# United States Patent [19]

**Lamer et al.**

[11] **3,924,753**

[45] **Dec. 9, 1975**


[54] **CRANE COUNTERWEIGHT SUPPORT AND MEANS FOR REMOVING AND MOUNTING SAME**


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[52] **U.S. Cl.** ..... **212/48;** 214/127; 214/142; 280/150 E

[51] **Int. Cl.²** ..... **B66C 23/72**

[58] **Field of Search** ..... 212/47, 48, 49; 214/127, 214/142; 280/150 E



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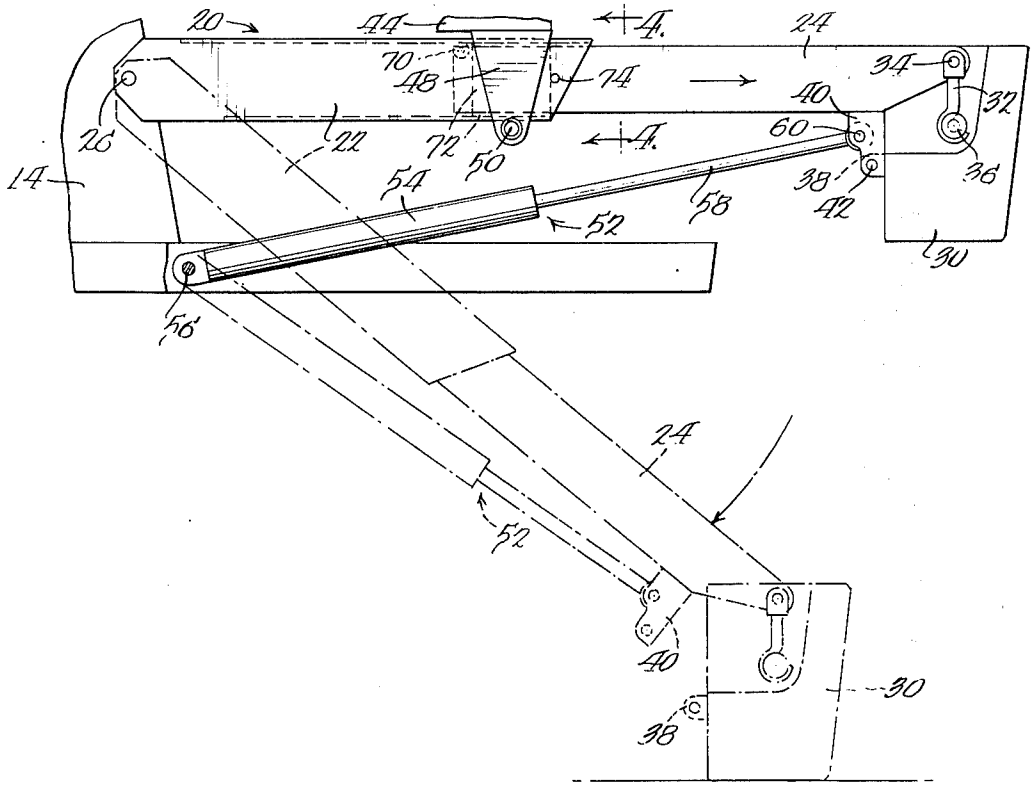
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[57] **ABSTRACT**

A Crane has a shiftable counterweight thereon. The counterweight is shifted by a fluid ram which can also be used to remove or mount the counterweight relative to the crane.


**8 Claims, 4 Drawing Figures**



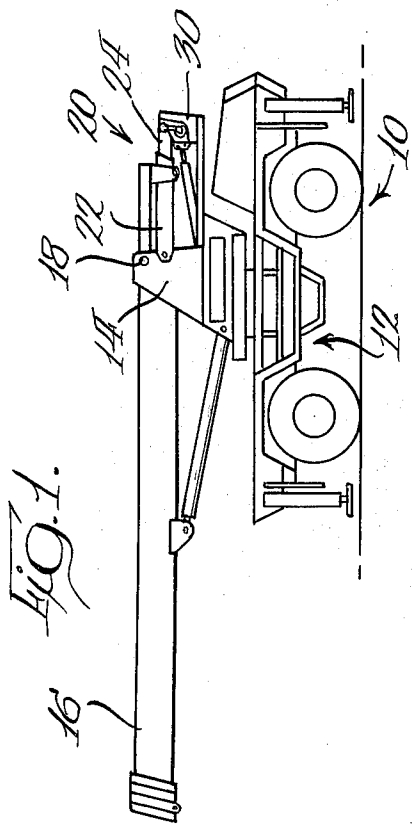

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FIG. 1.

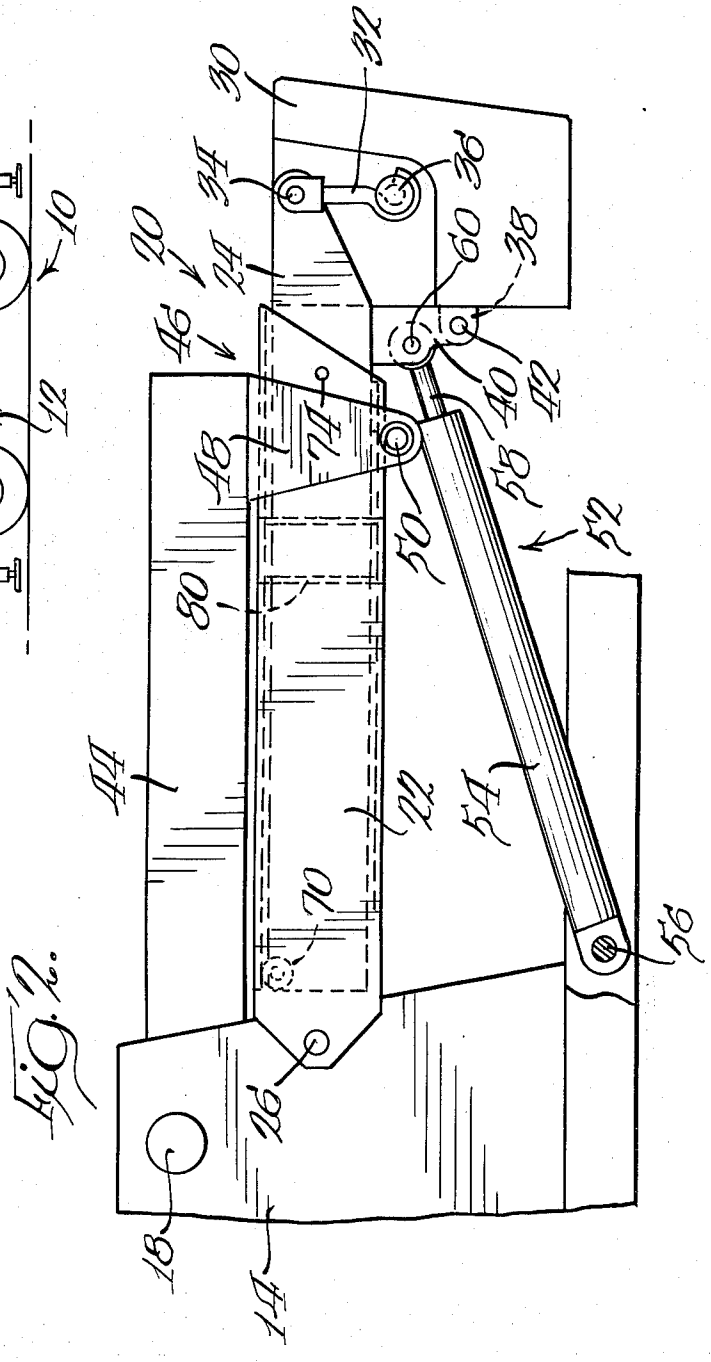

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FIG. 2.

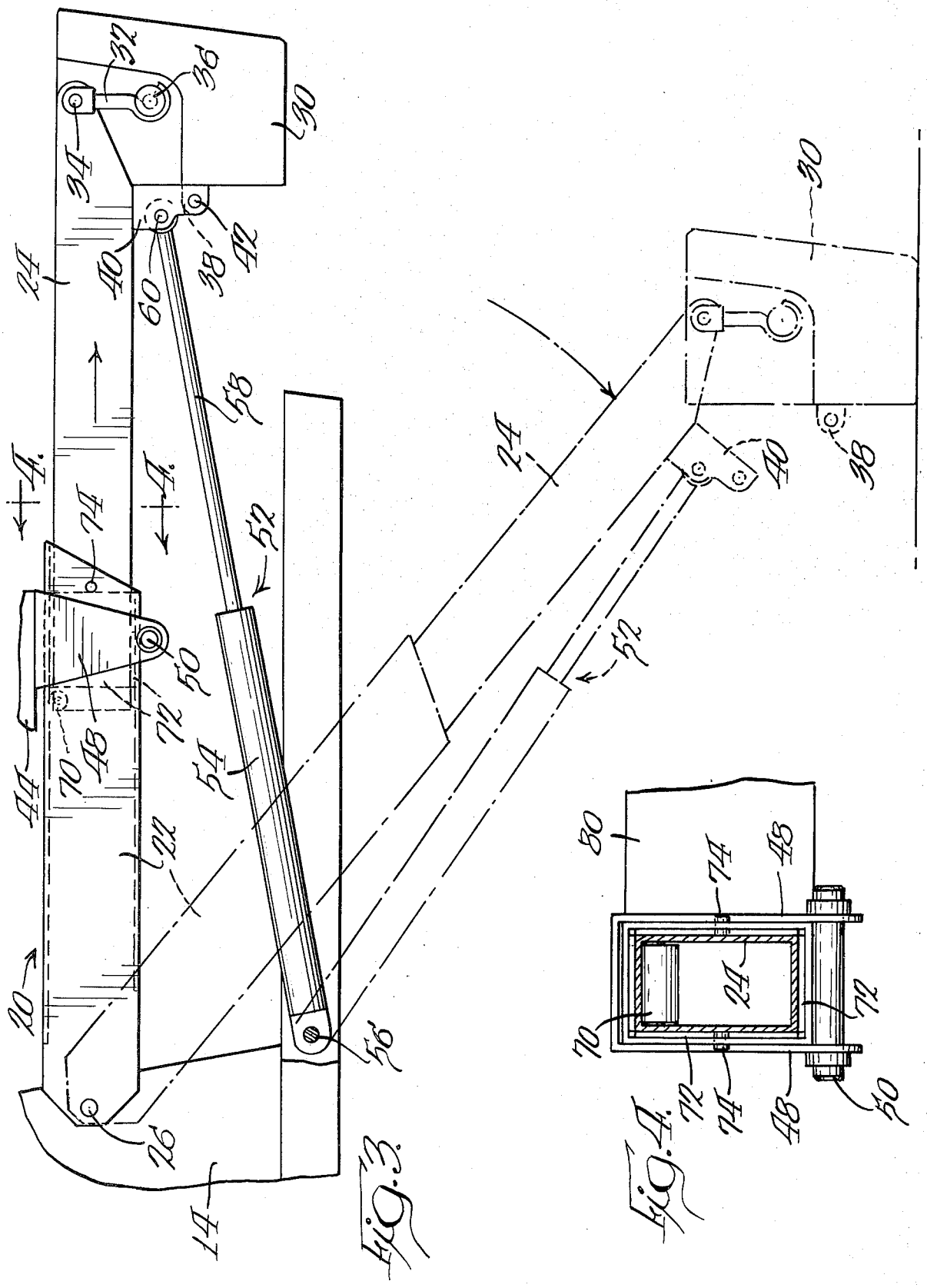

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Fig. 3.

Fig. 4.

# CRANE COUNTERWEIGHT SUPPORT AND MEANS FOR REMOVING AND MOUNTING SAME

## BACKGROUND OF THE INVENTION

Shiftable counterweights for cranes or other types of heavy duty machinery have been known for years.

In recent years the increased capacity and size of the crane has resulted in a corresponding increase in the mass of the counterweight. In fact, the size of the crane and the counterweight have resulted in some problems in transporting the equipment. Because of weight limitations that are placed on most roads, it has become necessary to remove the counterweight from the crane and transport the counterweight separate from the crane when the unit is being moved along most roadways.

One type of system that has been proposed is disclosed in U.S. Pat. No. 3,726,416. While this type of system serves the purpose of having a shiftable counterweight as well as being able to remove the counterweight from the crane, the system disclosed in this patent requires separate equipment for removing the counterweight. Furthermore, before removing the counterweight, it is necessary to physically attach the counterweight to a crane boom section before it can be manipulated. This arrangement is not only time consuming but also requires ancillary equipment.

## SUMMARY OF THE INVENTION

According to the present invention, a counterweight is supported on a crane and is extended and retracted by a fluid ram which may also be utilized to raise and lower the counterweight for removal. The counterweight can be lowered to the ground or other vehicle by simply removing a single pin.

More specifically, the counterweight is supported on an extensible and retractable carriage which is pivoted on the base for the crane and the extensible and retractable elements of the carriage are moved relative to each other by a fluid ram. The carriage is normally supported in a fixed position by support means which can be manipulated to accommodate pivotal movement of the counterweight carriage on the base by the fluid ram. In the specific embodiment illustrated, the support means consists of a beam or member that extends from the base and has releasable latch means on the outer end thereof which cooperates with the pivotally supported element of the carriage to hold the carriage in a fixed position. When it is desired to remove the counterweight from the crane, the releasable latch means or pin is removed to allow pivotal movement of the counterweight and carriage with respect to the base for the crane.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a side elevational view of a crane having the present invention incorporated therein;

FIG. 2 is an enlarged fragmentary view of the counterweight system;

FIG. 3 is a further enlarged view similar to FIG. 2; and

FIG. 4 is a section through the support carriage, as viewed along line 4—4 of FIG. 3.

## DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a preferred embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated.

FIG. 1 shows a large mobile crane **10** having the present invention incorporated therein. Mobile crane **10** consists of a vehicle or support **12** having a turntable or base **14** rotatably supported thereon for rotation about a vertical axis. An extensible and retractable crane boom **16** is pivotally supported on base **14** for vertical movement by horizontal pivot means **18.**

FIGS. 2 and 3 show the details of the counterweight system including the counterweight and its support. The counterweight system for crane **10** includes a counterweight support structure consisting of a carriage **20** having first and second extensible and retractable elements **22** and **24.** First element **22** is pivotally supported by pivot means or a pin **26** on base **14** so that the entire counterweight carriage may be pivoted in a vertical plane, for a purpose that will be described later. Second element **24** has releasable counterweight connecting means on the outer end thereof for supporting a counterweight **30.**

In the illustrated embodiment, the releasable counterweight connecting means consists of a pair of hooks **32** (only one being shown) which are pivotally supported on element **24** by pins **34.** Counterweight **30** has a permanent cross pin **36** thereon which is received into the end of hooks **32** so that the counterweight is pivotally supported on carriage element **24.**

To prevent pivotal movement of the counterweight on carriage **20** during normal extension and retraction, releasable counterweight connecting means also include a lug **38** secured to counterweight **30** and a bracket **40** extending from carriage element **24.** Lug **38** and bracket **40** have openings which are aligned when the counterweight system is in the position illustrated in FIG. **2** so that a removable pin **42** may be inserted through the openings to prevent swinging of the counterweight about the support pins **34.**

The counterweight support structure also includes support means on the base that cooperate with the counterweight carriage for normally supporting the carriage in a substantially fixed position relative to the base and accommodating pivotal movement of the counterweight carriage on the base. The support means consists of an elongated arm or member **44** that has one end fixed to base **14** and extends generally horizontally away from base **14.** The outer end of member or arm **40** incorporates releasable latch means **46** for normally holding carriage **20** in a substantially fixed position relative to base **14.** In the illustrated embodiment, releasable latch means **46** consists of a pair of legs **48** depending from member **44** and positioned to extend on opposite sides of carriage element **22** with the lower edges of legs **48** extending below the lower edge of carriage element **22.** The two legs **48** have horizontally aligned openings at the lower end thereof so that a pin **50** may be inserted through the openings. Pin or releasable pin means **50** and legs **48** cooperate to define a cradle which supports counterweight carriage **20** in a substantially fixed position, as shown in FIG. **2.**

Carriage elements **22** and **24** are extended and retracted relative to each other by extensible fluid ram means **52** consisting of a cylinder or first element **54** pivotally supported on base **14** by a pin **56.** Fluid ram means **52** also includes a piston rod or second ram element **58** that has its outer end connected by a pin **60** to carriage element **24.** Thus, extension and retraction of ram elements **54** and **58** will produce telescoping movement between carriage elements **22** and **24** so that the position of counterweight **30** can be changed relative to base **14,** which will change the position of the center of gravity for the counterweight system with respect to base or turntable **14.** To prevent carriage element **24** from being separated from carriage element **22,** the two carriage elements also have cooperating means defining the fully extended position for carriage elements **22** and **24.** Referring to FIG. **4,** it will be noted that carriage elements **22** and **24** are rectangular or hollow polygonal members that are telescoped relative to each other. The inner end of the second or outer telescoping element **24** has a roller **70** positioned to engage the upper, inner surface of the first element **22.** The inner end of carriage element **24** also has wear plates **72** which engage the inner surfaces of element **22.** The outer end of the first or inner telescoping carriage element **22** has pins **74** extending through opposite sides thereof with the inner ends of pins **74** located in the path of movement of wear plates **72.** Thus, pins **74** and wear plates **72** cooperate to define stop means which defines the fully extended position for carriage elements **22** and **24.**

While one type of stop means has been specifically described, it will be appreciated that the fully extended position could readily be defined by other means, such as an additional set of wear plates located on the inner surface adjacent the outer end of carriage element **22** to be located in the path of movement of wear plates **72.** Another type of stop means could be a bar that is welded to the outside of telescoping element **24** which would engage a plate welded to the outer end of telescoping element **22.**

During normal use, telescoping elements **22** and **24** are extended and retracted relative to each other by extension and retraction of ram elements **54** and **58.** However, according to an important feature of the present invention, the fully extended position, defined by stop means **72** and **74,** is reached before fluid ram **52** is in a fully extended position. Thus, when it is desired to remove the counterweight from the crane, it is only necessary to continue extension of fluid ram **52** after elements **22** and **24** are in the fully extended position. This will then pivot carriage **20** and counterweight **30** about horizontal pivot pin **26** to a point where carriage **20** engages a lower edge of member **44.** When this position is reached, the weight is removed from pin **50** so that the pin can be removed with a minimum force. After the pin has been removed, retraction of fluid ram **52** will cause carriage **20** to pivot about horizontal pivot pin **26** and allow the counterweight to be lowered to the ground. Before lowering the counterweight to the ground, removable pins **42** are also removed so that the counterweight will pivot about a horizontal pivot axis defined by pins **34.** The lowered position for the counterweight is shown in phantom in FIG. **3.**

As can be appreciated from the above description, the present invention provides a simple and inexpensive method and apparatus for shifting a counterweight relative to a boom and in which the shifting mechanism can also be utilized for raising and lowering the counterweight with respect to the supporting base. It will be appreciated that while a single carriage element has been shown and described in the preferred embodiment of the present invention, two telescoping carriages **20** are envisioned and these carriages would be horizontally spaced from each other with the outer ends of the second elements **24** interconnected by a mechanism, such as a tie beam **80,** illustrated in FIG. **4.**

What is claimed is:

**1.** In a crane having a base with an extensible and retractable boom supported on said base; a counterweight; counterweight support structure including a counterweight carriage having first and second relatively extensible and retractable elements; horizontal pivot means supporting one of said elements for pivotal movement on said base; releasable counterweight connecting means on said other element for supporting said counterweight; extensible fluid ram means having one end connected to said base and an opposite end connected to said other element for extending and retracting said elements; and support means on said base cooperating with said counterweight carriage, said support means including a member fixed to said base and extending along said one element above said horizontal pivot means and releasable latch means carried by said member and including a pair of vertically depending legs being located on opposite sides of said one element at a location spaced from said horizontal pivot means with free ends located below a lower edge of said one element, said releasable latch means also including releasable pin means extending between said legs below said lower edge, said releasable latch means defining a cradle supporting said counterweight carraige so that said support means (1) normally supports said carriage in a substantially fixed position relative to said base and (2) accommodates pivotal movement of said counterweight carriage on said base so that said counterweight may be lowered and removed from said base.

**2.** A crane as defined in claim **1,** in which said ram means includes first and second extensible and retractable ram elements movable between fully retracted and fully extended positions, said ram elements, when moved to the fully extended position, pivoting said counterweight carriage away from said releasable pin means to allow for removal of said releasable pin means to accommodate pivotal movement of said counterweight carriage away from said member and lower said counterweight.

**3.** A crane as defined in claim **2,** in which said carriage elements are polygonal and are telescoped relative to each other.

**4.** A crane as defined in claim **3,** in which said releasable counterweight connecting means normally holds said counterweight fixed with respect to said other carriage element and incorporates releasable means to accommodate relative pivotal movement between said other element and said counterweight.

**5.** In a crane having a base with an extensible and retractable boom supported on said base; a counterweight; a counterweight carriage having first and second elongated relatively extensible and retractable elements; horizontal pivot means supporting one of said elements for pivotal movement on said base; means on said other element for supporting said counterweight; extensible fluid ram means having one end connected to said base and an opposite end connected to said other element for extending and retracting said ele-

ments; a substantially horizontal elongated support arm on said base extending generally parallel to and above said one of said elements; and releasable latch means carried by said arm and cooperating with said counterweight carriage for normally supporting said carriage in a substantially fixed position on said base for horizontal movement of said elements relative to each other, said latch means being selectively releasable to accommodate pivotal movement of said counterweight carriage on said base so that said counterweight may be lowered by said extensible fluid ram means and removed from said base.

**6.** A crane as defined in claim **5,** in which said elements have cooperating stop means that define a fully extended position for said elements so that extension of said fluid ram means will cause engagement of said stop means and continued extension will pivot said carriage about said horizontal pivot axis to accommodate release of said latch means and subsequent retraction of said fluid ram means will pivot said carraige about said horizontal pivot axis to lower said counterweight.

**7.** A crane as defined in claim **5,** in which said latch means includes a removable pin extending below said one element for normally supporting said carriage in a fixed position.

**8.** A crane as defined in claim **7,** in which said counterweight is pivotally supported on said carriage.

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