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D. J. MARTIN

3,354,599

METHOD OF ERECTING A MAST

Filed Aug. 23, 1965

3 Sheets-Sheet 1

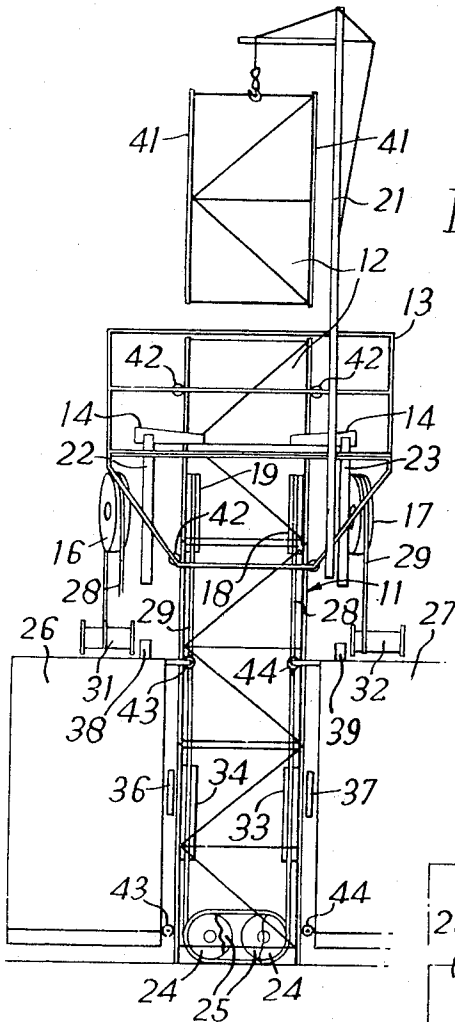


Fig. 1.

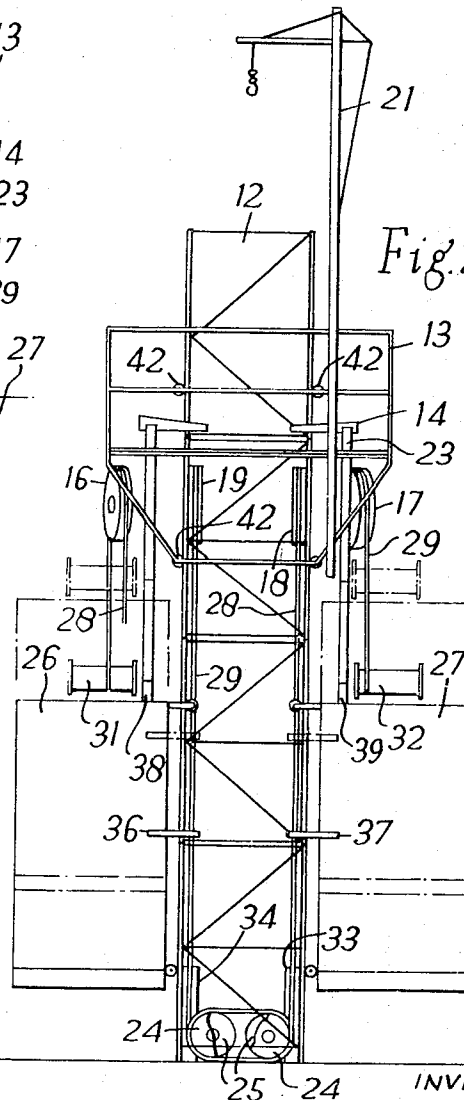


Fig. 2.

INVENTOR
DEREK JOHN MARTIN

BY

Kernon, Palmer, Stewart & Catalano
ATTORNEY

Nov. 28, 1967

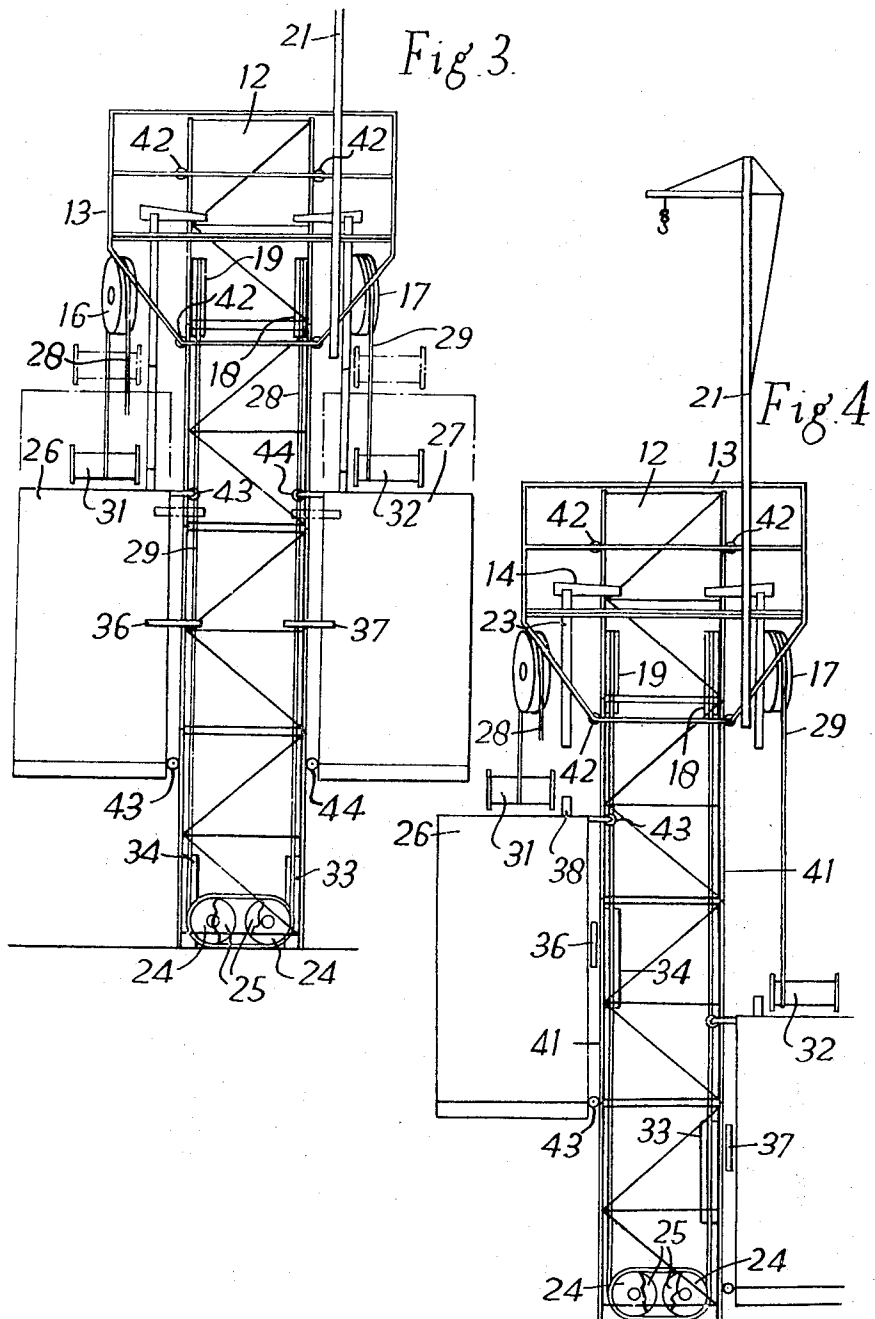
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3 Sheets-Sheet 2



INVENTOR
DEREK JOHN MARTIN

BY
Kernan, Palmer, Stewart & Estabrook
ATTORNEY

Nov. 28, 1967

D. J. MARTIN

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3 Sheets-Sheet 3

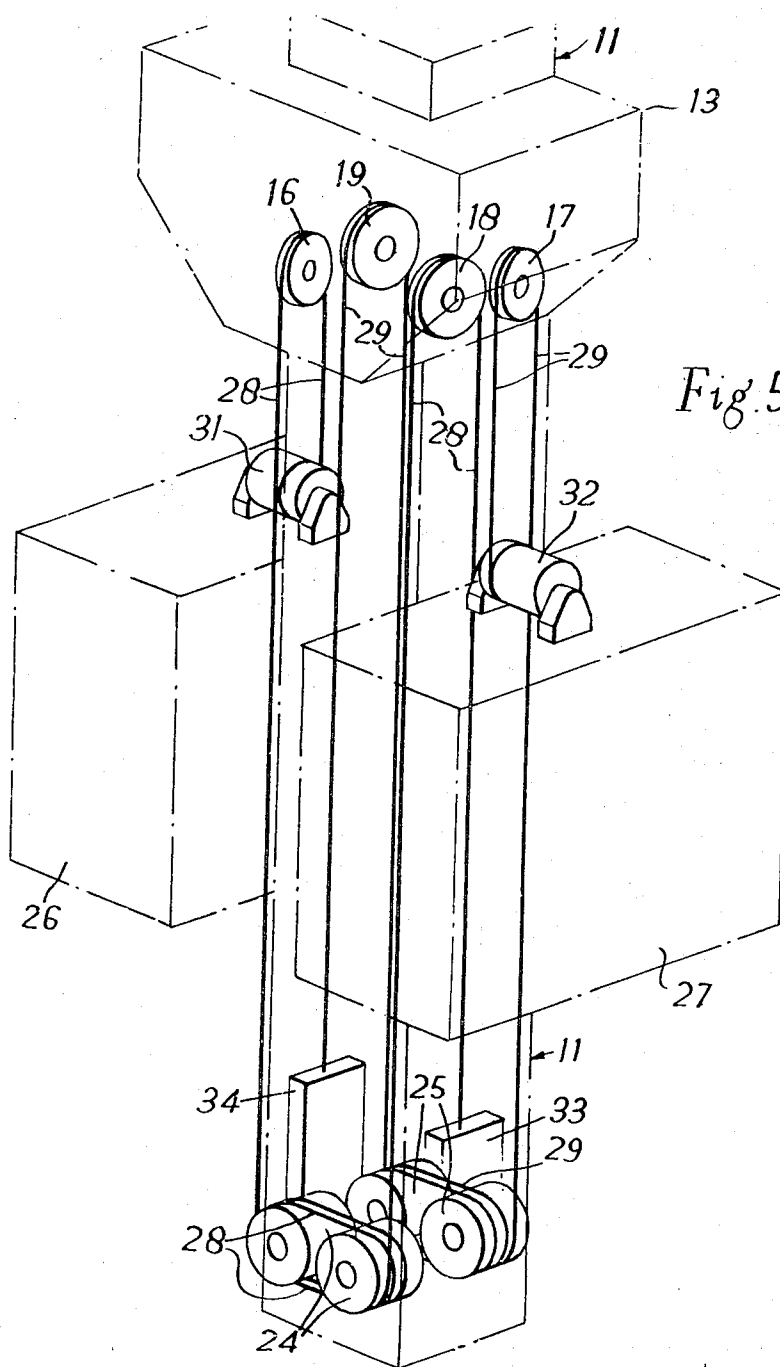


Fig. 5.

INVENTOR
DEREK JOHN MARTIN

BY
Kernan, Palmer, Stewart &
Estabrook
ATTORNEY

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METHOD OF ERECTING A MAST

Derek John Martin, Much Hadham, England, assignor to
D. Wickman & Company Limited, Ware, England

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6 Claims. (Cl. 52—741)

ABSTRACT OF THE DISCLOSURE

A method of erecting a hoist on a mast is disclosed in which a cathead and a pair of cages are advanced up the mast by successive expansion and contraction of rams. The cathead and cages are arranged to slide up the mast, the cathead being disposed above the cages, and the rams are connected between the cages and the cathead. Advance up the mast is accomplished by expanding the rams while the cages are secured to the mast and the cathead is released from it, thus raising the cathead, and contracting the rams while the cathead is secured to the mast and the cages are released from it, thus raising the cages. After each alteration in height of the hoist, the position of a counterweight is adjusted.

This invention relates to masts and particularly, though not exclusively, to masts used in the construction of tall buildings and other permanent structures. More specifically, the invention relates to a method of erecting a hoist for passengers and/or goods on a mast, to a method of increasing the height at which a hoist for passengers and/or goods on a mast will operate and to methods of adding a mast section to the top of a mast.

It is an object of the invention to provide such methods which are particularly rapid, convenient, and economical of manpower and equipment.

Summary of the invention

In general the objects of the invention are achieved by providing a cathead and cages slidably mounted on a mast with the cathead disposed vertically above the cages. Rams which are connected between the cages and the cathead are expanded to move the cathead up the mast while the cage is secured to the mast and then the rams are contracted while the cathead is secured to the mast and the cages released to move relatively thereto. The cages are additionally supported by means of cables and conventional counterweights for vertical movement independent of the cathead once the desired elevation has been reached.

There is provided according to the present invention a method of erecting a hoist for passengers and/or goods on a mast, the hoist comprising a movable platform on which is mounted a rotary idler, a cage, and a winch connected to the cage by a flexible tensile-force-transmitting member passing from the said winch over the rotary idler and down to the cage wherein the platform and cage are raised to positions near the top of the mast by connecting the lower end of a contractible and extendible jacking device to the cage, the upper end of the jacking device being secured to the platform, and alternately extending the jacking device while the cage is secured to the mast and the platform is released from it and contracting the jacking device while the platform is secured to the mast and the cage is released from it.

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The present invention also provides a method of increasing the height at which a hoist for passengers and/or goods on a mast will operate, the hoist comprising a movable platform on which is mounted a rotary idler, a cage, and a winch connected to the cage by a flexible tensile-force-transmitting member passing from the said winch over the rotary idler and down to the cage wherein the platform and cage are raised to positions near the top of the mast by connecting the lower end of a contractible and extendible jacking device to the cage, the upper end of the jacking device being secured to the platform, and alternately extending the jacking device while the cage is secured to the mast and the platform is released from it and contracting the jacking device while the platform is secured to the mast and the cage is released from it.

The present invention also provides a method of adding a mast section to the top of a mast fitted with a hoist comprising a platform releasably secured to the mast near the top thereof and having a rotary idler mounted upon it, a cage which is releasably securable to the mast, and a winch operatively connected to the cage by a flexible tensile-force-transmitting member passing from the winch over the rotary idler and down to the cage, wherein the mast section is raised to the top of the mast and secured thereto and the platform and cage are raised to positions near the top of the mast section by connecting the lower end of a contractible and extendible jacking device to the cage, the upper end of the said jacking device being releasably secured to the platform and alternately extending the jacking device while the cage is secured to the mast and the platform is released from it and contracting the jacking device while the platform is secured to the mast and the cage is released from it.

The present invention also provides a method of adding a mast section to the top of a mast fitted with a hoist comprising a platform releasably secured to the mast on which is mounted a rotary idler, a cage, and a winch connected to the cage by a flexible tensile-force-transmitting member passing from the said winch over the rotary idler and down to the cage wherein the platform and cage are raised to positions near the top of the mast by connecting the lower end of a contractible and extendible jacking device to the cage, the upper end of the jacking device being secured to the platform, and alternately extending the jacking device while the cage is secured to the mast and the platform is released from it and contracting the jacking device while the platform is secured to the mast and the cage is released from it, the mast section is raised to the top of the mast and secured thereto, and the platform and cage are raised to positions near the top of the mast section by further alternate extension and contraction of the jacking device.

The invention will now be described by way of example with reference to the accompanying drawings, in which: FIGURES 1 to 4 are diagrammatic representations, in side elevation, of a mast and a hoist in successive stages of erection, some parts being removed, and

FIGURE 5 is a diagrammatic perspective view of the mast and hoist, with some parts removed.

Referring to the drawings, there is shown a mast 11 made up of a plurality of mast sections 12 arranged on top of one another and secured together, the mast being fitted with a hoist for passengers and/or goods as described below. A movable platform comprised by a cathead 13 is releasably secured to the mast 12 by means of sprags 14

mounted on the cathead 13 so that they can slide horizontally relative to it. The cathead 13 has a top surface forming a working platform on which workmen may stand. In the drawings the sprags 14 are shown slid inwardly to their fullest extent when, as can be seen, they engage cross-members of one of the mast sections 12 and thus secure the cathead 13 to the mast 11. When the sprags 14 are slid outwardly, however, they no longer engage a mast section 12 and the cathead 13 is consequently released from the mast 11. The cathead 13 has four rotary idlers constituted by pulleys 16, 17, 18 and 19 mounted upon it. A mechanical lifting device constituted by a swiveling jib-crane 21 is secured to the cathead 13, while two contractible jacking devices constituted by double-acting hydraulic rams 22 and 23 are pivotally secured to the cathead 13 and hang downwards from it. Two winches 24 and 25 are positioned near mast 11 at ground level, as shown. Two cages 26 and 27 are arranged one on either side of the mast 11. The winches 24 and 25 are arranged for lifting and lowering the cages 26 and 27 respectively in the conventional manner, flexible tensile-force-transmitting members constituted by a cable 28 connecting the winch 24 to the cage 26 and a cable 29 connecting the winch 25 to the cage 27 being provided for this purpose. For clarity, the greater parts of the cables 28 and 29 have been removed from FIGURES 1-4; the disposition of the cables is best appreciated from FIGURE 5. One end of each of the cables 28 and 29 is secured to the cages 26 and 27 respectively; this is done by wrapping one end of the cable 28 around a drum 31 mounted above the cage 26 and wrapping one end of the cable 29 around a drum 32 mounted above the cage 27. The drums 31 and 32 are so mounted that they can be rotated; in normal use, however, they are locked against rotation so that the cables 28 and 29 are firmly secured to the cages 26 and 27 respectively.

From the drums 31 and 32 the cables 28 and 29 pass upwards over the pulleys 16 and 17 respectively and thence down to the winches 24 and 25. From the winches 24 and 25 the cables 28 and 29 pass upwards again and over the pulleys 18 and 19 respectively and thence down to respective counterweights 33 and 34.

The cages 26 and 27 have sprags 36 and 37 respectively mounted on their sides, as shown. The sprags 36 and 37, shown diagrammatically in the drawings, comprise arms pivoted on the cages which are weight-loaded into operative positions in which, as shown in FIGURES 2 and 3, they extend horizontally outwardly from their pivots on the cages but are prevented by stops from swinging upwardly above their operative positions. Then can, however, be swung downward against the weight-loading into inoperative positions in which, as shown, in FIGURES 1 and 4, they extend vertically downward. They can be locked in their inoperative positions. The cages 26 and 27 carry means 38 and 39 respectively, shown diagrammatically whereby they can be releasably secured to the lower ends of the hydraulic rams 22 and 23 respectively. The mast sections 12 are each fitted with vertically extending guides, shown diagrammatically at 41, which guide the movement of the cathead 13, cages 26 and 27 and counterweights 33 and 34 up and down the mast 11 and restrain them from horizontal displacement away from the mast 11. The cathead 13 is fitted with rollers 42 and the cages 26 and 27 with rollers 43 and 44 respectively which engage the guides 41.

A sequence of operations employed when adding an additional mast section 12 to the top of the mast 11 will now be described, the initial conditions being as shown in FIGURE 1, that is to say the cages 26 and 27 being at the bottom of the mast 11 with the sprags 36 and 37 locked in their inoperative positions and the cathead 13 and counterweights 33 and 34 being at the top of the mast. While the mast 11 is still fairly low and the cathead 13 is therefore sufficiently near to the ground, the jib-crane 21 can be used to raise the additional mast section 12 off the ground and deposit it on the top of the mast 11, where

it is fixed in position. The cages 26 and 27 are then raised up the mast in the normal manner by means of the winches 24 and 25 until they reach positions just below the cathead 13. When they reach these positions, their respective counterweights 33 and 34 ground. The lower ends of the hydraulic rams 22 and 23 are connected to the cages 26 and 27 respectively, after being adjusted to appropriate lengths to reach between the cathead 13 and the tops of the cages 26 and 27. The weight-loaded sprags 36 and 37 on the cages 26 and 27 are unlocked from their inoperative positions, and are consequently urged by the weight-loading towards their horizontally-extending operative positions. The rams 22 and 23 are then caused to contract, thus raising the cages 26 and 27 up the mast 11 and causing the cables 28 and 29 to slacken. As the weight-loaded sprags 36 and 37, during the upward movement of the cages 26 and 27, contact horizontal cross-members of the mast 11, they are urged downwardly out of their operative positions against the weight-loading. After they pass such cross-members, however, they are again urged into their operative positions by the weight-loading, and, on account of the stops which prevent them from swinging upward above their operative positions, they engage the upper surfaces of the cross-members and secure the cages 26 and 27 to the mast 11, i.e., prevent them from descending the mast 11. The sprags 36 and 37 having thus been engaged, the cable storage drums 31 and 32 are unlocked, so that they are free to rotate. Next the rams 22 and 23 are extended slightly to take the weight of the cathead 13 off its sprags 14 which are then slid outwardly, thus releasing the cathead 13 from the mast 11. The rams 22 and 23 are then caused to extend further, thus raising the cathead 13 up the additional mast section 12. After the extending of the rams 22 and 23 the sprags 14 on the cathead 13 are slid inwardly to engage cross-members of the additional mast section 12 and secure the cathead 13 to the mast 11, i.e., prevent it from descending the mast 11. The position is then as shown in full lines in FIGURE 2. The rams are then caused to contract, thus raising the cages 26 and 27 up the mast 11 to the position shown in chain-dotted lines in FIGURE 2. As previously described, the sprags 36 and 37 on the cages 26 and 27 are automatically returned to their operative positions by the weightloading after each cross-member of the mast 11 is passed, and the cages 26 and 27 are thus automatically secured to the mast 11 after being raised by the rams 22 and 23. The process of alternately extending the rams 22 and 23 while the cages 26 and 27 are secured to the mast 11 and the cathead 13 is released from it and contracting the rams 22 and 23 while the cathead 13 is secured to the mast 11 and the cages 26 and 27 are released from it is continued until the cathead 13 is at the top of the additional mast section 12 and the cages 26 and 27 are just beneath it. In the case illustrated, only one further extension and contraction of the rams 22 and 23 is necessary. The stage when the rams 22 and 23 have been extended a second time and the cathead 13 has been secured by means of the sprags 14 is shown in full lines in FIGURE 3 and the stage when the rams have been contracted a second time is shown in chain-dotted lines in the same figure. When the final position, as shown in chain-dotted lines in FIGURE 3, is reached, the cathead 13 being secured to the mast 11 by its sprags 14, the cables 28 and 29 are adjusted to appropriate lengths for the new overall height of the mast 11, additional lengths having been unreeled from the storage drums 31 and 32, and the drums 31 and 32 are then locked against rotation. The cages 26 and 27 are now raised a short additional distance by the rams 22 and 23 in order to facilitate disengagement of the sprags 36 and 37 from the mast 11 and the sprags 36 and 37 are disengaged and locked in their inoperative positions. The rams 22 and 23 are then extended until the cages 26 and 27 are supported on the cables 28 and 29 after which the rams 22 and 23 are disconnected from the cages 26 and 27. Normal operation of the cages, that is to say raising and lowering them by

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means of the winches 24 and 25, can then be begun. FIGURE 4 shows the arrangement during normal operation, with the sprags 36 and 37 disengaged and the cage 27 in the process of being lowered to the ground.

To add further mast sections 12 to the mast 11, the above procedure can, of course, be repeated. As the mast 11 becomes higher, the jib-crane 21 may be too high to lift objects from ground level, in which case further mast sections 12 required to be added are loaded onto one or both of the cages 26 and 27 which are then raised to the top of the mast 11 by the winches in the normal manner. The further mast sections 12 are then added one by one to the mast 11 using the sequence of operations described above. After each mast section has been added, the cathead 13 and cages 26 and 27 are raised to the top of that mast section, after which another mast section is added in the same manner.

The invention is also applicable to the erection of a hoist for passengers and/or goods on an already erected mast. In such a case, of course, it would not be required to add an additional mast section to the mast. The sequence of operations described above, other than those operations involved in the addition of the further mast section 12, are used to erect the hoist. Starting if necessary from ground level, the above-described process of alternately extending the rams 22 and 23 while the cages 26 and 27 are secured to the mast 11 and the cathead 13 is released from it and contracting the rams 22 and 23 while the cathead 13 is secured to the mast 11 and the cages 26 and 27 are disconnected from it is continued until the desired height is reached.

A similar sequence of operations to that described in the preceding paragraph can be used when it is desired to increase the height at which a hoist fitted to a mast will operate. If a mast has been erected and a cathead is at an intermediate position up the mast, the cathead and cages can be raised to any desired position higher up the mast by a similar technique of winching the cages up to just below the cathead, connecting the rams to the cages and performing alternate extension and contraction of the rams as described above.

For clarity, the hoist has been described above and shown in the drawings as having single cables 28 and 29 connecting respectively the winch 24 with the cage 26 and the counterweight 33 and the winch 25 with the cage 27 and counterweight 34. It may often be preferable to use twin cables in place of the single cable and the single cable 28 and the single cable 29. In this case, the twin cables are secured to the respective cages 26 and 27 by being wound on twin drums mounted in similar manner to the drums 31 and 32 and releasably locked against rotation. Twin pulleys would be provided in place of the single pulleys 16, 17, 18 and 19. The invention is, of course, equally applicable when the hoist employs twin, or greater numbers of, cables.

What is claimed is:

1. A method of erecting a hoist on a mast, comprising the steps of

providing a hoist comprising a platform, a rotary idler mounted on said platform, a cage, a counterweight and a flexible tensile-force-transmitting member connecting the cage to the counterweight and passing over the idler to suspend the cage and counterweight therefrom,

securing the platform to the mast,

connecting opposite ends of a contractible and extendible jacking device respectively to the platform and the cage,

securing the cage to the mast below the platform,

releasing the platform from the mast,

extending the said device to raise the platform up the mast,

securing the platform to the mast,

releasing the cage from the mast,

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contracting the said device to raise the cage up the mast, repeating the six last-mentioned steps until the platform and cages reach the desired position on the mast, and increasing the length of the said member by an amount which corresponds to the displacement of the platform up the mast.

2. A method as claimed in claim 1, wherein the step of adjusting the length of the said member is performed by rotating a drum mounted on the cage and which drum has the said member wound upon it and locking the drum against rotation when the said member reaches the desired length.

3. A method of adjusting the operating height of a hoist on a mast, the hoist comprising a platform, a rotary idler mounted on the platform, a cage, a counterweight, and a flexible tensile-force-transmitting member connecting the cage to the counterweight and passing over the idler to suspend them therefrom, the said method comprising the steps of

connecting opposite ends of a contractible and extendible jacking device respectively to the platform and the cage,

securing to the mast a first member of the group comprised by the platform and the cage being the member which is less far advanced than the second member of the said group in the desired direction of movement of the hoist on the mast,

releasing the said second member from the mast,

extending the said device to shift the said second member in the said direction on the mast,

securing the said second member of the group to the mast,

releasing the said first member from the mast,

contracting the said device to shift the said first member in the said direction on the mast,

securing the said first member to the mast,

repeating the six last-mentioned steps until the platform and cages reach the desired positions on the mast, and

adjusting the length of the said member by an amount which corresponds to the displacement of the platform up the mast.

4. A method as claimed in claim 3, wherein the step of adjusting the length of the said member is performed by rotating a drum mounted on the cage and which drum has the said member wound upon it and locking the drum against rotation when the said member reaches the desired length.

5. A method of adding a mast section to the top of a mast fitted with a hoist comprising a platform secured to the mast, a rotary idler mounted on the platform, a cage, a counterweight, and a flexible tensile-force-transmitting member connecting the cage to the counterweight and passing over the idler to suspend the cage and counterweight therefrom, the said method comprising the steps of loading the mast section on the cage at a loading station, connecting opposite ends of a contractible and extendible jacking device respectively to the platform and the cage,

securing the cage to the mast below the platform,

releasing the platform from the mast,

extending the said device to raise the platform up the mast,

securing the platform to the mast,

releasing the cage from the mast,

contracting the said device to raise the cage up the mast, repeating the six last-mentioned steps until the platform and cage reach positions near the top of the mast,

removing the mast section from the cage,

securing the mast section to the top of the mast,

repeating the said six steps until the platform and cages reach positions near the top of the mast section, and

increasing the length of the said member by an amount which corresponds to the displacement of the plat-

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form up the mast to permit the return of the cage to the loading station while the platform remains at the top of the mast.

6. A method as claimed in claim 5 wherein a mechanical lifting device is mounted upon the platform and wherein the step of removing the mast section from the cage is performed by
operatively connecting the said lifting device to the mast section, and
operating the said lifting device to raise the mast section off the cage.

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FRANCIS K. ZUGEL, *Primary Examiner.*