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(54) **RATCHET BUCKLE**

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A44B 21/00 (2006.01)

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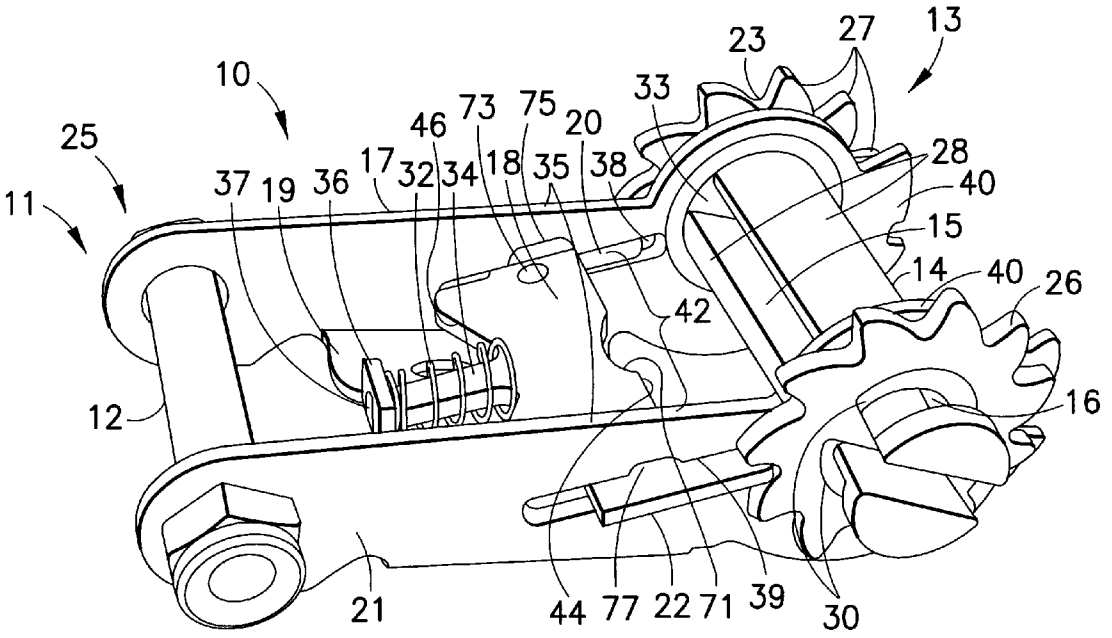
(57) **ABSTRACT**

In the present invention, a lightweight apparatus for secure transport of cargo in cargo compartments, such as those found in trucks and freight trains, is provided. The ratchet buckle has a front reel which receives a cargo strap. The light weight of the ratchet buckle is achieved by the use of a dual purpose detachable ratcheting lever or wrench. The wrench has a wrench head which engages the front reel to tighten the ratchet buckle. The wrench also has a release end which engages a release hole in the ratchet buckle, to disengage the ratcheting mechanism and allow removal of the cargo strap. Additional purposes and advantages are provided herein.



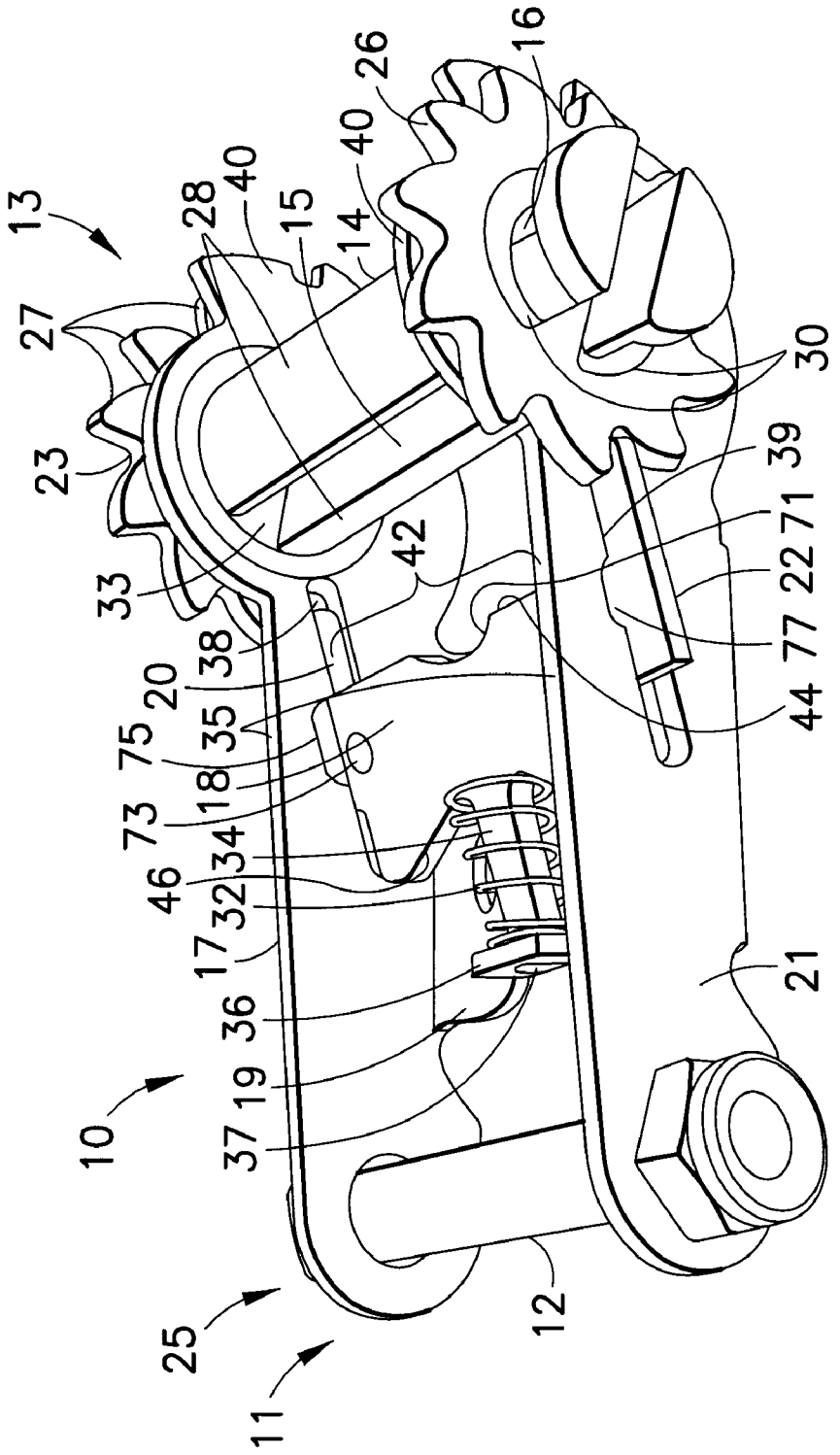

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FIG. 1

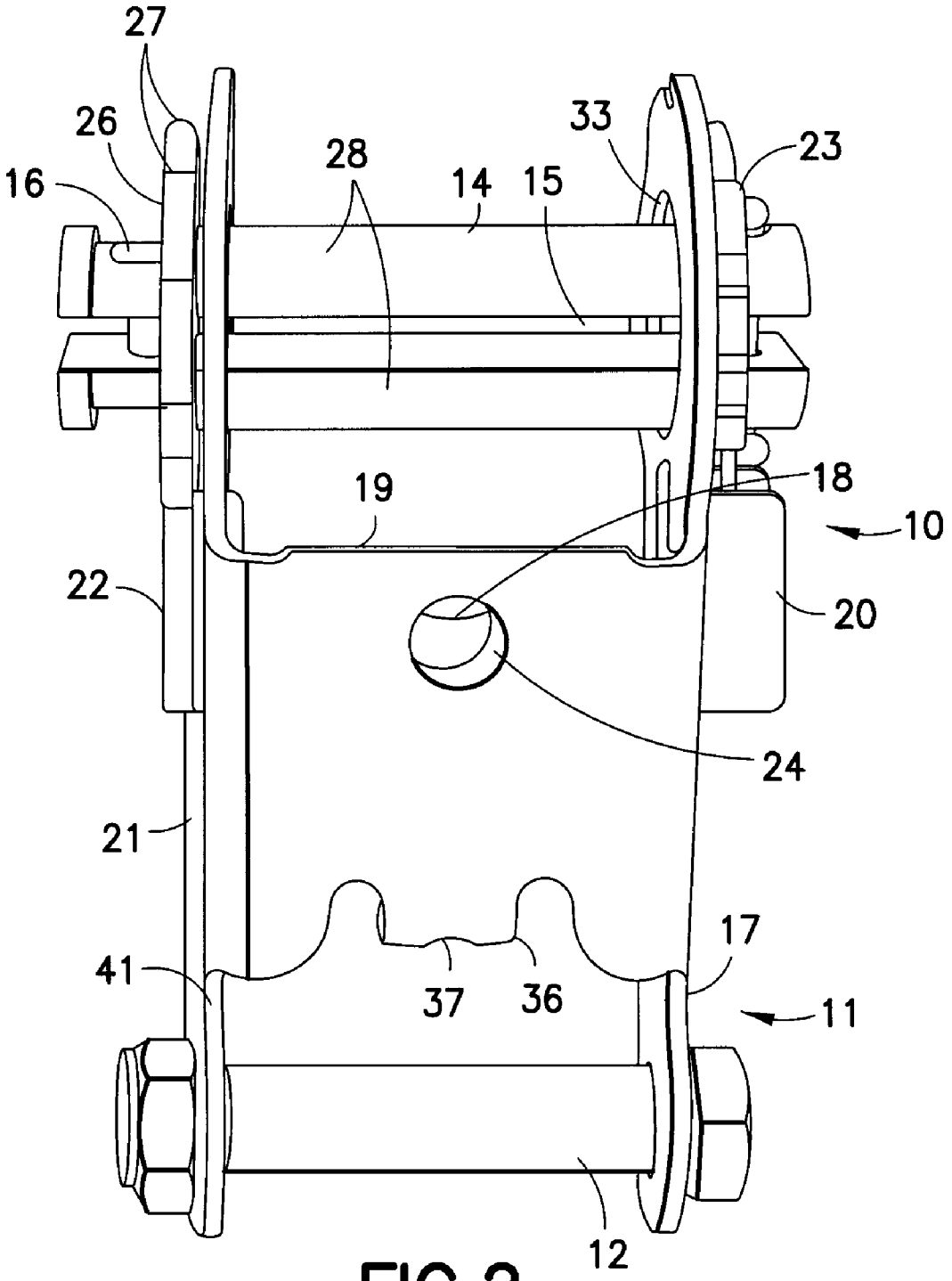

FIG.2

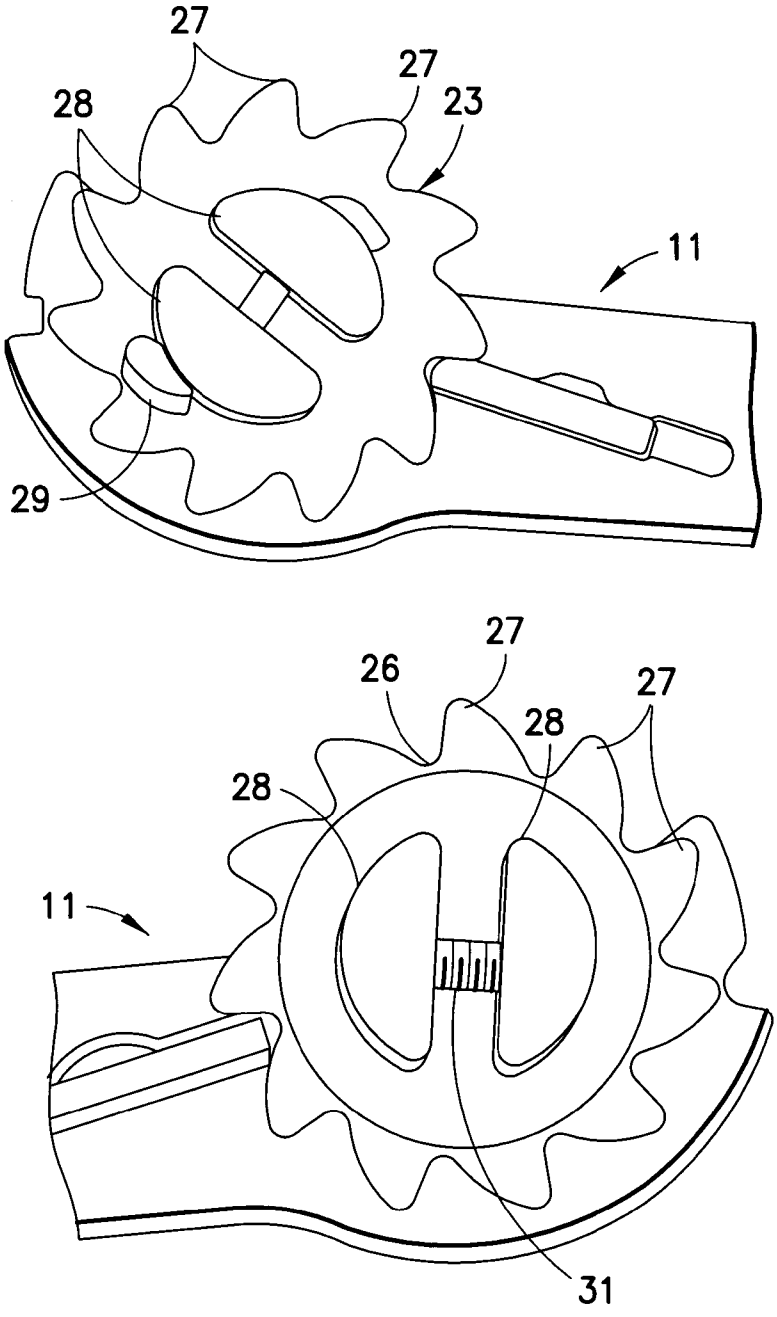

FIG.3

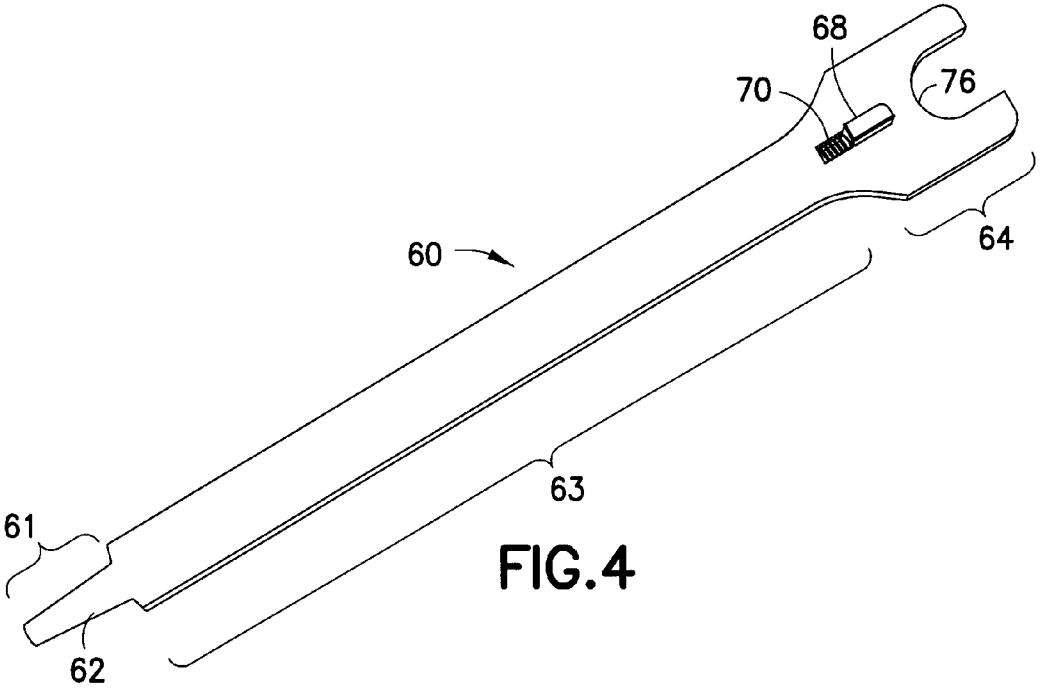

FIG.4

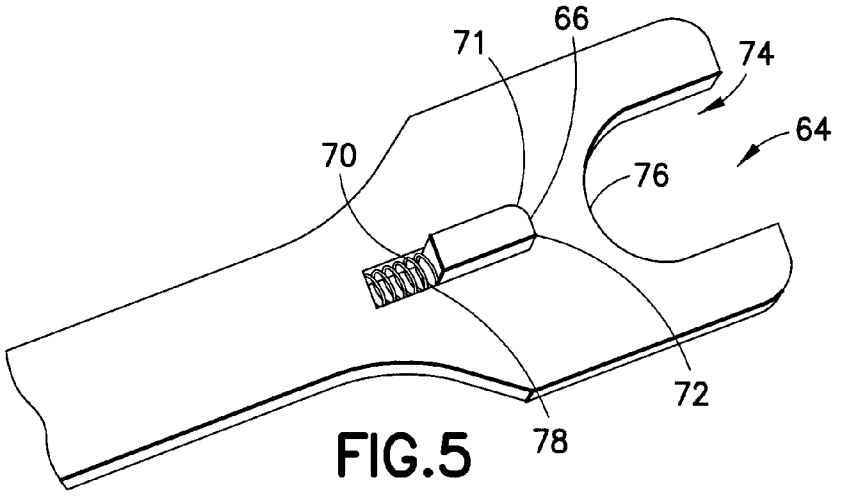

FIG.5

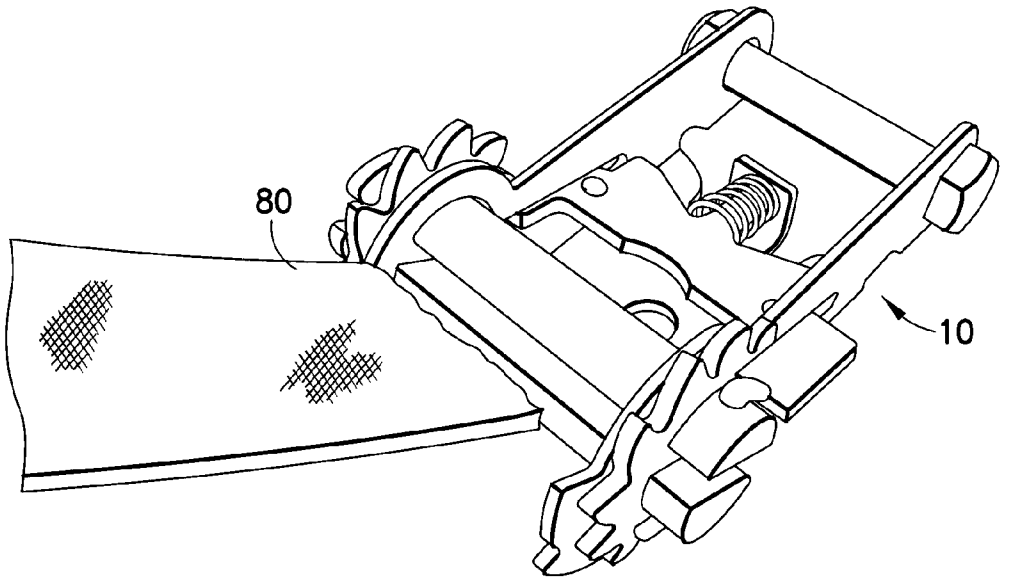

FIG.6A

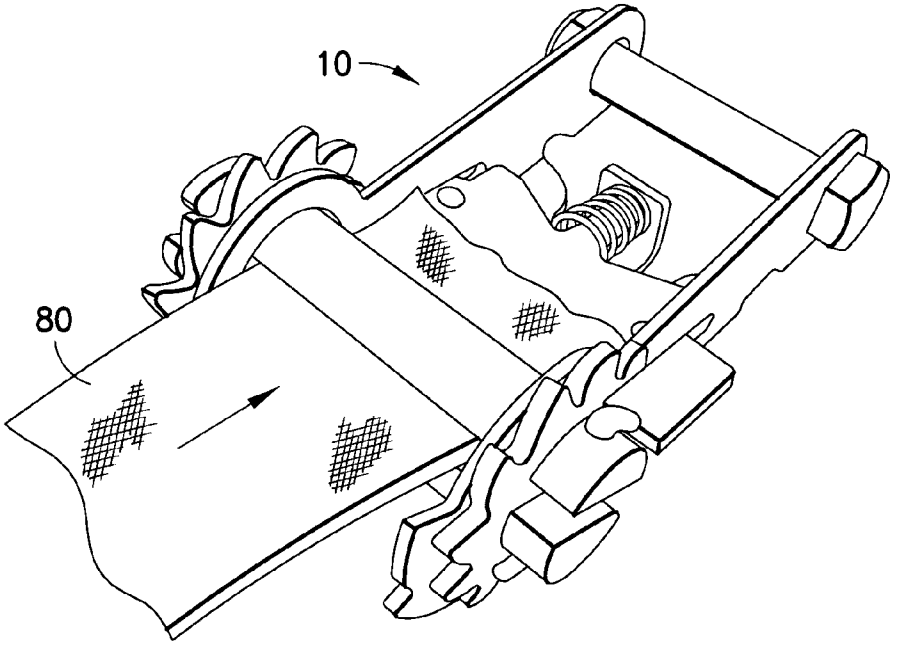

FIG.6B

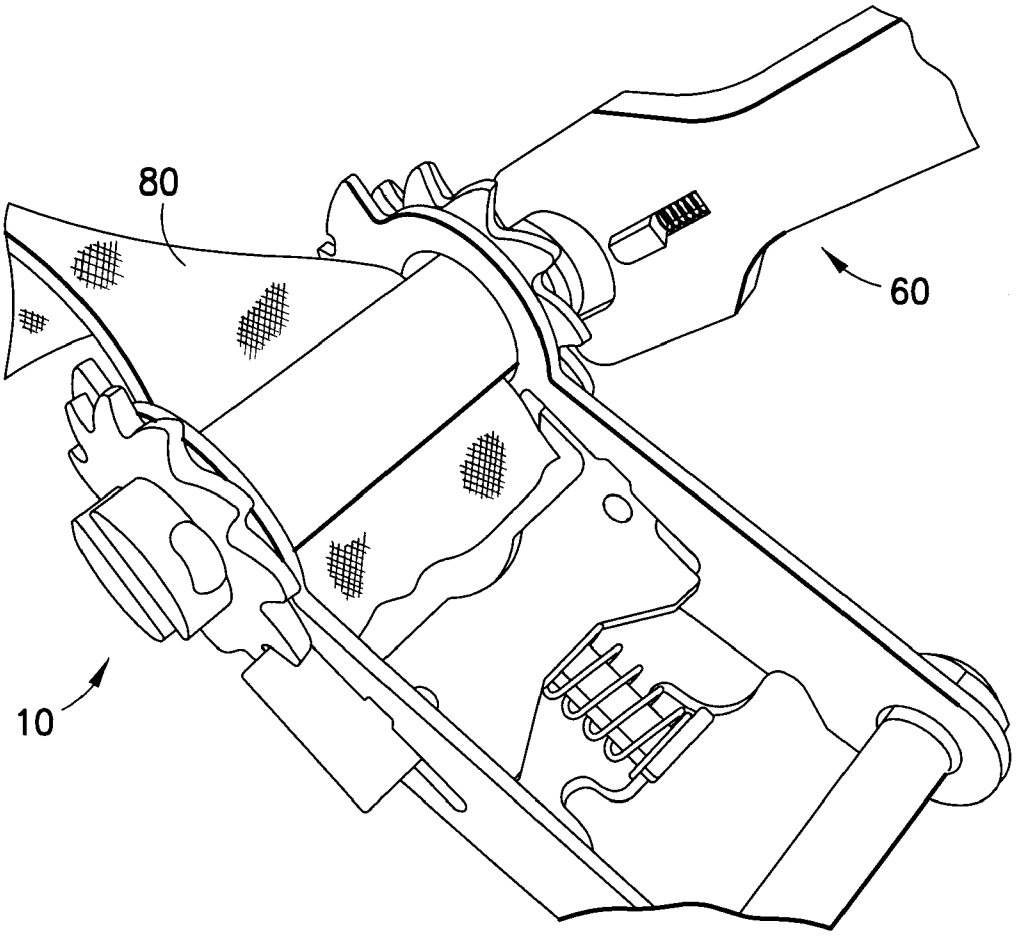

FIG.6C

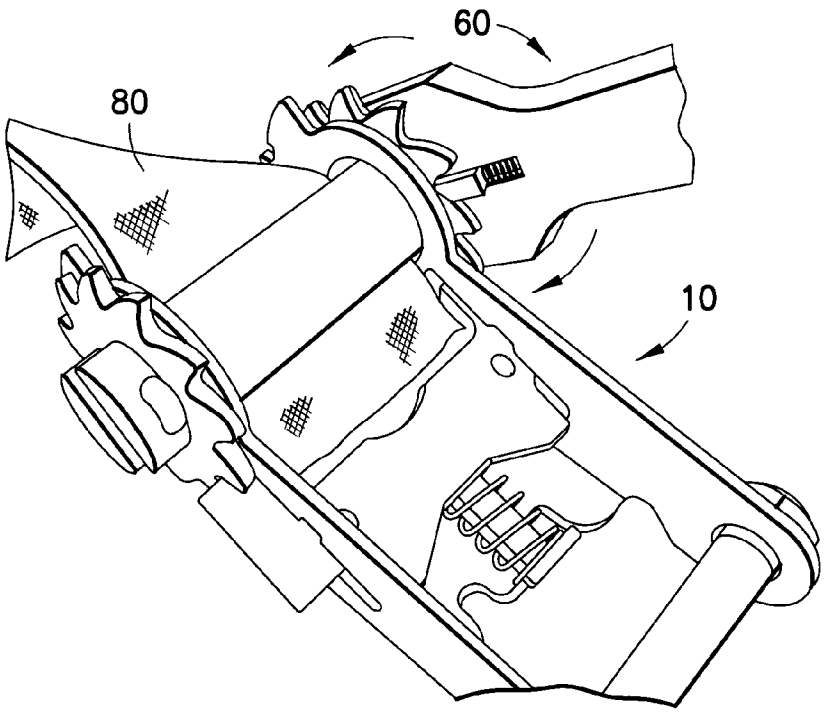

FIG.6D

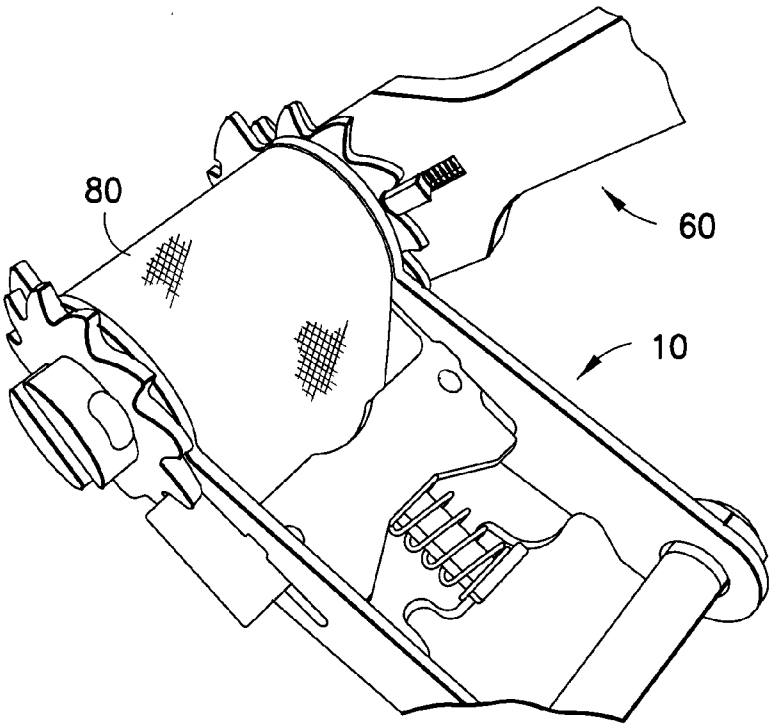

FIG.6E

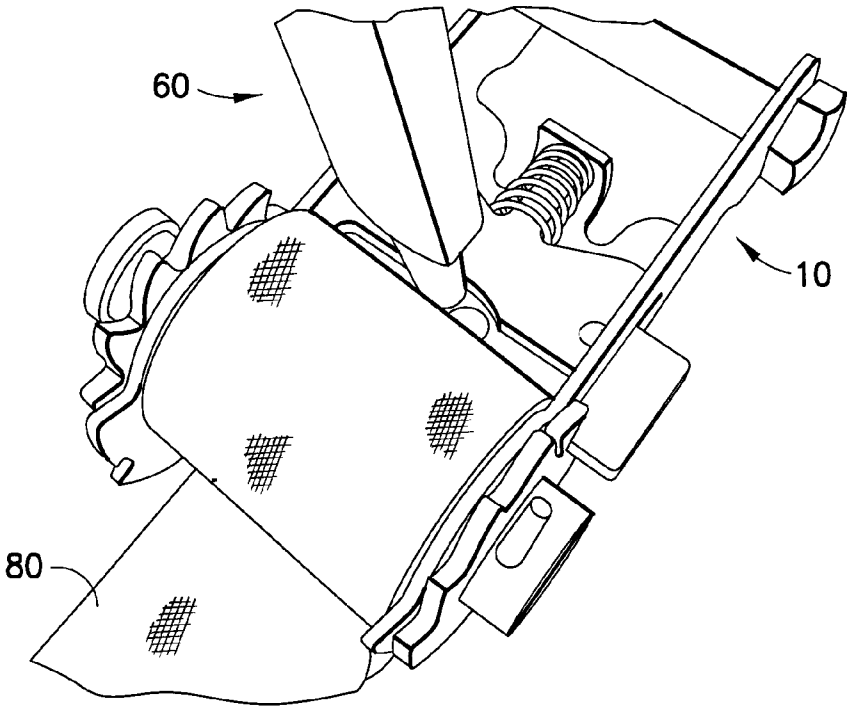

FIG.7A

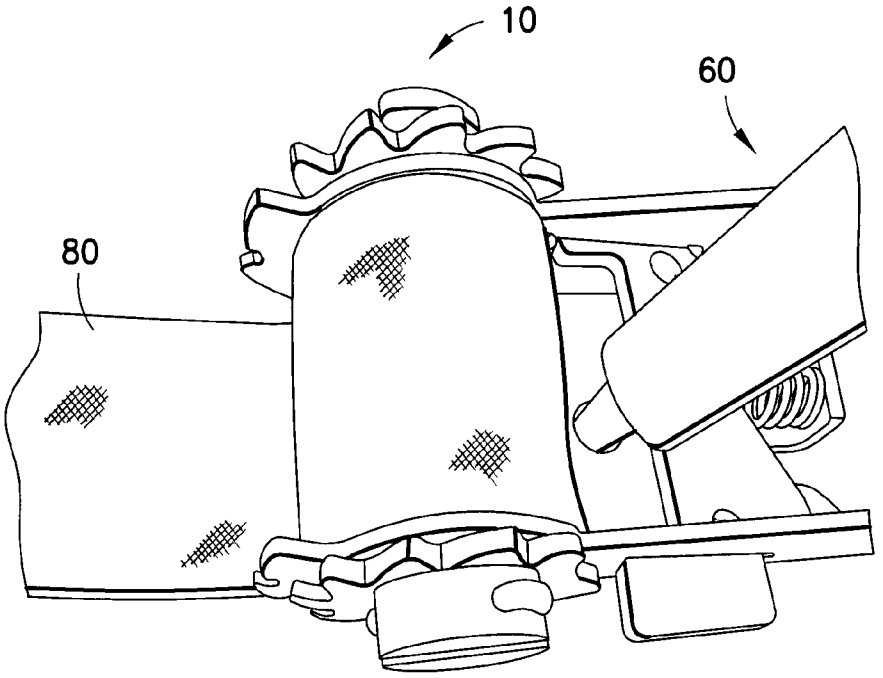

FIG.7B

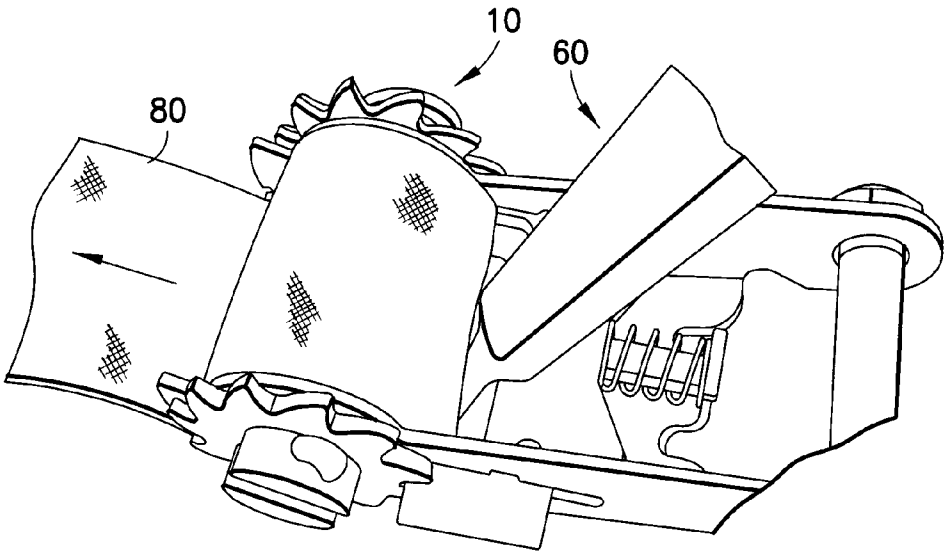

FIG.7C

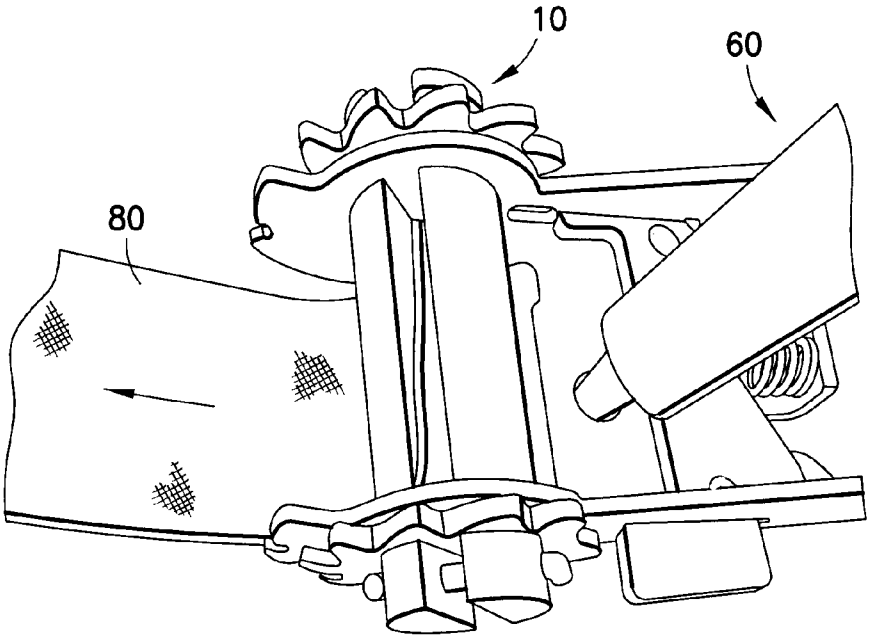

FIG.7D

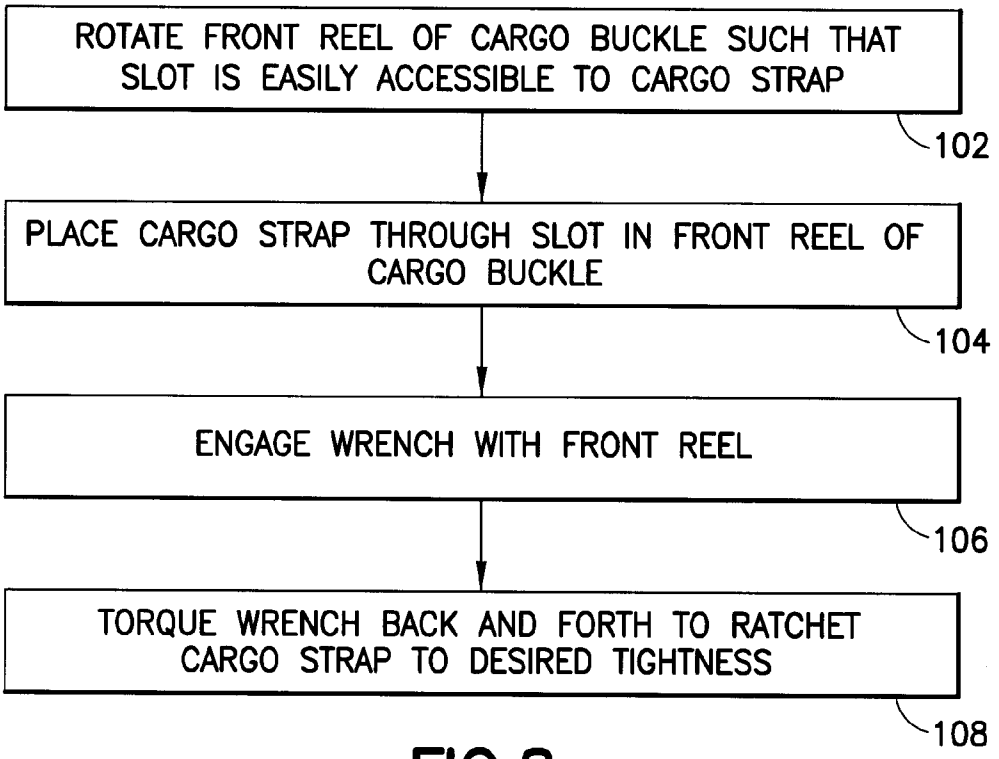
ROTATE FRONT REEL OF CARGO BUCKLE SUCH THAT SLOT IS EASILY ACCESSIBLE TO CARGO STRAP
102
PLACE CARGO STRAP THROUGH SLOT IN FRONT REEL OF CARGO BUCKLE
104
ENGAGE WRENCH WITH FRONT REEL
106
TORQUE WRENCH BACK AND FORTH TO RATCHET CARGO STRAP TO DESIRED TIGHTNESS
108

FIG.8

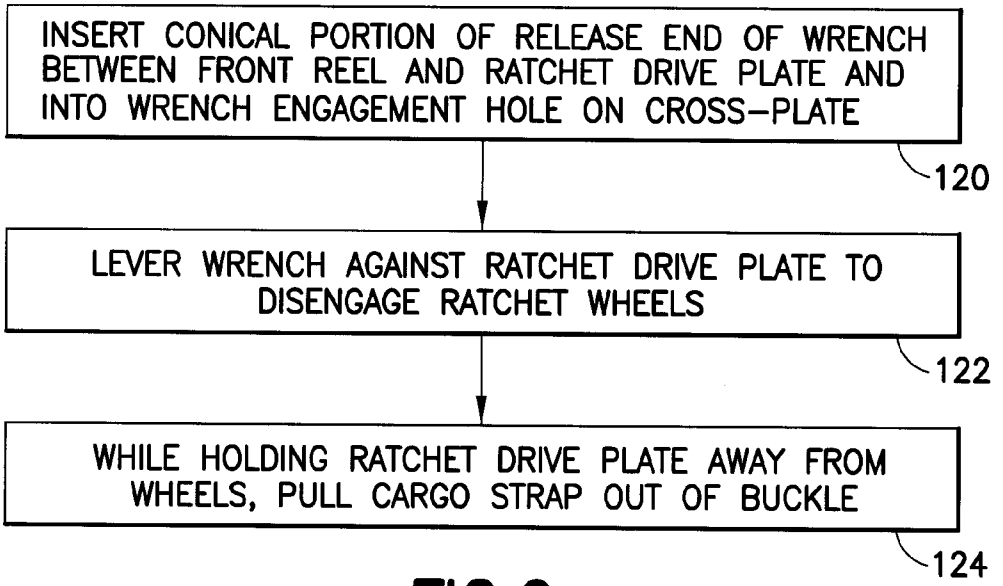
INSERT CONICAL PORTION OF RELEASE END OF WRENCH BETWEEN FRONT REEL AND RATCHET DRIVE PLATE AND INTO WRENCH ENGAGEMENT HOLE ON CROSS-PLATE
120
LEVER WRENCH AGAINST RATCHET DRIVE PLATE TO DISENGAGE RATCHET WHEELS
122
WHILE HOLDING RATCHET DRIVE PLATE AWAY FROM WHEELS, PULL CARGO STRAP OUT OF BUCKLE
124

FIG.9

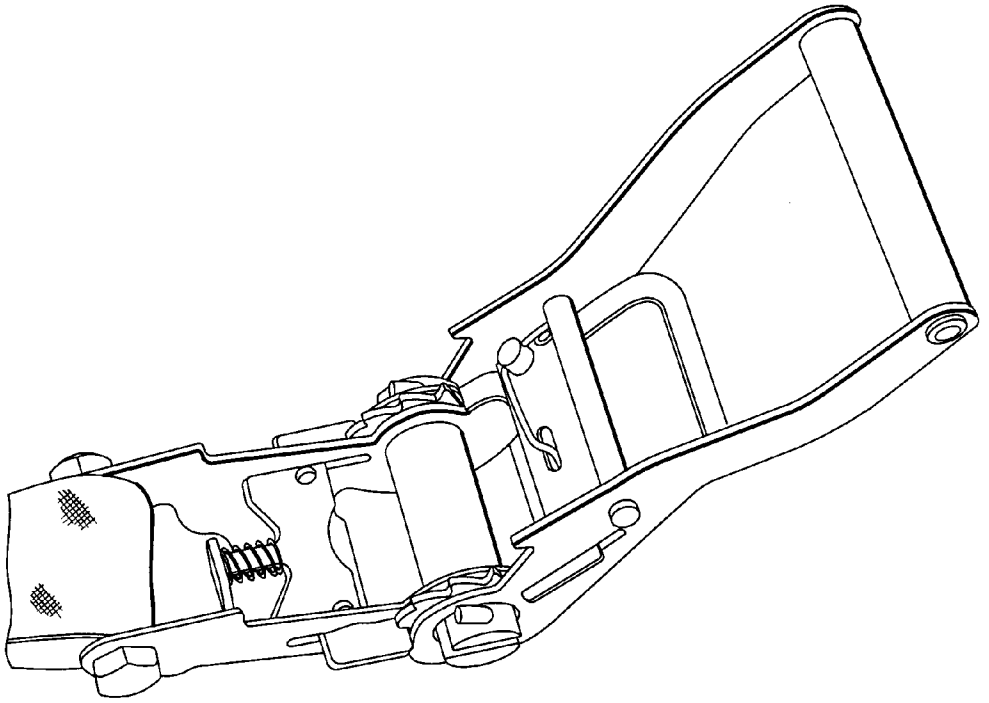

FIG. 10
PRIOR ART

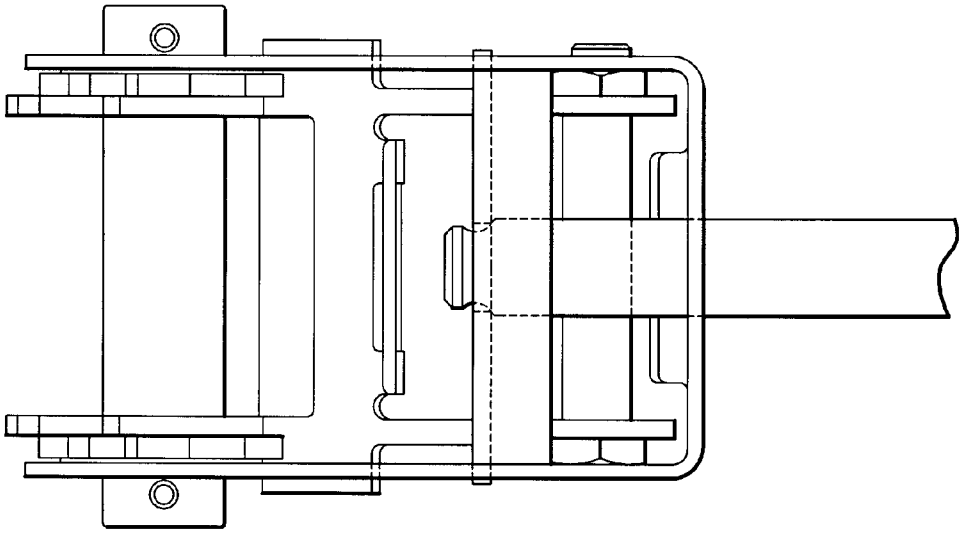

FIG. 11
PRIOR ART

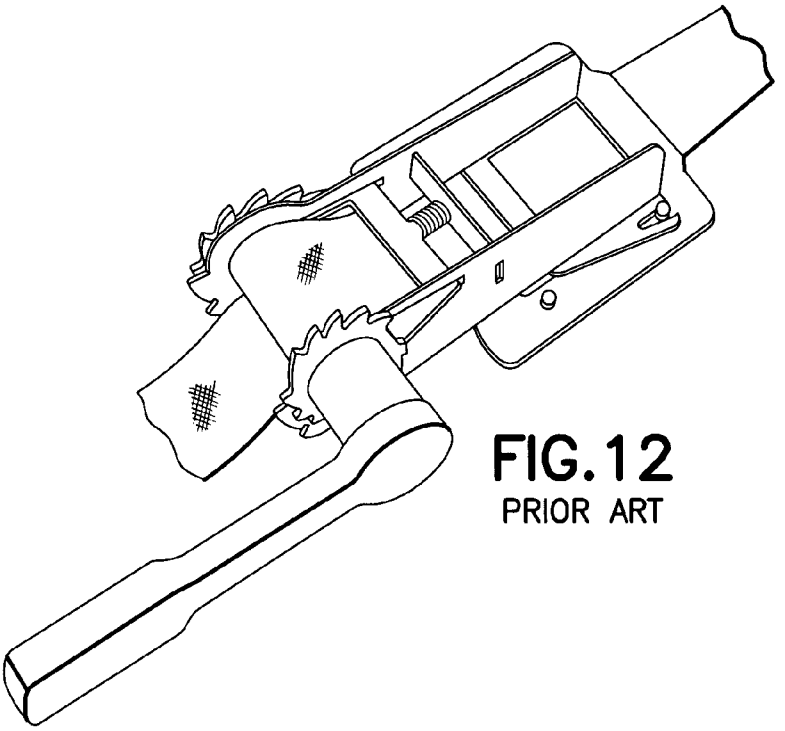

FIG. 12
PRIOR ART

PRIOR ART

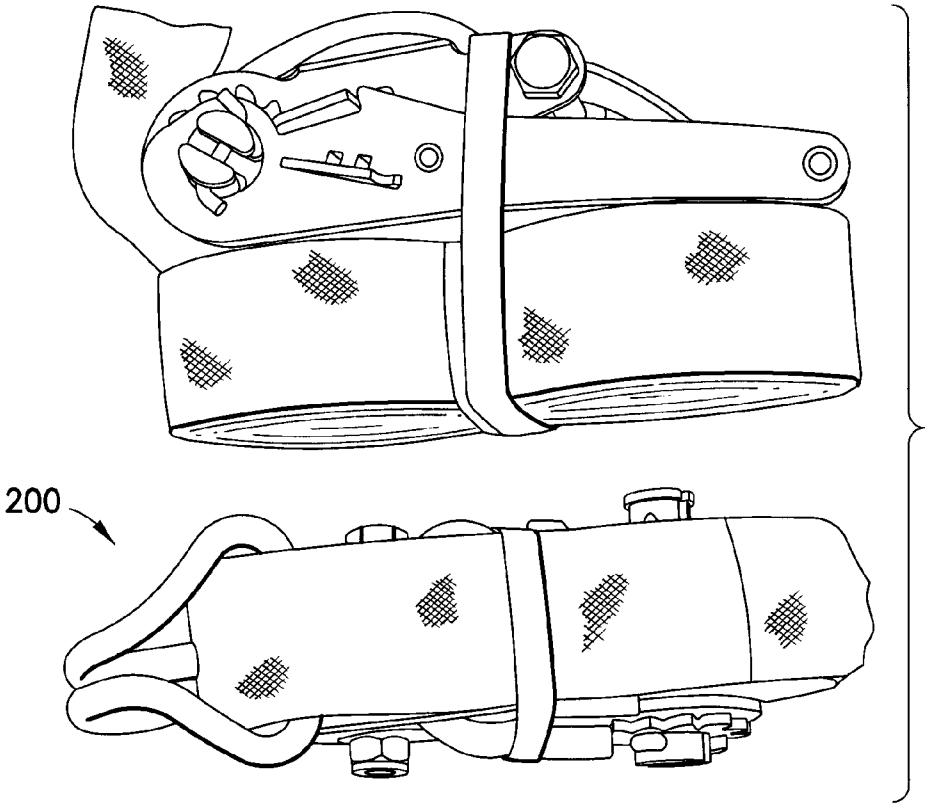

FIG. 13

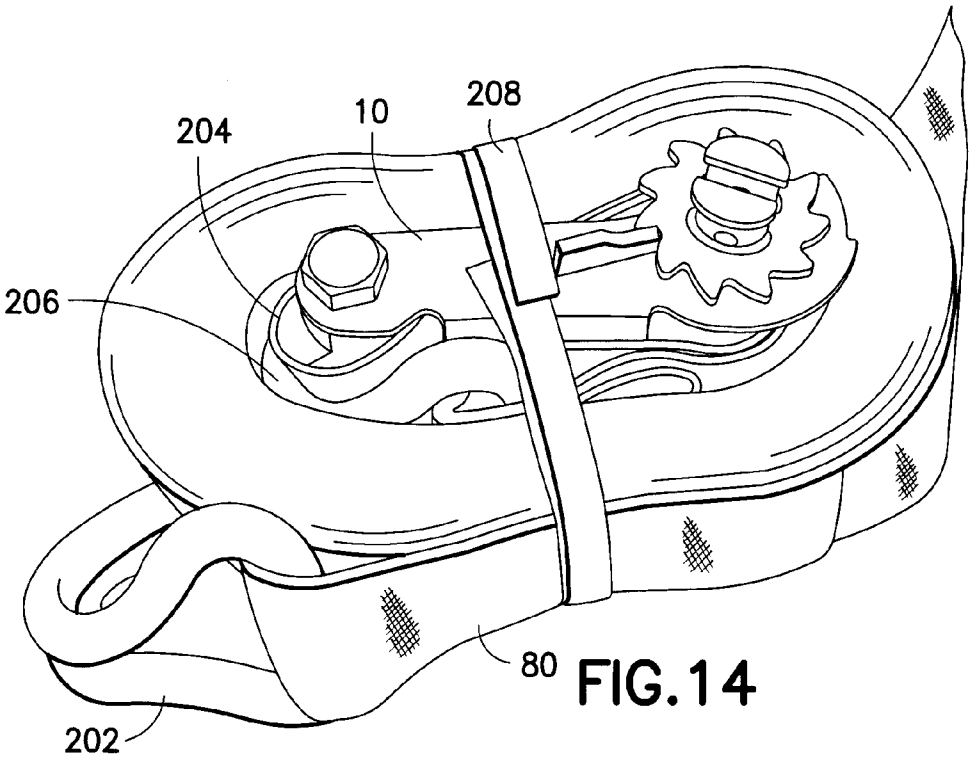

FIG. 14

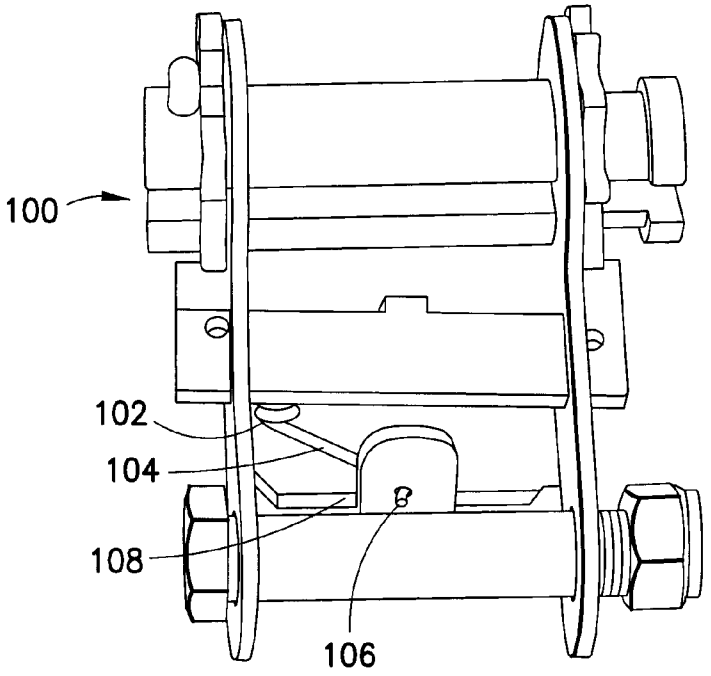

FIG. 15

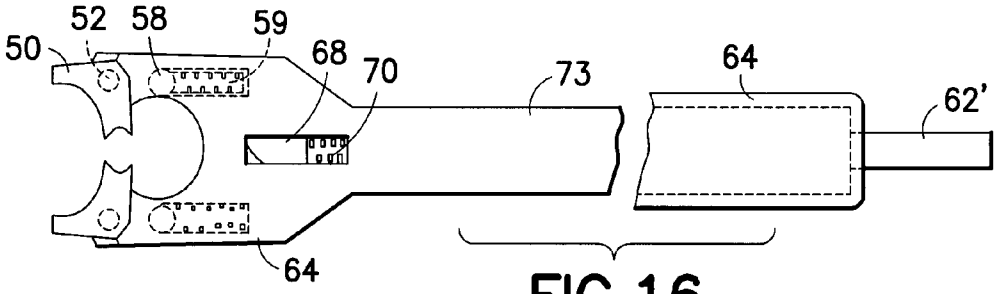

FIG.16

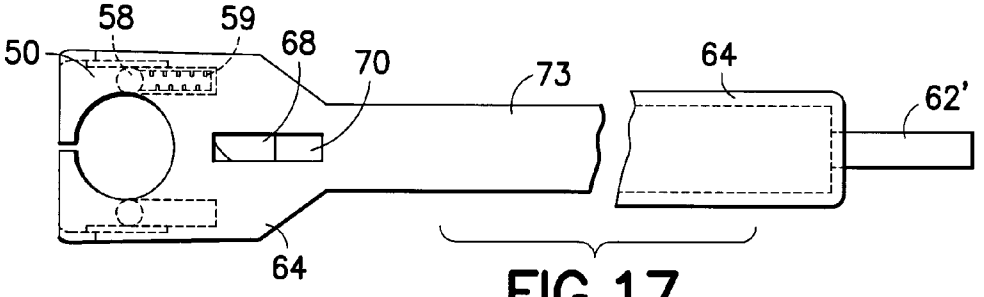

FIG.17

RATCHET BUCKLE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a non-provisional claiming priority from pending provisional application Ser. No. 61/151,495 filed Feb. 10, 2009, the specification of which is incorporated by reference herein.

TECHNICAL FIELD

[0002] This invention relates to a ratchet buckle that can be used to tighten straps for securing cargo and, more particularly, to a lightweight ratchet device and detachable operating lever or wrench.

BACKGROUND

[0003] In general, ratchet mechanisms for cargo storage and other general uses, having ratchet drive wheels and spring loaded ratchet drive plate mechanisms are well known. Such ratchet buckles are commonly used to assist in securing cargo straps for transport or storage of cargo. Ratchet buckles generally consist of a ratcheting mechanism and a mechanism for receiving, securing and tightening a strap to be used for securing cargo. To operate such a buckle a cargo strap is coupled to the buckle and tightened using the ratcheting feature. Current ratchet buckles contain many heavy metallic parts which lead to high weight and bulk.

[0004] The following exemplary ratchet buckles are illustrative of the state of the art: a first prior art device, the "Cargo Ratchet" depicted in FIG. **10**; a second prior art device, depicted in FIG. **11** and described in U.S. Pat. No. 4,510,651, and a third prior art device, depicted in FIG. **12** and described in U.S. Pat. No. 4,510,652.

[0005] The prior art Cargo Ratchet depicted in FIG. **10** employs a permanently affixed handle for ratcheting the ratchet drive. This prior art Cargo Ratchet generally comprises a ratchet buckle frame and a permanently affixed handle. The ratchet buckle frame has front and rear reels and a spring-loaded ratchet drive plate, the front reel having toothed wheels. The permanently affixed handle comprises a large handle frame, a cross-beam fixed transversely into the handle frame, and a ratcheting plate with release handle. The handle is rotatably attached to the front reel to facilitate driving the ratchet wheels.

[0006] The prior art Cargo Ratchet shown in FIG. **10**, suffers the disadvantages of high weight and space consumption. The permanently affixed handle provides a ratcheting function but is very bulky due to the inclusion of the large frame parts, cross-bars, and ratchet drive/release plate. Further, release of an installed strap requires that the handle be opened fully so that the drive/release plate is disengaged from the ratchet wheels, thereby increasing the length of the device by twofold during this procedure, which may make the Cargo Ratchet more difficult to use in tight spaces.

[0007] The prior art ratchet buckle shown in FIG. **11** and disclosed in U.S. Pat. No. 4,510,651 has a similar structure to the FIG. **10** buckle, but has a smaller handle frame. To assist with the ratcheting action, the FIG. **11** ratchet buckle uses a removable lever or wrench which can be inserted into a receiving slot in the handle frame and subsequently fixed into place with a pin. As the removable lever still requires a handle frame with large bulky parts, this FIG. **11** buckle still suffers from the problem of high weight and space consumed as discussed in relation to FIG. **10**. Additionally, the lever must be secured into place with a pin, thereby increasing the amount of time required for operation.

[0008] The prior art cargo buckle disclosed in U.S. Pat. No. 4,510,652 and shown in FIG. **12** has a ratchet buckle and removable lever for ratcheting the buckle. This device is meant to be used in conjunction with a fixed strap securing plate as shown. This use requires that the strap traverse the entire length of the ratchet buckle, as it is fed and tightened at opposite ends. Due to this fact, the ratcheting wrench cannot be used as a lever to remove the strap in a simple fashion.

[0009] Thus it is an object of the present invention to provide a lightweight ratchet buckle which can be easily operated and from which a strap can easily be disengaged.

[0010] It is a further object to provide a ratchet buckle which consumes low space.

[0011] It is a further object to provide a ratchet buckle which has minimized shipping and production costs.

SUMMARY

[0012] In the present invention, these purposes, as well as other which will become apparent, are achieved generally by providing a lightweight apparatus and related method for transport in cargo compartments, such as trucks and freight trains. The light weight of the ratchet buckle is achieved by the use of a dual purpose detachable ratcheting lever or wrench. The lever has the capacity to ratchet the ratchet buckle, thereby tightening a strap, and further has the capacity to disengage the ratchet buckle to allow for unfastening of the strap. The lever is fully detachable from the ratchet buckle, resulting in a lightweight ratchet buckle device and reduced space consumption and expenses on packaging and shipping costs.

[0013] In a preferred embodiment of the invention, the ratchet buckle and wrench combination generally comprises a frame having a top side and a bottom side, left and right opposing sidewalls and a front end, each of said left and right opposing sidewalls defining a ratchet drive plate slit; a front reel disposed at the front end; a ratchet drive plate having a front side, a rear side, and a right edge, wherein said ratchet drive plate is disposed through said slits in said left and right opposing sidewalls; left and right ratchet wheels disposed on said front reel, said left and right wheels engaged with said ratchet drive plate, and said right wheel having a right face; a ratchet wrench comprising: a shaft with a wrenching end and a release end, a length and a width; a grasping head at said wrenching end; a release protrusion at said release end; and a spring loaded member extending from and perpendicular to the shaft, wherein said spring loaded member is located at the wrenching end and is adjacent to the grasping head; wherein said right edge of said ratchet drive plate is substantially aligned with the right face of the right wheel, thereby providing a flush surface to allow engagement by a wrench.

[0014] Further, a method of operating the cargo buckle is provided comprising providing a securing strap; providing a ratchet buckle and wrench combination comprising: a frame having left and right opposing sidewalls and having a front end, each of said left and right opposing sidewalls defining a ratchet drive plate slit; a front reel disposed at the front end, said front reel having an annular depression; a ratchet drive plate having a right edge, wherein said ratchet drive plate is disposed through said slits in said left and right opposing sidewalls; left and right ratchet wheels disposed on said front reel, said left and right wheels engaged with said ratchet drive

plate, and said right wheel having a right face; a shaft with a wrenching end and a release end, a length and a width; a grasping head at said wrenching end; a release protrusion at said release end; and a spring loaded member extending from and perpendicular to the shaft, wherein said spring loaded member is located at the wrenching end and is adjacent to the grasping head; wherein said right edge of said ratchet drive plate is substantially aligned with the right face of the right wheel, thereby providing a flush surface to allow engagement by a wrench; sliding the strap through said slit in said front reel; engaging said wrench with said annular depression such that said spring loaded member engages a tooth on one of the ratchet wheels; driving said wrench to rotate said front wheel, thereby drawing the strap towards the buckle.

[0015] Advantage is thereby provided by the ability to operate the buckle without a heavy ratchet frame handle body, and in the provision of a multi-function wrench which can quickly and easily tighten and release a cargo buckle strap.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Other objects, features and advantages of the present invention will be apparent when the detailed description of the preferred embodiments of the invention are considered in conjunction with the drawings which should be construed in an illustrative and not limiting sense as follows:

[0017] FIG. **1** is a perspective view of a preferred embodiment of the ratchet buckle.

[0018] FIG. **2** is a bottom-side view of the preferred embodiment of the ratchet buckle.

[0019] FIG. **3** depicts the left and right ratchet wheels and the fasteners used to retain them to the buckle frame.

[0020] FIG. **4** is a top down view of the wrench of a preferred embodiment of the ratchet buckle.

[0021] FIG. **5** is a close-up view of the head section of the lever portion of a preferred embodiment of the ratchet buckle.

[0022] FIG. **6**A-**6**B shows the first step of a first embodiment of a method of tightening a strap with a cargo buckle, the first step being inserting a strap into a cargo buckle.

[0023] FIG. **6**C shows the second step of a first embodiment of a method of tightening a strap with a cargo buckle, the second step being engaging a wrench with the front reel of the cargo buckle.

[0024] FIG. **6**D-**6**E show the third step of a first embodiment of a method of tightening a strap with a cargo buckle, the third step being rotating the lever to ratchet the ratchet wheels of the cargo buckle, thereby tightening the cargo buckle.

[0025] FIG. **7**A shows the first step of a first embodiment of a method of removing a strap from a cargo buckle, the first step being inserting a conical end of a wrench between a front reel and a drive plate and into a wrench engagement hole.

[0026] FIG. **7**B shows the second step of a first embodiment of a method of removing a strap from a cargo buckle, the second step being levering a wrench to disengage a ratchet drive plate from ratchet wheels.

[0027] FIG. **7**C-**7**D show the third step of a first embodiment of a method of removing a strap from a cargo buckle, the third step being removing the cargo strap from the buckle while the ratchet drive plate is disengaged from the ratchet wheels.

[0028] FIG. **8** **9** is a flow chart illustrating a preferred embodiment of a method of inserting and fastening a strap into the cargo buckle device.

[0029] FIG. **9** is a flow chart illustrating a preferred embodiment of a method of removing a strap from a cargo buckle device.

[0030] FIG. **10** shows a first prior art cargo buckle device exhibiting a large ratcheting handle.

[0031] FIG. **11** shows a second prior art cargo buckle device exhibiting a large ratcheting handle.

[0032] FIG. **12** shows a third prior art cargo buckle device.

[0033] FIG. **13** shows a prior art shipping assembly in comparison with the shipping assembly facilitated by the ratchet buckle of the present invention.

[0034] FIG. **14** is a close-up view of the shipping assembly used to ship the ratchet buckle which is the subject of the present invention.

[0035] FIG. **15** shows an alternative ratchet drive plate spring mechanism.

[0036] FIG. **16** is a cross-sectional view of an alternative wrench head showing the wrench head in an open position.

[0037] FIG. **17** is a cross-sectional view of an alternative wrench head showing the wrench head in a locked position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] This disclosure is directed to a Ratchet Buckle that can be used in various locations such as trucks, trailers, airplanes and trains, to secure cargo during transport or during other situations that may disrupt cargo in storage. To utilize such a ratchet buckle, a strap for securing cargo is coupled to the ratchet buckle, and the buckle is ratcheted, such that the strap is tightened over cargo.

[0039] Reference is now made to FIGS. **1** and **2** of the drawings, showing a preferred embodiment of a Ratchet Buckle **10**. The Ratchet Buckle **10** generally comprises a frame **11** with spaced rear and front reel bars **12**, **14** that extend between opposing left and right side walls **17** and **21** of the frame **11** for supporting tensioning cargo straps (not pictured). Preferably, the left and right side-walls **17** and **21** are approximately 5.5", in length approximately one inch in height, and approximately ⅛" in thickness. The front reel **14** is preferably approximately 3.5" in length and approximately 1" in diameter while the rear reel **12** is preferably approximately 3" in length and ½" in diameter. Further, frame **11** has a front end **13** and a rear end **25**. The rear reel **12** preferably comprises a bolt slid through two circular holes in the rear of the frame **11**, and fastened with a nut. The frame is preferably made from a metal material, such as steel.

[0040] The front end **13** of each side wall **17** and **21** preferably expands out to an approximately flat circular portion **40** with an approximate diameter of 2". The circular portions **40** of the side-walls **17** and **21** each preferably define a circular slot **33** for insertion of a cylindrical front reel **14**. The top edge **35** of each side wall **17** and **21** is preferably approximately flat, except for the circular portion **40** at the front ends **25**. The side-walls **17** and **21** and a cross-plate **19** are preferably stamped out of a single piece of material, and bent to form the two side-walls **17** and **21** of the frame **11** and cross-plate **19** at the bottom of the frame **11**. The result, as can be seen in FIG. **2** is that the bottom side **41** of each side wall **17** and **21** is approximately flat, though having contours corresponding to the presence of the cross plate **19**. The cross-plate **19** will be discussed in more detail below, with reference to FIG. **2**.

[0041] A slot **15** in front reel **14** is provided to receive a tensioning strap. Preferably, the front reel **14** is composed of

two spaced, semi-cylindrical bars **28**, the space defining a slot **15**. The slot **15** is preferably approximately ¼" in width. Other strap attachment mechanisms may be used.

[0042] Preferably, left and right ratchet wheels **23**, **26** are disposed on the outside surfaces of the left and right side-walls **17**, **21**. The two semi-cylindrical portions **28** of the front reel **14** are disposed through semi-circular holes or slits **30** in the left and right ratchet wheels **23**, **26**, and through the circular holes **33** in the left and right side-walls **17**, **21**.

[0043] The ratchet drive wheels **23**, **26** have ratchet teeth **27** which allow for ratcheting of the front reel **14**. The teeth **27** are preferably rounded on one end and straight-edged on the other such that a ratcheting tool like a wrench **60** may engage the straight-edged end and pass over the rounded end. There are preferably eleven teeth **27** on each wheel **23**, **26** although more or less may be used. The teeth **27** preferably have a height of approximately ¼". A wrench engagement notch or annular depression **16** is cut out of the front reel **14**. Preferably, this notch **16** is on the right side of the front reel **14** but the notch **16** may be anywhere along the reel **14** that allows attachment by a wrench **60**. Additionally, the notch **16** is preferably approximately ⅜" in length and approximately ⅛" in depth.

[0044] Now referring to FIG. **3**, the two semi-cylindrical portions or bars **28** of the front reel **14** are fastened together with reel retainer fasteners **29**, **31**. The semi-cylindrical bars **28** preferably have reel retainer fastener holes at both left and right ends, extending radially through the bars such that fasteners **29**, **31** may be inserted through those holes. On one side, a fastener **29** may connect the two bars by being inserted through the radial holes and then having each end bent over the cylindrical surface of the bar, thereby preventing removal of the fastener from the bar. This fastener **29** must therefore be a long, non-threaded fastener **29**.

[0045] As the front reel **14** preferably has an annular notch **16** at the right end, the fastener **31** that passes through the annular notch **16** must allow attachment by a wrench **60**. Since the front reel **14** extends past the right ratchet wheel **26**, the fastener **31** must be short enough that it does not extend past the cylindrical surface of the notch. As the ends cannot be bent around the reel like with fastener **29**, a mechanism must be used to ensure that the fastener does not slip out of the radial holes. One preferred mechanism is to thread the fastener **31** and the holes. Other mechanisms that retain the fastener in place while allowing attachment by a wrench may be used as well. The fasteners **29**, **31** are preferably approximately 3/16" in diameter.

[0046] A ratchet drive plate is disposed roughly in the center of the ratchet buckle frame **11**. The ratchet drive plate **18** is preferably formed from a separate piece of material than the rest of the frame **11** and is preferably approximately ⅛" in thickness. The ratchet drive plate **18** comprises a central portion **42** and a left and right wheel engagement member **20**, **22**. The central portion has a front edge **44** and a rear edge **46**. The front edge **44** is preferably approximately straight. Preferably the center of the front edge **44** has an indent **48** such that it can receive the release end **61** of a wrench **60**. The indent **48** is preferably round and approximately ½" in length. The rear edge **46** of the central portion **42** of the ratchet drive plate **18** is preferably shaped as follows. The portion of the rear edge **46** nearest the side-walls **23**, **26** of the frame **11**, is substantially parallel to the front and rear reels **14**, **12**. Following the rear edge **46** towards the center of the ratchet drive plate **18**, the edge angles forward (towards the front reel **12**). From the center of the rear edge **46** projects a thin spring attachment member **34** which preferably has a rounded end. The spring attachment member **34** is preferably approximately ¾" in length and approximately ⅜" in width.

[0047] Alternatively, as shown in an alternate embodiment of a ratchet buckle **100** in FIG. **15**, a spring **102** may be affixed to the ratchet drive plate. The free end **104** of the spring **102** may be inserted into a small hole **106** in an alternate spring retention nub **108** extending from the cross-plate **19**. This alternate spring **102** biases the ratchet drive plate towards the front reel such that the wheel engagement members **20**, **22** come into contact with the teeth **27** of the wheels **23**, **26**.

[0048] The ratchet drive plate **18** preferably has left and right wheel engagement members **20** and **22** which are disposed through slits **38** and **39** in the frame **11** and which serve to ratchetably engage the teeth **27** of the ratchet drive wheels **23** and **26**. The slits **38** and **39** are preferably approximately 1.5" in length and approximately 3/16" in height.

[0049] Preferably, the left and right engagement members **20** and **22** extend from the left and right sides of the central portion of the ratchet drive plate, respectively. In a first preferred embodiment, the left engagement member **20** is wider than the right engagement member **22**, and is approximately ½" in width and approximately 1" in length. The right engagement member **22** is preferably approximately ⅜" in width and 1" in length. Preferably, the right engagement member **22** is narrow enough such that its right end is substantially aligned with the right face of the right wheel **26**, thereby forming a substantially flush surface or even edge with the right ratchet drive wheel **26**.

[0050] It should be appreciated that, as described below, this flush surface configuration allows a wrench **60** to drive the right ratchet drive wheel **26** by allowing the wrench **60** to make contact with the front reel **14** and the teeth **27** of the wheel **26**, and to permit freely rotating the wrench **60** and front reel **14**, without blocking rotation of the wrench. In embodiments where the annular notch **16** is in a different location, a different ratchet drive shape should be used. For example, the narrowed engagement member **22** may be on the left side of the ratchet buckle to allow wrenching from that side. Alternatively, there may be no narrowed engagement member and the front reel may be ratcheted from within the opposing side-walls **17**, **21** of the ratchet frame **11**.

[0051] The ratchet drive plate **18** may include rivets **73**. The rivets **73** protrude from the top of the drive plate **18**, causing an increased thickness at the area of the rivets **73**. The slits **38**, **39** therefore preferably include small widened portions **75**, **77**, which allows the rivets **73** to pass through the slits **38**, **39**. Preferably the rivets **73** are approximately 3/16" in diameter and the widened portions **75**, **77** are slightly larger, to accommodate the rivets **73**.

[0052] A ratchet spring **32** is preferably disposed around the spring attachment member **34** and against a spring retention nub **36** attached to a cross-plate **19**. The spring retention nub **36** defines a spring retention hole **37** through which the spring attachment member **34** may pass. The spring **32** biases the ratchet drive plate **18** towards the front reel **14**, thereby engaging the left and right wheel engagement members **20** and **22** with the teeth **27** of the left and right wheels **23** and **26**.

[0053] A cross plate **19** is disposed at the bottom of the ratchet buckle frame **11**. Preferably, the thickness of the cross-plate **19** is approximately ⅛", the width is approximately 2.25" and the length is approximately 2". The cross-plate **19** is disposed at the bottom of the ratchet buckle frame

11 and is approximately rectangular in shape. At the front edge of the cross-plate **19** is preferably a roughly trapezoidal ridge jutting forward which measures approximately 1.625" in length. Towards the rear of the frame **11**, the outline of the cross-plate **19** is roughly straight at the area of the plate **19** towards the side-walls **17**, **21** of the frame **11**, and curves in towards a spring retention nub **36** which defines a spring retention hole **37**. Preferably, the spring retention nub **36** extends approximately ⅝" towards the top of the buckle and is approximately ⅝" in width. The spring retention hole is preferably approximately ⅜" in diameter.

[0054] The cross-plate **19** additionally defines a wrench engagement hole **24**, which can be used in conjunction with a wrench **60** to disengage the ratchet drive plate **18** from the wheels **23** and **26**. The wrench engagement hole **24** is located towards the front part of the cross-plate **19** and is positioned to correspond to the indent **77** in the front edge **44** of the ratchet drive plate **18**, to allow engagement and levering by a lever or wrench **60**. The wrench engagement hole **24** is preferably approximately ⅜" in diameter.

[0055] Referring now to FIG. **4**, the wrench **60** preferably comprises a shaft **63** connecting a wrenching end or wrenching head **64** with a release end **61**. A conical release protrusion **62** may be located at the release end **61**, which may be used to disengage the ratchet drive plate **18** from the wheels **23** and **26**. Alternatively, as shown in FIGS. **16** and **17**, an alternative release protrusion **62'** may be cylindrical rather than conical. The shaft **63** of the wrench **60** is preferably approximately ¾" in width, approximately ⅜" in depth, and approximately 8.25" in length. Further, it is preferably made of a hollow rectangular metal material, the metal having a thickness of approximately 1/16". As shown in FIGS. **16** and **17**, the wrench **60** may have a manual gripping structure **65** disposed around the wrench, for providing optimal gripping function to a user.

[0056] Reference is now made to FIG. **5** which is a close-up view of the wrenching end **64** of the wrench **60**. The wrench head section **64** has a semi-circular wrench opening **74** set into the front end of the wrench head **64**. The reel engagement surface **76** of the wrench opening **74** preferably comprise two parallel substantially straight sections measuring approximately ⅜" in length, connected to a semi-circular section having a diameter of approximately ⅞". The wrench opening surface is intended for engagement with the annular notch **16** of the front reel **14** of the ratchet buckle **10**.

[0057] An elongated tooth engagement member **68** is set into the wrench head section **64**. Preferably, the tooth engagement member **68** is positioned such that the leading short edge **66** of the tooth engagement member **68** is set back from by about ⅜", and corresponds roughly to, the closest part of the reel engagement surface **76** of the wrench opening **74**. Preferably, the member **68** has a rounded corner **71** for slipping over ratchet teeth and a straight corner **72** for engaging ratchet teeth, thereby facilitating a ratcheting action. The member **68** is preferably approximately ½" in length, approximately ¼" in height and approximately 3/16" in width.

[0058] A spring **70** biases the tooth engagement member **68** towards the wrenching end **64**, in order to provide secure engagement of the member **68** with the teeth **27** of a wheel **23**, **26**. The spring **70** and member **68** are preferably disposed within a cut-out **78** in the wrench head, the cut-out **78** measuring approximately ⅞" in length and approximately 3/16" in width. The wrench head **64** may be of a different width than the shaft **63**. Preferably the wrench head **64** has a smaller width than the shaft **63**. Preferably this width variation is facilitated by cutting out the walls of the shaft **63** at the wrench head **64**, compressing the floor and ceiling of the shaft to a desired width, forming new walls with plies of metal (such as aluminum or steel), and fastening the plies of metal together. Preferably, 2 plies of metal are used.

[0059] Reference is now made to FIGS. **16** and **17**, depicting an alternate embodiment of a wrench with alternate wrenching end **64'**. The alternate wrenching end **64'** has two movable gripping portions **50**. The gripping portions **50** rotate around gripping portion axles **52** and are preferably L-shaped. The gripping portions preferably have reel holding ends **54** and nub receiving ends **56**. The gripping portions **50** are rotatable between an open position, in which the wrench **60** is ready to engage a front reel **14** of a ratchet buckle **10**, and a locked position, in which the wrench **60** is engaged around a front reel **14** of a ratchet buckle **10**. The nub receiving ends **56** are shaped to receive preferably rounded spring loaded nubs **58** which serve to hold the gripping portions **50** in a locked position, thereby steadying the wrench **60** during engagement and ratcheting of the ratchet buckle **10**. The spring loaded nubs **58** are set back within the wrenching end **64'**, against springs **59** which bias the nubs **58** towards the nub receiving ends **56** of the gripping portions **50**. Upon engagement of the wrenching end **64'** with the front reel **14**, the front reel **14** pushes the two movable gripping portions **50** inwards. The spring loaded nubs **58** hold the nub receiving ends **56** of the gripping portions **50** in place, thereby locking the gripping portions **50** around the front reel **14**. In a preferred embodiment, both the nub receiving ends **56** and the spring loaded nubs **58** are approximately semi-circular in shape, but any shape which provides a sturdy temporary lock may be used.

[0060] Preferably, the gripping portion axles **52** are situated in such a way as to allow rotation of the gripping portions **50** inwards into a locked position, but to prevent rotation of the gripping portions **50** past a certain degree either inward or outward.

[0061] Referring now back to FIG. **4**, the release end **61** of the wrench **60** will now be described in more detail. Preferably the release end **61** is approximately 1" in length. The release end is approximately 7/16" in diameter towards the shaft **63** and tapers slightly to about a diameter of approximately ¼". The end of the release end **61** is preferably circular and flat. The release end **61** preferably is manufactured from a separate piece of metal, inserted into the hollow shaft and welded or affixed to the shaft through an appropriate method.

[0062] Reference is now made to FIGS. **6**A-**6**E, and FIG. **8**, which show a method of utilizing the ratchet buckle **10** and wrench **60** to secure a cargo strap **80**. As one purpose of tightening cargo straps with this buckle is to secure cargo, a cargo strap **80** may optionally be secured to a surface and wrapped around or otherwise secured to a cargo package. Preferably, in step **102**, prior to installation of the strap **80** into the ratchet buckle **10**, the front reel **14** of the ratchet buckle **10** is rotated such that the slot **15** in the front reel **14** is easily accessible to the cargo strap **80**.

[0063] In a preferred embodiment, the right wheel **26** is ratcheted clockwise, as viewed from the right side of the ratchet buckle **10**. Therefore, to quickly secure the cargo strap **80**, the slot **15** of the front reel **14** should be pointed upwards and slightly towards the rear of the buckle **10**. In this position, the cargo strap **80** should be inserted from the bottom of the ratchet buckle **10**. This allows for the best tradeoff between easy insertion of the cargo strap **80** into the slot **15** in the front

reel **14** and quickest time to when the strap **80** is securely wrapped under itself around the front reel **14**.

[0064] Rotation of the front reel **14** for this initial set-up can be accomplished by either ratcheting the front reel **14** with the wrench **60** as described below with respect to FIGS. **6**D-**6**E, or by using the conical end **61** to disengage the ratchet drive plate **18** from the teeth **27** of the wheels **23**, **26** and then rotating the front reel **14** by hand. As shown in FIGS. **6**A-**6**B, in step **104**, a strap is placed through the slot **15** in the front reel **14**. The strap should be placed all the way through the slot to ensure secure fastening while ratcheting the ratchet buckle, but should not be placed too far into the slot such that ratcheting is hindered.

[0065] As shown in FIG. **6**C, in step **106**, the reel engagement surface **76** of a wrench **60** is engaged with the annular groove or notch **16** of the front reel **14**. This must be done such that the tooth engagement member **68** of the wrench **60** is able to engage the teeth **27** of the ratchet wheels **23**, **26**. For example, in the preferred embodiment shown in the figures, the tooth engagement member **68** must be pointed inwards, towards the right wheel **26**, as the annular groove **16** in the front reel **14** is disposed outwards from the teeth **27** of the right wheel **26**. In order to facilitate ratcheting, the flat side of the tooth engagement member **68** must be against the flat side of one of the teeth **27** of a ratchet wheel **23**, **26**.

[0066] As shown in FIGS. **6**D and **6**E, in step **108**, the wrench **60** is torqued or rotated towards the front side of the ratchet buckle, thereby rotating the front reel **14**, and is then brought back towards the rear reel **12**. Preferably the cargo strap **80** is pulled taught away from the cargo buckle **10** to ensure tight wrapping of the strap **80** around the front reel **14**.

[0067] Each time the wrench tightens the front reel **14**, it must be brought back such that the tooth engagement member **68** slides over the teeth **27** of the ratchet wheel **23**, **26** and engages a new tooth **27**. This ratcheting motion is repeated until the cargo strap **80** is tightened to a desired tightness.

[0068] For releasing the cargo strap **80**, reference is now made to FIGS. **7**A-**7**D and FIG. **9**. In step **120**, the conical portion **62** of the release end **61** of the wrench **60** is inserted between the front reel **14** and the ratchet drive plate **18**, and into the wrench engagement hole **24** in the cross plate **19**. A substantially firm grip should be established such that the conical release end **61** does not slip out of the wrench engagement hole **24**. In step **122**, the wrench **60** is levered against the ratchet drive plate **18**, as shown in FIG. **7**B, thereby disengaging the plate **18** from the teeth **27** on the wheels **23** and **26**. As shown in FIGS. **7**C-**7**D, in step **124**, while holding the ratchet drive plate away from the ratchet wheels, the cargo strap **80** is pulled outward from the buckle **10**, as shown in FIGS. **7**C-**7**D.

[0069] Referring now to FIG. **13**, a prior art shipping assembly and a shipping assembly **200** for the cargo ratchet **10** can be seen and described. As can be seen, the prior art shipping assembly requires much more space than the ratchet buckle **10** which is the subject of this disclosure, due to the inclusion of a bulky handle in the prior art.

[0070] Referring now to FIG. **14**, the shipping assembly **200** for the cargo ratchet **10** will be described in more detail. The shipping assembly **200** generally comprises the cargo ratchet **10**, a cargo strap **80** with a hook **202** attached, and a rear reel strap **204** with rear reel hook **206** attached to the rear reel **12**. The rear reel strap **204** and cargo strap **80** are both wrapped around the cargo ratchet **10** and tied in place with a tie **208**.

[0071] Although the invention has been described with reference to preferred embodiments, it will be appreciated by one of ordinary skill in the art that numerous configurations and modifications are possible in light of the above disclosure. For example, the strap may be attached to the buckle with hooks or other means. Further, the positioning of the notch allowing for engagement by a wrench may be located in various places on the front reel or other attached parts. All such variations and modifications are intended to be within the scope of the invention.

We claim:

1. A ratchet buckle comprising:

a ratchet buckle frame with a front side and a rear side, a top side and a bottom side, a left opposing sidewall and a right opposing sidewall, said left opposing sidewall defining a left ratchet drive plate slit and said right opposing sidewall defining a right ratchet drive plate slit, each opposing sidewall having a front and rear side;

a front reel at said front side of said ratchet buckle frame, said front reel having a cargo strap slot;

a left and right ratchet drive wheel, each having teeth and each being situated around the front reel; and

a ratchet drive plate with left and right wheel engagement members, wherein said left and right wheel engagement members are disposed through the left and right ratchet drive plate slits, respectively, such that the wheel engagement members may engage the teeth of the ratchet drive wheels;

wherein the ratchet drive plate is biased towards the ratchet drive wheels; and

wherein the right wheel engagement member has a right edge and the right ratchet drive wheel has a right face, and the right edge of the right ratchet drive wheel and the right edge of the right wheel engagement member are substantially aligned, thereby providing a substantially even and continuous surface.

2. The ratchet buckle of claim **1**, wherein:

the front reel has a central portion between the left and right opposing sidewalls of the ratchet buckle frame, a left portion to the left of the left opposing sidewall, and a right portion to the right of the right opposing sidewall;

the right portion of the front reel defines an annular groove, thereby allowing engagement by a wrench.

3. The ratchet buckle of claim **2**, further comprising:

a cross plate affixed to the bottom side of said ratchet buckle frame.

4. The ratchet buckle of claim **3**, wherein:

the cross plate defines a wrench engagement hole substantially aligned with a curved notch in the ratchet drive plate.

5. The ratchet buckle of claim **4**, further comprising:

a spring retention nub defining a spring retention hole, wherein said nub protrudes perpendicular to said cross plate and towards the top of said ratchet buckle.

6. The ratchet buckle of claim **5**, further comprising:

a spring attachment member extending from the rear side of the ratchet drive plate, and aligned with said spring retention hole.

7. The ratchet buckle of claim **6**, further comprising:

a spring disposed around the spring attachment member and against the spring retention nub, biasing the ratchet drive plate towards the ratchet wheels.

8. The ratchet buckle of claim **7**, wherein:

the left portion of the front reel defines a left reel retainer hole extending axially through the reel and the right portion of the front reel defines a right threaded reel retainer hole extending axially through the reel;

a reel retainer fastener is disposed through the left reel retainer hole;

a threaded retainer fastener is disposed through the right threaded reel retainer hole;

the left ratchet wheel is located between the left reel retainer pin and the left opposing sidewall of the ratchet frame; and

the right ratchet wheel is located between the right threaded reel retainer pin and the right opposing sidewall of the ratchet frame.

9. The ratchet buckle of claim **1**, further comprising:

a rear reel at said rear side of said ratchet buckle frame.

10. A ratchet buckle, comprising:

a frame having a top side and a bottom side, left and right opposing sidewalls and a front end, each of said left and right opposing sidewalls defining a ratchet drive plate slit;

a front reel disposed at the front end;

a ratchet drive plate having a front side, a rear side, and a right edge, wherein said ratchet drive plate is disposed through said slits in said left and right opposing sidewalls;

left and right ratchet wheels disposed on said front reel, said left and right wheels engaged with said ratchet drive plate, and said right wheel having a right face;

a ratchet wrench comprising:

a shaft with a wrenching end and a release end, a length and a width;

a wrenching head at said wrenching end;

a release protrusion at said release end; and

a spring loaded tooth engagement member extending from and perpendicular to the shaft, wherein said spring loaded member is located at the wrenching end and is near the grasping head;

wherein said right edge of said ratchet drive plate is substantially aligned with the right face of the right wheel, thereby providing a flush surface to allow operation of an engaged wrench.

11. The ratchet buckle of claim **10**, wherein:

the front reel has a central portion between the left and right opposing sidewalls of the ratchet buckle frame, a left portion to the left of the left opposing sidewall, and a right portion to the right of the right opposing sidewall;

the front reel defines an annular groove, thereby allowing engagement by a wrench.

12. The ratchet buckle of claim **11**, further comprising:

a cross plate affixed to the bottom side of said ratchet buckle frame.

13. The ratchet buckle of claim **12**, wherein:

the cross plate defines a wrench engagement hole substantially aligned with a curved notch in the ratchet drive plate.

14. The ratchet buckle of claim **13**, further comprising:

a spring retention nub defining a spring retention hole, wherein said nub protrudes perpendicular to said cross plate, extending towards the top of said ratchet buckle.

15. The ratchet buckle of claim **14**, further comprising:

a spring attachment member extending from the rear side of the ratchet drive plate, and aligned with said spring retention hole; and

a spring disposed around the spring attachment member and against the spring retention nub, biasing the ratchet drive plate towards the ratchet wheels.

16. The ratchet buckle of claim **15**, further comprising:

a pair of L-shaped reel gripping portions disposed at the wrenching head for locking around the front reel;

a pair of spring loaded nubs set into the wrenching head, said nubs biased towards the gripping portions, said spring loaded nubs capable of releasably retaining the pair of L-shaped reel gripping portions in a locked position.

17. The ratchet buckle of claim **16**, wherein:

the left portion of the front reel defines a left reel retainer hole extending axially through the reel and the right portion of the front reel defines a right threaded reel retainer hole extending axially through the reel;

a reel retainer fastener is disposed through the left reel retainer hole;

a threaded retainer fastener is disposed through the right threaded reel retainer hole;

the left ratchet wheel is located between the left reel retainer pin and the left opposing sidewall of the ratchet frame; and

the right ratchet wheel is located between the right threaded reel retainer pin and the right opposing sidewall of the ratchet frame.

18. A method of operating a cargo buckle, comprising:

providing a securing strap;

providing a ratchet buckle and wrench combination comprising:

a frame having left and right opposing sidewalls and having a front end, each of said left and right opposing sidewalls defining a ratchet drive plate slit;

a front reel disposed at the front end, said front reel having an annular groove;

a ratchet drive plate having a right edge, wherein said ratchet drive plate is disposed through said slits in said left and right opposing sidewalls;

left and right ratchet wheels disposed on said front reel, said left and right wheels engaged with said ratchet drive plate, and said right wheel having a right face;

a shaft with a wrenching end and a release end, a length and a width;

a wrenching head at said wrenching end;

a conical release protrusion at said release end; and

a spring loaded tooth engagement member extending from and perpendicular to the shaft, wherein said spring loaded member is located at the wrenching end and is near the grasping head;

wherein said right edge of said ratchet drive plate is substantially aligned with the right face of the right wheel, thereby providing a flush surface to allow operation of an engaged wrench;

sliding the strap through said slit in said front reel;

engaging said wrench with said annular depression such that said spring loaded member engages a tooth on one of the ratchet wheels;

driving said wrench to rotate said front wheel, thereby drawing the strap towards the buckle.

19. The method of claim **18**, further comprising:

repeatedly torquing said wrench until the strap reaches a desired tightness.

20. The method of claim **18**, further comprising:

inserting the release protrusion of the wrench into a wrench engagement hole in a cross plate;

rotating the wrench to force the ratchet drive plate to disengage from the ratchet wheels; and

unwinding the strap is removed from the buckle.

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