

Dec. 23, 1969

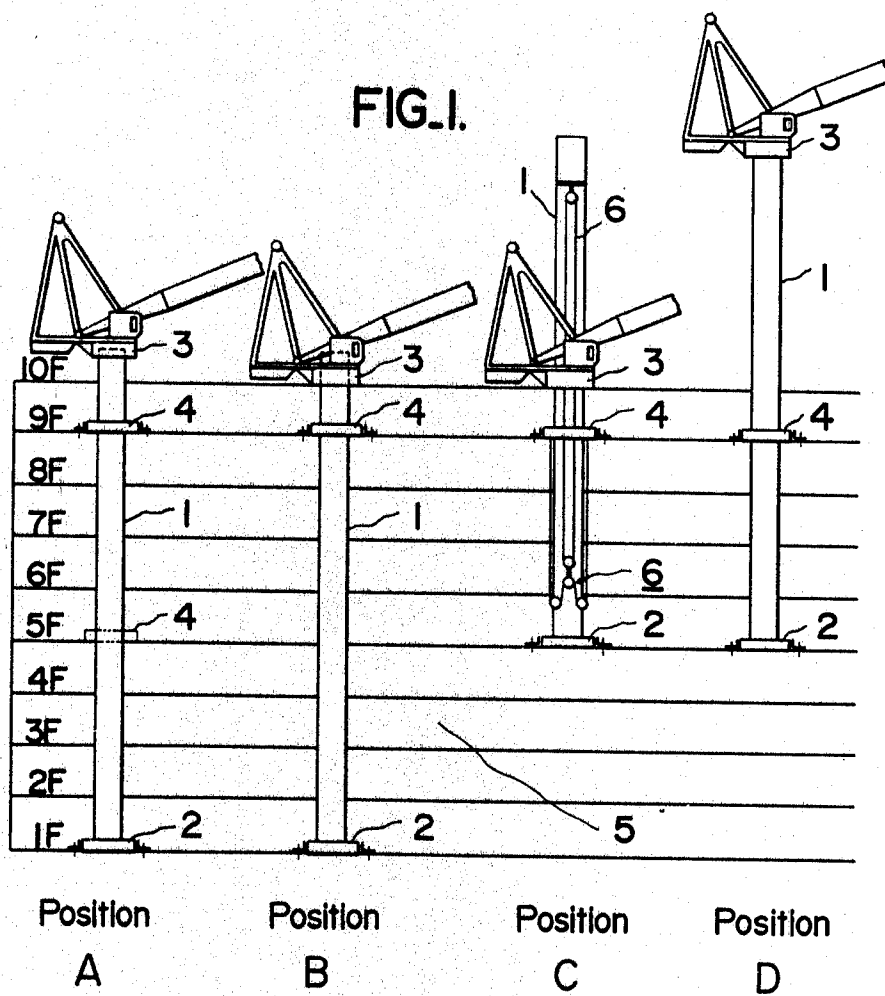
SEI NIKAI ET AL
METHOD OF CLIMBING A TOWER CRANE FOR
CONSTRUCTING HIGH BUILDINGS

3,485,384

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2 Sheets-Sheet 1

FIG. 1.



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FIG.2.

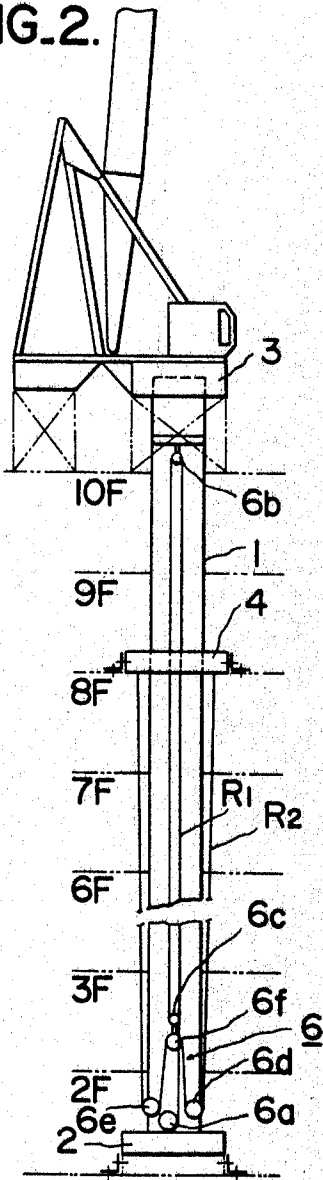
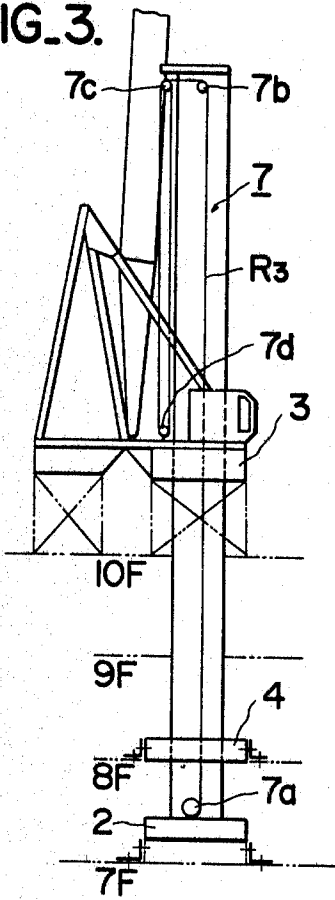


FIG.3.



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METHOD OF CLIMBING A TOWER CRANE FOR CONSTRUCTING HIGH BUILDINGS

Sei Nikai, Yu Kojima, Tsuneo Mukai, and Shigeru Hirata,
Tokyo, Japan, assignors to Kaiima Construction Com-
pany Limited and Mitsui Construction Company
Limited

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1 Claim

ABSTRACT OF THE DISCLOSURE

A method of climbing a tower crane for construction of high buildings, comprising steps of fabricating structures of several floors of a building by a tower crane having a mast and a bell portion and a guide frame, resting said bell portion upon the uppermost floor of the floors thus fabricated, raising the mast upwards while using both said guide frame and said bell portion as two guide points, fastening the mast to the floor structures thus fabricated, raising said bell portion along the mast, and repeating said fabrication of the floors above said uppermost floor and said raise of said tower crane.

This invention relates to a method of climbing a tower crane for constructing high buildings, more particularly to a method of climbing a tower crane in such a manner that the tower crane can be used for construction of different floors of a high building by climbing it in steps to the previously constructed portion of the building.

Heretofore, in fabricating skeleton members of a building, a tower crane assembled on the ground level has been utilized. If a tall mast is used, such tower crane can be used for fabricating skeletons of buildings as high as about ten stories. However, for construction of very high buildings of 20 stories or more above the ground, it is impossible to use a tower crane assembled on the ground level. In order to facilitate handling of skeleton or structural members for upper floors of a building of an order of 20 stories or more, a crane can be mounted temporarily on that portion of the building skeleton which has been fabricated previously. However, in such temporary mounting of a crane, its component parts have to be brought up to the desired floor level, and also such component parts have to be disassembled before structural members for higher floors are fabricated on said previously completed portion of the building skeleton. The process of transferring, mounting, and dismantling component parts of such temporary cranes interferes with the fabricating work of the building structure and causes waste of time. Besides, to ensure safety, extra care has to be taken to transfer the crane component parts smoothly and to check secure fastening of the crane to the building structures, etc. If, for instance, the crane component parts strike the previously assembled skeleton members during the transportation thereof, it can cause damage on the latter, and if the temporary crane is not fastened properly to the building structure, it can cause fatal casualties to the personnel in addition to serious damage to the building structure itself.

Therefore, the principal object of the present invention is to obviate the aforesaid difficulties of conventional tower cranes for construction of high buildings by providing a novel method of climbing a tower crane, in which after fabricating body and floor structures of a certain number of stories of the building, the tower crane is raised above the upper end of thus fabricated portion

of the structure to facilitate fabrication of structures for the next higher floors of the building.

For a better understanding of the invention, reference is made to the accompanying drawings, in which:

FIG. 1 is a diagrammatic illustration of the process in which a tower crane climbs a building according to the method of the present invention;

FIG. 2 is a simplified skeleton diagram of a pulley assembly for raising a base frame of the tower crane; and

FIG. 3 is a diagram similar to FIG. 2, showing another pulley assembly for raising a bell portion of the tower crane.

The same reference numerals and symbols represent the same components and members throughout the drawings.

In FIG. 1, a tower crane usable in accordance with the method of the present invention preferably comprises a mast 1, a base frame 2 secured to the lower end of the mast, a bell portion 3, and a guide frame 4 mounted slidably on skeleton members 5 of a building. In the figure, the first ten floors 1F, 2F, . . . 10F of a building above the ground level are shown. The use of the method of the present invention, however, is not limited to ten storied buildings only, but it can be used with a high building having any number of stories.

According to the method of the invention, both the bell portion 3 and the guide member 4 are made slidable along the mast 1. For fabrication of structural members of the first few stories of the building from the ground level, the mast 1 is mounted on the foundation of the building by securing the base frame 2 of the tower crane to the base portion of the building structure 5, by suitable means, such as by bolts and nuts, as shown in the Position A of FIG. 1. With such arrangement, fabrication of the structure or skeleton up to the maximum operative height of the crane, for instance up to the 10th floor, can be carried out with ease. In fabricating structures of lower floors, it is not necessary to support the mast 1 with the guide frame 4. It is, however, preferable to set the guide frame at a certain floor structure when fabricating structural members of higher floors. In the example shown in FIG. 1, Position A, the guide frame 4 is set and secured to the fifth floor skeleton member 5F, and for working on still higher floor structures, the guide frame 4 can be set on a higher floor, e.g., on the 9th floor.

When the building structure is completed up to the maximum possible height, e.g. up to the 10th floor in this example, the tower crane can be climbed upwards in a manner as shown in Positions B, C, and D of FIG. 1. The bell portion 3 is first released from the mast 1 and brought down to the 10th floor structure 10F for resting it thereon, and then the guide frame 4 is raised to a floor structure different from that on which the bell portion 3 rests. For instance, the guide frame 4 is brought up to the 9th floor 9F, as shown in the Position B, FIG. 1. Since the guide frame 4 is made slidable along the mast 1, it can be raised by any suitable raising means, such as by a simple winch. Thereafter, the bondage between the base frame 2 and the structure foundation is released, for instance, by releasing nuts from bolts, and the mast 1 having the base frame 2 secured at the lower end thereof is raised or climbed by using the guide frame 4 as a slidable support. In climbing the mast 1, it is guided at two points; namely, at the guide frame 2 and at the bell portion 3.

FIG. 2 shows an example of pulley means 6 suitable for such climbing of the mast 1. The pulley means 6 comprises a drive drum 6a, which is mounted on the base frame 2 of the tower crane and adapted to be driven by a suitable driving means (not shown), such as an electric

motor, a top pulley 6b secured to the upper end of the mast 1, and a suspended pulley 6c, and a rope R1. The upper end of the rope R1 is fastened to, for example, the top pulley 6b, and then extend downwards to the suspended pulley 6c, and then brought up to said top pulley 6b, and again downwards to the drive pulley 6a, and the lower end of the rope R1 is fastened to the drive drum 6a. It is apparent that the suspended pulley 6c can be vertically reciprocated as the drive drum 6a is rotated in a clockwise or counterclockwise direction. The pulley means 6 further comprises an intermediate pulley 6f bonded to the suspended pulley 6c by a suitable rigid member, a pair of side pulleys 6d and 6e mounted on the base frame 2, and a second rope R2 of fixed length. One end of the rope R2 is secured at one end of the guide frame 4, e.g. at the extreme right end thereof, and extended downwards to the side pulleys 6d and 6e, and then brought upwards to the opposite end of the guide frame 4, e.g. to the extreme left end thereof, and the other end of the rope R2 is fastened to said opposite end of the guide frame 4. The intermediate pulley 6f is engaged with the second rope R2 at the middle of the two side pulleys 6d and 6e in such a manner that as the intermediate pulley 6f is raised by the suspended pulley 6c, the intermediate portion of the second rope R2 between the two side pulleys are pulled upwards by the pulleys 6c and 6f. With the pulley means 6 of such construction, it is apparent that by turning the drive drum 6a clockwise the mast 1 having the base frame 2 can be climbed upwards to any desired position below the guide frame 4, for instance, to the fifth floor 5F, as shown in the Position C of FIG. 1. After the base frame 2 is set to structures of the desired floor level, the base frame 2 is fastened to the building structure 5 by a suitable means, such as by bolts and nuts.

The bell portion 3 is then pulled upwards along the thus raised mast 1 by means of another pulley means 7, and held at a position suitable for handling structural members for the upper floors of the building.

FIG. 3 shows an example of the pulley means 7 suitable for raising or climbing the bell portion 3, which comprises a drive drum 7a, which is mounted on the base frame 2 and adapted to be driven by a suitable driving means (not shown), such as by an electric motor, a pair of top pulleys 7b and 7c secured to the top end of the mast 1, a bell pulley 7d mounted on the bell portion 3, and a rope R3. The upper end of the rope R3 is secured to one of the two top pulleys, e.g. to the top pulley 7c, then extended downwards to the bell pulley 7d, further brought upwards back to the top pulley 7c, and finally extended downwards again to the drive drum 7a through the other top pulley 7b. The lower end of the rope R3 is fastened to the drive drum 7a. With the bell raising pulley means 7 of the aforesaid construction, it is apparent that the bell portion 3 can be raised along the mast 1 responsive to the clockwise rotation of the drive drum 7a to any position below the top end of the mast 1, for instance, to the height as shown in the Position D, FIG. 1.

In the aforesaid examples of the pulley means, since the two drive drums 6a and 7a are both located on the

base frame 2, it is possible to actuate both drive drums by means of a single actuating means, such as by an electric motor, through a suitable selective clutch means.

In the example of FIGS. 1 to 3, a base frame 2 is shown as secured to the lower end of the mast 1, but it is possible to replace such a base frame with any other means suitable for fastening the mast 1 to the building structure 5.

By using a tower crane in a manner according to the method of the present invention, structural members or skeletons of a building of any height can be easily assembled by repeating the process of climbing the tower crane as explained hereinbefore referring to FIGS. 1 to 3. Furthermore, the tower crane of any conventional type can be used in the method of the present invention, and the means for climbing or raising such tower crane are very simple. Therefore, the method of the present invention provides a very economical means for handling materials in the course of constructing very high buildings. Thus, the present invention contributes greatly to the industry.

What we claim is:

1. A method of climbing a tower crane for constructing high buildings, the tower crane being of the type having a movable mast of fixed length, a bell portion slidably mounted on the mast and including a superstructure, and including a guide frame slidably mounted on said mast, the method comprising the steps of constructing a predetermined number of first floors of a building by using a tower crane disposed within the building, releasing said bell portion from the mast to rest the bell portion on the uppermost floor of said predetermined number of first floors such that the bell slidably supports the mast, setting the guide frame on a floor lower than said floor on which said bell portion rests such that the guide frame slidably supports the mast, climbing said mast by a certain distance while using both said bell portion and said guide frame as two sliding guide supports by a driving means incorporated in the tower crane, fastening a lower portion of the mast to the previously constructed portion of the building at another floor lower than that where said guide frame is set, raising the bell portion along the mast to the highest possible position of the mast for operating the tower crane, fastening said bell portion at the position thus raised and repeating said construction of the building floors and said climbing of the tower crane while allowing subsequent building construction processes at floors left behind the thus raised mast.

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HARVEY C. HORNSBY, Primary Examiner

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