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R. P. ANDERSON

3,111,228

CRANE

Filed Feb. 12, 1962

3 Sheets-Sheet 1

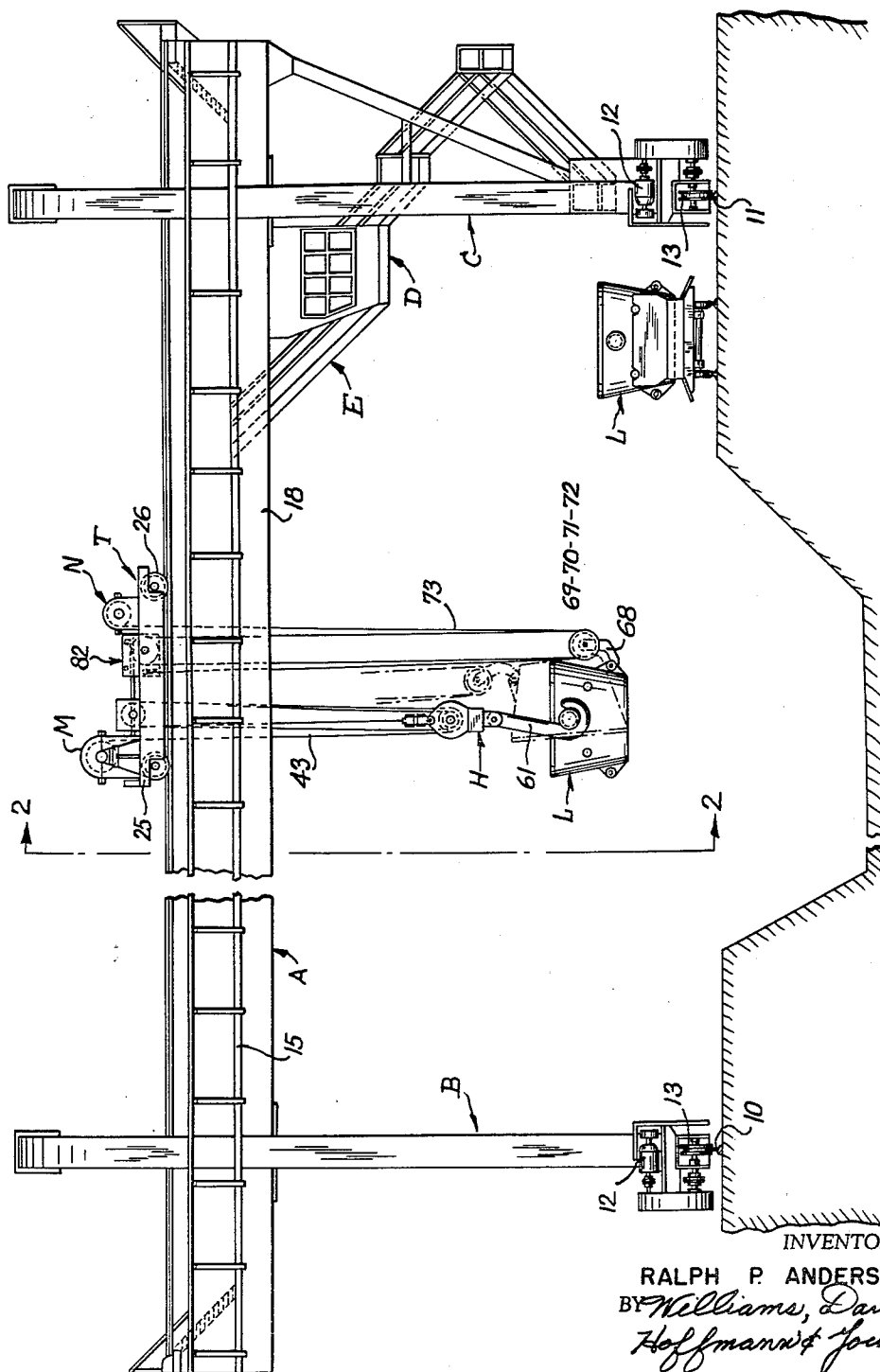


FIG. 1

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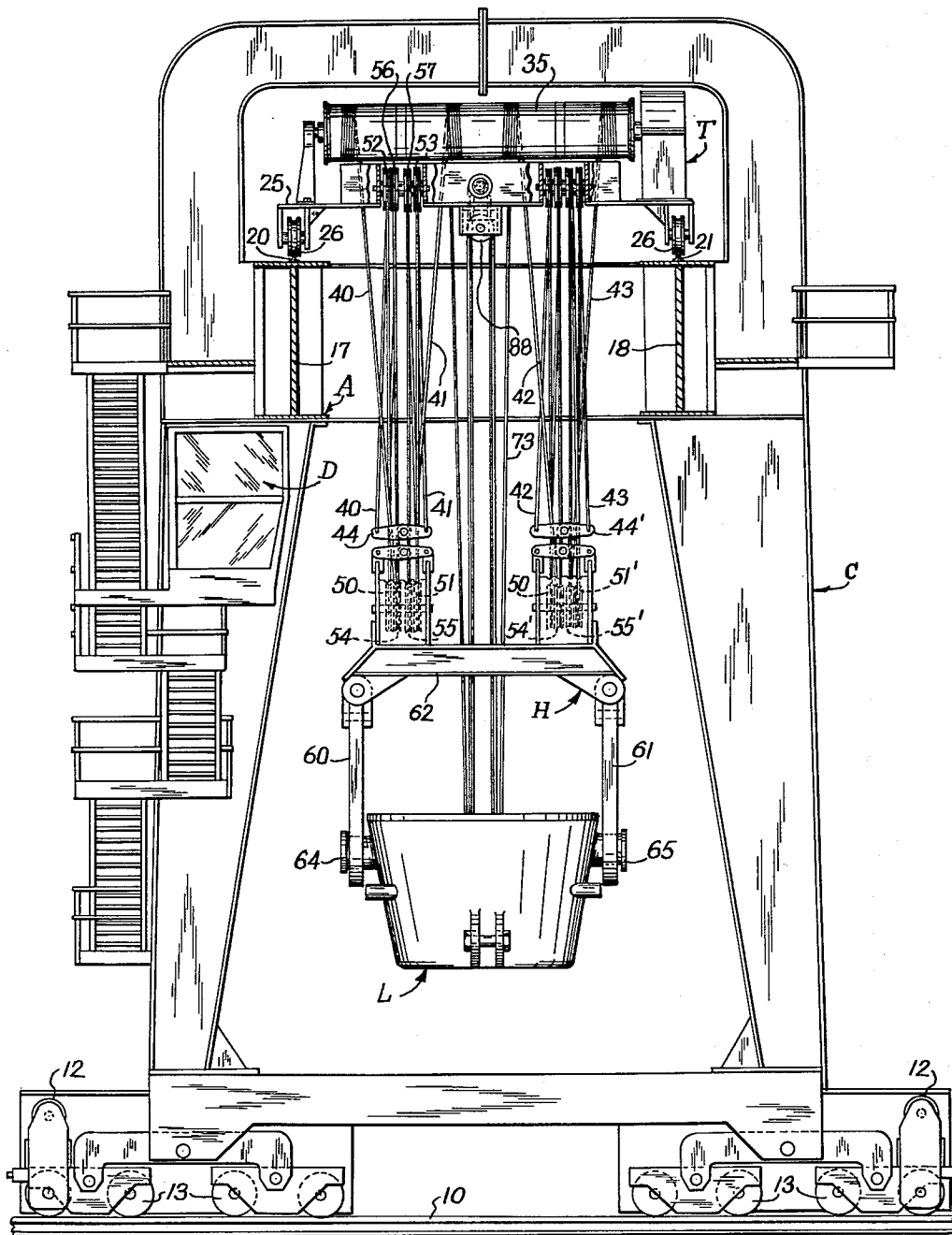
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FIG. 2

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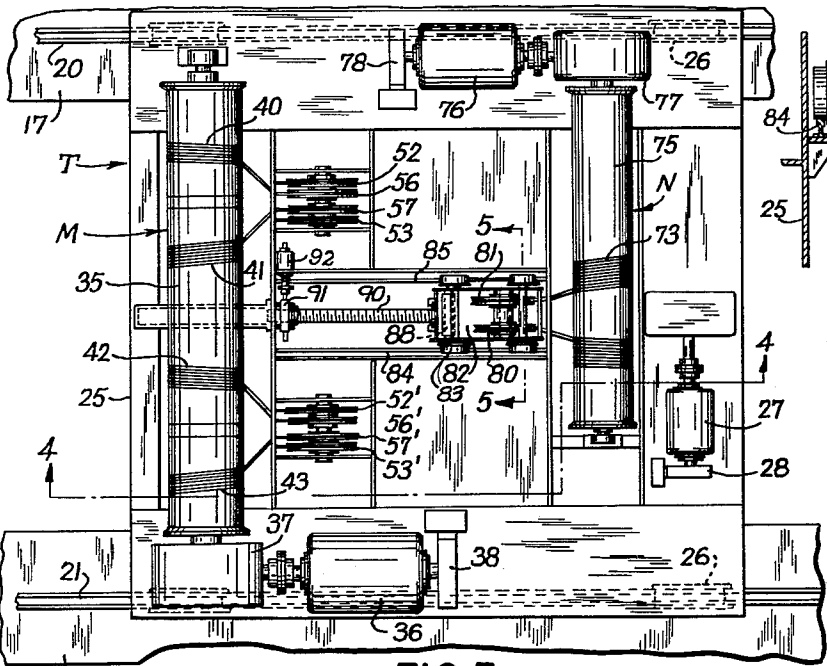


FIG. 3

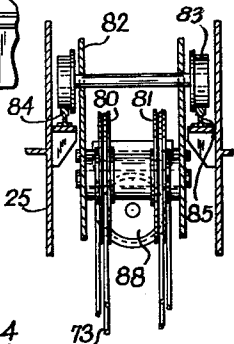


FIG. 5

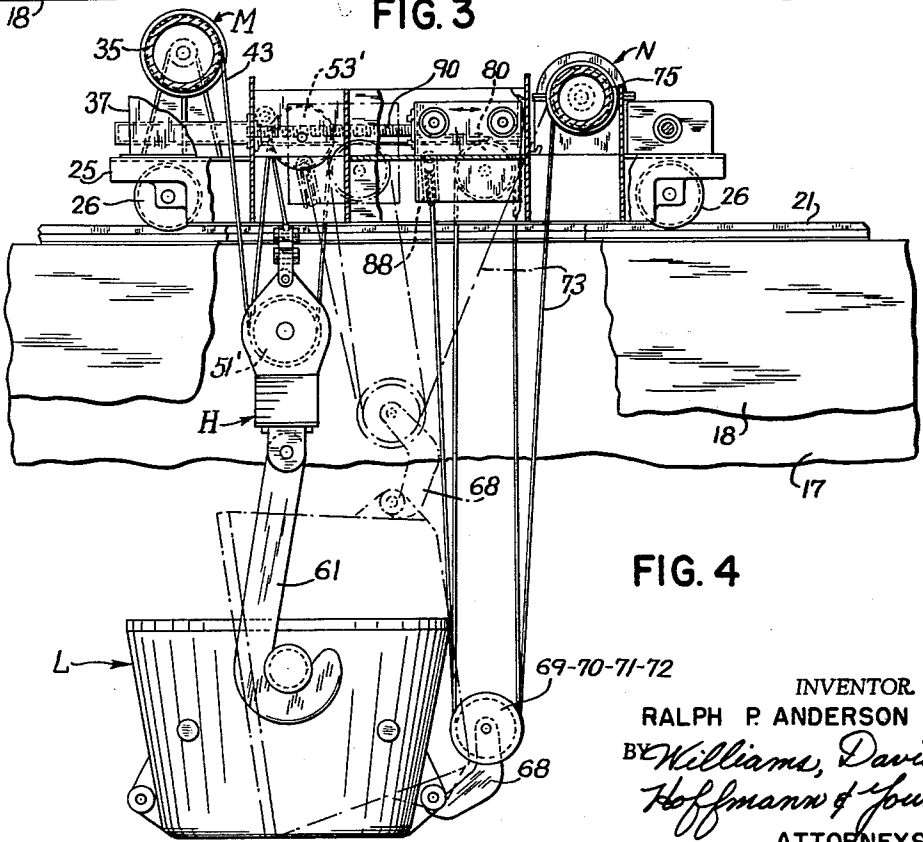


FIG. 4

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3,111,228

CRANE

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3 Claims. (Cl. 212-130)

The present invention relates to cranes and more particularly to cranes especially designed for dumping ladles, such as, slag ladles employed in steel mills.

One of the principal objects of the invention is the provision of a crane especially adapted for dumping ladles, and the like, which is relatively inexpensive in construction but efficient and reliable in operation.

More specifically, the invention contemplates the provision of a crane especially adapted for dumping large ladles, and the like, having a horizontally movable trolley comprising a main hoist mechanism for lifting the ladle and an auxiliary hoist mechanism for tilting the ladle, the hoist mechanisms, or at least parts thereof, being movable horizontally in the trolley relative to one another so that the grabs of the respective hoist mechanisms can be moved closer together as the ladle is tipped.

The invention resides in certain constructions and combinations and arrangements of parts and further advantages of the invention will be apparent to those skilled in the art to which it relates from the following description of the preferred embodiment described with reference to the accompanying drawings forming a part of this specification, and in which:

FIG. 1 is a side elevational view of a crane embodying the present invention;

FIG. 2 is a sectional view, with parts omitted, approximately on the line 2-2 of FIG. 1;

FIG. 3 is a fragmentary plan view of the crane;

FIG. 4 is a fragmentary side elevational view of the crane with parts in a different operating position, other parts broken away, and portions in section approximately on the line 4-4 of FIG. 3; and

FIG. 5 is a sectional view, with portions in elevation, approximately on the line 5-5 of FIG. 3.

While the invention is susceptible of various modifications and alternate constructions, the present preferred embodiment is shown in the drawings and herein described in detail. It is to be understood, however, that there is no intention to limit the invention to the apparatus shown, but it is the intention to cover hereby any and all embodiments of the invention herein disclosed.

Referring to the drawings, the crane shown therein is a traveling-type gantry crane formed of a plurality of structural members welded or otherwise secured together and comprising a horizontal bridge member or structure A supported by side frame members or structures B, C, connected to the bridge A adjacent to its opposite ends. The side frames B, C, are supported on and travel along spaced rails 10, 11 forming a wide runway along which the crane is driven by operator controlled reversible electric bridge travel motors 12, suitably connected to one or more of the support wheels 13 of the end frame. The control for the motors 12, as well as the other motors of the crane, hereinafter referred to, is located in a control cab D fixedly suspended from the bridge A and

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to which access may be had by means of a stairway, designated generally by the reference character E. The stairway E also provides access to the walkway 15 extending around the bridge, etc. The crane thus far described may be of any commercial construction and will not be further described except to say that the bridge A comprises two girders 17 and 18 having rails 20, 21 on their top sides which form a runway for a carrier or trolley T.

The trolley T comprises a suitable frame 25 provided with a plurality of wheels 26 by which it is supported for movement lengthwise of the bridge upon the bridge runway formed by the rails 20, 21 on the girders 17, 18. The right-hand end wheels 26, as the trolley is viewed in the drawings, are driven by an operator controlled reversible electric trolley travel motor 27 on the trolley frame 25 and connected to the wheels, referred to, in a conventional manner. The construction is such that the trolley may be traveled selectively in either direction by the crane operator or held in a predetermined position upon the bridge A, the motor 27 being provided with an automatic solenoid operated brake 28.

The trolley T shown is provided with a main hoist mechanism, designated generally by the reference character M and an auxiliary hoist mechanism, designated generally by the reference character N. The main hoist mechanism comprises a cable drum 35 adapted to be rotated in opposite directions by a reversible electric main hoist drive motor 36 fixed to the frame 25 of the trolley and under the control of an operator in the control cab D. The motor 36 is connected to the cable drum 35 by a conventional drive mechanism 37 including a hoist brake. The motor 36 is also supplied with an automatic solenoid operated brake 38.

The main cable drum 35 is provided with two pairs of cables 40, 41 and 42, 43 adapted to be wound onto the near and far ends of the cable drum, respectively, as viewed in the drawings, or unwound therefrom depending upon the direction of rotation of the drum 35. The ends of the main hoist cables 40, 41 not connected to the drum 35 are connected to opposite ends of a member 44, the center of which is pivotally connected by a link to one side of a grab assembly, designated generally by the reference character H. From the cable drum 35, the cables 40, 41, pass downwardly about sheaves 50, 51 rotatably connected to the grab assembly H adjacent to the connection of the member 44 thereto. From the sheaves 50, 51, the cables extend upwardly and about sheaves 52, 53, rotatably supported in the frame 25 of the trolley. From the sheaves 52, 53, the cables extend downwardly around sheaves 54, 55, coaxial with and similar to the sheaves 50, 51, previously referred to, then upwardly and about sheaves 56, 57 in the frame of the trolley coaxial with and similar to the sheaves 52, 53. From the last mentioned sheave, the cables extend downwardly to the member 44 to which the ends thereof are fixedly secured.

The other pair of main hoist cables 42, 43 are connected to the main hoist drum 35 and to the grab H in a manner similar to that in which the main hoist cables 40, 41 are connected thereto, and will not be described in detail. In the drawings the corresponding parts are designated by the same reference characters with prime marks applied thereto. It is to be understood, however, that the second pair of main hoist cables 42, 43 are connected to the opposite end of the grab H from the end to which the

first mentioned main hoist cables 40, 41 are connected thereto.

The grab assembly H comprises a plurality of hook members 60, 61 pivotally connected to a cross member 62 to which latter member the bottom sheaves about which the main hoist cables engage are connected. The lower ends of the hook members 60, 61 are adapted to engage about projections 64, 65, respectively, on opposite sides and adjacent to the top of a ladle L which it is desired to dump.

From the foregoing it will be apparent that as the main hoist mechanism M is operated to wind or unwind the main hoist cables on or off of the main hoist cable drum 35, the grab assembly H and in turn the ladle L will be raised or lowered depending upon the direction of rotation of the cable drum 35.

In addition to the main hoist mechanism M, the trolley T comprises the auxiliary hoist mechanism N, previously referred to. This mechanism includes an auxiliary grab assembly including a hook member 68 pivotally connected between two pairs of coaxial sheaves 69, 70 and 71, 72 and which assembly is suspended by a cable 73, opposite ends of which are connected to and adapted to be wound on or unwound off an auxiliary cable drum 75 rotatably supported in the frame 25 of the trolley T. The drum 75 is adapted to be rotated in opposite directions by an operator controlled reversible electric motor 76 carried by the frame 25 of the trolley T and connected to the auxiliary cable drum 75 by a suitable drive 77 similar to the drive 37, previously referred to. The motor 76 is also provided with an automatic solenoid operated brake 78. From the auxiliary cable drum 75, the opposite end reaches of the cable 73 extend downwardly and then about the two outer sheaves 69, 72, then upwardly and about sheaves 80, 81 pivotally connected to a carriage 82 supported by wheels 83 on a runway formed of two spaced rail-like members 84, 85 fixed in the frame 25 of the trolley T. The members 84, 85 extend lengthwise of the trolley and are located between the main and auxiliary cable drums 35, 75 which drums are parallel to one another and extend transversely of the length of the trolley T, that is, transversely of the direction in which the trolley T moves on the bridge A. From the sheaves 80, 81, the auxiliary hoist cable 73 extends downwardly about the inner two sheaves 70, 71 and then upwardly where the center loop of the cable passes over an equalizing sheave 88 pivotally connected to the carriage 82 on the trolley T. The carriage or movable assembly 82 is adapted to be moved lengthwise of the runway formed by the rail-like members 84, 85 by a lead screw 90 fixedly connected to the left-hand end of the carriage, as viewed in the drawings, and projecting through a rotatable nut located in a housing 91 connected to the frame 25 of the trolley. The threaded nut, referred to, has a worm wheel formed on its exterior which is continuously in mesh with a worm rotatably supported in the housing 91 and adapted to be driven in opposite directions by an operator control reversible electric worm drive motor 92, carried by the frame 25. The construction is such that when the motor 92 is operated the carriage 82 and in turn the sheaves 80, 81, 88, are moved lengthwise of the trolley T depending upon the direction of rotation of the motor 92.

In operation, the auxiliary hook-like grab 68 is connected to the ladle L adjacent to the bottom thereof at a point spaced approximately midway between the projections 64, 65 engaged by the main grab H, and with the ladle L suspended by the main grab it is dumped by actuation of the auxiliary hoist mechanism N to raise the auxiliary grab 68 and thus tilt the ladle about an axis extending through the projections 64, 65 thereof. The runway formed by the rail-like members 84, 85 is preferably of such a length that when the carriage 82 is at the end thereof adjacent to the auxiliary drum 75 the auxiliary grab 68 and the sheaves to which it is connected are approximately in line with the edge of the ladle. As the

auxiliary grab is raised by actuation of the auxiliary hoist mechanism N to dump the ladle, the worm drive motor 92 is operated to move the carriage 82 towards the opposite end of the runway formed by the rail-like members 84, 85, that is, towards the main hoist drum 35, so as to keep the pull on that part of the auxiliary hoist cable extending from the carriage 82 to the auxiliary grab assembly substantially vertical or slightly inclined towards the main hoist mechanism. As the dumping of the ladle L progresses the carriage moves towards the main hoist as indicated in dot-dash lines in FIGS. 1 and 4 of the drawings. The advantage of this construction is the fact that as the ladle is dumped the pull exerted by the auxiliary hoist mechanism is maintained in a direction for maximum efficiency. As the ladle L is again righted the carriage 82 is returned to its initial starting position shown in full lines in the drawings.

As an alternative construction to that shown, the main and auxiliary hoist mechanisms may be made movable in their entirety relative to one another, but the preferred construction shown is considered a less expensive way of accomplishing the desired result.

From the foregoing discussion of the preferred embodiment of the invention, it will be apparent that the objects heretofore enumerated and others have been accomplished and that there has been provided a novel and improved crane especially designed for dumping large ladles. As previously mentioned, the invention is not limited to the particular construction shown, but it is the intention to hereby cover any construction utilizing a trolley having both main and auxiliary hoist mechanisms movable relatively towards and away from one another for the purpose indicated or in which parts of the hoist mechanisms are movable relative to one another, as in the preferred embodiment shown.

Having thus described my invention, what I claim is:

1. In a crane: an overhead bridge; a crane trolley movable along said bridge; a main grab assembly; a first sheave rotatably connected to said main grab assembly; a main hoist on said trolley comprising a main hoist cable drum; a main hoist cable extending from said main hoist cable drum, encircling said first sheave and returning to said crane trolley; an auxiliary grab assembly; a second sheave rotatably connected to said auxiliary grab assembly; an auxiliary hoist on said trolley comprising an auxiliary hoist cable drum; an auxiliary hoist cable extending from said auxiliary hoist cable drum, encircling said second sheave and returning to said crane trolley; means supporting said cable drums in said trolley for rotation but against linear movement relative thereto; and means for moving a portion of one of said cables other than the portion thereof on its cable drum in a generally horizontal direction relative to the other of said cables.

2. In a crane: an overhead bridge; a crane trolley movable along said bridge; a main hoist on said trolley comprising a main hoist cable drum; a main grab assembly adapted to engage a ladle; a first sheave rotatably connected to said main grab assembly; a main hoist cable operatively connected to said main hoist drum and having a depending loop reaved about said first sheave and returned to said trolley; an auxiliary hoist on said trolley comprising an auxiliary hoist cable drum; an auxiliary grab assembly adapted to engage a ladle; a second sheave rotatably connected to said auxiliary grab assembly; cable supporting means slidably supported in said crane trolley for movement in a general horizontal direction toward and from said auxiliary hoist cable drum; an auxiliary hoist cable operatively connected to said auxiliary hoist cable drum and having a depending loop reaved about said second sheave and returned to said cable supporting means slidably supported in said crane trolley, and means for moving said cable supporting means.

3. In a crane: an overhead bridge; a crane trolley movable along said bridge; a main grab assembly adapted to engage a ladle; a main hoist on said trolley comprising a

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main hoist cable operatively connected to said main grab assembly; an auxiliary hoist on said trolley comprising an auxiliary hoist drum; an auxiliary grab assembly adapted to engage a ladle; first sheave means rotatably connected to said auxiliary grab assembly; second sheave means slidably supported in said crane trolley for movement in a generally horizontal direction towards and from said auxiliary cable drum; an auxiliary hoist cable having opposite ends thereof operatively connected to said

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auxiliary cable drum and having its intermediate portion reaved about said first and second sheave means; and power means for moving said second sheave means in said generally horizontal direction towards and from said auxiliary cable drum.

**References Cited in the file of this patent****UNITED STATES PATENTS**

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