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54 **Mobile crane structure.**

57 The invention relates to a crane of the type which is transportable to the job site, is adaptable for making very heavy lifts and may be operated as a mobile or stationary crane. The crane includes the crane body, the rearward end of which is arranged to be transported on the highway on a trailer which can subsequently be used as an auxiliary counterweight. The front end of the crane body is adapted for connection to and support on a conventional truck tractor. The overall dimensions of the crane body are such that it may be transported on the highway from job location to job location and there assembled and subsequently disassembled. The crane body has an outrigger support body rotatably positioned therebelow which is adapted for the attachment of outriggers. In operation the outriggers can be used to raise and lower the crane body to remove the trailer and the truck from the crane body, such that the crane may be supported on the outriggers. The crane may have an extendable bridge attached to the trailer, with the trailer having its longitudinal axis transverse to the crane body to swing therewith. In certain embodiments the outriggers may be supported on contra rotatable crawlers to thus provide a fully mobile crane. Another crawler means may be added to support the forward end of the crane body, thereby providing a swinging outrigger for assisting in the rotation of the crane body. The crane of this invention is also adapted for use as a guy derrick or a tower crane, and in other configurations, as described hereinafter.

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This invention relates to a very high capacity crane apparatus of the type which are transportable on the highway from job site to job site and which may be operated as a mobile crane and as a stationary crane.

There has been a need for many years for a very high capacity lift crane which is simple to assemble and disassemble and is readily adaptable for transport on the highway at highway speeds. Transportability from job site to job site is important to provide ease of use of the crane and to facilitate setup and takedown in very short periods of time. There has also been a need for such a lift crane that can be converted to many different modes of operation at the job site. There has also been need of such a crane which can utilize the principles of diesel hydraulic power for operating the various components of the crane.

There are many examples of prior art cranes which have attempted to provide certain of the foregoing features but have not been fully satisfactory in so doing. The use of a swinging counterweight trailer has been shown, as for example, in U.S. Patent No. 3,842,984. However, that patent teaches nothing concerning the use of the auxiliary trailer as a portion of the transport means for delivering the crane body to a job site. U.S. Patent No. 3,836,010 discloses a crane wherein the crane body itself is used as the auxiliary counterweight.

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However, neither this patent nor the prior patent teaches anything concerning the use of outriggers in association with a crane body.

In addition, a company known as American Hoist & Derrick Company of St. Paul, Minnesota has produced and offered for sale a number of heavy lift cranes under the trademark SKY HORSE and SUPER SKY HORSE. However, none of these cranes utilize the portability and mobility concepts disclosed in the present application, nor the use of outriggers in connection with crawler means as contemplated herein.

A company known as Sparrows International of Houston, Texas offers to the trade a crane construction which it designates as the GOTTWALD MOBILE CRANE, which utilizes the concept of outriggers for supporting a crane. The Gottwald Mobile Crane is sometimes referred to as the Gottwald MK 600. However, it teaches nothing concerning the use of a trailer for assisting in the transport of the crane body and subsequent use of the trailer as auxiliary counterweight. Neither does it teach the use of crawler means in association with or attached to the outriggers, nor the use of a crawler as a front auxiliary outrigger as disclosed in the present application.

It is therefore an object of this invention to provide a transportable crane which is operable on the diesel hydraulic principles, that is simple to assemble and disassemble at the job site, can be

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operated in either the mobile or stationary mode, and can be operated in various configurations.

Briefly stated, one embodiment of the invention includes a highway-transportable crane having a crane body having means for pivotally supporting a boom thereon. Means are attached to a forward portion of the crane body for detachably connecting a transport vehicle such as a truck tractor thereto and for support thereby during transport thereof. A trailer is detachably connected to a rearward portion of the crane body and adapted for supporting the crane body thereon during transport. The trailer has hydraulic power means for rotating the wheels to alternately track in a longitudinal direction and in a transverse direction. The crane body has attached thereto and supported therebelow an outrigger support body which is arranged for rotation relative to the crane body about a generally vertical axis. The crane includes a plurality of outriggers detachably connected to the outrigger support body and extending generally horizontally therefrom. Each of the outriggers is provided with vertically extendable and retractable ground support means for raising and lowering the outriggers, the outrigger support body and the crane body. During transport of the crane, the crane body is supported on the transport vehicle and on the trailer and when the outriggers are attached to the outrigger

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support body and the ground support means operated to raise the outrigger support body and the crane body, the trailer and support vehicle may be detached from the crane, with the crane then being in one of its operating modes. By attaching a boom and mast both to the cab body, and attaching the trailer with counterweights supplied therein, extremely heavy lifts may be made. In certain configurations of the crane, powered crawler means may be rotatably attached to and support a forward portion of the crane body after the transport vehicle has been detached, such that the powered crawler means acts as a powered auxiliary outrigger for supporting a portion of the load carried by the crane body and for assisting in the rotation of the crane body. In certain embodiments of the invention the outriggers may be supported on a pair of powered crawler means, whereby the entire crane becomes mobile along with the auxiliary outrigger and the auxiliary counterweight.

Another embodiment of the crane includes a crane body having means for pivotally supporting a boom thereon, and, as desired, a mast. An outrigger support body is connected to the crane body for relative rotation therewith about a generally vertical axis. The crane includes at least two pairs of outriggers attached to the outrigger support body. Each of the outriggers has vertically extendable and retractable ground support means connected

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thereto. Powered crawler means are connected between and support each of the aforesaid pair of outriggers whereby the crane is fully mobile and capable of transporting a load when the ground support means are raised from contact with the ground. The crane may be placed in a stationary position for raising a load when the ground support means are in contact with the ground. In this embodiment additional powered crawler means may also be rotatably attached to and supporting a forward portion of the crane body to provide an auxiliary outrigger which is adaptable for providing mobility and rotation to the crane body. In this embodiment of the invention a boom and mast may both be attached to the crane body along with the aforesaid counterbalance trailer for adapting the crane to extremely heavy lifting and wherein the crane may still be operated in a mobile mode.

In each of the aforesaid embodiments the same may be adapted for conversion to operating in a guy derrick mode or a jib crane mode as desired.

The present invention will be further described, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 is a side elevation view showing the crane body disassembled for transport along a public highway to a job site.

Fig. 2 is a partial top plan view showing a portion of the diesel hydraulic system and reaving

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drums of the crane.

Fig. 3 is a partial side elevation view showing the crane at a job site assembled for operation on outriggers and with the use of one boom or mast, such that the crane may be operated as a standard crane.

Fig. 4 is a top plan view of the crane shown in Fig. 3.

Fig. 5 is a full side elevation view of the crane shown in Figs. 2 and 3 and shown having a counterweight supported on the rearward end thereof.

Fig. 6 is a partial side elevation view showing the crane converted to a very high capacity lift crane by the addition of a mast and a power-steered auxiliary counterweight trailer.

Fig. 7 is a full side elevation view of the crane shown in Fig. 6.

Fig. 8 is a top plan view of the crane in a mode of operation similar to that shown in Figs. 6 and 7 but arranged such that the counterweight trailer is extended further rearwardly, the outriggers have have been retracted to supply close by ground support, and crawler means have been added to the forward end of the crane body to provide an auxiliary outrigger which is useful in providing full 360-degree rotation of the crane while the crane is supported on the outriggers.

Fig. 9 is a plan view of an embodiment of the crane similar to that shown in Fig. 8 but wherein

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crawler means have been attached to and support the outriggers, whereby the crane becomes fully mobile while supporting a load thereon.

Fig. 10 is a partial side elevation view of the auxiliary counterweight trailer of the type shown in Fig. 8 but having a second power-steered auxiliary counterweight trailer attached therewith for rotation and movement with the first trailer.

Fig. 11 is a top plan view of the trailer assemblies shown in Fig. 10 showing the direction of travel of the wheels thereof.

Fig. 12 is a top plan view of a crane utilizing the trailer assemblies shown in Figs. 10 and 11 in which the crane is otherwise similar to the fully mobile crane shown in Fig. 9.

Fig. 13 is a top plan view of an embodiment of the crane similar to that shown in Fig. 12 but having the outriggers fully extended and supported on the ground such that the crawlers act as additional outriggers and wherein the outriggers and crawlers are operated in a stationary position, but the crane body is still adaptable for adjusting rotation by means of the front crawler.

Fig. 14 is a partial side elevation view of the crane shown in Fig. 13.

Fig. 15 is a side elevation view of one embodiment of the invention operated as a guy derrick.

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Fig. 16 is a side elevation view of another embodiment of the invention operated as a jib crane in a stationary position, and which crane may be converted to a mobile jib crane as desired.

Description of the Preferred Embodiments

Referring now to the drawings, and Fig. 1 in particular, a portable crane is generally designated by the numeral 11 having the rearward end thereof attached to and supported on a sixteen-wheeled auxiliary counterweight trailer 12 and the forward end or crane body hitch 29 is connected to and supported on a transport vehicle in the form of a tractor truck 13. The crane includes a crane body 14, the overall width of which may be on the order of ten feet and the height of which may be on the order of thirteen to fourteen feet such that the same is highway transportable.

Crane body 14 has attached therewith and suspended therebelow outrigger support body 15. Outrigger support body 15 is supported for rotation about a vertical axis relative to crane body on bull ring gear bearing 16, by means of one or more hydraulic motors 21 mounted in crane body 14.

Outrigger support body 15 has a plurality of radially extending bores generally rectangular in cross-section, which bores are designated by the numerals 25 and which are adapted for detachably connecting outriggers, as will be described hereinafter. Crane body 14 also has pivotally supported

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thereon conventional boom inner 17 and mast inner 18. It is to be understood that in certain instances the words boom and mast may be interchangeably used when only one of the two is in use or operation of the crane of this invention. In addition, crane body 14 has attached thereto and supported thereon conventional gantry 19, which is adapted for raising and lowering by means of cylinder assembly 20. Crane body 14 has supported thereon operator cab 22 mounted on a pivotal support 23 by means of cab pivot 24. Transport vehicle 13 is provided with a fifth wheel 26 which is adapted for engagement by trailer hitchpin 27 of conventional design.

Counterweight trailer has sixteen wheels 28, each of which are pivoted by power means such that the wheels 28 may be aligned longitudinally with trailer 12 for movement in a longitudinal direction or may be rotated transversely for movement in a transverse direction. A trailer of this general type with such rotatable wheels is generally taught in U.S. Patent No. 3,842,984. Wheels 28 may also be powered by a hydraulic motor, so as to provide locomotion to trailer 12 as desired, such that it is a powered vehicle.

Referring now to Fig. 2, the means for providing power to the crane will be described. Crane body 14 is shown having supported therein diesel engine 30 connected and adapted through conventional pulley means for operating hydraulic pump 31 from

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which hydraulic power may be taken as by hydraulic lines to operate various hydraulic motors to facilitate operation of the crane, as will be described hereinafter.

Crane body 14 is shown supporting a split drum generally designated by the numerals 32-32, each of which is operated by a hydraulic motor 33, the power source of which comes from hydraulic pump 31 via hydraulic lines. Split drums 32 are generally utilized for operating the load block, and by being split, both ends of the load line may be taken up, thereby increasing the speed with which loads may be raised and lowered.

Spaced immediately rearward of split drums 32 is jib drum 34 which has wound thereon cable for operating a fly jib, for example, and is operated by hydraulic motor 35 supplied by hydraulic lines connected to pump 31. Immediately rearward thereof is boom suspension drum 36 which has wound thereon line for controlling the boom in certain configurations of the crane and is similarly operated by hydraulic motor 37. Immediately rearward thereof is another drum designated by the numeral 38 and may sometimes be described as a gantry, mast, boom guy-line drum as the need arises and may have two separate lines wound thereon for operating any of those elements. Drum 38 is arranged for operation by hydraulic motor 39.

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It is to be understood that the connection between hydraulic pump 31 and each of the hydraulic motors heretofore described is by means of hydraulic lines or hoses connected in conventional manner. It is also to be understood that hydraulic pump 31 provides power for rotating crane body 14 relative to outrigger support body 15 as well as the telescoping outriggers, the crawler means hereinafter described, and trailer 12, again by connection of hydraulic lines in conventional fashion. Hence, the power system of this crane may sometimes be described as being operated on the diesel hydraulic principle.

Referring now to Figs. 3, 4 and 5 in particular, setup and operation of the crane of this invention as a standard lifting crane will now be explained. When crane body 14 arrives at the job site in the condition shown in Fig. 1, hydraulically-extendable and telescoping outriggers 41 are inserted and pinned in bores 25 of outrigger support body 15. Each of the outriggers 41 is provided with hydraulically-extensible means in the form of outrigger extensions 42, whereby the length of outriggers 41 may be varied by hydraulically extending or retracting extensions 42. Each of the outrigger extensions 42 has supported on the outwards end thereof vertically aligned hydraulic cylinder assemblies comprising a hydraulic cylinder 43 arranged to operate as a depending piston 44, the lower ends of which are each adapted for support on an outrigger equalizing pad 45.

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With outriggers 41 thus installed, pistons 44 may be extended, thereby raising outriggers 41, outriggers support body 15 and crane body 14. This raising is continued until crane body 14 is freed from contact with trailer 12 and truck 13, which may then be removed. A mast center 47 and mast outer 48 may then be attached to mast inner 18, as shown in Figs. 3 and 5 and thereafter raised in conventional manner by operation of gantry suspension 53, with the mast operated as a conventional boom. It is to be understood that when mast center 47, with inner 18 and outer 48 are utilized by themselves, they may sometimes be referred to as a boom, since the same are interchangeable therewith.

Referring now to Fig. 5, mast center 47 is shown having supported thereon mast outer 48, the upper end of which is adapted for supporting main load tackle 49 which supports load block 50 and load hook 51. The upper end of mast outer 48 has connected thereto mast suspension 52 which in turn is connected to the upper end of gantry 19. Hence, by taking up on gantry suspension 53, the mast is raised and lowered accordingly. Mast center 47 has pivotally attached therewith mast stop 55, the lower end of which is pivotally connected to crane body 14 to limit the rearward movement of mast center 47 as desired. Gantry 19 is arranged for initial raising and subsequent lowering by means of cylinder assembly 20 as described above. As shown in Fig. 5, the

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rearward end of crane body 14 may have supported thereon conventional counterweight 56 which may be slabs of concrete or the like.

Hence by taking up on gantry suspension 53, mast center 47 may be raised and lowered or otherwise moved through a vertical arc. By taking up on load line 57 which is connected to main load tackle 49, load hook 51 may be raised and subsequently lowered with the load thereon. It is to be understood that load line 57 may be a double line and arranged for reaving on and off of split drums 32 as explained above. Similarly, gantry suspension 53 is comprised of a line which is wound on and off of drum 38 as heretofore described. Thus it will be seen that this invention provides a crane which is readily adaptable for self erecting into a standard crane mode of operation. As shown, operator cab 22 is rotated 90 degrees to place the operator in a better viewing position.

Referring now to Figs. 6 and 7, an embodiment of the crane is shown wherein it has been converted to a high capacity lift crane by the addition of a boom or another mast and wherein the trailer 12 is converted to an auxiliary counterweight trailer. The rigging for the mast and boom will now be described. A boom center 60 is attached to and supported on boom inner 17, which has attached to the upper end thereof boom outer 61. Boom suspension 62

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is attached to the boom outer 61 and to mast outer 48 such that boom center 60 may be raised and lowered through a vertical arc lying in the same plane of rotation as mast center 47, which movement is effected by boom line 63. Thus the mast and boom are both arranged for independent pivotal movement through vertical arcs lying in the same general plane by operation of gantry suspension 53 which operates on mast suspension line 52, and by operation of boom line 63 which operates boom suspension 62. In this embodiment load tackle 49 and load block 50 are suspended from boom outer 61 as shown in Fig. 7.

The capacity of the crane of this embodiment is further enhanced by the attachment of auxiliary trailer 12 with the longitudinal axis thereof generally transverse to the longitudinal axis of crane body 14, as shown in Figs. 6 and 7 with wheels 28 thereof aligned for longitudinal travel by the trailer. Trailer 12 may have supported thereon additional auxiliary counterweight 64 in the form of concrete slabs or the like. Trailer 12, in this mode of operation, is connected to crane body 14 by means of an extendable bridge frame 65 having pins for attachment to each side of crane body 14 for attachment thereto in variable extended positions. The other end of bridge frame 65 is attached to trailer 12. Trailer 12 is connected by connector 66 to counterweight pendant 67, the upper end of which is attached to mast outer 48.

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In operation of the embodiment of the invention shown in Figs. 6 and 7, boom center 60 and boom outer 61 are attached to boom inner 17 with load tackle 49 suspended from the upper end of boom outer 61. Boom suspension 62 is connected between boom outer 61 and mast outer 48 and the mast and boom are raised by taking in on gantry suspension 53 and boom line 63. A load may be raised by taking in on load line 69. It will be thus seen that the embodiment shown in Figs. 6 and 7 provides a high capacity lift crane utilizing both a mast and boom arrangement together with auxiliary counterweight and with the crane body being supported on outriggers. Crane body 14 is supported such that it may rotate on outrigger support body 15 for 360 degree rotation carrying with it auxiliary trailer 12.

Referring now to Fig. 8, another embodiment of the invention will be described which is similar to the Figs. 6-7 embodiment insofar as the arrangement of the boom and mast is concerned. However, in this embodiment auxiliary trailer 12 is shown moved rearwardly a substantial distance by the extension of bridge frame 65, which is pinned to the side of crane body 14. In addition, in the Fig. 8 embodiment, outrigger extensions 42 are retracted with pistons 44 of cylinders 43 being supported on somewhat smaller pads 71.

In addition, crane body hitch 29 is shown having supported therebeneath and attached thereto crawler means in the form of a crawler 72 having a pair of

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contra-rotating crawler tracks 73 and 74. It is to be understood that crawler tracks 73 and 74 are operated in conventional fashion by hydraulic motors connected to hydraulic pump 31. It should also be understood that crawler 72 may have a vertically adjustable fifth wheel 75 for engagement with hitch pin 27, such that crawler 72 acts not only as an auxiliary outrigger but in the embodiment shown in Fig. 8 can assist in swinging crane body 14 a full 360 degrees while a load is supported on the crane body. It is to be understood that the connection of crawler 72 may be accomplished by raising crane body 14 by operation of cylinders 43 connected to outriggers 41 followed by the positioning of crawler 72 as shown and thereafter lowering crane body 14 into contact therewith. Alternatively, the connection may be made by means of the hydraulically-adjustable fifth wheel 75 on crawler 72. There is thus provided a mode of operation wherein the crane is stationary, but adapted for making heavy lifts and is still rotatable 360 degrees.

Referring now to Fig. 9, a further alternative embodiment of the invention will be described. Its arrangement is substantially similar to that described with respect to Fig. 8, except that a pair of contra-rotating crawlers 76 are shown attached as by pinned connection 77 to outriggers 41, as shown. Again, this attachment can be made by initially raising crane body 14 by operating pistons 44, the attachment then made, and thereafter crane body 14 lowered by retracting pistons 44 to the point that pistons 44 are fully

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retracted and crane body 14 is then supported by
contra-rotating crawlers 76. Again, it is to be
understood that crawlers 76 are operated by hydraulic
motors in conventional fashion connected to a source
5 of hydraulic fluid in the form of hydraulic pump 31.

By operation of tracks 73 and 74 of crawler 72,
the same may be positioned for longitudinal travel
as shown in Fig. 9. In addition, wheels 28 of
trailer 12 are rotated such that they are now
10 positioned transverse to longitudinal axis of trailer
12 whereby the crane is now fully mobile in both for-
ward and backward directions and for turning purposes.
Thus arranged, the crane is fully mobile, both with
and without a load, and having a very high capacity
15 when loaded. As discussed above, the rigging of the
boom and mast will be substantially the same in the
Fig. 9 embodiment as in the Fig. 8 embodiment.

Referring now to Figs. 10, 11 and 12, a further
alternative embodiment of the crane is shown which is
20 generally similar to the Fig. 9 embodiment, except
that a second auxiliary counterweight trailer has been
added, which is designated by the numeral 79. Trailer
79 is generally similar to trailer 12 and is supported
on eight wheels 80 which are operated in the same
25 manner as wheels 28 of trailer 12. That is to say,
that in highway transport it may be connected to the
rearward end of trailer 12 with wheels 80 longitudi-
nally aligned for highway travel. In utilizing
trailer 79 as an auxiliary counterweight, the same is
30 connected to the side of trailer 12 by connector 81

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such that in rotation of crane body 14, trailers 12 and 79 are arranged to traverse a circle and to provide additional counterweight for the crane. In this embodiment, connector 66 is connected at the lower end to alternate connector lug 82 so as to place the same in the center of gravity of the two trailers 12 and 79, as shown in Fig. 10. Wheels 28 and 80 are longitudinally aligned as shown in Fig. 11. Crawler 72 is rotated to the transverse position as shown in Fig. 12. Thus assembled the crane is equipped to make very heavy lifts and for 360-degree rotation, and with crawler 72 arranged for assisting in the rotation and with crawlers 76 in position supporting outriggers 41. In this embodiment, the boom and crane arrangement is the same as with the prior embodiments except with respect to the location of connector 66 as discussed above.

Referring now to Figs. 13 and 14, an embodiment of the invention will be described wherein it is arranged for making an ultra high capacity lift wherein the crane support system is stationary, but crane body 14 may be rotated slightly for adjustment purposes. In this embodiment the crane is essentially the same as that described with respect to Figs. 10, 11 and 12 embodiment, except that outrigger extensions 42 are fully extended, with the outer ends thereof now supported on pads 45. Hence, the weight of crane body 14 and any load supported thereon is, in turn, supported on outriggers 41 through extensions 42 and pads 45 and on crawler 72 acting as an auxiliary

outriggers. Thus positioned, the support members for crane body 14 are immobile, but crane body 14 may be rotated slightly by operation of crawler 72 to make small adjustments in the swinging position of crane
5 body 14, which may be useful or desirable in carrying out certain lifting operations. Again, the boom and mast operation of this embodiment will be generally the same as with the prior embodiment. In this configuration, the crane is placed in its maximum
10 lifting capacity, but still has rotational ability within small limits for adjustment purposes.

Fig. 14 shows one method by which crawlers 76 may be driven, as by chain drive 84 coupled over appropriate sprockets and operated by a hydraulic
15 motor, as heretofore described. It is to be understood that crawler tracks 73 and 74 are similarly contra-rotatable, as is well known to those skilled in the art.

Referring now to Fig. 15, an embodiment of the
20 crane operated as a guy derrick will be described. In this embodiment, the suspension for crane body 14 is essentially the same as that shown in Fig. 7 except as noted hereinafter. That is to say, crane body 14 is shown supported on outriggers 41 which, in turn,
25 are supported on pads 45, which engage the ground. In the Fig. 15 embodiment, auxiliary counterweight trailer 12 and counterweight pendant 67 are removed. Further, a guy cap 85 is shown attached to the upper end of mast outer 48 for rotation therewith. Guy
30 cap 85 has a plurality of guy lines 86 attached

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therewith in conventional fashion. Mast center 47 has added thereto mast extensions 87.

In operation of the Fig. 15 embodiment, and with guy cap 85 and guy lines 86 attached, mast center 47 is raised upwardly to the point that guy cap 85 is positioned over the center line of rotation of crane body 14 as shown. Thus positioned, guy lines 86 are made fast and mast suspension 52 is let slack. In this embodiment, the crane is operable as a guy derrick, and is easily converted to such operations.

Referring now to Fig. 16, an embodiment of the crane is shown where the same has been converted to a very high capacity stationary tower crane which may be also supported on crawlers as will be described hereinafter. As shown in Fig. 16, crane body 14 is supported on the same suspension system as described with respect to the Fig. 15 embodiment. However, in the Fig. 16 embodiment, the boom has been removed, and mast outer 48 has been removed and replaced by mast end 89, which has pivotally attached to the upper end thereof jib 90, the outer end of which is arranged to support load tackle 49. Mast end 89 also supports jib masts 91, over which jib line 92 is trained for raising and lowering jib 90. Jib line 92 is attached to jib pendant 93, the lower end of which is attached to jib suspension 94 for raising and lowering. Jib suspension 94 is operated off of one of the drums in crane body 14. In addition, mast center 47 and the other portions of the mast are moved to and held

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in the upright position through operation of gantry suspension 53 and mast suspension 52. Mast stop 55 is arranged to control the rearward movement of mast center 67 beyond a safe position. Thus arranged, 5 the Fig. 16 embodiment provides a very high lift stationary tower crane which is adapted for making lifts at great reach or distances.

The crane as shown in Fig. 16 can be converted to a mobile crane by the addition of crawlers 76 as 10 with the Fig. 9 embodiment and by retracting out-rigger extensions 42 and disengaging or lifting pistons 44 from engagement with the ground. It will thus be seen that this invention provides a crane which is very versatile and is easily converted to different 15 configurations for carrying out different lifting operations. It is operated on the diesel hydraulic principle which is simple and reliable. It provides a crane which is portable over highways and arranged such that the mast or boom may be interchangeable, 20 such that the crane can work in a number of configurations with ease of assembly and disassembly. Thus arranged, it is a crane which requires low maintenance and can be operated with a minimum of expertise.

25 Further modifications and alternative embodiments of the apparatus of this invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the

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manner of carrying out the invention. It is to be understood that the form of the invention herewith shown and described is to be taken as the presently preferred embodiments. Various changes may be made
5 in the shape, size and arrangement of parts. For example, equivalent elements or materials may be substituted for those illustrated and described herein, parts may be reversed, and certain features of the invention may be utilized independently of the use
10 of other features, all as would be apparent to one skilled in the art after having the benefit of this description of the invention.

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CLAIMS

1. A transportable crane which comprises a highway transportable crane body having means for pivotally supporting a boom thereon; means attached to a forward portion of said crane body for detachably connecting a transport vehicle thereto
5 and for support thereby during transport thereof; a trailer detachably connected to a rearward portion of said crane body and adapted for supporting said crane body thereon during transport thereof, said trailer having means for rotating the wheels to
10 alternately track in a longitudinal direction and in a transverse direction; an outrigger support body connected to said crane body for relative rotation therewith about a generally vertical axis; a plurality of outriggers detachably connected to said outrigger
15 support body and extending generally horizontally therefrom; vertically extendable and retractable ground support means connected to an outward portion of each of said outriggers for raising and lowering said outriggers, said outrigger support body,
20 and said crane body; whereby, during transport of said crane body, said crane body is supported on said transport vehicle and said trailer, and when said outriggers are attached to said outrigger support body and said ground support means are
25 operated to raise said outrigger support body and said crane body, said trailer and said transport

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vehicle may be detached from said crane body, with said crane then being in an operating mode.

2. A crane as claimed in claim 1 wherein each of said outriggers includes a generally horizontally
5 telescoping assembly, whereby said outriggers may be extended and retracted relative to said outrigger support body for varying the radial distance at which said ground support means may be engaged with the ground.
- 10 3. A crane as claimed in claim 1 or claim 2, including: a boom and a mast pivotally attached to said crane body for movement through vertical arcs lying in the same general plane; means for detachably connecting said trailer with said crane body such
15 that the longitudinal axis thereof is transverse to the longitudinal axis of said crane body, whereby said trailer rotates with said crane body; counterbalance weight means supported on said trailer; and line means connected between said mast and said trailer with
20 said weight supported thereon; whereby said trailer and weight operates as an auxiliary counterbalance for said crane.
4. A crane as claimed in claim 3 wherein: said
25 means for connecting said trailer transversely with said crane body includes extendable and retractable bridge means, whereby the counterbalancing effect of said trailer may be varied by variably spacing said trailer from said crane body.

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5. A crane as claimed in any one of the preceding claims including: powered crawler means rotatably attached to and supporting said forward portion of said crane body after said transport vehicle has
5 been detached; whereby said crawler means acts as a powered auxiliary outrigger for assisting in the rotation of said crane body on said vertical axis relative to said ground supported outriggers.

6. A crane as claimed in claim 5, wherein: said
10 crawler means includes a pair of endless crawler tracks, each of which is contra-rotatable, whereby the direction of travel of said crawler means may be controlled thereby.

7. A crane as claimed in claim 5 or claim 6,
15 including: at least two additional powered crawler means, each one of which is connected to at least one of said outriggers; and including a second powered crawler means connected between and supporting each of said pair of outriggers; whereby said crane is
20 fully mobile and capable of transporting a load when said ground support means are raised from contact with the ground.

8. A crane as claimed in claim 7, wherein: each of said second powered crawler means includes a
25 contra-rotatable crawler track, whereby the direction of travel of said crane may be controlled thereby.

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9. A crane as claimed in claim 7 or claim 8,
including a second trailer having means for supporting
a counterweight thereon and having means for rotating
the wheels thereof to alternately track in a
5 generally longitudinal direction and in a transverse
direction; and means for attaching said second trailer
to the side of said first trailer for horizontal
movement therewith, whereby said second trailer
provides additional counterbalancing capabilities
10 to said crane.

10. A crane as claimed in any one of claims 7
to 9, wherein, said ground support means are engaged
in load supporting contact with the ground, whereby
said second crawler means act as auxiliary outriggers
15 to thereby increase the load lifting capability of
said crane, and whereby said crane body may be
rotated about its vertical axis.

11. A crane as claimed in claim 10, wherein:
said outriggers are telescopically extended whereby
20 the lifting capability of said crane body is
increased and said crane body is still capable of
minor rotational adjustment.

12. A crane as claimed in any one of the preceeding
claims, including: a boom and mast pivotally
25 attached to said crane body for movement through
vertical arcs lying in the same general plane;

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a guy cap attached to said mast for rotation relative thereto; and guy lines attached to said guy cap; whereby said crane is operable in a guy derrick mode.

13. A crane as claimed in any one of claims 1 to 11, including: a mast pivotally attached to said crane body for movement through a vertical arc; a jib attached to an upper portion of said mast and extendable generally horizontally therefrom; and means for supporting a load on the outer end of said jib; whereby said crane may be operated as a jib crane.

14. A crane as claimed in claim 13 wherein: said plurality of outriggers include a pair thereof extending horizontally from each side of said crane body; and including a powered crawler means connected between and supporting each of said pair of outriggers; whereby said crane may be operated as a fully mobile jib crane when said ground support means are raised from contact with the ground.

15. A crane comprising: a crane body having means for pivotally supporting a boom thereon; an outrigger support body connected to said crane body for relative rotation therewith about a generally vertical axis; a plurality of outriggers attached to said outrigger support body; vertically extendable and retractable ground support means connected to an outward portion of each of said outriggers; powered crawler means connected to support said outriggers; whereby said

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crane is fully mobile and capable of transporting a load when said ground support means are raised from contact with the ground, and whereby said crane may be placed in a stationary position when said ground
5 support means are in contact with the ground.

16. A crane as claimed in claim 15, wherein: said outriggers include at least two pairs thereof; and each of said pairs of outriggers is supported by one of
10 said powered crawler means.

17. A crane as claimed in claim 15 or claim 16 wherein: each of said outriggers includes a generally horizontally telescoping assembly, whereby said outriggers may be extended and retracted relative to said outrigger
15 support body for varying the radial distance at which said ground support means may be engaged with the ground.

18. A crane as claimed in any one of claims 15 to 17 including: second powered crawler means rotatably attached to and supporting a forward portion of said
20 crane body, whereby said second powered crawler means acts as powered auxiliary outrigger.

19. A crane as claimed in claim 18 wherein: said second crawler means includes a pair of endless tracks each of which is contra-rotatable, whereby
25 the direction of travel of said second crawler means may be controlled thereby.

20. A crane as claimed in any one of claims 15 to 19, including: a boom and a mast pivotally

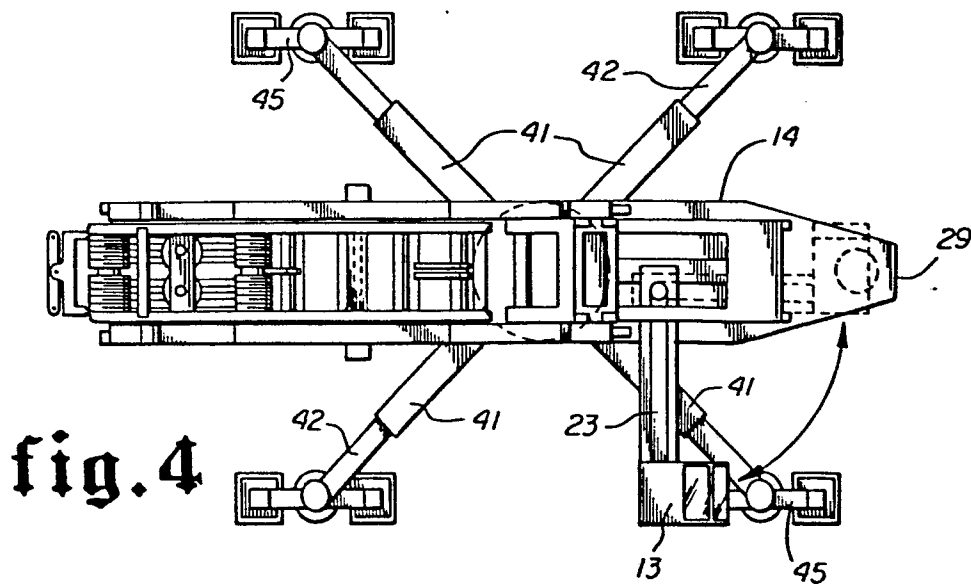
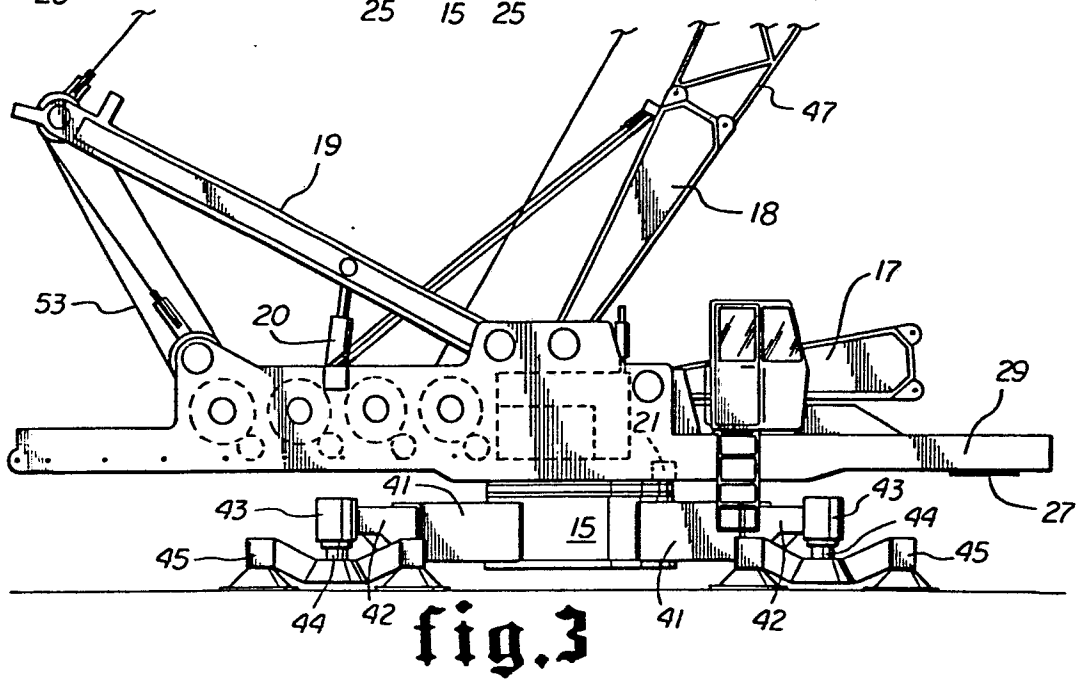
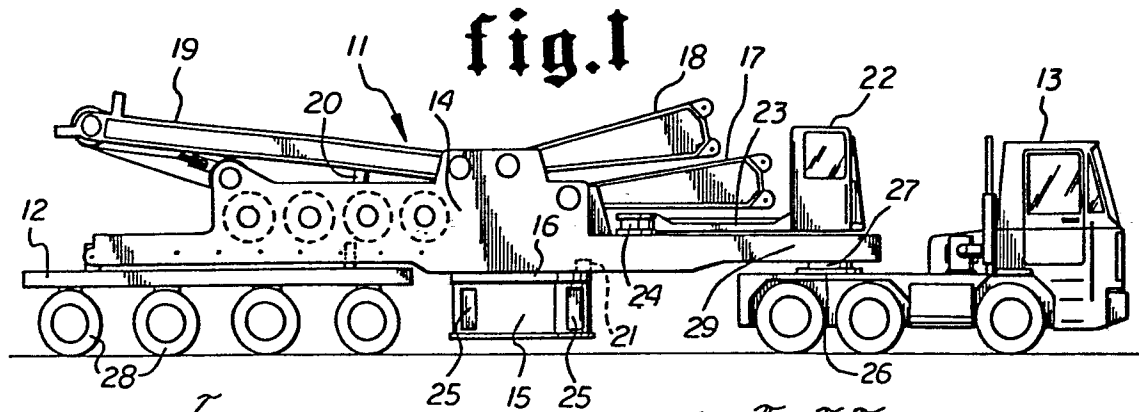
-7-

attached to said crane body for movement through vertical arcs lying in the same ground plane; a counterbalance trailer attached to said crane body for horizontal movement therewith; and means connected
5 between said mast and said trailer, whereby said trailer operates as an auxiliary counterbalance for said crane.

21. A crane as claimed in any one of claims 15 to 19, including: a mast pivotally attached to said crane body for movement through a vertical arc lying
10 in the same general plane as the arc of movement of said boom; a guy cap attached to said mast for rotation relative thereto; and guy lines attached to said guy cap; whereby said crane is operable in a guy derrick mode.

15 22. A crane as claimed in any one of claims 15 to 19, including a jib attached to an upper portion of said boom and extendable generally horizontally therefrom; and means for supporting a load on said jib; whereby said crane may be
20 operated as both a mobile and a stationary jib crane.

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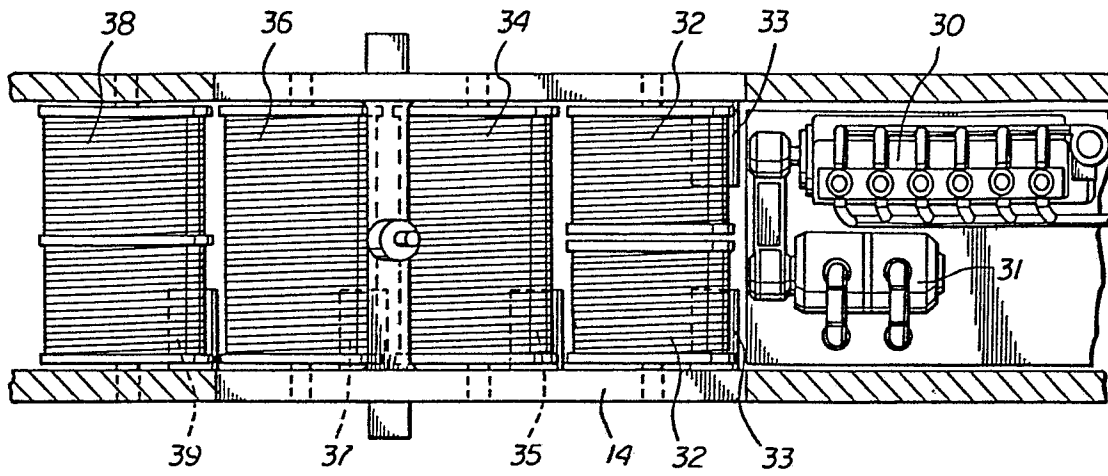


fig.2

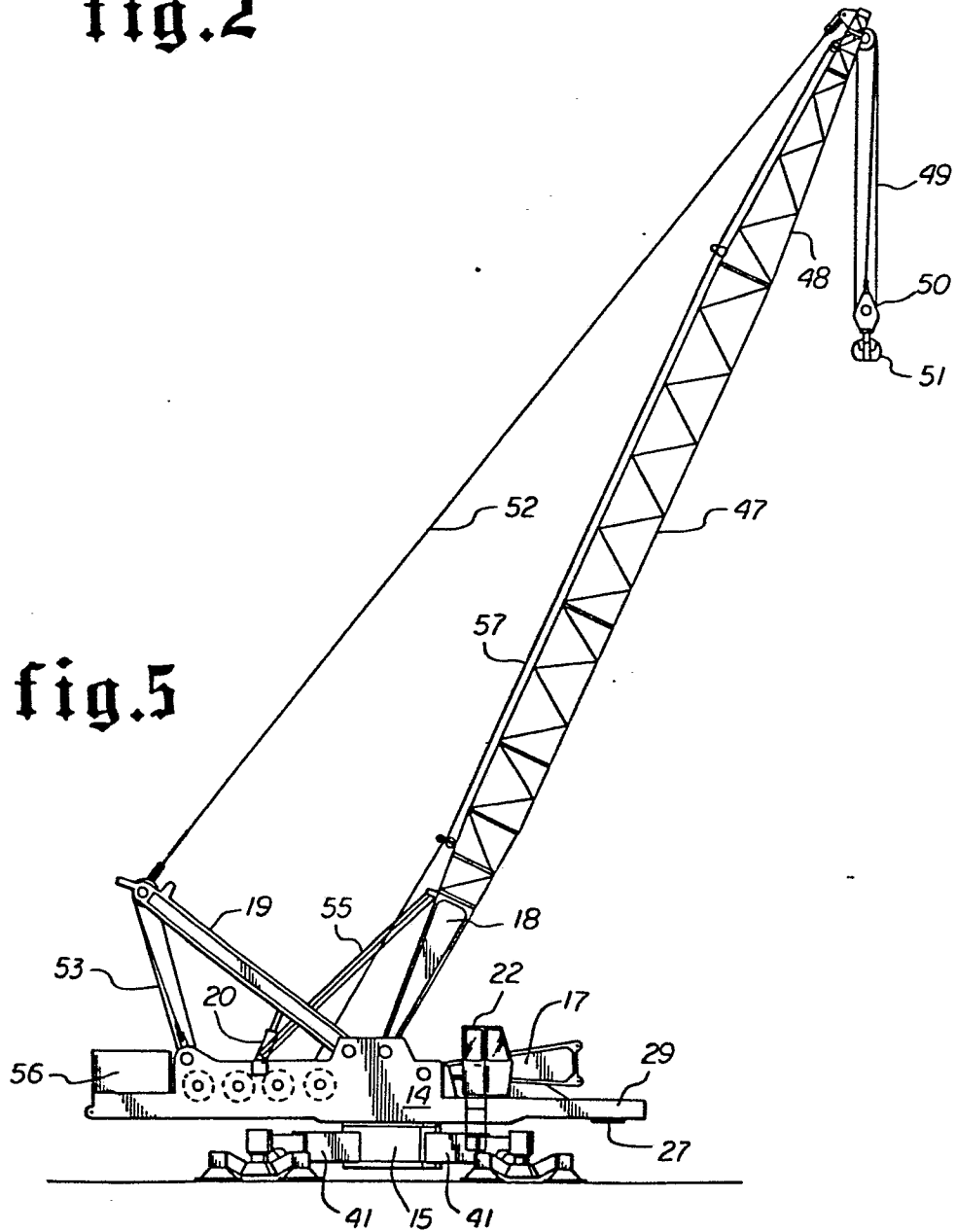


fig.5

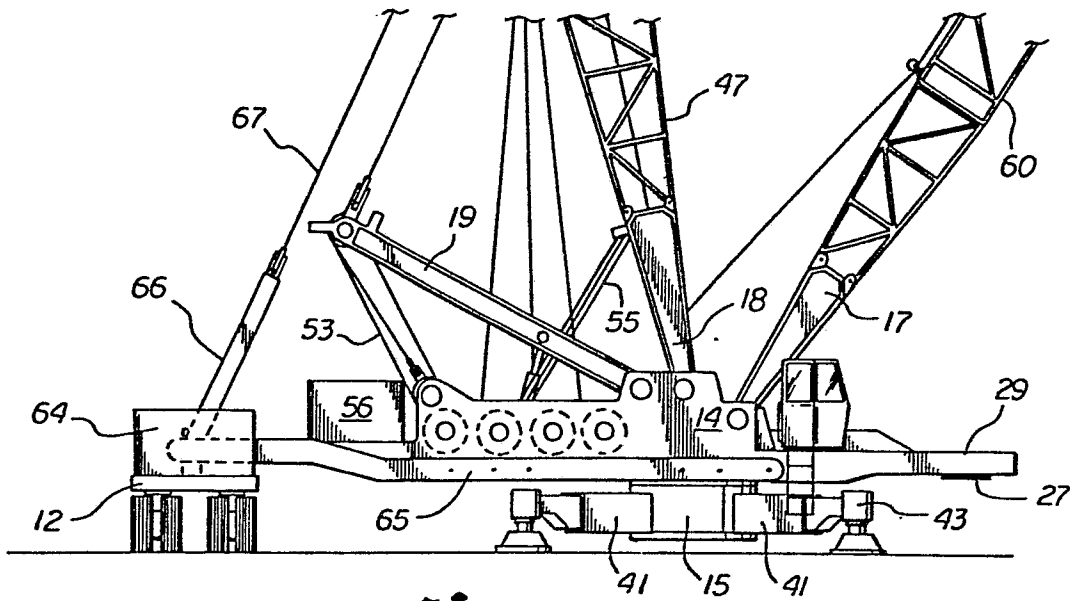


fig. 6

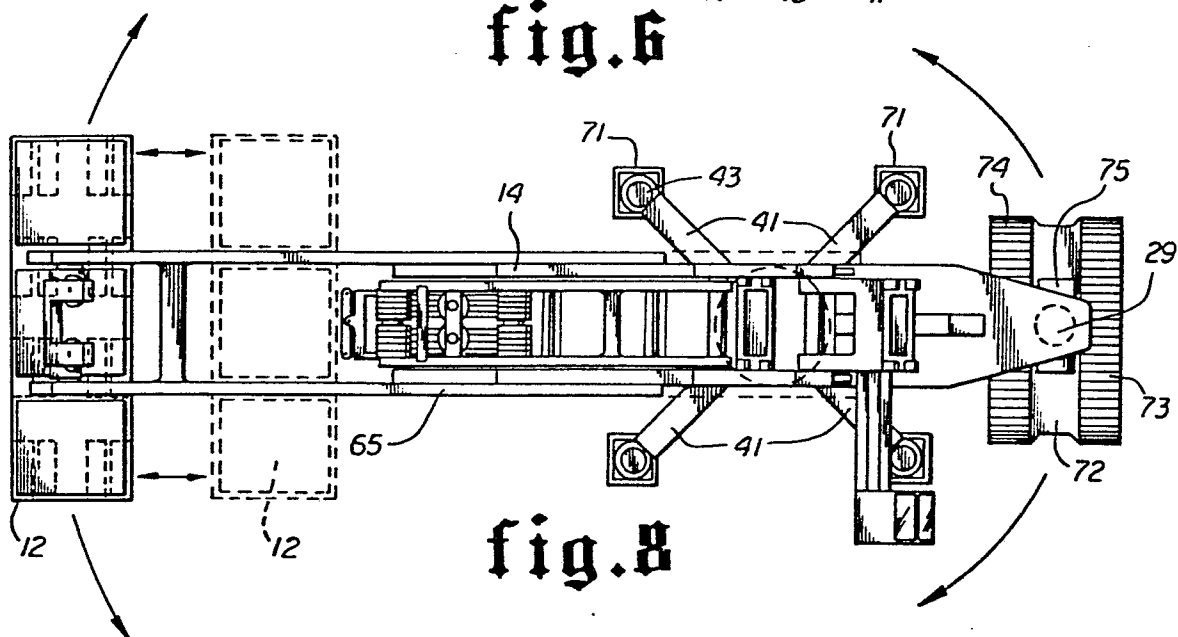


fig. 8

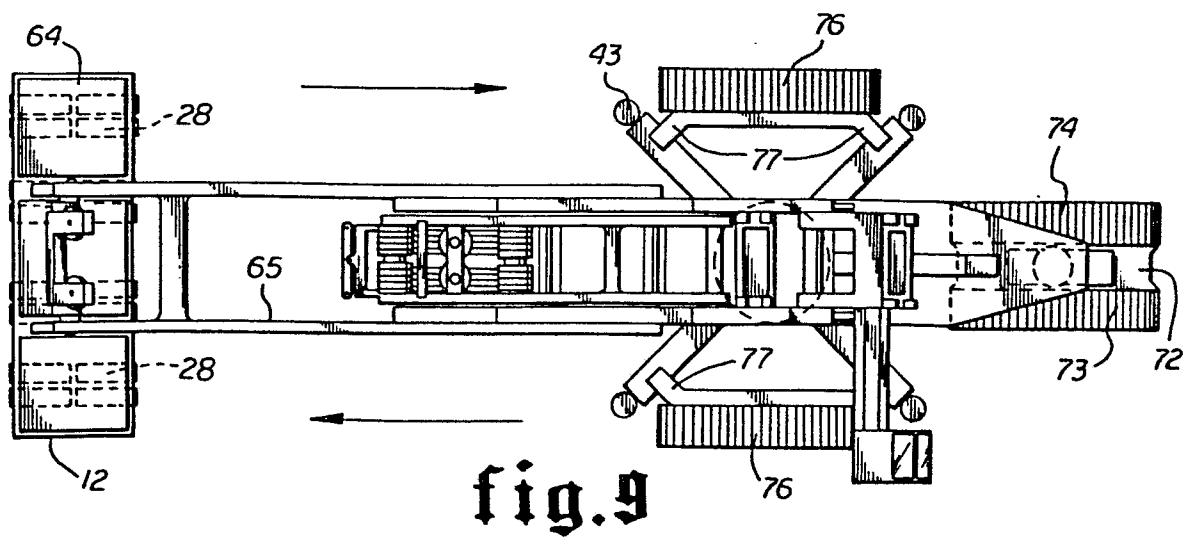


fig. 9

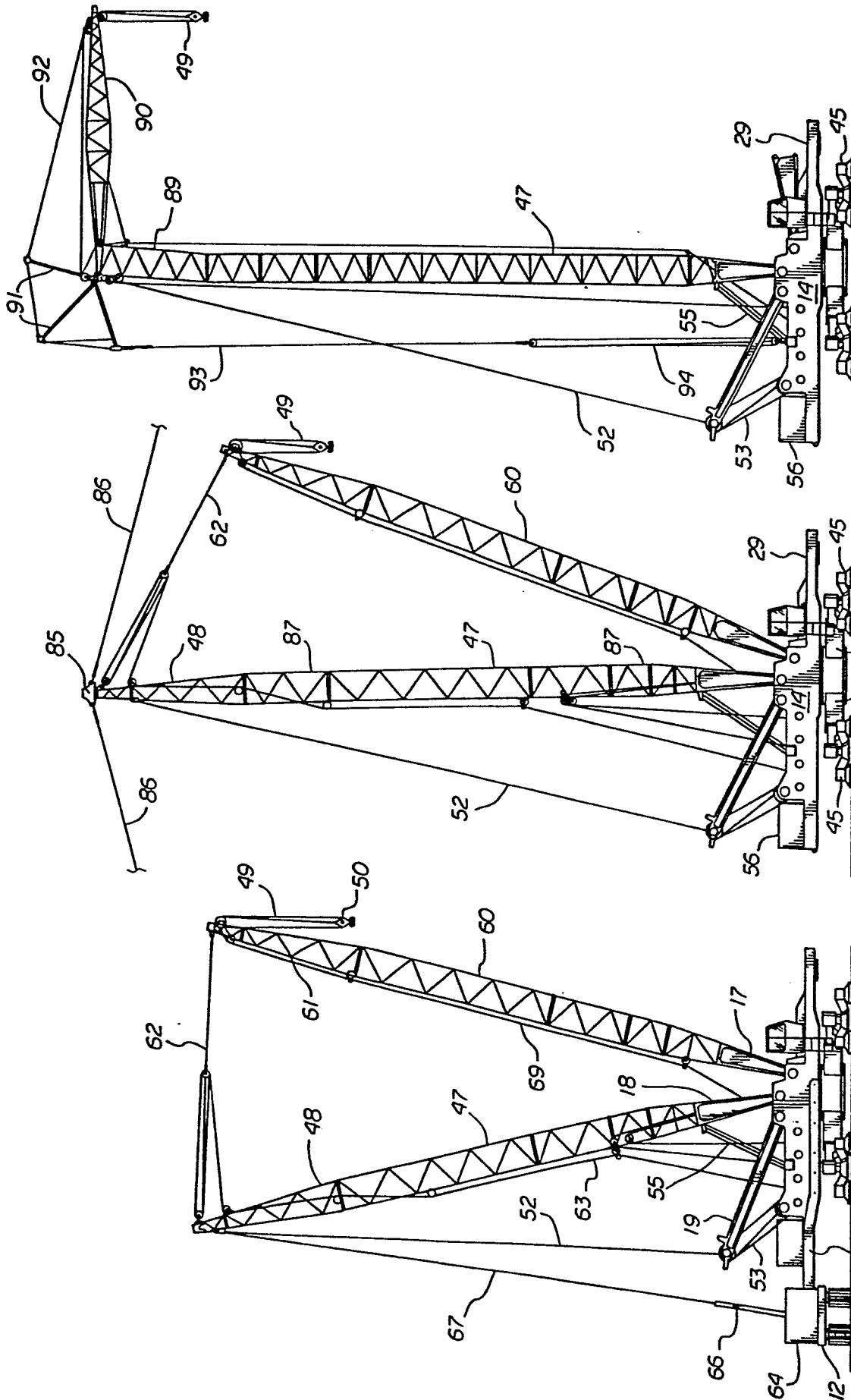
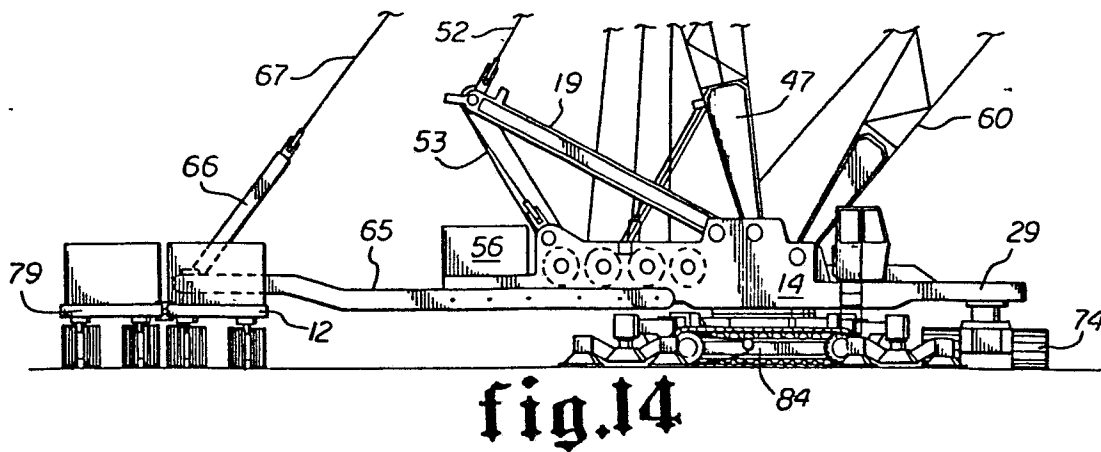
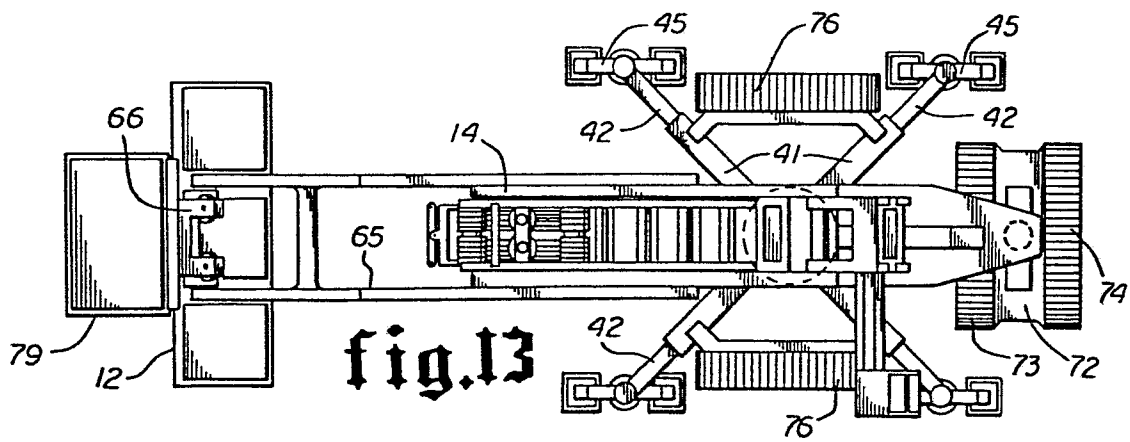
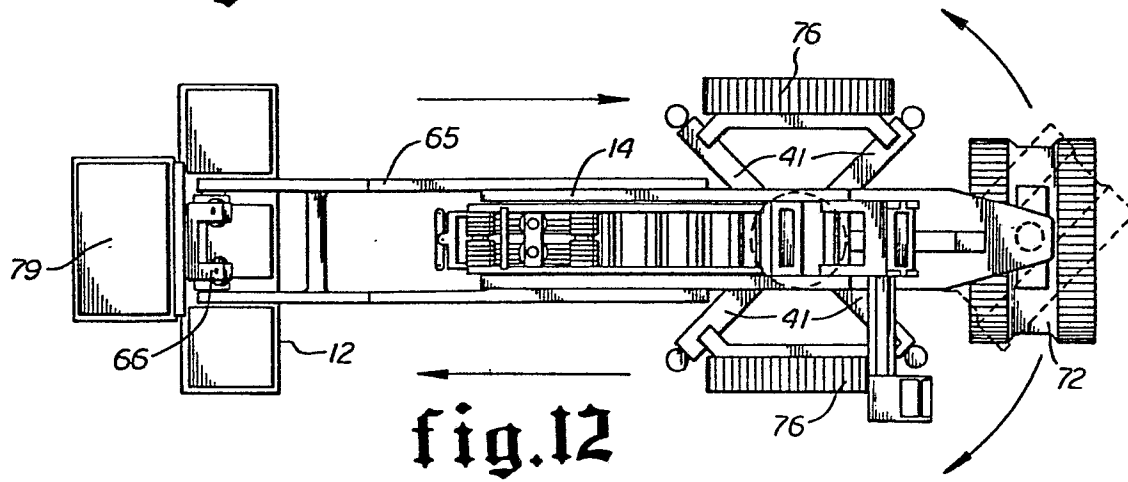
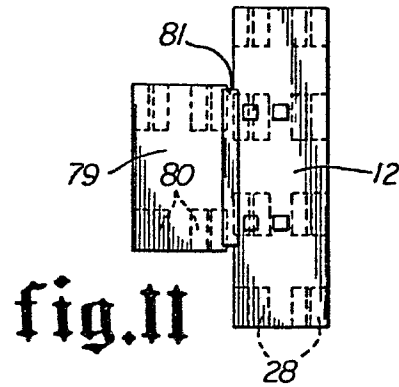
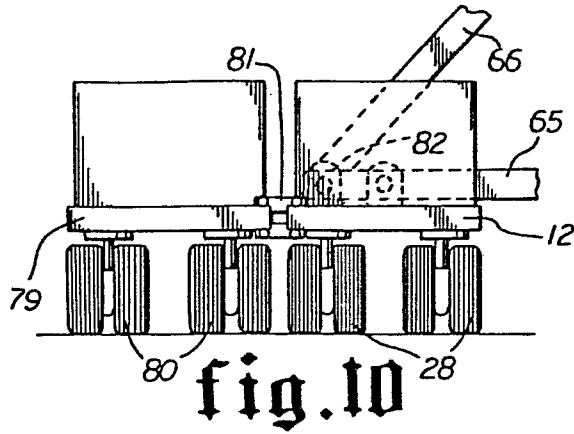


fig. 16

fig. 15

fig. 7

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0048076

Application number

EP 81 30 2612

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	DE - A - 2 517 203 (LIEBHERR-WERK) * page 5, complete; page 6, paragraphs 1 and 2; page 7, paragraphs 1,2 and 3; page 8, paragraph 3 * --	1,7,14,15	B 66 C 23/62 23/74 23/78
X	FR - A - 2 135 317 (WELLMAN) * page 4, lines 22-41; page 5, lines 1-37; figures 1 to 5 * & GB - A - 1 374 253 CA - A - 965 738 CA - A - 965 739 CA - A - 967 117 -- DE - B - 1 246 969 (BETEILIGUNGS-UND PATENTVERWALTUNGSGESELLSCHAFT) * column 3, lines 4-68; column 4, lines 1-8 * --	1,2,7,11,13,14,15,16,17,22	TECHNICAL FIELDS SEARCHED (Int. Cl.)
D	US - A - 3 836 010 (LAMPSON) * column 3, lines 8-62; column 4, lines 13-20 * -- FR - A - 2 172 931 (RICHER) * page 1, lines 29-39; page 2, lines 1-29 * --	1,3,13,20,22 3,4,6,8,19,20 5,6,18,19	B 66 C
			CATEGORY OF CITED DOCUMENTS
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			corresponding document
X The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		16-12-1981	VAN DEN BERGHE



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EUROPEAN SEARCH REPORT

0048076

Application number

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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
P,X	FR - A - 1 408 409 (DECUIR) * page 4, left-hand column, last paragraph * --	12,21	
	FR - A - 2 453 817 (HARNISCH-FEGER CORP.) * the whole document * & GB - A - 2 046 701 DE - A - 3 013 513 US - A - 4 266 679 --	1,3,7, 8,9, 14,15, 16,19, 20	
A	GB - A - 2 029 795 (LIEBHERR-WERK)		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	US - A - 3 638 805 (GARNIER)		
A	US - A - 4 170 309 (LAMPSON)		
A	US - A - 3 930 583 (JOUFFRAY)		
A	LU - A - 56 859 (STOOF)		
A	DE - B - 1 180 502 (M.A.N.)		
A	DE - B - 1 264 010 (GROSS) -----		