of a typical boat storage frame;

[0019] FIG. **5**A is a plan view of the prime mover;

[0020] FIG. **5**B is a side elevation of the prime mover;

[0021] FIG. **5**C is an end elevation of the prime mover;

[0022] FIG. **6**A is a plan view of the tow frame;

[0023] FIG. **6**B is a side elevation of the tow frame; and

[0024] FIG. **6**C is an end elevation of the tow frame.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] Illustrated in FIGS. **1** and **2** is a typical building section for the new watercraft, boat or power yacht storage facility. The exterior walls **10** and roof **12** may be fully covered or not, depending on climate and location. The steel frame elements **14** are of robust construction, as is the foundation (not shown) to support the structure and a plurality of very valuable large boats, such as the "cigarette" offshore racing boats **16** shown.

[0026] The building has a center aisle **18** extending upwardly to the roof **12**. Below the roof is a traveling crane **20** which movably rests on a pair of crane rails **22** which, in turn, extend the length of the aisle **18**. Such traveling cranes are commonly used in heavy manufacturing. On the travel-

ing crane **20** are a pair of crane trolleys **24** separated by a spread beam **26** attached to each crane trolley at **28** to provide a fixed distance between the crane trolleys. Steel lifting cables **30** descend from each crane trolley **24** to a prime mover **32** upon which rests a wheeled cradle or storage frame **34** and boat **16**. A pair of steel lifting cables **30** descend from each crane trolley **24** to either side of the prime mover **32**. Although shown as single cables **30**, block and tackle cable sets may be used, as necessary.

[**0027**] Each storage location **36** comprises a volume defined by the frame elements **14** of the building, and the multiple storage locations form a rack configuration of the frame elements. Within a storage location **36** are a pair of steel beams forming storage rails **38** upon which rests a movable storage frame **34**. In addition to performing the function of rails, the storage rails **38** form an integral part of the building structure as horizontal steel frame elements in FIG. **1**. The ends of the storage rails **38** terminating at the aisle **18**, as best shown in FIG. **2**, are equipped with horizontal positioners **40** and vertical stops **42** that engage and align the prime mover **32**. As shown in more detail in FIGS. **2**A and **2**B, the horizontal positioner **40** is in the form of a truncated "V" extending horizontally from the lower flange of the storage rail **38**. Directly beneath the horizontal positioner **40** is the vertical stop **42**, also adapted to engage the prime mover **32**. The shelf beam **44** not only supports the end of the storage rails **38** but also the vertical stop **42** and inboard end of the horizontal positioner **40**. The outboard end of the horizontal positioner **40** is supported by the stop **42**.

[**0028**] Illustrated in FIGS. **3**, **4**A and **4**B is a storage frame **34** of steel construction and equipped with a plurality of hull supports or boat pads **46**. The boat pads **46** are mounted on the storage frame **34** and extend upwardly into supporting contact with a boat hull. The configuration and location of the boat pads **46** is uniquely determined by the shape and structure of the boat to be supported.

[**0029**] The storage frame **34** is generally rectangular, with multiple cross-members **48** for supporting the boat pads **46** and joining together side members **50**. Attached to the side members **50** are a plurality of flanged rollers or wheels **52** that movably support the storage frame **34**. The wheels **52** may be on axles **54**, as shown, or stub axles welded to the side members **50**. Extending down the center of the storage frame **34** is a pair of center members **56** in FIG. **3** to distribute the forces imposed upon the storage frame by the tow bar **58**. In FIG. **4**A, a single center member **56** is shown.

[**0030**] The wheels **52** roll upon the storage rails **38** and onto or off the prime mover rails **60**. As also shown, a tow frame **62** equipped with flanged wheels **64** rests upon the prime mover rails **60**.

[**0031**] The storage frame **34** shown in FIGS. **4**A and **4**B is somewhat simpler in construction from that shown in FIG. **3**. The axles **54** pass inside tube steel cross-members **66**. The tow bar **58** for either version of the storage frame **34** is equipped with an upwardly extending stud or handle **68** for attachment to the tow frame **62**. The tow frame **62** is equipped with a double-ended tow bar **70** having a countersunk tow hole **72** at each end for attachment to a storage frame **34** to either side of the aisle **18**.

[**0032**] Illustrated in more detail in FIGS. **5**A, **5**B and **5**C, is the prime mover **32** suspended from the cables **30**. Transverse beams **74** are welded to the prime mover rails **60** and extend outwardly beyond the rails to side beams **76**. The tip ends **78** of two of the transverse beams **74** are connected to the cables **30** on each side of the prime mover **30**. Longitudinally down the center of the prime mover **30** extends an endless cable or chain **80**. The cable **80** extends about tail pulleys **82** on axles **84** at each end **86** of the prime mover **30**. Centered in the prime mover **30** is a drive assembly **88** for the cable **80** and tow frame **62**, which is attached to the cable at **90**.

[**0033**] The drive assembly **88** comprises one or more submersible electric motors **92** drivably attached to an axle **94** carrying a drive pulley **96**. The drive pulley **96** is located between a pulley **98** on an axle **100**, which is fixed in horizontal location, and a pulley **102** on an axle **104**, which is horizontally adjustable longitudinally. All three pulleys **96**, **98** and **102** engage the cable **80** in a serpentine manner, as shown, with pulley **102** serving as an adjustable cable tensioner. The drive assembly **88** is supported on beams **106** extending between prime mover rails **60**.

[**0034**] Illustrated in more detail in FIGS. **6**A, **6**B and **6**C, is the tow frame **62** which rests upon the prime mover rails **60**. The tow frame **62** comprises a rectangular frame with longitudinal side members **108** and transverse members **110** welded together. Passing through the frame are axles **112** to support the flanged wheels **64**. Welded to the transverse members **110** is the tow bar **70**, and extending beneath the tow bar is a dual attachment **90** to the cable **80**. The tow hole **72** at each end of the tow bar **70** is countersunk from underneath to more easily fit over a stud or handle **68** on a storage frame **34**. Although shown as a stud and hole configuration, the means to connect and disconnect the tow frame **62** from a storage frame **34** can take many other forms, such as a typical railroad car coupler.

[**0035**] Beneath the flanged wheels **64** on the tow frame **62** are undercarriage rollers **114** mounted on axles **116**, in turn fastened to the tow frame. The rollers **114** serve to prevent the tow frame **62** from tilting transversely or longitudinally off the prime mover rails **60** when under heavy load.

1. A watercraft storage and retrieval apparatus comprising a plurality of storage locations defined by structural members, a plurality of cradles for supporting watercraft thereon, said cradles movable into, and out of, the storage locations,

a prime mover having a tow frame thereon movable horizontally relative to the prime mover, said prime mover movable both horizontally and vertically,

and means on the tow frame to engage and disengage a cradle for movement of a cradle onto, and off of, the prime mover.

2. The watercraft storage and retrieval apparatus of claim 1 wherein at least some of the structural members forming the storage locations are horizontal and form storage rails for supporting cradles.

3. The watercraft storage and retrieval apparatus of claim 1, including a traveling crane, said prime mover being suspended from the crane.

4. A watercraft storage and retrieval system comprising a plurality of storage locations, a prime mover for carrying, delivering and retrieving a watercraft, said prime mover including a tow frame thereon,

a plurality of boat supporting cradles associated with the storage locations, said cradles connectable to the tow frame for retrieval from, and delivery to, the storage locations.

5. The watercraft storage and retrieval system of claim 4, including means to engage and align the prime mover to any one of the storage locations for delivery of a cradle to, or retrieval of a cradle from, said storage location.

6. The watercraft storage and retrieval apparatus of claim 1, including means to engage and align the prime mover to any one of the storage locations for delivery of a cradle to, or retrieval of a cradle from, said storage location.

* * * * *