The present invention is an improvement in mast raising for a sailboat where a pivoting mast is raised or lowered rapidly by use of a pair of shroud struts, that are an integral part of the sailing rigging, all of which is done in a very stabilized manner.
RAPID SAILBOAT MAST RAISING/LOWERING METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

0001 This application claims the benefit of U.S. Provisional Application No. 61/147,434, filed on Jan. 26, 2009.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

0002 Not applicable.

REFERENCE TO SEQUENCE LISTING, A TABLE, OR COMPUTER PROGRAM LISTING

0003 Not applicable.

BACKGROUND OF THE INVENTION

0004 (1) Field of the Invention
0005 This invention is directed toward sailboat mast raising and lowering methods that are convenient for masts in sailboats launched from a trailer. Trailerable sailboats present unique problems in regard to raising the mast to prepare for sailing and in regard to lowering the mast for transportation and/or storage. This invention is directed toward sailboats in general that are transported over the public highway systems throughout the United States. This invention is also directed toward sailboats in general where it may be necessary or convenient to lower the mast in order to pass under a bridge or other low obstruction on the water. Important features and methods are described which allow a sailboat to be trailerable with special considerations for safety, convenience, operational simplicity, and expense.

0006 (2) Description of Related Art
0007 Historically, sailboats have provided important transportation and have more recently evolved into a significant recreation activity. Sailboats are commonly transported to desirable sailing locations on trailers over the US public roadway system. Because sailboats have a high sailing mast, the mast must be lowered and stored so the trailered boat will comply with the US highway transportation specifications for overall length, width and height. Therefore, provision must be made for raising and lowering the mast. How the mast is lowered, raised, and stored on a trailer becomes an important practical issue. Masts are commonly longer than the corresponding overall boat length, making the task of raising or lowering the mast both difficult and dangerous without the use of external mechanical devices, such as cranes, to assist with the loads involved and to stabilize the mast.

0008 It is a distinct advantage to transport a sailboat on a trailer from the water to dry storage. This eliminates the need for an in water slip, which has the advantage of reducing cost to the owner for storage and handling. Being stored away from the harsh in-water environment also has the advantage of reducing maintenance expenses to the owner by reducing corrosion, fouling, mildew, organic growth, power use, and wear. Land storage of boats also has the advantage of releasing fewer toxins and other foreign and man-made compounds into the water. The ability to conveniently transport a boat over highways also offers the owner the advantage of opening up new and distant sailing waters in much shorter time than moving a sail boat by water to these additional locations.

0009 Others have considered the difficulties in raising and lowering a mast, including pivoting ones. For example, U.S. Pat. No. 4,259,917 discloses a foldable mast assembly for sailboats where the main mast fits into a pivoting stub mast that incorporates a mast-pivoting point above the base of the main mast. This design lowers and relocates the mast to a position “centered approximately lengthwise of the boat.” Typically, most sailboat masts are substantially longer than the boat, so this leaves the mast extending over the stern which is problematic to transportation on highways as it may result in illegal rear overhang of the trailer. A lowered mast will commonly require manual relocation on the boat for transport. The relocation of the mast usually requires the disconnecting of electrical sensors, lighting, and radio antenna, as well as additionally disconnecting the halyards and shrouds. Further, this design does not provide for a preferred solid boom yang or method to support or control the boom during the raising or lowering of the mast.

0010 U.S. Pat. No. 7,341,014 discloses a method of raising and lowering a mast on a boat using four separate frames, none of which are part of the sailing rig or useful for sailing. The design is overly complicated and utilizes equipment that is preferably removed from the boat for sailing. Additionally, this design does not provide for a preferred solid boom yang or method to support or control the boom during the raising or lowering of the mast.

0011 U.S. Pat. No. 3,827,386 describes an invention for raising and lowering the mast on a sailboat without requiring any adjustment or release of the shrouds, stays or sails. The method utilizes a pivoting mast that slides on a track on the bow of the boat. The sliding track is a distinct disadvantage on a sailboat, as it takes up important deck space that is utilized for other important purposes including pleasure seating. U.S. Pat. No. 3,898,948 discloses an enhancement for a catamaran sailboat. Detachable rigid steadying braces are added to the foot of the mast in a sliding engagement with the mast. It is less desirable to have separate equipment utilized in raising and lowering of the mast when a boatman wishes rapid utilization of the mast, or rapid storage of the mast in the lowered position. U.S. Pat. No. 6,990,916 discloses a telescoping lift installed in the cockpit, which gets the mast to an angle where a line from the bow has the required geometry to complete the lift. This equipment must be removed for sailing.

International Publication Number WO87/02322 discloses an A-Frame that pivots on the foredeck and becomes the bowsprit (part of the rig) when the mast is up. This invention makes no provision for the boom or solid boom yang and requires the mast to be relocated on the boat for trailering. These four references have similar problems already mentioned with the mast having illegal rear overhang of the trailer, lack of solid boom yang, or method to support or control the boom during raising or lowering.

0012 U.S. Pat. No. 4,655,154 discloses a permanently mounted stub mast that mounts the boom. However, important considerations are omitted in the mast raising and lowering system as follows: the geometry of the line controlling the mast will not produce any upward force on the mast when the mast is below the longitudinal alignment with the line, and the mast is not restrained longitudinally against the pull of the line controlling the mast, so the mast will simply slide forward against the tension of the control line. This invention is liable to be dangerous when lowering the mast as the mast would simply fall uncontrollably at a certain point. In summary, the invention does not appear to be able to reliably and safely raise the mast.
As previously discussed, a number of sailboats utilize a mast that is completely disconnected from the sailboat and then relocated horizontally on top of the sailboat during overland transport or storage. This is necessary to eliminate the mast hanging over the rear of the boat and trailer to comply with trailering laws and to protect the mast from damage. This method is undesirable as modern masts include numerous important rigging, halyards and electrical wiring used for sailing that all must be disconnected in order to reposition the mast in this manner.

Also, larger sailboats have a commensurately heavier and longer mast which makes the method of completely disconnecting and relocating the mast on the sailboat highly undesirable, very difficult and dangerous. The movement or storage of a mast in this manner is very unappealing to an operator, as it requires a lot of time and care, along with sophisticated equipment that is extraneous to sailing (as seen in the above efforts) and makes an operator vulnerable to injury, and is likely to damage the sailboat.

In summary, several deck-mounted mechanisms have been taught but all are lacking important features as follows:

1. They omit important considerations for conveniently and safely handling the various components of the sailing rig such as the boom and boom yachts.
2. The equipment is overly complicated.
3. The equipment is extraneous to sailing and must be preferably removed to sail the boat.

These problems with the efforts of others undesirably add time and complexity to raising or lowering the mast.

BRIEF SUMMARY OF THE INVENTION

The present invention is an improvement in mast raising or lowering for a sailboat where a normal state-of-the-art sail mast with preferred architecture and geometry is raised or lowered rapidly via the articulation of a pair of solid struts, which become an integral part of the sailing rig. When the mast is raised, the solid struts perform the same function as the lower shrouds in any conventional sailing rig. Raising or lowering can be done manually with smaller masts or with mechanical or powered assistance when larger loads require it. The geometry of the present invention also automatically relocates the mast when lowered to a position that is preferred for transportation or storage without the need to disconnect the mast rigging, wiring or halyards. This invention comprises the distinct advantage over all prior efforts in that the machinery that is used to raise and lower the mast is also a fundamental component of the sailing rig and therefore does not have to be removed for sailing thus dramatically simplifying and speeding up the process.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

FIGS. 1A-IC shows an important embodiment of the present invention where the mast is rapidly and conveniently raised.

FIG. 1D shows the mast in the raised position in an end view.

FIG. 2 shows an important view of details of the solid strut and a linear actuator.

FIG. 3 is an illustration of the preferred sailing rig design in current art.

FIG. 4 shows an embodiment where the mast lowering is in sequential steps.

FIG. 5 shows an alternate embodiment of important view of details of the solid strut.

DETAILED DESCRIPTION OF THE INVENTION

The present invention redesigns standard components of the sailing rig in existing, state of the art rig geometry, to raise or lower the mast using equipment that is also used for sailing. The present invention practically and effectively accommodates preferred sailing rig components in state of the art architecture, geometry and realistic dimensions. The present invention is simple in operation. The present invention need never be removed from the boat or adjusted for sailing, storage or transportation. The present invention substantially accelerates and simplifies the process of raising or lowering the mast.

The present invention relates to trailerable sailboats in general and additionally to larger trailerable sailboats with very heavy masts and lengths that would customarily be limited to commercial trailers.

It is also desirable to provide a sailboat with features that simplify the launching of the boat from a variety of docks and boat landings where marina equipment may not be available to raise or lower the mast. In particular, larger sailboats have masts that are excessively long, heavy and complex normally requiring a crane to lift or move. It is desirable to provide for raising a mast that cannot be conveniently moved manually. The sailing masts of dock stored sailboats or large trailerable sailboats have greater forces to accommodate as the mast height and sail area become very large. These masts may weigh as much as 100 to 200 pounds with lengths in excess of 50 feet, making them very inconvenient to handle safely on deck and impossible to raise or lower manually.

It is highly desirable to provide for raising and lowering a sailing mast with as simple a method as possible. The present invention carefully considers this important problem from a variety of factors and provides for an elegant, simple, and practical solution. The factors involved with solving this problem include convenience, safety, stability, use of existing sailing equipment, and timeliness to launching and sailing.

With longer masts, it is important that the mast is stabilized laterally while being raised, and is allowed to rotate only in a substantially single plane about the pivoting axis. Trailerable sailboats of the past have required both standing rigging for sailing, and non-sailing rigging for raising and lowering the mast. This added complexity creates longer launching times. Besides this, the non-sailing rigging typically used with past trailerable sailboats must be removed or stowed for sailing. On the other hand, the present invention advantageously incorporates the method of raising and lowering the mast with the standing rigging.

The present invention replaces the flexible lower shroud lines with a specialized solid or structural strut which becomes an important feature for raising the mast. This provides key mast stability during mast raising and lowering, and also provides for mast stability during sailing. The solid struts have a dual purpose and become part of the mast sailing rigging to keep the mast vertically rigid during sailing.

The methods of the present invention are a distinct advantage for larger trailerable sailboats where the sailboat rigging or raising the mast may be performed within a period of time of approximately ten minutes or less.
The methods of the present invention are a distinct advantage for launching the sailboat without the use of an external crane or hoist. Further, the steps of launching and rigging the sailboat for sailing are preferably done by a single individual. Equally, additional people may help in rigging and launching for redundancy and improved safety.

In actual practice, the mast raising mechanisms and method shown in the drawings and described herein enables a large, heavy mast to be rigged in about 10 minutes without special equipment. This time requirement is short compared to thirty to forty minutes typically required for rigging most other current trailerable sailboats or the one to three hours required to raise or lower the mast and launch a larger trailerable sailboat.

This invention enables the easy and safe raising and lowering of a normal, state of the art sailing mast to clear low obstructions or for transportation or for storage. It also provides for a reduction in overall height during sailing if there is a need to pass under a bridge. One primary feature of the invention is solid, “strut-type” lower shrouds that will support the mast safely after the mast is disconnected from the boat at its base. The mast-head (top) can then be rotated back till it rests in a yoke in the boom-end. The shroud struts can then be rotated forward and down, taking the mast along and lowering the entire rig sufficient to clear low obstructions or for storage or for transportation. The process of rotating the shrouds struts forward also conveniently repositions the mast on the boat so its extra length overhangs the front of the boat and the tow vehicle, and not disadvantageously the back of the trailer. All wiring, and halyards are routed inside or along the pivoting geometry of the struts negating the need to disconnect these components for raising or lowering. The shroud struts are articulated manually or in larger masts by linear motion actuators near the base of the struts. When raised for sailing, the mast is placed under compressive force by being jacked up vertically via a mast jack to tension the shrouds for sailing or to de-tension the shrouds for preparing for lowering.

In the present invention the mast base is secured inside a U-section tabernacle that is open forward and extends vertically sufficient to permanently mount the sailing boom and boom yachts. This feature is one embodiment of the present invention as it relieves the need to dismount the boom to lower the mast. In one embodiment this is an aluminum or stainless steel weldment.

FIGS. 1A-1C shows an important embodiment of the present invention where the mast is rapidly and conveniently raised. In FIG. 1A the sailboat mast 101a is secured in a yoke on the end of the sailing boom for transportation or storage. A U-Section tabernacle 102 that has open forward sides which form a yoke at the top used to secure the sailing mast when it is down for transportation or storage. A normal sailing boom 103 is shown on the sailing boat 104. A rigid boom yachts 105 is used to support the sailing boom 103. The sailboat rests on a boat trailer 106 prior to launching. Alternatively, the mast could be raised after boat launching into the water. A linear motion actuator 107 is used to raise and lower the shroud struts and sailing mast when loads exceed manual capabilities. It preferably utilizes a hydraulic or electric based power source. It is possibly a ball screw, winch, chain, cylinder, or a mechanical gear in its operation. Shroud struts 108a are rotated down for low bridge clearance, transportation, or storage. The shroud struts are described in more detail later. A mast support 109 mounted on the trailer, is used for transportation and storage.

Fig. 1B shows the mast being rotated part way as being raised or being lowered. The sailing mast 101b slides in a yoke on the end of the sailing boom 103 while raising or lowering. The sailing boom 103, the sailing boat 104, the rigid boom yachts 105, boat trailer 106, and the linear motion actuator 107 have already been mentioned. In FIG. 1B, the shroud struts 108b are rotated up for supporting the sailing mast when mast is dismounted from the tabernacle 102. A line 120 is used to pull the sailing mast down into tabernacle when raising, or to control the sailing mast when lowering.

FIG. 1C-1D shows the sailboat mast 101c rotated all the way up into the sailing position and pinned. Sailing rigging 131 is shown which includes spreaders, as well as upper and intermediate shrouds. Other embodiments of the present invention include any number of spreaders and shrouds. Shroud struts 132 are rotated up for supporting the sailing mast when the sailing mast is secured inside the tabernacle. The sailing mast base 133 is pinned in the tabernacle 134 for sailing. The tabernacle 134 is a U-section mast tabernacle which is open forward and is used to secure sailing mast base for sailing and to mount boom permanently to deck. There is a pivot axis 135 through the mast and a pivot axis 136 at or near the deck line for the shroud struts. The mast pivots around pivot axis 135. A mechanical or hydraulic mast jack 137 is used at the base of the sailing mast to tension the sailing rigging 139 for sailing (or remove tension from the sailing rig so mast can be lowered). The mast jack raises or lowers the mast vertically inside the tabernacle to put the mast under lengthwise compression and the rigging under tension. The sailing rigging 139 includes spreaders, as well as upper and intermediate shrouds.

An important feature of the present invention is the two shroud struts 132 which operate in tension when the sailing mast is jacked up for sailing. The shroud struts thereby operate as standard sailing rigging by placing the mast under a lengthwise compressive force, in addition to any other sailing rigging that is being used. The shroud struts have a dual purpose in that they also rotate the sailing mast when raising or lowering the mast. Port to starboard rotation of the sailing mast while it is being raised or lowered is controlled by the line from the tabernacle to the mast base by the crew, and also by controlling one of the halyards from the top of the mast. The mast is vulnerable to the wind while it is being raised or lowered and must be carefully controlled by the crew during its motion.

The shroud struts are made of any suitable structural material, which includes, but is not limited to, material such as aluminum, carbon fiber, filled plastic, stainless steel, wood, metal, laminate, or a composite. They are preferably made so that there is low wind resistance in normal upwind sailing angles relative to the wind.

FIG. 2 shows further details at the base of the sailboat mast and include: a shroud strut 201 which is used to rotate the sailing mast 209 during raising and lowering of the sailing mast. In one embodiment, the shroud strut incorporates an adjusting mechanism to vertically align the mast for sailing (see FIG. 5). A slotted pin hole with pin 207 is used to secure the sailing mast 209 in the U-section mast tabernacle 208. The tabernacle nests and secures the mast base for sailing and mounts the boom permanently to the sailboat deck. The sailing boom 202, rigid boom yachts 203, linear motion actuator 204, mast jack 206, and sailing boat 210 have already been mentioned in other figures.
The advantage of this invention is that it achieves a very easy and convenient raising or lowering of a state of the art sailing mast and rig without any extraneous gear to remove after the mast is articulated. To lower, simply release the rigging (i.e., shroud) tension by lowering the mast with the mast jack, un-pin the mast base from the tabernacle, rotate the mast-head aft to the boom and articulate the lower shroud struts forward and down. In larger masts the shroud struts may be powered as necessary for the loads involved, via a linear motion actuator that is hydraulic or electric powered. When down, the mast and rigging can be secured to the boom, tabernacle and fore-deck or trailer for overland travel. Alternately, the mast can be secured to the stern and fore-deck, or secured by other rigid equipment that is attached to the sailboat. Finally, the geometry involved automatically relocates the mast to an optimum position on the boat for transportation or storage without further dismounting or moving of the mast, rigging, halyards, wiring or boom required. The location of the pivoting point on the mast is chosen to facilitate this. The shroud struts are designed to withstand the tension forces needed for normal sailing and also the needed forces for raising and lowering the mast.

To raise the mast, the mast is unsecured from its storage position. The lower shroud-struts are rotated backward and upward until the pivot point of the mast is raised above the tabernacle so that the mast end has clearance to engage in the tabernacle. The mast is then rotated by utilizing a line from the lower end of the mast to pull the lower end of the mast into the tabernacle. The mast is then pinned in the tabernacle and lifted vertically by a mast jack or similar lifting device, a wedge, mechanical screw, cam, or linear actuator to tension the rig for sailing. By using the mast jack to achieve the proper tension in the shroud struts, the remaining shrouds can be adjusted to their proper tension.

The terms vertical and horizontal, when referring to the mast and boat equipment, are in reference to the sailboat.

FIG. 3 shows current art rigging on a sailboat. A normal sailing mast 301 is shown with typical sailing rigging such as a fore stay 302, a back stay 312, and various shrouds and spreaders 303, which may have ends that are swept aft. Intermediate shrouds 305, lower shrouds 306, and upper shrouds 311 are shown. All shrouds and stays are used in tension to make the mast stable and able to bear the sailing loads from the sail(s). The number of shrouds and stays depends upon the mast size and sailing load design. A sufficient number must be used to stabilize the mast. A normal sailing boom 307 is used in combination with the main sail (not shown) to sail the boat. A rigid boom yard 308, is used to prevent the boom from rising on certain points of sail and when not sailing it supports the sailing boom. The sailing boat 304 is shown on the boat trailer 309. A mechanical lift or hydraulic ram 310, commonly called a mast jack, at the base of the mast is commonly used to tension the rigging by lifting the mast for sailing, but is not used in all sailboats.

Another advantage of the present invention is the ability to route the electronic cables commonly needed in the mast through the pivoting shroud strut into the mast. This avoids the need for electrical disconnects if a standard wiring path through the pivoting mast is utilized.

FIG. 4 shows an embodiment where the pivoting mast lowering is in two separate steps. After the mast is released from lengthwise compression, it is rotated 401 about the pivot point and then the mast pivot axis is rotated 402 about the shroud strut pivot axis. The mast is thereby brought to the storage or travel position in these steps. For a simple illustration, the shrouds are shown only for the pivoting mast in the vertical and storage positions. A line 403 from the sailboat to the lower free end of the pivoting mast is used to stabilize the mast while it is being lowered. Alternately, other lines or ropes could be temporarily attached to the mast to control the pivoting. The mast pivot axis is maintained substantially perpendicular to the boat lengthwise centerline when it is raised and lowered, to ensure the mast is stable and controlled during the motion. The shroud pivot axis is also substantially perpendicular to the boat lengthwise centerline.

FIG. 4 also can be used substantially in reverse for raising the mast. Optionally, if needed, the lower end of the mast can be initially lifted manually to lower the amount of force needed to rotate the shroud struts.

In another embodiment, the two primary rotations shown in FIG. 4 can also be performed substantially simultaneously. That is, the pivoting mast and the pivoting of the lower shrouds can be done at the same time, provided proper care is taken to ensure that mast ends are controlled at all times. The operator can secure the mast to the boom when it is lowered at that end and then continue to finish the lower shroud rotation to complete the entire mast lowering. This may be more efficient when more than one operator is available to lower the mast. Also, in another embodiment, the mast can be raised by performing the two primary rotations shown in FIG. 4 substantially simultaneously.

FIG. 5 shows an alternate embodiment of a solid strut of the present invention. A shroud strut 501 is used to rotate the sailing mast when it is raised or lowered. The shroud strut 501 preferably incorporates a threaded adjusting linkage 502 to align the pivoting mast vertically (with respect to the boat) for sailing. A strut linkage 503 and an actuator 504 are used to articulate the mast, and provide for low initial lifting forces when raising the mast. The shroud strut is designed to withstand the tension forces needed for normal sailing and also the needed forces for raising and lowering the mast. The actuator and shroud strut are attached to the sailboat 505. Other features seen in FIG. 5 have already been described in FIG. 2.

While various embodiments of the present invention have been described, the invention may be modified and adapted to sailboats by those skilled in the art. Therefore, this invention is not limited to the description and figure shown herein, and includes all such embodiments, changes, and modifications that are encompassed by the scope of the claims.

I claim:

1. A mast lowering method for a sailboat comprising:
   a. a pivoting mast used for sailing said sailboat wherein said pivoting mast is relieved from lengthwise compression,
   b. a first axis, wherein said first axis is substantially horizontal and is oriented substantially perpendicular to said sailboat's lengthwise centerline,
   c. wherein said pivoting mast rotates about said first axis,
   d. wherein said first axis is incorporated into said pivoting mast,
   e. a plurality of shroud struts made of structural material,
   f. wherein said shroud struts are attached to said sailboat,
   g. wherein said shroud struts pivot primarily about a second axis,
   h. wherein said second axis is substantially oriented perpendicular to said sailboat's lengthwise centerline,
i. wherein said shroud struts are attached to said first axis and are used to lower said pivoting mast to a storage position, and
j. wherein said shroud struts are used as sailing rigging during normal sailing operation, whereby said pivoting mast is lowered from a sailing position to a storage position free of the use of an external lifting crane.

2. The method according to claim 1 wherein the rotating motion of said shroud struts is powered manually, electrically, or hydraulically.

3. The method according to claim 2 wherein said shroud struts incorporate a length adjustment for the purpose of aligning said pivoting mast vertically with respect to said sailboat.

4. The method according to claim 1 wherein said shroud struts are utilized for routing wiring into said pivoting mast.

5. A mast raising method for a sailboat comprising:
a. a plurality of shroud struts made of structural material,
b. wherein said shroud struts are attached to said sailboat,
c. wherein said shroud struts pivot about a second axis,
d. wherein said second axis is substantially oriented perpendicular to said sailboats lengthwise centerline.

6. The method according to claim 5 wherein the rotating motion of said shroud struts is powered manually, electrically, or hydraulically.

7. The method according to claim 6 wherein said shroud struts incorporate a length adjustment for the purpose of aligning said pivoting mast vertically with respect to said sailboat.

8. The method according to claim 5 wherein said shroud struts are utilized for routing wiring into said pivoting mast.

9. An improved shroud strut useful for raising a pivoting mast in a sailboat comprising:
a. an elongated element structure in the lengthwise direction,
b. wherein said elongated structure is made out of a structural material,
c. wherein each end of said elongated structure allows rotation of said elongated structure,
d. wherein said elongated structure is used for raising or lowering said pivoting mast by pivoting at both ends and substantially maintaining its shape,
e. wherein said elongated structure is capable of withstanding a tension force needed to stabilize said pivoting mast during sailing according to a predetermined criterion,
f. wherein said elongated structure is capable of withstanding forces during raising or lowering of said pivoting mast, and

10. An improved shroud strut according to claim 9 wherein a. said elongated structure is attached to said sailboat at one end at a first rotating point,
b. said elongated structure is attached to a first linkage at a second rotating point,
c. said first linkage is attached to a powered actuator at a third rotating point,
d. a second linkage is attached to said third rotating point and said first rotating point, and
e. wherein said elongated structure incorporates a length adjustment, whereby said powered actuator is used to rotate said improved shroud strut.

* * * * *