

[54] TUGBOAT-BARGE CONNECTION SYSTEM

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[51] Int. Cl.² B63B 21/60

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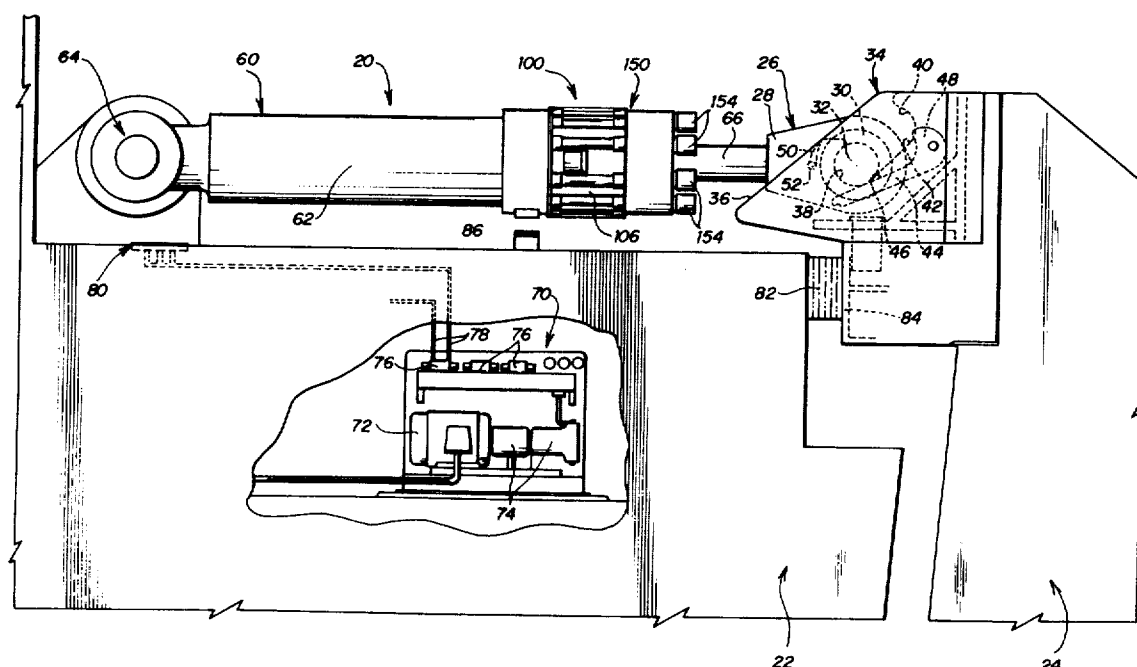
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[57] ABSTRACT

In a tugboat-barge connection system a hook-shaped latching member is mounted on the barge and a T-shaped latching member is mounted on the tugboat for cooperation with the hook-shaped latching member to couple the tugboat to the barge. A hydraulic cylinder is provided for extension to position the T-

shaped latching member both for coupling to and uncoupling from the hook-shaped latching member, and for retraction to draw the tugboat and the barge together and into proper positioning for the tugboat to propel the barge. The hydraulic cylinder includes a piston rod having a locking portion comprising a segmented screw and a housing including a main portion secured to the tugboat and a locking portion comprising an internally segmented nut which is aligned with the segmented screw portion of the piston rod when the hydraulic cylinder is in the retracted position and which is adapted for rotation relative to the piston rod to threadedly engage the segmented screw portion of the piston rod, thereby securing the T-shaped latching member in the retracted position. The locking portion of the housing is secured to the main portion by means of a plurality of bolts extending from the main portion parallel to the piston rod and through the locking portion and a plurality of expandable nuts each normally threadedly engaged with the distal end of one of the bolts to secure the locking portion of the housing to the main portion thereof. The expandable bolts are each adapted for actuation by fluid pressure for release from the associated bolt. Therefore, in the event that it is necessary to uncouple the tugboat from the barge in a situation in which the locking portion of the housing cannot be disengaged from the piston rod, a fluid pressure signal is simultaneously applied to all of the expandable nuts, thereby releasing the locking portion of the housing from the main portion thereof. This permits actuation of the hydraulic cylinder to the extended condition even though the internally segmented screw of the locking portion of the housing remains threadedly engaged with the segmented screw of the locking portion of the piston rod.

12 Claims, 12 Drawing Figures



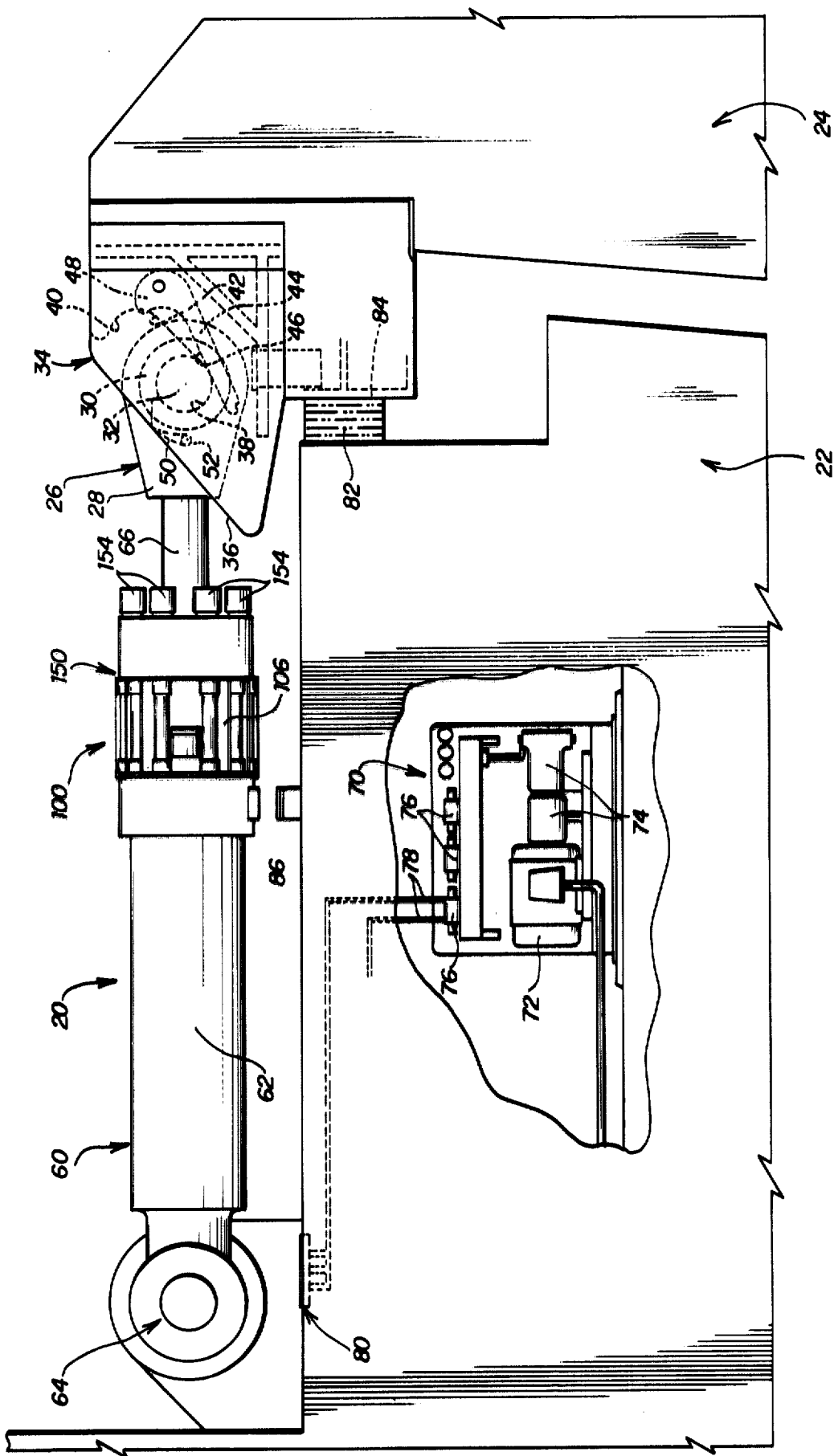


FIG. 1

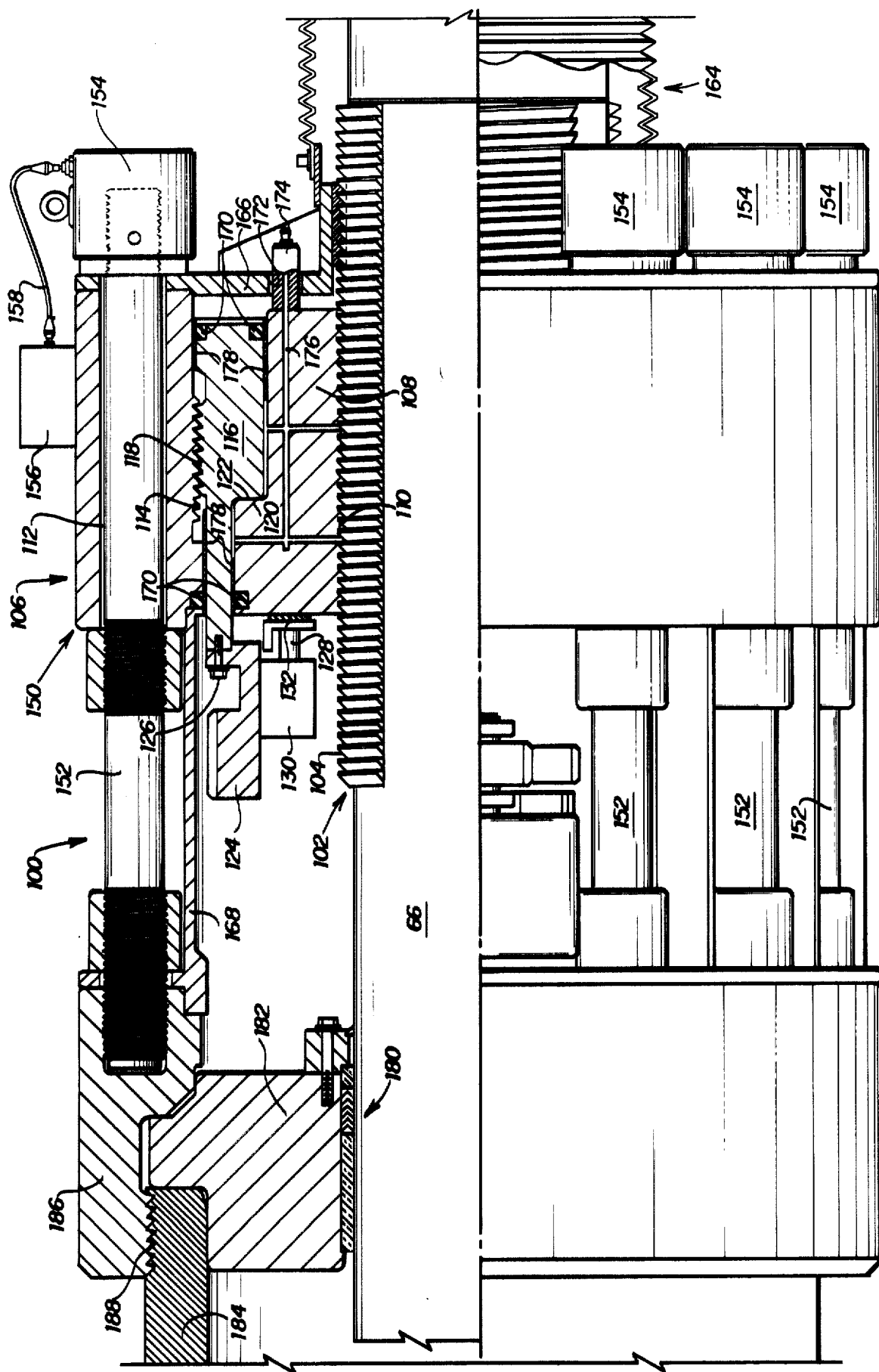


FIG. 2

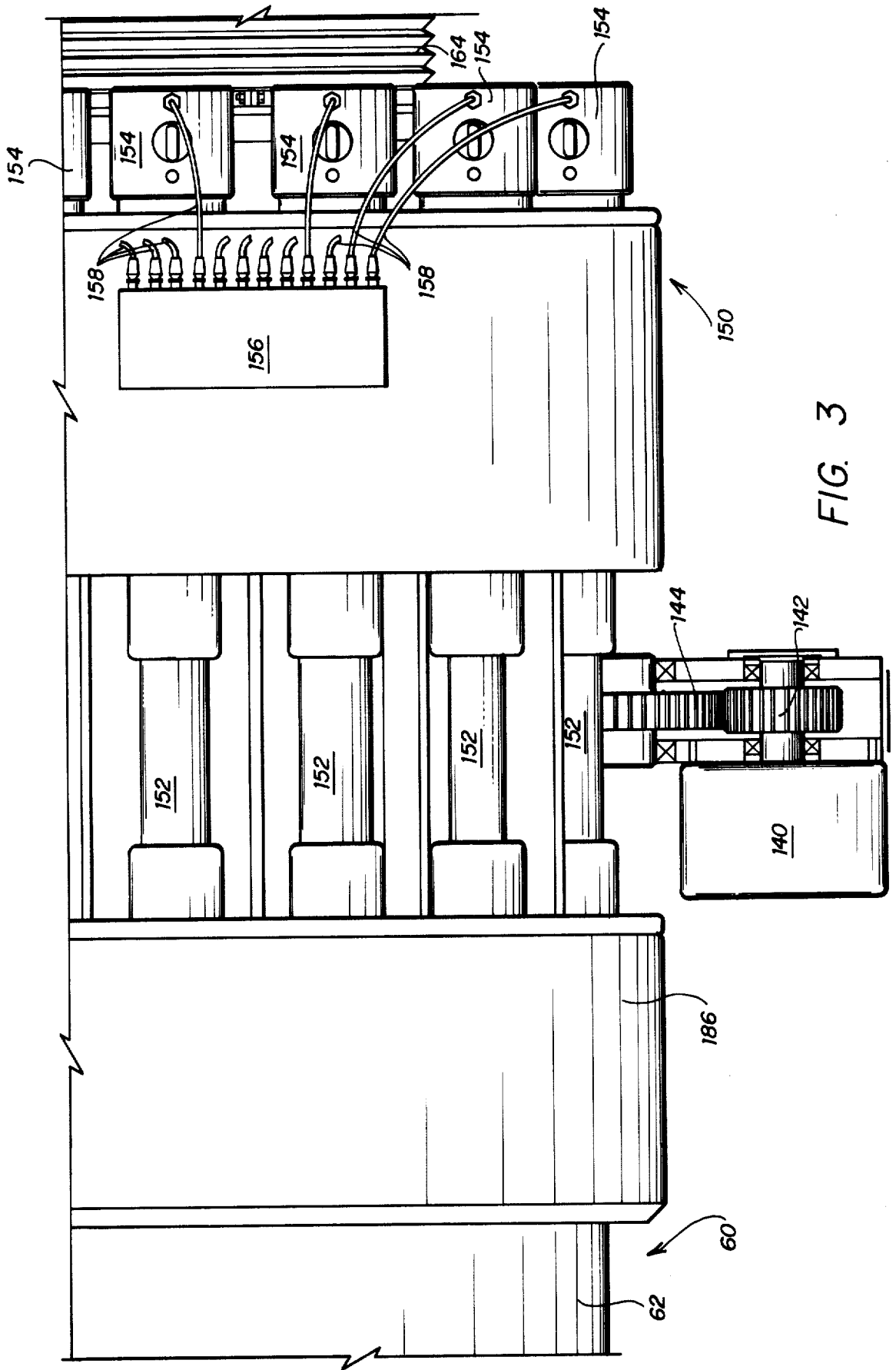


FIG. 3

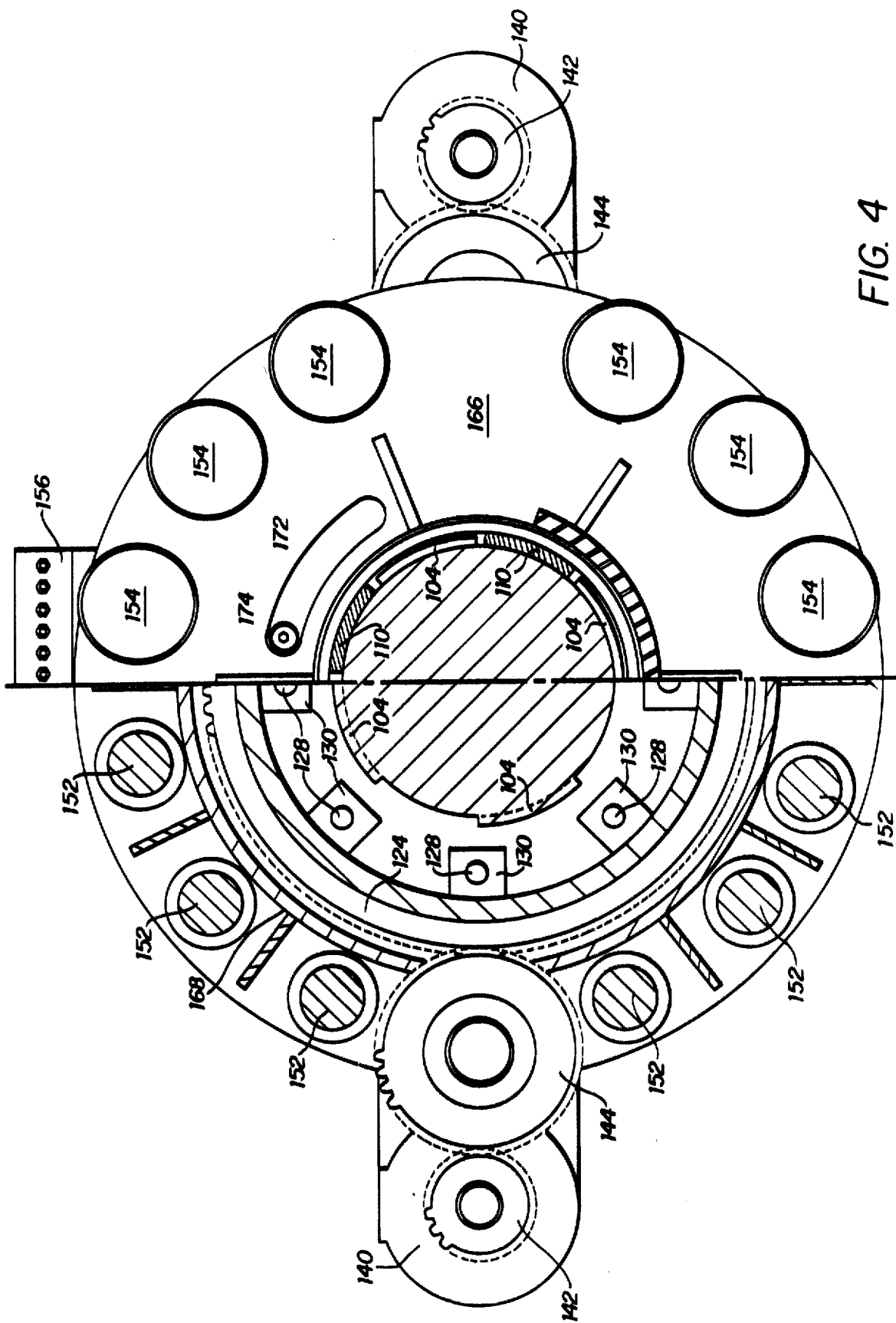


FIG. 4

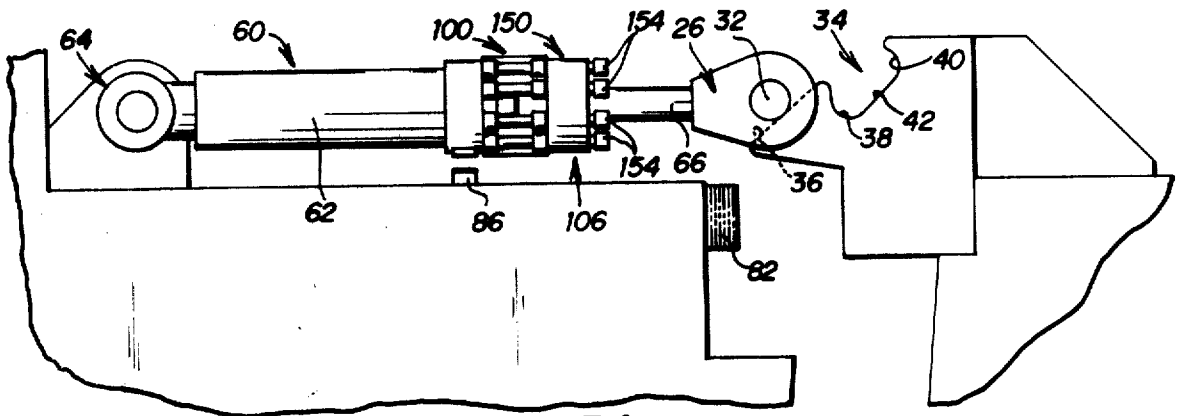


FIG. 5A

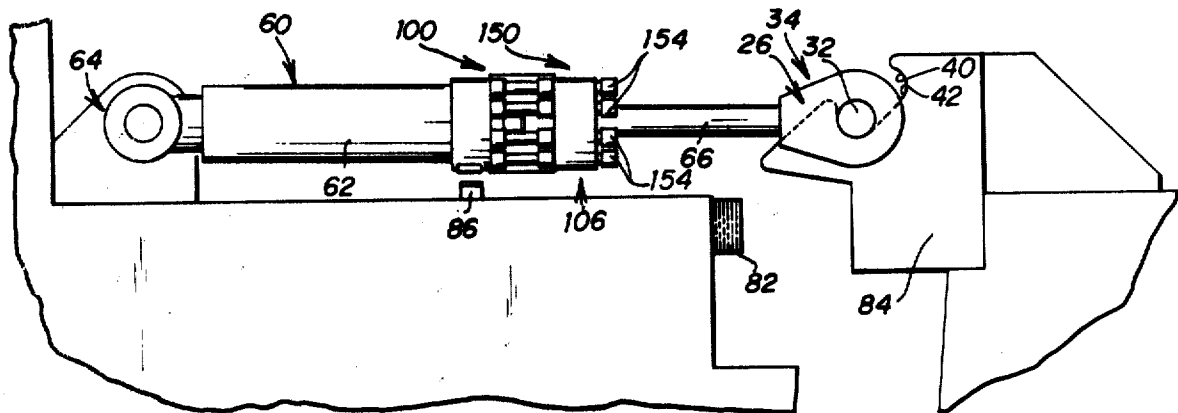


FIG. 5B

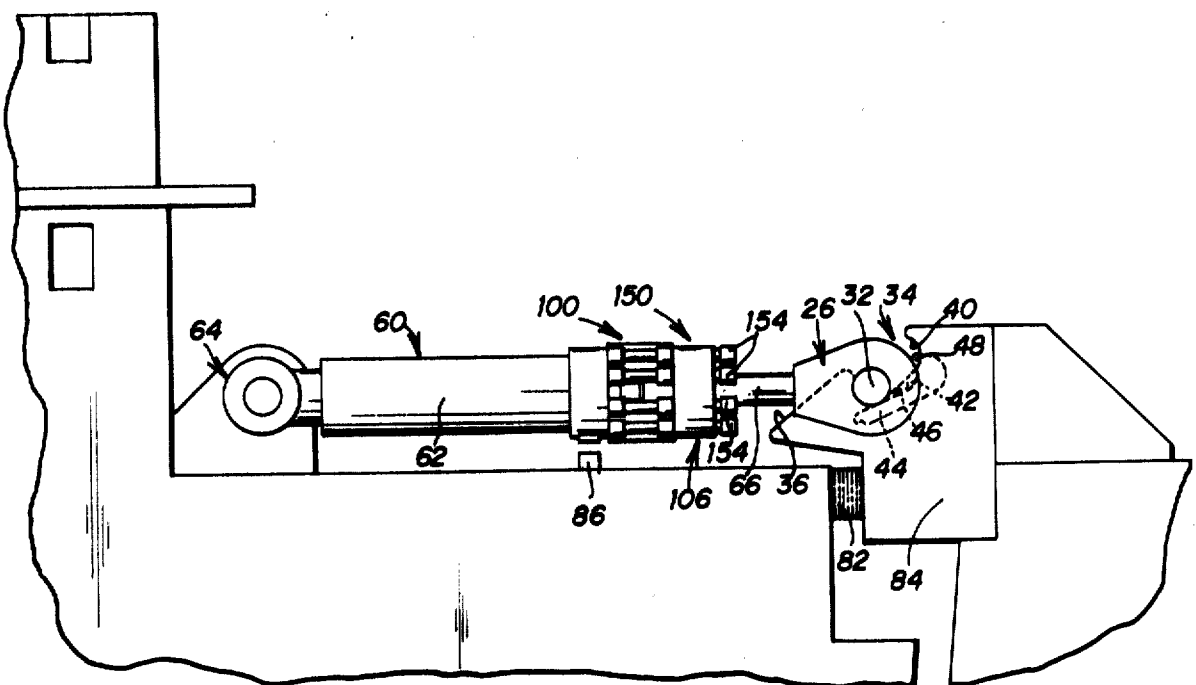


FIG. 5C

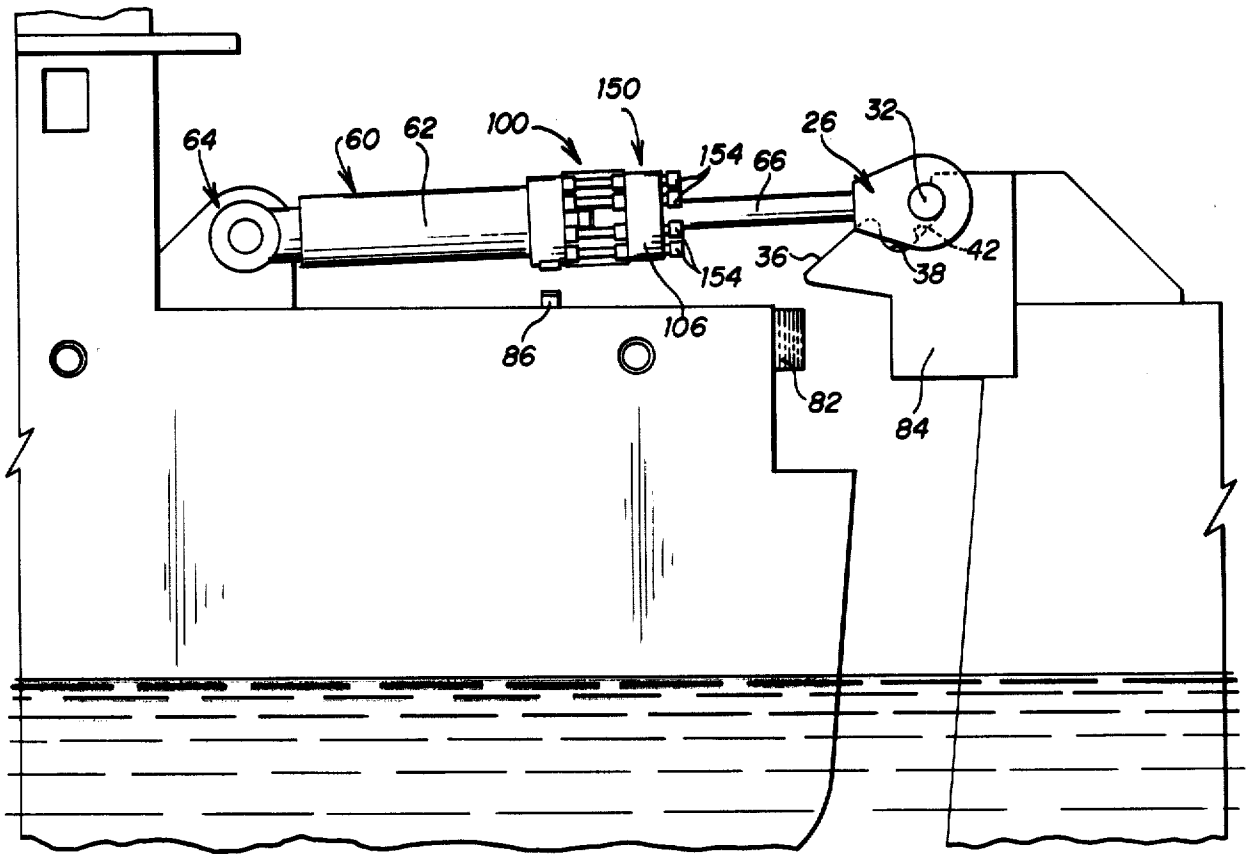


FIG. 6A

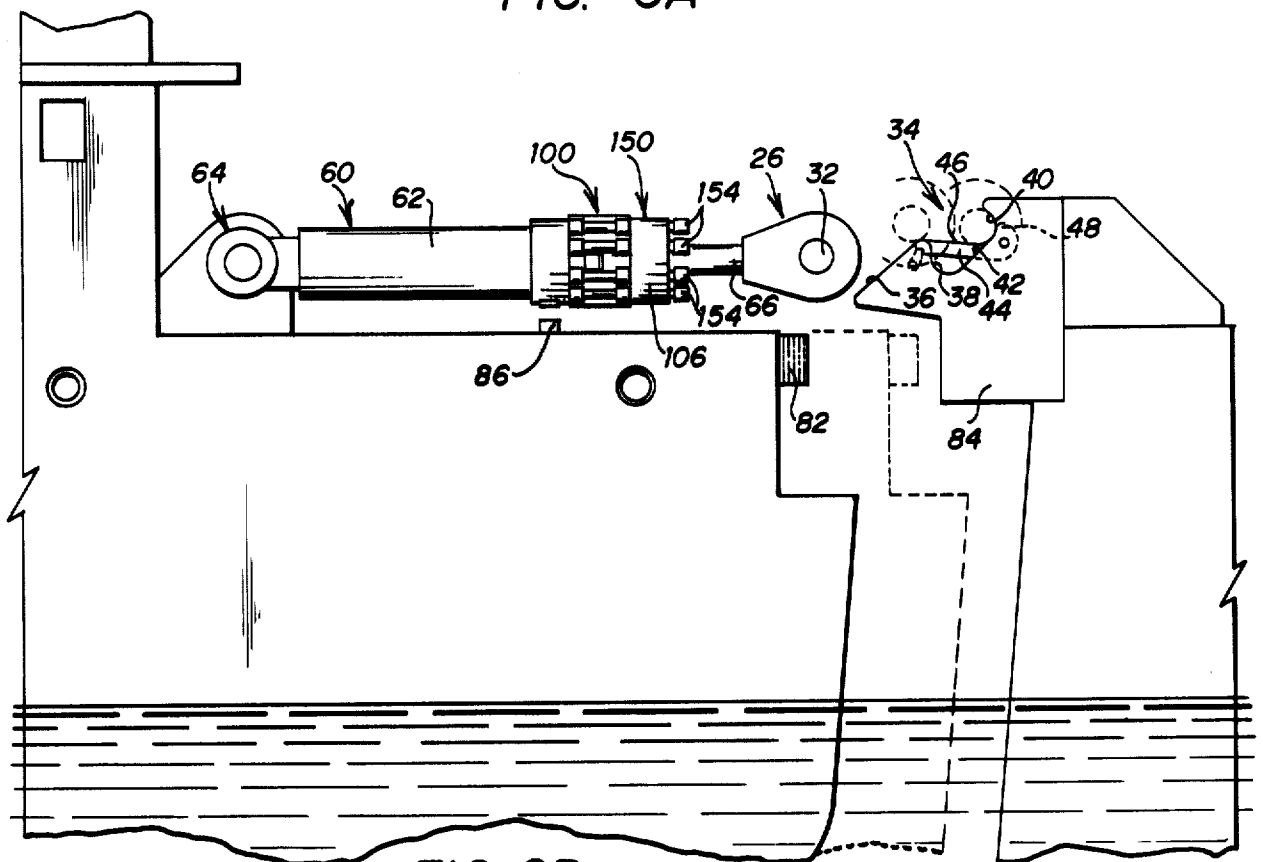
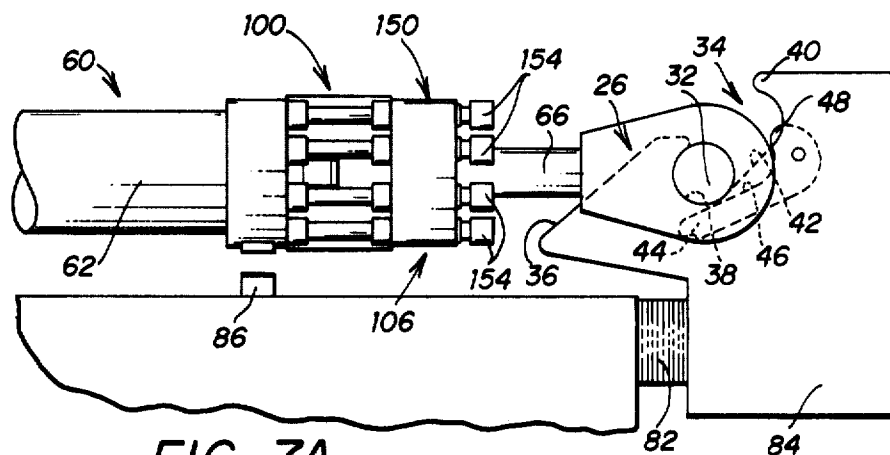


FIG. 6B



TUGBOAT-BARGE CONNECTION SYSTEM

FIELD OF THE INVENTION

This invention relates to a tugboat-barge connection system, and more particularly to a tugboat-barge connection system having emergency release apparatus.

THE PRIOR ART

At the present time, a wide variety of materials and cargos are transported on barges which are propelled by tugboats. In practice, the tugboat is positioned adjacent one end of the barge and is secured thereto by means of a tugboat-barge connection system. One embodiment of a tugboat-barge connection system which has served well in practice includes a hydraulic cylinder which is utilized to engage latching apparatus on the tugboat with cooperating latching apparatus on the barge. In order to insure that the tugboat and the barge are rigidly secured, such prior art systems have included structure for locking the hydraulic cylinder in the retracted condition. When it is desired to uncouple the tugboat from the barge, the locking structure is disengaged and the hydraulic cylinder is extended to uncouple the latching apparatus, whereupon the tugboat is permitted to move away from the barge.

During the transportation of such materials as explosives and potentially dangerous chemicals, there exists the possibility of the need to quickly disconnect the tugboat from the barge. For example, it is possible that a leak could occur in chlorine gas cylinders being transported on a barge, resulting in the tugboat personnel being exposed to lethal chlorine gas. Inasmuch as the gas masks carried on board tugboats are generally suitable only for relatively short periods of time, it becomes imperative in such a situation to immediately disconnect the tugboat from the barge and to move the tugboat a substantial distance from the barge.

In the use of the above-described type of prior art tugboat-barge connection system, problems have occasionally arisen during attempts to quickly disconnect the tugboat from the barge. For example, in certain instances the tugboat-barge connection system necessarily remains in the locked condition for a substantial period of time, during which galling or other deterioration of the component parts of the system can effectively disable the locking structure, thereby preventing actuation of the locking structure to unlock the hydraulic cylinder for actuation to uncouple the tugboat from the barge. Such a failure of the tugboat to quickly move away from the barge could result in safety hazards, and, accordingly, a need has arisen for a tugboat-barge connection system which may be positively unlocked in case of an emergency.

SUMMARY OF THE INVENTION

The present invention comprises a novel tugboat-barge connection system which fulfills the above-described need and simultaneously overcomes various other problems long since associated with the prior art. In accordance with the broader aspects of the invention, a tugboat-barge connection system includes latching apparatus on the barge, latching apparatus on the tugboat, and fluid pressure operated cylinder apparatus for extending the latching apparatus of the tugboat to facilitate coupling to and uncoupling from the latching apparatus of the barge and for retracting the latching apparatus to draw the tugboat and the barge together.

Locking apparatus is provided for securing the cylinder apparatus in the retracted condition. The system further includes emergency release apparatus independent of the locking apparatus for facilitating operation of the cylinder apparatus to extend the latching apparatus and thereby uncouple the tugboat from the barge even though the locking apparatus remains in the lock condition.

In accordance with more specific aspects of the invention, the cylinder apparatus includes a housing comprising a main portion secured to the tugboat and a locking portion detachably secured to the main portion. A piston rod extends from the housing and includes a locking portion for cooperation with the locking portion of the housing to define the locking apparatus of the system. The emergency release apparatus functions to detach the locking portion of the housing from the main portion thereof, thereby permitting actuation of the cylinder apparatus to extend the piston rod and the latching apparatus connected thereto.

In accordance with still more specific aspects of the invention, the locking apparatus comprises a segmented screw portion of the piston rod and an internally segmented nut portion of the housing positioned to threadedly engage the segmented screw portion of the piston rod when the cylinder apparatus is in the retracted condition. The emergency release apparatus comprises a plurality of bolts extending from the main portion of the housing parallel to the piston rod and passing through the locking portion of the housing. An expandable nut is normally threadedly engaged with the distal end of each bolt for cooperation therewith to secure the locking portion of the housing to the main portion. The expandable nuts are responsive to an emergency pressure signal for disengagement from the bolts, thereby permitting actuation of the cylinder apparatus to extend the piston rod even though the internally segmented screw portion of the housing remains threadedly engaged with the segmented screw portion of the piston rod.

DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention may be had by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings, wherein:

FIG. 1 is a side view of a tugboat-barge connection system incorporating the invention;

FIG. 2 is an enlarged side view of the system in which certain portions have been broken away more clearly to illustrate certain features of the invention;

FIG. 3 is an enlarged top view of the system in which certain parts have been broken away;

FIG. 4 is an enlarged end view of the system in which certain parts have been broken away;

FIGS. 5A, 5B and 5C are illustrations of progressive steps in the operation of the system of FIG. 1 in coupling a tugboat to a barge;

FIGS. 6A and 6B are illustrations of the normal operation of the system in uncoupling the tugboat from the barge; and

FIGS. 7A, 7B and 7C are illustrations of the operation of the system of FIG. 1 in uncoupling the tugboat from the barge under emergency conditions.

DETAILED DESCRIPTION

Referring now to the Drawings, and particularly to

FIG. 1 thereof, there is shown a tugboat-barge connection system 20 incorporating the invention. In the practice of the invention, the system 20 is utilized in conjunction with a tugboat 22 to effect both coupling of the tugboat to and uncoupling of the tugboat from a barge 24. Following coupling, the system 20 is also utilized to draw the tugboat 22 and the barge 24 together, and to lock the vessels in their respective positions illustrated in FIG. 1. The tugboat 22 is thereupon utilized to propel the barge 24 in the usual fashion.

The system 20 includes a first latching apparatus 26 which is mounted on the tugboat 22. The apparatus 26 includes a housing 28 which encloses a ball and socket joint 30. A pair of cylindrical arms 32 extend outwardly from the opposite sides of the ball and socket joint 30, whereby the latching apparatus 26 comprises a generally T-shaped member.

A second latching apparatus 34 is mounted on the barge 24. The apparatus 34 includes a camming surface 36, a lower hook-shaped portion 38, an upper curved portion 40, and a surface 42 extending angularly upwardly and interconnecting the lower hook-shaped portion 38 and the upper curved portion 40. A support finger 44 includes a support surface 46 and a tip 48. The apparatus 34 further includes a latching finger 50. During uncoupling operations, the latching finger 50 serves to support the finger 44 in such a position that the surface 46 prevents the arms 32 of the latching apparatus 26 from entering the lower hook-shaped portion 38, and thereby facilitates uncoupling of the latching apparatus 26 from the latching apparatus 34. Following the uncoupling operation, an apparatus 52 actuates the latching finger 50 to restore the component parts of the latching apparatus 34 to the positions illustrated in FIG. 1.

The latching apparatus 26 is supported on the tugboat 22 by a hydraulic cylinder 60. The hydraulic cylinder 60 is provided with a housing including a main portion 62 which is secured to the tugboat 22 by means of a ball and socket joint 64. The main portion 62 of the housing of the hydraulic cylinder 60 receives a conventional piston (not shown) having a piston rod 66 extending therefrom. In the operation of the apparatus 20, pressurized hydraulic fluid is selectively admitted to and spent hydraulic fluid is simultaneously withdrawn from the opposite ends of the main portion 62 of the housing of the hydraulic cylinder 60. By this means the hydraulic cylinder 60 operates through the piston rod 66 to selectively extend and retract the latching apparatus 26.

Pressurized hydraulic fluid for operating the hydraulic cylinder 60 is supplied by apparatus 70 mounted on the tugboat 22. The apparatus 70 includes an electric motor 72 which drives one or more hydraulic pumps 74. The flow of hydraulic fluid between the apparatus 70 and the hydraulic cylinder 60 is regulated by a plurality of conventional valves 76. The valves 76 are coupled to the hydraulic cylinder by means of suitable lines 78 and a manifold 80 mounted in the deck of the tugboat 22. Electrical power for operating the motor 72 of the apparatus 70 is supplied by a generator driven by the engine of the tugboat 22.

The operation of the system 20 in coupling the tugboat 22 to the barge 24 will be better understood by reference to FIGS. 5A, 5B and 5C. The tugboat 22 is initially maneuvered relative to the barge 24 until the arms 32 of the latching apparatus 34 engage the cam-

ming surface 36 of the latching apparatus 34 in the manner illustrated in FIG. 5A. The hydraulic cylinder 60 is then actuated to extend the latching apparatus 26. This operation is continued until the arms 32 of the latching apparatus 26 drop into engagement with the lower hook-shaped portion 38 of the latching apparatus 34 in the manner illustrated in FIG. 5B.

The hydraulic cylinder 60 is then actuated to retract the latching apparatus 26. Retraction of the hydraulic cylinder 60 is then continued so that the tugboat 22 and the barge 24 are drawn toward one another. This operation is continued until a bumper 82 on the tugboat 22 engages a bumper 84 on the barge 24, whereupon the vessels are positioned in the manner illustrated both in FIG. 5C and FIG. 1.

The normal operation of the system 20 to uncouple the tugboat 22 from the barge 24 is illustrated in FIGS. 6A and 6B. The hydraulic cylinder 60 is initially actuated to extend the latching apparatus 26. This causes the arms 32 to ride upwardly on the surface 42 until they engage the upper curved portion 40 of the latching apparatus 34. As the arms 32 enter the upper curved portion 40, they engage the tip 48 of the finger 44. By this means the finger 44 is cammed upwardly until the surface 46 extends substantially horizontally in the manner illustrated in FIG. 6B. At this point the latching finger 50 moves under the finger 44 and thereafter functions to retain the finger 44 in the raised position.

The function of the finger 44 is to prevent the arms 32 of the latching apparatus 26 from re-entering the lower hook-shaped portion 38 of the latching apparatus 34. Therefore, as soon as the finger 44 is positioned as shown in FIG. 6B, the hydraulic cylinder 60 is actuated to retract the latching apparatus 26. When the latching apparatus 26 clears the latching apparatus 34, the hydraulic cylinder 60 falls downwardly under the action of gravity until it engages a cushioned guide device 86 mounted on the deck of the tugboat 22. The tugboat 22 may then be maneuvered away from the barge 24.

Referring now to FIGS. 2, 3 and 4, the tugboat-barge connection system 20 further includes apparatus 100 for locking the latching apparatus 26 in the retracted position illustrated in FIG. 1. As is best shown in FIGS. 2 and 4, the piston rod 66 of the hydraulic cylinder 60 includes a locking portion 102 comprising a segmented screw 104. Those skilled in the art will appreciate the fact that structure of this type is frequently identified with breech block locking structure for firearms and similar applications. As is best shown in FIG. 2, the segmented screw 102 is provided with a buttress thread, it being understood that other thread types may be utilized in the practice of the invention, if desired.

The housing of the hydraulic cylinder 60 of the system 20 is also provided with a locking portion 106. The locking portion 106 includes an annular member 108 comprising an internally segmented screw 110 adapted to threadedly engage the segmented screw 104 of the locking portion 102 of the piston rod 66. As is best shown in FIG. 4, the circumferential dimensions of the threaded portions of the internally segmented screw 110 are similar to but somewhat smaller than the circumferential dimensions of the unthreaded portions of the segmented screw 104, and the circumferential dimensions of the threaded portions of the segmented screw 104 are similar to but somewhat smaller than the circumferential dimensions of the unthreaded portions of the internally segmented screw 110. Therefore,

whenever the threaded portions of the segmented screw 104 are aligned with the unthreaded portions of the internally segmented screw 110 and vice versa, the piston rod 66 is unlocked, and the hydraulic cylinder 60 is adapted to extend and retract the latching apparatus 26 in the manner illustrated in FIGS. 5A, 5B and 5C, and in FIGS. 6A and 6B.

The locking portion 106 of the housing of the hydraulic cylinder 60 further includes a cylindrical housing 112 which is normally fixed to the main portion 62 of the housing of the hydraulic cylinder. The housing 112 is provided with an internal thread 114 which is identical in pitch to the segmented screw 104 and the internally segmented screw 110. An annularly shaped member 116 is mounted between the housing 112 and the annular member 108 and is provided with an external thread 118 which threadedly engages the thread 114 of the housing 112. The member 116 is further provided with a shoulder 120 which engages a corresponding shoulder 122 on the annular member 108.

A ring gear 124 is secured to the annularly shaped member 116 by means of a plurality of fasteners 126. A plurality of plungers 128 are mounted for rotation with the ring gear 124 and are spring biased outwardly from housings 130 secured thereto. Each plunger 128 supports a friction pad 132 which engages the facing surface of the annular member 108. This establishes a friction drive between the ring gear 124 and the annular member 108, whereby the annular member 108 is urged to rotate with the ring gear 124.

Referring to FIG. 4, the locking apparatus 100 further includes a pair of hydraulic motors 140 each having an output pinion 142. The pinions 142 are mounted in mesh with gear 144 which are in turn mounted in mesh with the ring gear 124. Therefore, upon actuation of the hydraulic motors 140, the ring gear 124 is caused to rotate relative to the piston rod 66.

Referring again to FIG. 2, rotation of the ring gear 124 causes rotation of the annularly shaped member 116 relative to the housing 112. Since these parts are threadedly engaged by means of the threads 114 and 118, the annularly shaped member 116 is caused to move leftwardly (FIG. 2). Moreover, due to the engagement of the shoulder 120 on the annularly shaped member 116 with the shoulder 122 on the annular member 108, rotation of the ring gear 124 also effects leftward movement (FIG. 2) of the annular member 108.

Leftward movement of the annular member 108 continues until the internally segmented screw 110 on the annular member 108 comes into alignment with the segmented screw 104 of the locking portion 102 of the piston rod 66. As soon as the internally segmented screw 110 and the segmented screw 114 come into alignment, the friction drive between the ring gear 124 and the annular member 108 causes rotation of the annular member 108 relative to the piston rod 66 thereby threadedly engaging the internally segmented screw 110 with the segmented screw 104. The annular member 108 is rotated approximately one-eighth turn, whereupon the operation of the hydraulic motor 140 is terminated by means of appropriate limit switches.

At the conclusion of the foregoing operations, the piston rod 66 and the latching apparatus 26 connected thereto are securely locked to the housing of the hydraulic cylinder 60 and hence to the tugboat 22. The tugboat 22 is thereafter utilized to propel the barge 24

in the usual fashion. When it is desired to uncouple the tugboat 22 from the barge 24, the normal operation of the locking apparatus 100 involves carrying out the foregoing steps in reverse order. That is, the ring gear 124 is rotated in the reverse direction, thereby causing rotation of the annular member 108 relative to the piston rod 66 until the unthreaded portions of the internally segmented screw 110 are aligned with the threaded portions of the segmented screw 104 and vice versa. It will be understood that rotation of the annular member 108 in the unlocking direction is also terminated by means of appropriate limit switches and results in restoration of the component parts of the locking apparatus 100 to their original positions. This in turn facilitates operation of the hydraulic cylinder 60 to extend and retract the latching apparatus 26 in the manner illustrated in FIGS. 5A, 5B and 5C in FIGS. 6A and 6B.

As will be appreciated by those skilled in the art, in actual tugboat operations the locking apparatus 100 is often utilized infrequently. This is because during operation of a tugboat is propelling one or more barges, it is often necessary for the vessels to remain interconnected for long periods of time, frequently for as long as several months or longer. When this fact is considered together with the fact that the tugboat is frequently operated in a salt-air environment, and further considering the fact that barges are frequently utilized to transport chemicals and other substances of a highly corrosive nature, it will be understood that it is sometimes impossible to effect rotation of the annular member 108 of the locking apparatus 100 relative to the piston rod 66. In such instances the piston rod 66 remains locked and the hydraulic cylinder 60 cannot be operated to extend the latching apparatus 26 and thereby uncouple the tugboat 22 from the barge 24.

It will be further appreciated that under emergency circumstances, any difficulty in rotating the annular member 108 relative to the piston rod 66 in order to effect unlocking of the system 20 might lead to disastrous results. For example, assume that the barge 24 is carrying a cargo of chlorine gas cylinders. In the event that a leak develops in one of the cylinders, the tugboat 22 must be immediately uncoupled from and moved a substantial distance apart from the barge 24 in order to prevent exposure of the tugboat personnel to lethal chlorine gas.

In order to eliminate any delay whatsoever in uncoupling the tugboat 22 from the barge 24, the apparatus 20 is provided with an emergency release mechanism 150. Referring to FIG. 2, the housing 112 of the locking portion of the housing of the hydraulic cylinder is secured to the main portion 62 of the housing of the cylinder by means of a plurality of bolts 152. The bolts 152 extend parallel to the piston rod 66 and pass through the housing 112. The housing 112 is normally secured in place on the bolts 152 by means of a plurality of releasable nuts 154 each of which is normally threadedly engaged with the distal end of one of the bolts 152.

The nuts 154 may comprise any of the various commercially available devices of the type which are adapted to normally retain the component parts in an assembled condition and to release the component parts in response to the receipt of an emergency signal. For example, the nuts 154 may comprise any of various commercially available explosive devices or any of var-

ious commercially available pressure actuated devices. Preferably, however, the nuts 154 are of the type disclosed and claimed in the co-pending application of Lawrence T. Boatman and John J. Swoboda, Jr., filed Jan. 30, 1973, Ser. No. 328,380, for EMERGENCY RELEASE LOCK NUT, the disclosure of which is incorporated herein by reference.

As is best shown in FIG. 3, a manifold 156 is mounted on the housing 112. A plurality of lines 158 are provided each extending from the manifold 156 to one of the nuts 154. Therefore, whenever an emergency signal is directed to the manifold 156, the nuts 154 are simultaneously actuated. In the case of releasable nuts of the type disclosed in the above-identified Boatman and Swoboda application, the emergency signal is a pressure signal and the nuts 154 are actuated in response to the pressure signal for disengagement from the distal ends of the bolts 152. By this means the entire locking portion 106 of the housing of the hydraulic cylinder 60 is immediately disengaged from the main portion 62 thereof. This in turn permits the locking portion 106 to move with the piston rod 66 as the hydraulic cylinder 60 is actuated to extend the latching apparatus 26 and thereby uncouple the tugboat 22 from the barge 24.

The operation of the emergency release mechanism 150 in facilitating uncoupling of the tugboat 22 from the barge 24 will be better understood by reference to FIGS. 7A, 7B and 7C. Upon the application of an emergency pressure signal to the manifold 156, the nuts 154 are simultaneously actuated. As is best shown in FIG. 7A, this causes a slight axial extension of the nuts 154, whereby the nuts are released from the bolts 152. Following the release of the nuts 154 from the bolts 152, the hydraulic cylinder 60 is actuated to extend the latching apparatus 26. Since the locking apparatus 100 is still in the locked condition, this action causes the locking portion 106 of the housing of the hydraulic cylinder to move with the piston rod 66. The locking portion 106 of the housing is therefore disengaged from the main portion 62 in the manner illustrated in FIG. 7B. It will be noted that during this action, the bolts 152 remain connected to the main portion 62 thereof. This illustrates an advantage to the use of the releasable nuts disclosed and claimed in the above-identified Boatman and Swoboda application in that actuation of the emergency release apparatus 150 does not result in the generation of "shrapnel" flying about the tugboat as is often the case with explosive devices.

Operation of the apparatus 20 in the emergency mode is identical to operation of the apparatus in the normal mode insofar as the operation of the latching apparatus 26 and the latching apparatus 34 are concerned. Thus, as the latching apparatus 26 is extended under the action of the hydraulic cylinders 60, the finger 44 is cammed upwardly and is locked in the raised position by the latching finger 50. This permits the tugboat 22 to immediately move away from the barge 24. Thereafter, the condition which prevented rotation of the annular member 108 to unlock the piston rod 66 may be corrected, whereupon the component parts of the tugboat-barge connection system 20 are reassembled and the system is returned to service.

FIG. 2 further illustrates numerous design features of the tugboat-barge connection system 20 which combine to provide superior operating characteristics and to simplify maintenance of the system. An accordion-pleated protection boot 164 extends continuously from

the locking portion 106 of the housing of the hydraulic cylinder to the latching apparatus 26. The protection boot 164 is connected to an end plate 166 of the housing and cooperates therewith to prevent exposure of the component parts of the locking apparatus 100 to the elements. Further protection is provided by a cylindrical housing section 168 extending from the main portion 62 of the housing to the housing 112 of the locking portion 106. Conventional seals 170 are provided at the intersections of the relatively moving parts within the locking apparatus 100.

Referring briefly to FIG. 4, the end plate 166 is provided with an arcuately shaped slot 172 which receives a conventional grease fitting 174. Returning to FIG. 2, the grease fitting 174 extends to a passageway 176 which directs lubricant to the internally segmented screw 110 and to the space between the annular member 108 and the annularly shaped member 116. Bronze overlay bearings 178 are also provided between the annular member 108 and the annularly shaped member 116, and between the annularly shaped member 116 and the housing 112. All of this structure is intended to provide free relative movement between the component parts of the locking system 100, thereby facilitating not only locking of the system 20 but also unlocking of the system by means of the normal procedure.

In addition to permitting uncoupling of the tugboat 22 from the barge 24 under emergency conditions, the emergency release mechanism 150 permits disassembly of the locking apparatus 100 from the hydraulic cylinder 60 without removing the entire system 20 from the tugboat 22. This is highly advantageous in that it provides access to packing structure 180 which is located between the piston rod 66 and the main portion 62 of the housing of the hydraulic cylinder 60. This permits the packing structure 180 to be adjusted and/or replaced without requiring disassembly of the entire hydraulic cylinder 60.

The main portion 62 of the housing of the hydraulic cylinder 60 includes an end member 182 and a tubular member 184. These parts are interconnected by a collar 186 which receives the bolts 152 of the emergency release apparatus 150. This construction has been found to be highly advantageous in that it permits the use of external threads 188 on the tubular member 184. This is advantageous in that the external threads 188 may be manufactured to very close tolerances, thereby facilitating both assembly and disassembly of the hydraulic cylinder 60. This construction has also been found to substantially prevent galling of the component parts of the main portion 62 of the housing of the hydraulic cylinder 60.

It is believed that a greater appreciation of the significance of the present invention may be had by means of a brief summary of the specifications of the tugboat-barge connection system 20. The hydraulic cylinder 60 has an internal diameter of 38 inches, and the piston rod 66 has a diameter of 18 inches. The overall length of the apparatus 20 when the component parts thereof are positioned as shown in FIG. 1 of the Drawings is approximately 28 feet. The overall weight of these component parts, including both the tug mounted components and the barge mounted components, is approximately 180,000 pounds.

From the foregoing, it will be understood that the present invention comprises a tugboat-barge connection system which incorporates numerous advantages

over the prior art. Thus, the system operates reliably to couple a tugboat to a barge, and thereafter to draw the tugboat and the barge together and into the desired positioning with respect to each other whereby the tugboat may be utilized to propel the barge. After the tugboat and the barge are properly positioned, the locking apparatus is actuated to securely retain the vessels in the desired relationship. The locking apparatus is normally operated in the reverse direction to facilitate uncoupling of the tugboat from the barge. However, in the event that the locking apparatus cannot be operated to facilitate uncoupling, the emergency release mechanism may be utilized to facilitate rapid uncoupling of the tugboat from the barge, thereby facilitating movement of the tugboat away from the barge.

Although particular embodiments of the invention have been illustrated in the Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications, and substitutions of parts and elements without departing from the spirit of the invention.

What is claimed is:

1. A boat-barge connection system comprising:
 - first latching means mounted on the barge;
 - second latching means mounted on the boat for cooperation with the first latching means to couple the boat to the barge;
 - cylinder means supporting the second latching means on the boat and adapted for actuation by fluid pressure to extend the second latching means and thereby facilitate coupling and uncoupling of the first and second latching means and to retract the second latching means and thereby draw the boat and the barge together and into a predetermined positioning with respect to each other;
 - said cylinder means including a housing comprising a main portion secured to the boat and a locking portion and a piston rod extending from the housing to the second latching means and including a locking portion, said locking portion of the housing and the piston rod operable for locking the cylinder means in the retracted condition; and
 - emergency release means independent of the locking means for selective actuation to permit operation of the cylinder means to extend the second locking means and thereby uncouple the boat from the barge even though the locking means remains in the locked condition, said emergency release means including a plurality of bolts extending from the housing parallel to the piston rod and through the locking portion of the housing and a plurality of expandable nuts each normally threadedly secured to the distal end of one of the bolts for cooperation therewith to normally retain the locking portion of the housing secured to the main portion thereof, said nuts responsive to the receipt of a predetermined emergency signal to disconnect the locking portion of the housing from the main portion thereof.
2. The boat-barge connection system according to claim 1 wherein the locking portion of the piston rod comprises a segmented screw and wherein the locking portion of the housing comprises an internally segmented nut positioned in alignment with the segmented portion of the piston rod when the cylinder means is in

retracted condition and adapted for rotation with respect to the piston rod to threadedly engage the segmented screw portion thereof.

3. A tugboat barge connection system comprising:
 - first latch means mounted on the barge;
 - second latch means mounted on the tugboat for cooperation with the first latch means to secure the tugboat to the barge;
 - a piston rod supporting the first latch means and having a locking portion;
 - a housing receiving the piston rod and including a main portion secured to the tugboat and a locking portion for cooperation with the locking portion of the piston rod to secure the piston rod to the housing;
 - said housing and piston rod comprising cylinder means adapted for actuation by fluid pressure to selectively extend the piston rod and thereby position the second latch means both for coupling to and for uncoupling from the first latch means and to selectively retract the piston rod and thereby draw the tugboat and the barge together and into relationship with respect to each other whereby the tugboat may propel the barge;
 - bolt means secured to the main portion of the housing;
 - releasable nut means normally threadedly engaging the bolt means for cooperation therewith to secure the locking portion of the housing to the main portion thereof; and
 - means for selectively releasing said nut means for detaching the locking portion of the housing from the main portion and thereby facilitating actuation of the cylinder means to extend the piston rod and thereby uncouple the tugboat from the barge even though the piston rod remains secured to the locking portion of the housing.
4. The tugboat-barge connection system according to claim 3 wherein the locking portion of the piston rod comprises a segmented screw and wherein the locking portion of the housing comprises an internally segmented nut which is aligned with the segmented screw portion of the piston rod when the cylinder means is retracted and which is supported for rotation relative to the piston rod to threadedly engage the segmented screw portion thereof and thereby secure the piston rod to the housing.
5. The tugboat barge connection system according to claim 3 wherein:
 - said bolt means comprise a plurality of elongate bolts secured to the main portion of the housing and extending therefrom substantially parallel to the axis of the piston rod through the locking portion of the housing;
 - said nut means comprise a plurality of releasable nut means each normally threadedly engaged with the distal end of one of the bolts for cooperation therewith to secure the locking portion to the main portion of the housing; and
 - means for simultaneously admitting fluid pressure to all of the nut means to disengage the nut means from the bolts and thereby permit disengagement of the locking portion from the main portion of the housing.
6. A vehicular connection system which comprises:
 - first latch means on a first vehicle;

second latch means on a second vehicle for cooperation with the first latch means to couple the vehicles;

cylinder means including a housing mounted on the second vehicle and a piston rod extending from the housing for supporting the second latch means;

said cylinder means for selective extension both to couple the second latch means to the first latch means and to uncouple the second latch means from the first latch means and for selective retraction to draw the vehicles together and into a predetermined relationship with respect to each other;

said piston rod of the cylinder means including a portion comprising a segmented screw;

said housing of the cylinder means including a portion comprising an internally segmented nut which is aligned with the segmented screw portion of the piston rod when the cylinder means is in the retracted condition and which is adapted for rotation with respect to the piston rod to threadedly engage the segmented screw portion of the piston rod and thereby lock the piston rod of the cylinder means in the retracted condition;

bolt means extending from the main portion of the housing and through the portion of the housing comprising the segmented nut;

nut means normally threadedly engaging the bolt means to secure the portion of the housing comprising the segmented nut to the main portion of the housing and adapted for selected release from the bolt means to permit disengagement of the portion of the housing comprising the segmented nut from the main portion of the housing; and

means for actuating said nut means for selectively detaching the portion of the housing comprising the segmented nut from the remainder of the housing and thereby facilitating extension of the cylinder means to disconnect the first latch means from the second latch means even though the segmented nut portion of the housing remains threadedly engaged with the segmented screw portion of the piston rod.

7. The vehicular coupling apparatus for coupling a tugboat to a barge according to claim 6 wherein the nut means are each adapted for actuation by a fluid pressure to disengage the bolt means and thereby facilitate movement of the portion of the housing comprising the segmented nut out of engagement with the bolt means as the piston rod of the cylinder means is extended.

8. A tugboat-barge connection system which comprises:

- a hook-shaped latching member mounted on the barge;
- a T-shaped latching member mounted on the tugboat for cooperation with the hook-shaped member on the barge to couple the tugboat to the barge;
- fluid pressure operated cylinder means mounted on the barge for supporting the T-shaped latching member and comprising a piston rod having a locking portion and a housing including a main portion secured to the barge and a locking portion detachably secured to the main portion;
- said cylinder means for selectively extending the rod to position the T-shaped latching member on the tugboat both for coupling to and for uncoupling from the hook-shaped latching member on the barge and for selectively retracting the piston rod and thereby drawing the tugboat and the barge to-

gether and into a towing relationship with respect to each other;

said locking portion of the piston rod comprising a segmented screw;

said locking portion of the housing comprising a segmented nut positioned in alignment with the segmented screw portion of the piston rod when the cylinder means is in the retracted condition and mounted for rotation relative to the piston rod and into threaded engagement with the segmented screw portion thereof;

a plurality of bolt members extending from the main portion of the housing through at least a portion of the locking portion of the housing;

expandable nut means normally threadedly engaging the bolt members for cooperation therewith to detachably secure the locking portion of the housing to the main portion thereof; and

means for actuating said nut means for selectively detaching the locking portion of the housing from the main portion thereof and thereby permitting extension of the cylinder means to uncouple the T-shaped latching member on the tugboat from the hook-shaped latching member on the barge even though the segmented nut portion of the locking portion of the housing remains threadedly engaged with the segmented screw portion of the piston rod.

9. The tugboat barge connection system according to claim 8 wherein:

- the bolt members each extend substantially parallel to the piston rod;
- each of the expandable nut means is normally threadedly engaged with the distal end of one of the bolt members;
- the expandable nut means are adapted for actuation by fluid pressure for disengagement from the bolt members; and
- the means for detaching the locking portion of the housing from the main portion thereof comprises means for simultaneously applying fluid pressure to all of the expandable nut means.

10. In a tugboat-barge connection system of the type including a first latching member on the barge, a second latching member on the tugboat for cooperation with the first latching member to couple the tugboat to the barge, and fluid pressure operated cylinder apparatus on the tugboat for extension to position the second latching member for coupling to and uncoupling from the first latching member and for retraction to draw the tugboat and the barge toward one another and into a towing relationship, said cylinder apparatus including a piston rod having a locking portion comprising a segmented screw and a housing including a main portion secured to the tugboat and a locking portion including a segmented nut positioned in alignment with the segmented screw portion of the piston rod when the cylinder apparatus is in the retracted condition and mounted for rotation relative to the piston rod to effect threaded engagement with the segmented screw portion thereof, the improvement comprising:

- means including a plurality of bolt members extending from the main portion of the housing through the locking portion thereof and expandable nut means normally threadedly engaging the bolt members for cooperation therewith to secure the locking portion of the housing to the main portion thereof, so that the locking portion of the piston

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rod and the housing are effective to secure the cylinder apparatus in the retracted condition; and emergency release means for detaching the locking portion of the housing from the main portion thereof and thereby permitting actuation of the cylinder apparatus to the extended condition even though the segmented nut portion of the locking portion of the housing remains threadedly engaged with the segmented screw portion of the locking portion of the piston rod.

11. The improvement according to claim 10 wherein the expandable nut means comprises a plurality of expandable nut members each normally threadedly en-

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gaged with the distal ends of one of the bolt members, and wherein the emergency release means comprises means for simultaneously disengaging all of the expandable nut members from the bolt members and thereby permitting movement of the locking portion of the housing with respect to the main portion thereof.

12. The improvement according to claim 11 wherein the expandable nut means are each adapted for actuation by fluid pressure for disengagement from the bolt members, and wherein the emergency release means comprises means for simultaneously applying fluid pressure to all the expandable nut members.

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