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Petrik et al.

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[54] **DISCONNECT MECHANISM FOR UPPER SECTION OF CRANE**

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[52] **U.S. Cl.** **212/66;** 403/349

[51] **Int. Cl.²** **B66C 23/84**

[58] **Field of Search** ..... 212/66–70; 214/131 A, 151; 285/361, 396, 402, DIG. 13, DIG. 21; 403/349, 359

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[57] **ABSTRACT**

A crane having an upper section removable from a base section is disclosed. The upper section of the crane is supported on an anti-friction bearing which has an outer race member secured to the base section. The inner race member of the bearing surrounds a depending ring portion of the upper section. The upper section ring portion and the inner race member of the bearing have teeth which, when shifted to one relative angular position, serve to lock the upper section of the crane to the base section thereof, but which, when shifted to another relative angular position, release the upper section from the base section. Power rams effect relative angular shifting of the toothed members. A pinion mounted in the upper section meshes with gear teeth on the outer race member of the bearing to rotate the upper section of the crane on the base section.

14 Claims, 6 Drawing Figures

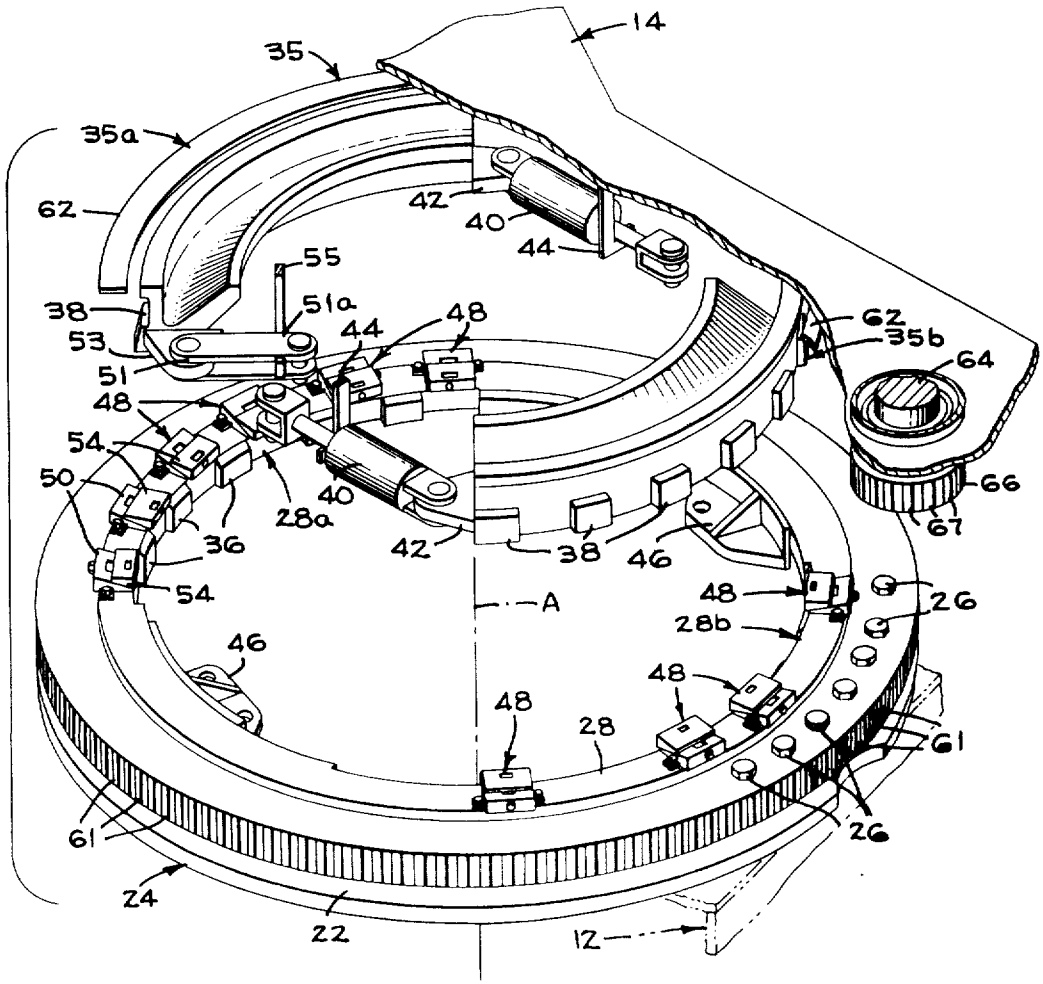

FIG_1

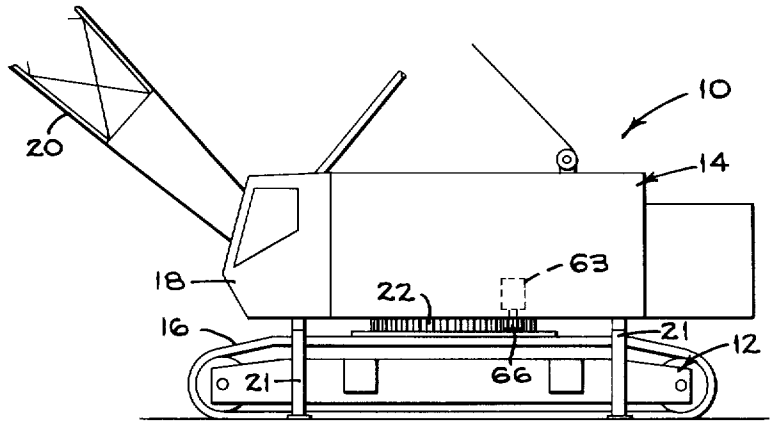
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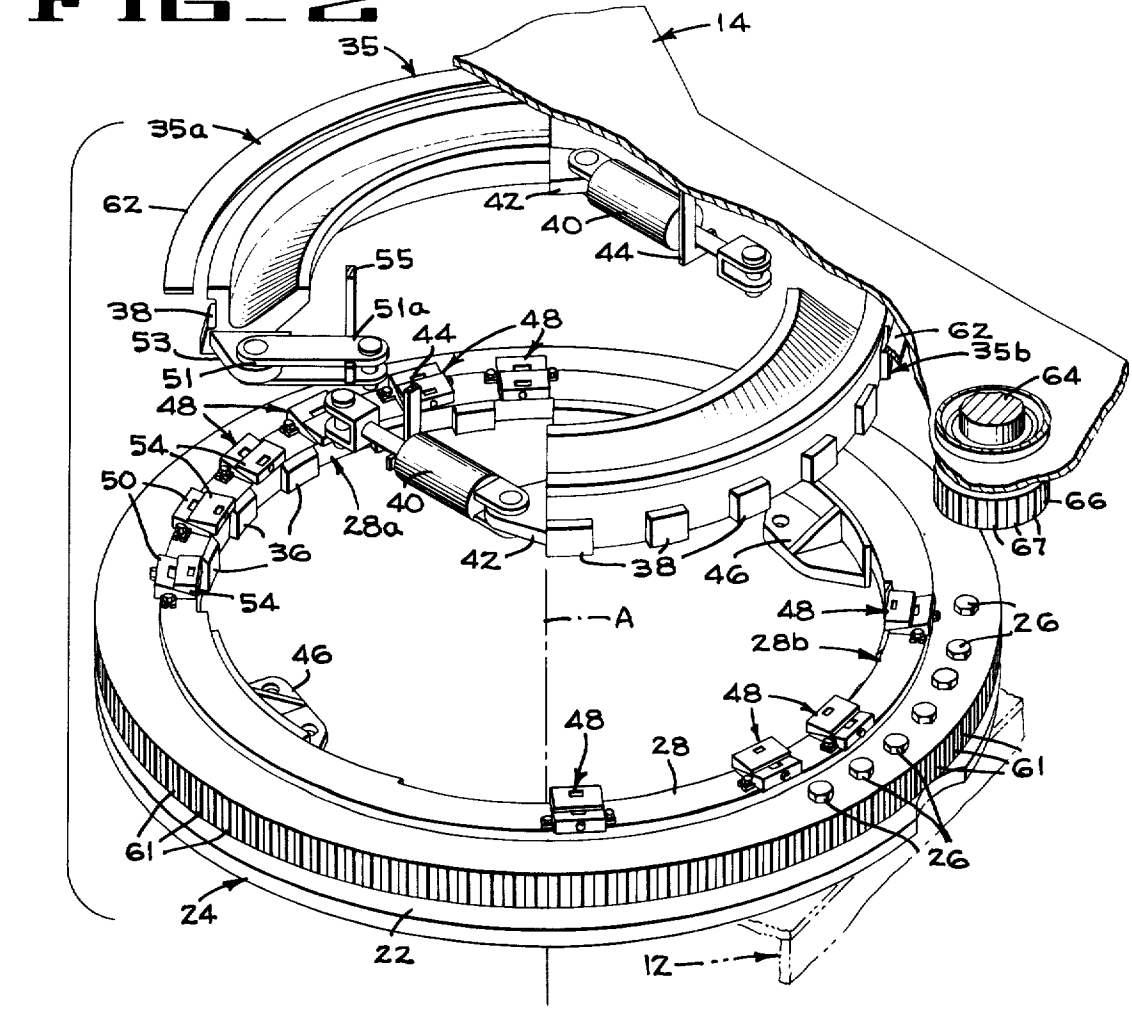
FIG_2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28a
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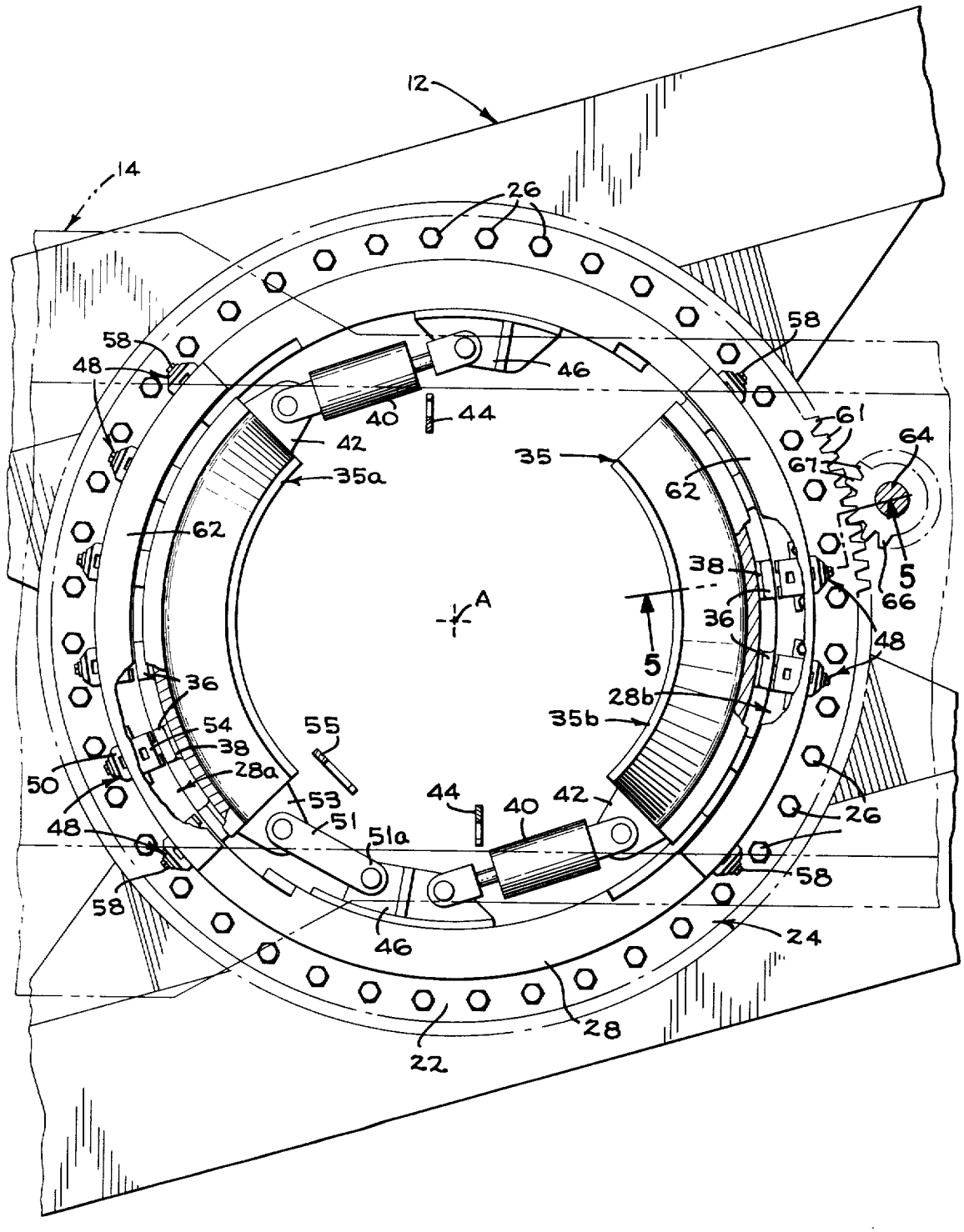
FIG_3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51a
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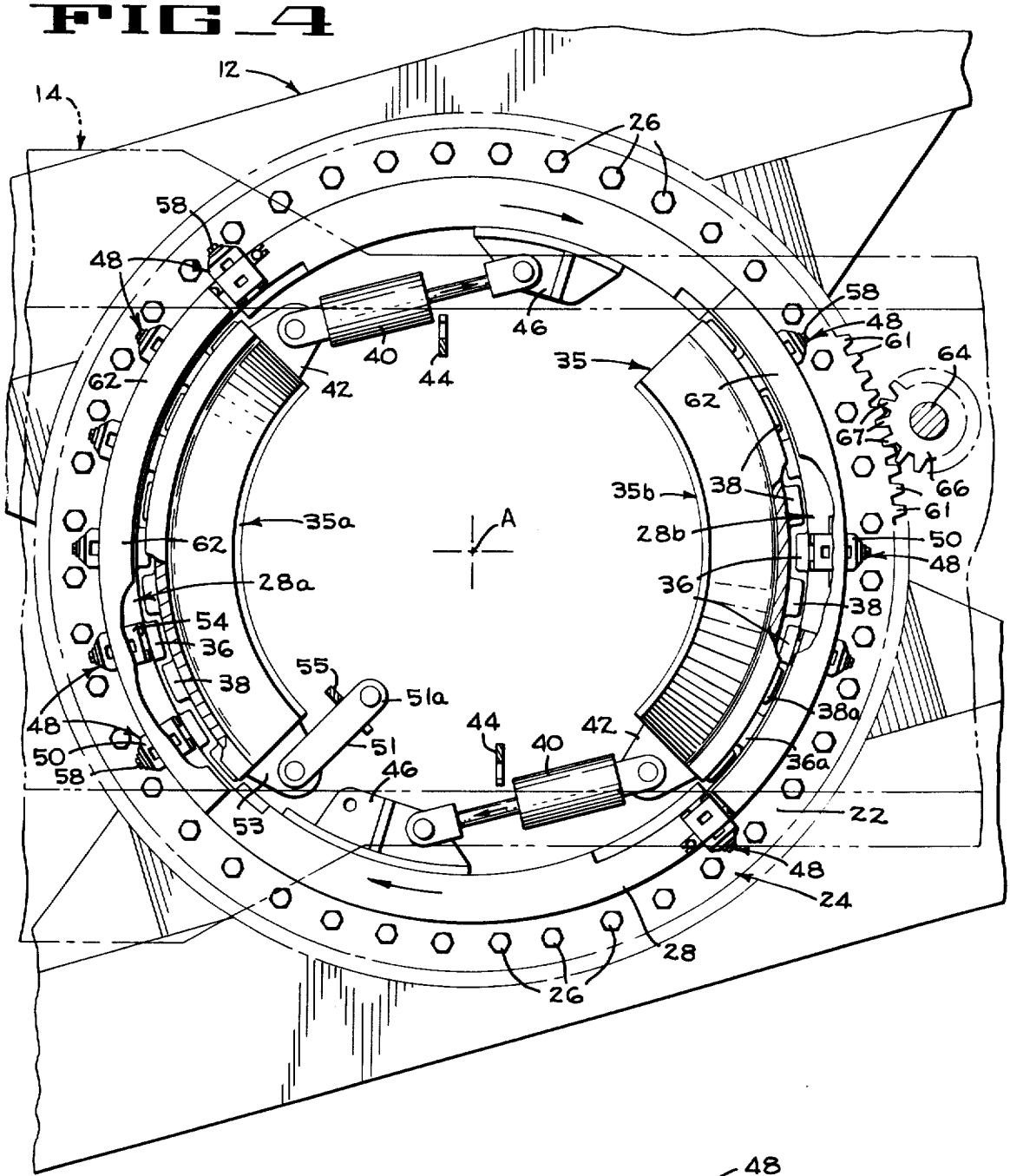
FIG_4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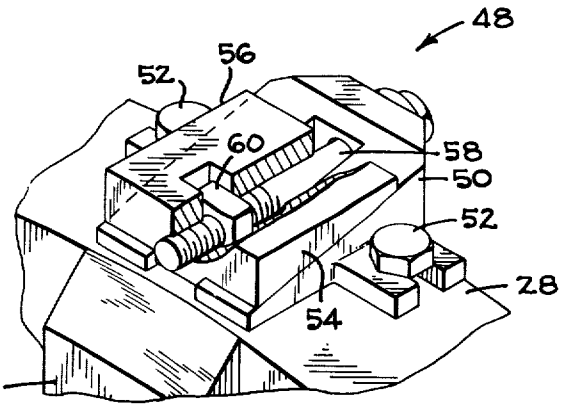
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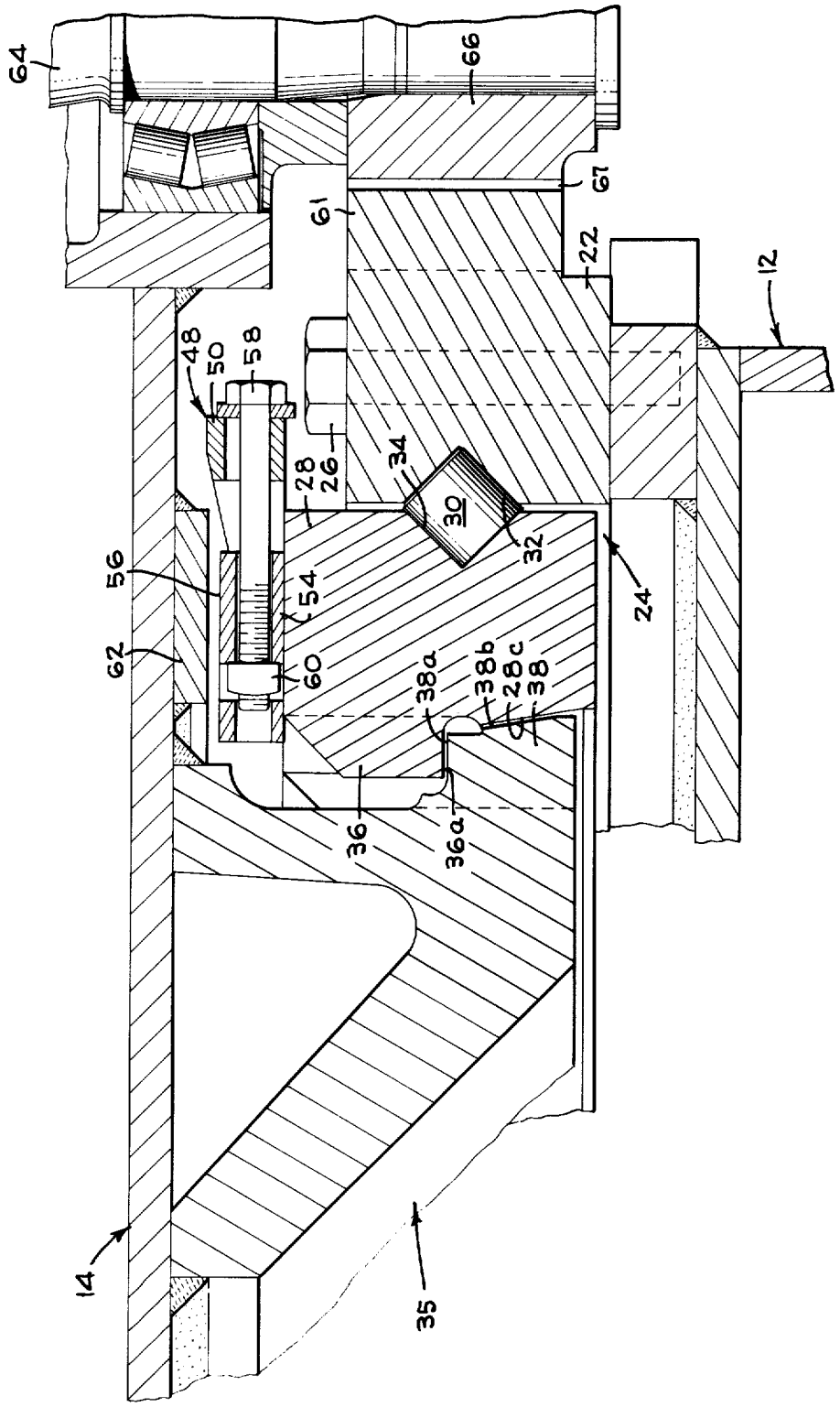
FIG_6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38a
38b
28c
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36a
14
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FIG_5

DISCONNECT MECHANISM FOR UPPER SECTION OF CRANE

BACKGROUND OF THE INVENTION

In order to facilitate the transportation of large cranes to and from a job site, it is often desirable or necessary to remove the upper, or superstructure, section from the base section. In a typical crane, a swing bearing, or turntable, is provided between the upper section and the base section to permit rotation, or swinging, of the upper section on the base section. Often, a large number of bolts will secure the bearing to the upper section or the base section, and their removal is necessary to separate the sections. Another arrangement for detachably securing the upper section to the base section utilizes tangs on the turntable bearing which extend through a plate in the base section. Each tang has an opening to receive a wedge member which acts as a cotter to secure the bearing to the base section. When the cotters are removed, the turntable bearing and upper crane section can be removed from the base section.

SUMMARY OF THE INVENTION

In the present invention, the mechanism for detachably connecting the upper section and the base section includes a power actuator to shift a member in one of said sections relative to a member in the other section into a position for clamping. In one form of the invention, interrupted surfaces on members of the respective sections are relatively rotated by the actuator between an overlapping position for clamping and an interdigitated release position. In a preferred form of the invention, one interrupted surface (which may, for example, consist of teeth) is on the inner race member of the swing bearing, the outer race member of which is secured to one of the crane sections, such as the base section. The other interrupted surface (which may also consist of teeth) is on the other section, such as on a depending ring portion of the upper section which, when the upper section is received on the base section, fits within the inner race member of the swing bearing. As the upper section of the crane is lowered onto the base section of the crane, the teeth defining the two interrupted surfaces are in a relative interdigitated position so the teeth of one section will pass between the teeth of the other section. A power ram, or rams, is provided to effect relative rotation between the teeth and to place one set of teeth in overlapping relation to the other set of teeth to hold the surfaces, and the two crane sections, together. Reverse rotation between the sets of teeth will return the sets to an interdigitated relationship to release the upper crane section from the base section.

It is therefore one object of the present invention to provide quick disconnect mechanism to releasably lock the upper section of a crane to the base section thereof.

It is another object of the present invention to provide a power operated quick disconnect mechanism between the upper and base sections of the crane.

BRIEF DESCRIPTION OF THE DRAWINGS

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

FIG. **2** is a view in perspective of the disconnect mechanism of the present invention shown with the upper section of the crane separated from the base section.

FIG. **3** is a plan view of the mechanism of FIG. **2** is a locked position.

FIG. **4** is a view similar to FIG. **3** except that the mechanism is in a release position.

FIG. **5** is a section taken on the line **5**—**5** of FIG. **3** before the mechanism has been locked.

FIG. **6** is a view in perspective of the wedge mechanism, shown in the locking position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIG. **1** a crane **10** having a base section **12** and an upper section **14.** The base section **12,** which is mobile, has crawler tracks **16** in the illustrative embodiment of the crane shown, although it should be understood that the base section of the crane may as well have a wheeled chassis. The upper section **14** of the crane, which is supported on the lower crane section, has a cab **18** swingable with respect to the base section and a boom **20** swingable with the cab.

In order to facilitate transportation of the crane from one job site to another, the two sections are separable. To lift the upper crane section from the base section, a plurality of jacks **21** (two of which are shown in FIG. **1**) are supported on the ground (or, alternatively, on the base section) for engagement with the upper crane section. The jacks are extended to lift the upper section of the crane from the base section, and the separate sections of the crane can then be hauled to a new job site. If necessary, or desirable, an additional hoisting means can be used to lift the upper section off the base section. For reassembly of the crane, the upper section **14** is lifted off the trailer on which it was hauled, and the base section **12** of the crane is moved under the upper section, which is then lowered onto the base crane section.

In FIG. **2,** the outer race member **22** of a swing bearing **24** (which renders possible the swinging movement of the upper crane section about an axis A) is secured by bolts **26** to the base section **12.** As shown best in FIG. **5,** the bearing has an inner race member **28** which is carried by a circle of rolling elements, such as cylindrical rollers **30** interposed between V-shaped races **32, 34** of the outer and inner race members, respectively, which define rolling surfaces.

The upper section **14** of the crane has a depending portion **35** which, as shown best in FIG. **2,** is in the form of an interrupted ring, having two angularly spaced sectors **35***a* and **35***b*. The inner race **28** of the bearing **24,** which is annular, has an inner periphery of circular conformation with spaced teeth **36** thereon. The teeth **36** do not extend completely around the inner race **28,** but, instead, are formed in sectors **28***a* and **28***b* only. The outer periphery of the depending portion **35,** which, although interrupted, is also of circular conformation, has spaced teeth **38** thereon. When the teeth in both crane sections are in a relative interdigitated, or staggered, relationship (as shown in FIG. **4**) the depending portion **35** of the upper crane section **14,** can be received inside the inner race member **28** of the bearing **24** mounted on the lower crane section. Similarly, when the teeth are in the staggered relationship of FIG. **4,** the upper crane section **14** can be lifted off the lower crane section **12.**

As shown best in FIG. **2,** two hydraulically operated rams **40** are each pivotally connected to a lug **42** se-

cured to the end of each section 35*a*, 35*b* of the segmented ring portion 35 of the upper section 14. Two brackets 44 depend from the upper crane section 14 to support the free ends of the rams 40 when the upper crane section is separated from the lower crane section.

The inner race member 28, which is freely rotatable relative to the outer race member 22 and the crane base section 12, has secured thereto two diametrically opposed brackets 46 to which the free ends of the rams 40 are connected when the upper crane section is lowered onto the lower crane section, as shown in FIG. 4. At this time, the rams 40 are extended.

As the upper crane section 14 is being lowered onto the lower crane section, the upper crane section must be positioned with respect to the lower crane section so that sectors 35*a* and 35*b* of the upper section interrupted ring 35 are in registration with the sectors 28*a* and 28*b* of the inner race in the lower crane section. The upper crane section must also be positioned so that the teeth 38 of the upper section are in interdigitated, or staggered, relation to the teeth 36 of the lower section 12.

As shown in FIG. 2, a plurality of wedge blocks 48 are mounted on the inner race member 28 of the bearing 24. As shown best in FIG. 6, wherein the wedge block is shown in the locking position, each wedge block 48 has a lower, wedge-shaped section 50 which is secured to race member 28 by bolts 52. An upper wedge section 54 is mounted on the lower wedge section, and is moved up and down the lower wedge section (to raise and lower the upper surface 56 of the upper wedge section) by rotation of a bolt 58. The bolt 58 is received in the lower wedge section and is in threaded engagement with a nut 60 received in the upper wedge section.

As shown best in FIG. 5, the upper crane section 14 has a flat ring 62 which encircles the depending portion 35 of the upper crane section. As the upper crane section 14 is lowered onto the lower crane section, the teeth 38 of upper crane section 14 pass between the teeth 36 of the inner bearing race member 28. The ring 62 of upper crane section 14 comes to rest on the upper surface 56 of the wedge blocks 48. At that time, the upper surfaces 56 of the wedge blocks are in their lowest positions, and the upper surfaces 38*a* of the teeth 38 on the portion 35 of upper crane section 14 lie in a horizontal plane just below the horizontal plane of the lower surfaces 36*a* of the teeth 36 of inner race member 28.

When the upper section of the crane is settled on the lower section of the crane as shown in FIG. 5, and the rams, which are mounted on the depending portion 35 of the upper crane section, are connected to brackets 46 on the inner race member 28, the rams are contracted to rotate the inner race member of the bearing relative to depending portion 35 of the upper crane section. The actuation of the rams places the teeth 36 of the inner race member directly over or in angular registration with the teeth 38 of the depending portion 35 of the upper crane section, as shown in FIG. 3. A link 51 is pivotally connected to a lug 53 at one end of one section 35*a* of the depending portion 35 of the upper crane section 14. When the upper crane section is separated from the lower crane section, the free end 51*a* of link 51 is supported on a depending bracket 55 suspended from the upper crane section. After the inner race member is in the position of FIG. 3, the free end of the link 51 is secured to bracket 46 on the inner race member.

After the inner race member 28 is secured in the position shown in FIG. 3 by link 51, the upper wedge sections 54 of the wedge blocks 48 are moved up the lower wedge sections 50 by bolts 58 to clamp the upper surfaces 38*a* of teeth 38 to the lower surfaces 36*a* of teeth 36 and thereby clamp the upper crane section portion 35 (and the upper crane section 14) to the inner race member 28. Because of machined tapers on both the inner race member 28 (at 28*c*) and the teeth 38 (at 38*b*), locking movement provided by the wedge packs forces the upper section portion 35 and bearing member 28 into proper alignment. When the members 35 and 28 are locked together by the wedge packs, the tapered surfaces retain the upper crane section from radial movement with respect to the bearing.

It will be noted that when the upper crane section 14 is clamped to the inner race member 28, the full weight of the upper section of the crane is transmitted through the bearing 24, and the rolling elements 30 thereof, to the base section 12 of the crane. The outer surface of the outer race 22 of the bearing has teeth 61 thereon. A hydraulic motor 63, or equivalent drive means, which is included in the upper crane section 14, rotates a depending shaft 64. A pinion 66 has teeth 67 which engage with teeth 61 when the upper crane section is mounted on the lower crane section. When the pinion 66 is rotated, the upper crane section, which is clamped on the inner race member of the bearing, rotates with respect to the crane base section and the outer race member 22 secured thereto.

In order to release the upper crane section for removal from the lower crane section, the free end 51*a* of link 51 is released from bracket 46 and replaced on bracket 55. The wedge blocks are then contracted to release the inner race member from the upper crane section. The rams 40 are then expanded to rotate the inner race member to the position of FIG. 4. It should be noted that before the rams are either expanded or contracted, the outer race member 22 is locked against rotation, as by actuation by the crane operator of a braking mechanism (not shown) acting on the shaft on which pinion 66 is mounted. The upper crane section is thus locked to the lower crane section, but the inner race member is free to rotate with respect to the depending portion 35 of the upper crane section. With the teeth 36 and 38 in the staggered relationship of FIG. 4, the upper section 14 can be lifted off the base section 12 by jacks 21, or other suitable means.

Thus, it will be seen that the inner bearing race member 28 defines a socket of generally circular conformation in the crane base section 12 which receives a fitting, also of generally circular conformation. The fitting is defined by the interrupted ring 35 which constitutes a depending portion of the upper crane section. The socket and the fitting each have interrupted surfaces, defined by the upper surfaces 38*a* of the teeth 38 and by the lower surfaces 36*a* of the teeth 36, which can be rotated between an overlapping relationship, where the surfaces are aligned (as shown in FIG. 3) and a staggered relationship where one set of surfaces, as for example 36*a*, lie between the other set of surfaces, such as 38*a*, as shown in FIG. 4. This mechanism thus ensures quick and easy separation and reassembly of the crane sections.

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, the combination comprising means defining a socket member in one of said sections, means defining a fitting member in the other of said sections, one of said members being rotatable about an axis therethrough, said fitting member receivable into said socket member when the upper section is lowered onto the base section, and means including a power operated actuator to effect a clamping between said members after the upper section is lowered onto the base section to hold the upper section firmly and rotatably on the base section.

2. In a crane having a base section and having an upper section rotatable on said base section, the combination comprising a socket member in one of said sections and a fitting member in the other of said sections, one of said members comprising one race of an antifriction bearing, the other race of said bearing being mounted in one of said sections, said fitting member receivable into said socket member when the upper section is lowered onto the base section, and means including a power operated actuator to clamp said fitting member in said socket member after the upper section is lowered onto the base section for relative rotation between said crane sections.

3. In a crane having a base section and having an upper section, the combination comprising means defining a socket member in one of said sections, means defining a fitting member in the other of said sections, one of said members rotatable, said fitting member receivable into said socket member when the upper section is lowered onto the base section, and a power operated actuator to effect relative shifting between said fitting member and said socket member after said fitting member is received into said socket member to position said members in overlapping relationship for clamping.

4. In a crane having a base section and having an upper section rotatable on said base section, the combination comprising a socket member in one of said sections and a fitting member in the other of said sections, one of said members comprising a rotatable race member of an antifriction bearing, said fitting member receivable into said socket member when the upper section is lowered onto the base section, said socket member and said fitting member having portions which overlap when said portions are in angular registration, a power operated actuator to effect relative rotation between said fitting member and said socket member after said fitting member is received into said socket member to position said portions in overlapping relationship for clamping, and a clamp to lock said overlapped portions together.

5. In a crane having a base section and having an upper section rotatable on the base section, the combination comprising means defining a fitting member in one of said sections, an antifriction bearing, said antifriction bearing having an outer race secured in the other of said sections and having an inner race defining a socket member, said fitting member receivable into said socket member when the upper section is lowered onto the base section, said fitting member and said socket member having spaced extending portions, said portions of the socket member and the fitting member overlapping in certain relative angular positions of said socket and fitting members, and a power operated actuator to effect relative rotation between said fitting member and said socket member after said fitting member is received into said socket member to position said members in overlapping relationship.

6. In a crane having a base section and having an upper section rotatable on the base section, the combination comprising an antifriction bearing having an outer race mounted in one of said sections, said bearing having an inner race of annular configuration to define a socket member, means defining a fitting member on the other of said sections, said fitting member having an outer periphery of generally circular conformation, each of said socket member and said fitting member having interrupted surface portions, said fitting member receivable into said socket member when the upper section is lowered onto the base section and said portions are angularly positioned in staggered relationship, and a power operated actuator to effect selectively relative reversible shifting between said fitting member and said socket member portions after said fitting is fully received into said socket member to position said portions in overlying registration for clamping and, alternatively, in staggered relationship for removal of the upper section from the base section.

7. In a crane having a base section and having an upper section rotatable on the base section, the combination comprising an antifriction bearing having an outer race mounted in the base section, said bearing having an inner race of annular configuration to define a socket member, means defining a fitting member on the upper section, said fitting member having an outer periphery of generally circular conformation, each of said socket member and said fitting member having extending interrupted surfaces, said fitting member receivable into said socket member when the upper section is lowered onto the base section and said interrupted surfaces are in staggered relationship, a power operated actuator to effect selectively relative reversible shifting between said fitting member and said socket member surfaces after said fitting is fully received into said socket member to position said interrupted surfaces in overlying registration for clamping, and a clamp to force said surfaces together when in overlying registration to lock the rotatable upper section on the base section.

8. The mechanism of claim 3 including means to clamp said overlapping members.

9. The mechanism of claim 5 including a clamp to force said overlapped members together to lock the upper section rotatably on the base section.

10. The mechanism of claim 1 wherein said socket member and said fitting member have portions which overlap when in registration, and wherein said power operated actuator effects a relative shifting between said fitting member and said socket member into registration, and a clamp to bring said portions together in clamped relationship.

11. The mechanism of claim 7 wherein said clamp comprises a pair of wedge members inserted between the upper section and the inner race member.

12. In a crane having a base section and having an upper section, the combination comprising a first member fixed to one of said sections, a second member rotatably mounted in the other of said sections, one of said members receivable into the other of said members when the upper section of the crane is lowered

onto the base section of the crane, and means including a power operated actuator to effect a clamping between said members after the upper section is lowered onto the base section to hold the upper section firmly and rotatably on the base section.

13. In a crane having a base section and having an upper section, the combination comprising a first ring fixed to said upper section, a second ring rotatably mounted on said base section, one of said rings receivable into the other of said rings when the upper section of the crane is lowered onto the base section of the crane, and means including a power operated actuator to effect a clamping between said rings after the upper

section is lowered onto the base section to hold the upper section firmly and rotatably on the base section.

14. In a crane having a base section and an upper section, the combination comprising a first ring member fixed to said upper section, a second ring member rotatably mounted on said base section and comprising the inner race of an anti-friction bearing, said first ring member receivable into said second ring member when the upper section of the crane is lowered onto the base section of the crane, and means including a power operated actuator to effect a clamping between said ring members after the upper section is lowered onto the base section to hold the upper section firmly and rotatably on the base section.

* * * * *