May 15, 1962 S. POLLACK ETAL 3,034,661

BEAM JIB AND CRANE ASSEMBLY

Filed Sept. 27, 1960 5 Sheets-Sheet 1

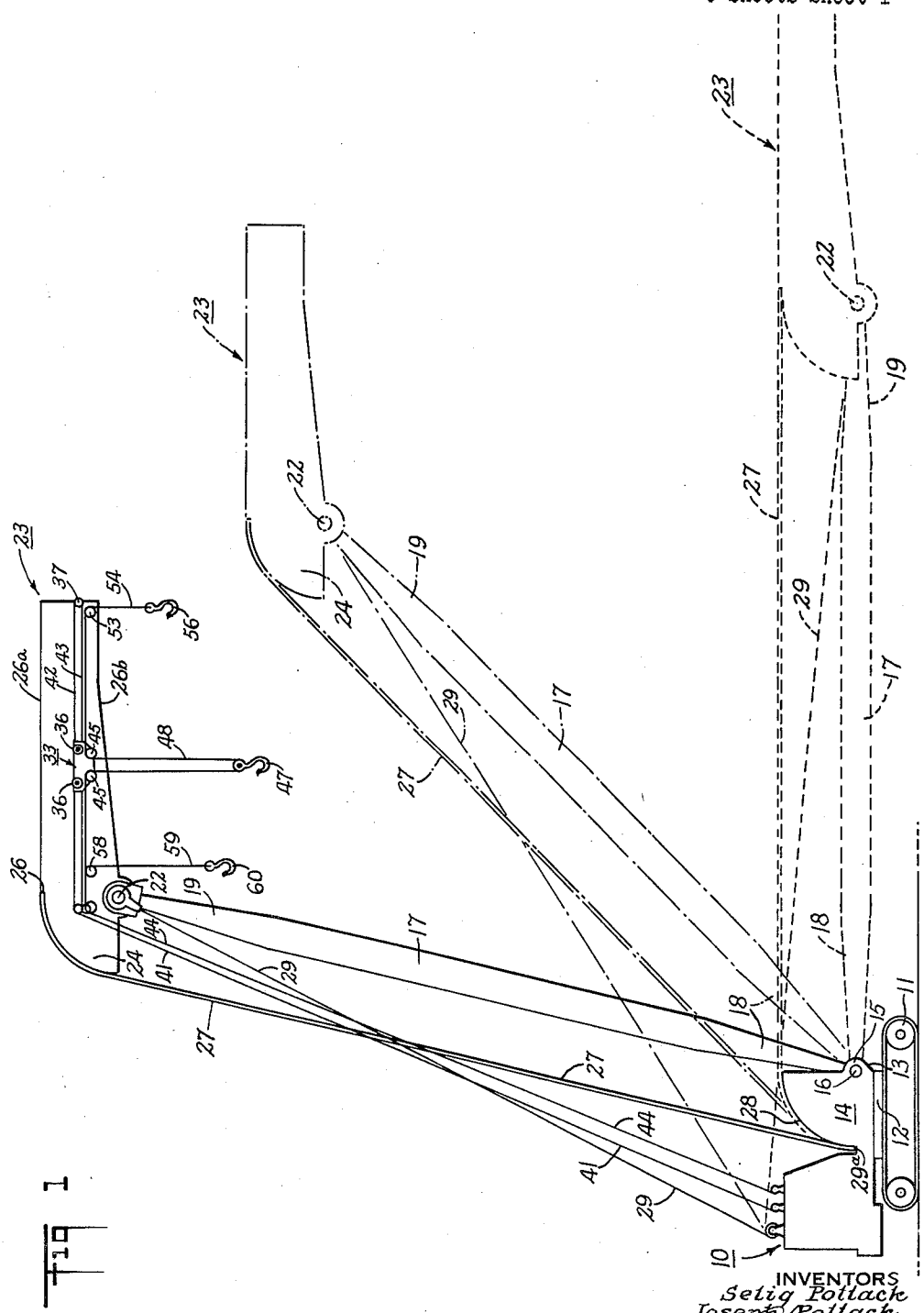


Fig. 1

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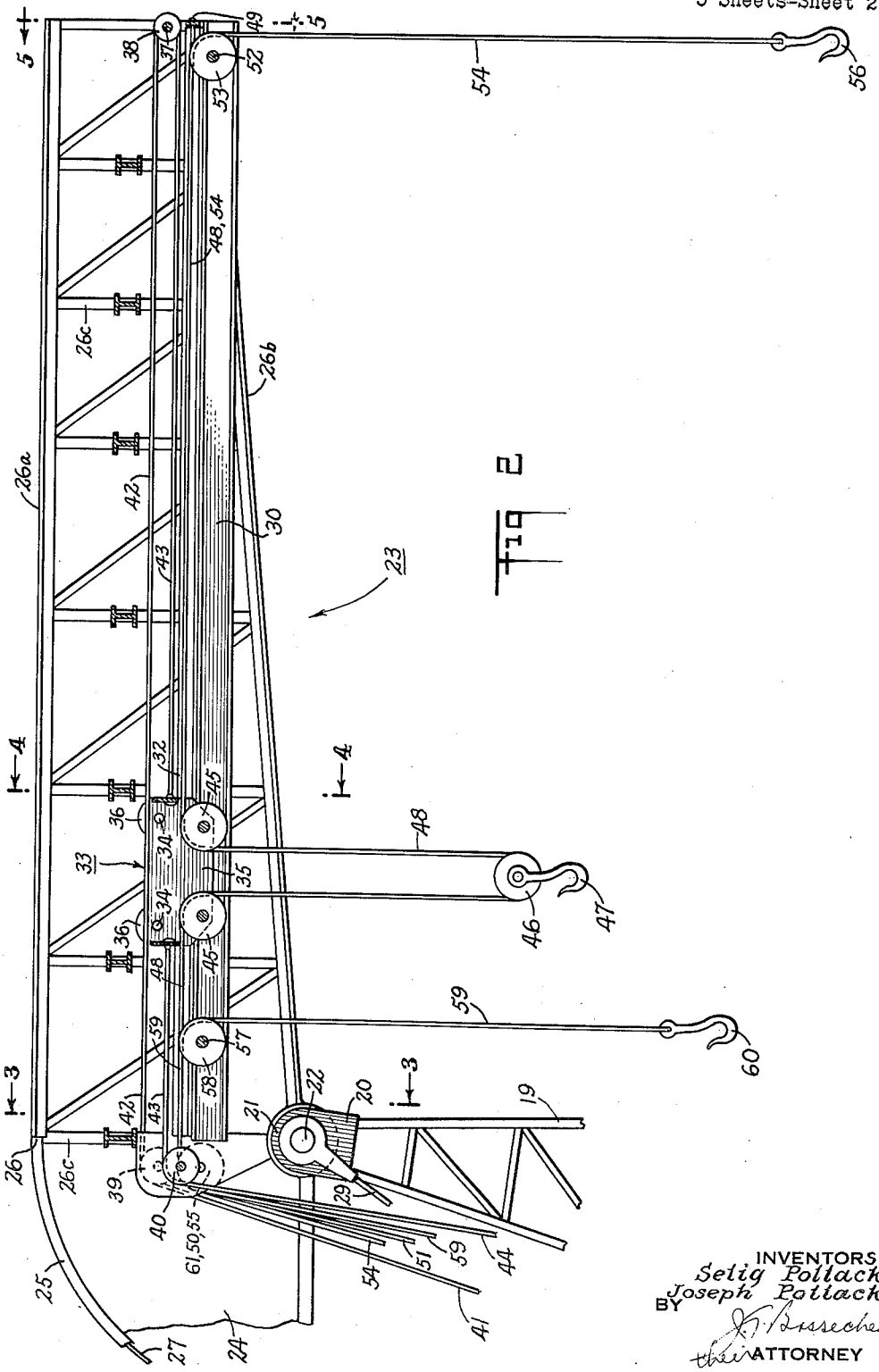


FIG 2

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BEAM JIB AND CRANE ASSEMBLY

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Fig 5

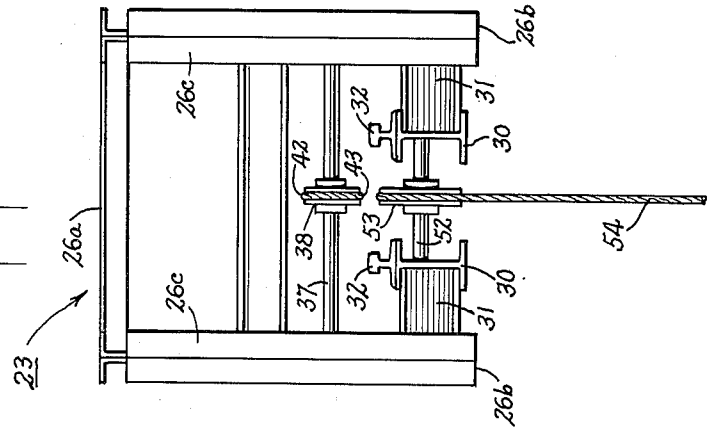


Fig 4

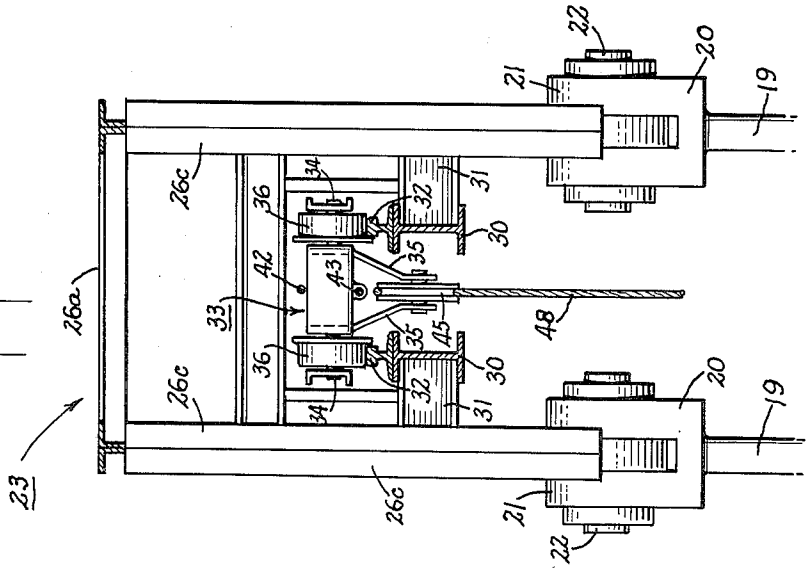
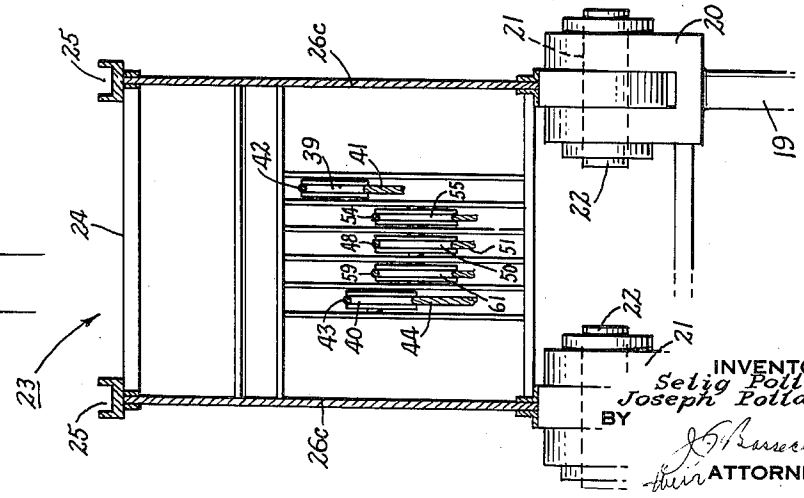


Fig 3



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FIG 6

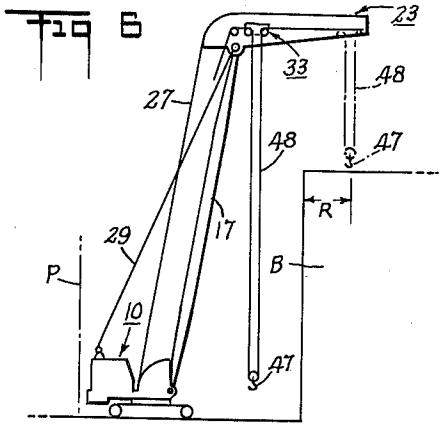


FIG 6A PRIOR ART

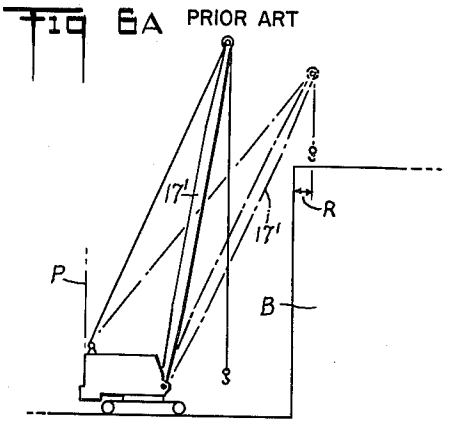


FIG 7

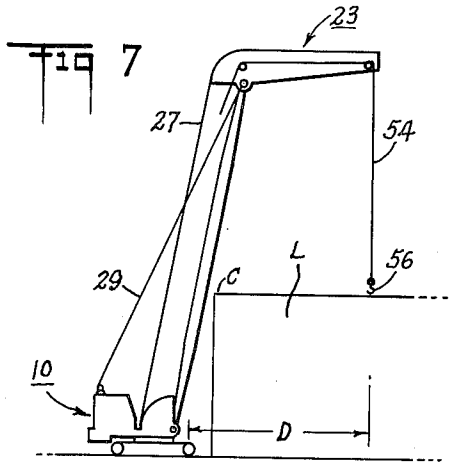


FIG 7A PRIOR ART

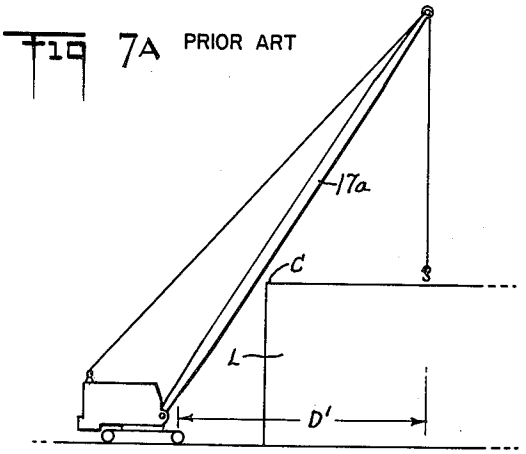


FIG 8

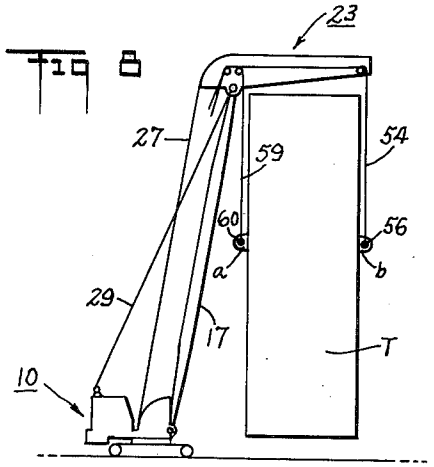
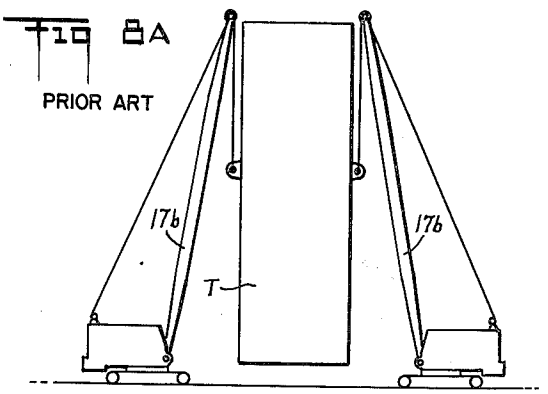


FIG 8A PRIOR ART



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Fig 9A PRIOR ART

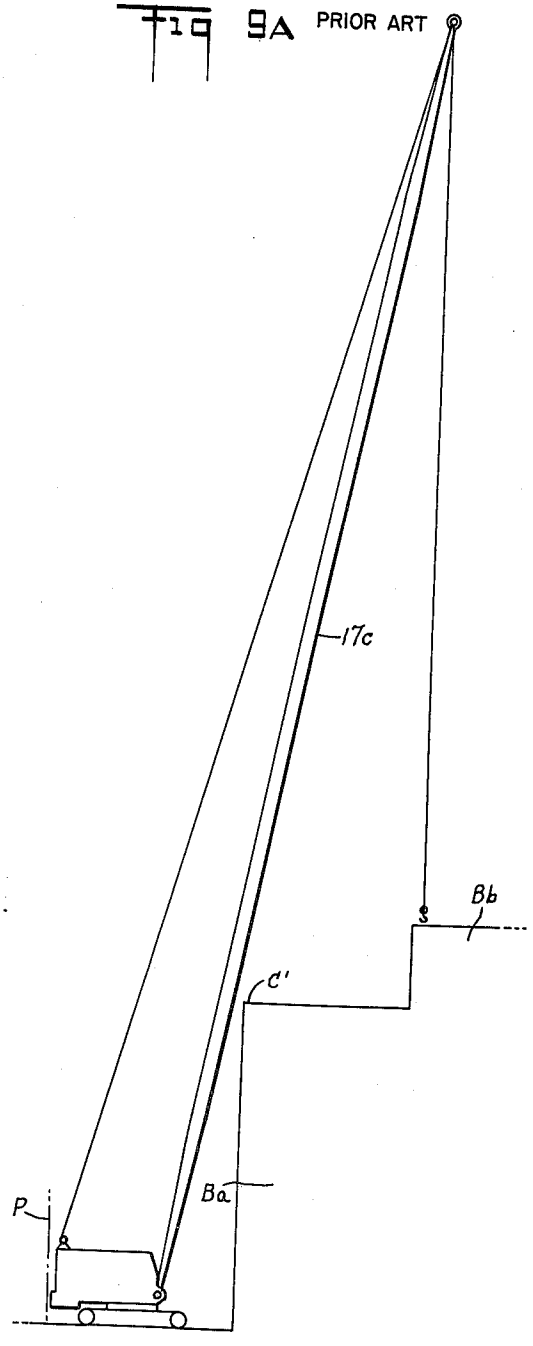
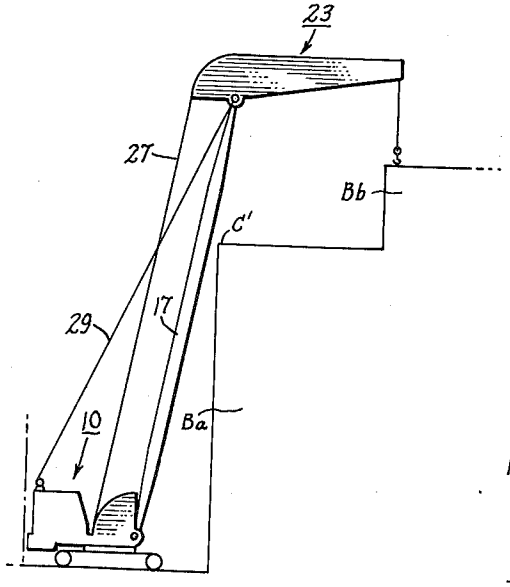


Fig 9



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BEAM JIB AND CRANE ASSEMBLY

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Filed Sept. 27, 1960, Ser. No. 58,668
4 Claims. (Cl. 212—59)

This invention relates to a jib construction for booms of derricks or cranes and more particularly to a beam jib and boom and assembly of derricks or cranes.

Known to us are the efforts to provide booms for horizontal or level luffing or extension jib booms wherein there is extended from a main boom, a sub-boom upon which articulation of the main boom serves to direct the terminally supported blocks and falls on the jib in horizontally directed positions. Known to us also are cranes having angular extensions, whether fixed or adjustable, providing a greater overhang, from whose terminal end work or load carrying blocks, falls and tackle are cable or rope operated to get a greater overhang than that structurally possible by a straight boom. Each of these extensions is limiting in operation, particularly where the load is bulky and required to be suspended accurately in a horizontal position at spaced points, which is not possible by a sling or like mounting, characteristic of positioning sections of a stack or water tower and canisters for liquid or plastic loads such as cement or like materials. Transferring bulky although not necessarily unusually heavy loads of this latter nature in closely confined areas or between buildings, or on roofs, in-between floors of skeleton buildings, echelon step-backs, in cramped spaces or narrow streets has frequently required highly skillful slinging, load guying control and, at times, a plurality of cranes and excessive manpower, with consequent great expense.

It is an object of our invention to provide a crane or derrick which generally provides greater facility of operation in confined spaces, capable of transferring and positioning loads, particularly horizontally transferring and shifting wide, bulky and cumbersome loads, such as stacked sections, tanks, bins, canisters, condensers and cooling assemblies, without special slinging and manually conducted guying during shifting of these loads, thereby to minimize traffic problems in busy thorofares and effect economical rigging where building operations and like installational operations are being conducted.

More particularly, it is an object of our invention to provide cranes or derricks with a beam jib construction for constructional or marine load handling which facilitates transferring operations in cramped quarters, to achieve both vertical and horizontal load shifting. Particularly, it is an object of our invention to provide a beam jib and crane construction which may be used to transfer loads of cumbersome outline without hazards due to the employment of excessively extended booms to meet both height and depth transfer problems, thereby avoiding excessive whiplash, breakage, overturning, unbalance, clearance of echelon offsets, back clearance for reach into inaccessible areas, ceiling limitations, whether in building or marine rigging operations.

Still more particularly, it is an object of our invention to provide a rigging crane or boom with a beam jib assembly which combines the maneuverability of a traveling crane for horizontal load shifting with the versatility of a boom type derrick or crane, to be mobile, articulatable for rotation, lifting, horizontal load transferring in confined areas in the handling of normally bulky and cumbersome loads, with economy of space and manpower.

Still more particularly, it is an object of our invention to provide, in combination with a rigging crane or boom, of an articulated beam jib which coordinates its movement automatically with the boom on or from which it is extended, to maintain a horizontal span or position with all angular shifting, and to include combined therewith runways, tracks, spacing of load, suspending and shifting contrivances along which horizontally extendible load shifting may be effected to and from a variety of elevations, whereby rotational and mobile maneuverability and the advantages of a crane may be retained, with maximum reach securing all the advantages of an overhead traveling crane, thereby to achieve lifting, rotational displacement, horizontal traverse of loads, to meet a wide variety of operating conditions, space and clearance requirements.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, we make reference to the accompanying drawings, in which:

FIGURE 1 is a side elevation schematically illustrating our invention of a boom and beam jib;

FIGURE 2 is a magnified detail of the upper assembly of beam jib;

FIGURE 3 is a section on the line 3—3 of FIGURE 2;

FIGURE 4 is a section on the line 4—4 of FIGURE 2;

FIGURE 5 is a section on the line 5—5 of FIGURE 2;

FIGURES 6 to 9 and FIGURES 6*a* to 9*a*, respectively, illustrate diagrammatically different operating conditions in a comparative relation for each such condition between our combined boom and beam jib and that of a straight length boom assembly, the latter being illustrative of the prior art.

Making reference to the drawings, our novel beam jib may best be illustrated in connection with a cab base **10**, mounted upon a Caterpillar tractor tread chassis **11**, with suitable provision for a rotational mount **12** to swing the cab base **10** on a vertical axis, in a manner well understood.

The cab **10** at its forward end **13**, has spaced side plates or frames **14** provided with spaced bearings **15** for the ends of a massive trunnion **16**, pivotally supporting between the plates **14**, the boom **17** at its lower terminal end **18**. The width of the bottom is not shown, as this construction as to width, span and intermediate strut and bracing or structural design is well understood.

The boom **17**, at its upper end **19**, is truncated into arms **20** and terminates in spaced apart bearings **21** to receive pin trunnions **22**, extending from the beam jib **23**.

The beam jib **23** has its base end **24** provided with quadrant shaped tracks **25** of outwardly directed channels, and at its outward peak **26** or point of tangency of the beam section **26***a*, there is suitably anchored the terminal ends of a pair of guy members **27** of flexible material, either chains, cable or similar flexible stress resisting component. Spaced from the trunnion center **16**, the side plates **14** are formed with quadrants **28** having edge channels or rails of similar construction and equal radial displacement from the axial line of the trunnion **16** as the quadrants **24**, and to the remote end **29***a* at a point of tangency to the quadrant **24** and about normal to the base there is then anchored the lower terminal end of each of the guy members **27**, which are likewise flexible in each of the contacting portions with the quadrants **28**.

Extending from the cab **10** is a winch controlled boom line **29** which, when actuated by tautening, raises the boom **17** and when relaxed lowers the boom **17**, and with it there is an automatic control of the beam jib in relation to the guys **27** of lower quadrants **28** and upper quadrants **24**, which quadrants are congruent and radially equal with each other to maintain the beam jib **23** in parallelism with the ground and horizontal in all of the angular positions of the main boom **17**, to have the boom controlled under the same guying influence because of the equal and parallel position of the guys to the main boom.

Mounted on the beam jib 23 between the upper beam sections 26*a* and the lower beam sections 26*b* are suitable beam stiffening struts 26*c* and between them, along the beam jib 23, for its full length, there are held opposed supports 30 in the form of I-beams from brackets 31 spaced at intervals in accordance with load values. Spaced rails 32 support a carriage or trolley 33 on axles 34 trunnioned in side plates 35 and on the axles there are flanged wheels 36, thereby providing a fixed guide for the trolley or carriage 33.

At the end of the beam jib 23 there is a shaft 37, fixedly supported between the vertical supports, on which is rotatably mounted a cable pulley or sheave 38. Between the stiffening struts 26*c*, at a point above the pin 22, there are trunnion pulleys or sheaves 39, 40.

Pulley 39 guides a trolley cable 41 as the upper flight 42 of a length thereof over the pulley 38. The lower flight 43 is fixed to the carriage 35 and is guided downwardly at the return section 44 over the sheave 40. The sections 41 and 44 of the trolley cable are directed to a winch (not shown) in the cab 10 and, under suitable control, may be moved along the tracks 32 between the supports 30.

The side plates 35, previously described, support a pair of carriage sheaves 45, over which is guided the travelling fall and tackle 46 for the hook 47. A cable or rope 48 has its terminal end 49 fixed at the end of the beam 23 by suitable means, the rearwardly directed end of the cable being guided over an idler sheave 50 at the rearmost end of the beam, and then to the return length 51 of cable 48, and then is directed to the cab 10 for control by an operator.

By this support of the fall and tackle 46 and any other equivalent load line, horizontal as well as vertical control is secured, as will be more clearly outlined.

Forwardly of the beam jib 23, between the supports 30, we may position a shaft 52 upon which is trunnioned an idler 53 for the load line assembly or cable or rope 54, which cable is guided rearwardly over the sheave 55 on the rearmost section of the beam jib and downwardly to a winch in the cab 10, as previously described. The cable or rope 54 for the hook 56 provides a fixed locational lift at the terminal end of the beam jib 23.

Adjacent the rearmost section of the beam jib, supported upon the shaft 57 which is suspended between the supports 30, there is provided a fixed sheave 58, over which is guided the cable, rope or equivalent load line assembly 59, from which cable a fixedly positioned tackle or hook 60 is provided. The powerized portion of the cable 59 is then rearwardly directed over a sheave or idler pulley 61 and then downwardly to a control winch in the cab, as previously described.

While we have shown and described single cable falls and tackles and corresponding sheaves for the work holding fall block hooks 47, 56, 60 and the carriage or trolley 33, it will be understood that these are so described for illustration only and the usual mechanical advantages may be secured for these load lines or load moving expedients with relation to the powerized winches for the cables or ropes which they actuate by a multiplicity of strands with corresponding multiplicity of sheaves in a well known manner by riggers, not to require illustration to those skilled in this field.

The operation of the assembly thus provided is as follows:

Upon angular displacement of the main boom 17 to different positions as shown in FIGURE 1, by draft or relaxing of the load line 29, the beam jib 23 will be maintained in parallelism in all angular positions as the guide members extending from the quadrants 24 to 28, will rise tangentially, to maintain the parallelogram of stress elements in equality. In each position, an overhang equivalent to a substantial overhead crane will be provided by the horizontal disposition of the guide rails 32 along which the carriage 33 may be shifted for substantially the full length of the beam jib. The reach of the load carrying fall and tackle may thus be increased in different horizontal positions into which the main boom may be moved and, likewise, travel in a horizontal position of the load carrying hook 47 may be secured in different levels, even in blind overhangs.

It will be observed that the fixed sheaves or idlers 53 and 58 may be maintained in parallelism in all angular positions of the beam jib when the main boom 17 is moved, and loads which are suspended at spaced points by the load lines for the hooks 56 and 60 will be maintained in a horizontal position in all lifting positions of the boom 17.

Likewise, when the beam jib 23 is moved to a predetermined height, the travelling hook 47 may be shifted horizontally by the carriage 33 into and over blind corners, without shifting the main boom 17 to change its angularity.

Examples of utility of the combination boom and beam jib in accordance with our invention are shown in FIGURES 6 to 9, as compared with a single length beam in FIGURES 6*a* to 9*a*, respectively.

In FIGURE 6, a boom 17 having a horizontally articulatable beam jib 23 is shown to one side of a building B within a permit clearance line P. It can readily be seen from an inspection of FIGURE 6*a* that the reach R' at the corner of the building B would cause obstruction back of the permit line P, without accomplishing a reach load transfer objective at different levels of the building B, as compared with the reach R of FIGURE 6 in accordance with our invention.

In FIGURE 6*a*, backing beyond the permit line would obstruct traffic if the installation of the cab and main boom were on a traffic street. Movement of the boom 17' for quick load shifting involves the hazards of whiplash of the boom 17' whereas with the provision of a load transfer carriage 33, such component of force for the lengthy main boom is completely avoided. In accordance with our invention, manual guying of loads to pass the obstructing corner into the point to be reached is also avoided and horizontal shifting is assured once the block and tackle supporting the hook 47 reaches the desired level in lifting the load from ground level to roof level of the building B.

Other advantages for both the transfer of loads over the fixed sheave 53 at the terminal end of the beam jib in the raising or lowering of the main boom 17 as well as in transferring loads to this terminal end by the travelling carriage 33 supporting the work load hook 47 will now readily become apparent.

In FIGURE 7 there is illustrated the utility of our articulated assembly of beam jib and boom 17 in connection with a bulky load L as compared with a similar load L in FIGURE 7*a*, with the latter employing a straight boom 17*a* of almost twice the length of the main boom 17. Both loads are supported by a single fall and tackle and the usual sling from the approximate center of the load L. The handling of a load of this bulky magnitude in accordance with this invention requires that the cab 10, on its chassis, be spaced a distance D before running into interference between the corner C and the main boom 17.

In FIGURE 7*a*, the cab 10 of the crane must be backed for a distance of greater magnitude D' from the center of the load L, as compared with the distance D, before the corner C interferes with the boom 17*a*, indicating not only the need for a greater length boom but the introduction of an overturning moment of force within dangerous limits for the assembly about the base.

The load shown in FIGURES 7 and about 7*a* is illustrative of the type of load which may be encountered in marine operations, and magnifies the utility of our assembly with regard to the weight of the load, the bulk of the load and the advantages of proximity to the load over a single length boom, especially in operating from a scow on which the boom may be mounted.

In FIGURE 8 we have shown our boom assembly 17 with the articulatable beam jib 23 for handling a load T, such as a section of a smoke stack, at spaced apart points *a* and *b* from the fixed terminal work holding hook 56 and the fixed inner work holding hook 60, a kind of load which is very difficult to sling. This rigging job frequently requires, in the interests of expediency, clearance limitation and time saving factors, that the load be maintained in parallelism in locating one stack section T on another. The boom 17, with its articulatable beam jib for horizontal lifting of the loads affixed to the spaced fall and tackle 56 and 60, permits of load travel to different heights, maintaining the load T horizontal at different positions of angularity and therefore different heights of load manipulated by the boom 17.

For purposes of illustrating the handling of a similar load T by straight booms, we refer to FIGURE 8*a* wherein a similar load requires the use of a pair of cranes 17*b*, 17*b* to each side of the load T.

In FIGURE 9 there is illustrated an operation of our boom assembly 17 with its articulatable beam jib 23 in connection with a building B*a*, having an echelon or set-back section B*b*. The boom is supported on the cab 10 whose position rearwardly is limited by the permit line P, as in the illustration given in FIGURE 6.

For purposes of comparison, FIGURE 9*a* shows the requirement of a length of straight line boom 17*c*, of almost three times the length of boom 17 in accordance with this invention, before the reach for transferring a load from ground level to the set-back is possible, without encountering the obstruction of the forward corner C′ of the building B*a*.

In accordance with this invention it is unnecessary to resort to guying to clear the corner C′ or the set-back.

Other advantages in handling other load problems by our boom assembly with its horizontally articulatable beam jib include roof clearance problems within hangers, operation between floors of a skeleton building, and in small working radii where main boom traversal is limited.

Still other advantages will readily appear to the skilled rigger in the art, to require no further amplification herein.

Having thus described our invention and illustrated its use, what we claim is new and desire to secure by Letters Patent is:

1. In a crane rigging device having a main boom and a supporting base chassis upon which said boom is pivotally supported for retraction and reach, in combination, a beam jib pivoted adjacent the upper terminal end of said boom, guying means for said beam jib and boom extending from said base to said beam jib and means for articulating said beam jib to maintain the beam jib automatically in a horizontal position in all angular movements of said boom comprising congruent and equal radially extended quadrants for said guying means on said base and beam jib, joined by flexible portions of said guy means tangentially extended from one quadrant to the other in all angular pivotal positions of said boom for retraction and reach.

2. In a crane rigging device having a main boom and a supporting base chassis upon which said boom is pivotally supported for retraction and reach, in combination, a beam jib pivoted adjacent the upper terminal end of said boom, guying means for said beam jib and boom extending from said base to said beam jib and means for articulating said beam jib to maintain the beam jib automatically in a horizontal position in all angular movements of said boom comprising congruent and equal radially extended quadrants for said guying means on said base and beam jib, joined by flexible portions of said guy means tangentially extended from one quadrant to the other in all angular pivotal positions of said boom for retraction and reach, and means on said beam jib for extending variable length load lines along the length of said beam jib whereby loads may be supported along the length of the beam jib at spaced points and maintained in horizontal transferring position in all angular positions of said main boom.

3. In a crane rigging device having a main boom and a supporting base chassis upon which said boom is pivotally supported for retraction and reach, in combination, a beam jib pivoted adjacent the upper terminal end of said boom, guying means for said beam jib and boom extending from said base to said beam jib and means for articulating said beam jib to maintain the beam jib automatically in a horizontal position in all angular movements of said boom comprising congruent and equal radially extended quadrants for said guying means on said base and beam jib, joined by flexible portions of said guy means tangentially extended from one quadrant to the other in all angular pivotal positions of said boom for retraction and reach, and means on said beam jib for extending variable length and spacially positioned load lines along the length of said beam jib comprising a carriage, and means on said beam for spacially positioning said carriage whereby loads may be transferred along the length of said beam jib at various heights in all angular positions of said main boom.

4. In a crane rigging device having a main boom and a supporting base chassis upon which said boom is pivotally supported for retraction and reach, in combination, a beam jib pivoted adjacent the upper terminal end of said boom, guying means for said beam jib and boom extending from said base to said beam jib and means for articulating said beam jib to maintain the beam jib automatically in a horizontal position in all angular movements of said boom comprising congruent and equal radially extended quadrants for said guying means on said base and beam jib, joined by flexible portions of said guy means tangentially extended from one quadrant to the other in all angular pivotal positions of said boom for retraction and reach, and means on said beam jib from which load lines may be vertically suspended comprising a carriage, means for variably positioning said carriage along said beam jib and tracks on said jib for guiding said carriage longitudinally along the beam jib whereby loads may be vertically and horizontally transferred with the angular movement of said main boom.

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