United States Patent [19]

Loomis et al.

[11] **3,749,438**

[45] **July 31, 1973**

[54] **TWIST LOCK**

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[21] Appl. No.: **131,247**

[52] **U.S. Cl.**..... **294/81 SF**, 24/221 R, 248/119 R, 294/67 R

[51] **Int. Cl.**..... **B66c 1/42**

[58] **Field of Search**..... 294/67 R, 67 DA, 294/81 R, 81 SF; 248/119 R, 361 R; 24/221; 214/15 R; 287/2

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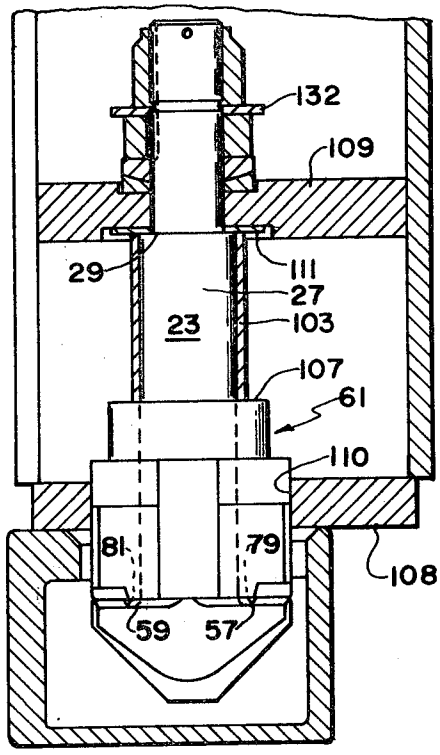
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Assistant Examiner—Johnny D. Cherry
Attorney—Bruce & McCoy

[57] **ABSTRACT**

A twist lock for use with lifting beams for handling different kinds of cargo containers.

17 Claims, 14 Drawing Figures



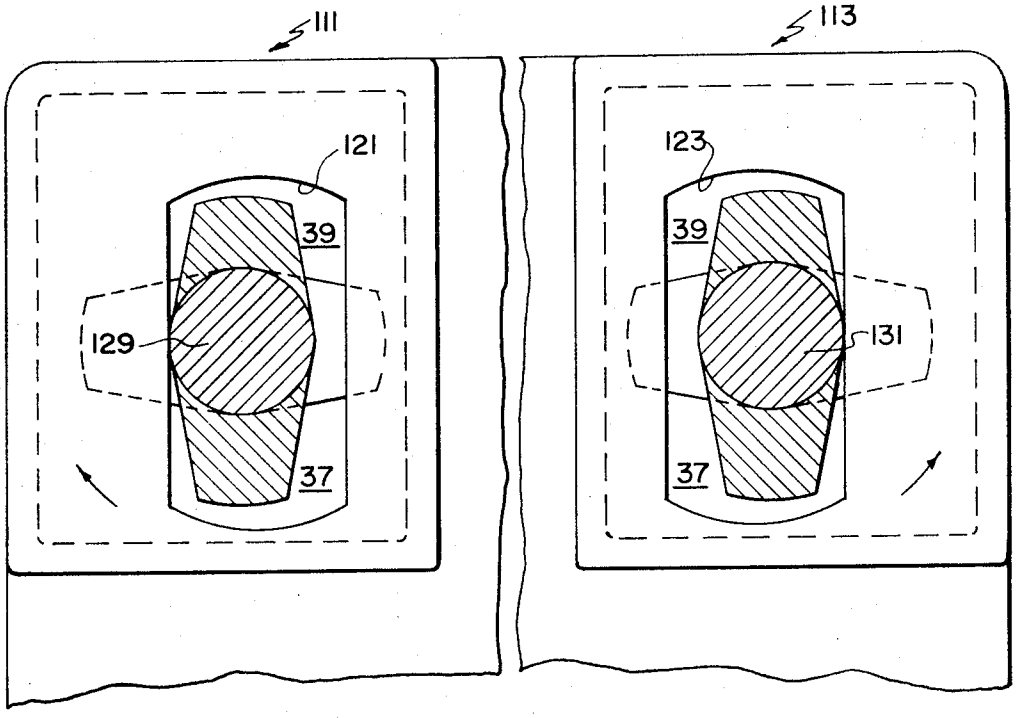
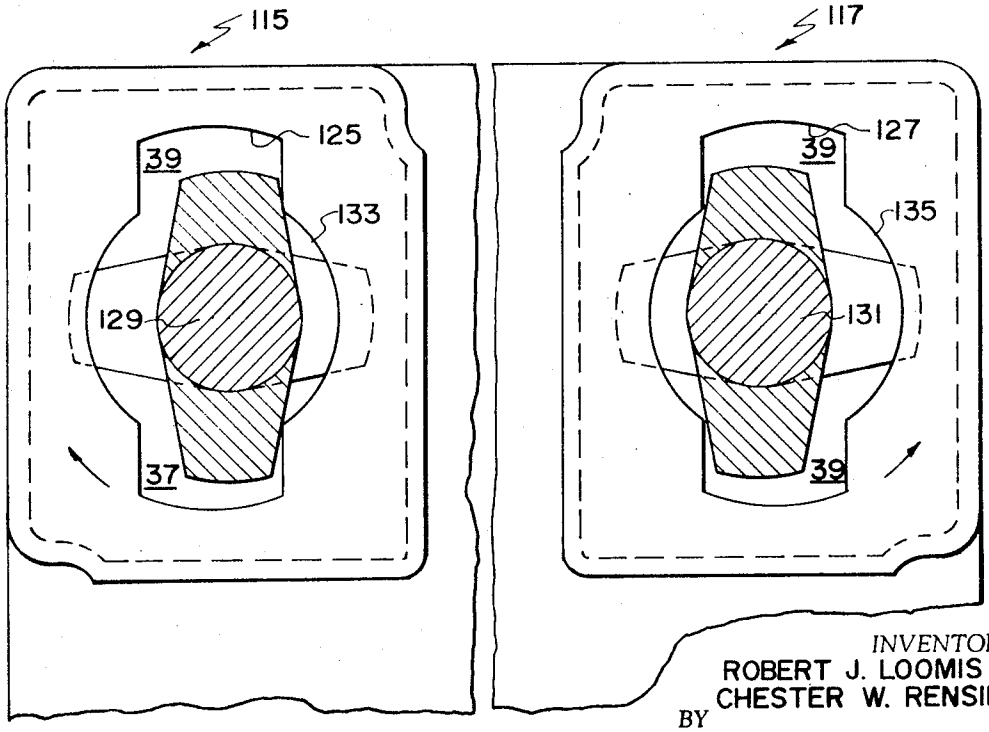


Fig-1



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Fig-2

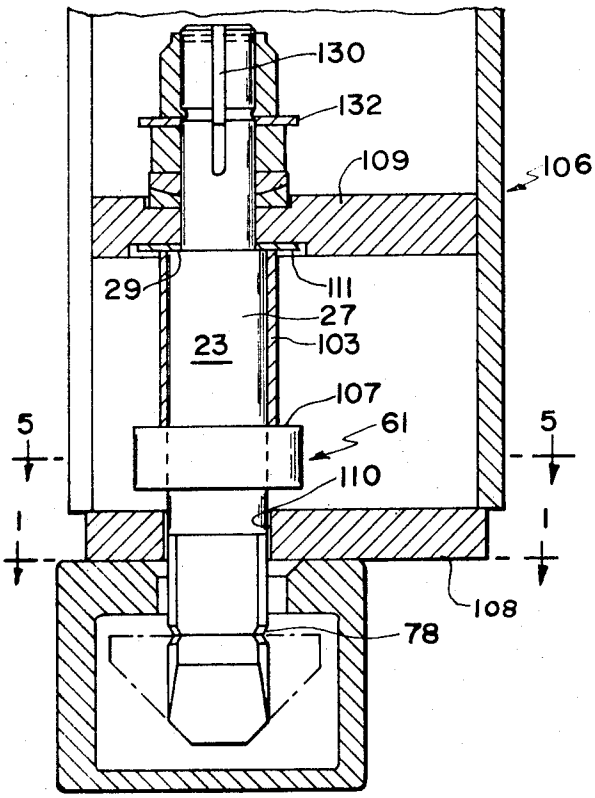


Fig-3

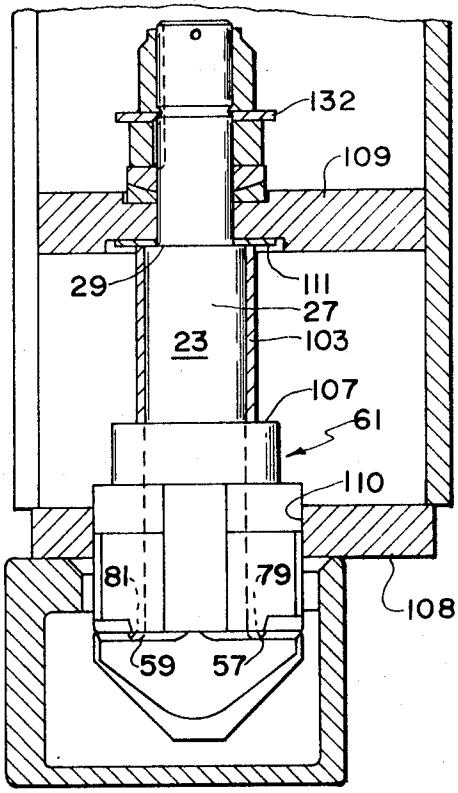


Fig-4

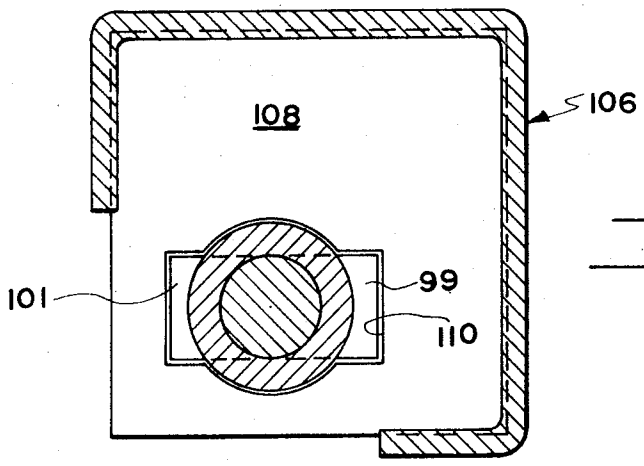


Fig-5

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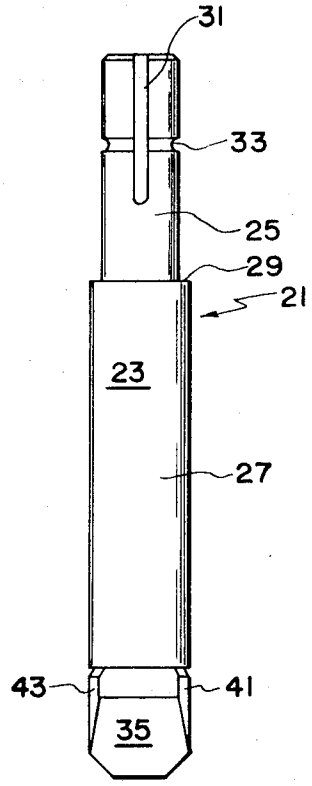


Fig-6

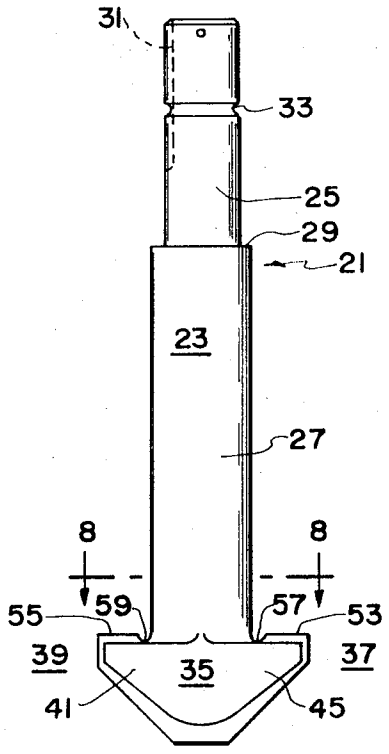


Fig-7

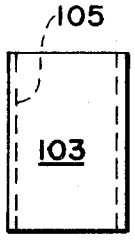


Fig-9

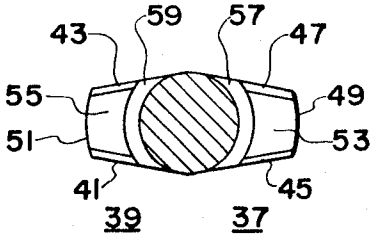


Fig-8

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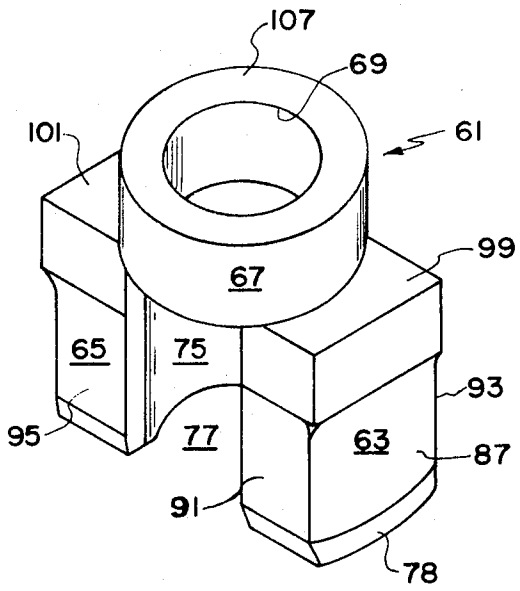


Fig-10

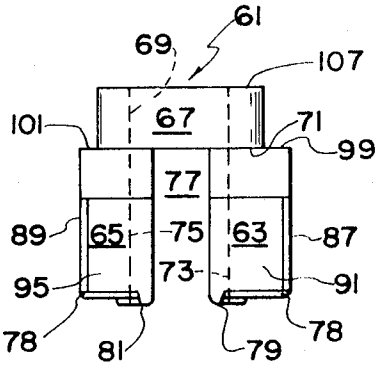


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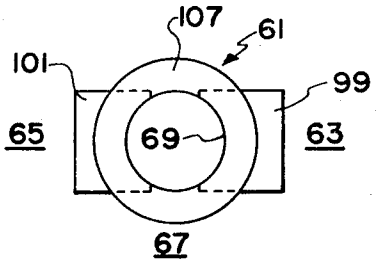


Fig-13

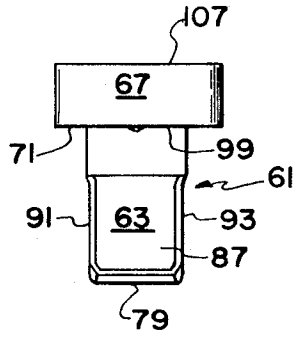


Fig-12

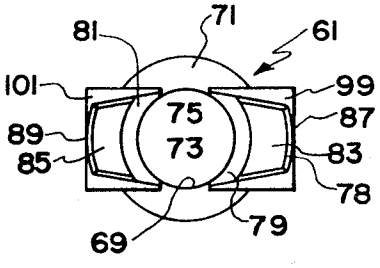


Fig-14

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TWIST LOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to twist locks and more particularly to the operable male member of twist locks used in connection with lifting spreaders for handling different kinds of cargo containers.

2. Description of the Prior Art

Shipping cargo in containerized units has become a commonly used worldwide method of handling materials. This new and efficient method of handling cargo includes the use of standardized cargo containers which may be loaded onto trucks, trailers, or railroad cars or into shipboard storage cells. Along with the development of these shipping containers was the development of equipment to lift and handle these containers by more efficient methods.

Certain standards have been developed for the size, configuration, and strength of cargo containers by such organizations as the American Standards Association and the International Organization for Standardization (ISO). Other than differences in lengths, the dimensions of International standard containers remain the same, and, therefore, telescoping lifting beams or spreaders can be designed to adjust for a difference in length. In the course of the development of international standards, other container dimensions have come into use in different sections of the industry and in other parts of the world. These differences cause even greater difficulty in utilizing one lifting beam to handle more than one kind of container.

In addition to standardization of the sizes of the containers, there have also been attempts to standardize the means utilized to pick up the containers. The most widely used pick-up means today comprises a lifting beam or spreader with twist locks disposed at the four corners thereof. These twist locks include operable male members which are lowered into engagement with corner fittings or female receptacles positioned in the four corners of the upper surface of a cargo container. Hereinafter, as used in the industry, the term twist lock will refer only to the projecting operable male member, and corner fittings will refer to the female receptacles in the corners of the cargo containers.

Problems, however, are encountered if different types of cargo containers having different corner fittings are attempted to be handled by one of the standardized lifting beams. The different kinds of containers, not meeting the International standard, not only have different lengths, which can be accommodated by a telescoping beam, but are also provided with corner fittings having varying lateral spacing as well as different configurations.

It is possible to change twist locks and their spacing each time these differences occur, but, in general, this is very time-consuming, much too costly, and requires storage facilities for the different types of twist locks not in use.

There have been various lifting spreader assemblies, utilizing twist locks, designed for handling cargo containers and with the capability of versatile manipulation for handling of different length containers. One such prior art device is disclosed in U. S. Pat. No. 3,514,146 dated May 26, 1970. That patent discloses a lifting spreader having a central portion and two end portions which can be reciprocated with respect to the central portion by means of hydraulic cylinders whereby the length of the spreader is adjustable. The four corners of the lifting spreader are provided with twist locks which project downwardly therefrom. The twist locks are operated by means of hydraulic cylinders which rotate the twist locks for engagement within the receptacles formed in the four corners of a container. A problem with the utilization of the lifting spreader set forth in that patent arises when cargo containers have differences in lateral spacing of the corner fittings and when differences of configuration of the corner fittings themselves are encountered.

The present widely used International standard twist locks are of a size that may be easily inserted into International fittings. The International twist locks and fittings are nominally spaced apart laterally 89 inches, center to center. This lateral distance is perpendicular to the longitudinal centerline of the spreader. Therefore, when International twist locks are mounted in each of the four corners of a lifting beam, they must be accurately spaced apart in relation to each other in order that all four twist locks may be simultaneously inserted into the upper four corners of a cargo container manufactured in accordance with the International standard. Because of this spacing, when a different kind of container is encountered, such as the widely used Sea-land container, many problems arise. At least some of these problems occur because the corner fittings on the Sea-Land containers are nominally spaced apart 90 inches, center to center, are larger than the International corner fitting, and have a different configuration.

To handle different kinds of cargo containers, it has usually been necessary to change cargo lifting spreaders. No prior art device known to applicant contains twist lock assemblies which can accommodate the different corner fittings, having varying locations, as presently incorporated in the various containers used throughout the world. The present invention provides a universal twist lock receptacle engagement means for a lifting beam or spreader which automatically fits many of the different types and sizes of cargo container corner fittings.

SUMMARY OF THE INVENTION

The present invention is an improved twist lock which comprises an elongated shank extending from a lifting beam and having a base portion at the lower end thereof; two lug members of different lengths extend laterally outward in opposite directions from the base portion different distances from the shank; and a locator means is carried by said shank above said base portion for fitting in the opening of a container corner fitting whereby said twist lock may be guided into and easily withdrawn from different kinds of container corner fittings.

The present invention further provides a method for mounting the novel twist locks and their guide means in the four corners of a lifting spreader, whereby the laterally opposite corner twist locks are spaced apart a predetermined distance to enable the spreader to accommodate different kinds of containers having corner fittings with different lateral spacing and configurations.

OBJECTS OF THE INVENTION

It is therefore an important object of the present in-

vention to provide a twist lock which can be used to handle different types of cargo containers.

It is another object of the instant invention to provide a twist lock which can be used with cargo container corner fittings having slightly different lateral spacing as well as different receptacle configurations.

It is a further object of the invention to provide a locator or guide means for a twist lock so that the twist lock can be adapted to fit into different types of corner fittings.

It is yet another object of the invention to provide a twist lock which can be used with a telescoping lifting spreader or beam to enable cargo containers of varying lengths to be handled by the same spreader.

And it is still a further object of the present invention to provide a method of employing locator means on the twist locks disposed at the four corners of a lifting spreader whereby different kinds of cargo containers having corner fittings with different lateral spacing and configurations may be handled by the same spreader.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view, taken along line **1—1** of FIG. **3**, showing a pair of improved twist locks of the present invention, spaced apart a predetermined distance, engaged in laterally opposite corner fittings conforming to the International standard;

FIG. **2** is a top plan view of the twist locks of FIG. **1** engaged in laterally opposite corner fittings of a Sea-Land cargo container;

FIG. **3** is a front elevation in partial section of a twist lock assembly showing the present invention attached to an operating arm and inserted in a corner fitting of a container in the open or unengaged position;

FIG. **4** is a side elevation of the twist lock assembly of FIG. **3**;

FIG. **5** is a cross-section taken along line **5—5** of FIG. **3**;

FIG. **6** is a front elevation of the novel twist lock of the present invention;

FIG. **7** is a side elevation of the twist lock of FIG. **6**;

FIG. **8** is a cross-section taken along line **8—8** of FIG. **7**;

FIG. **9** shows a spacer used in the twist lock assembly of FIG. **3**;

FIG. **10** shows a perspective view of the novel locator of the twist lock assembly of FIG. **3**;

FIG. **11** shows a side elevation of the twist lock locator of FIG. **10**;

FIG. **12** shows a front elevation of the twist lock locator of FIG. **11**;

FIG. **13** is a top plan view of the twist lock locator of FIG. **11**; and

FIG. **14** is a bottom plan view of the twist lock locator of FIG. **11**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The twist lock that is most widely used throughout the world in the handling of containerized cargo is the so-called International standard twist lock. One of these bayonet type twist locks is normally mounted in each of the four corners of a lifting beam or spreader which is suspended from a crane. Each of the twist locks has an elongated cylindrical shank portion which includes a substantially rectangular shaped base portion at the lower end thereof. The base portion is provided with two laterally extending arms or lug members which extend in opposite directions. The lugs of the International standard twist lock which extend from the base portion are of the same length; i.e., extend laterally or radially outward from the center of the shank for the same distance.

The twist locks are insertable into rectangular openings, formed in accordance with the International standard, in corner fittings provided in the four corners of a container. After insertion into the corner fittings, the twist locks are remotely rotated 90° by the crane operator for locking engagement with the fitting to enable the container, to which the corner fittings are attached, to be picked up by the crane. When the twist lock is rotated, the lugs are moved under the edges of the receptacle, preventing the twist lock from being withdrawn.

FIGS. **3–14** show the preferred embodiment of the novel twist lock assembly of the instant invention. In particular, FIGS. **6–8** show a modified International twist lock **21** comprising a cylindrical shank **23** having at least two different diameter portions **25, 27** divided by a positioning stop, such as a shoulder **29** formed therebetween. The smaller or reduced diameter portion **25** includes a slot **31** running along a portion of the length thereof and an annular groove **33** formed around its circumference for attachment to an operating or rotating means.

The lower larger diameter portion **27** of the shank is integrally connected to a base or locking portion **35** formed at the lower end of the shank. The base portion includes two integrally and oppositely extending arms or lug members **37, 39,** one of which extends laterally outward from the center of the shank for a greater distance than the other for reasons explained more clearly hereinafter.

The lugs extend outward in opposite directions from the shank 180° from each other and they narrow or taper together, in the plan view projection, to a generally rounded end **49,51** formed concentric to the shank. The side faces **41,43,45,47** are beveled at the lower edges, and the bottoms of the lugs are tapered to a flat lower end at the center of the shank. The rounded outer ends **49,51** and the taper of each of the lugs is to eliminate sharp edges. The longer of the two lugs points toward the lift center of the lifting spreader in the unengaged position and rotates 90° to point outward, or perpendicular to the longitudinal axis of the spreader, in the engaged position.

The top surface **53,55** of each lug is provided with a groove or quill **57,59** surrounding the larger diameter portion **27** of the shank **23** at its connection to the base portion. The truncated cone shape of the bottom or lower end of the base is to facilitate the insertion of the twist lock **21** into a corner fitting on a cargo container.

FIGS. **10–14** show the unique locator and guide means or positioning device **61,** also referred to as a "twist lock locator." This locator is mountable over the enlarged diameter portion **27** of the twist lock **21** whereby it is disposed over and adjacent the lug members when in operative position. The locator is fabricated by securing two separate lower segments **63,65,** in opposed aligned relationship, spaced 180° apart, to an upper interconnecting member portion **67.**

The upper portion **67** may be annular, as shown, with a bore **69** extending therethrough or it may be any other configuration which serves to interconnect the segments and hold them in position with respect to the

shank. The lower segments **63,65** are secured to one face **71** of the ring member **67**, in any suitable manner, such as by welding. Of course the whole element could be cast as a single unit and machined to shape.

The assembled locator **61** is then provided with a centrally located bore or hole **69,77** substantially equivalent in diameter to the larger diameter portion **27** of the shank **23**. The bore **69,77** may be formed in the assembled locator by reaming or drilling through the bore **69** formed in the annular portion **67** to remove any excess material from the underlying lower segments and to thereby form concave faces **73,75** in the lower segments. In this manner, the partial bore **77** formed in the segments, which may be considered to be an extension of the bore **69** of the ring member, is formed by the concave faces **73,75**.

The lower ends of the segments **63,65** must be capable of fitting into the receptacles in the cargo container corner fittings and are preferably provided with chamfers **78** to guide the insertion of the locator **61** and to match the upper configuration of the lugs. The bottoms of the segments are further provided with curved flanges or guides **79,81** capable of fitting into the curved grooves **57,59** formed in the upper faces of the lug members. The flanges **79** coact with the grooves **57,59** to align and position the locator **61** when it is mounted on the twist lock shank.

Each of the lower segments **63,65** extends laterally outward past the maximum diameter of the annular portion **67** for different or unequal distances and substantially equal to the length of the lug **37,39** above which each segment rests when mounted on the base portion in operative position. As shown in FIGS. **10** to **14**, the bottoms of the lower segments **63,65** form planar surfaces **83,85** provided with rounded peripheral ends **87,89** whereby the bottoms of the segments coincide with the upper faces of the lug members while the vertical sides **91,93,95,97** of the segments merge into substantially rectangular top portions **99,101** secured to the annular portion **107**.

Referring to FIG. **9**, there shown is a tubular spacer **103** having a central passage **105** formed therein of a diameter which is sufficient to fit over the large diameter portion **27** of the shank of the twist lock.

FIGS. **3–5** show the assembled twist lock mounted in a lifting beam **106**. The twist lock locator **61** is slid over the larger diameter portion **27** until the bottom flanges **79,81** fit into the lug grooves **57,59**. The spacer **103** is then slid over the shank to cover the remaining portion of the larger diameter portion of the shank between the guide **61** and the shoulder **29**. The twist lock assembly is attached to an operating arm **109** by means of a flat key **130** and flat washer **132**, and a positioning stop in the form of a thrust washer **111** is preferably placed between the operating arm and the spacer to ensure accurate positioning of the locator **61** on the twist lock **21** and to hold the locator in place. The twist lock assembly may be secured to the operating arm in any convenient manner other than shown.

As clearly shown in FIG. **5**, a bottom plate **108** of the lifting beam is provided with a hole **110** having an enlarged central portion and rectangular end portions. The twist lock locator **61** of the assembled twist lock slips through the hole **110** and is held against rotation therein by the coaction of the rectangular top portions **99,101** with the rectangular ends or sides of the opening.

FIGS. **1** and **2** illustrate the engagement of the twist lock lugs of the assemblies of the present invention in different kinds of corner fittings. In this regard, the pair of International corner fittings **111, 113** shown in FIG. **1** should be compared to the Sea-Land corner fittings **115, 117** shown in FIG. **2**. It can be seen from the illustrations that the openings **121, 123, 125, 127** for receiving a twist lock in each fitting are considerably different in both configuration and spacing from the edges of the container. Furthermore, since the pair of twist lock assemblies **129, 131** in each pair of corner fittings is spaced apart laterally on the spreader the same predetermined distance explained more fully hereinafter, the position of these twist lock assemblies in the corner fittings, shown by the figures, illustrates the different lateral spacing of the corner fittings with respect to the spreader twist locks.

In FIGS. **1** and **2**, only two laterally opposite corner twist lock assemblies are shown, but the other two corner twist lock assemblies at the other end of the spreader cooperate in exactly the same manner. As the twist lock lugs **37,39** enter the corner fittings, the locators carried by the shank of the twist lock assemblies align the assemblies in their fittings. Once inside the fittings, the twist locks are rotated a quarter turn in the direction of the arrow to bring the lugs under the edges of the corner fitting. The longer **37** of the two lugs points toward the outside of the container corner fitting, and the shorter **39** of the lugs points toward the inside of the fitting as shown in phantom line. Although this results in a slightly unbalanced load bearing area on the corner casting or fitting, depending on whether the International standard or Sea-Land container is being handled, the bearing pressures are relatively low, and it is not subjected to any substantial sideways bending. The segment portions of the locators bear against one of the inside edges of the corner fitting openings and keep the shank of the twist lock from moving horizontally in the corner fitting openings.

Without the novel guide means or "twist lock locator" of this invention, the presently used International standard twist locks are just not workable in Sea-Land fittings. When International twist locks are inserted into Sea-Land corner fittings, the twist locks can easily shift horizontally to the point where engagement can be completely one-sided (on only one lug), causing extreme bending in the twist locks and eccentric loading of the container fittings. Both of these conditions are extremely undesirable, especially the latter, which could cause damage to containers and, further, cause failure of the twist locks.

In addition, the horizontal shifting action may also cause mechanism interference when the twist locks are attempted to be withdrawn. The shanks of the International twist locks, not containing a locator, shift into the enlarged central area **133, 135** of the Sea-Land fittings to the extent that the twist lock lugs move under the edge of the smaller portion of the fitting and cannot be lifted out unless the shank is somehow moved outwardly to free the lugs.

In a series of tests conducted by applicant, wherein an improved twist lock assembly, similar to that shown in the arrangement of FIGS. **1** and **2**, was pulled to destruction, the strength of the twist lock is such that it is always the corner fitting which gives first. It is estimated that four to one safety factor exists with a twist lock having unequal length lugs which extend laterally

or radially outwardly from the center of the shank for 2 inches and 2⅜ inches respectively, from a shank which is 2 inches in diameter. With a twist lock of this size, even if one of twist locks was somehow bent or forced out of line, the corner fitting within which it was held would still give before the twist lock would fail.

The twist lock locator of the present invention is so designed that when a twist lock assembly carrying the same is inserted into a corner fitting, the locator preferably bears against one of the inside edges of the fitting and will not rotate with the twist lock since it is held in the opening **110**. The locator will remain in the inserted position against the edge of the opening to restrain horizontal movement of the twist lock assembly. With the assembly in this alignment, as shown in phantom line in FIGS. **1, 2** and **3**, the lugs of the twist lock will always be engaged underneath the edges of the corner fittings to thereby enable the containers to be lifted. Wen it is desired to withdraw the twist lock assemblies from the corner fittings, the lugs of the twist locks are rotated to their unengaged positions under the segments of the locator and the entire assembly may be removed from the corner fitting.

In the embodiment of the invention shown in FIGS. **1** and **2**, the lateral spacing, i.e., the center-to-center location of the twist locks when mounted on a lifting beam, is preferably 89½ inches. In this position on a lifting spreader, the twist locks of the present invention rest midway between the nominal International standard of 89 inches and the nominal Sea-Land standard of 90 inches. This center-to-center spacing enables the twist lock assemblies of the invention to be inserted into numerous kinds of cargo containers having different lateral center-to-center spacing of their corner fittings in addition to the two described heretofore.

In some situations, where the accumulation of dimensional tolerances of the different containers and the lifting beam brings about misalignment between the two, the shank of a twist lock inserted into a corner fitting may be forced out of plumb with relation to the center line of the twist lock assembly. In these extreme cases, the twist lock locator bears against the edge of the fitting opening and prevents the twist lock lugs from moving under the edge, where the lugs cannot be withdrawn in a conventional manner, thereby permitting the improved twist locks to be withdrawn from the corner fittings without interference.

Therefore, an important advantage of the invention lies in the fact that a single lifting spreader provided with the novel twist lock and guide means of the present invention ensures proper engagement, alignment, and withdrawal from different kinds of cargo container corner fittings.

It should be understood, of course, that the foregoing disclosure relates only to a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. An improved twist lock for a lifting beam comprising

an elongated shank extending from said beam and having a base portion at the lower end thereof,

two lug members of different lengths extending laterally outwardly in opposite directions from said base portion different distances from said shank, and

locator means comprising a separate element rotatably disposed on said shank above said lugs, said locator including two opposed segments held together by an interconnecting member whereby said segments and said member may be mounted on said shank, and said segments vertically aligned with said lugs for fitting in the opening of a container corner fitting to prevent undesirable movement of the shank in the corner fitting when the twist lock is disposed therein.

2. The twist lock of claim **1** wherein the longer of said lugs points toward the lift center of the lifting beam when the twist lock is in the unengaged position and which points outward from the longitudinal axis of the lifting beam when the shank is rotated to the engaged position.

3. The twist lock of claim **1** including means for holding said locator against rotation when said twist lock is rotated for engagement in the corner fitting.

4. The twist lock of claim **4** wherein said rotation holding means comprises a shaped opening formed on said lifting beam into which said locator is slipped when the twist lock is mounted in the operative position.

5. The twist lock of claim **1** wherein said segments have a width approximately the width of said lugs.

6. The twist lock of claim **1** wherein said lug members include guide means for positioning the locator means with respect to said lug members.

7. The twist lock of claim **6** wherein said guide means includes a groove formed in the top of said lug members concentric to said shank, and

said segments of said locator means include a curved flange extending from the bottom portion thereof which fits into said grooves of said lugs for coaction therewith.

8. The twist lock of claim **1** wherein each of said segments is of a different length whereby each extends laterally outward from said shank a different distance and substantially the same as the distance the lug over which it lies extends from said shank.

9. The twist lock of claim **1** including a spacer slidably mounted on said shank and extending between said locator means and a positioning stop whereby said spacer acts to hold the locator means in its operative position adjacent said lug members.

10. The twist lock of claim **1** wherein said locator means includes an annular portion having two parallel faces with a bore extending between said faces and said segments are secured to one face of said annular portion in aligned relationship whereby they do not block the bore of said annular portion and are disposed on opposite sides of said shank when said locator means is disposed in operative positions.

11. The twist lock of claim **1** wherein each of said segments of said locator means has concave, opposed inner surfaces, generally rounded peripheral faces at the lateral ends thereof, and generally planar top surfaces, said top surfaces being secured to said interconnecting member whereby said opposed inner surfaces of said segments are concentric to the bore of said annular portion to form partial extensions thereof and said rounded ends of said segments extend radially outward from the center of said annular portion approximately the same distance the corresponding lug members extend from the center of said shank.

12. The twist lock of claim **11** wherein said top portions are rectangular and said lifting beam is provided

with a shaped opening having rectangular ends into which said rectangular top portions are held to prevent rotation of said locator.

13. The twist lock of claim 1 wherein said lugs extend from the center of said shank 2 inches and 2⅜ inches respectively.

14. The twist lock of claim 1 wherein said lifting beam has four corners with an improved twist lock mounted in each of said corners, said twist locks mounted in laterally opposite corners being spaced apart, 89 ½ inches, center-to-center.

15. An improved twist lock comprising

an elongated shank extending from a lifting beam and having a base portion at the lower end thereof,

two lug members formed on said base portion and extending laterally outward in opposite directions different distances from said shank, approximately 2 inches and 2 ⅜ inches respectively, the longer of said lugs pointing toward the lift center of the lifting beam when the twist lock is in the unengaged position and pointing outward from the longitudinal axis of the lifting beam when the shank is rotated to the engaged position, said lugs including a groove formed in the top surfaces thereof concentric to said shank,

a locator disposed on said shank and resting on said lugs for fitting in the opening of different kinds of container corner fittings whereby said twist lock may be held in position when said twist lock is rotated to engage said different kinds of container corner fittings, said locator being rotatably disposed on said shank above said lugs and including an annular upper portion with two opposed lower segments secured to said annular portion, each of said segments being substantially the same width as said lugs and of a different length whereby each extends laterally outward from said shank a different distance and substantially the same as the distance the lug over which it lies extends from said shank, and

means holding the locator in its operative position adjacent said lug members.

16. A locator for a twist lock having a shank and a base portion at the lower end thereof with lug members extending in opposite directions from the center of said shank, said locator comprising

an interconnecting member for mounting on said shank of the twist lock above the base portion of said lock, and means , including a pair of opposed segments disposed on opposite sides of said shank when said locator is mounted on a twist lock, secured to said interconnecting member for fitting in the opening of a container corner fitting to prevent said shank from moving horizontally in a cargo container corner fitting, said segments being formed to align with the lugs of said twist lock and including guide means mounted on the lower surfaces of said segments for engaging cooperating guide means formed in the tops of said lugs to position said locator means with respect to said lugs.

17. A top lift cargo container lifting beam with four corners having an improved twist lock attached to each of said corners, each of said twist locks comprising

an elongated shank portion depending from said bean and having a base portion at the lower end thereof, said base portion including two lug members extending laterally outwardly in opposite directions from the center of said shank for different distances, and

locator means removably mounted on said shank above said lugs and vertically aligned therewith for fitting in the opening of a container corner fitting to prevent undesirable movement of the shank in the corner fitting when the twist lock is disposed therein whereby said beam may be utilized to handle cargo containers having different dimensions and corner fittings.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,749,438 Dated July 31, 1973

Inventor(s) Robert Jewelle Loomis and Chester William Rensink

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Change Mr. Rensink's address from "Gastro" to -- Castro --.

Column 2, line 27, change "Sea-land" to -- Sea-Land --.

Column 4, line 52, after "portion" add -- 35 --.

Column 6, line 13, before "explained" add -- (-- and
after "hereinafter" add --) --.

line 53, change "mechanism" to -- mechanical --.

line 66, after "that" add -- a --.

Column 7, line 4, after "of" add -- the --.

line 18, change "Wen" to -- When --.

IN THE CLAIMS

Claim 4, column 8, line 20, change the numeral "4" to -- 3 --

Claim 17, column 10, line 26, change "bean" to -- beam --.

Signed and sealed this 18th day of December 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Pate

FORM PO-1050 (10-69)