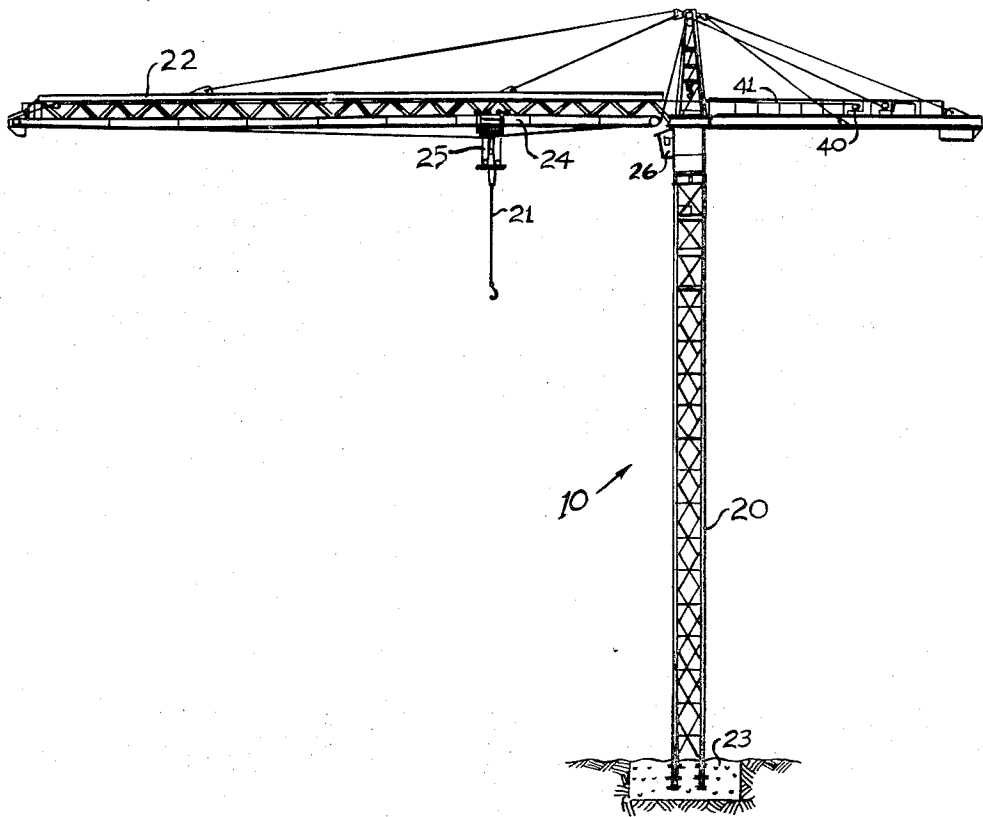


[54] CRANE TROLLEY INDICATOR
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[22] Filed: Nov. 24, 1972
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340/267 C
[51] Int. Cl. B66c 23/02
[58] Field of Search 212/63; 254/173 R; 187/9,
187/10; 340/177 R, 267 C
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Primary Examiner—Allen N. Knowles
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Chovanes

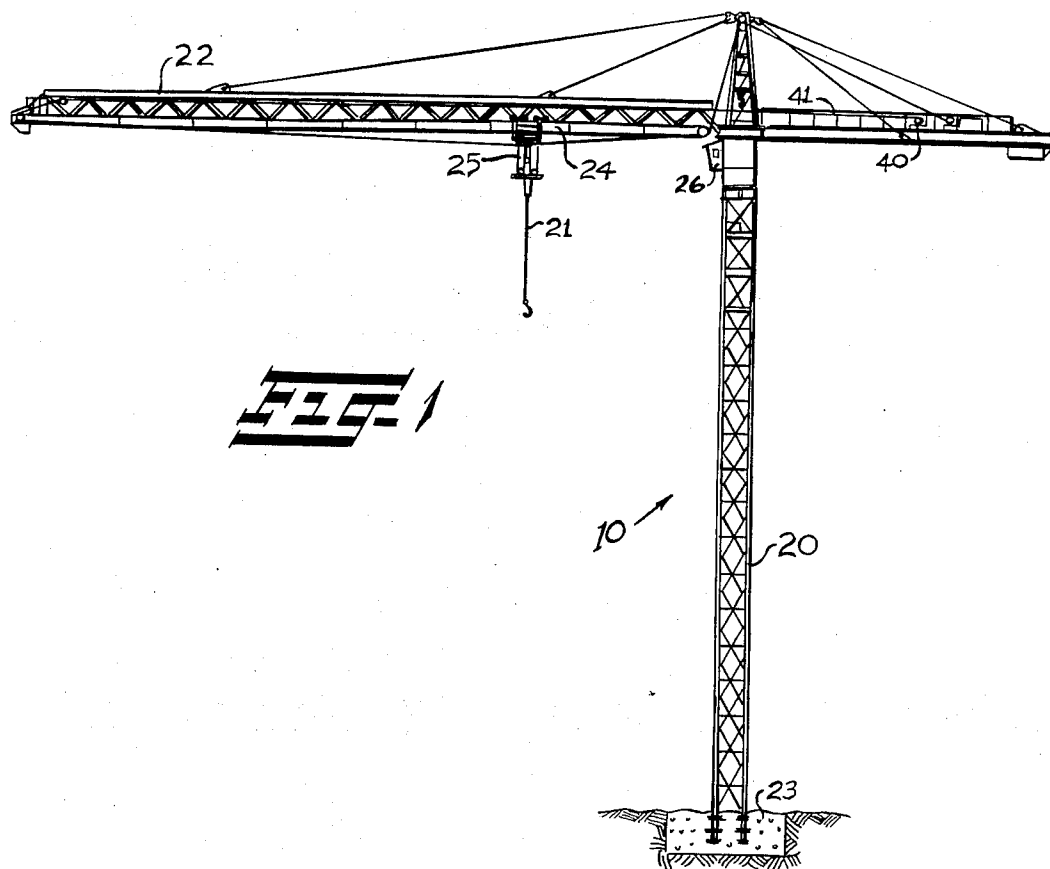
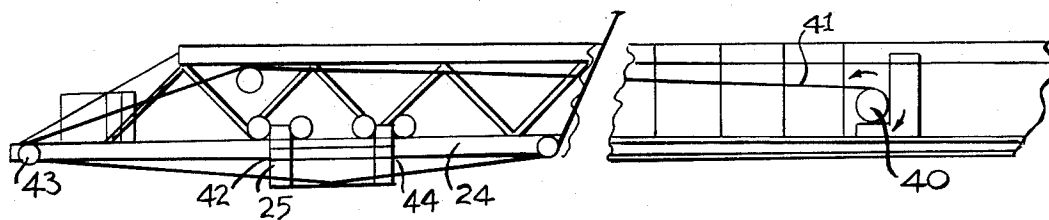
[57] ABSTRACT
A device for indicating the location of the trolley on the horizontal boom of a tower crane. A monitor on the trolley cable drive drum sends a signal to a meter in the operator's cabin within the mast of the crane.
1 Claim, 4 Drawing Figures



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SHEET 1 OF 2



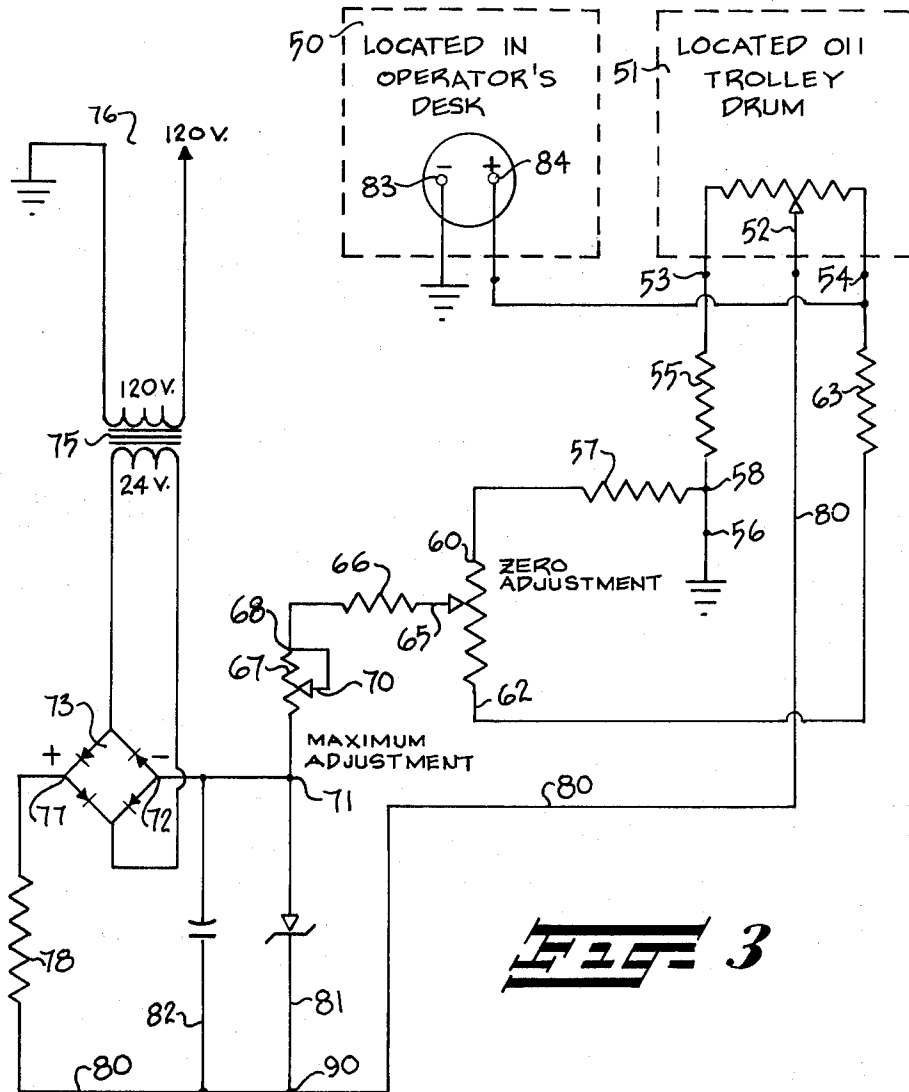


FIG. 3

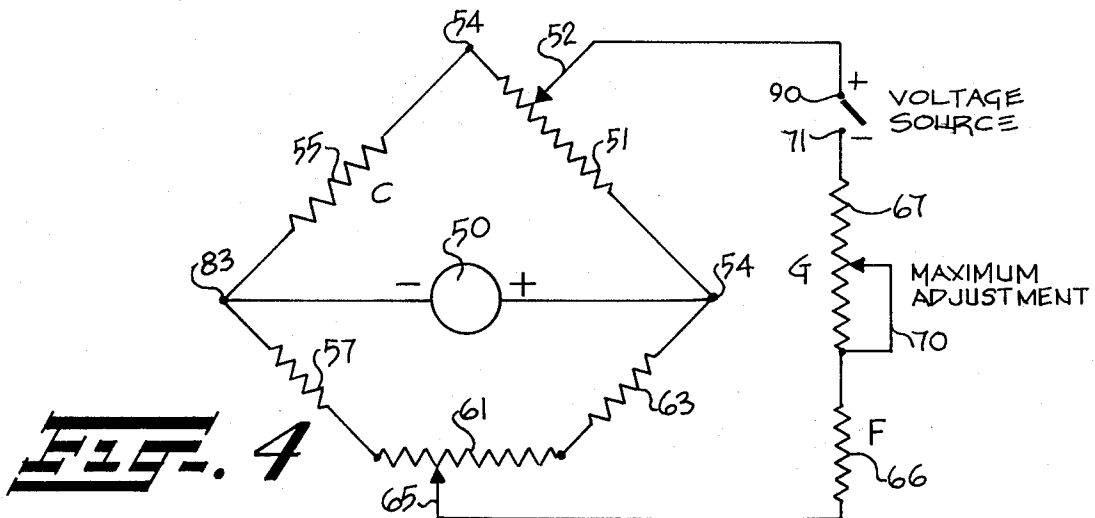


FIG. 4

CRANE TROLLEY INDICATOR

BACKGROUND OF THE INVENTION

Construction tower cranes, including those of the climbing type, have essentially a vertical or mast portion and a horizontal boom portion which in cantilever manner extends from the mast and rotates thereon. A trolley rides horizontally on the boom, which can be, for instance, of a 200 foot length. A dependent cable extends from the trolley and has attachment means for lifting the load.

An operator located in a cabin within the mast and slightly below the boom controls the swing of the boom, the radial position of the trolley on the boom, and the lift of the cable.

In the prior art the position of the trolley was observed from within the cab, and the operator would correspondingly operate the controls. Particularly, when the trolley was positioned outwardly, radially, on the boom, the operator had difficulty in judging with necessary accuracy the trolley position.

Efforts were made to assist the operator in judging trolley position by fixing flags along the track of the main boom. In booms extending, for instance, 165 feet and beyond, errors in visual judgment continued to occur, particularly when the trolley was at the outer extreme of the boom. In many instances, misjudgment of 5 feet horizontal error could be made.

In other efforts to determine location of the trolley, a mechanically driven sliding scale was connected to the trolley and extended into the cabin area. However, where booms extended beyond for instance 100 feet, the interference of such an arrangement with operation was just too great.

SUMMARY OF THE PRESENT INVENTION

In the present invention the position of the trolley on the boom is determined by remote means. Such remote means involve a monitoring arrangement on the trolley cable drive drum. The trolley drive drum is the driven drum which has wound thereon the trolley driving cable. The monitoring arrangement follows the angular movement of the drum. Such angular movement is translated into linear measure to indicate linear movement of the trolley driving cable, which in turn determines the position, along the boom, of the trolley.

The determination of the rotational, angular position of the trolley drum is electronically transmitted via the circuitry of the invention to a meter positioned within the cab. The meter within the cab has indicating means thereon whereby the position of the trolley along the boom can be determined to an accuracy of, for instance, $\frac{1}{2}$ inch.

The present invention is necessarily accurate and relatively fool-proof so that error which could possibly result in serious property damage and personal injury is avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of the tower crane of the invention.

FIG. 2 is a schematic view showing the trolley on a boom, and the drive cable and drum.

FIG. 3 is a schematic wiring diagram of the circuitry and components of the indicator of the invention.

FIG. 4 is a circuit diagram representing the bridge arrangement of the balancing and indicating components of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, a tower crane 10 has a mast 20 and a boom 22 which is supported in cantilevered manner from the mast. Mast 20 may be supported from the ground, or other surface 23 and may be of the climbing type wherein sections are added as the need arises. Boom 22 rotates, clockwise or counterclockwise, about the mast. A track 24 of any suitable type has riding thereon a trolley 25, having wheels which ride the track. A lift cable 21 depends from trolley 25.

A trolley cable drive drum 40 driven generally by an electric motor, has wound thereon a trolley cable 41. One end of cable 41 is connected to trolley 25 at 42, and the other end of cable 41 extends along mast 20 to and over a suitable change of direction pulley 43 located at the radially outward end of boom 22. The cable is then attached to the trolley 25 at 44.

It will be seen that as drum 40 is rotated selectively in either a clockwise or counterclockwise direction, the trolley will be moved either inwardly or outwardly along the boom. An operator within a cabin in the mast at 26 controls the swing of the boom, the trolley position on the boom track, and the movement of lift cable 21 from within the cabin. These features are all conventional and well known in the prior art.

The present invention, which permits the operator within the cabin to determine the position of trolley 25 along the boom, includes a meter 50 located at the operator's desk in the cabin at 26 at a suitable position for easy reading and adjacent the operating controls. The meter is suitably graduated in linear measurement, for instance feet and inches, to indicate the position of trolley 25 along boom 22.

A multi-turn potentiometer 51 is suitably connected to trolley cable drive drum 40 so that the movable element 52 follows the drum rotation. Fixed terminal 53 of potentiometer 51 is connected to fixed resistor 55, for instance a 1500 ohm resistor. Resistor 55 is grounded at 56. Resistor 57, also for instance of 1,500 ohms, is connected at the grounded end 58 of resistor 55. The other end of resistor 57 is connected to one of the end terminals 60 of potentiometer 61 similar to potentiometer 51. The other fixed terminal of potentiometer 61 at 62 is connected through a resistor 63, suitably of 1,500 ohms, to fixed terminal 54 of potentiometer 51.

The movable element of potentiometer 61 at 65 is connected through a resistor 66, for instance of 1,500 ohms, to a potentiometer 67 at fixed terminal 68. The movable element 70 of potentiometer 67 is also connected to terminal 68. The other end terminal 71 of potentiometer 67 is connected to the negative terminal 72 of a rectifier bridge 73, which is connected to the secondary of transformer 75, whose primary is energized from a suitable AC source 76.

The positive output terminal 77 of the bridge 73 is connected through a 1,000 ohm resistor 78 through line 80 to the movable element 52 of potentiometer 51. A zener diode 81 is connected between the conductor 80 and at point 90 the fixed terminal 71 of potentiometer 67 in parallel with a smoothing capacitor 82.

The negative terminal 83 of milliammeter 50 is grounded and the positive terminal 84 is connected to fixed terminal 54 of potentiometer 51. The ground connections, in effect, connect the negative terminal 83 of the milliammeter and the ground 56 at the junction between resistors 55 and 57 form an electrical connection between terminals 83 and 58.

In operation the transformer 75, rectifier 73, resistor 78, zener diode 81 and smoothing capacitor 82 represent a conventional source of DC power supply at the terminals 90 and 71.

The potentiometer 51 is connected to the trolley cable drive drum 40 by inter-meshing gears yielding a 60 to 1 ratio, whereby the drum turns 60 revolutions for every revolution of the potentiometer. Although a single turn potentiometer is used in this embodiment, a multi-turn potentiometer, if necessary, may be used. The potentiometer is geared to the shaft of the trolley cable drive drum 40.

Referring now to FIG. 4, which is a schematic diagram of the variable bridge circuit of FIG. 3, I show the source of DC current, for instance 9 volts, supplied to the terminals 71 and 90. The conventional arrangement for furnishing this source, as shown in detail in FIG. 3, is not shown in FIG. 4.

With the trolley 25 at the extreme innermost end or location of the path trolley, adjacent the cabin, movable element 52 of potentiometer 51 will be pushed adjacent end 54. With movable element 52 positioned at adjacent end 54 element 65 of potentiometer 61 is adjusted manually to get a zero feet or index reading on indicating meter 50. In this condition there is no current passing through meter 50 since, when element 65 is adjusted to provide such zero reading, the bridge is in balance. The trolley 25 is then run to the outermost end of its path causing element 52 to follow rotation of the trolley cable drive drum 40, as described above. At the extreme outermost point toward the terminal 54, the adjustable element 70 of potentiometer 67 is manually adjusted to increase or decrease the current so that meter 50 will read the proper distance in feet, to the outer limit of travel, since this is a known distance. As

the movable element 52 travels away from point 54, the bridge becomes unbalanced and current flows through the meter 50 proportional to the distance moved. Hence, the operator within the cabin at 26 can read, on meter 50 located within the cabin, the exact position of trolley 25 along boom 22.

Potentiometer 61 is considered the "zero adjust" control and potentiometer 67 is considered the "maximum adjust" control. It should be noted that resistor 66 is a current limiting resistor and resistor 67 is a potentiometer or current adjusting resistor.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a tower crane having

1. a mast portion extending vertically;
2. a boom portion extending horizontally from the mast portion;
3. a track on the boom having riding thereon a trolley;
4. a trolley cable secured to the trolley and adapted to move the trolley along the track;
5. and a trolley cable drive drum having wrapped thereon the trolley cable, and being driven rotationally in either a clockwise or counterclockwise direction selectively from a remote operating position whereby the trolley is driven along the track;

a device for indicating the position of the trolley on the track comprising

- a. monitor means on the trolley cable drive drum for monitoring the drum rotation;
- b. means for generating an electrical signal proportional to the trolley cable drive drum rotation connected to the monitor means,
- c. an indicator at the remote operating position having means for indicating the trolley position on the boom,
- d. and means for transmitting the generated electrical signal to the indicator means for indicating the trolley position on the boom.

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