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(54) LIFTING BOOM USEABLE WITH A FORKLIFT

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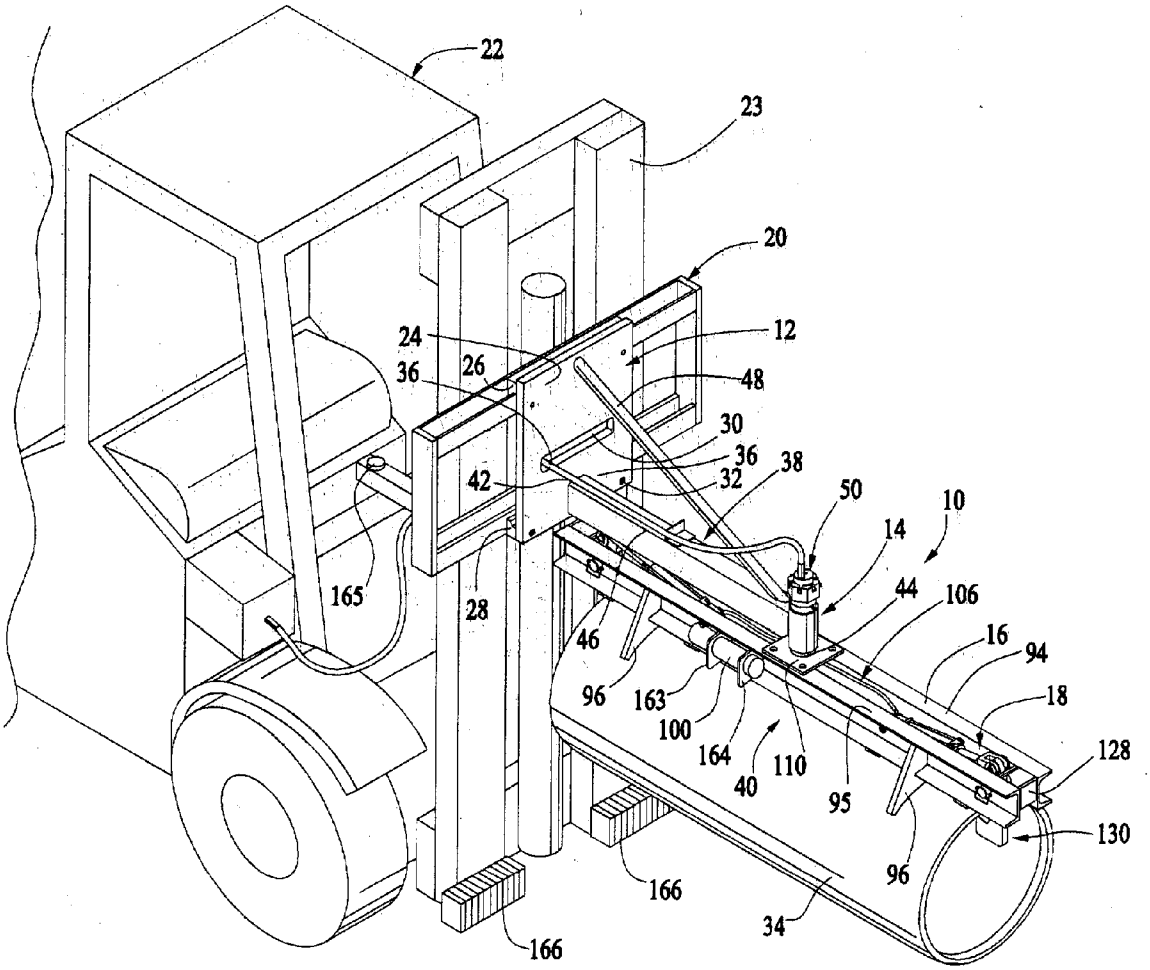
(57) **ABSTRACT**

A lifting boom useable with a forklift having a lifting mechanism includes an attachment plate and a boom assembly. The attachment plate is used to attach the boom assembly to the forklift. The boom assembly includes an elongate lifting beam which is swivelably attached to one end of the boom assembly about a vertical axis. The boom assembly optionally includes a swivel lock for alternatively locking and unlocking the ability of the lifting beam to swivel about the vertical axis. A clamp is positioned at either end of the lifting beam. The clamps are optionally hydraulically operated.



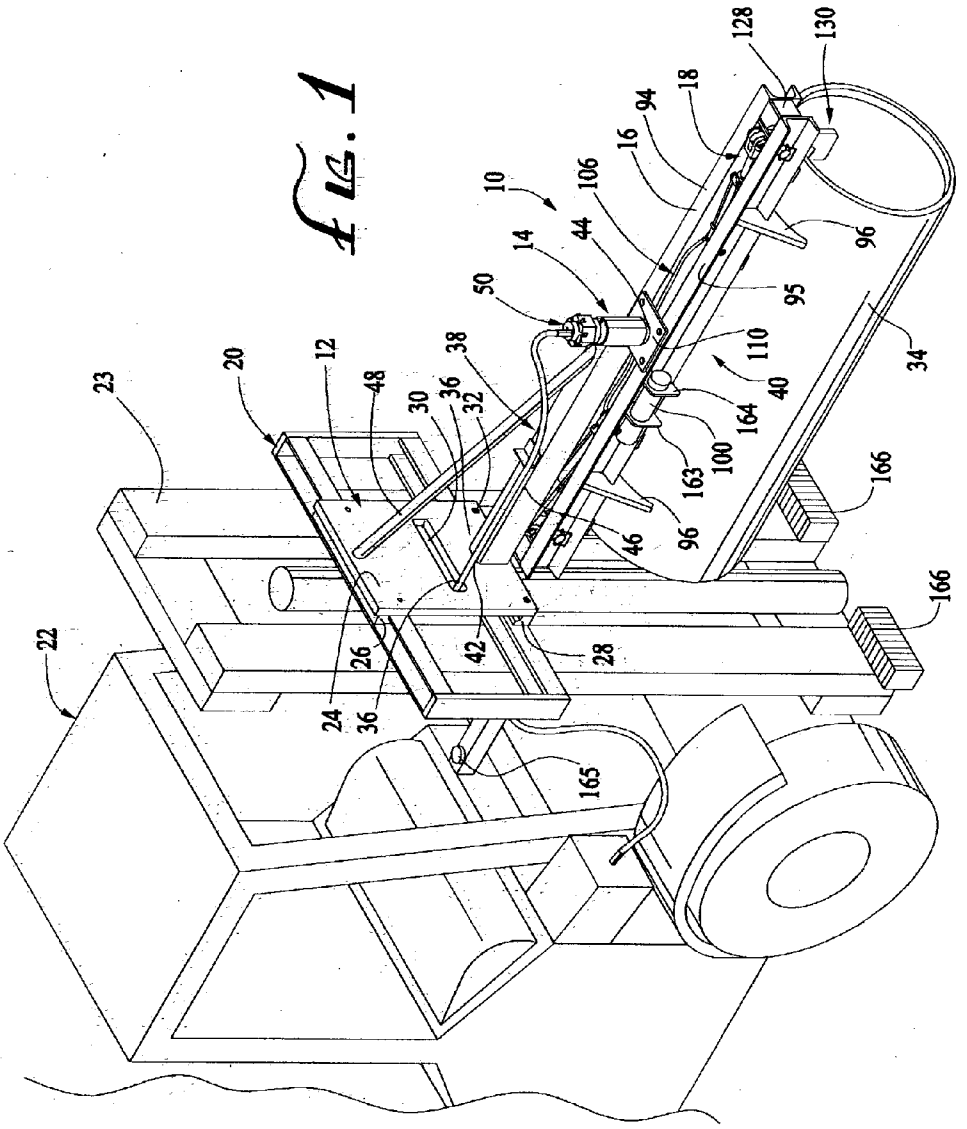

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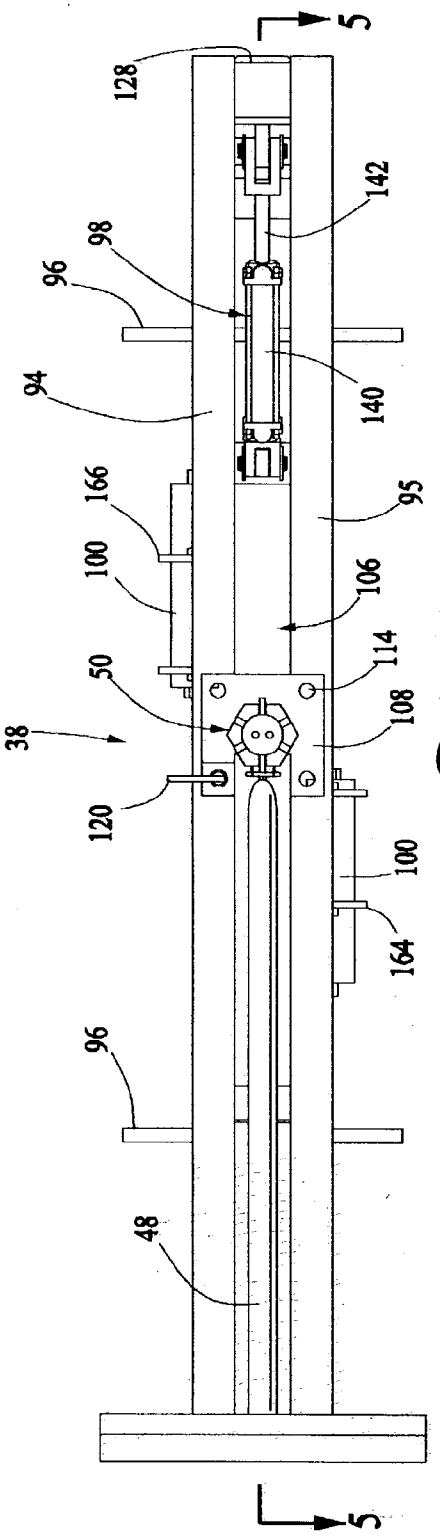
FIG. 1


5
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142
98
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140
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166
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106
114
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120
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48
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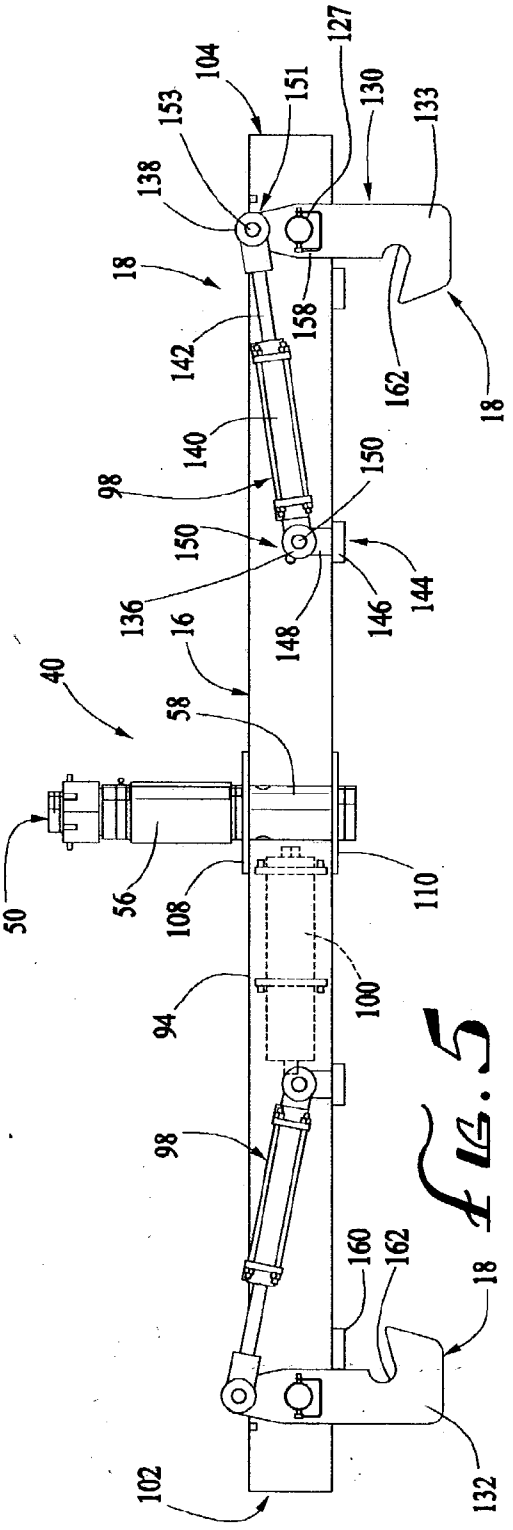
FIG. 2


127
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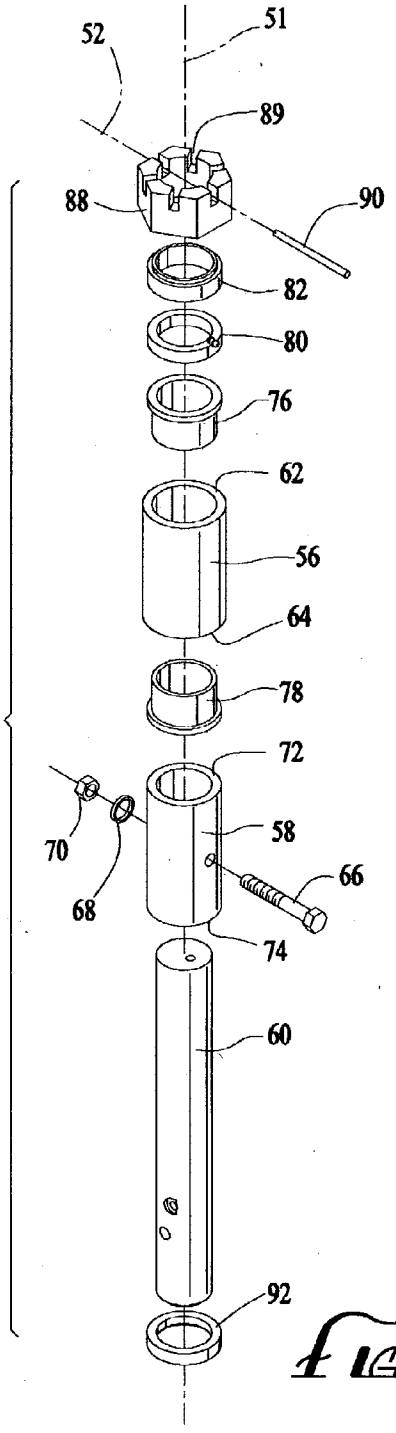
132

FIG. 5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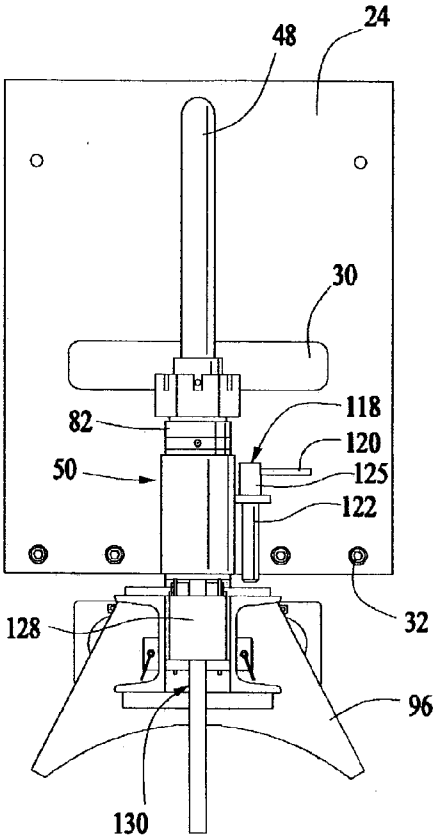
92

FIG. 6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118
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FIG. 3

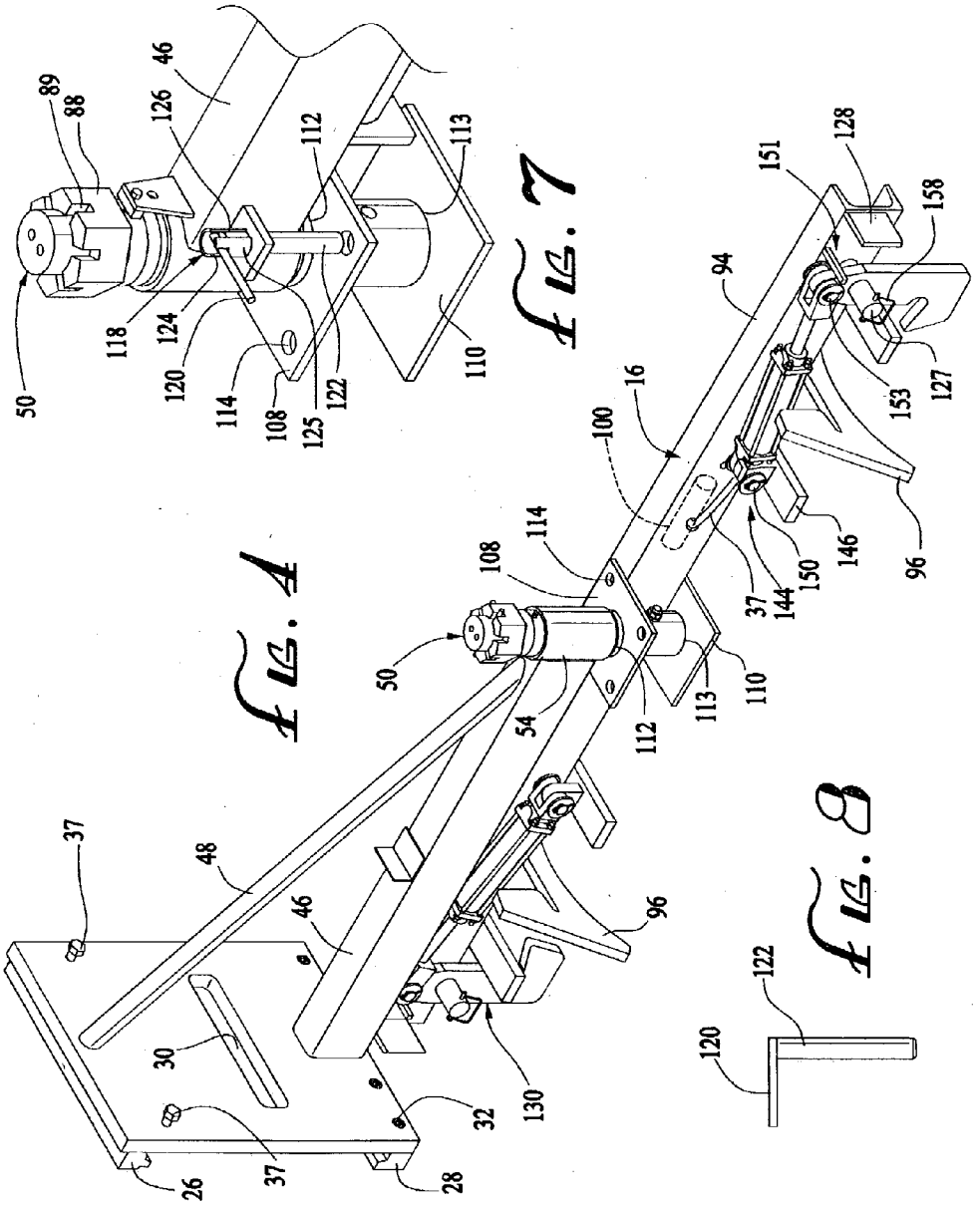
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FIG. 7
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16
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146
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144
37
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FIG. 4
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96
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32
130
26
37
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FIG. 8
122
120

LIFTING BOOM USEABLE WITH A FORKLIFT

FIELD OF THE INVENTION

[0001] This invention relates generally to lifting booms useable with a forklift having a lifting mechanism, and more particularly, to lifting booms containing a lifting beam swivelably attached to a boom assembly and having clamps to engage and lift loads that weigh up to one ton or more.

BACKGROUND OF THE INVENTION

[0002] The use of lifting devices with a forklift to lift heavy objects is known in the manufacturing and construction industries. A typical lifting device is attached to a forklift through an attachment plate, and further comprises a boom assembly, and a lifting beam. The boom assembly contains a long bolt that holds the lifting beam and allows the beam to freely swivel about a vertical axis. Such lifting devices typically contain clamps on each end of the lifting beam for engaging and lifting a load. The clamps are manually engaged and disengaged.

[0003] The problem with such forklift lifting boom assemblies is that they do not have a mechanism to lock and unlock the swivel of the lifting beam. Another problem with such assemblies is that the clamps have to be engaged and disengaged manually. The limitations of such apparatuses are apparent when the lifting beam has to be positioned directly over a container that is to be lifted. The forklift operator can only control the up and down movement of the lift, and does not have any control over the position of the lifting beam, as the lifting beam is free to swivel about its vertical axis. Also, since the clamps on the ends of the lifting beam have to be engaged to or disengaged from the load manually, the forklift operator can only engage or disengage the clamps by leaving the forklift or with assistance of one or more workers. Such limitations of the previous apparatuses require two additional operators to position, clamp and unclamp the lifting beam. The use of additional operators to lift a load is expensive and adds to the cost of operation of the forklift.

[0004] Accordingly, there is a need for a forklift lifting device that is capable of alternatively locking and unlocking the ability of the lifting beam to swivel about the vertical axis and that contains a mechanism allowing automated operation of the clamps on the ends of the lifting beam.

SUMMARY

[0005] The invention satisfies this need. The invention is a lifting boom useable with a forklift having a lifting mechanism. This lifting boom comprises (a) an attachment plate for attachment to the lifting mechanism of a forklift; (b) a boom assembly having an attachment plate end and a swivel end, the attachment plate end being attached to the attachment plate; (c) an elongate lifting beam swivelably attached to the swivel end of the boom assembly about a vertical axis, the beam having a first end and a second end; and (d) at least one clamp disposed proximate to both the first end and the second end of the lifting beam. In one embodiment, the clamps are hydraulically operated clamps. In another embodiment, the apparatus further comprises a swivel lock for alternatively locking and unlocking the ability of the lifting beam to swivel about the vertical axis.

DRAWINGS

[0006] These features, aspects and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying figures where:

[0007] **FIG. 1** is a perspective view of a forklift and a lifting boom having features of the invention.

[0008] **FIG. 2** is a plan view of a lifting boom having features of the invention.

[0009] **FIG. 3** is a frontal view of the lifting boom illustrated in **FIG. 2**.

[0010] **FIG. 4** is a perspective view of the lifting boom illustrated in **FIG. 3**.

[0011] **FIG. 5** is a cross-sectional side view of the lower boom assembly illustrated in **FIG. 2**, taken along line **5-5**.

[0012] **FIG. 6** is an exploded view of a swivel assembly useable in the invention.

[0013] **FIG. 7** is a perspective view of the swivel assembly illustrated in **FIGS. 1 and 6**.

[0014] **FIG. 8** is a side view of lynch pin useable in the invention.

DETAILED DESCRIPTION

[0015] The following discussion describes in detail two embodiments of the invention and several variations of those embodiments. This discussion should not be construed, however, as limiting the invention to those particular embodiments. Practitioners skilled in the art will recognize numerous other embodiments as well.

[0016] The invention is a lifting boom **10** for lifting loads weighing up to one ton and more. This lifting boom **10** comprises an attachment plate assembly **12**, a boom assembly **14**, a lifting beam **16**, and at least one clamp **18** disposed on either end of the lifting beam **16**. The lifting boom **10** is suitable for attachment to the lifting assembly **20** of a large industrial forklift **22**, such as a 12,000 pound model forklift manufactured by Hyster Company of Greenville, N.C. In the embodiment illustrated in the drawings, the attachment plate assembly **12** comprises an attachment plate **24**, two lugs **26** and **28** and a cavity **30**. The attachment plate **24** is attached to the lifting assembly **20** of a forklift **22**. The attachment plate **24** is typically made up of a rectangular metal plate, but any other suitable material or shape may be used. The attachment plate **24** contains an upper lug **26** and a lower lug **28**, as shown in **FIG. 4**. In the embodiment illustrated in the drawings, the attachment plate **24** contains a cavity **30**. The lugs **26** and **28** are made of metal, typically of steel. Each of the lugs **26** and **28** connects to the attachment plate **24** at a 90° angle. The attachment plate **12** is clamped to the lifting assembly **20** of the forklift **22** by lugs **26** and **28**. The upper lug **26** is welded to the attachment plate **24**, while the lower lug **28** is bolted to the attachment plate **24**. Lateral shifting of the attachment plate assembly **12** relative to the lifting assembly **20** is prevented by jam bolts **37**. Thus, attachment and removal of the lifting boom **16** is facilitated by the upper lug **26** which carries the weight of the lifting boom **16** and the removable lower lug **28** that holds the attachment assembly **12** to the lifting assembly **20**.

[0017] In the embodiment illustrated in the drawings, the boom assembly **14** comprises an upper boom assembly **38** and a lower boom assembly **40**. The upper boom assembly **38** is typically connected to both the attachment plate **24** and to the lifting beam **16**. The upper boom assembly **38** has an attachment plate end **42**, which is welded to the attachment plate **24**, and a swivel end **44**, which is connected to the lifting beam **16**. In the embodiment illustrated in the drawings, the upper boom assembly **38** is comprised of an upper boom beam **46**, an elongate pipe **48**, and a swivel assembly **50**. The upper boom beam **46** is welded to the attachment plate **24**, and extends horizontally from the lower part of the attachment plate **24**. The end **54** of the upper boom beam **46** distal to the attachment plate **24** is vertically radiused to accept the upper sleeve **56** of the swivel assembly **50**. The upper boom beam **46** is welded to the upper sleeve **56** of the swivel assembly **50**. The elongate pipe **48** extends downwardly from the upper portion of the attachment plate **24**. The function of this pipe **48** is to vertically stiffen the upper boom beam **46** by acting as a tension member. The end of this pipe **48** distal to the attachment plate **24** is welded to the upper boom beam **46** at an acute angle. The end of the pipe **48** adjacent to the plate **24** is welded to the plate **24**.

[0018] The swivel assembly **50** is shown in detail in **FIG. 6**. This swivel assembly **50** is positioned along a vertical axis **51**. In the embodiment illustrated in the drawings, the swivel assembly **50** comprises an upper sleeve **56**, a lower sleeve **58** and a swivel shaft **60**. The upper sleeve **56** is a cylinder typically made of steel, which is typically welded to the end of the upper boom assembly **38**. The upper sleeve **56** has an upper end **62** and a lower end **64**. The swivel shaft **60** is typically made out of low carbon cold roll carbon steel. The lower sleeve **58** is a cylinder typically made of steel, and it is pinned to the swivel shaft **60** with a bolt **66**, a lockwasher **68**, and a nut **70**, as shown in **FIG. 6**. The lower sleeve **58** has an upper end **72** and a lower end **74**.

[0019] In the embodiment illustrated in the drawings, the swivel assembly **50** further comprises an upper swivel bushing **76** and a lower swivel bushing **78**. The upper swivel bushing **76** and the lower swivel bushing **78** are typically made of oil impregnated sintered bronze ("oil lite bronze") and are fit into the upper end **62** and the lower end **64** of the upper sleeve **56**, respectively. The swivel shaft **60** passes through the swivel bushings **76** and **78**, maintaining alignment of the lower boom assembly **40** with the upper boom assembly **38**. A thrust bearing **80**, typically made of brass, is disposed on top of the upper swivel bushing **76** and fits between the upper swivel bushing **76** and either a weight sensor **82** or a replacement spacer (not shown), depending on whether or not the optional weight sensor **82** is used. In one embodiment, the thrust bearing **80** has an off center round groove so as to provide an off center lubrication annulus (not shown). In the embodiment illustrated in the drawings, the weight sensor **82** is provided by a load cell.

[0020] The weight sensor **82** is an optional feature of the invention that allows the forklift operator to read a digital display (not shown) mounted on the dashboard of the forklift **22**, indicating the total lifting boom load **34**. The load cell range is chosen so that it will include the weight of the load **34** to be lifted by the lifting boom **10**. The range typically is 0-5000 lbs. When there is no load **34** on the boom **10**, the digital display reads zero. A load cell useable in the invention is an Omegadyne Model # LC8450-313-5K load cell, made by Omegadyne, Inc. of Stamford, Conn. Alternatively, other commercially available load cells, compatible with the swivel assembly **50**, may be used.

[0021] If no weight sensor **82** is installed, a load cell replacement spacer **86** is present. This load cell replacement spacer **86** is typically made of steel. The thrust bearing **80** is fitted with a standard Zerk fitting to apply lubrication. A plain castle nut **88** having multiple indentations **89** at one end is disposed on top of either the load cell replacement spacer **86** or the weight sensor **82**, depending on which option is used. A spring pin **90** passes through two of the indentations of the plain castle nut **88**. During assembly, the castle nut **88** is only tightened enough to eliminate the free play, but not tight enough to hinder the swivel motion in any way. An end cap **92** is welded to the lower end of the swivel shaft **60**.

[0022] In the embodiment illustrated in the drawings, the lower boom assembly **40** comprises a lifting beam **16**, at least one ship channel **94**, at least one load saddle **96**, at least one hydraulic ram **98**, a hydraulic accumulator **100**, and at least one clamp **18**. The lower boom assembly **40** is illustrated in **FIG. 5**.

[0023] The lifting beam **16** is an elongate beam having a first end **102** and a second end **104**. In the embodiment illustrated in the drawings, the lifting beam **16** contains two ship channels **94** and **95**. These channels **94** and **95** are joined to each other using two end plates **128**, as shown in **FIG. 1**. The end plates **128** are typically made of steel. In the embodiment illustrated in the drawings the ship channels **94** and **95** provide the lifting beam **16** with a cavity **106**, the cavity extending longitudinally along the beam's length, as shown in **FIG. 1**. The cavity **106** has a width that is sufficient to allow the through passage of the lower part of the swivel assembly **50**, as shown in **FIG. 5**. Two swivel assembly mount plates **108** and **110** are welded to the lifting beam, one plate **108** from above the beam, and one plate **110** from below the beam. These plates **108** and **110** are seen in **FIG. 4**. Each mount plate **108** and **110** has a circular cavity **112** and **113**, the circular cavities having a diameter that is typically equal to the width of the lifting beam cavity **106**. The cavities of the mount plates **112** and **113** are aligned with the cavity **106** of the lifting beam **16** so as to allow the through passage of the lower sleeve **58** of the swivel assembly **50**. The lower sleeve **58** of the swivel assembly **50** is at least partially disposed within the lifting beam **16** and both of the swivel mount plate cavities **112** and **113**. In the embodiment illustrated in the drawings, the lower sleeve **58** is free to rotate about a vertical axis **51**. This sleeve **58** is typically welded to both of the swivel assembly mount plates **108** and **110**.

[0024] The swivel assembly **50** allows the lifting beam **16** to be rotated about the vertical axis **51** of the swivel shaft **60**. In the embodiment illustrated in the drawings, the swivel assembly **50** is positioned along a vertical axis **51**. Because the lower sleeve **58** of the swivel assembly **50** is welded to the lifting beam **16**, the lifting beam **16** is only capable of movement along with the lower sleeve **58**, and the angle between the swivel assembly **50** and the lifting beam **16** does not change. This prevents unwanted wobbling of the lifting beam **16** while the load **34** is being lifted by the lifting boom **10**.

[0025] In the embodiment illustrated in the drawings, the top swivel assembly mount plate **108** is square-shaped, and

contains four cavities **114**, each disposed proximate to one corner of the plate **108**. In the embodiment illustrated in the drawings, the lifting beam **16** contains four correspondingly sized cavities **116**. The top mount plate **108** is positioned with respect to the lifting beam **16** so that its one large cavity **112** and four smaller cavities **114** are aligned with the corresponding cavities **106** and **116** of the lifting beam **16**.

[**0026**] In the embodiment illustrated in the drawings, a swivel lock **118** is provided by a simple lynch pin **120** which is mounted to a cylindrical pin **122** that is attached to the upper boom assembly **38**. This swivel lock **118** is shown in detail in **FIG. 7**. The housing **125** has two slots **124** and **126** cut in it. If the pin **120** is lifted and placed in the shallower of the slots **124**, it is prevented from dropping into the cavity **114**, drilled in the top swivel assembly mount plate **108** and the cavity **116** of the lifting beam **16**. This allows free rotation of the lower boom assembly **40**. If the pin **120** is placed into the deeper slot **126**, it is allowed to drop into one of the four cavities **114** and into one of the four corresponding cavities **116**, thereby locking the lifting beam **16** in any one of four positions that are either perpendicular to or in-line with the upper boom assembly **38**. Thus the swivel lock **118** prevents unwanted swiveling of the lifting beam **16**.

[**0027**] In the embodiment illustrated in the drawings, the lifting beam **16** contains two load saddles **96**, each disposed proximate to either the first **102** or the second **104** end of the beam **16**, as shown in **FIG. 4**. Each load saddle **96** is typically manufactured from metal, and is welded to the lifting beam **16**. The shape of each load saddle **96** is typically complementary to the shape of the load **34**. In the embodiment illustrated in the drawings, where the load **34** is cylindrical in shape, the shape of each load saddle **96** is semi-circular, with the radius being appropriately sized to accommodate the cylindrical load **34**, as shown in **FIG. 3**. Thus, the saddles **96** prevent unwanted roll of the load **34**.

[**0028**] In the embodiment illustrated in the drawings, the lifting beam **16** contains two hydraulic rams **98** and two clamps **18**, each disposed proximate to either the first end **102** or the second end **104** of the beam **16**, as shown in **FIG. 5**. In the embodiment illustrated in the drawings, each clamp **18** is provided by a hook assembly **130**. The hook assembly **130** of the illustrated embodiment comprises a hook **132**. Each hook **132** is swivelably attached to the beam **16** by an attachment pin **127**. The hydraulic rams **98** and the hook assemblies **130** are attached to the lifting beam **16** and connected to each other. The ship channels **94** and **95** of the lifting beam **16** typically house the hydraulic rams **98** and the top portions of the hook assemblies **130**, as shown in **FIG. 1**.

[**0029**] A hydraulic ram **98** is shown in **FIG. 5**. The ram has a mount plate end **136** and a hook assembly end **138**. The ram **98** has a piston-like shape, containing a sleeve **140** that houses a rod **142**. The rod **142** is capable of extending away from the sleeve **140**. The extension of the rod **142** occurs due to hydraulic pressure supplied to the hydraulic ram **98** by hydraulic lines **36**. This pressure originates from the auxiliary hydraulic circuit (not shown) on the forklift **22**. The rod **142** is proximate to the hook assembly end **138** of the hydraulic ram **98**, and the sleeve **140** is proximate to the mount plate end **136**. Movement of the rod **142** creates rotation of the hook **132** because the hydraulic ram **98** is connected to the hook assembly **130**.

[**0030**] Each hydraulic ram **98** is attached to the lifting beam **16** using a mount assembly **144**. In the embodiment illustrated in the drawings, the mount assembly **144** is comprised of a mount plate **146**, a mount **148**, and a ram pin assembly **150**, all shown in **FIG. 5**. The mount plate **146** is typically made of metal and rectangular in shape. Part of the top surface of the mount plate **146** is welded to the underside of the lifting beam **16**. In the illustrated embodiment, two hydraulic rams **98** and two hook assemblies **130** are attached to the lifting beam **16**. Thus, two mount assemblies **144** are used to secure hydraulic rams **98** to the lifting beam **16**.

[**0031**] As illustrated in the embodiments illustrated in **FIGS. 4 and 5**, the ram pin assembly **150** contains a ram pin **153** having one square snap pin **158** disposed proximate to each end of the ram pin **153**. The ram pin **153** connecting the hydraulic ram **98** to the hook assembly **130** and the attachment pin **127** connecting the hook assembly **130** to the lifting beam **16** allow for rotation of the hook **132**. Proximate to each hook assembly **130**, a hook stop **160** is welded to the lifting beam **16**. In the embodiment illustrated in the drawings, two hooks **132** and **133** and two hook stops **160** and **161** are used. Each hook stop **160** and **161** controls the degree of rotation of each hook **132** and **133**. The hooks **132** and **133** are shown in detail in **FIG. 5**. As can be seen from this figure, the two hooks **132** and **133** have differing distances between attachment pin **127** and ram pin **153**. In the embodiment illustrated in the drawings, the distance between attachment pin **127** and ram pin **153** is greater for hook **132** than for hook **133**. Because of this configuration, hook **132** will always rest against stop **160** when engaging a load. Hook **133**, on the other hand, will "float." The distances from each hook stop **160** and **161** to each end of the beam are not equal, as shown in **FIG. 5**. Each hook **132** and **133** has to be positioned at its specific hook stop **160** and **161**, observing pre-defined distances to the ends of the lifting beam **16**, as shown in **FIG. 5**

[**0032**] Each hook assembly **130** has a failsafe mechanism **163** associated with it. The failsafe mechanism **163** prevents the hooks **132** and **133** from opening and releasing the load **34** in case of accidental loss of hydraulic pressure to the hooks **132** and **133**. The fail-safe mechanism **163** could be provided by metallic springs (not shown), configured to be large enough to support the desired load weight. In the embodiment illustrated in the drawings, the failsafe mechanism **163** is provided by two hydraulic accumulators **100**. Each accumulator **100** is attached to the lifting beam via an accumulator bracket assembly **164**, as shown in **FIG. 1**. The two accumulators **100** are disposed proximate to the center of the beam **16**. In the illustrated embodiment, the accumulators **100** are located on the opposing sides of the beam **16**, as shown in **FIG. 2**. Each accumulator **100** contains a hydraulic line **37** that passes through the lifting beam **16**. The hydraulic line **36** extends from each accumulator **100** and attaches to its respective hydraulic ram **98** inside the cavity **116** of the lifting beam **16**. In embodiment illustrated in the drawings, each accumulator **100** is charged behind a piston with approximately 800-1000 psig of Nitrogen. The pressure from each accumulator **100** is applied to the closing side of each hydraulic ram **98**, acting as a fail-safe mechanism. In the event that there is failure of the hooks **132** and **133** due to a loss of forklift auxiliary hydraulic circuit pressure, each accumulator **100** will provide its corresponding hydraulic ram **98** with sufficient pressure to keep the load **34** locked into place by the hooks **132** and **133**. Absent this

hydraulic accumulator **100**, the hooks **132** and **133** would unclasp and release the load **34** upon failure of the hydraulic lines **36**.

[**0033**] As an optional feature of the invention, the lifting boom **10** contains a level monitor **165** for monitoring the angle at which the beam **16** is disposed with respect to the horizontal. In one embodiment of the invention, this level monitor **165** is a sight glass. The level monitor **165** is positioned on the lifting assembly **20** in order to acquire an accurate reading of the angular position of the load **34**. This feature of the invention can be used both to insure that the load **34** is in a perfectly horizontal position, and to achieve a specific angle of the load **34** required by a receptacle (not shown) accepting the load **34**.

[**0034**] As illustrated in **FIG. 1**, the lifting assembly **20** of the forklift **22** can be equipped with bumpers **166**. Such bumpers **166** can be used in some operations to index the front of a load **34** to the back of the lifting boom **10**.

[**0035**] In operation, the lifting boom **10** of the invention is brought into proximity to the load **34** of interest by a forklift operator. The load **34** can be approached from any orientation because the lifting boom **10** is capable of swiveling about a vertical axis **51** to align property with the orientation of the load **34**. Once the forklift operator sets the desired orientation of the lifting boom **10**, the lynch pin **120** can be dropped by the forklift operator into any one of the four cavities **114** in the top swivel assembly mount plate **108**. This dropping of the pin **120** prevents rotation of the lifting boom **10** about the swivel axis. Once the lifting boom **10** is oriented and locked in longitudinal alignment with the load **34**, the forklift operator moves and centers the lifting boom **10** over the load **34**. In the absence of the swivel lock **118** mechanism, additional operators would be necessary to maintain the desired orientation of the lifting boom **10**, since the lifting boom **10** would normally freely swivel about a vertical axis **51** during the movement of the forklift **22** or during the vertical movement of the lifting boom **10**.

[**0036**] The forklift operator subsequently opens the hooks **132** and **133** by using the forklift auxiliary hydraulic controls. Specifically, the pressure in the hydraulic lines **36** is transmitted to the hydraulic rams **98**, and the movement of the hydraulic rams **98** moves each hook **132** and **133** in the unclamp, or open position. Once the hooks **132** and **133** are opened, the forklift boom **10** is lowered onto the target load **34** until the load saddles **96** come in contact with the top surface of the load **34**. At that point, the operator uses the forklift auxiliary hydraulic controls (not shown) to remove the hydraulic pump pressure from the hydraulic rams **98**. The hydraulic accumulators **100** provide the motive force to close the hooks **132** and **133** at that point. Hydraulic pressure from the forklift auxiliary hydraulic system is used only to open the hooks **132** and **133**. In the unlikely event that auxiliary system hydraulic pressure is lost to the hydraulic rams **98**, the hooks **132** and **133** go to their closed position and stay that way until auxiliary hydraulic system pressure is once again available to overcome accumulator pressure. This design prevents the dropping of the load **34** in case of auxiliary hydraulic system failure. Once the hooks **132** and **133** are locked onto the load **34**, the operator may lift the load **34** at that point using the lifting assembly **20** of the forklift **22**.

[**0037**] After the load **34** is lifted, the forklift operator, or another worker, may rotate the load **34** by pushing on one end of the load **34**. In order to rotate the load **34**, the operator will lift the lynch pin **120** from its previous position, thus removing the swivel lock **118**. Rotation of the load **34** allows for orienting it in alignment with a receptacle that will accept the load **34**. This rotation is possible because the lifting boom **10** is free to swivel about the vertical axis **51**. The rotation of the lifting boom **10** requires minimal force because the thrust bearing **80** in the swivel assembly **50** takes the load **34** and is lubricated. The position of the lifting boom **10** can be fixed in any one of four possible positions that are either perpendicular to or in-line with the upper boom assembly **38**. The lynch pin **120**, which acts as a swivel lock **118**, can be again dropped by the forklift operator into any one of the four cavities **114** in the top swivel assembly mount plate **108** to achieve the desired load orientation, and prevent inadvertent rotation of the load **34** about the vertical axis **51** while it is being moved.

[**0038**] Once the load **34** is lifted by the lifting boom **10**, if the optional weight sensor **82** is installed, the forklift operator can read a digital display mounted on the dashboard of the forklift **22** that would indicate the total lifting boom load weight. The weight sensor **82** avoids the step of placing the load **34** on a scale to determine its weight, thus minimizing material handling steps.

[**0039**] A typical forklift truck **22** is equipped with a mechanism that allows for tilting of its mast rails **23**, thus changing the horizontal position of the load **34**. In the embodiment illustrated in the drawings, the forklift boom **10** is free to swivel about its vertical axis **51**, and such rotation does not change the horizontal positioning of the load **34** with respect to the ground. In cases where the receptacle of the load **34** requires the load **34** not to be parallel to the ground, the optional level monitor **165** can be used for for monitoring the angle at which the beam **16** is disposed with respect to the ground. By looking at the angle displayed by the level monitor **165**, the forklift operator can achieve specific angle of the load **34** required by the load receptacle.

[**0040**] Having thus described the invention, it should be apparent that numerous structural modifications and adaptations may be resorted to without departing from the scope and fair meaning of the instant invention as set forth hereinabove and as described hereinbelow by the claims.

What is claimed is:

1. A lifting boom useable with a forklift having a lifting mechanism, the lifting boom comprising:

(a) an attachment plate for attachment to the lifting mechanism of a forklift;

(b) a boom assembly having an attachment plate end and a swivel end, the attachment plate end being attached to the attachment plate;

(c) an elongate lifting beam swivelably attached to the swivel end of the boom assembly about a vertical axis, the beam having a first end and a second end; and

(d) at least one hydraulically operated clamp disposed proximate to both the first end and the second end of the lifting beam.

2. The lifting boom of claim 1 further comprising a swivel lock for alternatively locking and unlocking the ability of the lifting beam to swivel about the vertical axis.

3. The lifting boom of claim 1 further comprising a level monitor for monitoring the angle at which the lifting beam is disposed with respect to the horizontal.

4. The lifting boom of claim 3 wherein the level monitor is a sight glass.

5. The lifting boom of claim 1 further comprising a weight sensor for sensing the weight of an object attached to the lifting beam by the clamps.

6. The lifting boom of claim 1 further comprising at least one hydraulic accumulator operatively connected to the hydraulically operated clamps so as to prevent the clamps from opening in the event of a sudden loss of hydraulic pressure.

7. A lifting boom useable with a forklift having a lifting mechanism, the lifting boom comprising:

(a) an attachment plate for attachment to the lifting mechanism of a forklift;

(b) a boom assembly having an attachment plate end and a swivel end, the attachment plate end being attached to the attachment plate;

(c) an elongate lifting beam swivelably attached to the swivel end of the boom assembly about a vertical axis, the beam having a first end and a second end;

(d) a swivel lock for alternatively locking and unlocking the ability of the beam to swivel about the vertical axis; and

(e) at least one clamp disposed proximate to both the first end and the second end of the beam.

8. The lifting boom of claim 7 further comprising a level monitor for monitoring the angle at which the lifting beam is disposed with respect to the horizontal.

9. The lifting boom of claim 8 wherein the level monitor is a sight glass.

10. The lifting boom of claim 7 further comprising a weight sensor for sensing the weight of an object attached to the lifting beam by the clamps.

11. A lifting boom useable with a forklift having a lifting mechanism, the lifting boom comprising:

(a) an attachment plate for attachment to the lifting mechanism of a forklift;

(b) a boom assembly having an attachment plate end and a swivel end, the attachment plate end being attached to the attachment plate;

(c) an elongate lifting beam swivelably attached to the swivel end of the boom assembly about a vertical axis, the beam having a first end and a second end;

(d) a swivel lock for alternatively locking and unlocking the ability of the beam to swivel about the vertical axis;

(e) at least one hydraulically operated clamp disposed proximate to both the first end and the second end of the beam; and

(f) at least one hydraulic accumulator operatively connected to the hydraulically operated clamps so as to prevent the clamps from opening in the event of a sudden loss of hydraulic pressure.

12. The lifting boom of claim 11 further comprising a level monitor for monitoring the angle at which the lifting beam is disposed with respect to the horizontal.

13. The lifting boom of claim 12 wherein the level monitor is a sight glass.

14. The lifting boom of claim 11 further comprising a weight sensor for sensing the weight of an object attached to the lifting beam by the clamps.

15. A lifting boom useable with a forklift having a lifting mechanism, the lifting boom comprising:

(a) an attachment plate for attachment to the lifting mechanism of a forklift;

(b) a boom assembly having an attachment plate end and a swivel end, the attachment plate end being attached to the attachment plate;

(c) an elongate lifting beam swivelably attached to the swivel end of the boom assembly about a vertical axis, the beam having a first end and a second end;

wherein the swivel assembly is connected to the lifting beam such that the the lifting beam is free to rotate only about the vertical axis, and the angle of the beam relative to the swivel assembly is constant.

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