Dec. 20, 1966 R. C. COUSINS ET AL 3,292,559

RAIL MOUNTED MOBILE JIB CRANE APPARATUS

Filed Feb. 5, 1964 3 Sheets-Sheet 1

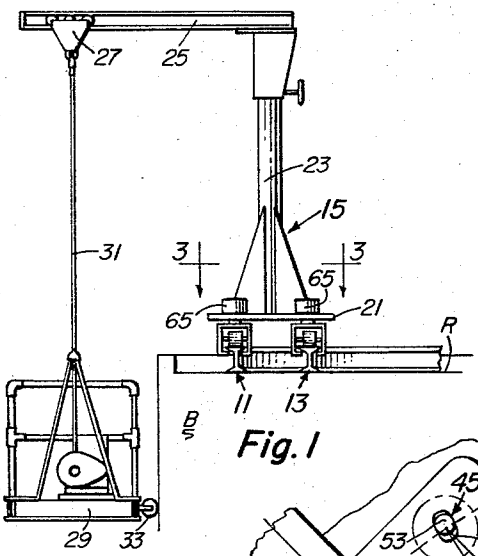


Fig. 1

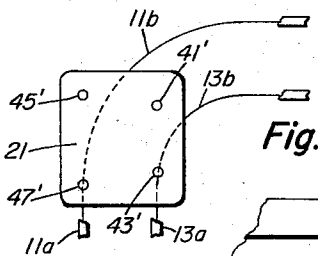


Fig.2A

Fig.2

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RAIL MOUNTED MOBILE JIB CRANE APPARATUS

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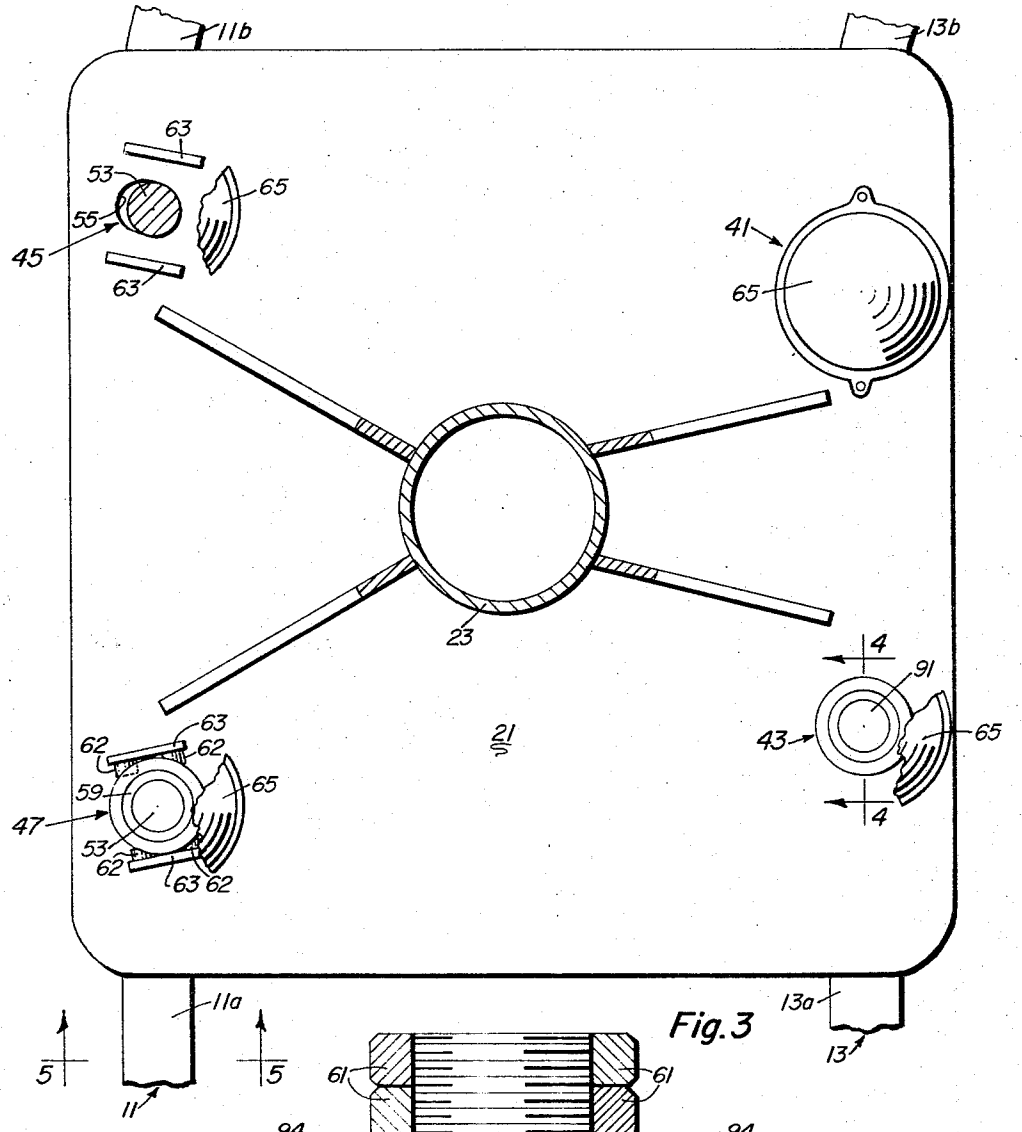


Fig. 3

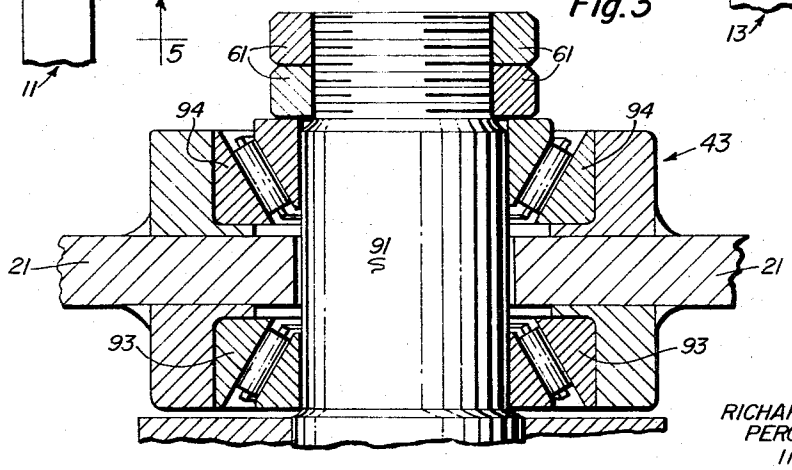


Fig. 4

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RAIL MOUNTED MOBILE JIB CRANE APPARATUS

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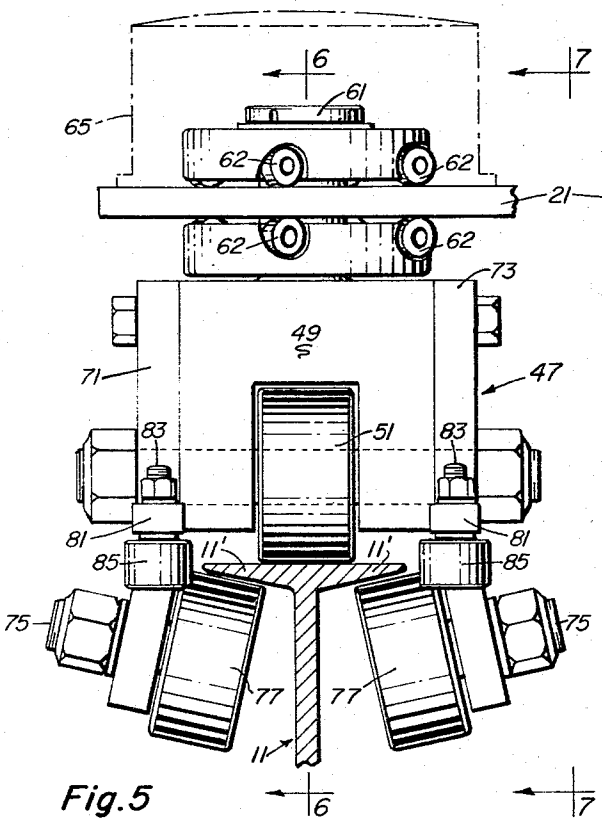


Fig.5

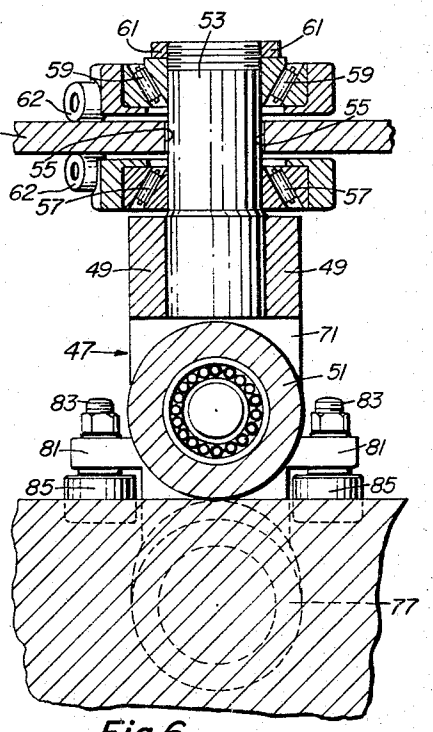


Fig.6

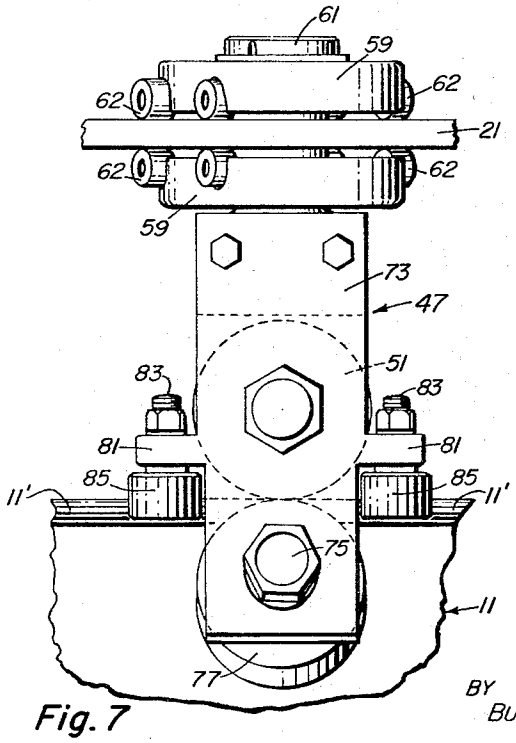


Fig. 7

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3,292,559

RAIL MOUNTED MOBILE JIB CRANE APPARATUS

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Filed Feb. 5, 1964, Ser. No. 342,701
6 Claims. (Cl. 104—246)

This invention relates to a rail mounted mobile jib crane apparatus and particularly to an apparatus of the type mounted on rails fixed to the roof of a building.

The patent to Wylie 3,111,094, discloses an apparatus of this general construction. In the Wylie apparatus each of the jib cranes has three wheel units mounted on a pair of rails. The rails follow the periphery of the building and are parallel except at the corners of the building, where they are specially bent or formed into a non-parallel relation so as to lessen the tendency of the wheel units to bind on the rails in such places.

It is more expensive to provide the specially formed curved rail corner portions than it is to provide arcuately curved parallel concentric rail portions.

It is a main object of the present invention to provide an apparatus of the type under consideration in which the two rails are parallel throughout their lengths, including the corner portions.

It is a further object of the invention to provide a mobile jib crane for travel along such rails and particularly to provide a jib crane supported by four wheel units rather than three wheel units to provide a more stable crane.

In a four wheel unit jib crane where the spacing between the rails is substantial relative to the spacing between the wheels, the wheels would bind on the rails were it not for a special feature of the present invention which enables the jib crane to navigate the curved parallel rail portions of the rails without any binding whatsoever.

In our mobile jib crane, the two wheel units nearest the outside of the building are mounted for bodily shifting movement relative to the inner wheel units and the inner wheel units are disposed closer to one another to lessen the amount of bodily shifting movement required of the outer wheel units. We have found that there is an optimum location of the inner wheel units relative to the outer wheel units for any particular spacing of the tracks from one another, and for any given mean radius of curvature of the tracks at the corners of a building.

Various other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a diagrammatic elevational view of a rail mounted mobile jib crane apparatus of our invention, which apparatus is shown mounted on the roof of a building and suspending a staging platform by means of cables;

FIG. 2A is a diagrammatic plan view illustrating certain problems to be overcome in regard to an apparatus of our invention;

FIG. 2 is a diagrammatic plan view of the apparatus, showing an important relationship of the mobile jib cranes to their rails;

FIG. 3 is an enlarged horizontal sectional view taken along line 3—3 of FIG. 1 showing in detail the base plate and associated structure of a mobile jib crane, parts being broken away for convenience in illustration;

FIG. 4 is an enlarged fragmentary vertical sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is an enlarged vertical sectional view taken along line 5—5 of FIG. 3;

FIG. 6 is a vertical sectional view taken along line 6—6 of FIG. 5; and

FIG. 7 is a side elevational view taken in the direction of the arrows 7—7 of FIG. 5.

Referring to FIG. 1 of the drawings, a mobile staging apparatus is shown mounted on the roof R of a building B. The mobile staging apparatus includes a pair of parallel tracks or rails in the form of I-beams **11** and **13** which are secured to the roof adjacent the periphery thereof. At each corner of the building, the rails **11** and **13** are curved, as shown in FIG. 2, to follow the contour of the building. FIG. 2 shows diagrammatically typical sections of the rails at a corner of the building B. The sections shown include straight rail portions **11***a* and **13***a* and curved portions **11***b* and **13***b*.

Referring to FIG. 2, mounted on and movable along such rails are a pair of mobile jib cranes **15** and **17** which are shown, for convenience in illustration, in positions closer to one another than they would occupy in practice. While in FIG. 2 crane **15** is shown as being located on the straight rail portions **11***a* and **13***a*, and crane **17** is located on the curved rail portions **11***b* and **13***b*, in FIG. 1, it is assumed that both cranes are located on the straight rail portions **11***a* and **13***a*, so that their profiles coincide and hence only crane **15** is seen.

Each of the cranes includes a wheel supported base plate **21** which in turn supports a fixed vertical mast **23**. A boom **25** is mounted on the upper end of the mast and projects in cantilever fashion outwardly beyond the side wall of the building B. The boom carries a trolley **27** which can be releasably held, by conventional means (not shown), against movement relative to the boom **25**.

A staging platform **29** is suspended from the trolleys of the booms of both jib cranes by means of a pair of cables **31**, one of which is shown in FIG. 1. The platform **29** is equipped with wheels **33** for engaging the side of the building B. Normally the trolleys are located so that the cables extend upwardly and slightly inwardly toward the building so that the staging platform **29** tends to hug the side of the building to remain in contact therewith at any position of the staging along such building side. Of course, the platform could be suspended free of the building, if desired.

In the patent to Wylie, 3,111,094, each mobile jib crane of the mobile staging apparatus has three wheel units which would bind on the rails at the curved corner portions thereof were the corner portions not specially bent (so that they assume a special non-parallel relationship), thereby to lessen the tendency of the wheel units of the jib cranes to bind on such rail portions. This arrangement is generally satisfactory with three wheel jib cranes provided a certain amount of play is provided. However, the necessity of forming the rails of special non-parallel curvature at the corners of buildings is more expensive than merely providing arcuately curved parallel corner portions. In any event, however, the Wylie arrangement is not satisfactory for a four wheel jib crane such as is employed in the present invention.

Referring now to FIG. 2, as previously stated, the rails **11** and **13** are parallel to one another, and the curved portions **11***b* and **13***b* are of arcuate form and are concentric, having a center at point C in FIG. 2. Thus the curved portions can be readily and inexpensively formed in a three roll bending machine. The rail **11** may be referred to hereinafter as the outer or outside rail, since it is nearer to the outside of the building than is rail **13**, and the rail **13** may be referred to as the inner or inside rail because it is nearer the inside of the building and also because it is of shorter length than is the outer rail.

The wheel mounted base plate **21** of each jib crane is generally of rectangular form, as is evident from FIGS. 2 and 3, and each plate has two pairs of wheel units, an inside pair **41** and **43** for the inner rail **13**, and an outer pair **45** and **47** for the outer rail **11**. More will be said

presently about the relationship of the wheel units to one another.

FIGS. 5–7 show the construction of an outer wheel unit, unit **47**. The wheel unit includes a yoke **49** which rotatably supports a wheel **51** which rides on the upper face of the upper flange **11'** of the outer rail **11**. Each yoke has an upstanding pivot shaft **53** (FIG. 6) which extends upwardly through an elongated slot **55** (compare FIGS. 3 and 6) formed in the base plate **21**. Before passing through plate **21** it passes through a lower tapered roller bearing **57** and after passing through plate **21** fits in an upper bearing **59**. A nut **61** holds the parts together.

Each of the bearings has an outer race carrying four small wheels **62** which ride against the adjacent face of the base plate **21**. The wheels are arranged with their axes at right angles to the length of, and are retained against lateral displacement relative to, the plate **21** by a pair of spaced guide bars **63** which are fixed to the base plate. Each pair of guide bars **63** is parallel to the direction of extension of the associated slot **55** and both are parallel to the associated radius line, r_1 in the case of wheel unit **45** and r_2 in the case of wheel unit **47**.

The upper portion of each wheel unit is covered by a cup-shaped housing **65** (FIGS. 1 and 3) which is detachably secured to the base plate **21**.

The elongated base plate slot **55** for each of the outer wheel units **45** and **47** allows the wheel unit to bodily shift relative to the base plate for a purpose to be described presently. For the present, it should be mentioned that each such slot extends parallel to the associated bars **63** and hence extends in generally transverse relation to the length of the rail **11**, so that shifting of the outer wheel units **45** and **47** changes the spacing thereof relative to the inner wheel units **41** and **43**.

Each yoke **49** has a pair of separate depending side members **71** and **73** (FIGS. 5 and 7) each of which is bent or angled outwardly slightly. Supported by each such outward portion is an axle **75** which rotatably supports a wheel or roller **77** which is disposed next to the underside of the upper flange **11'** of the rail **11** with its axis of rotation parallel to the adjacent lower face of such flange. Actual contact between the wheels **77** and the flange **11'** is not required, but such wheels do positively limit upward movement of the wheel units relative to the rails without impairing the ability of the jib crane to be moved along the rails **11** and **13**. It is pointed out that the booms of the jib cranes have to support considerable weight, such as that of the platform **29** and cable winch units thereon and related equipment, that of the men to occupy the platform, and that of any loads carried by the platform. Thus, the rollers **77**, particularly of the inner wheel units, are necessary to prevent tipping of the jib cranes under the loading referred to above.

Each of the depending side members **71** and **73** has a pair of oppositely extending horizontal ears **81** (FIG. 7), each of which carries a vertical axle **83** for a small guide wheel **85**. The guide wheels are spaced slightly (FIG. 5) from the opposed edges of the flange **11'** but can engage such edges and prevent binding of the wheel unit against such edges.

Referring to FIGS. 3 and 4, the inner wheel units **41** and **43** are of the same construction as units **45** and **47** except at the upper portions thereof. At such upper portions, the pivot shaft **91** of each of the units **41** and **43** extends through a lower tapered roller bearing **93**, through a circular hole in the base plate **21**, and then through an upper bearing **94**. The outer races of the bearings **93** and **94** are welded (or othewise secured) to the base plate **21**.

Referring to FIG. 2A, this figure shows a base plate **21** and four wheel units **41'**, **43'**, **45'** and **47'** which it is assumed can swivel but can not bodily shift. The rails shown are of the type shown in FIG. 2 and thus have straight rail portions **11***a* and **13***a* and parallel, concentrically curved rail portions **11***b* and **13***b*. When the base

plate **21** assumes the position shown in FIG. 2A, with the rear set of wheel units **43'** and **47'** located on the straight rail portions **11***a* and **13***a* and with the front set of wheel units **41'** and **45'** located forwardly of the ends of such straight rail portions, the problem to be encountered is apparent. The problem is simply this: the plate **21** can not itself pivot, being so limited by wheel units **43'** and **47'**, and hence the forward wheel units **41'** and **45'** are constrained to travel straight ahead, whereas the curved track portions **11***b* and **13***b* want to constrain them to move along arcuate paths. Therefore, it is evident that the wheel units **41'** and **45'** simply can not assume the positions shown in FIG. 2A but instead would be engaged in binding relation with the curved rail portions **11***b* and **13***b* shortly after such wheel units left the straight portions **11***a* and **13***a*.

Now referring to FIG. 2, it is apparent that the wheel units **45** and **47** can bodily shift their positions thereby allowing the plate **21** to turn to enable the wheels units to remain in rolling engagement with the rails without binding thereon. In fact, FIG. 2 shows that the base plate **21** of crane **15** has the wheel unit pivot shafts **53** located at the inner ends of the slots **55**, whereas the pivot shafts **53** of the wheel units **45** and **47** of the crane **17** are disposed outwardly from the inner ends of the slots **55**. The amount of bodily shifting of the wheel units **45** and **47** is not as great as indicated in FIG. 2, but the showing has been exaggerated for purposes of convenience in disclosure. The amount of bodily shift or displacement of the wheel units would be even greater than that indicated in FIG. 2 were it not for the special location of the inner wheel units.

Again referring to FIG. 2, and particularly to crane **17** it is apparent that if the inner wheel units **41** and **43** were located on the radius lines r_1 and r_2, the distance between an outer wheel unit and its opposite inner wheel unit would be equal to the distance between the tracks. Thus, no bodily shift of any wheel units would be required if a crane traveled at all times on a circular set of tracks, or if the crane traveled at all times on straight track sections. It is the movement of a crane from the straight track sections onto the curved track sections that causes the difficulty.

We have discovered that the location of the wheel units **41** and **43** on the radius lines r_1 and r_2 does not result in the minimum displacement of the wheel units **45** and **47**. For convenience, this minimum displacement will be referred to as the optimum displacement. We have discovered on the contrary, that the inner wheel units **41** and **43** should be located between the radius lines r_1 and r_2 on one hand and parallel lines p_1 and p_2 on the other hand. Lines p_1 and p_2 pass through the axes of rotation of the wheel units **45** and **47**, respectively, or at least through the mean positions of such axes. In fact, we have discovered that a generally medial location of the inner wheel units between the radius lines and the parallel lines results in an optimum displacement of the outer wheel units, i.e., a minimum displacement. It is further pointed out that the inner wheel units and the outer wheel units are located in symmetrical location to the center line ℄ which extends from the center C and bisects the arc between the radius lines r_1 and r_2.

In actual practice, we have found that with a wheel unit location as specified above, that the wheel unit displacement of the outer units **45** and **47** is rather small and in fact in the neighborhood of $\frac{5}{16}$ of an inch, with a spacing of nineteen inches between the tracks and with a radius of curvature of the inner track at twenty-three inches and with the outer wheel units spaced from one another by a distance of approximately twenty-four inches.

Since there is only a small amount of bodily shifting of the wheel units **45** and **47**, because of the special location of the wheel units, it is possible to eliminate any

bodily shifting of any of the wheel units and instead provide sufficient play between the wheel units and the rails to prevent binding. The arrangement would have certain disadvantages as compared with the arrangement in the drawings, but it would be workable.

It will be appreciated that the binding problem of the wheel units is created by a combination of certain relationships. If the spacing between the outer wheel units could be made very small relative to the radii of curvature of the inner and outer rails, obviously no binding problem would be encountered but the apparatus would be unstable or, if the outer wheel units were widely spaced but the radius of curvature of the tracks relative to the spacing of the outer wheel units is large, no problem of binding is encountered. It is when the distance between the outer wheel units is substantial in relation to the radius of curvature of the inner track and is substantial in relation to the spacing between the tracks that binding problems arise. This very problem is encountered in roof mounted equipment of the type under discussion.

Some details of construction not previously mentioned are as follows. The boom **25** is preferably pivotally mounted on the mast **23** so that when the platform **29** is raised above the level of the roof, the booms can be swung around to deposit the platform on the roof. A suitable lock, not shown, is provided for releasably locking the boom against movement. Also a lock, not shown, is provided to hold each crane against movement along the rails when this is desired.

This invention has been explained in connection with a roof mounted mobile jib crane apparatus which supports staging at the side of a building, but it will be understood that the invention is not intended to be limited to this application. Also, while the outer wheel units are shown as the ones which are bodily shiftable, the inner ones or both pairs of wheel units could be so mounted if desired. Some buildings have a jog in the contour thereof, making it necessary to have a reverse bend in the rails. Under these circumstances, the spacing of the wheel units of both pairs of units would be the same. This would unavoidably result in considerably more shifting movement of the shiftable wheel units than with the single curve arrangement shown in the drawings, with consequent greater wear, but a workable structure would be provided.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

We claim:

1. A mobile jib crane for travel along a pair of tracks having straight track portions and arcuately curved track portions, said crane comprising,

a base structure,

means for supporting said base structure on said tracks including a first pair of wheel means for one track and a second pair of wheel means for the other track,

mounting means for each wheel means,

each mounting means swivelly connecting its wheel means to said base structure,

said base structure having portions providing a horizontally extending slot in association with each of said first wheel means,

said slots extending in a direction generally toward the other track,

a mounting means for each first wheel means including a vertical unit slidably received in the associated slot for movement lengthwise of such slot to permit variations in the spacing between the first wheel means and the second wheel means as demanded by said tracks as the crane moves therealong.

2. A mobile jib crane as set forth in claim **1** wherein said slots converge inwardly toward one another in a direction toward the other wheel means.

3. A mobile jib crane as set forth in claim **1** in which each vertical unit includes antifriction bearing means above and below said base structure and riding against said base structure.

4. A mobile device for travel along a pair of parallel tracks which have straight and curved portions, comprising:

a frame having a pair of swivel-mounted wheel means for each track,

means mounting the wheel means of one pair for independent bodily shifting rectilinear movement toward and away from the remaining wheel means, and the wheel means of one pair being permanently spaced apart a greater distance than the other pair to prevent binding of said wheel means as said crane moves from said straight track portions onto said curved track portions ad vice versa, said wheel means being located so that a straight line extending equidistantly between the wheel means for one track and then equidistantly between the wheel means of the other track is perpendicular to said tracks.

5. A mobile jib crane for travel along a pair of parallel tracks, which tracks include straight track portions and portions arcuately curved in a predetermined direction, whereby one track may be considered as the outside track and the other track as the inside track, said crane comprising:

a platform extending above and overhanging said tracks and a first pair of wheel means mounted on said platform for engaging one track and a second pair of wheel means mounted on said platform for engaging the other track,

means mounting each wheel means for swiveling movement about a vertical axis,

the wheel means of one pair being arranged in generally opposed relationship to the wheel means of the other pair so as to provide two sets of opposed wheel means,

the wheel means of each pair being spaced apart a distance at least equal to one-half the distance between the tracks, and the latter distance being at least equal to one-half the radius of curvature of the inside track whereby whenever the jib crane assumes a position with two of its wheel means on the straight track portions and two on the curved track portions, separating forces will be created on said opposed wheel means tending to cause them to bind on said tracks,

means, including openings in said platform, mounting said wheel means for independent bodily separating movement of the opposed means to enable them to shift relative to said platform and thus preclude their binding on said tracks,

said wheel means being so located that the pair on said inside track are closer together than the other pair whereby to reduce substantially the separating movement of said wheel means over that which would exist if said opposed wheel means axes intersected such parallel lines.

6. In combination:

a pair of parallel tracks wherein each track includes a straight track portion and an arcuately curved track portion, and wherein the arcuately curved track portions have a common center of curvature so that one curved track portion has a smaller radius of curvature than the other,

a mobile jib crane for travel along said tracks,

said crane comprising:

a base having a first pair of wheel means for engaging one track and a second pair of wheel means for engaging the other track,

the wheel means of one pair being generally opposite the wheel means of the other pair so as to provide two sets of opposed wheel means,

the wheel means being so constructed that they engage their respective tracks in a manner such as to be held against substantial lateral movement relative to the

tracks, and against substantial vertical movement away from said tracks,

means mounting each wheel means for swiveling movement about a vertical axis,

the spacing between the wheel means of each pair in relation to the distance between the tracks and in relation to the radius of curvature of said one curved track portion being such that whenever the jib crane assumes a position with two of its wheel means on the straight track portions and two on the curved track portions, the latter track portions will tend to cam the associated wheel means apart which would tend to cause them to bind on said tracks,

means, including openings in said base, mounting at least two of said wheel means, which are not laterally opposed to one another, for independent movement relative to said base so as to provide bodily separating movement of the opposed wheel means and thus preclude their binding on said tracks,

and means fixedly positioning the remaining wheel means aginst movement relative to said base,

said wheel means also being so located that when said crane occupies a position with all said wheel means on said curved track portions, the vertical planes containing the vertical axes of the sets of opposed wheel means are inclined inwardly toward said center of curvature whereby to lessen the extent of separating movement of said wheel means.

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