# United States Patent [19]

**Jensen et al.**

[11] **3,923,407**

[45] **Dec. 2, 1975**


[54] **MECHANISM FOR CONNECTING AND DISCONNECTING CRANE SECTIONS**


[75] Inventors: **Lyle B. Jensen; Robert E. Thune,** both of Cedar Rapids, Iowa

[73] Assignee: **FMC Corporation,** San Jose, Calif.



[22] Filed: **Feb. 6, 1974**

[21] Appl. No.: **440,120**

[52] **U.S. Cl.** ..... **403/165;** 403/322; 212/66

[51] **Int. Cl.²** ..... **F16G 11/00**

[58] **Field of Search** ..... 403/322, 326, 316, 317, 403/165, 321; 308/221, 230, 136; 212/66, 67, 68, 69, 70; 248/349, 425; 285/321, 277



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,052,439 | 2/1913 | Crosby | 212/70 |
| 1,473,935 | 11/1923 | Horton | 212/70 |
| 2,877,732 | 3/1959 | Eaton | 285/321 X |
| 3,061,389 | 10/1962 | Bargmann | 308/221 |
| 3,521,911 | 7/1970 | Hanes et al. | 285/27 |



*Primary Examiner*—Andrew V. Kundrat

*Attorney, Agent, or Firm*—J. F. Verhoeven; C. E. Tripp



[57] **ABSTRACT**

There is disclosed a crane having a base section, and an upper section separable from the base section. An anti-friction bearing on which the upper section swings relative to the base section has an outer race member connected to the base section. The inner race member of the bearing receives therein a ring on the upper section when the upper section is mounted on the base section. Opposing circumferential grooves in the ring and inner race member receive a locking ring which is expanded and contracted by a power actuator. When the ring bridges the grooves, the upper crane section is locked to the crane base section, and when the ring is contained entirely in one of the grooves, the crane upper section is released from the crane base section for separation of the sections.


**8 Claims, 8 Drawing Figures**

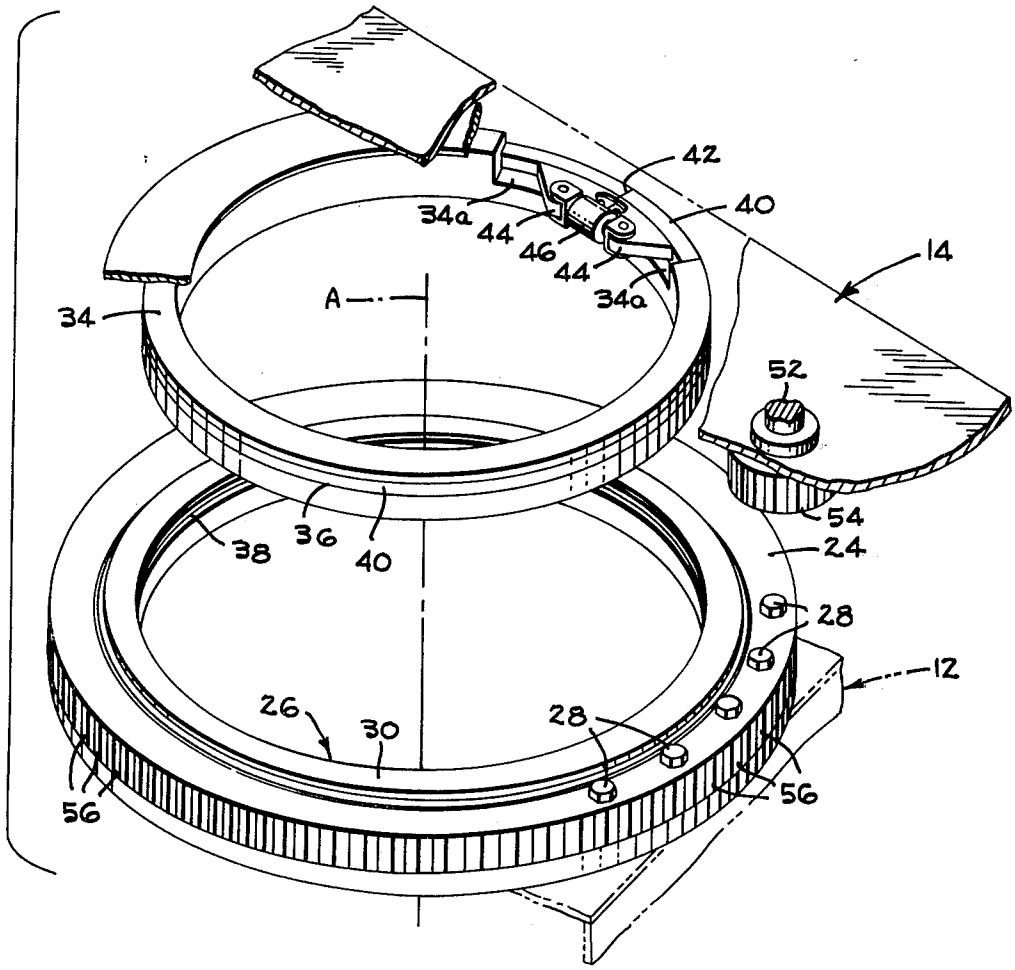
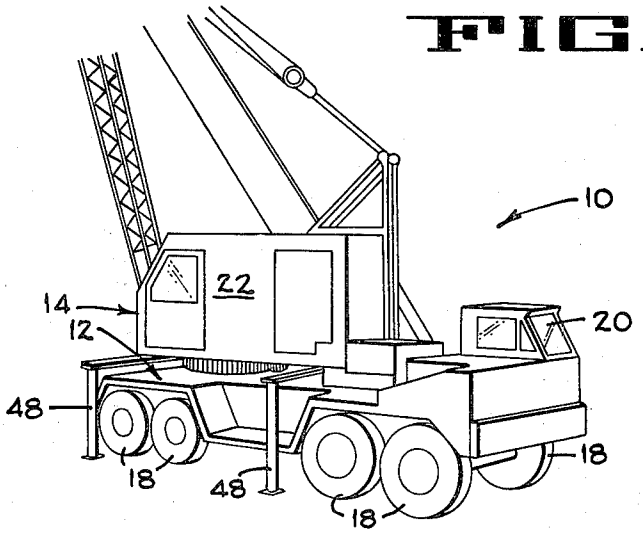


FIG_1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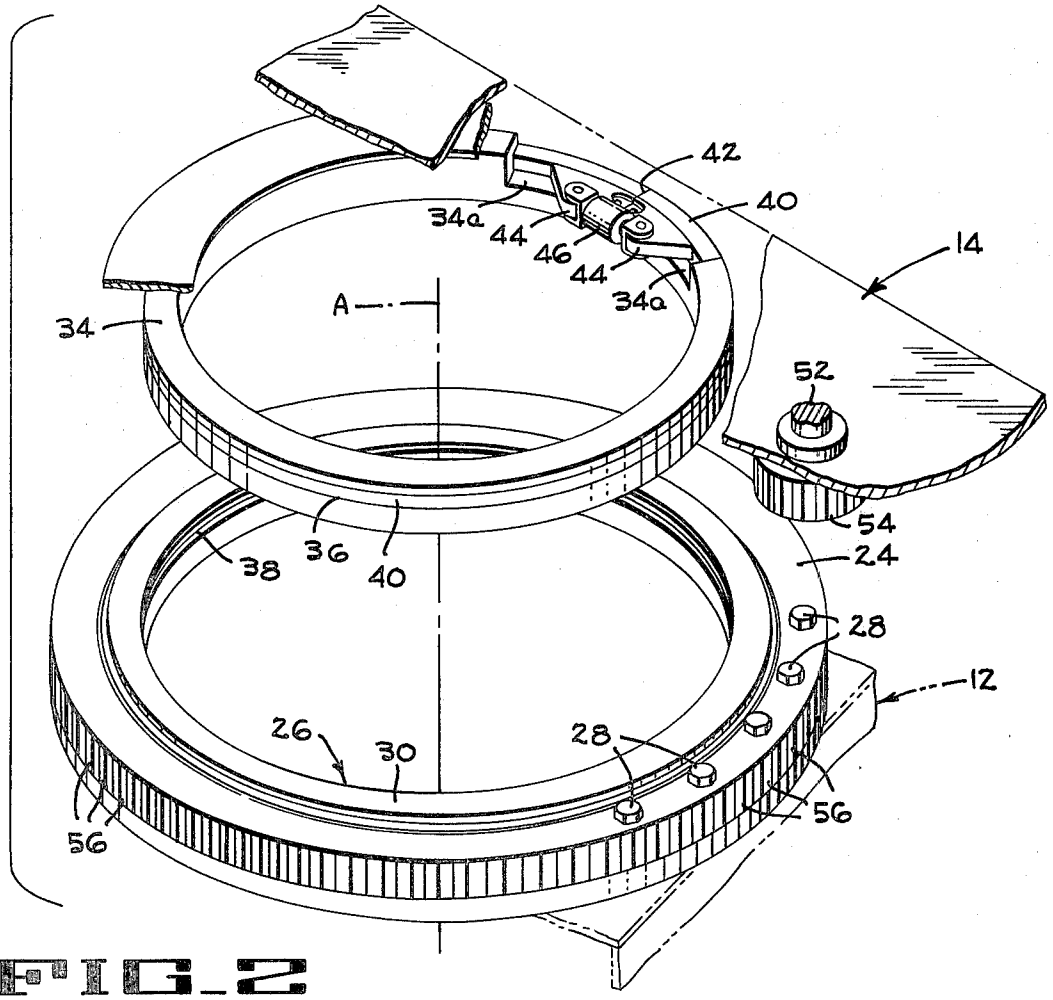
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FIG_2

FIG_3

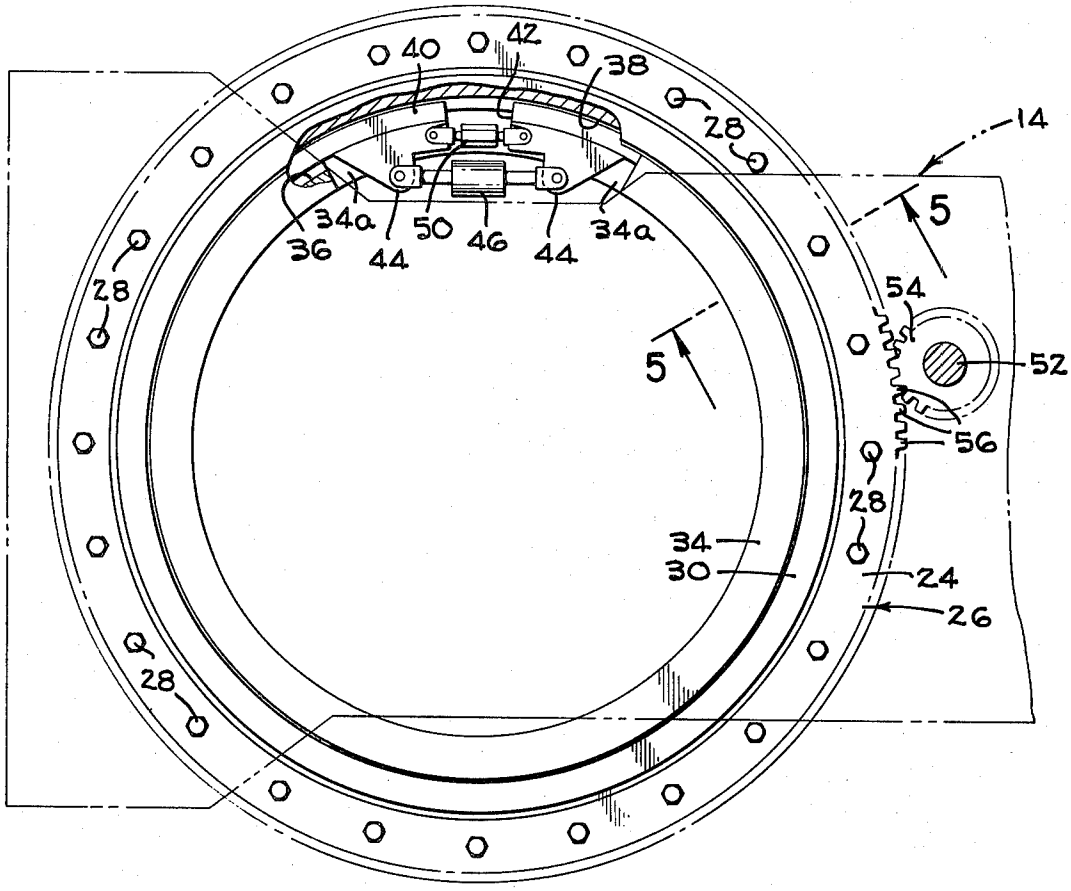
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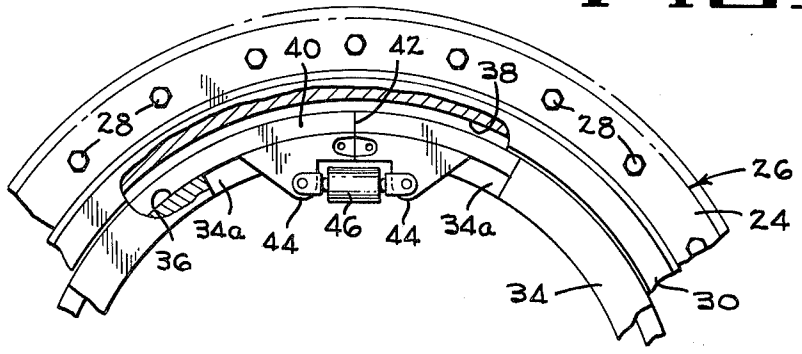
FIG_4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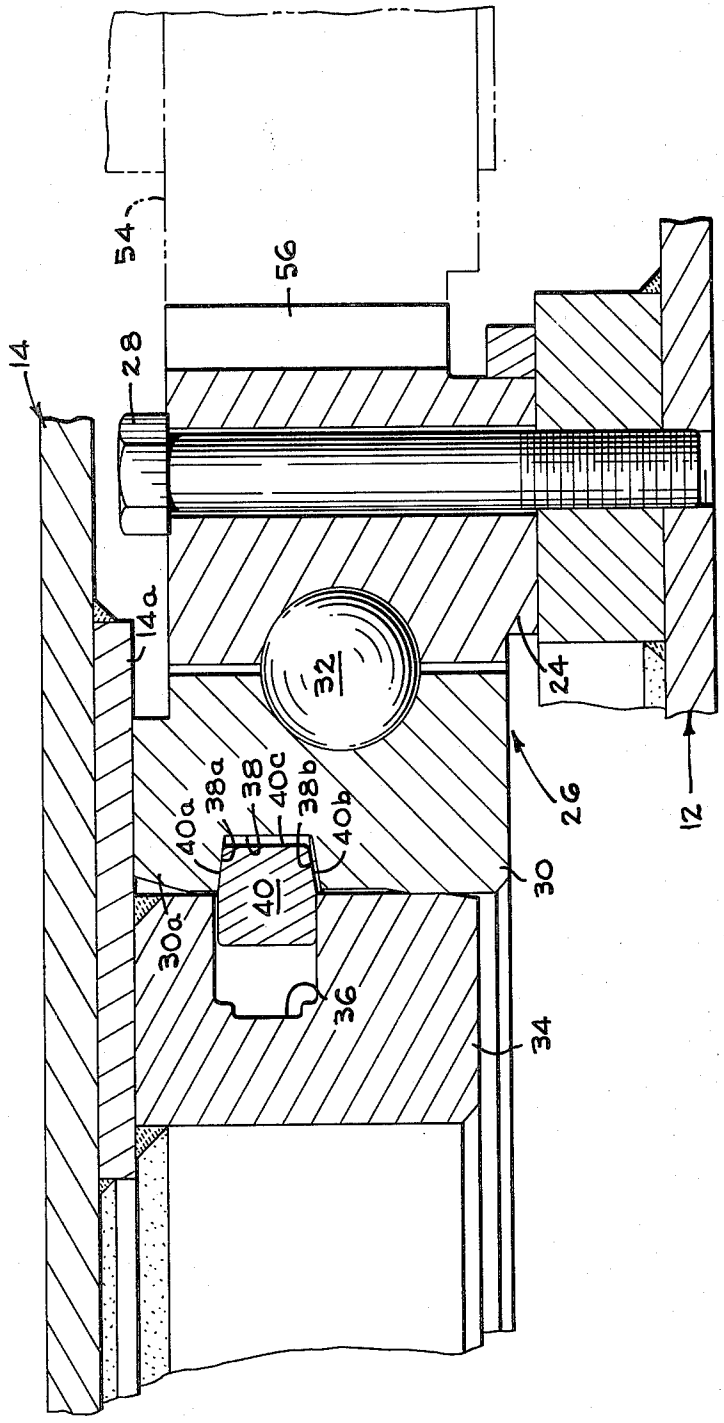


FIG_5

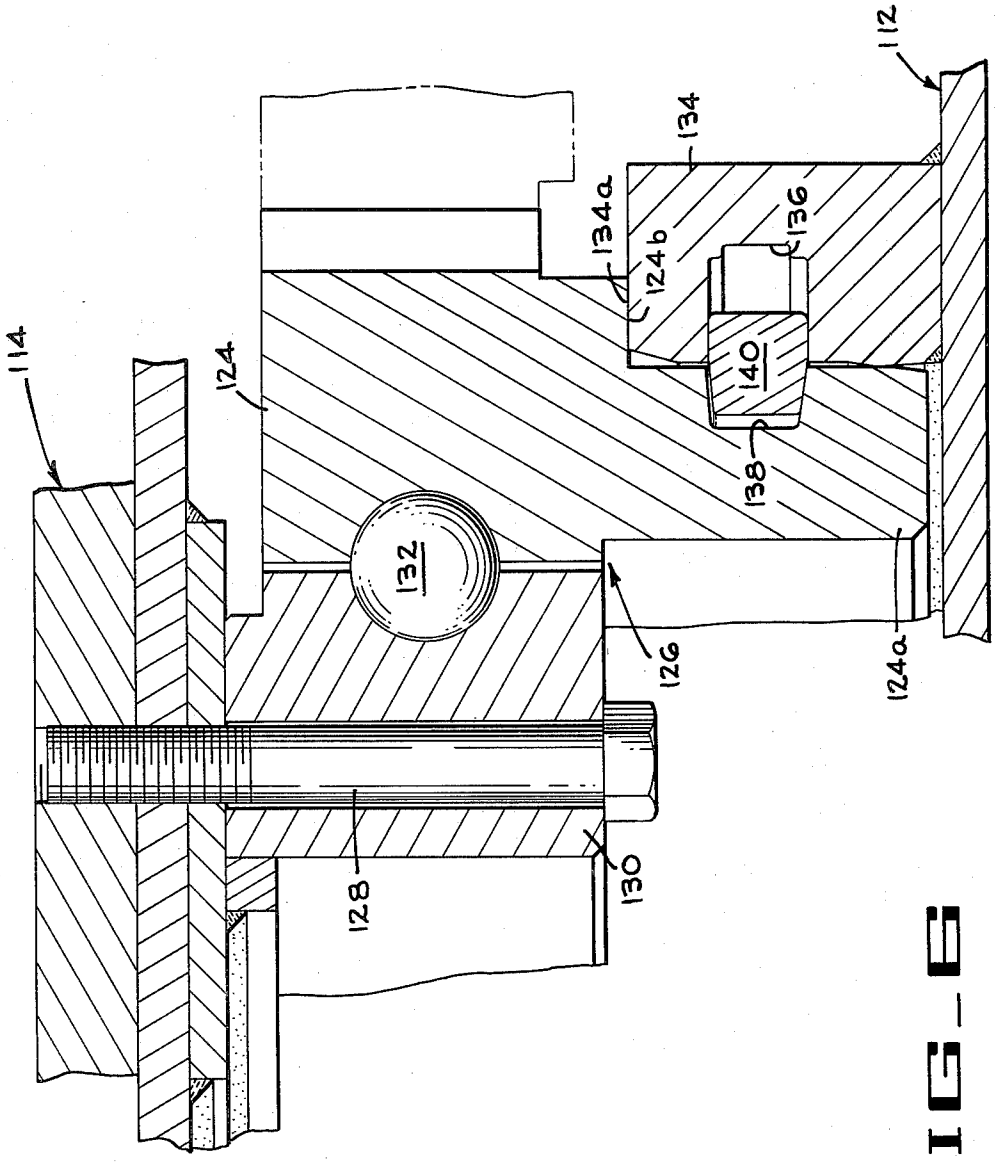


FIG_6

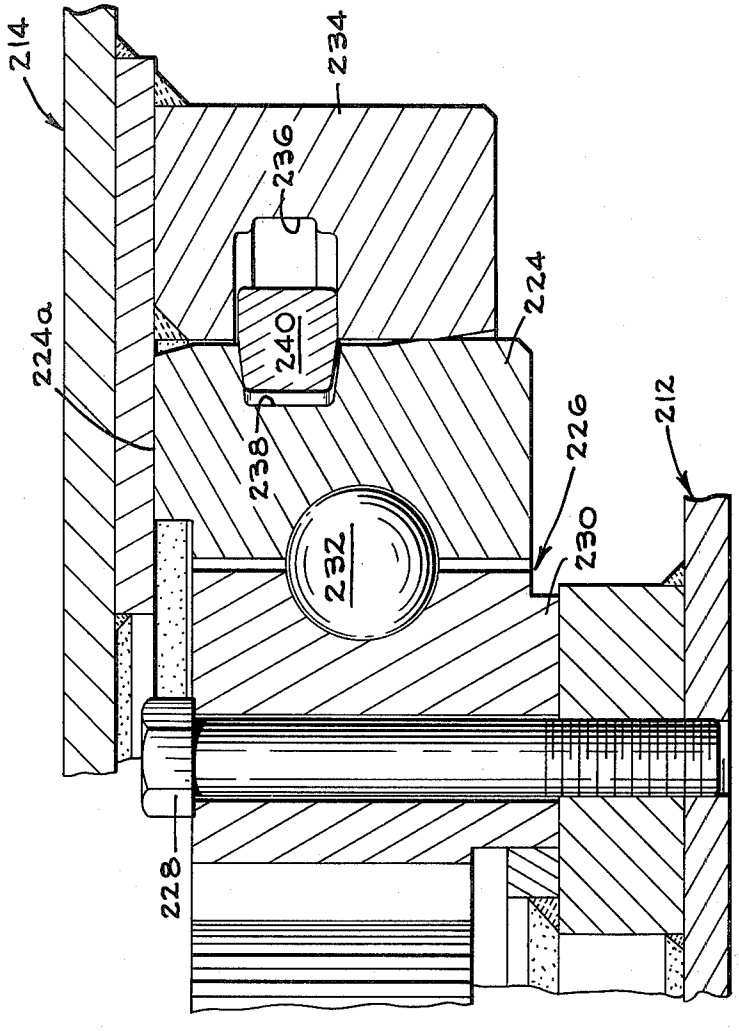


FIG. 7

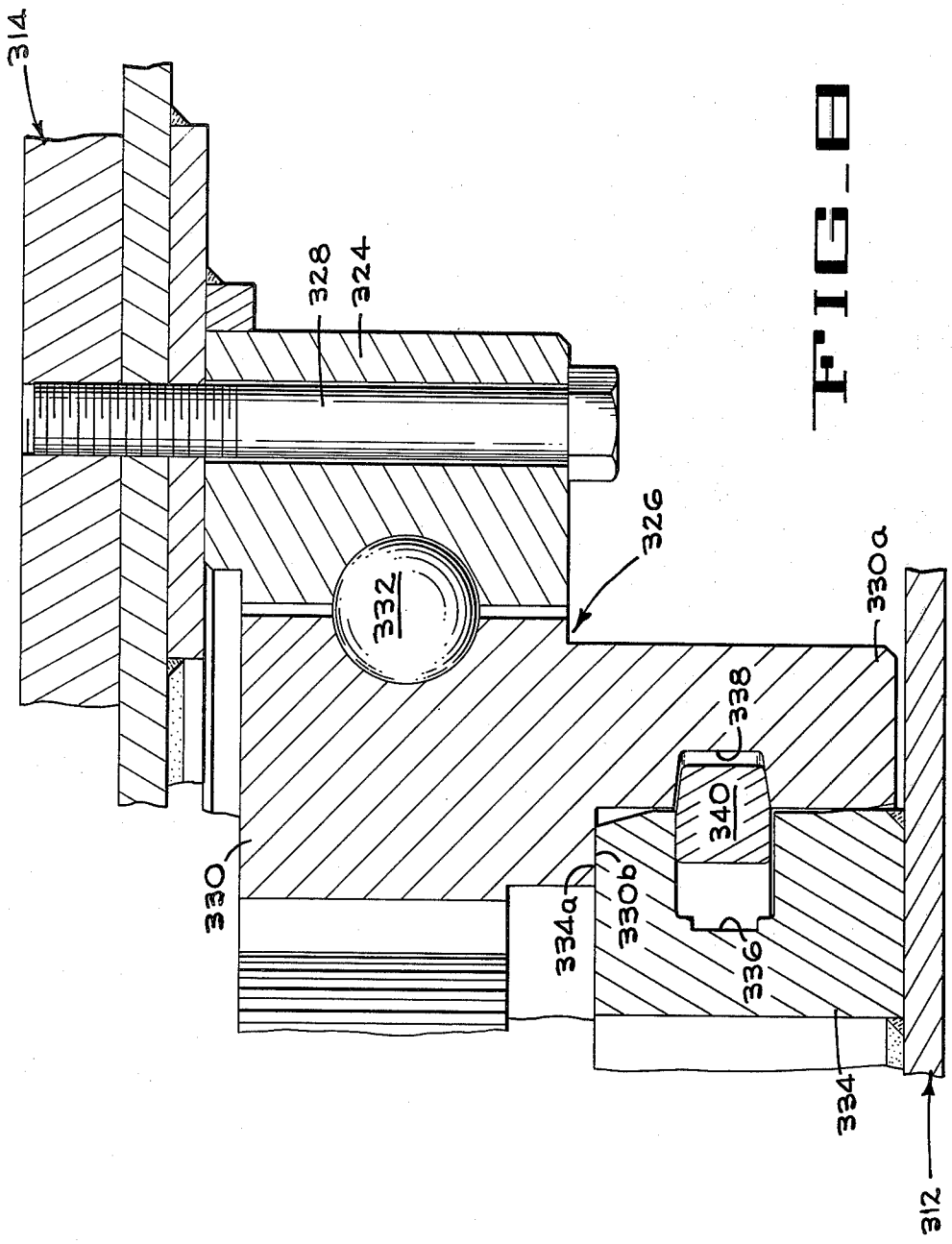


FIG-8

# MECHANISM FOR CONNECTING AND DISCONNECTING CRANE SECTIONS

## BACKGROUND OF THE INVENTION

Because of the size and weight of large cranes, it is often necessary to disassemble the cranes to transport them from one job site to another. The disassembly of the crane is usually accomplished by removing the upper section, or superstructure, of the crane from the base section of the crane.

Commonly, the upper section of the crane is connected to the lower section of the crane by a large number of high torque bolts which must be removed to separate the upper section of the crane from the lower section thereof. The removal of the bolts on disassembly takes considerable time and effort.

In another method of securing the upper crane section to the lower crane section, a series of cotter type joints are used wherein tangs on one section extend through the base plate of the other section. Each tang has an opening to receive a wedge member which acts as a cotter. Again, removal and replacement of a multitude of wedge members takes time and effort.

Still another method of assembly and disassembly of the upper section of a crane with the lower section thereof has been proposed in the copending United States patent application of Petrik and Dvorsky to Disconnect Mechanism For Upper Section of Crane, filed Feb. 6, 1974, U.S. Ser. No. 440,233 assigned to the same assignee as the present invention. In this latter method, an interrupted ring member on the upper crane section fits within the inner race member of the turntable bearing which is mounted in the crane base section. Interrupted surfaces on the ring member and on the inner race member, in the form of teeth, define locking surfaces when a power-operated actuator rotates the inner race member relative to the upper crane section to place the teeth of the race member in overlying relationship to the teeth of the ring member. The upper crane section is released from the lower crane section when the power-operated actuator reverses the rotation of the inner race member to a position where the teeth of the race member are in staggered relation to the teeth of the upper section ring member to permit removal of the ring member from the race member.

## SUMMARY OF THE INVENTION

In the present invention, the upper crane section is detachably secured to the crane base section by means of a power-actuated locking member which, in the locking position, bridges members connected, respectively, to the upper crane section and the crane base section. One of the bridged members, however, as in the Petrik and Dvorsky application Ser. No. 440,233, is not connected rigidly to one of the sections but is rotatable with respect thereto. In the preferred form of the invention, the locking member is in the form of a ring which is received in the external groove of an annular ring member housing secured to the upper crane section. The crane turntable bearing on which the upper section of the crane swings relative to the base section has an outer race member secured to the crane base section and an inner race member into which the ring member housing of the upper crane section is received when the crane sections are assembled. A power actuator extends between the ends of the locking ring member and can selectively expand or contract the ring. A groove in the inner race member of the turntable bearing, in opposing relation to the groove in the upper section ring member when the crane sections are in assembled relation, receives a portion of the ring member when the ring member is expanded, thus bridging the grooves and locking the crane upper section to the inner race of the turntable bearing on the crane base section. When the ring member is contracted entirely into the ring member housing, the crane upper section can be separated from the crane base section.



It is therefore one object of the present invention to provide mechanism for easy locking and releasing of the crane upper section with the crane base section.

It is another object of the present invention to detachably secure the upper crane section to the crane base section by means of a power actuated locking member bridging the two sections.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a crane embodying the present invention.

FIG. **2** is a fragmentary view, in perspective, of portions of the crane upper section and the crane base section when the sections are separated.

FIG. **3** is a plan view of the mechanism, shown in lock position, connecting the crane upper section to the crane base section.

FIG. **4** is a fragmentary view, taken as the view of FIG. **3**, showing the mechanism in release condition.

FIG. **5** is a view taken on the lines **5–5** of FIG. **3**.

FIGS. **6**, **7** and **8** are views taken as the view of FIG. **5** but showing different embodiments of the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

There is shown in FIG. **1**, a crane **10** having a base section **12** and an upper, or superstructure, section **14** which is mounted on the base section for rotation relative thereto. In the crane disclosed for illustrative purposes, the base section **12** is mounted on wheels **18**, but it should be understood that other motive means, such as an endless crawler track, could be used instead. Alternatively, the base section could be fixed, as on a pedestal on an off-shore drilling platform or on a floating ship or barge. The base section **12** has a cab **20** for drilling the crane, or at least the base section thereof, over the highway. The upper section **14** also has a cab **22** which is for the crane operator during operation of the crane on the job site.

As shown best in FIG. **2**, an outer race member **24** of a anti-friction bearing **26** is secured to the base section **12** by bolts **28**. As shown best in FIG. **5**, the bearing has an annular inner race member **30** which is rotatably supported on the outer race member through a circle of balls **32**.

The upper section **14** of the crane has a depending ring portion, or member, **34** which has an external circumferential groove **36**. The inner race member **30** has an internal circumferential groove **38** which, when the upper crane section is assembled with the base section resting on the inner race member **30** as shown in FIG. **5**, is in registration with the groove **36** in the upper section ring **34**.

A locking ring **40** is carried in groove **36** of ring **34**. As shown best in FIGS. **2**, **3** and **4**, the locking ring **40** is split, at **42**, and a tab **44** is secured at each end to extend inwardly therefrom. A hydraulic ram **46** is connected between the tabs and is selectively extendable

and retractable to expand and contract the ring **40.** The ring **34** is cut away, as at **34***a*, to accommodate the tabs **44** and ram **46.**

The ring **40** is shown fully contracted (that is, with minimum diameter) in FIGS. **2** and **4.** When contracted, the ring **40** fits entirely within the groove **36** of the upper crane section ring **34,** which constitutes a housing for the locking ring **40.** When the locking ring **40** is entirely within housing **34,** the upper crane section **14** can be raised or lowered (as by removable jacks **48** or with an auxiliary crane or hoisting device), with ring **34** moving telescopically with respect to the inner race member **30.**

When the ram **46** is extended, the ring **40** expands, increasing the diameter thereof, and the ring **40** moves into the groove **38,** to bridge both grooves **36** and **38** as shown in FIG. **5.** The groove **38** is wedge-shaped, with tapered upper and lower surfaces **38***a* and **38***b*. The top and bottom edges **40***a* and **40***b* of ring **40** are tapered toward the outer periphery **40***c* of the ring to form a wedge. When the ring **40** is expanded, the upper portion **30a** of race member **30** is gripped between the ring **14***a* on upper section **14** and the upper surface **40***a* of locking member **40,** as shown in FIG. **5.** When the ring **40** tightly grips the inner race member **30,** an adjustable link **50** is connected between the ends of the ring, adjacent to ram **46,** as shown in FIG. **3.** The link **50** is adjusted to hold the ring **40** and race member **30** in gripping relationship.

When ring **40** is held tightly with race member **30,** as shown in FIG. **5,** the upper section of the crane will be resting on, and secured tightly to, the inner race member **30.** At that time, the weight of the upper crane section is transmitted through inner race member **30,** the ring of balls **32,** the outer race member **24,** to the crane base section **12.**

It should be noted that the upper section of the crane, when assembled to the base section, is rotatable about an axis A through the center of the bearing. The rotary power is supplied by a hydraulic motor (not shown) or other suitable swing drive mechanism mounted in the upper crane section. The hydraulic motor has a motor shaft **52** with a pinion **54** mounted thereon. Pinion **54** is engaged with teeth **56** on the outer periphery of the outer race **24** of bearing **26.** Operation of the hydraulic motor, which is reversible, rotates the upper section of the crane in one direction and the other.

In order to release the upper crane section from the crane base section, the link **50** is removed and then the locking ring **40** is contracted by the ram **46,** which constitutes a power operated actuator. After the ring **40** is contracted entirely within groove **36** of ring **34,** the upper crane section can be lifted off the inner race member **34** of the bearing and transported separately from the base section to a new job site.

In the embodiment of the invention shown in FIGS. **1** to **5,** the bearing is mounted in the base section of the crane, and the upper crane section is selectively locked to the inner race member thereof by means of an expandable locking ring. It will be evident from FIGS. **6, 7** and **8** that other arrangements of the bearing and locking ring can be used to releasably lock the upper crane section to the base section.

In the embodiment of FIG. **6,** the bearing **126** has an inner race member **130** which is secured to the upper crane section **114** by bolts **128.** The outer race member **124,** which is separated from the inner race member by a ring of balls **132,** has a tapered groove **138** therein. A ring **134** is secured to the crane base section **112,** and has a diameter slightly greater than a necked lower portion **124***a* of outer race member **124.** The necked portion **124***a* defines a shoulder **124***b*, with the main portion of the outer race member **124,** which rests on the upper surface **134***a* of the ring **134** when the upper crane section is mounted on the lower crane section in assembled relation.

The ring **134,** which defines a housing for a locking ring **140,** has a groove **136** which is in registration with groove **138** when the crane sections are in assembled relation. The locking ring **140** is split, as ring **40,** and has a ram (not shown) connected between its ends in the same manner as ram **46.** When the ring is expanded by extension of the ram, the ring is held entirely within the groove **136,** and the upper section of the crane can be lowered onto, or raised from, the base section. When the ram is contracted, the ring **140,** which has tapered upper and lower edges like the ring **40,** can be wedged into groove **138,** thereby bridging the two grooves **136, 138,** to force the outer race member **124** of the bearing down onto the upper surface **134a** of ring **134,** thereby holding the upper crane section on the base section. An adjustable link, similar to link **50,** is secured between the ends of the ring **140** to hold the ring in the locking position.

In the embodiment of FIG. **7,** the inner race member **230** of a bearing **226** is secured to the base section **212** by bolts **228.** The outer race member **224** is supported on the inner race member by a circle of balls **232.** A ring **234** on the upper section of the crane fits over the outer race member **224** when the crane sections are in assembled relation.

A tapered groove **238** in the outer periphery of the outer race member **224** is in registration with a groove **236** in ring **234** when the crane sections are in assembled relation, with the upper crane section **214** resting on the upper surface **224***a* of the outer race member **224.** A ring **240** is housed in groove **236** of the ring-shaped housing **234.** The ring **240** is split, as ring **40,** and has a ram (not shown) between its ends as the ram **46.** When the ram is contracted to wedge the ring **240** into groove **238,** the ring will bridge the grooves **236** and **238** to force the upper crane section **214** down onto the upper surface **224***a* of outer race member **224,** thereby locking the crane upper section to the crane base section. When the ring is expanded to fit entirely within groove **236,** the upper section of the crane will be released from the base section for separation therefrom.

In the embodiment of FIG. **8,** the outer race member **324** of a bearing **326** is secured to the upper section of the crane **314** by bolts **328.** The inner race member **330** of the bearing is separated from the outer race member by a circle of balls **332.** The inner race member has a necked portion **330***a* which is received around a ring **334** secured to the crane base section **312** when the crane sections are in assembled relation. A shoulder **330***b*, which is formed where the necked portion of the inner race member joins the main portion of the race member, seats on the upper portion **334***a* of the ring **334** when the crane sections are joined.

A groove **336** in the ring **334** houses a locking ring **340** which is split, as ring **40,** and which has ends connected by a ram, in the same manner as ram **46** joins the ends of ring **40.** A tapered groove **338** in the inner race member is in registration with groove **336** when the crane sections are assembled, and the locking ring

is wedged into tapered groove **338** when the ram is extended. At that time, the locking ring will bridge the grooves and lock the crane sections together by forcing the shoulder **330b** onto the upper surface **334***a* of the ring. An adjustable link, similar to link **50,** holds the locking ring in the locking position. When the link is removed and the ram contracted, the locking ring will lie completely within groove **336.** With the locking ring inside groove **336,** the crane sections can be disassembled for separate transportation to a new job site.

It will be noted that in each embodiment of the invention, a socket member is defined on one of the crane sections (inner race member **30** on base section **12** in FIG. **5;** ring **134** on base section **112** in FIG. **6;** ring **234** on upper section **214** in FIG. **7;** inner race **330** on upper section **314** in FIG. **8**), and a fitting member is defined on the other crane section (ring **34** on upper section **14** in FIG. **5;** outer race **124** on upper section **114** in FIG. **6;** outer race **224** on base section **212** in FIG. **7;** ring **334** on base section **312** in FIG. **8**).

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

What is claimed is:

**1.** In a crane having a base section and having an upper section, said crane having a bearing with relatively rotatable inner and outer portions interposed between said sections, one of said bearing portions connected to one of said sections, the improvement comprising a locking member mounted in the other of said sections and shiftable relative thereto, and a power operated actuator connected to said locking member to shift said member into and out of locking engagement with the other of said bearing portions.

**2.** In a crane having a base section and having an upper section, said crane having a bearing with relatively rotatable inner and outer portions interposed between said sections, said outer bearing portion connected to said base section, the improvement comprising a locking member mounted in the upper section and shiftable relative thereto, and a power actuator connected to said locking member to shift said member into and out of locking engagement with the inner bearing portion.

**3.** In a crane having a base section and having an upper section, said crane having an antifriction bearing with inner and outer race rings interposed between said sections, said outer race ring connected to said base section, the improvement comprising a locking member mounted in the upper section and shiftable relative thereto, and a power actuator connected to said locking member to shift said member into and out of locking engagement with the inner race ring.

**4.** In a crane having a base section and having an upper section with a depending ring, said crane having an antifriction bearing with inner and outer race rings interposed between said sections, said inner race ring receivable over said depending ring and said outer race ring connected to said base section, the improvement comprising, means defining opposing grooves in said depending ring and said inner race ring, a locking ring received in said grooves, and a power actuator to expand and contract said locking ring from a position bridging both grooves to a position within one of said opposing grooves.

**5.** In a crane having a base section and having an upper section with a depending ring, said crane having an antifriction bearing surrounding said depending ring, said antifriction bearing having an inner ring surrounding said upper section depending ring and having an outer race connected to said base section, a groove in said upper section depending ring and a groove in said antifriction bearing inner race, said grooves in registration when the upper section of the crane is mounted on the base section, a locking ring mounted in the groove of the upper section depending ring, and a power actuator connected to said locking ring to expand said ring to bridge both grooves and to contract said ring into the groove of the upper section depending ring.

**6.** In a crane having a base section and having an upper section, said crane having a bearing with relatively rotatable inner and outer race rings interposed between said sections, one of said race rings connected to one of said sections, the improvement comprising a locking ring mounted in the other of said sections for expansion and contraction relative thereto, and a power operated actuator connected between the ends of said locking ring to change the diameter thereof for locking engagement with the other of said race rings.

**7.** In a crane having a base section and having an upper section removably mounted on the base section, said crane having a bearing with relatively rotatable inner and outer race rings interposed between said sections, one of said race rings connected to one of said sections, the improvement comprising a peripheral groove in the other of said sections and in the other of said race rings, said peripheral grooves being in alignment when the upper section of the crane is mounted on the base section of the crane, a locking ring mounted in one of said peripheral grooves, and a power actuator connected between the ends of said locking ring to alter the diameter of the locking ring to bring the locking ring into bridging relationship with both of the grooves.

**8.** In a crane having a base section and having an upper section, said upper section having a depending portion and said crane having a bearing with relatively rotatable inner and outer portions interposed between the base section and the depending portion of said upper section, said outer bearing portion connected to said base section, the improvement comprising a peripheral groove encircling the inner bearing portion and a peripheral groove encircling the depending portion of said upper section, said peripheral grooves being in alignment when the upper section of the crane is mounted on the base section of the crane, a locking ring mounted in one of said peripheral grooves, and a power actuator connected between the ends of said locking ring to alter the diameter of the locking ring to bring the ring into bridging relationship with both of the grooves and exert a locking action between, and completely around, the inner bearing portion and the depending portion of said upper section.

* * * * *

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,923,407 Dated December 2, 1975

Inventor(s) Lyle B. Jensen et al.

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

In the Abstract, line 2, delete "An" and insert -- A --.

Column 2, line 45, delete "dril-" and insert -- driv- --.

Column 2, line 46, delete "ling" and insert -- ing --.

Signed and Sealed this

*twenty-ninth* Day of *June 1976*

[SEAL]

*Attest:*

**RUTH C. MASON**
*Attesting Officer*

**C. MARSHALL DANN**
*Commissioner of Patents and Trademarks*