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Mordre

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[54] **VARIABLE CAPACITY CRANE HOIST**

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[52] **U.S. Cl.** **212/11,** 254/188

[51] **Int. Cl.** **B66c 17/00**

[58] **Field of Search** 212/10, 11, 14, 15, 21, 212/22, 125, 128; 254/189, 188; 214/86, 87, 212/88

[56] **References Cited**

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[57] **ABSTRACT**

A convertible crane is provided with a main trolley which carries a powered hoist along a pair of girders and a trailer trolley which carries a set of sheaves. A traveling block is reeved by a line to sheaves on the main trolley and to sheaves on the the trailer trolley. The trailer trolley increases the load carrying capacity of the main trolley by increasing the number of parts of line and increasing the number of load bearing points on the girders and the distance between these points. The main trolley is designed to carry ordinary loads with the trailer trolley being employed only for initial high capacity loads.

10 Claims, 4 Drawing Figures

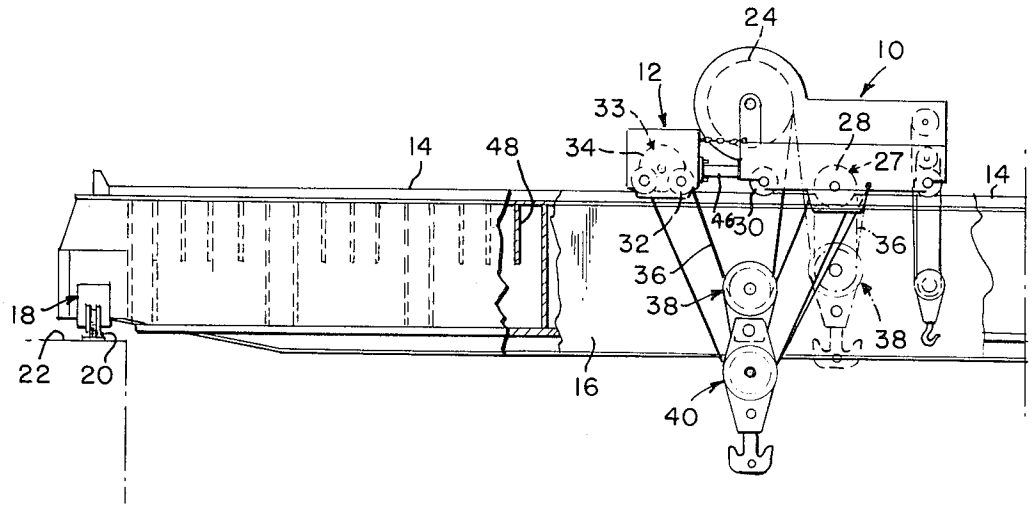
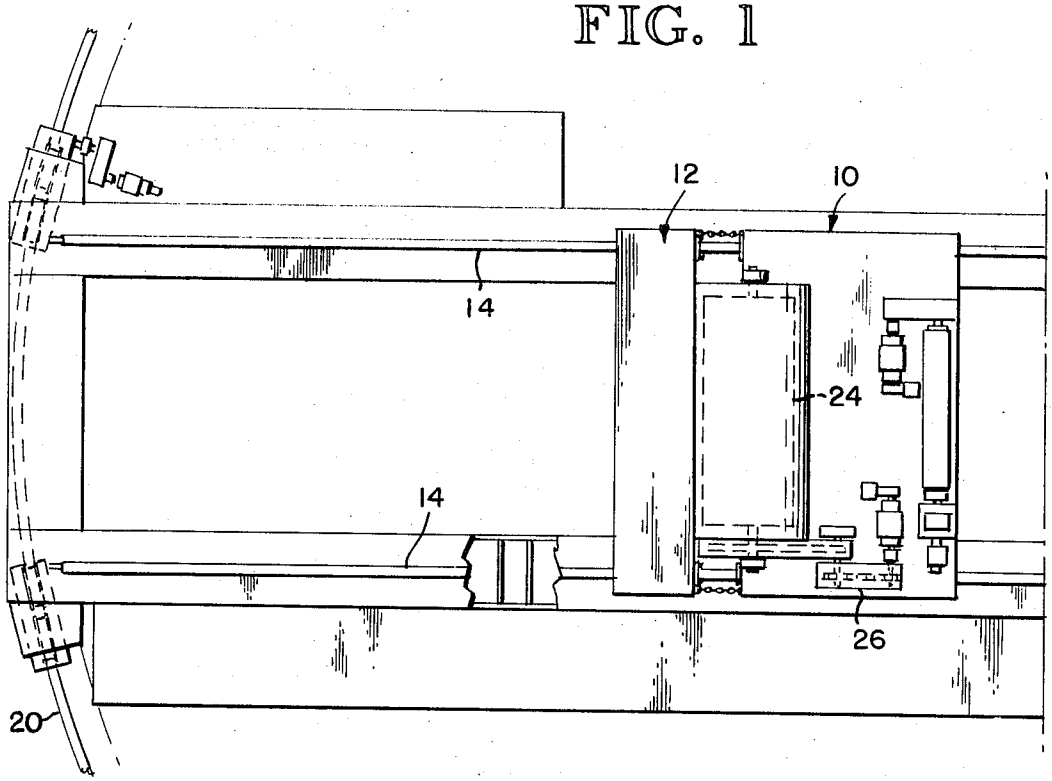


FIG. 1


12
10
14
24
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26
20

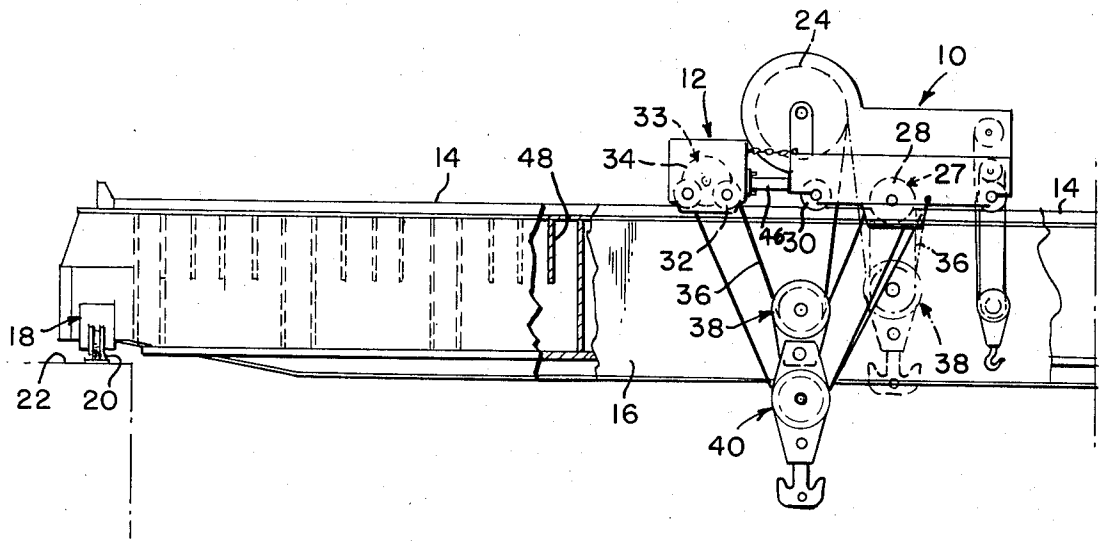

24
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12
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FIG. 2

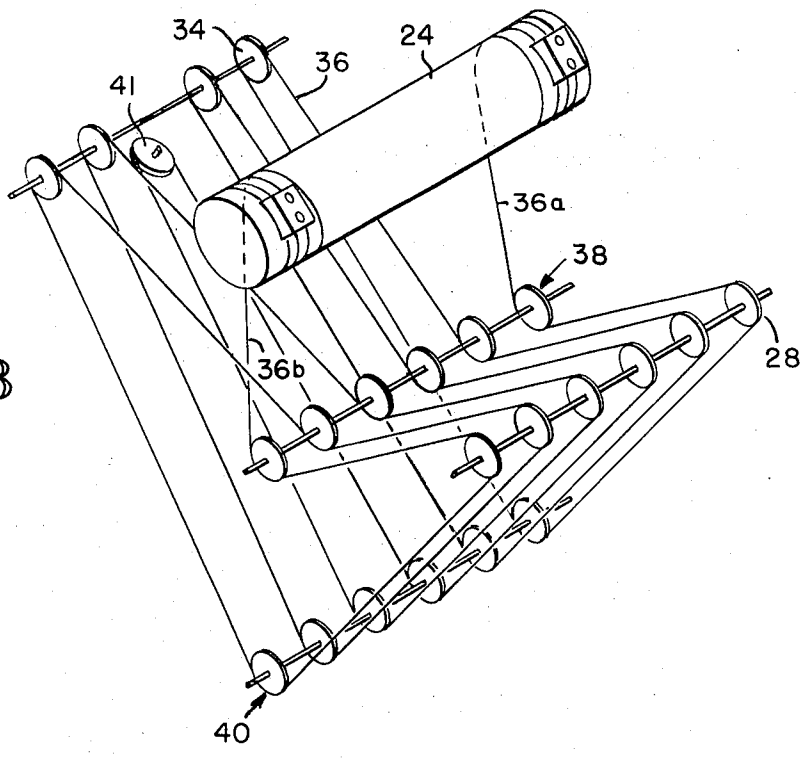


FIG. 3

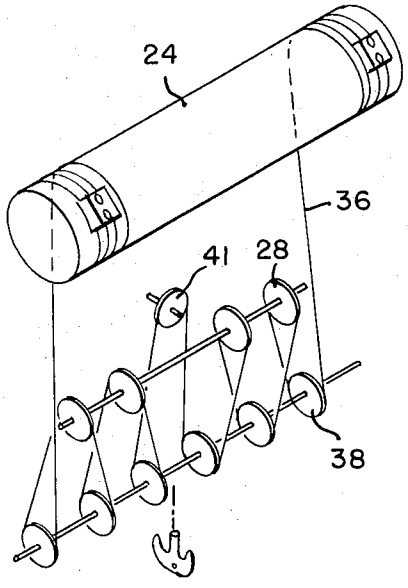


FIG. 4

VARIABLE CAPACITY CRANE HOIST

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to cranes of the type in which a support holds a hoist on a girder.

2. Description of the Prior Art

A common problem in the construction of hydroelectric dams, atomic reactors, and other construction projects which ultimately require a long-lasting crane is that the crane frequently is temporarily used during the initial construction and the placement of permanent equipment at the site but thereafter is required only for repair work on this equipment. The subsequent use of the crane for repair work requires substantially less load capacity than for the initial construction. For example, in a nuclear reactor, a typical load capacity for initial construction, may be 400 tons whereas the subsequent capacity for ordinary long term use of the crane may be as small as 200 tons or less.

One proposed solution to this problem is to construct the crane initially for its maximum capacity. Since the crane must be designed for a useful life of 50 to 100 years, this solution is extremely expensive because of the wasted components that later may not be used and the increased amount of strengthening and power to provide for the higher capacity. For example, if the basic hoist support is modified to increase its capacity, most of the components of the hoist support must be increased in size thus increasing the weight of the hoist support and in the case of mobile hoists, requiring a modification of the trolley drive. Furthermore, the girders or beams supporting the hoist support must also be strengthened to carry the load of the heavier hoist support and the heavier loads. Another equally expensive solution customarily employed is to install a large capacity crane for the initial construction and then disassemble the crane and replace it with a smaller capacity. crane designed for long life.

Alternatively, some permanent low capacity hoists must temporarily be used for higher capacity loads. In this situation, the problem has heretofore likewise been met with expensive over capacity design for permanent use.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a method of temporarily converting a crane designed for ordinary small capacity loads to a crane for higher capacity loads.

It is another object of this invention to provide a crane having a main support for the hoist designed for small capacity loads in ordinary use and supplemented by a temporary secondary support for substantially increasing the lifting capacity of the combined supports.

It is still another object of this invention to provide a method of temporarily increasing the lifting capacity of a crane without substantially increasing the cost or efficiency of the crane.

It is another object to provide method and apparatus to temporarily convert a mobile crane having a low capacity hoist to a higher capacity hoist.

It is another object to convert a low capacity traveling block to a higher capacity block without substantially increasing the axial length of the block.

Basically, these objects are obtained by providing a convertible crane having a main support designed for ordinary loads of a first capacity and for a long life span, a traveling block, and a secondary support carrying a plurality of sheaves for increasing the number of parts of line to the traveling block and for more uniformly distributing the load at the traveling block over the girders or other platform.

With this system, the main support can be designed for the lower capacity at a great savings in expense and efficiency and the main and secondary supports can be temporarily combined to increase the lifting capacity of the total crane. The secondary support, in the case of initial high capacity needs, can then be removed after the initial construction phase and possibly used again at another construction site. Since the main support is designed for ordinary lower capacity use, it can be built with smaller components than for the larger capacity of the girders. Another advantage for designing the crane for its normal lower capacity use is that the supports can be reduced in size allowing in the case of bridge cranes a lower roof or ceiling over the crane and allowing use of the hoist closer to the side walls of the building. This is particularly important in large construction projects.

BRIEF DESCRIPTION OF THE FIGURES OF THE DRAWINGS

FIG. **1** is a schematic plan of a preferred embodiment of a crane embodying the principles of the invention.

FIG. **2** is a side elevation of the crane shown in FIG. **1.**

FIG. **3** is a typical reeving system employed with the crane of FIG. **1.**

FIG. **4** is a typical reeving system employed with the portion of the crane shown in FIG. **1** which is left after the initial construction is completed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention as described above applies to both fixed cranes and mobile cranes with or without independent trolleys. For the purpose of this description, however, only a mobile crane will be described.

As best shown in FIGS. **1** and **2**, a typical mobile crane includes a main or primary trolley or support **10** joined to a secondary or trailer trolley or support **12.** The trolleys ride on tracks or rails **14** secured to conventional girders **16.** The girders are provided with trucks **18** that ride on rails **20.** The rails **20** are secured to the floor **22** of the upper story of the construction site. The main trolley, girders and trucks, are well known in this art and all details are not necessary for a full understanding of the invention. Accordingly, only those details necessary to an understanding of the invention will be described.

The main trolley **10** is provided with a hoist drum **24** powered by a motor and drive **26.** As best shown in FIGS. **2** and **3,** the main trolley is also provided with a stationary upper block **27** having a set of sheaves **28.** The trolley is supported on the rail **14** by wheels **30.**

The trailer trolley **12** is also provided with wheels **32** which ride on the track **14** and with a stationary upper block **33** having a plurality of sheaves **34.** A line **36** is reeved about the sheaves **28** and **34** and is wrapped on the hoist drum **24** with two simultaneous wraps. The

free ends of the line are secured to the drum near its outer ends. Thus rotation of the drum will simultaneously wrap both ends of the line **36** on the drum. The line is also reeved around upper and lower traveling blocks **38** and **40**, respectively in the manner shown in FIG. **3**. The line passes over a conventional equalizing sheave **41** in a conventional manner to balance the load on the two parts of the line **36**. In other words, each of the two parts of the line **36** are joined on opposite sides of the equalizing sheave **41**. Sheave **41** is mounted for rotation generally at a right angle to the axes of rotation of the sheaves **28**. In general, this reeving arrangement is conventional and well known in the art. Both parts **36***a* and **36***b* of the line **36** are arranged to be closely adjacent the center of the drum **24** when the traveling blocks **38** and **40** are in an uppermost position. In this manner the lead angle of the line approaching the hoist drum is kept at a minimum.

By increasing the number of sheaves through the use of a trailer trolley the number of parts of line are increased thus increasing the loading capacity of the trailer and main trolley. The number of parts is increased without adding additional transverse width to the main trolley and thus keeps the lead angle on the sheaves of the main trolley stationary block well below the practical limit of 3°. If, for example, the additional lift capacity needed for initial construction were to be obtained solely by increasing the number of sheaves on the main trolley, then the traveling block would have to be also increased axially to avoid too great a lead angle between the main trolley block and the traveling block.

Another unique feature of the invention is the use of a temporary piggyback traveling block. The piggyback block, which has applications other than with the main and secondary hoist supports of this invention, is especially useful for increasing the lifting capacity of a hoist at less expense and keeping the axial length of the traveling block to a minimum. The blocks other than being releasably pinned together in piggyback fashion are conventional in construction. Thus in the embodiment disclosed the upper traveling block **38** is used not only during initial construction but is retained as a permanent part of the main trolley after initial construction as part of the main trolley's ordinary use, as shown in phantom lines in FIG. **2**, after the trailer trolley and block **40** are removed.

The trailer trolley abuts the main trolley by bumpers **46**. A chain connects the two trolleys so that the trailer trolley can be pulled with the main trolley. An important advantage of the use of two trolleys to carry the greater construction loads is that the loading on the beam **16** is distributed over a greater length of beam and over the additional four points provided by the wheels of the trailer trolley. This reduces the amount of expensive strengthening of the beam required for greater than ordinary loads. This savings represents a great cost savings since strengthening of fabricated beams of the type customarily employed usually means increasing the cross-section and adding additional diaphragms or plates **48** to the beam which are generally very difficult to install.

The operation of the mobile crane is readily apparent. During initial construction the reeving is shown as in solid lines in FIG. **2** and as in FIG. **3** and the load, for example **400** tons, is supported by both the main trolley and the trailer trolley substantially equally. Thus the main trolley need be designed for only one-half the load or 200 tons. Obviously increases in capacity other than double are obtainable with the temporary supplemental support concept of this invention. After initial construction, the trailer trolley can be easily removed and the reeving changed to that shown in the phantom line position with only the main trolley and upper traveling block **38** being employed. Since the number of parts of line is substantially reduced, the operating speed over that of the combined main and trailer trolleys is increased. The temporary increase in parts of line for the increased capacity use does not generally require a larger hoist drum since the higher capacity uses generally require lifting through shorter distances than for the ordinary lower capacity use.

The method of the invention includes the steps of temporarily providing an independent secondary support such as a mobile trailer in the method illustrated for use with a main hoist support such as the mobile hoist-supporting trolley illustrated, with the former being capable of carrying only loads of a first small capacity, and supporting a traveling block by reeving between the main and secondary supports to distribute a load of a substantially greater amount than the smaller capacity of the main support between the main support and the secondary support. Thus the method allows the use in the embodiment illustrated of a single low capacity trolley for both high capacity initial construction and lower capacity ordinary use.

To give some idea of the savings available, one crane installation employed a set of girders **16** that were 115 feet long and 10 feet high with an approximate weight of trolleys and girders of 470,000 pounds. With such large structures any percentage weight increase by having to use a conventional larger permanent hoist results in a considerable savings in cost. Furthermore, manufacturing and handling the hoist trolley is considerably easier when using two smaller trolleys rather than a single larger trolley as in conventional practice.

While the preferred forms of the invention have been illustrated and described, it should be understood that variations will be apparent to one skilled in the art without departing from the principles of the invention. Accordingly, the invention is not to be limited to the specific embodiments disclosed.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A convertible crane suitable for large-capacity temporary use and long-life, lower capacity ordinary use comprising primary support means movable along a horizontal surface and carrying powered hoist means for lowering and and raising a line, means on said primary support means for propelling the primary support means along said horizontal surface, said hoist means being designed for ordinary use substantially less than the capacity for said temporary use, and secondary support means on said horizontal surface for supporting auxiliary sheave means for receiving said line, movement of said primary and secondary support means along said horizontal surface being powered by said propelling means on said primary support means and traveling block means for receiving said line from said hoist means and said auxiliary sheave means and adapted to be connected to a load whereby the combined primary and secondary support means increases the load capacity of the crane to said large capacity for

temporary use but without substantially increasing the size of the primary support means and powered hoist means.

2. The crane of claim **1** said traveling block including two sets of sheaves vertically overlying one another and removable from one another whereby one set of sheaves can be removed leaving a single set for said ordinary use to increase the speed of lifting.

3. The apparatus of claim **1**, said auxiliary sheave means being rotated solely by the line from said traveling block means.

4. The apparatus of claim **3**, said crane including girder means movable along a track, said horizontal surface including an upper end of said girder means.

5. A convertible crane suitable for large capacity temporary use and long-life, lower capacity ordinary use comprising primary support means carrying powered hoist means for lowering and raising a line, said hoist means being designed for ordinary use substantially less than the capacity for said temporary use, and secondary support means for supporting auxiliary sheave means for receiving said line, and traveling block means for receiving said line from said hoist means and said auxiliary sheave means and adapted to be connected to a load whereby the combined primary and secondary support means increases the load capacity of the crane to said large capacity for temporary use but without substantially increasing the size of the primary support means and powered hoist means, said crane including girder means movable along a track, said primary support means including a mobile primary trolley movable along said girder means, said secondary support means including a trailer trolley operatively connected to the primary trolley for movement therewith.

6. The apparatus of claim **5** said primary and trailer trolleys being joined by a compression member to withstand the compressive forces acting therebetween when lifting a load.

7. The apparatus of claim **5**, said girder means including a pair of spaced girders movable jointly along said track.

8. A method of temporarily increasing the capacity of a crane from a first capacity to a larger capacity comprising;

providing a first hoist support capable of carrying loads only of a first capacity, self-propelling the first hoist support along a horizontal path,

providing a second support spaced horizontally from said first hoist support along said horizontal surface and capable of carrying loads only of a second capacity less than said crane larger capacity, propelling said second support along said horizontal surface by movement of said first hoist support and

providing a traveling block adapted for connection to a load supported by a line reeved in desired ratio from said first and second supports for increasing the capacity of the crane to said larger capacity by combining the capacities of said first and second supports.

9. The method of claim **8** including the step of reducing the load-carrying capacity of the crane by removing the second support from the crane.

10. The method of claim **8** wherein said second support carries a plurality of sheaves, said step of supporting the traveling block including reeving a line between said second support, said first support and two vertically spaced sets of sheaves on said traveling block and including the step of increasing the lifting speed of said crane by removing the line from said second support and one set of sheaves on said traveling block to increase the lifting speed of the hoist.

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