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(54) **APPARATUS FOR RELEASING A RACK CHOCK OF A JACK-UP RIG**

(75) Inventors: **Morris Shear**, Metairie; **Paul Geiger, Sr.**, New Orleans, both of LA (US)

(73) Assignee: **Friede & Goldman, Ltd.**, Houston, TX (US)

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(52) **U.S. Cl.** **405/198**; 254/97
(58) **Field of Search** ..... 405/196–198; 254/95, 97, 112, 89 R; 74/89.14, 89.15

(56) **References Cited**

U.S. PATENT DOCUMENTS

Re. 32,589	*	2/1988	Goldman et al.	405/198
3,343,371	*	9/1967	Heitkamp	405/198
4,662,787	*	5/1987	Tatsuguchi	405/198
4,813,814	*	3/1989	Shibuta et al.	405/198
5,921,714	*	7/1999	Goldman	405/198
5,943,919	*	8/1999	Babinski	74/89.14 X
6,030,149	*	2/2000	Foo et al.	405/198 X

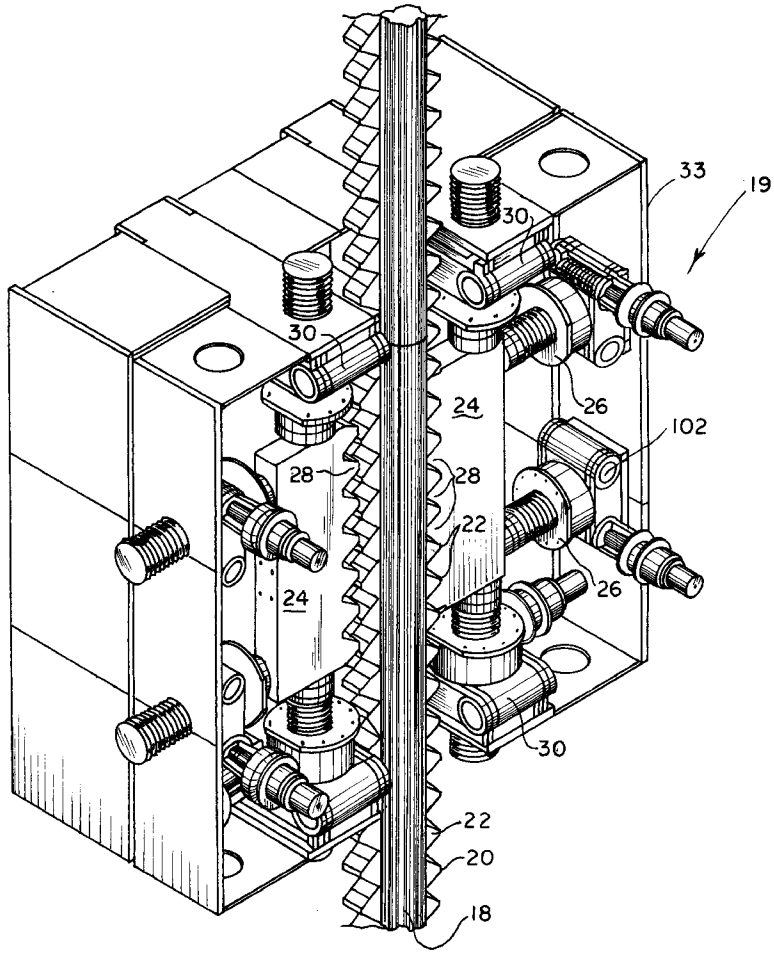
* cited by examiner

Primary Examiner—David Bagnell
Assistant Examiner—Sunil Singh
(74) *Attorney, Agent, or Firm*—Keaty Professional Law Corporation

(57) **ABSTRACT**

A "frozen" rack chock of a jack-up rig is released by a moving force imparted on the rack chock by a worm gear assembly. The worm gear assembly has a tooth wheel with a plurality of teeth and a worm gear member provided with a worm thread that engages the teeth for transmitting rotational force from a drive motor to the tooth wheel. A shaft of the tooth wheel is operationally connected to the rack chock to cause disengagement of the rack chock from the contact surface of a leg chord when the tooth wheel is rotated.

28 Claims, 5 Drawing Sheets



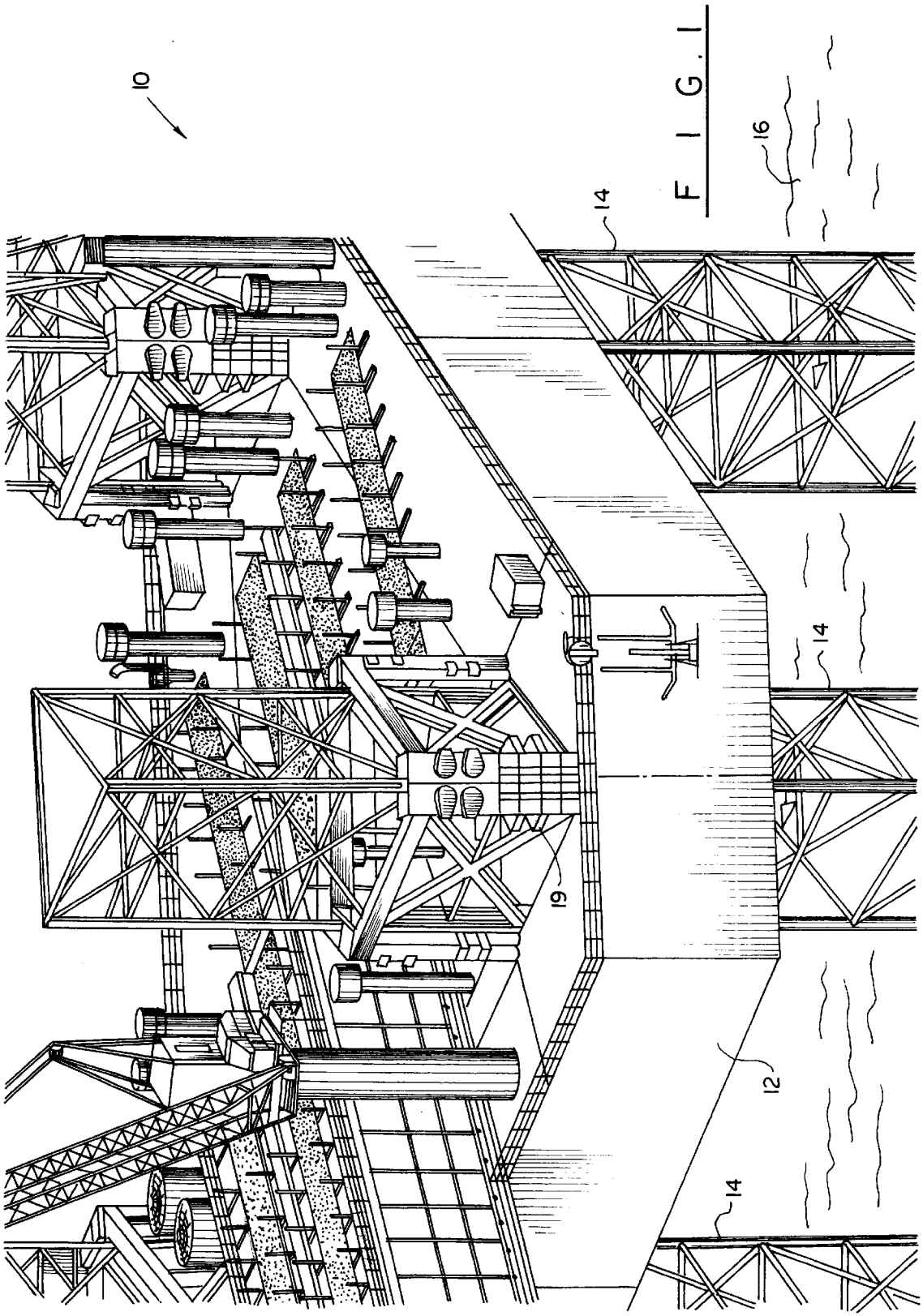


FIG. 1

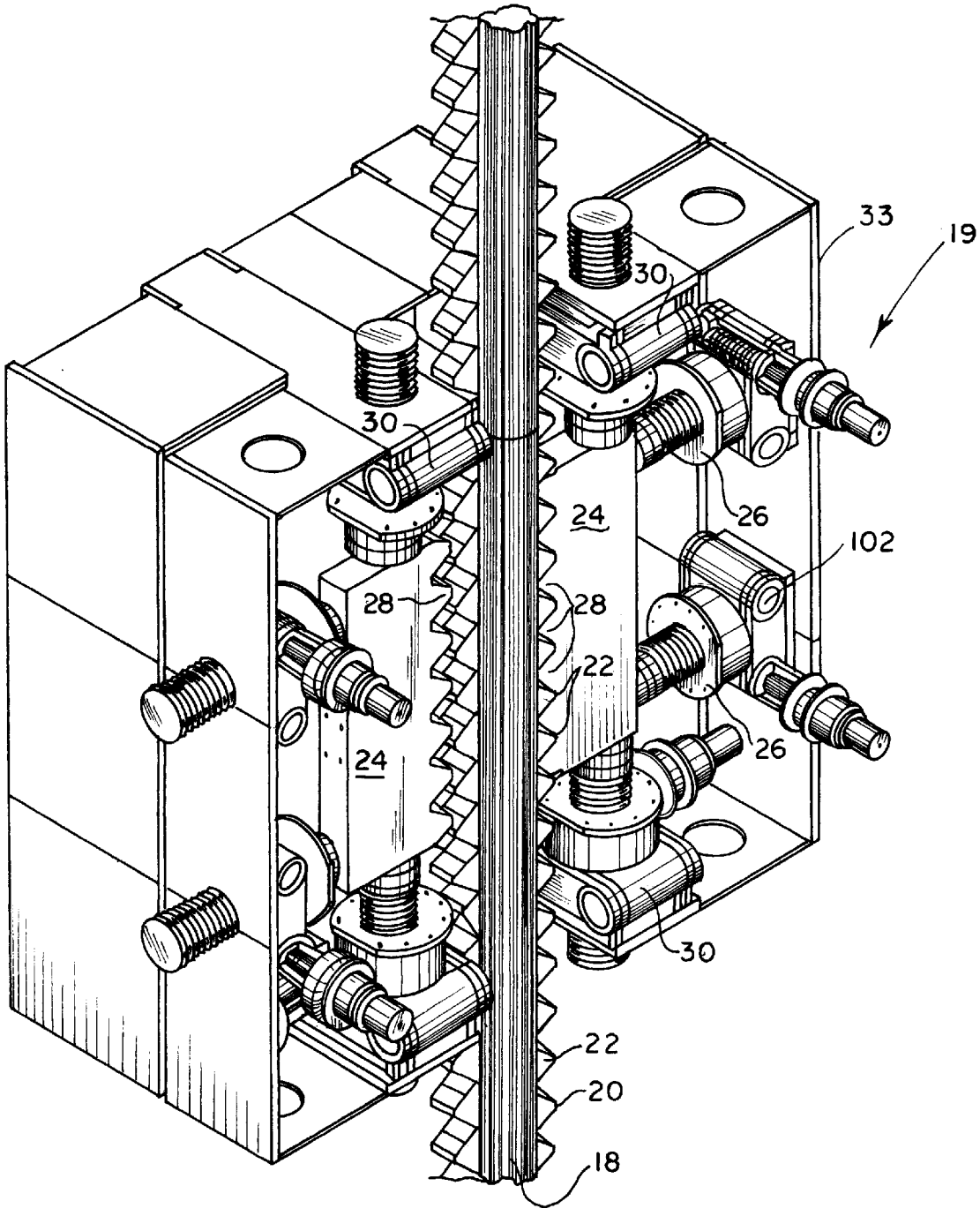


FIG. 2

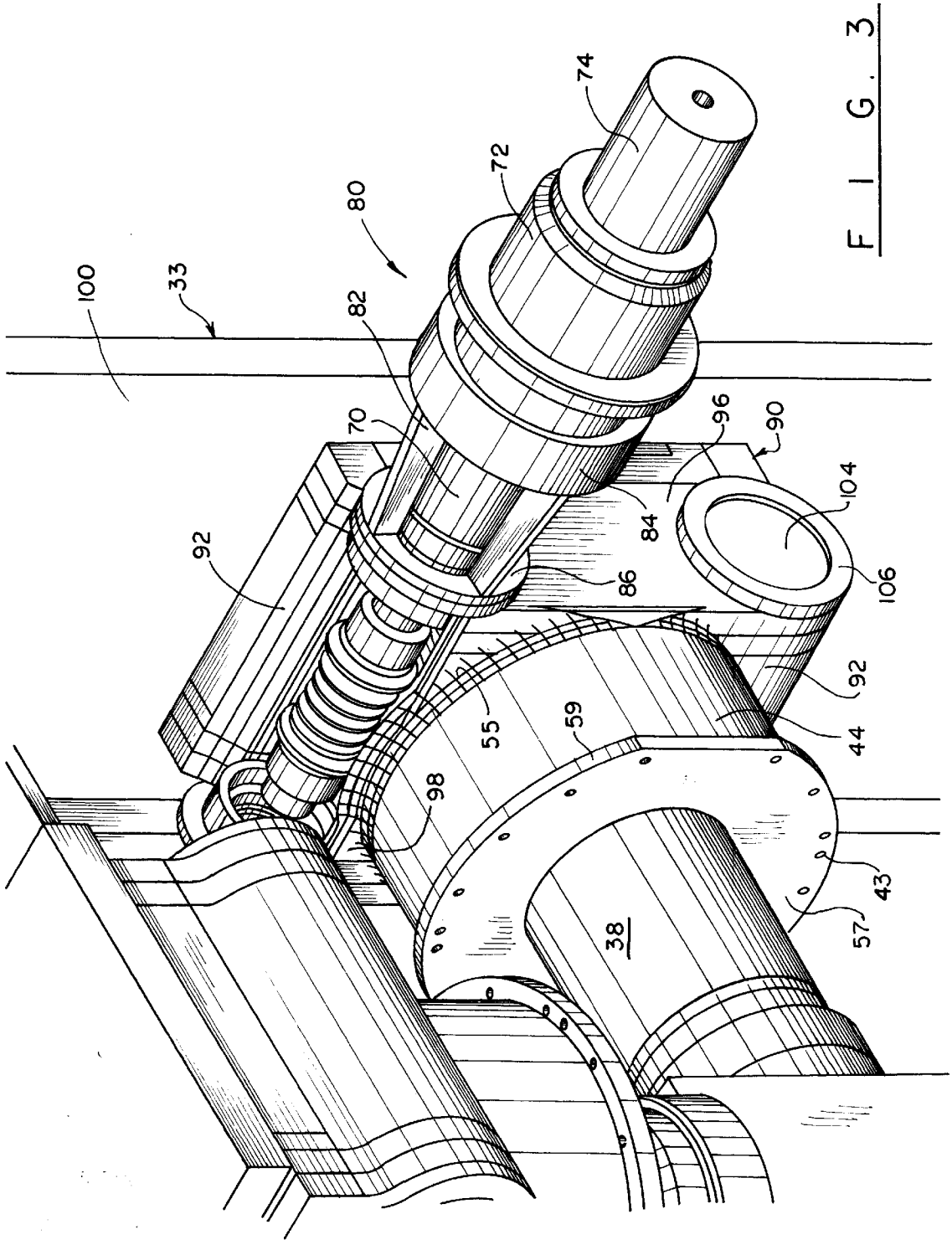


FIG. 3

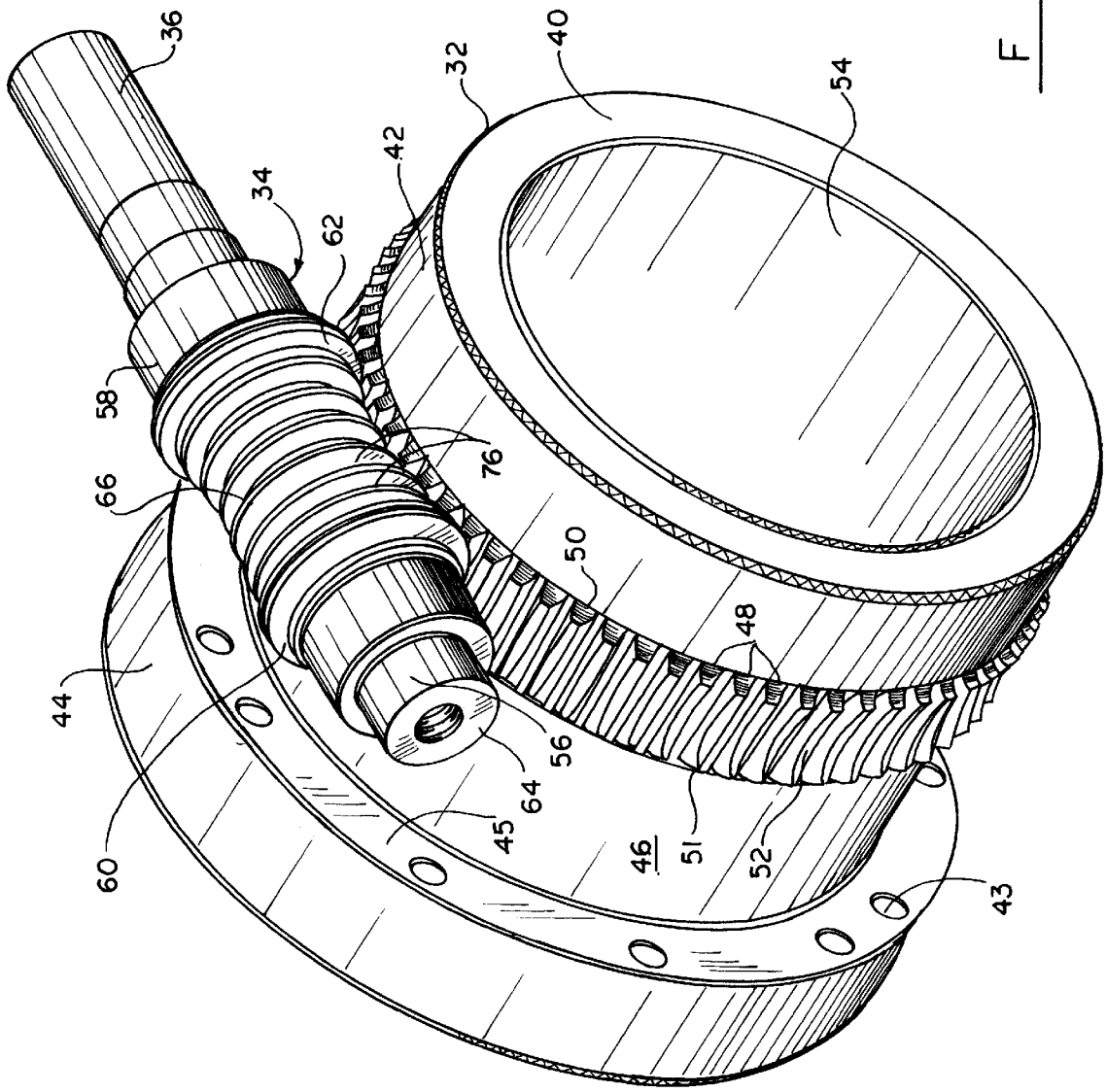


FIG. 4

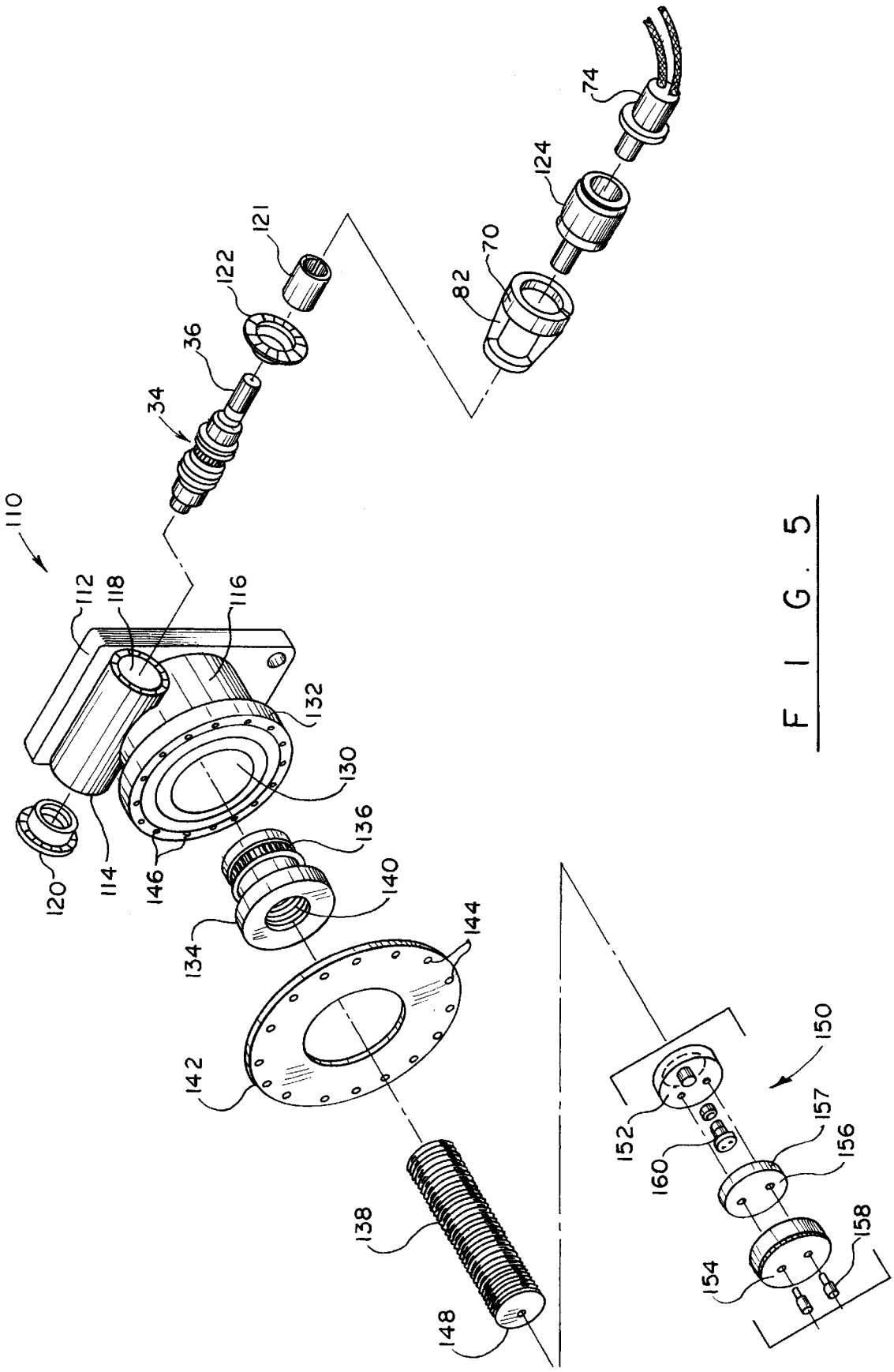

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FIG. 5

APPARATUS FOR RELEASING A RACK CHOCK OF A JACK-UP RIG

BACKGROUND OF THE INVENTION

The present invention relates to an offshore rig suitable for conducting mineral exploration and production operations, and more particularly to a self-elevating jack-up rig incorporating a releasing mechanism for a rack chock.

Jack-up rigs have been extensively used as the types of offshore working platforms especially suitable for deployment in medium water depth. Generally, this type of rig uses jackable legs for supporting a working platform, or hull at an elevated position in a selected location. When a jack-up rig is towed to a desired location, the legs extend upwardly through wells in the hull so as not to interfere with the towing. Once the rig is delivered to the selected location, the legs are lowered to the bottom of an ocean, and powerful jacks elevate the hull to an operating level above the waves.

The hull and the legs are rigidly engaged with each other through a system of rack teeth on the supporting legs and opposed, matching rack sections of rack chocks. The rack chocks are moved horizontally and vertically to allow a mating alignment with the leg chords. When the alignment is completed, the rack chock rigidly connects the hull to the legs of the rig. During operation of the rig, the legs and the hull remain locked in their unitary connection, resisting overturning moments imposed on the legs by wave forces.

When the legs and the hull are rigidly engaged, considerable pressures act on the surfaces of the meshed teeth of the leg chords and the rack chocks. In effect, the teeth become locked, and withdrawal of the rack chock from engagement with a leg chord becomes extremely difficult.

Still, under certain circumstances, such when repositioning the hull or the entire rig, the engagement between the legs and the hull must be broken. Oftentimes, conventional methods and equipment cannot generate sufficient force to release a "frozen" jack.

Heretofore, various methods have been employed for releasing of a screw jack. One of the conventional methods involves burning of the jack bearing plate or cap in order to break the rigid engagement between a leg chord and a rack chock. This method is labor-intensive, time-consuming and relatively expensive. Additionally, the cap must be replaced before the screw jack is moved laterally into an engagement with the leg teeth to reinstate the rigid engagement of the hull to the legs.

Other known techniques involve the use of a wedge-shaped device, wherein an inclined surface of the wedge facilitates release of the chock mechanism. This design is disclosed in U.S. Pat. Nos. 5,486,069 and 5,611,645 issued to John O. Breeden. Both patents disclose a fixation system that uses a toothed chord chock, which moves both horizontally and vertically. The toothed rack chock has upper and lower inclined surfaces. The fixation system includes an upper and lower wedge, which rides on upper and lower fixed inclined surfaces. The upper and lower wedges move to engage the upper and lower inclined surfaces of the rack chock and release the engagement between the leg chord and the rack chock. While such design can work satisfactory in many cases, there exists a need for a more straightforward design for releasing of a rack chock.

The present invention contemplates elimination of drawbacks associated with prior designs and provision of an improved mechanism for releasing of a rack chock from its rigid engagement with a leg chord.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a jack-up rig with a rack chock releasing mechanism.

It is another object of the present invention to provide a rack chock releasing mechanism, which prevents locking of the rack chock in relation to a leg chord.

It is a further object of the present invention to provide an improved jack-up rig assembly, wherein the danger of a frozen rack chock is eliminated.

These and other objects of the present invention are achieved through a provision of a worm gear assembly operationally connected to a frame that carries a rack chock of a jack-up rig. The worm gear assembly comprises a tooth wheel with plurality of teeth disposed about a circumference of at least a portion of the tooth wheel and a worm gear member. The teeth have inwardly concave upper surface. The tooth wheel has a hollow body mounted on a shaft that is operationally connected to the rack chock.

The worm gear member is provided with a worm thread about a middle portion thereof, the thread having a generally frustoconical configuration. The worm gear member has a central shaft connected to a drive motor, and when the thread is engaged with the teeth of the tooth wheel rotational force is transmitted from the drive motor to the tooth wheel shaft.

By causing rotation of the tooth wheel, a moving force is imparted on the rack chock to facilitate positioning of the rack in engagement with a contact surface of the leg chord and disengagement therefrom when the tooth wheel is rotated in an opposite direction.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will now be made to the drawings, wherein like parts are designated by like numerals, and wherein

FIG. **1** is a perspective view of a jack-up rig of the present invention.

FIG. **2** is a detail view showing a rack chock engaged with a leg chord.

FIG. **3** is a detail view showing a two-part worm gear release mechanism in accordance with the present invention connected to a hydraulic motor.

FIG. **4** is a detail view of the release mechanism, with the operational worm gear release mechanism engaged for rotation; and

FIG. **5** is an exploded view illustrating another embodiment of a worm gear holder.

DETAIL DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to the drawings in more detail, numeral **10** designates a jack-up rig shown schematically in an elevated position. A hull **12** is supported by a plurality of legs **14** above a waterline **16**. The legs **14** rest on the ocean floor (not shown), supporting the hull and working operations conducted from the hull decks.

Each leg **14** has a plurality of leg chords **18**, each of which is provided with a chord rack **20** having a series of horizontally extending teeth **22**. Raising and lowering of the legs is performed with the help of a jacking system that is located above rack chock assemblies **19** (FIG. **1**). Conventional leg jacking systems use driving pinions operationally connected to jacks. Jacking systems use jack pinions for engagement with opposite teeth of each leg chord rack **20**.

After the rig **10** has been delivered to the pre-selected location and the legs have been lowered into the bottom of

a body of water, the hull **12** is elevated. To retain the hull in its elevated position above the wave motions, the rack chock assemblies **19** must be moved into engagement with the leg chord rack **20**.

With reference to FIG. **2**, the present invention comprises a rack chock assembly **19** for engaging and disengaging teeth **22** of the leg chord leg **20** with the teeth of the rack chock assembly. Each rack chock assembly **19** has a plurality of horizontally extending teeth **28** adapted for engagement with the teeth **22** of the leg chord rack **20**. It is preferred that the teeth **22** and **28** have a matching profile, so as to provide a better contact between the meshed teeth.

The rack chocks assemblies **19** are supported by the hull **12** and move in and out of engagement with the chord racks **20** through a system of horizontal driving pinions, or jack screw assemblies **26**. Typically, there are four horizontal jack screw assemblies **26** per each leg chord rack **20**.

A plurality, typically four, vertical jack screw assemblies **30** are provided for each leg chord to allow vertical adjustment of the rack chock position in relation to the leg chord rack **20**. Both horizontal jack screw assemblies **26** and vertical jack screw assemblies are enclosed in a housing **33**, which moves both vertically and horizontally along with the jack screw assemblies **26** and **30**, moving the rack chock assembly **19** in and out of engagement with a contact surface of the teeth **22** of the leg chord rack **20**.

With reference to FIGS. **3** and **4**, each jack screw assembly **26** and **30** comprises a worm gear unit, or worm gear assembly **80**, having a tooth wheel **32** and a worm gear member **34**. The worm gear units **80** are mounted in the housing **33** that protects the rotating engaging portions of the jack screw assemblies **26** and **30**.

Each worm gear unit **80** ensures a positive motion of the rack chock assembly **19** through rotation of the worm gear member **34** and the tooth wheel **32**. When the tooth wheel **32** and the worm gear member **34** are engaged, rotation from a power source is transmitted to the worm gear member **34** to the wheel **32** and then translating to a linear movement of the chock **24**, as will be described in more detail below. The longitudinal axes of the central shaft **36** of the worm gear member **34** and the central shaft **38** of the wheel **32** are oriented at a right angle to each other.

The tooth wheel **32** comprises a hollow body **40** having a first cylindrical portion **42**, a second cylindrical portion **44** and a middle cylindrical portion **46**. A plurality of parallel teeth **48** are formed on the exterior circumference of the middle portion **46**, extending to a line **50** on the first portion **42** and extending to a line **51** that separates the first cylindrical portion **42** and the middle portion **46**.

Each tooth **48** has an inwardly concave contact surface **52** for engagement with the mating surface of the worm gear, as will be described in more detail hereinafter. A central opening **54** formed in the tooth wheel **32** receives the rotating shaft **38**. A flange **45** connects the middle portion **46** with an enlarged diameter portion **44**. A symmetrical flange **57** is fixedly attached to the outer circumferential edge **59** of the second portion **44** (see, FIG. **3**). The attachment of the flanges **55** and **57** can be accomplished with the use of bolts **43**, or in other suitable manner well known to those skilled in the art.

As can be seen in FIGS. **3** and **4**, the worm gear member **34** comprises an elongated body having a pair of cylindrical portions **56** and **58**, a pair of bevel portions **60**, **62**, a reduced diameter attachment portion **64** and a central portion **66**. The central portion has a reduced diameter middle part and larger diameter outer parts.

A drive shaft **36** is attached to a motor adapter **70**, which, in turn, is secured with a gear reducer **72**. The gear reducer is operationally connected to a power means **74**, which can be a hydraulic motor, or any other suitable power means. The motor **74** imparts rotational movement on the worm gear member **34** and transmits torque to the tooth wheel **32**.

As can be more clearly seen in FIG. **3**, each worm gear unit **80** is provided with splines **82** that are positioned between a flange **84** of the motor adapter **70** and a collar **86** encircling an opening in the worm gear holder, as will be explained in more detail below. The splines **82** can be two or more in number; they are designed to provide extra structural strength to the unit with rotating shafts extended in series, from the motor **74** to the worm gear member **34**. These shafts extend in coaxial relationship to each other and are operationally connected for transmitting the rotational force.

The worm gear unit **80** further comprises a worm gear holder **90** (FIG. **3**), which is formed as a box-like hollow body defined by an outer wall **92**, an inner wall **94**, a front plate **96** and a rear wall **98**. The inner wall **94** is fixedly attached, such as by welding, to an interior wall **100** of the housing **33**. In this manner, the body **90** is supported by the walls of the housing **33** at a pre-determined distance from the chock **24**.

The front wall **96** is provided with openings **102** and **104**; opening **102** being surrounded by a collar **86**, and opening **104** being surrounded by a collar **106**. The openings **102** and **104** are adapted to alternatively receive the worm gear member **34** during engagement or disengagement of the chock **24** with the leg chord **18**. The opening **102** may serve as a receiving position for the worm gear member **34** threaded with a right-hand thread, and opening **104** may serve as a receiving position for the worm gear member **34** threaded with a left-hand thread to allow rotation of the worm gear member, or worm screw **34** in an opposite direction.

The holders **90** are pre-cast with the right-hand and the left-hand threads. When installed in the unit **80**, the operator would select which of the openings **102** or **104** the worm gear member is to occupy and install the worm gear member **34** in that opening. When changing direction of rotation of the worm gear member **34**, the direction of rotation of the motor **74** is reversed, allowing disengagement of the chock **24** from the leg chord teeth **22**.

An alternative design of the worm gear holder is shown in FIG. **5**. As can be seen in the drawings, the holder **110** comprises an attachment plate **112** adapted for fixed securing on the wall **100** of the housing **33**. The holder **110** is provided with one sleeve **114** which receives the worm gear member, or worm screw **34** therein. The plate **112** also carries a tooth wheel cover **116**. The longitudinal axes of the cover **116** and the sleeve **114** intersect at a right angle, and cutouts (not shown) in the contact surfaces of the sleeve **114** and the cover **116** allow engagement of the worm gear member **34** with the teeth of the wheel **32**.

As can be further seen in the drawings, a central opening **118** in the sleeve **114** receives the worm gear member **34**. The open ends of the sleeve **114** receive bearing houses **120**, **122** therein. The bearing houses **120**, **122** engage the shaft **36** of the worm screw **34** on opposite sides and facilitate rotation of the worm gear member in response to the torque transmitted from the motor **74**.

A coupling **121** is fitted between the bearing house **122** and the motor adapter. The motor adapter **70**, similar to the embodiment shown in FIG. **3**, is engaged with the gear reducer **124**, which, in turn, is operationally connected to the motor **74**.

A central opening **130** in the cover **116** is surrounded by a flange **132**. An internally threaded jack screw nut **134** is provided with teeth **136** formed on the exterior surface thereof. The teeth **136** match the threads on the worm screw **34** to impart rotation on the screw nut **134** when the worm gear member **34** is rotated. A jack screw **138** engages threads **140** formed on the interior wall of the jack screw nut **134** and rotates clockwise or counterclockwise depending on the direction of rotation of the worm gear member **34**.

A cover plate **142** is mounted on an exterior side of the cover **116**. The cover plate **142** is provided with a plurality of apertures **144** that are aligned with apertures **146** on the flange **132** and receive suitable securing means, for example bolts, engaging the cover plate **142** and the cover **116**. Although not shown, the assembly **110** is positioned in a manner similar to the unit **80** within the housing **33** to provide connection and transmit linear movement to the jack screw **138**.

An optional collapsible bearing assembly **150** may be interposed between the jack screw **138** and the chock **24**. The collapsible bearing assembly **150** is provided with a bearing plate **152** which contacts an end **148** of the jack screw **138**. A contact plate **154** is adapted for contacting a rack chock **24**. A collapsible insert **156** is fitted between the contact plate **154** and the bearing plate **152**. A collapsible removable medium **157** is sandwiched between the parallel plates that define the collapsible insert **156** to facilitate disengagement of the rack chock from the leg chord, when necessary. The contact plate **154** and the insert **156** are secured together and to the bearing plate **152** with the use of bolts **158**, and the bearing plate **152** is secured to the jack screw **138** with a bolt **160**. Of course, other securing means can be utilized, if desired.

Turning now in more detail to FIG. **4**, the central portion **66** of the worm gear member **34** is machined to form worm threads **76**, which facilitate transmission of power generated by the power means **74** to the tooth wheel **32** through engagement with the teeth **48**. The threads **76** have frusto-conical configurations with flat exterior surfaces, as shown in FIG. **4**, that match the teeth **48** of the wheel **32**.

The threads **76** have working depth and pitch diameter substantially similar to the depth and pitch of the teeth **48**. The chordal thickness of the teeth **48** generally corresponds to the thickness of the worm threads **76**. Circular pitch of the threads **76** is approximately equal to corresponding points on the circumference of the teeth **48**. The clearance of the teeth **48** is generally the same as the distance between the top of the threads **76** and the bottom circumferential surface of the central portion **66**. As a result, when the threads **76** are brought into engagement with the teeth **48**, the threads **76** and the teeth **48** matingly engage with each other.

When rotation is imparted on the shaft **36**, torque is transmitted to the tooth wheel **32**. Since the shaft **38** of the tooth wheel **32** is operationally connected to a rack chock assembly **24**, the latter is moved in and out of engagement with the leg chord teeth **22**. Depending on the direction of rotation of the shaft **36**, engagement and disengagement of the rack chock assembly **24** can be effected.

In the embodiment shown in FIGS. **2–4**, each rack chock assembly **24** is provided with two horizontal and two vertical worm gear units **80** to allow precision positioning of the rack chock **24** in the horizontal and vertical planes in relation to the leg chord teeth **22**. The design and structure of each unit **80** is similar to the design and structure described above. All moving and rotating parts of the releasing mechanism are enclosed in the housing **33**, thereby preventing accidental injuries of the operator.

The worm gear assembly **30** can be used for releasing a locked rack chock. With the different diameter worm gear portions, the job of disengagement of the leg chord and the rack chock is substantially simplified. Additionally, less power is needed for moving the rack chock assembly out of engagement with the leg chord.

Many changes and modifications can be made in the design of the present invention without departing from the spirit thereof. We, therefore, pray that our rights to the present invention be limited only by the scope of the appended claims.

We claim:

1. An apparatus for releasing a rack chock pressed into engagement with a contact surface, comprising:

a worm gear assembly adapted for operational connection to said rack chock; and

a means for imparting rotation to said worm gear assembly, said worm gear assembly translating said rotation into linear movements for exerting moving force on said rack chock, thereby moving said rack chock out of engagement with said contact surface, said movements having horizontal and vertical components.

2. The apparatus of claim **1**, wherein said worm gear assembly comprises a tooth wheel and a worm gear member, said worm gear member transmitting rotation from said rotation imparting means to said tooth wheel by engaging teeth of said tooth wheel.

3. The apparatus of claim **2**, wherein said tooth wheel comprises a generally cylindrical hollow body secured on a wheel shaft, said wheel shaft being adapted for engagement with said rack chock.

4. The apparatus of claim **3**, wherein said worm gear member comprises a central driving shaft oriented at a substantially right angle to said wheel shaft.

5. The apparatus of claim **2**, wherein said tooth wheel is provided with a plurality of teeth disposed about a circumference of said tooth wheel and said worm gear member is provided with worm threads for engaging said plurality of teeth, said worm gear member being operationally connected to said rotation imparting means.

6. The apparatus of claim **5**, wherein each of said plurality of teeth has an inwardly concave middle portion.

7. The apparatus of claim **6**, wherein said plurality of teeth are oriented in a substantially parallel relationship to a central axis of said tooth wheel.

8. The apparatus of claim **5**, wherein said worm threads have a generally frustoconical configuration.

9. The apparatus of claim **2**, wherein said rotation imparting means comprises a hydraulic motor connected to a gear reducer, said gear reducer being connected to a motor adapter secured co-axially with said worm gear member.

10. The apparatus of claim **2**, wherein said worm gear member has a middle portion provided with worm threads, said middle portion having a reduced diameter central part disposed between larger diameter end parts.

11. The apparatus of claim **1**, wherein said worm gear assembly comprises at least one horizontal worm gear unit for moving said rack chock along a horizontal plane, at least one vertical worm gear unit for moving said rack chock along a vertical plane and power means for transmitting moving force separately to said at least one horizontal worm gear unit and said at least one vertical worm gear unit.

12. The apparatus of claim **11**, wherein said power means comprises a motor operationally connected to each worm gear unit.

13. The apparatus of claim **11**, wherein each of said worm gear units comprises a tooth wheel mounted on a central

shaft adapted for engagement with said rack chock, a worm gear member provided with worm threads for engaging teeth of said tooth wheel, said tooth wheel being internally threaded to allow engagement of the tooth wheel with a jack screw of said rack chock.

14. The apparatus of claim **13**, wherein said worm gear assembly comprises an enclosure having an opening to allow extension of a central shaft of said worm gear member outwardly from said enclosure.

15. The apparatus of claim **14**, wherein said power means comprises a gear reducer and a motor mounted co-axially with said gear reducer, said motor being operationally mounted to said gear reducer and said worm gear member.

16. An apparatus for releasing a rack chock pressed into engagement with a contact surface of a jack-up rig leg chord, comprising:

a worm gear assembly adapted for operational connection to said rack chock; and

a means for imparting rotation to said worm gear assembly, said worm gear assembly translating said rotation into linear movements for exerting moving force on said rack chock, thereby moving said rack chock out of engagement with said contact surface, said movements having horizontal and vertical components, said worm gear assembly comprising at least one tooth wheel provided with a plurality of teeth about an exterior thereof and at least one worm gear member provided with worm threads, said plurality of teeth engaging said worm threads to impart a moving force on said rack chock and thereby cause disengagement of said rack chock from said contact surface of the leg chord when the worm gear assembly is rotated.

17. The apparatus of claim **16**, wherein said at least one tooth wheel comprises a hollow body adapted for mounting on a jack screw of the rack chock, said at least one worm gear member comprises a central driving shaft operationally connected to a drive motor, and wherein said central driving shaft is adapted for orienting at a substantially right angle to the jack screw of the rack chock.

18. The apparatus of claim **16**, wherein said plurality of teeth are inwardly concave and are disposed about a circumference over at least a portion of said at least one tooth wheel, and wherein said at least one worm gear member is provided with a reduced diameter central portion.

19. The apparatus of claim **16**, wherein said worm gear assembly comprises at least one horizontal worm gear unit for moving said rack chock along a horizontal plane, at least one vertical worm gear unit for moving said rack chock along a vertical plane and wherein each of said worm gear units is provided with an independent power means for transmitting moving force separately to said at least one horizontal worm gear unit and said vertical worm gear unit.

20. The apparatus of claim **19**, wherein said power means comprises a motor operationally connected to each worm gear unit.

21. The apparatus of claim **19**, wherein each of said worm gear units comprises a worm gear member holder for receiving said worm gear member therein, said worm threads of the worm gear member being oriented in a pre-determined direction in relation to said plurality of teeth of the tooth wheel, said tooth wheel being formed with internal threads to allow engagement of the tooth wheel with a jack screw of the rack chock.

22. The apparatus of claim **21**, wherein said worm gear member holder comprises an enclosure having an end plate with an opening to allow extension of a central shaft of said worm gear member outwardly from said enclosure, and wherein said power means is located outside of said enclosure.

23. The apparatus of claim **16**, wherein said worm gear assembly comprises a pair of horizontal worm gear units and a pair of vertical gear units to allow precise positioning of said rack chock in relation to said leg chord of the jack-up rig.

24. The apparatus of claim **16**, further comprising a collapsible bearing plate assembly mountable between the worm gear assembly and a rack chock body.

25. An apparatus for releasing a rack chock pressed into engagement with a contact surface of a jack-up rig leg chord, comprising:

a worm gear assembly adapted for operational connection to said rack chock, said worm gear assembly comprising at least one horizontal worm gear unit for moving said rack chock along a horizontal plane, at least one vertical worm gear unit for moving said rack chock along a vertical plane and wherein each of said worm gear units is provided with an independent power means for transmitting moving force separately to said at least one horizontal worm gear unit and said vertical worm gear unit; and

a means for imparting rotation to each of said worm gear units, said worm gear units translating said rotation into linear movements for exerting moving force on said rack chock, thereby moving said rack chock out of engagement with said contact surface, each of said worm gear units comprising at least one tooth wheel provided with a plurality of teeth about an exterior thereof and at least one worm gear member provided with worm threads, said plurality of teeth engaging said worm threads to impart a moving force on said rack chock and thereby cause disengagement of said rack chock from said contact surface of the leg chord when the worm gear units are rotated.

26. The apparatus of claim **25**, wherein said plurality of teeth are inwardly concave and are disposed about a circumference over at least a portion of said at least one tooth wheel, and wherein said at least one worm gear member is provided with a reduced diameter central portion disposed between enlarged diameter end portions.

27. The apparatus of claim **25**, wherein said worm threads have a generally frustoconical configuration.

28. The apparatus of claim **25**, wherein each of said worm gear units comprises a pair of horizontal worm gear units and a pair of vertical gear units to allow precise positioning of said rack chock in relation to said leg chord of the jack-up rig.

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