June 10, 1969 E. O. MARTINSON 3,448,874

MOBILE CRANE WITH SPACED PIVOTALLY MOUNTED BOOMS

Filed July 3, 1967 Sheet 1 of 5

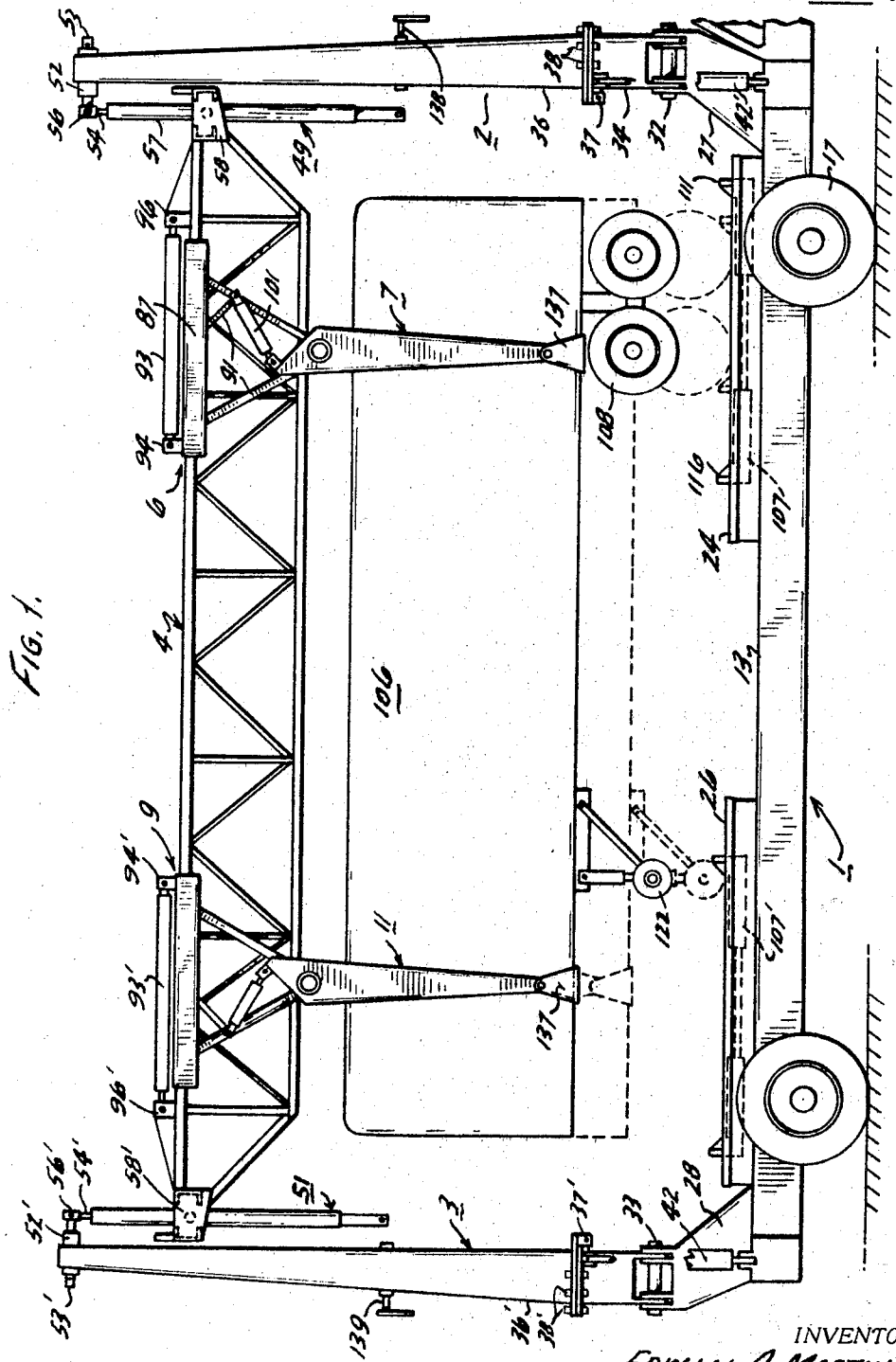


FIG. 1.

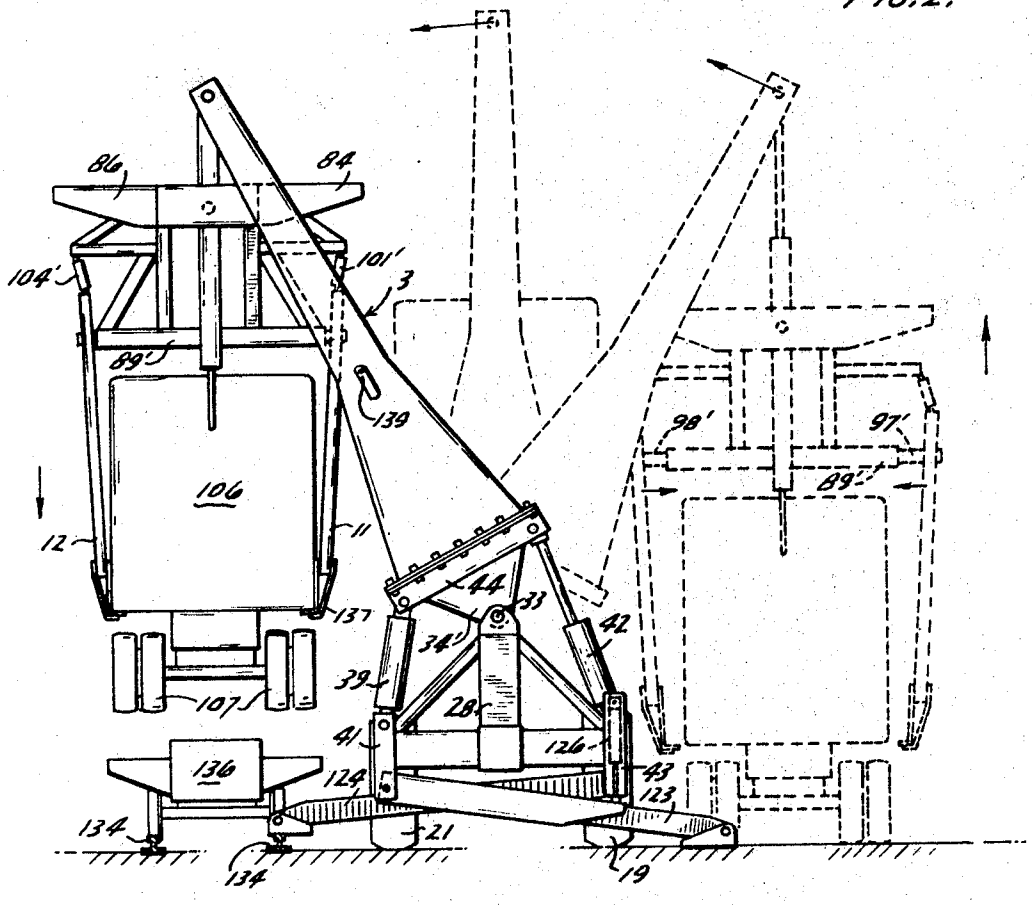
INVENTOR.
EDWIN O. MARTINSON
BY W. Fischer
ATTORNEY.

June 10, 1969 E. O. MARTINSON 3,448,874

MOBILE CRANE WITH SPACED PIVOTALLY MOUNTED BOOMS

Filed July 3, 1967 Sheet 2 of 5

FIG. 2.



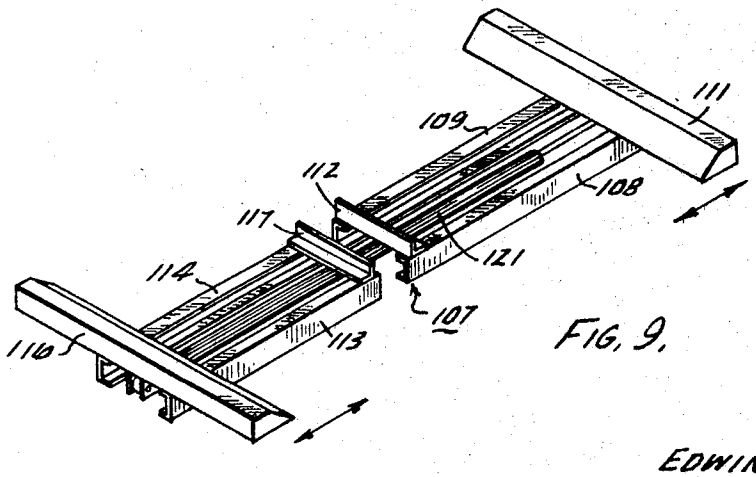


FIG. 9.

INVENTOR.
EDWIN O. MARTINSON
BY
W. Fitzgerald
ATTORNEY

June 10, 1969 E. O. MARTINSON 3,448,874

MOBILE CRANE WITH SPACED PIVOTALLY MOUNTED BOOMS

Filed July 3, 1967 Sheet 3 of 5

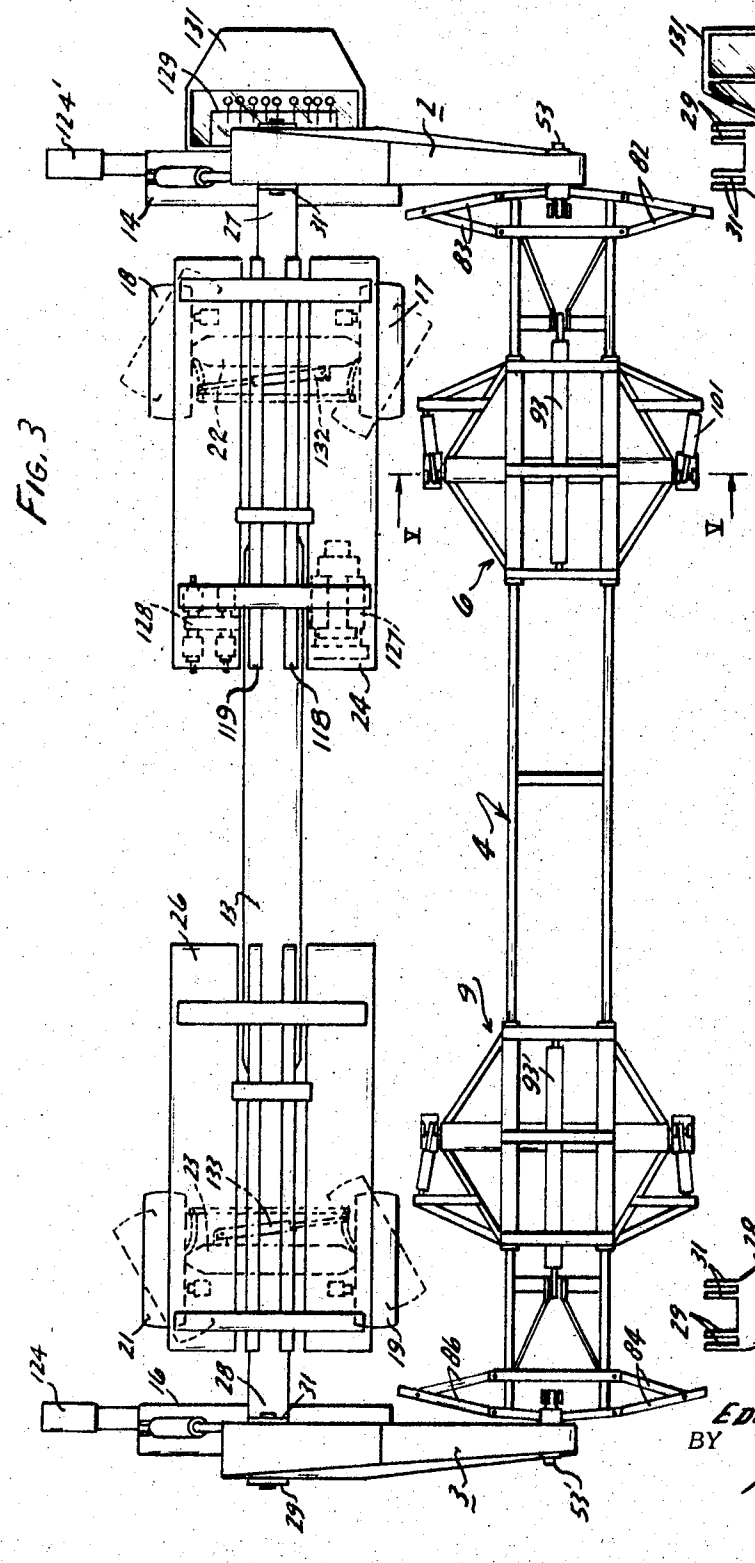


FIG. 3

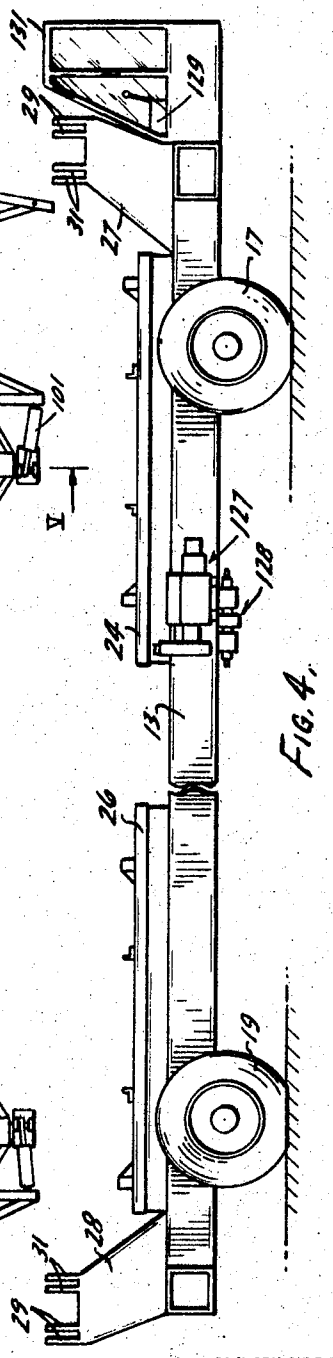


FIG. 4.

INVENTOR.
EDWIN O. MARTINSON
BY
W. Fierabb
ATTORNEY.

June 10, 1969 E. O. MARTINSON 3,448,874

MOBILE CRANE WITH SPACED PIVOTALLY MOUNTED BOOMS

Filed July 3, 1967 Sheet 4 of 5

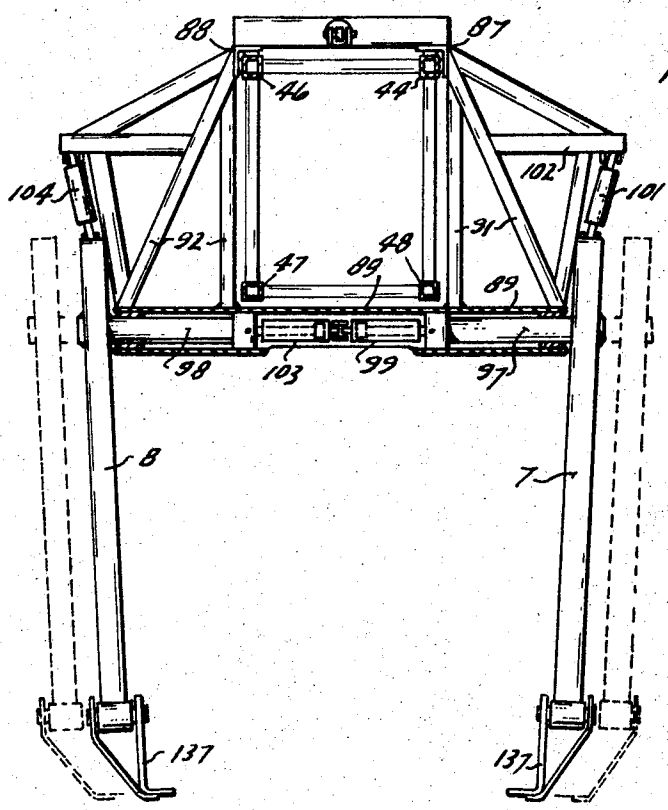


FIG. 5.

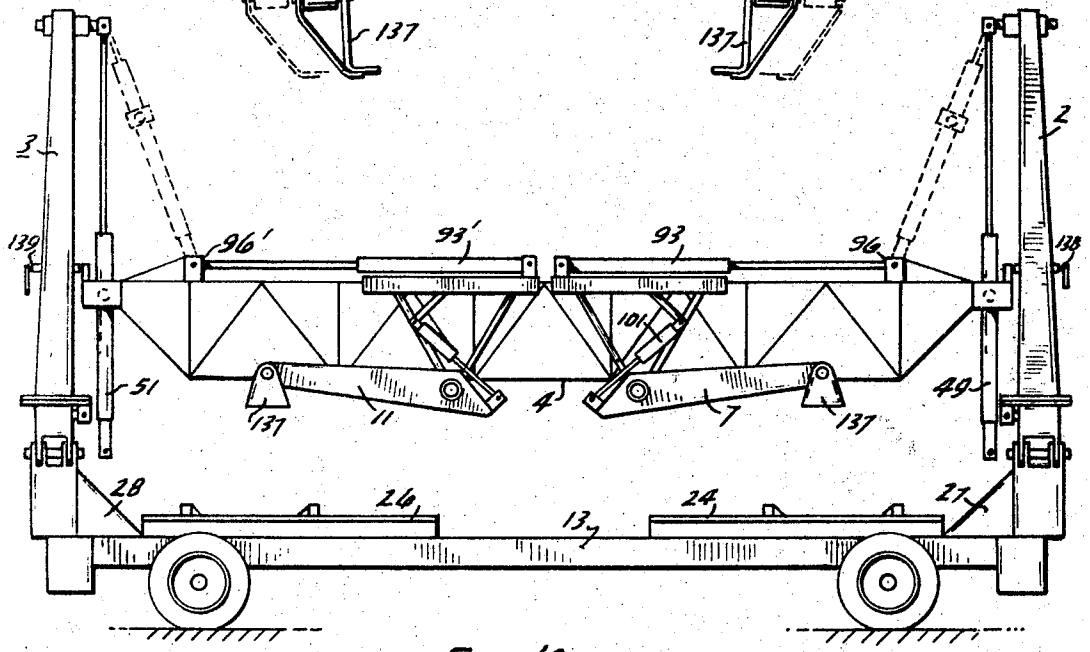


FIG. 10.

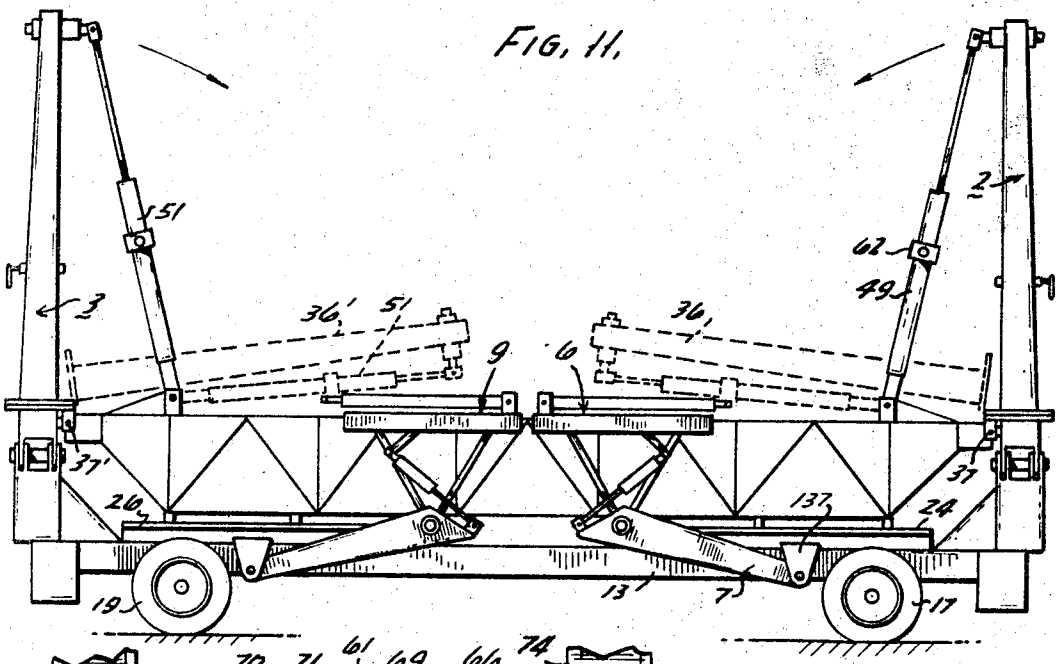
INVENTOR.
EDWIN O. MARTINSON
BY
W. Fitzsimmons
ATTORNEY.

June 10, 1969 E. O. MARTINSON 3,448,874

MOBILE CRANE WITH SPACED PIVOTALLY MOUNTED BOOMS

Filed July 3, 1967 Sheet 5 of 5

FIG. 11.



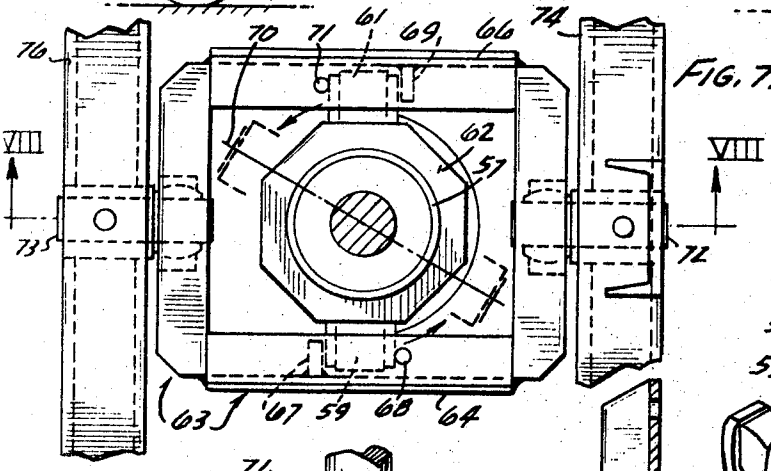
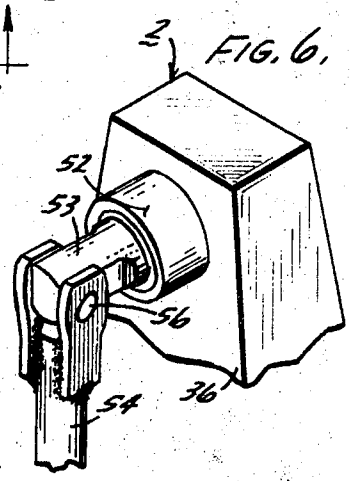


FIG. 7.

FIG. 6.



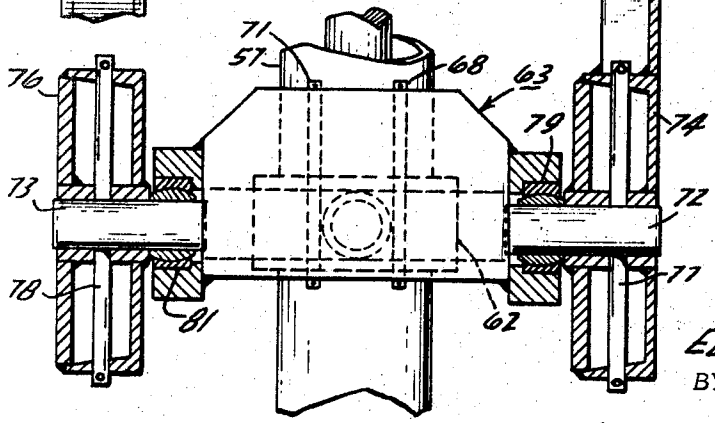


FIG. 8.

INVENTOR.
EDWIN O. MARTINSON
BY
ATTORNEY.

United States Patent Office 3,448,874
Patented June 10, 1969

3,448,874

MOBILE CRANE WITH SPACED PIVOTALLY MOUNTED BOOMS

Edwin O. Martinson, Milwaukee, Wis., assignor to Koehring Company, Milwaukee, Wis., a corporation of Wisconsin

Filed July 3, 1967, Ser. No. 650,757
Int. Cl. B60p 1/46, 1/48; B65g 67/02
U.S. Cl. 214—75 6 Claims

ABSTRACT OF THE DISCLOSURE

A crane for transferring semi-trailers or their cargo containers from the road to railroad flat cars and vice versa, comprises a wheeled vehicle frame, front and rear booms swingable independently of each other to pickup positions at either side of the vehicle frame, a truss flexibly suspended from the booms by front and rear hoist rams; and front and rear pairs of grapple arms swingably suspended from front and rear crane trolleys on the truss.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to material handling apparatus, and it is concerned more particularly with a mobile crane for use at railroad yards where truck drawn semi-trailers or the cargo containers of such trailers are loaded upon and unloaded from railroad flat cars. Description of the prior art.

Description of the prior art

The loading of semi-trailers, or of the cargo containers of such trailers, upon flat cars for rail shipment has become an accepted practice in the trucking industry, and special cranes known as TOF (trailer on flat car) cranes are commonly employed for that purpose.

One type of TOF crane which has heretofore been suggested comprises a relatively wide and high traveling gantry which straddles the railroad track and a truck road next to it. Movably suspended from the gantry is a grapple apparatus picks it up at the road side of the gantry, tween the rail side and the road side of the gantry. In order to load a trailer or container on a flat car the grapple apparatus picks it up at the road side of the gantry, moves it over to the rail side and deposits it on the flat car. Likewise, in order to unload a trailer or container from a flat car, the grapple apparatus picks it up at the rail side of the gantry, moves it over to the road side and deposits the trailer on the road or the container on a trailer chassis, as the case may be.

In this type of crane the grapple apparatus engages the trailer or container from opposite sides at spaced points intermediate its front and rear ends; and front and rear hoists on the gantry raise and lower the grapple apparatus together with the grappled trailer or container. The required large size of the gantry, and the shift and hoist mechanisms for the grapple apparatus render the gantry type of TOF crane relatively bulky and expensive.

Another type of TOF crane which has heretofore been suggested comprises a side loading vehicle which may be pulled up alongside a railroad flat car and operated to swing a trailer or container from the road side to the rail side of the vehicle for loading, and from the rail side to the road side for unloading. This type of TOF crane is less bulky and expensive than the gantry type but, as heretofore constructed, it lacks the stability and load handling capacity of the gantry type crane.

SUMMARY OF THE INVENTION

The present invention relates to a TOF crane of the side loading vehicle type, and its principal object is to overcome the heretofore existing shortcomings and disadvantages of that type of crane without sacrificing its advantages, that is, greater compactness, better maneuverability and lower manufacturing costs as compared with the gantry type of TOF crane.

More specifically, it is an object of the invention to provide an improved TOF crane of the side loading vehicle type which incorporates an articulated, laterally swingable superstructure including a forward pair and a rearward pair of grapple arms which are engageable with trailer body or container at longitudinally spaced portions between its front and rear ends.

A further object of the invention is to provide an improved TOF crane of the mentioned character which will be operable efficiently regardless of whether its chassis is positioned exactly parallel or somewhat non-parallel to the flat car which is to be loaded or unloaded, and regardless of whether the crane chassis extends exactly parallel or somewhat non-parallel to the trailer or container which is to be transferred.

A further object of the invention is to provide an improved TOF crane of the above mentioned character which incorporates a forward and a rearward pair of grapple arms, and a mechanism for clamping the grapple arms of each pair against a trailer body or cargo container from opposite side by translatory movement of the arms towards each other, and also for swinging the arms at right angles to their direction of translatory movement.

A still further object of the invention is to provide an improved TOF crane of the mentioned character which will be operable to transport a trailer or container between loading and unloading locations, and which incorporates a simple and conveniently operable mechanism for securing a picked up trailer against shifting on the crane chassis during travel of the crane from one location to another.

A still further object of the invention is to provide an improved TOF crane of the mentioned character which may be collapsed into a self-contained compact unit for shipment, and which may readily be changed over from its collapsed transport condition into an erected working condition with a minimum amount of effort and within a relatively short time.

These and other objects and advantages are attained by the present invention, various novel features of which will be apparent from the disclosure herein of a preferred embodiment of the invention, and will be pointed out by the appended claims.

Referring to the accompanying drawings:

FIG. 1 is a side elevation of a TOF crane embodying the invention;

FIG. 2 is a rear view showing an adjusted condition of the crane of FIG. 1 in full lines, and two other adjusted conditions in dotted lines;

FIG. 3 is a plane view showing the crane of FIG. 1 adapted to the dotted line position, at the right of FIG. 2;

FIG. 4 is a side elevation of the chassis of the crane shown in FIG. 1 including a driver's cab;

FIG. 5 is a section on line V—V of FIG. 3;

FIG. 6 is an enlarged perspective view of a universal joint;

FIG. 7 is an enlarged top view of a gimbal joint;

FIG. 8 is a section on line VIII—VIII of FIG. 7;

FIG. 9 is a perspective view of a wheel chock; and

FIGS. 10 and 11 are side elevations similar to FIG. 1, showing the crane in different stages of knock-down for transport.

The principal components of the crane shown in FIG. 1 are: a wheeled chassis 1; front and rear booms 2 and 3; a truss 4; a front crane trolley 6 mounting a front pair of grapple arms 7 and 8 (FIG. 5); and a rear crane trolley 9 mounting a rear pair of grapple arms 11 and 12 (FIG. 2); the trolleys and associated grapple arms affording semi-trailer or load grasping means operatively mounted on the truss.

The wheeled chassis 1 (FIG. 3 and 4) comprises a longitudinal center beam 13 mounting transverse frame beams 14, 16 at its opposite ends. A forward pair of steerable, individually powered front wheels 17, 18 and a rearward pair of steerable, individually powered rear wheels 19, 21 are mounted respectively, on transverse front and rear axle beams 22, 23 secured to the center beam 13. Also secured to the center beam 13 are horizontal front and rear platforms 24, 26 on which a semi-trailer or cargo box may be supported for transport by the crane, as shown in FIG. 1 and as will be explained more fully herein below.

Rigidly secured to and extending upwardly from the front and rear ends of the center beam 13 are front and rear bracket assemblies 27, 28, each presenting a pair of boom mounting lugs 29 and 31.

The front and rear booms 2 and 3 are operatively mounted on the front and rear bracket assemblies 27 and 28, respectively, for pivotal adjustment independently of each other about a fore and aft extending, generally horizontal axis which is determined by front and rear pivot pins 32 and 33 (FIG. 1).

A lower section 34 of the front boom 2 has depending front and rear lugs which are fitted, respectively, between the front and rear boom mounting lugs 29, 31 and are connected thereto by the pivot pin 32.

An upper section 36 of the front boom 2 is hingedly connected to the lower boom section 34 of a transverse axis 37 which is spaced upwardly from the fore and aft extending axis of the pivot pins 32, 33. Abutting flanges of the lower and upper boom sections 34, 36 are separably connected by bolts 38 for releasably securing the upper boom section against pivotal movement about the transverse axis 37.

The foregoing explanations regarding the mounting and construction of the front boom 2 analogously apply to the rear boom 3. That is, the rear boom has a lower section 34′ and an upper section 36′ which are hinged together on a transverse axis 37′ and are releasably locked together by bolts 38′. Depending lugs of the lower boom section; 34′ are fitted between the lugs 29, 31 of the rear bracket assembly 28, and the pivot pin 33 connects the assembled rear boom 3 to the bracket assembly 28 for swinging movement on the same longitudinal horizontal axis on which the assembled front boom 2 is connected with the bracket assembly 27 by the pivot pin 32.

Referring to FIG. 2, a double acting hydraulic ram 39 is pivoted at its barrel end on an upright bracket 41 at one end of the rear transverse frame-beam 16, and another double acting hydraulic ram 42 is similarly pivoted on an upright bracket 43 at the other end of the beam 16. The piston rods of the rams 39, 42 are pivotally connected with the boom 3 at radial distances from the pivot pin 33, a transverse bar 44 secured to the lower boom section 34 mounting pivot pins for the piston rods of the rams 39, 42. Contraction of the ram 39 and simultaneous expansion of the ram 42 swings the boom 3 to the laterally inclined position at one side of the vehicle frame in which it is shown in full lines in FIG. 2; and conversely, expansion of the ram 39 and simultaneous contraction of the ram 42 swings the boom 3 to the laterally inclined position at the other side of the vehicle frame in which it is shown in dotted lines at the right of FIG. 2. Adjustment of the rams 39 and 42 to equal lengths swings the boom 3 to an upright center position, as indicated in dotted lines in FIG. 2.

The front boom 2 is swingable to laterally inclined positions at opposite sides of the vehicle frame and to an upright center position in the same manner as explained herein before and shown in FIG. 2 with reference to the rear boom 3. The tilting rams 42, 42′ for the rear and front booms are show broken away in FIG. 1 at the near side of the vehicle frame, and the companion ram 39 for the rear boom and a corresponding companion ram, shown, for the front boom are similarly arranged at the far side of the vehicle frame.

The truss 4 is of lattice type construction and has front and rear ends adjacent, respectively, to the front and rear booms 2 and 3. The width of the truss, as shown in FIG. 3, is uniform from end to end. Its height, as shown in FIG. 1, is also uniform throughout its length, except for short upwardly tapering portions at its longitudinally opposite ends. The mid section of the truss between the tapered end sections is of rectangular cross section and, as shown in FIG. 5, includes a pair of tubular top beams 44, 46, and a pair of tubular bottom beams 47, 48.

Front and rear double acting hydraulic hoist rams 49 and 51 swingably suspend the truss 4 at its front and rear ends from the front and rear booms 2 and 3 in up and down adjustable relation thereto.

The front hoist ram 49 is connected with the free end of the front boom 2 for universal swinging movement as illustrated in detail in FIG. 6. A bearing sleeve 52 is secured in a bore of the upper boom section 36, as by welding, and mounts a swivel pin 53 which projects horizontally inward from the boom 2. The piston rod 54 of the hoist ram 49 has a forked end which is pivotally connected with the swivel pin 53 on an axis at right angles to the pivot axis of the latter by a pin 56.

The cylinder 57 of the front hoist ram 49 has a flexible supporting connection with the forward end of the truss 4, the connection being afforded by a gimbal joint 58 which is shown in detail in FIGS. 7 and 8. A first pair of axially alined trunnions 59, 61 of the gimbal joint are formed on an octagonal collar 62 which in the assembled condition of the joint is surrounded by a knuckle block 63. The collar 62 surrounds the ram cylinder 57 intermediate its ends as shown in FIG. 11, and it is rigidly secured thereto as by welding. The trunnions 59, 61 are surrounded by bearing sleeves, and opposite side members 64, 66 of the knuckle block 63 have bottom flanges on which the sleeves may rest in order to support the collar 62 and cylinder 57 on the knuckle block. The side member 64 has a fixed abutment 67 and a withdrawable stop pin 68 in straddling engagement with the trunnion 59 bushing, and the side member 66 of the knuckle block 63 similarly has a fixed abutment 69 and a withdrawable stop pin 71 in straddling engagement with the trunnion 61 bushing.

When the stop pins 68, 71 are removed the collar 62 and its associated cylinder 57 may be disengaged from the knuckle block 63 by rotation of the cylinder 57 on its axis through an angle of about 45 degrees in anti-clockwise direction as viewed in FIG. 7. Conversely, the joint may be reassembled by moving the cylinder 57 axially into the knuckle block with the axis of the trunnion blocks extending about diagonally of the block as indicated by the dash-dotted line 70 in FIG. 7, and by then rotating the cylinder clockwise so as to reengage the trunnion bushings with the bottom flanges and abutments 67, 69 of the side members 64, 66. Thereafter, the stop pins 68, 71 are reinserted to retain the collar 62 and knuckle block 63 is assembled condition.

A second pair of axially trunnions 72, 73 of the gimbal joint 58 are rigidly mounted in transverse frame beams 74, 7 at the forward end of the truss 4. The trunnions 72, 73 are secured in position on the frame beams 74, 76 by vertical pins 77, 78, respectively, and they project into the knuckle block 63 from opposite sides in the longitudinal direction of the truss 4. Spherical bearings 79 and 81 universally connect the knuckle block 63 with the fixed trunnions 72 and 73, respectively.

The foregoing explanations with respect to the front hoist ram **49** and its connections with the front boom **2** and with the front end of the truss **4** analogously apply to the rear hoist ram **51** and its connections with the rear boom **3** and with the rear end of the truss **4**. A universal joint **52–56'** corresponding to the universal joint **52–56** connects the piston rod of the rear hoist ram **51** with the free end of the rear boom **3**, and a gimbal joint **58'** corresponding to the gimbal joint **58** provides a flexible supporting connection between the cylinder of the rear hoist ram **51** and the rear end of the truss **4**.

As best shown in FIG. 3, a pair of front guide wings **82, 83** extend from laterally opposite sides of the truss **4** at its forward end in cooperative relation to the front boom **2**. Likewise, a pair of rear guide wings **84, 86** corresponding to the front guide wings **82, 83**, extend from laterally opposite sides of the truss **4** at its rear end in cooperative relation to the rear boom **3**. The purpose of the front and rear guide wings is to prevent the truss **4** from swinging lengthwise forwardly across the front boom **2** or rearwardly across the rear boom **3**, while the booms are swung in one direction or the other on the common horizontal axis of the pins **32, 33**.

The front crane trolley **6** comprises a frame which surrounds the truss **4** and is supported thereon for sliding movement in lengthwise opposite directions. Angle iron members **87, 88** (FIG. 5) at opposite sides, respectively, of the trolley have horizontal flanges overlying the top beams **44** and **46** of the truss, and a cross tube **89** underlying the truss **4** is connected with depending flanges of the angle irons **87, 88** by brace assemblies **91** and **92**. A double acting hydraulic shift ram **93** for the trolley **6** is connected at its barrel end with a bracket **94** at the upper side of the trolley, and the piston rod of the shift ram **93** is detachably connected with a bracket **96** at the upper side of the truss **4**. Contraction of the shift ram **93** moves the trolley **6** to its forward end position on the truss in which it is shown in FIG. 1, and expansion of the shift ram **93** moves the trolley to its rearward end position in which it is shown in FIGS. 10 and 11.

The cross tube **89** of the trolley **6** shiftably supports the forward grapple arms **7** and **8** for translatory horizontal movement toward and away from each other; and the cross tube **89** also supports the grapple arms **7** and **8** for pivotal movement at right angles to their translatory movement. In order to provide for such translatory and pivotal movement of the grapple arms, elongated tubular side journals **97, 98** (FIG. 5) are connected, respectively, to the grapple arms at their upper ends, and are telescopically and rotatably supported within the opposite end portions of the tube **89**.

Actuating means for the grapple arm **7** comprise a double acting hydraulic shift ram **99** within the cross tube **89**, and a double acting hydraulic swing ram **101** at the same side of the trolley **6** as the grapple arm **7**.

The shift ram **99** is anchored at its barrel end on a vertical pin within the tube **89** adjacent the longitudinal vertical mid plane of the truss, and the piston rod of the ram is connected to the inner end of the journal **97**. Contraction of the ram **99** adjusts the grapple arm **7** to its limit of translatory inward movement as shown in full lines in FIG. 5, and expansion of the ram **99** adjusts the grapple arm **7** to its limit of translatory outward movement as shown in dotted lines in FIG. 5.

Th swing ram **101** is universally connected at its barrel end with a bracket arm **102** of the brace assembly **91**, and the piston rod of the swing ram is universally connected with the grapple arm **7** at a radial distance from the axis of the tubular journal **97**. Contraction of the swing ram **101** lowers the grapple arm **7** to the vertical position in which it is shown in FIG. 1 irrespective of the lateral position to which the grapple arm is adjusted by the shift ram **99**. Conversely, expansion of the swing ram **101** raises the grapple arm **7** to the approximately horizontal position in which it is shown in FIG. 10, regardless of its lateral adjustment by the shift ram **99**.

A shift ram **103** corresponding to the shift ram **99**, and a swing ram **104** corresponding to the swing ram **101** are connected to the tubular journal **98** and to the grapple arm **8** for translatory shifting and vertical swinging of the latter relative to the crane trolley **6**, the same as the grapple arm **7**.

The foregoing explanations with respect to the front trolley **6** analogously apply to the rear trolley **9**. A shift ram **93'** is connected at its opposite ends to brackets **94'** and **96'** on the rear trolley frame and on the truss **4**, for shifting the rear trolley **9** back and forth longitudinally of the truss. A cross tube **89'** of the rear trolley frame mounts tubular trunnions **97', 98'** on the grapple arms **11** and **12**, respectively; and a pair of shift rams, not shown but corresponding to the shift rams **99, 103**, are mounted within the tube **89'** for adjusting the grapple arms **11** and **12** by translatory movement toward and away from each other. Swing rams **101'** and **104'**, corresponding to the swing rams **101** and **104**, are connected with the rear grapple arms **11** and **12**, respectively, for raising and lowering them, the same as the front grapple arms **7** and **8**.

FIG. 1 shows a semi-trailer **106** suspended from the truss **4** by the front and rear pairs of grapple arms, and sustained above the front and rear platforms **24, 26** of the vehicle frame by the contracted front and rear hoist rams **49** and **51**. For transport purposes the trailer may be set down upon the platforms **24, 26**, as indicated in dotted lines in FIG. 1, by expansion of the front and rear hoist rams **49, 51**. The platform **24** is equipped with a wheel chock mechanism **107** for blocking the trailer running **108** so that the trailer will be prevented from rolling forward or backward on the platforms **24, 26** while the crane is moved on its propelling wheels **17, 18** and **19, 21**.

As shown in FIG. 9, the wheel chock mechanism **107** comprises two relatively reciprocable sections, one having parallel side beams **108, 109**, a wheel blocking beam **111** and an angle iron connecting bar **112**; and the other having parallel side beams **113, 114**, a wheel blocking beam **116** and an angle iron connecting bar **117**. In the installed condition of the wheel chock sections on the platform **24** the wheel blocking beams **111, 116** and the bars **112, 117** rest on top of the platform; the side beams **108, 113** are in sliding engagement with a guide slot **118** which extends longitudinally of the platform at one side of the frame center beam **13**; and the side beams **109, 114** are in sliding engagement with a guide slot **119** which extends parallel to the guide slot **118** at the other side of the frame center beam **13**. The wheel blocking beams **111** and **116** are thus slidably mounted on the platform in transversely extending, fore and aft movable relation thereto and at a variable spacing from each other. A double acting hydraulic ram **121** is disposed below the platform and is connected at its cylinder end with the wheel blocking beam **116** and at its rod end with the wheel blocking beam **111**.

Preparatory to lowering of the trailer **106** upon the platforms **24, 26** the wheel chocking ram **121** is fully extended so that the blocking beams **113, 114** will be spaced a maximum distance from each other. When the wheels of the trailer running gear **108** have come to rest on the platform **24**, and the trailer landing gear **122** has come to rest on the platform **26**, the chocking ram **121** is contracted and the blocking bars **111, 116** will then floatingly adjust themselves into cooperative engagement with the wheels of the trailer running gear **108**. The running gear wheels will thus be prevented from rolling either forward or backward on the platform **24**, and longitudinal shifting of the trailer on the crane chassis will thus be prevented.

The rear platform **26** is equipped with a wheel chocking mechanism **107'** which is a duplicate of the wheel chocking mechanism **107** of the front platform **24**. The rear

chocking mechanism **107'** may be used to block the running gear of a trailer whose position on the platform is reversed with respect to the trailer position as shown in FIG. 1.

FIG. 2 shows a pair of outrigger arms **123** and **124** at the rear end of the vehicle frame, and a corresponding pair of outrigger arms **123'** and **124'** (FIG. 3) are mounted on the forward end of the vehicle frame. The outrigger arm **123** is pivoted on the lower end of the frame bracket **41**, and a hydraulic ram **126** on the frame bracket **43** is operable to swing the arm **123** up and down about its pivot connection with the bracket **41**. The arm **123** is further telescopically contractable and extendable by an internal hydraulic ram not shown. The outrigger arm **124**, and the forward outrigger arms **123'** and **124'** are constructed and operable in a manner corresponding to that of the outrigger arm **123**.

FIGS. 3 and 4 show an internal combustion engine **127** and an associated hydraulic pump assembly **128** mounted on the center beam **13** of the vehicle frame. A hydraulic circuit, not shown, connects the pump assembly with a control station **129** (FIG. 3) in an operator's cab **131** at the forward end of the vehicle frame, and with the various hydraulic actuating mechanisms of the crane including hydraulic drive motors, not shown, for the supporting wheels **17, 18, 19, 21**, hydraulic steering rams **132, 133**, and the boom tilting rams, hoist rams, trolley shift rams, grapple arm shift rams, grapple arm swing rams, and wheel chocking rams.

When the crane is pulled up alongside a railroad track **134**, as shown in FIG. 2, the outriggers **124, 124'** are extended to bear on the rail next to the crane, and the outriggers **123, 123'** are extended to bear upon the road at the other side of the crane. The front and rear pairs of grapple arms are adjusted to their widest transverse spacings and to their raised positions on the trolleys **6** and **9**. The front and rear booms may then be swung to the dotted line position at the right of FIG. 2 so as to bring the truss **4** and front and rear trolleys **6** and **9** over a semi-trailer waiting to be loaded upon a flat car **136** on the track **134**. The grapple arms are then dropped to their vertical positions on the trolleys **6** and **9**, and the trolleys are shifted lengthwise of the truss to positions adjacent the front and rear ends, respectively, of the trailer box. The hoist rams **49, 51** are then operated, if necessary, to bring the pivoted retainer shoes **137** at the lower ends of the grapple arms to the level at which they will engage the longitudinal bottom edges of the trailer box when the shift rams for the grapple arms are operated to move the grapple arms against the opposite sides of the trailer box. The hoist rams **49, 51** are then operated to lift the trailer from the road, and the boom tilting rams are operated to swing the lifted trailer over the flat car **136** as shown in full lines at the left of FIG. 2. The hoist rams are then operated to lower the trailer on the flat car, the front and rear pairs of grapple arms are spread apart to disengage the retainer shoes **137** from the trailer box, and the spread apart grapple arms are swung upward so that they will clear the trailer box when the booms are subsequently swung back toward the road side of the crane chassis.

In order to unload a trailer from the flat car upon the road the described loading operation may be reversed. It will also be apparent that instead of a semi-trailer including running and landing gear, a cargo box may be similarly loaded upon or unloaded from the flat car.

The hydraulic circuit for the boom tilting rams is so arranged that an operator at the control station **129** may swing the booms about their common horizontal pivot axis independently of each other. To do so will be helpful for the proper handling of a trailer or cargo box in case the crane chassis should stand on the road in an oblique position relative to the railroad track, or the trailer or cargo box to be transferred should stand in an oblique position relative to the crane chassis. The universal suspension of the hoist rams **49, 51** from the booms **2** and **3**, and the flexibility of the gimbal joints **58, 58'** will readily accommodate any differential pivoting of the booms for the purpose of compensating oblique positioning of the crane chassis relative to the railroad track or relative to the trailer or cargo box to be transferred.

Referring to FIGS. 10 nd 11, the crane may be knocked down into a compact unit for shipment by first lowering the truss **4** to the position shown in FIG. 10; then detaching the hoist rams **49, 51** from the gimbal joints **58, 58'** and repinning bottom extensions of the hoist ram cylinders to the lug **96, 96'** of the truss as shown in dotted lines in FIG. 10 while the truss is temporarily sustained on the booms **2** and **3** by withdrawable locking pins **138, 139'** then extending the repinned hoist rams as shown in FIG. 11 so as to lower the truss and crane trolleys upon the crane chassis; and finally folding the upper boom sections **36, 36'** into the dotted line positions shown in FIG. 11 after the connecting bolts **38, 38'** between the upper and lower boom sections have been removed.

In order to re-erect the crane from the knocked down condition, the repinned hoist rams **49, 51** may be expanded so as to tilt the upper boom sections **36, 36'** about their transverse pivot axes **37, 37'** back into vertical positions the connecting bolts **38, 38'** are then reinstalled; the truss is lifted by contraction of the hoist rams to the position shown in FIG. 10, and temporarily locked to the erected booms by the pins **138, 139**; the hoist rams are then disconnected from the truss brackets **96, 96'** and in contracted condition swung back over the gimbal joints **58, 58'**. Expansion of the contracted hoist rams then lowers the hoist ram cylinders through the knuckle blocks of the gimbal joints, and subsequent rotation of the expanded hoist ram cylinders will recouple the trunnions **59, 61** with the respective knuckle block. The locking pins **138, 139** are then withdrawn to release the truss for up and down adjustment by the hoist rams.

I claim:

1. A mobile crane comprising, a wheeled vehicle frame; front and rear booms operatively mounted on said vehicle frame for pivotal adjustment about a fore and aft extending, generally horizontal axis; hoist rams swingably suspended, respectively, from said booms; a truss connected with said rams for up and down movement thereby relative to said booms; front and rear crane trolleys mounted on said truss for back and forth travel lengthwise thereof; front and rear pairs of grapple arms operatively mounted, respectively, on said trolleys for movement therewith lengthwise of said truss; a pair of front guide wings extending from laterally opposite sides of said truss in cooperative relation to said front boom; and a pair of rear guide wings extending laterally from opposite sides of said truss in cooperative relation to said rear boom.

2. A mobile crane for transferring semi-trailers from the road to railroad flat cars and vice versa, comprising a wheeled vehicle frame; front and rear booms pivotally mounted on said frame for swinging movement to pick-up positions at either side thereof; hoist rams swingably suspended, respectively, from said booms; a truss connected with said rams for up and down movement thereby relative to said booms; front and rear crane trolleys mounted on said truss for back and forth travel lengthwise thereof; front and rear pairs of grapple arms operatively mounted, respectively, on said trolleys for movement therewith lengthwise of said truss; and a wheel chock mechanism for a semi-trailer positioned for transport on said vehcile frame, said chock mechanism comprising a pair of parallel beams slidably mounted on said vehicle frame in transversely extending fore and aft movable relation thereto, and a hydraulic ram connected at its cylinder end with one of said beams and at its rod end with the other.

3. A crane as set forth in claim **2** wherein said wheel chock mechanism is mounted at one end of said vehicle

frame, and wherein a duplicate of said wheel chock mechanism is mounted at the other end of said vehicle frame.

4. A mobile crane comprising, a wheeled vehicle frame; front and rear booms operatively mounted on said vevehicle frame for pivotal adjustment about a fore and aft extending, generally horizontal axis; a truss having front and rear ends adjacent, respectively, to said front and rear booms; front and rear hoist rams for said truss, each comprising a cylinder and associated piston rod; gimbal joints at said front and rear ends of said truss for connecting the latter with the cylinders of said front and rear hoist rams, respectively; means connecting the piston rods of said hoist rams with the free ends of said booms in universally swingable relation thereto; front and rear crane trolleys mounted on said truss for back and forth travel lengthwise thereof; and front and rear pairs of grapple arms operatively mounted, respectively, on said trolleys for movement therewith lengthwise of said truss.

5. A mobile crane comprising, a wheeled vehicle frame; front and rear booms operatively mounted on said vehicle frame for pivotal adjutsment about a fore and aft extending, generally horizontal axis and each being hinged intermediate its ends on a transverse axis spaced upwardly from said fore and aft extending axis so that an upper section of each boom may be folded downward and toward the other boom on an associated lower boom section; separable connecting means between said upper and lower sections of each boom for releasably maintaining said upper section thereof upright on its associated lower section; a truss having front and rear ends adjacent, respectively, to said front and rear booms; front and rear hoist rams swingably suspending said truss at said front and rear ends thereof from said front and rear booms, respectively, in up and down adjustable relation thereto; front and rear crane trolleys mounted on said truss for back and forth travel lengthwise thereof; and front and rear pairs of grapple arms operatively mounted, respectively, on said trolleys for movement therewith lengthwise of said truss.

6. A crane as set forth in claim 5 and further comprising front and rear upper pivot means swingably connecting the piston rods of said front and rear hoist rams, respectively, with the upper sections of said front and rear booms; flexible upper supporting connections between the cylinders of said front and rear hoist rams and the front and rear ends, respectively, of said truss; each of said flexible connections being separable for disconnection of said front and rear hoist rams from said trus; separable locking means operatively associated with said front and rear booms and said truss for supporting the latter on said booms independently of said hoist rams; and separable pivot means operatively associated with the lower ends of said hoist ram cylinders and with said truss for supporting the latter on said booms independently of said locking means.

References Cited

UNITED STATES PATENTS

3,174,630	3/1965	Tantlinger et al.	
3,251,496	5/1966	Lamer et al.	
2,773,614	12/1956	Edward et al.	
2,941,678	6/1960	Keys	214—77
2,995,263	8/1961	Fitch	214—731
2,996,206	8/1961	McKee	214—75
3,233,759	2/1966	Turturro et al.	214—80

FOREIGN PATENTS

1,025,407	4/1953	France.
181,253	6/1966	U.S.S.R.

GERALD M. FORLENZA, *Primary Examiner.*

R. B. JOHNSON, *Assistant Examiner.*

U.S. Cl. X.R.

212—8; 214—38, 77