July 25, 1967 J. T. POTTER 3,332,384

SAILBOAT

Filed Oct. 21, 1965 3 Sheets-Sheet 1

Fig. 1.

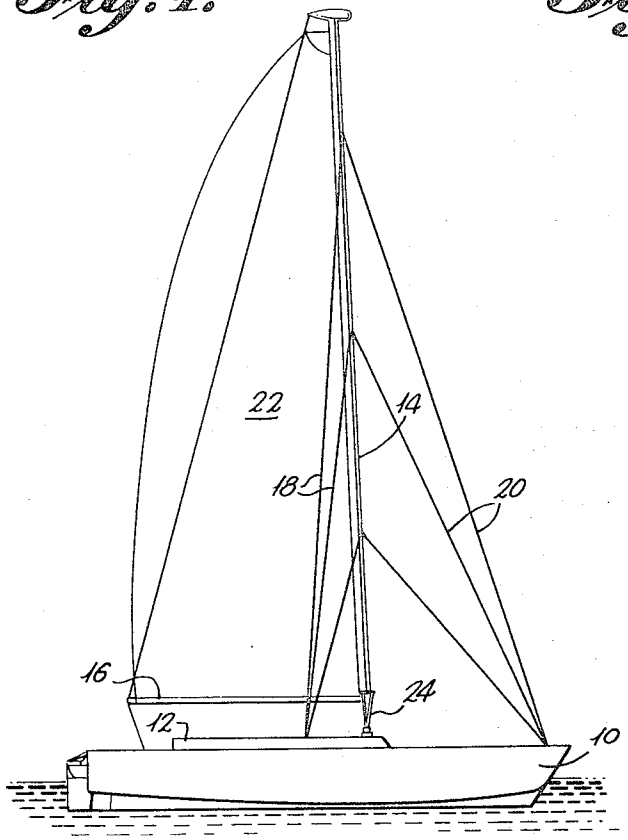


Fig. 2.

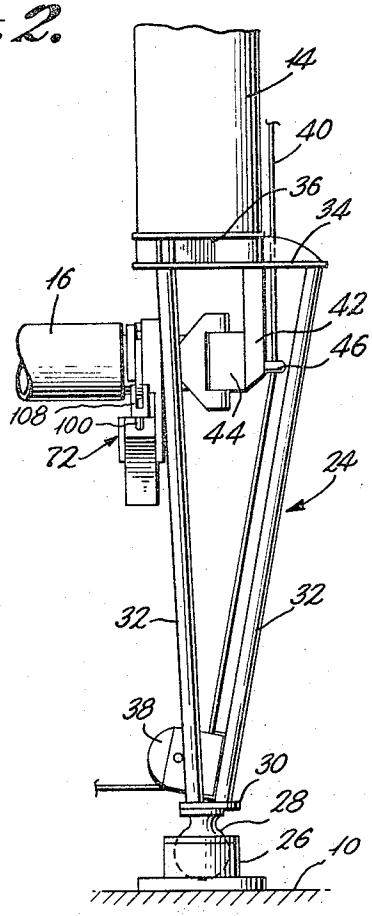


Fig. 5.

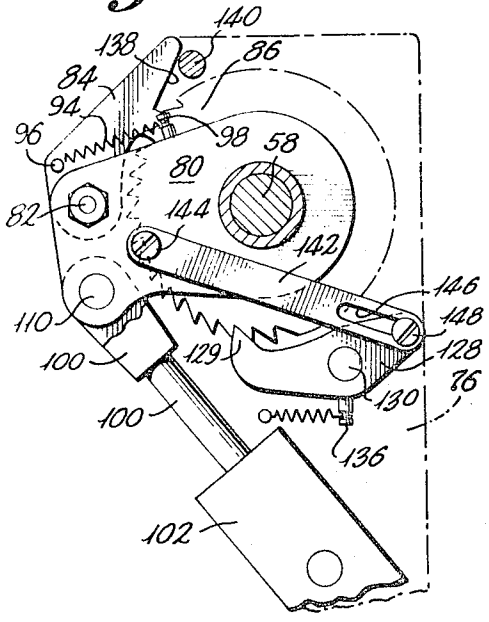
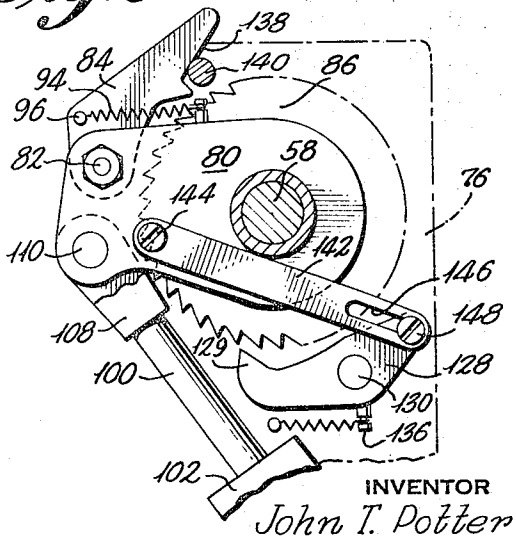


Fig. 6.



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SAILBOAT

Filed Oct. 21, 1965 3 Sheets-Sheet 2

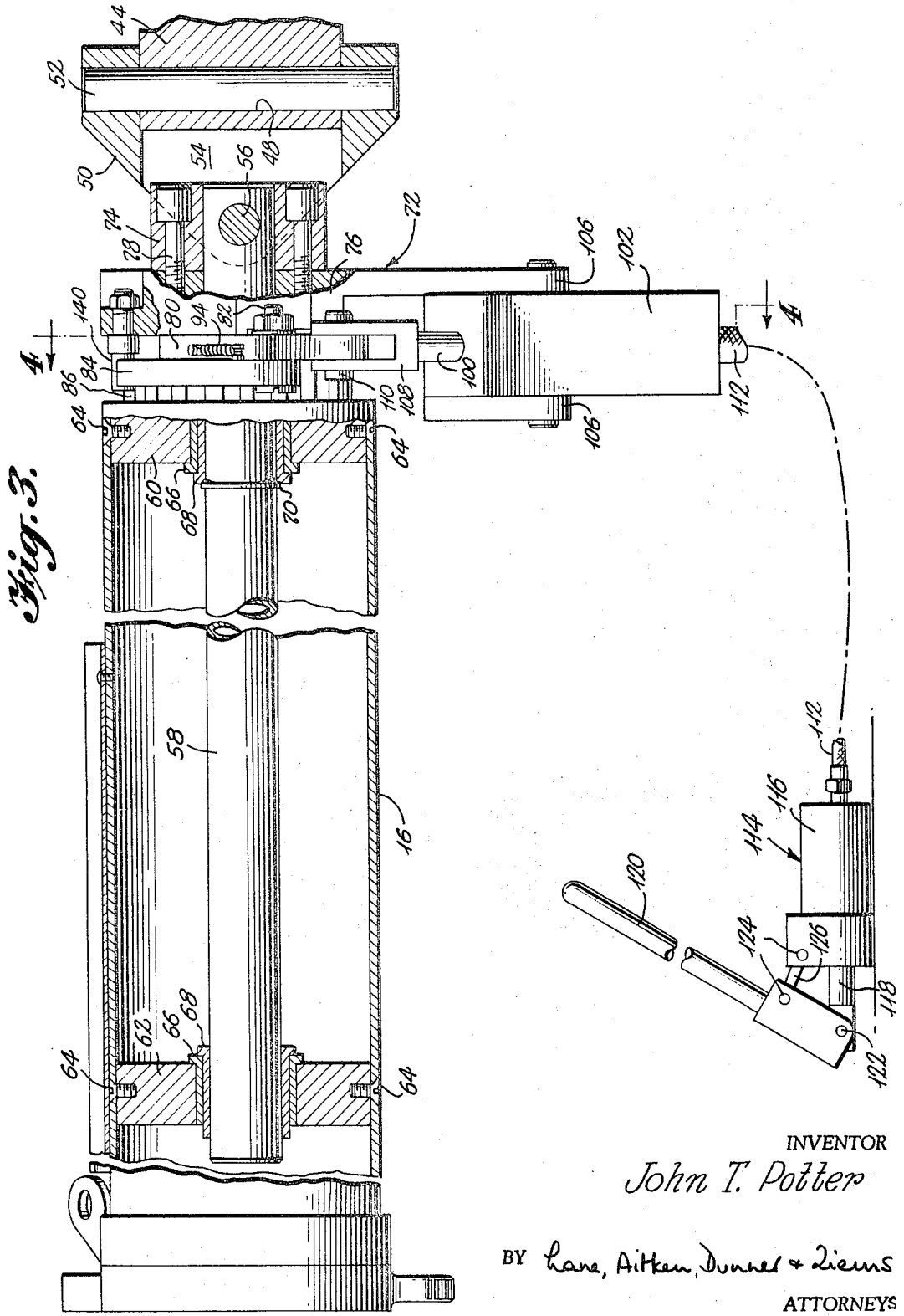


Fig. 3.

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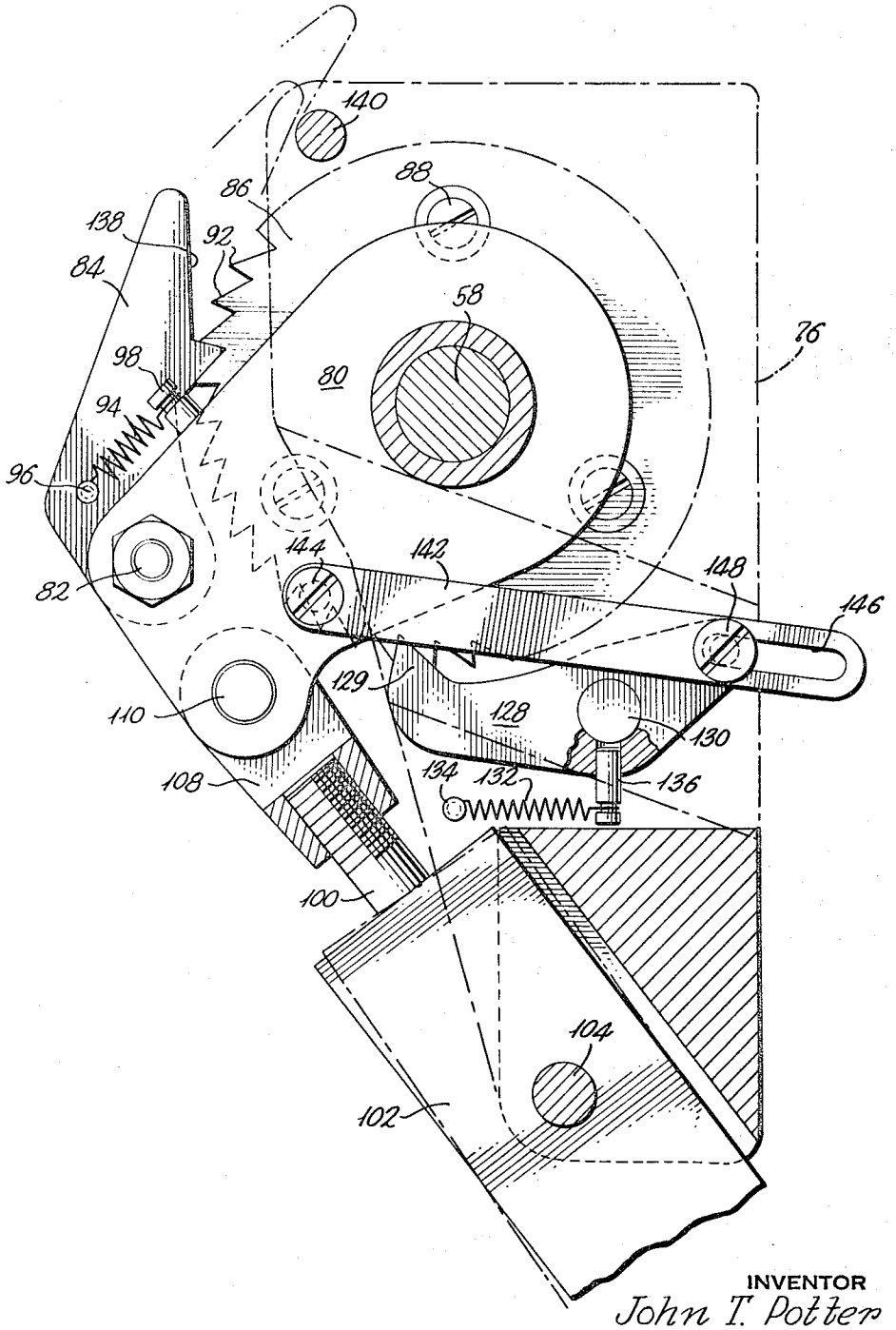
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SAILBOAT

Filed Oct. 21, 1965 3 Sheets-Sheet 3

Fig. 4.



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SAILBOAT

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10 Claims. (Cl. 114—39)

This invention relates to sailboats, and more particularly, it concerns sailboat rigging having a novel sail reefing apparatus.

It is common practice in the art of sailing to reef or haul in sails in high winds to reduce the effective sail area. Various means have been provided in the past to reef sails; such as rotatable booms on which sails may be rolled, or more commonly, reef lines by which the foot of partially reefed sails may be tied to the booms. Because of the high winds and high seas prevailing in many instances when it becomes necessary to reef sails, the sail reefing operation in conventional sailboats can be and often is a hazardous one both from the standpoint of equipment and personnel. For example, sail reefing under high winds is usually started by bringing the sailboat into the wind to remove the wind load from the sail. The sail is then hauled in or reefed to the desired amount and secured. Not only does the flapping of a loose sail make this operation extremely difficult, but also the pitching of the boat in high seas causes the boom to oscillate across the boat hull and thus create a hazardous situation. It is not uncommon under these conditions therefore, for a crew member to be thrown overboard or otherwise be injured by the boom to say nothing of the possibility of severe sail damage.

In accordance with the present invention, the reefing of boat sails is greatly facilitated by an apparatus capable of rotatably supporting a boom to which the foot of a sail is secured and by which the boom may be rotated manually from the boat cockpit to roll the sail thereon. The apparatus enables the development of more than adequate boom rotating torque by transmitting manually applied force to a pawl and ratchet assembly operably associated with the boom by means of a closed hydraulic system including a flexible conduit extending between the boat cockpit and the pawl and ratchet assembly. Also, the invention provides a unique mast step arrangement by which the mast, boom and reefing apparatus are supported and interconnected for optimum strength and minimum interference with normal sailing operations.

A principal object of this invention is, therefore, the provision of sailboat rigging by which the problems commonly incurred during sail reefing are substantially and effectively overcome.

Another object of this invention is the provision of a sailboat having an improved mast step to which a rotatable boom may be attached together with means for rotating the boom to reef a sail by rolling it on the boom without imposing increased loads on the mast of the sailboat.

A further object of this invention is that of providing a sail reefing apparatus for drivably rotating a boom for rolling and thus reefing a sail thereon which may be operated manually from a point remote from the fore end of the boom, such as the cockpit of the boat, and which may be adapted to have a large force multiplication factor to overcome the forces tending to resist sail reefing.

Still another object of this invention is the provision of a sail reefing apparatus which is light and compact and which offers a minimum of obstruction to normal sailing operations.

Other objects and further scope of applicability of the present invention will become apparent from the detailed description to follow taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevation of a sailboat rigged in accordance with this invention;

FIG. 2 is an enlarged fragmentary elevation of the mast step and sail reefing apparatus of this invention;

FIG. 3 is an enlarged fragmentary view in partial cross-section showing the sail reefing apparatus of this invention;

FIG. 4 is an enlarged fragmentary cross-section taken on line 4—4 of FIG. 3; and

FIGS. 5 and 6 are respectively, fragmentary views similar to FIG. 4 but showing the sail reefing apparatus of this invention in different positions of operation.

With reference to the drawings and particularly to FIG. 1 thereof, it will be noted that the sailboat with which the apparatus of this invention is employed includes a hull **10** having a cockpit **12**, a single mast **14** stepped forwardly of the cockpit and a rotatable boom **16**. The mast is stayed at multiple points spaced along its length with shrouds **18** and stays **20**. A single sail **22** is adapted to have its leading or luff edge secured to the mast **14** and its foot or lower edge secured to the boom **16**. While the sailboat illustrated in FIG. 1 therefore, is a cat-rigged boat having one sail **22**, it is contemplated that the apparatus of this invention may be employed equally as well with sloop-rigged and other multi-sail rigged boats.

The mast **14** is supported at its lower end on a mast step generally designated by the reference numeral **24** and shown most clearly in FIG. 2 of the drawings. The mast step **24** includes a socket base member **26** adapted to be secured at a suitable point on the hull **10** to receive a ball member **28** in conventional ball-and-socket fashion to permit universal pivotal movement. A foot plate **30** is secured such as by welding, bolting or the like to the upper end of the ball **28** and supports the lower ends of three upwardly diverging legs **32**. A step plate **34** is welded or otherwise secured to the upper ends of the legs **32** and is provided with reinforcing flanges shaped to define a receptacle **36** for receiving the mast **14**. The mast is secured within the receptacle by welding, bolting or other suitable means (not shown).

A sheave **38** is pivotally secured to the forwardmost of the legs **32** to enable a halyard **40** to be manipulated and secured within the cockpit **12** positioned aft from the mast **14**. The halyard is conventional in the sense that it constitutes a line extending from the head of the sail **22** over a mast head sheave (not shown) to enable the sail **22** to be hoisted on the mast. A boom supporting bracket **42** is connected to the underside of the step plate **34** and includes a rearwardly extending boss portion **44** for pivotally supporting the fore end of the boom in a manner which will be described in more detail below. An eyelet **46** is mounted on the front face of the bracket **42** to provide a further measure of guiding for the halyard **40**.

As shown in FIG. 3 of the drawings, the boss **44** on the bracket **42** is provided with a vertically disposed bore **48** to enable a yoke **50** to be mounted on the boss **44** by

a pin 52 for free pivotal movement in a horizontal plane. The yoke 50 is also provided with a pair of rearwardly extending spaced ears 54 having aligned apertures to receive a second pin 56 which also passes through the forward end of a boom mounting shaft 58. Because of the configuration of the yoke 50 and arrangement of pins 52 and 56, it will be appreciated that the shaft 58, though non-rotatable about its longitudinal axis, is freely and universally pivotal with respect to the boss 44 and thus with respect to the mast step 24.

The boom 16 is tubular and as shown in FIG. 3, is adapted to receive a pair of spaced discs 60 and 62 secured in place by a suitable means such as screws 64. The disc 60 provides a front face for the boom and both discs are centrally apertured to receive bushings 66, which in turn are journaled on sleeves 68 secured on the shaft 58. The bushings and sleeves are oppositely shouldered as shown and at least one of the sleeves 68 secured against axial displacement on the shaft 58 by a snap ring 70 or other suitable means. Also it will be seen that the bushings and sleeves 66 and 68 respectively establish bearings by which the mast is journaled for rotation on and about the axis of the shaft 58.

The forward end of the shaft 58 projecting from the boom 16 carries a pawl and ratchet mechanism generally designated by the reference numeral 72 and shown most clearly in FIGS. 3–6 of the drawings. The mechanism 72 includes a bearing block 74 having a longitudinal bore for receiving the forward end of the shaft 58 and a transverse bore to receive the pivot pin 56. A mounting block 76, also apertured to receive the shaft 58, is secured to the bearing block 74 by a suitable means such as bolts 78. Thus, the bearing block and mounting block 74 and 76 respectively are non-rotatably secured for universal pivotal movement with the shaft 58.

Positioned rearwardly of and adjacent to the mounting block 76 is an arm 80 journaled for oscillatory rotation about the axis of the shaft 58. A stud 82 is supported on the arm for pivotally mounting a driving pawl 84 on the rear of the arm 80. Also adjacent the rear face of the arm 80 and journaled for rotation on the shaft 58 is a circular ratchet 86 adapted to be non-rotatably secured to the fore end of the boom 16 by screws 88 extending through the ratchet 86 and into the disc 60 connected to the boom by screws 64 as aforementioned. By virtue of the location of both the ratchet 86 and the pawl 84 adjacent the rear face of the arm 80, it will be seen that inward movement of the pawl 84 will result in a pawl tooth 90 thereon being brought into operable engagement with teeth 92 on the periphery of the ratchet 86. To effect such inward movement, a tension spring 94 extends between a stud 96 on the driving pawl 84 and a pin 98 secured on the arm 80.

Oscillatory movement of the arm 80 to effect a similar or reciprocable motion of the drive pawl 84 to impart intermittent rotary motion to the ratchet 86 is effected by a plunger 100 received within a cylinder 102 pivotally mounted such as by studs 104 extending through ears 106 defining a yoke portion of the mounting block 76. The plunger 100 is operably connected to the arm 80 by a yoke 108 and a pin 110.

The plunger 100 is slidable and in fluid-tight relation within the cylinder 102 so that it may be reciprocated relative to the cylinder by alternate introduction of hydraulic fluid into and withdrawal out of the end of the cylinder opposite from the plunger 100. To enable this action, the cylinder 102 is connected by a flexible conduit or hose 112 to a manually actuated hydraulic pulsing device 114 preferably located in the cockpit 12 of the sailboat. The pulsing device 114 includes a cylinder 116 adapted to be secured suitably to the floor or other convenient place in the cockpit 12 and a ram 118 slidably received in fluid-tight relationship within the cylinder 116. An actuating handle 120 is pivotally connected at one end by a pin 122 to the plunger 118. The handle 120 is also connected intermediate its length by pins 124 and links 126 to the cylinder 116. Thus it will be seen that a closed hydraulic system is provided between the cylinder 116 and the cylinder 102; that is, movement of the ram 118 into the cylinder 116 will be accompanied by a predetermined proportionate extension of the plunger 100 from the cylinder 102. Also it is contemplated that the respective sizes of the plunger 100 and ram 118 may be selected to develop force multiplication or reduction as desired. In other words, if a force multiplication is desired, the effective size of the ram 118 would be smaller than that of the plunger 100. Conversely, where the effective size of the plunger 100 is smaller than that of the ram 118, a force reduction would be effected wherein a predetermined amount of movement of the ram 118 into the cylinder 116 would result in a predetermined greater amount of movement of the plunger 100 from the cylinder 102.

To retain the ratchet and thus the boom against retrograde rotational movement during retraction of the drive pawl 84, a retaining pawl 128 having a ratchet engaging tooth 129 at one end is pivotally mounted on the mounting block 76 by a pin 130. A tension spring 132 secured between a pin 134 on the mounting block and a pin 136 on the retaining pawl 128 functions to bias the pawl 128 into engagement with the ratchet 86.

To enable the boom 16 and the ratchet 86 to rotate freely about the axis of the shaft 58 when the sail 22 is hoisted, for example, means are provided for withdrawing both the driving pawl 84 and the retaining pawl 128 out of engagement with the ratchet 86 when the plunger 100 is advanced fully out of the cylinder 102. To effect such disengagement of the drive pawl 84 with the ratchet 86, the forward end of the drive pawl is provided with a nose defining an inclined or cam surface 138 cooperable with a camming stud 140 on the mounting block 76. The camming stud 140 is located in such a manner that the surface 138 rides on the stud as the pawl 84 is advanced to its forwardmost position to withdraw the tooth 90 radially from the teeth 92 on the ratchet. To withdraw the retaining pawl 128 from engagement with the teeth 92 on the ratchet 86, a link 142 is connected at one end by a pivot pin 144 carried by the arm 80. The opposite end of the link 142 is provided with a slot 146 through which a pin 148 extends. The pin 148 is connected to the end of the retaining pawl 128 opposite from the end carrying the tooth 129. The link 142 and the slot 146 therein are dimensioned so that the link will have no effect on the retaining pawl 128 during normal operation of the ratchet mechanism. When however, the plunger reaches its maximum extended position, the link carries the pin 148 in a direction to pivot the retaining pawl tooth 129 outwardly from engagement with the ratchet teeth 92.

In use, and when it is desired to hoist or bend the sail 22, the handle 120 is moved to a position wherein the ram 118 moves completely and fully into the cylinder 116. Correspondingly, due to the closed hydraulic circuit between the cylinders 102 and 116, the plunger 100 will be moved to its position of maximum extension from the cylinder 102. In this condition, and as shown in FIG. 6, the driving pawl 84 will be moved out of engagement with the teeth 92 of the ratchet 86 by the camming stud 140 in the manner mentioned above and simultaneously, the link 142 will operate to withdraw the retaining pawl 128 from engagement with the ratchet. In this position, the boom is free to rotate and the sail 22 may be hoisted by pulling on the halyard 40 and securing it in place.

Should it be necessary to reef the sail 22, the halyard 40 is released and the handle 120 oscillated manually to effect simultaneous reciprocation of the ram 118 and the plunger 100. Since the cylinder 102 is fixed relative to the axis of the shaft 58, reciprocation of the plunger 100 relative to the cylinder 102 will effect oscillation of the arm 80 about the axis of the shaft carrying with it the drive pawl 84. Since the retaining pawl 128 and the drive pawl 84 are biased into engagement with the teeth 92 on the ratchet

86 the ratchet will be intermittently rotated to rotate the boom **16**. The sail **22** therefore will be rolled about the boom **16** and thus reefed. When the sail has been reefed to a desired amount, the halyard **40** will again be drawn taut and secured assuming continued sailing is contemplated. If it is desired to completely reef the sail **22**, the handle **120** is operated until the sail is completely rolled about the boom **16**. It is contemplated that the handle **120** will be equipped with adjustable movement limiting means (not shown) so that during operation to reef the sail **22**, the maximum extent to which the plunger **100** projects is limited to the position shown in FIG. 5 of the drawings. In this manner accidental disengagement of both pawls **84** and **128** from the ratchet will be prevented.

Thus it will be seen that by this invention an extremely effective sailboat rigging is provided by which the above-mentioned objectives are completely fulfilled. Not only does the arrangement of the sail reefing apparatus enable complete control over the sail **22** from the cockpit **12** of the sailboat but moreover, the mounting of the boom and reefing apparatus on the mast step **24** provides for almost completely unhampered sailing operations during normal conditions.

Since it will be apparent to those skilled in the art that many changes can be made in the described embodiment without departing from the true spirit and scope of the present invention, it is to be distinctly understood that the foregoing description is illustrative of a preferred embodiment only, not limiting, and that the true scope of the present invention is to be determined by the appended claims.

What is claimed is:

1. In a sailboat, the combination comprising: a hull having a cockpit therein; a mast; a mast step to support said mast remotely from said cockpit, said mast step including a socket member secured to said hull, a ball member received in said socket, a plurality of spaced legs supported on said ball and diverging upwardly, and a step plate supported on the upper end of said legs for receiving the lower end of said mast; a rotatable boom; means supporting the fore end of said boom from said mast step, said supporting means comprising a bracket depending from said step plate, a shaft supported for universal pivotal movement on said bracket and journaled in the fore end of said boom; and means to rotate said boom including a ratchet fixed on the fore end of said boom, a driving pawl engageable with said ratchet, and means operable from said cockpit to reciprocate said pawl and rotate said ratchet and said boom to reef a sail by rolling it on said boom.

2. The combination recited in claim **1** in which said means to reciprocate said pawl includes a manually actuated hydraulic pulsing device positioned in said cockpit; a cylinder mounted in a fixed position relative to the axis of said boom; a plunger slidable in said cylinder; means connecting said plunger to said pawl; and flexible conduit means establishing a closed hydraulic system between said pulsing device and said cylinder.

3. In a sailboat having a cockpit: a mast step positioned remotely from the cockpit; a boom adapted to have the foot of a sail secured thereto; means to mount the fore end of said boom on said mast step and including a pivotal shaft, said boom being journaled for rotation on the axis of said shaft; a ratchet fixed to the fore end of said boom; a pawl assembly on said shaft, said pawl assembly including a supporting block fixed against rotation about the axis of said shaft, an arm mounted for pivotal movement about the axis of said shaft, a driving pawl pivotally mounted on said arm for movement into engagement with said ratchet, and means on said supporting block for oscillating said arm and said driving pawl about the axis of said shaft to rotate said boom during engagement of said driving pawl with said ratchet; manually actuated pulsing means located near the cockpit of the sailboat; and force transmission means interconnecting said oscillating means and said pulsing means.

4. The apparatus recited in claim **3** in which said means to mount the fore end of said boom includes a bracket on said mast step, and a universal joint connecting said shaft to said bracket.

5. A sail reefing apparatus for a sailboat having a rotatable boom, said apparatus comprising: a shaft adapted to have the fore end of the boom journaled for rotation about the axis thereof; a ratchet journaled for rotation on said shaft axis and adapted to be fixed to the boom; and a ratchet driving assembly on said shaft, said assembly including a driving pawl engageable with said ratchet, a supporting block fixed against rotation about the axis of said shaft, and reciprocable means connected to said supporting block for driving said driving pawl to advance said ratchet; manually actuated, remote pulsing means for developing driving power for said reciprocable means; and flexible transmission means interconnecting said remote pulsing means and said reciprocable means.

6. The apparatus recited in claim **5** including a retaining pawl engageable with said ratchet to hold said ratchet against rotation during retraction of said driving pawl.

7. The apparatus recited in claim **5** in which said ratchet driving assembly includes an arm journaled for oscillatory movement about the axis of said shaft, said arm pivotally supporting said driving pawl and operably connected to said reciprocable means.

8. A sail reefing apparatus for a sailboat having a rotatable boom, said apparatus comprising: a shaft adapted to have the fore end of the boom journaled for rotation about the axis thereof; a ratchet journaled for rotation on said shaft axis and adapted to be fixed to the boom; and a ratchet driving assembly on said shaft, said assembly including a driving pawl engageable with said ratchet, a supporting block fixed against rotation about the axis of said shaft, reciprocable means connected to said supporting block for driving said driving pawl to advance said ratchet, an arm journaled for oscillatory movement about the axis of said shaft, said arm pivotally supporting said driving pawl and operably connected to said reciprocable means, a retaining pawl mounted on said supporting block for engagement with said ratchet to prevent rotation thereof upon retraction of said driving pawl, said pawls being biased into engagement with said ratchet, and means to simultaneously retract said driving pawl and said retaining pawl out of engagement with said ratchet; remote means for developing driving power for said reciprocable means; and flexible transmission means interconnecting said remote means and said reciprocable means.

9. The apparatus recited in claim **8** in which said means to retract said pawls out of engagement with said ratchet comprises: a camming stud on said supporting block in the path of said driving pawl at a position to be inoperative during normal reciprocation of said drive pawl to rotate said ratchet but engageable with said pawl to cam it out of engagement with said ratchet upon said pawl being advanced beyond the normal range of reciprocation; and a link connected between said retaining pawl and said arm, said link having a lost-motion connection with said retaining pawl to have no effect during normal reciprocation of said drive pawl but operable to retract said retaining pawl out of engagement with said ratchet upon advancement of said drive pawl beyond said normal range of reciprocation.

10. A sail reefing apparatus for a sailboat having a rotatable boom, said apparatus comprising: a shaft adapted to have the fore end of the boom journaled for rotation about the axis thereof; a ratchet journaled for rotation on said shaft axis and adapted to be fixed to the boom; a ratchet driving assembly on said shaft, said assembly including a supporting block fixed against rotation about the axis of said shaft, a cylinder mounted on said supporting block, a plunger slidably received in said cylinder, and arm journaled for oscillatory movement about the axis of said shaft, said arm being pivotally connected to said plunger, a driving pawl pivotally mounted on said arm

to engage said ratchet and develop intermittent rotary movement of said ratchet upon oscillatory movement of said arm, and a retaining pawl pivotally mounted on said supporting block for engaging said ratchet during retraction of said driving pawl; and remote actuating means for reciprocating said plunger in said cylinder, said actuating means comprising a manually operated hydraulic pulsing device and flexible conduit means extending between said pulsing device and said cylinder whereby said plunger is directly responsive to fluid pulses developed by said pulsing device.

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