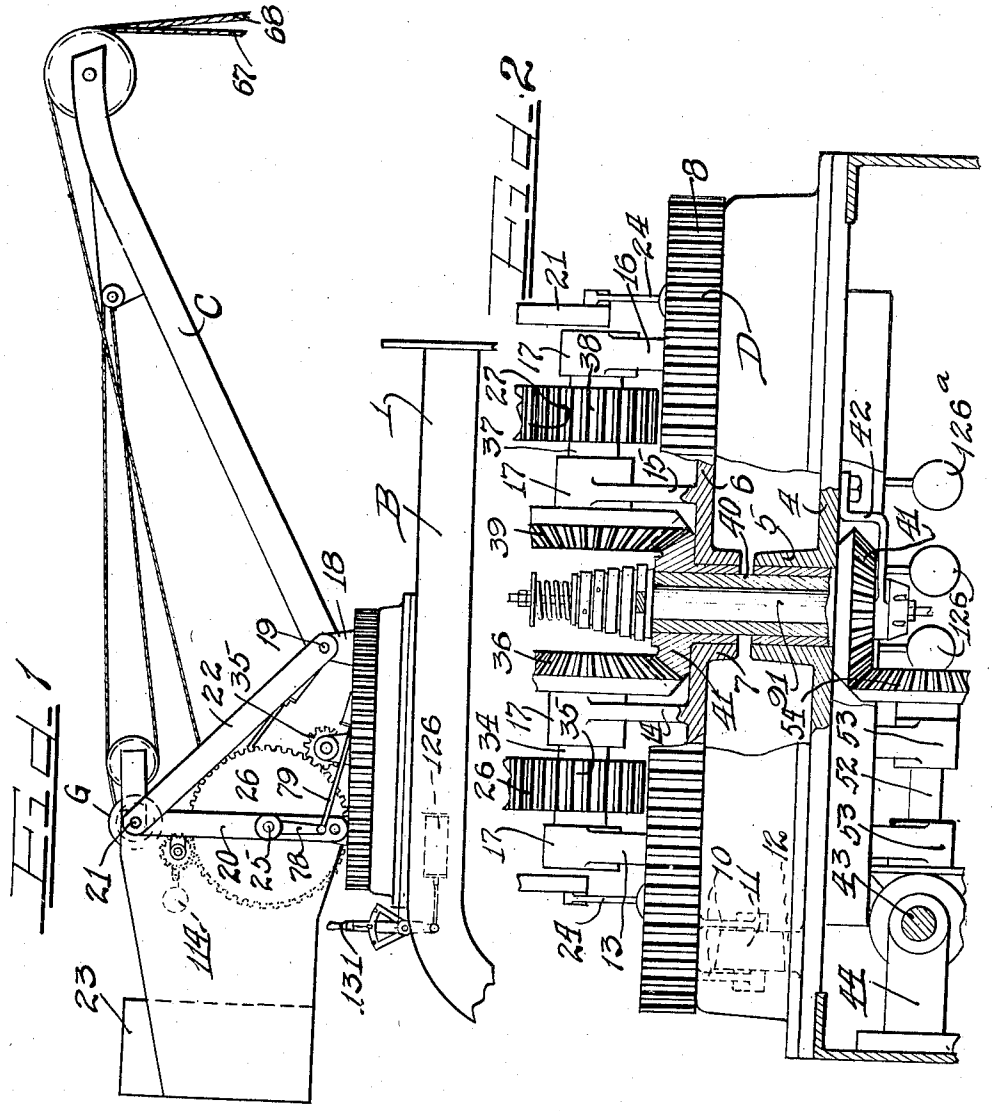
April 6, 1937. F. G. MANLY 2,075,819

FULL SWING CRANE

Filed July 10, 1935 7 Sheets-Sheet 1



Inventor
Fred G. Manly
By Charles A. Wright
Atty.

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FULL SWING CRANE

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Fig. 3

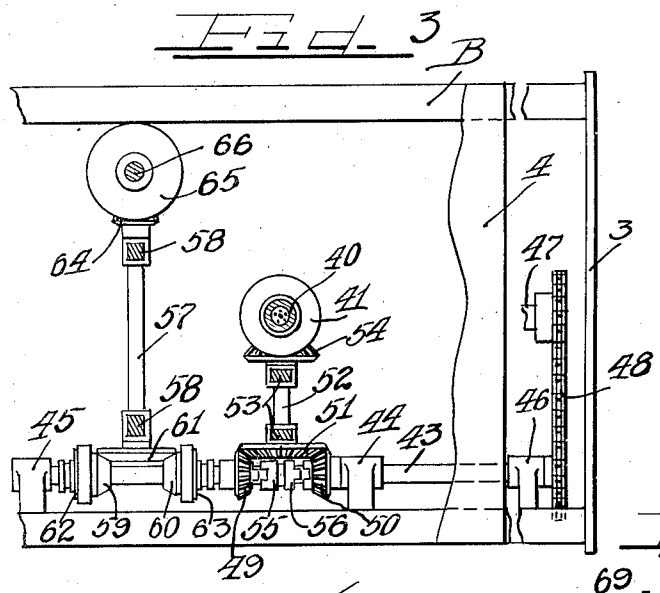


Fig. 4

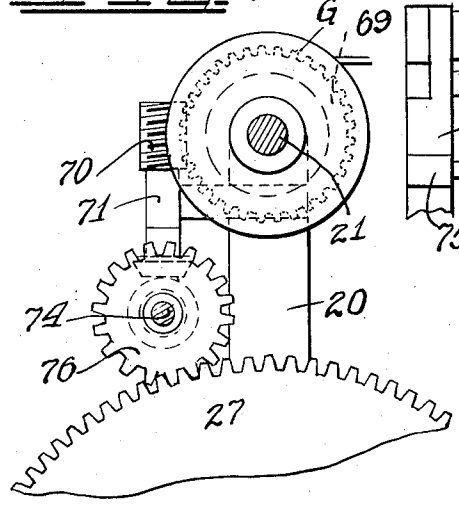
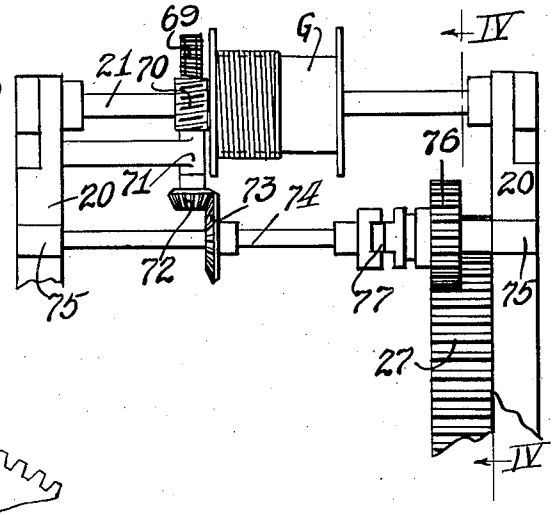


Fig. 5



Inventor
Fred G. Manly
By Charles A. Wright
Atty.

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FULL SWING CRANE

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Fig. 6

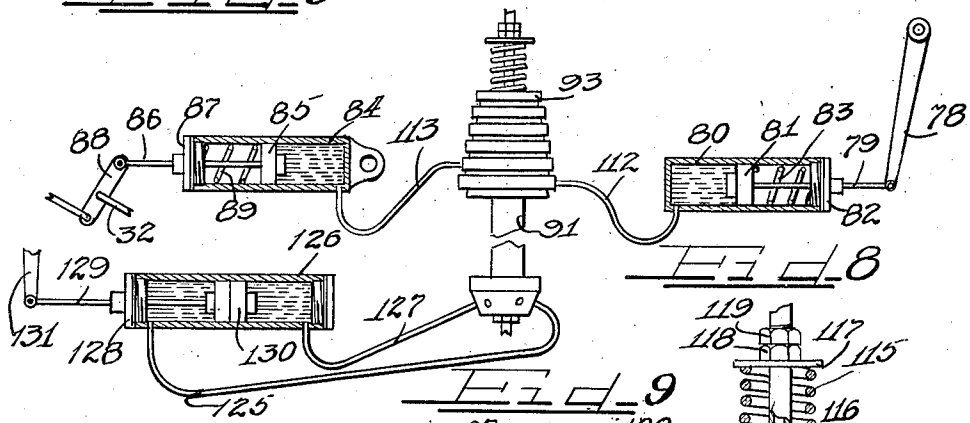


Fig. 8

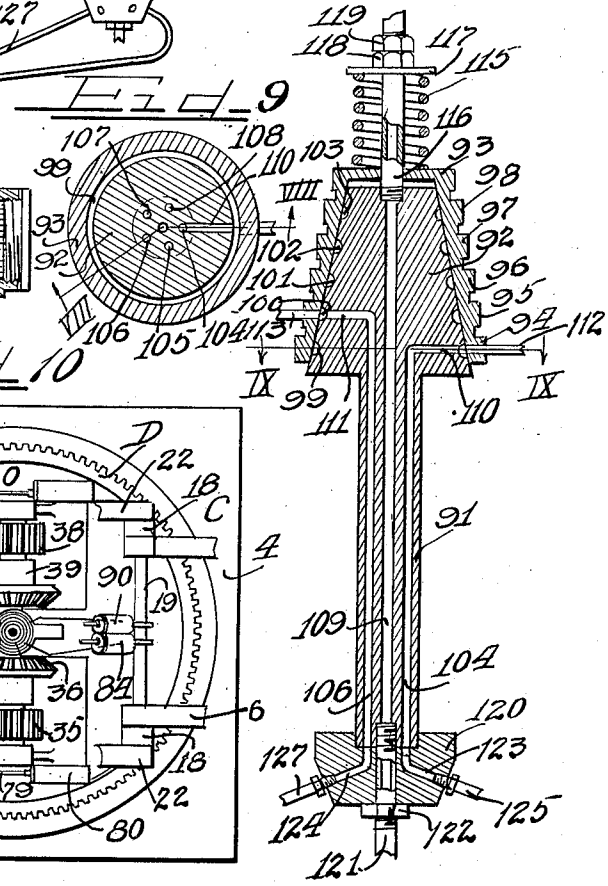


Fig. 9

Fig. 7

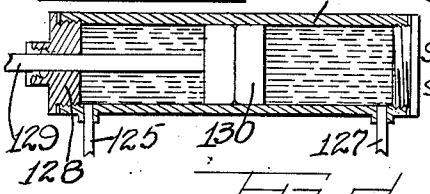
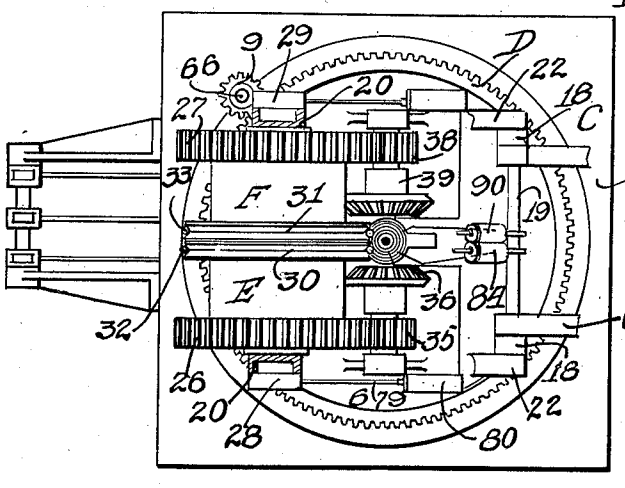


Fig. 10



Inventor
Fred G. Manly.

By Charles A. Wilkins.

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FULL SWING CRANE

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Fig. 11

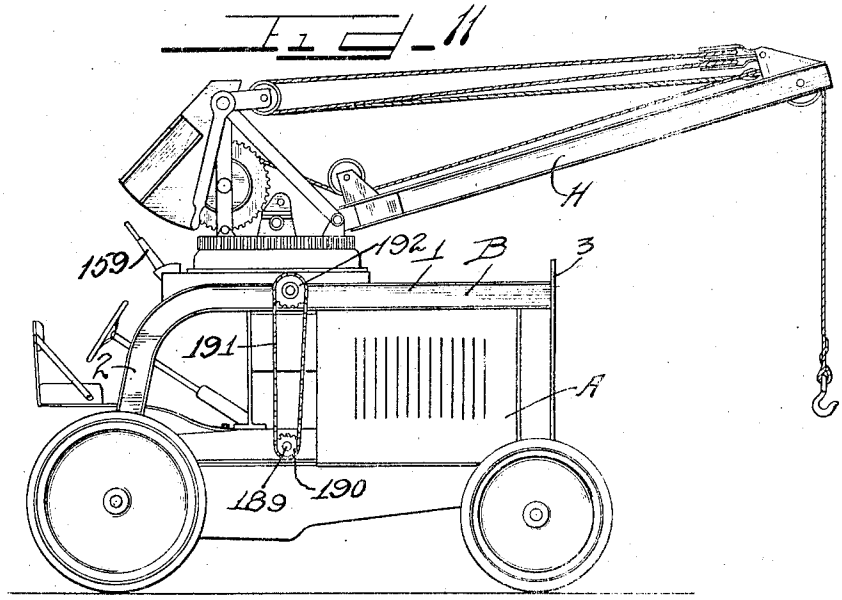
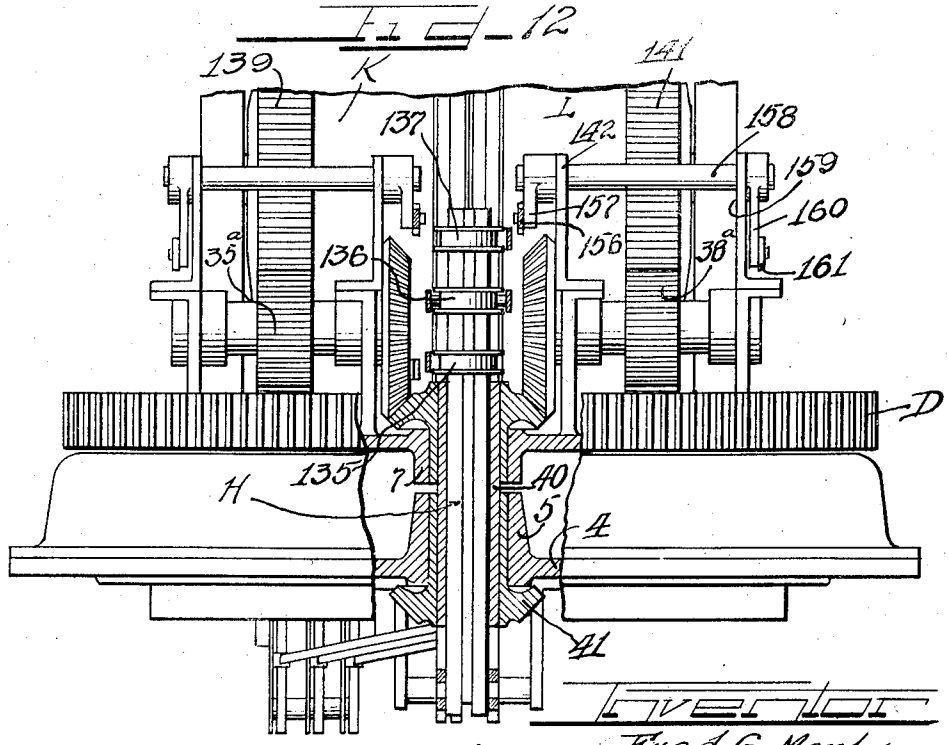


Fig. 12



Inventor

Fred G. Manly.

by Charles O'Neill Attys

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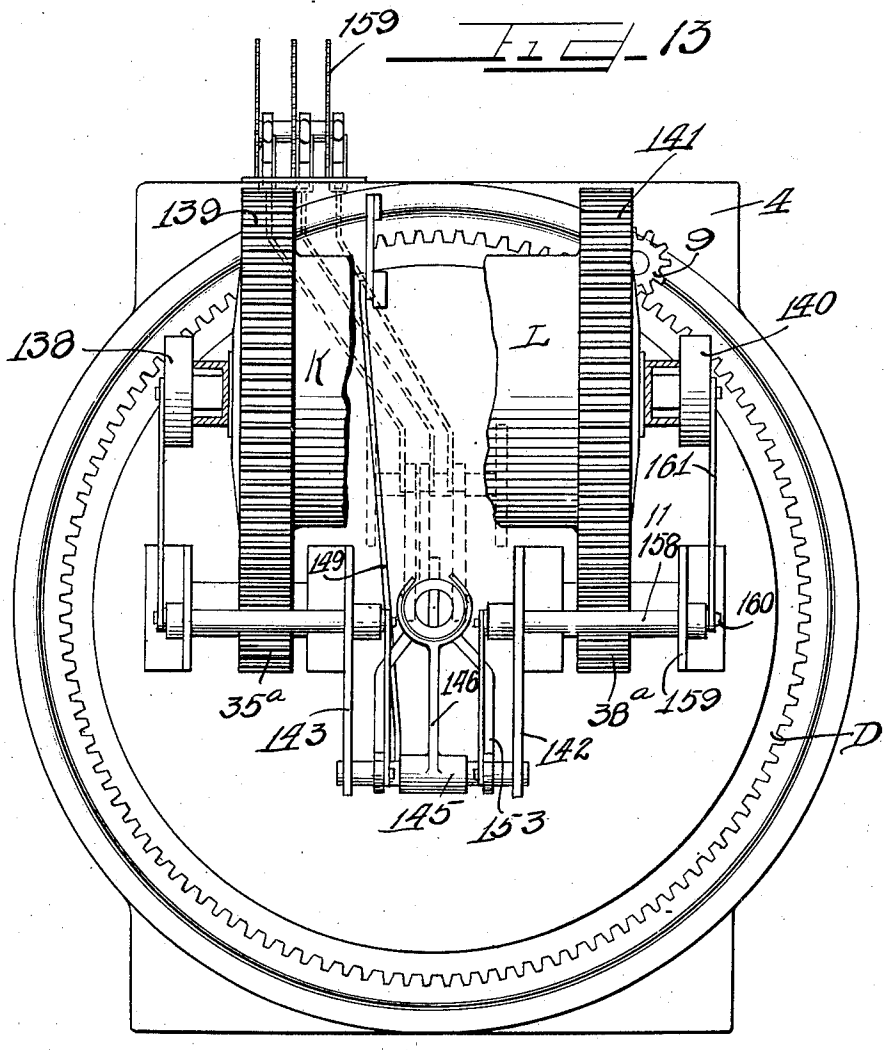


Fig. 13

Inventor
Fred G. Manly.

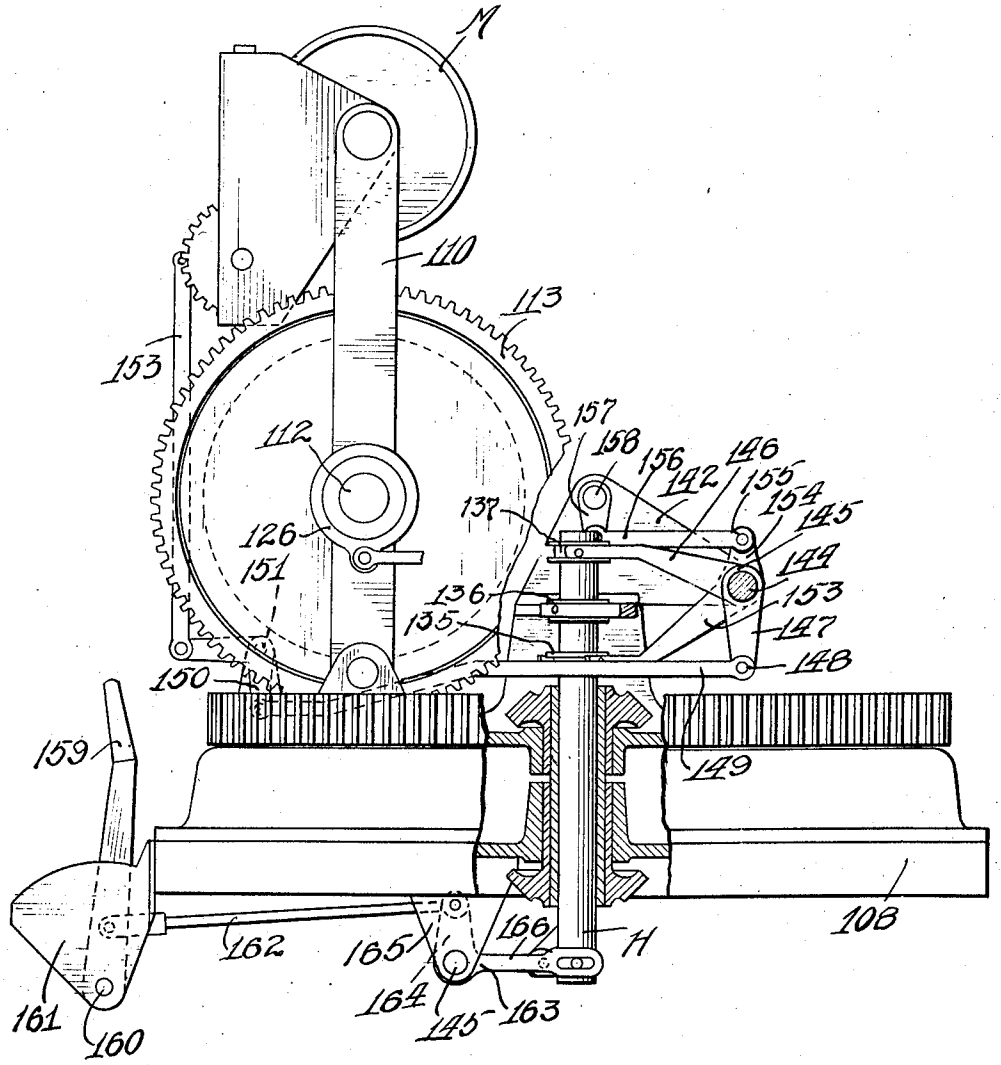
by Charles O. Fields Atty

April 6, 1937. F. G. MANLY 2,075,819

FULL SWING CRANE

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Fig. 14



Inventor
Fred G. Manly.
by Charles O. Hill Attys

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FULL SWING CRANE

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Fig. 15

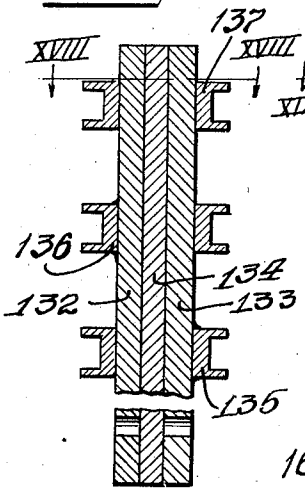


Fig. 16

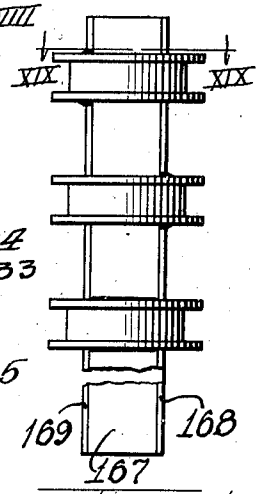


Fig. 17

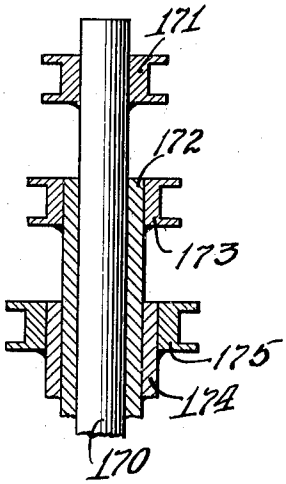


Fig. 18

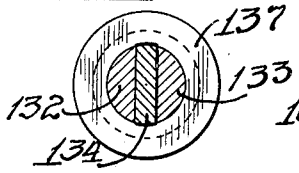


Fig. 19

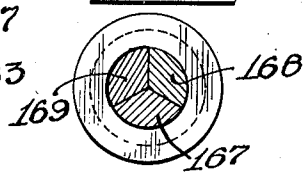


Fig. 20

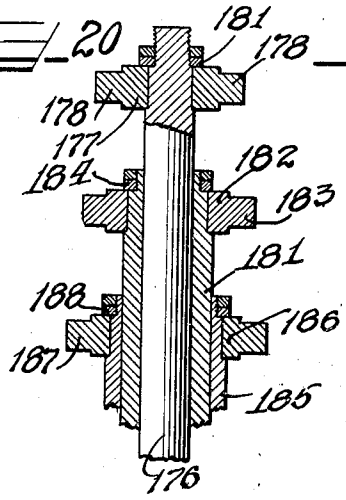
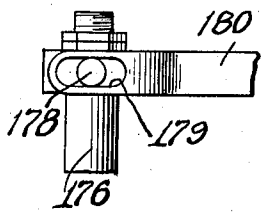


Fig. 21



Inventor
Fred G. Manly.
By Charles A. Hill Atty

Patented Apr. 6, 1937 2,075,819

UNITED STATES PATENT OFFICE

2,075,819

FULL-SWING CRANE

Fred G. Manly, Chicago, Ill.

Application July 10, 1935, Serial No. 30,644

9 Claims. (Cl. 212—38)

The present invention relates to a full-swing crane, and more particularly to one which is adapted to be mounted on an automotive vehicle, for instance, a tractor, so constructed and operated that the crane may be swung, the boom lifted or lowered, while the tractor is moving, as well as when the tractor is at rest.

The invention relates also to a novel control for a full-swing crane, for operating the boom movement and also the winches or drums for the load cables, which control is effective and operative through the axis of rotation of the turntable, and which control may be a fluid control or a mechanical control.

The present invention is directed more particularly to a small, sturdy crane adapted to be mounted on a tractor, and movable with the tractor, for utility work of all kinds.

The crane of the present invention is so constructed that it may be fully operated while the tractor is moving; that is to say, the turntable may be rotated through any angular distance, the boom raised or lowered, and the load line winches operated while the tractor is in motion, a feature which has been impossible with movable cranes, as heretofore designed.

Movable type swinging cranes have heretofore been constructed, of such character that the winches or drums for the cables have been mounted below the turntable, thus causing twisting of the cables as the turntable is swung. This construction necessarily limits the angular range of movement of the turntable, and thus limits the effectiveness of the crane as a whole. Any twisting of the cables is detrimental to the longevity of the cables, as well as the usefulness of the crane.

The present invention has to do with a control mechanism for a portable swinging crane wherein the control mechanism for operating the boom and the load is effective through the axis of rotation of the turntable, so that the crane may be rotated any angular amount about its pivot.

An object of the present invention is to provide a portable swinging crane to be fully operated while being moved in travel.

Another object of the present invention is to provide a control mechanism for a portable swinging crane wherein the operation of the crane is controlled through the axis for rotation of the crane turntable.

Another object of the present invention is to provide novel control means for a swinging crane.

A further object of the present invention is to provide control mechanism for a swinging crane, in which the crane is mounted as a whole on an auxiliary frame, which frame, in turn, may be readily applied to a tractor and operated from the engine of the tractor. The control means for the crane structure are carried by the crane structure itself, and constitute a part of the unitary construction of the apparatus.

The above, other and further objects of the present invention will be apparent from the following description and accompanying drawings.

The accompanying drawings illustrate various embodiments of the present invention, and the views thereof are as follows:

Figure 1 is an elevational view of one form of swinging crane, constructed in accordance with the principles of the present invention, showing it mounted on an auxiliary frame for attachment to a tractor.

Figure 2 is an enlarged fragmental view, partially in elevation and partially in section through the axis of the turntable, showing certain details of construction.

Figure 3 is a fragmental view, partially in plan and partially in section, of the drive mechanism for utilizing the engine of a tractor for operating the crane of the present invention.

Figure 4 is a view, partially in elevation and partially in section, taken substantially on the plane indicated by line IV—IV of Figure 5, showing the preferred mechanism for operating the boom winch.

Figure 5 is a fragmental elevational view of mechanism for operating the boom winch.

Figure 6 is a schematic view, partially in elevation and partially in section, of certain of the operating instrumentalities employed in the fluid control system for operation of the crane.

Figure 7 is an axial sectional view through one of the controller units of the fluid control system.

Figure 8 is a vertical sectional view through that portion of the fluid control apparatus which extends through the axis of rotation of the turntable.

Figure 9 is a horizontal sectional view taken substantially in the plane indicated by the line IX—IX of Figure 8.

Figure 10 is a top plan view of the turntable of the crane of Figure 1, with certain parts in section.

Figure 11 is a side elevational view of a gasoline tractor having applied to it a swinging crane of the present invention, somewhat schematically illustrated, for showing the relationship of the parts when in place on a tractor. The crane of this figure illustrates a different form of counter-

weight and a slightly different arrangement of parts on the turntable, from that illustrated in Figure 1.

Figure 12 is a view similar to Figure 2, showing the mechanical control means, effective through the axis of rotation of the turntable, for operating the winches on the table.

Figure 13 is a top plan view, with certain parts fragmentarily shown, and other parts in section, of a turntable employed with the type of control illustrated in Figure 12.

Figure 14 is a fragmental elevational view, with parts in section, through the axis of the turntable, showing certain details of the mechanical control system.

Figure 15 is a fragmental axial sectional view through one form of stem extending axially through the axis of rotation of the turntable, for mechanically operating the winches on the table.

Figure 16 is an elevational view of another form of such stem mechanism.

Figure 17 is a view in axial section showing a still further modification of operating stem.

Figure 18 is a horizontal sectional view taken substantially in the plane indicated by line XVIII—XVIII of Figure 15.

Figure 19 is a horizontal sectional view taken substantially in the plane indicated by line XIX—XIX of Figure 16.

Figure 20 is a view similar to Figures 15 and 17, showing a still further modification of control stem.

Figure 21 is a fragmental elevational view of one means for connecting an actuator to one of the stems of the form of mechanical control means of the present invention.

The drawings will now be explained.

Figure 11 illustrates a gasoline tractor A of typical form which has applied to it a swinging crane constructed in accordance with the principles of the present invention.

For supporting a crane on such a tractor A, an auxiliary or sub-frame B is provided which, in the present instance, is illustrated as consisting of two side members of structural shape, each bent to provide a horizontal portion **1** and a substantially vertical portion **2**. The lower extremities of the portions **2** are riveted or bolted to the tractor frame adjacent the driving wheels, while the front ends of the horizontal portions **1** are fastened by riveting, welding, or bolting, to an upstanding plate **3**, or equivalent structural member, disposed adjacent the radiator of the tractor.

Referring to the crane illustrated in Figures 1 to 10, inclusive, there is, suitably secured to the sub-frame B, a horizontally disposed base plate **4**, which may be made in the form of a forging or casting, and which is provided with a centrally disposed upstanding hub **5**.

The turntable comprises a bull wheel D, having a flat web **6**, in which is centrally formed a depending hub **7**, in axial alignment with the hub **5** of the plate **4**. The periphery of the bull wheel is provided with gear teeth **8** for meshing with a driving pinion **9** for rotating the table. To the underside of the bull wheel are secured by casting or otherwise, lugs **10**, which support rollers **11**, so that the bull wheel may be rotated about its axis and supported on the plate **4** by means of the rollers in engagement with track **12** on the plate. The track or runway **12**, for the rollers **11**, is secured to the plate **4**, in any suitable manner.

The bull wheel D is preferably formed as a casting and carries on the upper face of its web **6** thereof, upstanding legs **13**, **14**, **15** and **16** which have bearing members **17**, respectively, constituting parts of the legs. The bull wheel also has integrally formed with it a pair of upstanding lugs **18** to which is pivotally attached, as by means of a pivot bolt **19**, a boom C.

Also secured to the web **6** of the bull wheel are upstanding frame members **20** which are connected at their upper ends by means of a bar **21**, which bar also serves to connect the upper ends of diagonal struts **22** with the uprights **20**. The lower ends of the struts **22** are secured to the pivot bolt **19**. The uprights **20** and the struts **22**, therefore, constitute a frame structure on the bull wheel for supporting certain of the instrumentalities of the crane structure.

Suitably secured to the upright members **20** is a box structure, designated generally at **23**, which extends from the uprights **20** in a direction opposite from the boom C. This box structure is for the purpose of receiving heavy weights, such as pig iron, bags of sand, or the like, which constitutes a counter weight to counterbalance the weight of the boom C and any load that may be suspended from it.

The uprights **20** are preferably secured to the web **6** of the bull wheel by means of upstanding lugs **24** integrally cast with the bull wheel.

The uprights **20** support a shaft **25** on which two winches E and F (Fig. 10) are freely rotatably mounted.

Supported on the shaft **25**, adjacent the outer ends of the winches are gears **26** and **27** respectively. Clutch mechanisms, designated generally at **28** and **29**, respectively, are provided for selectively connecting the gears **26** and **27** in driving relation with their winches E and F. The inner or abutting ends of the winches are provided with grooved pulleys **30** and **31**, each of which is fastened to its winch, and in which pulleys are cables **32** and **33**, respectively, constituting parts of brake mechanisms for the winches.

Supported in the bearings **17** of the legs **13** and **14** of the bull wheel, is a stub shaft **34** which carries a pinion **35**, intermediate the legs, in mesh with the gear **26** of the winch E. The stub shaft **34** also carries, at its end, adjacent the axis of rotation of the bull wheel, a bevel gear **36**. In like manner the legs **15** and **16** support a stub shaft **37** on which is a pinion **38** in mesh with the gear **27** of the winch F. A bevel gear **39** is secured to the stub shaft **37** at its end adjacent the axis of rotation of the bull wheel D.

Extending vertically axially through the hubs **5** and **7** of the plate **4** and bull wheel D respectively, is a hollow shaft **40**. Keyed to this hollow shaft at its upper end is a bevel gear **41** in mesh with the bevel gears **36** and **39**. At the lower end of the hollow shaft **40** is a bevel gear **41** keyed to the shaft. A bracket **42** attached to the under surface of the plate **4**, serves to support the gear **41** and the hollow shaft **40** in position.

The mechanism for utilizing the power of the tractor engine, for operating the crane of the present invention, is illustrated in Fig. 3.

Referring to Fig. 3, it may be observed that along the inner face of one of the frame members of the auxiliary frame B, is a jack shaft **43**, parallel to the frame member, and supported in journals **44** and **45**. Another journal **46** supports the end of the shaft **43** adjacent the plate **3**, that is, adjacent the front end of the tractor.

The crankshaft of the tractor engine is shown as extended at **47** where it is provided with a

sprocket wheel for operating a sprocket chain 48 passing over another sprocket wheel on the shaft 43, for rotating the shaft 43 as desired. Suitable clutch mechanism, not shown, may be interposed between the crank shaft extension 47 and its sprocket wheel, for rotating the shaft 43 at will.

On the shaft 43, and adjacent the longitudinal length of the sub-frame B and in line with the axis of rotation of the turntable D, are bevel gears 49 and 50 meshed with a bevel gear 51 on a cross shaft 52, which is supported from the under side of the plate 4, by suitable journals 53. The cross shaft 52 carries a bevel gear 54 meshed with the gear 41 at the lower end of the hollow shaft 40 of the turntable. The gears 49 and 50 are selectively connected in driving relation with the shaft 43 by means of clutch members 55 and 56, of well known form.

Rearwardly of the cross shaft 52 is a second cross shaft 57 supported in journals 58 depending from the plate 4. The jack shaft 43 is provided with bevel gears 59 and 60, freely rotatable on the jack shaft and meshed with a bevel gear 61 keyed to the shaft 57. The bevel gears 59 and 60 are selectively connected in driving relation with the jack shaft 43 by means of friction clutches, indicated generally at 62 and 63 respectively. The other end of the shaft 57 is provided with a bevel gear 64 meshed with a bevel gear 65 keyed to a vertical shaft 66 to which is keyed the driving pinion 9 for the turntable D.

Supported on the bar or shaft 21 of the frame structure is a winch G provided for the purpose of raising and lowering the boom C. The winches E and F are utilized for operating the lifting cables 67 and 68.

Fastened to the winch G is a worm wheel 69 in mesh with a worm 70 secured to a shaft supported in a journal 71 of the frame structure. A bevel gear 72 on this shaft meshes with a bevel gear 73 keyed to shaft 74, extending transversely between the frame members. The shaft 74 is supported in journals 75 formed in the uprights 20 of the frame structure, and carries a pinion 76 in mesh with the gear 27 of the winch F. Suitable clutch mechanism 77 is provided to connect the pinion 76 in driving relation with the shaft 74, or to disconnect it from such relationship. The worm 70 and worm wheel 69 are so intermeshed as to prevent retrograde rotation of the worm wheel 69 by reason of any weight transmitted to the winch G from the boom C. In other words, there is locking relationship between the worm and worm wheel, thus eliminating the need for a brake for the winch G. The clutch 77 is operated by a mechanism to be later described.

The winches E, F and G are operated by means of a fluid control system which will now be described.

For actuating the clutch mechanisms 28 and 29, to connect the gears 26 and 27 in driving relation with their respective winches E and F, each clutch mechanism is actuated by means of a crank 78, connected to the clutch mechanism, which in turn is operated by a rod 79 which enters a fluid cylinder 80 and constitutes a piston rod. On the end of the rod within the cylinder is a piston 81 (Fig. 6). There is a cylinder 80 for each of the clutch mechanisms 28 and 29, which function in a similar manner, so that the description of one will suffice. Within the cylinder 80, between the piston 81 and the head 82 through which the piston rod 79 passes, is interposed a spring 83, the function of which is to urge the piston in a direction away from the head 82 of the cylinder. The brake cables 32 and 33 are actuated by a brake mechanism as follows.

A fluid cylinder 84 contains a piston 85 on a piston rod 86 which passes through a head 87 and is connected at its end to a link 88. To the link 88 are attached the ends of a cable 32, or 33, as the case may be. The link 88 is adapted to be rocked when pulled in counter-clockwise direction as viewed in Fig. 6, to apply the brake, and in opposite direction to release the brakes.

The pistons within the cylinders 80 and 84 are actuated by any suitable fluid such as air, gas, water, oil, or any other satisfactory fluid. The fluid illustrated is a liquid and, referring to Fig. 6, is shown as occupying the interior of the cylinder 80 between the piston 81 and the end of the cylinder remote from the head 82, while in cylinder 84 it occupies the space between the piston 85 and the end of the cylinder remote from the head 87. In the cylinder 84 is a spring 89 between the head 87 and the piston 85 tending to urge the piston away from said head.

A similar brake cylinder 90 is provided for actuating the brakes of the winch F. The cylinder 90 is constructed and operates in all respects in the same manner as the cylinder just mentioned. For controlling the operation of the clutch and brake cylinders 80, 84 and 90, and also for controlling the fluid cylinder which actuates the clutch 77 of the boom winch mechanism, a novel structure, such as that illustrated in Figures 6, 8 and 9, and as in position in Fig. 2, is provided.

This structure includes a cylindrical member 91 lying within the hollow shaft 40 and provided at its upper end with a head 92 which, in axial section, is in the form of a truncated cone, with the convergence upwardly from the part 91. The cone 92 is housed within a cap 93 having tight engagement with the surface of the conical head 92 to prevent fluid escape, which head on its exterior is provided with a series of lands 94, 95, 96, 97 and 98.

The surface of the conical head 92 is provided with a series of parallel grooves 99, 100, 101, 102 and 103. These grooves are disposed preferably in substantially horizontal alignment with the lands just mentioned.

Inasmuch as there are five fluid cylinders illustrated in connection with the fluid control system of this form of the invention, the cylindrical member 91 is provided axially thereof with five ducts 104, 105, 106, 107 and 108, distributed through it, and a central duct 109. Within the conical head 92 horizontal portions, such as shown at 110, 111 (Fig. 8) afford communication between the several of the ducts and the corresponding grooves in the face of the head 92. Thus, for instance, Figure 8 shows the duct 104 in communication with the lowermost groove 99 of the head, and the duct 106 in communication with the groove 100 next above it. Fluid passing through the duct 104 enters the groove 99 while fluid through the duct 106 enters the groove 100. The other ducts within the member 91 communicate with the others of the grooves in the surface of the conical head 92. Connected into the cap 93, in flow communication with the groove 99 is a pipe 112 which communicates with one of the clutch cylinders 80, as shown in Fig. 6. Communicating through the land 95 with the groove 100 is a pipe 113 in communication with the brake cylinder 84, as shown in Fig. 6. Similar pipes communicate through the other lands

of the cap with the other of the clutch cylinders 80, the other brake cylinder 90 and the cylinder 114 (Fig. 1) which actuate the clutch 77 of the winch G.

The cap 93 is maintained in tight engagement with the head 92 by means of a spring 115 surrounding a pipe 116 threaded into the upper end of the central bore 109 and retained under compression by means of a washer 117 and nuts 118 and 119 which are threaded on the pipe to properly tension the spring against the cap 93.

The member 91 extends downwardly below the plate 4 through the shaft 40, below the bevel gear 41 and at its lower end is provided with a cap 120 held in position by means of a pipe 121 threaded into the lower extremity of the central bore 109, which receives a nut 122 for maintaining the head 120 in operative relationship against the lower end of the member 91. The lower head 120 is provided with a plurality of individual ducts or passages two of which are shown at 123 and 124, which afford communication with the several of the ducts through the member 91. The passage 123 is shown in communication with the duct 104, while the passage 124 is shown in communication with the duct 106. A flexible conduit 125 affords fluid communication between the passage 123 and one end of a control cylinder 126 (Fig. 6). A similar flexible conduit 127 affords fluid communication between the passage 124 and the opposite end of the control cylinder 126.

It will thus be observed that the control cylinder 126 is effective to cause movement of the pistons in the cylinders 80 and 84, that is the cylinder 80 which controls the clutch mechanism for the winch E and the brake mechanism for the same winch.

One end of the cylinder 126 is closed by a head 128 through which passes a rod 129 connected at its inner end to a double piston 130 and its outer end to an operating lever 131. In neutral position, that is with the clutch disengaged and the brake off, the double piston 130 is substantially at mid-length of the cylinder 126, as may be observed in Fig. 6. There is another cylinder, similar to 126, provided for the operation of the clutch mechanism of winch F and the operation of its brake cylinder 90.

For actuating the cylinder 114 of the boom winch G, a control cylinder, constructed like cylinder 84 or 80, is provided and operated by a similar control lever 131. The control cylinder for this winch is a single acting cylinder, in contradistinction to the cylinders 126 which are double acting. The three control cylinders 126, 126 and 126*a*, for the winch G, are mounted on the sub-frame B adjacent the driver's seat of the tractor, which may be observed in Fig. 1. The control lever 131, of Fig. 1, is shown in neutral position, that is, the position of the parts as shown in Fig. 6.

The several cylinders 80, 85 and 126 as well as the several ducts and conduits are filled with fluid so that as any of the pistons is actuated, a movement of the fluid results.

According to Fig. 6, suppose, for instance, it is desired to connect the winch E in driving relation with its gear 26. The control lever 131 would then be swung to move the piston 130 to the left, as viewed in Fig. 6, which would thus force fluid through the conduit 125, duct 104 in the member 29 and into the cylinder 80 to move its piston 81 to the right, thus swinging the link 78 in counter-clockwise direction which would thereupon manipulate the clutch 28 to effect driving relationship between the gear 26 and the winch E. Such movement of the piston 130, in the cylinder 126, would tend to draw fluid from the cylinder 84 thus assuring full release of the brake for the winch E. When the winch has been rotated to secure the desired result, the control lever 131 is swung in the opposite direction whereupon fluid is forced into the cylinder 84 to move its piston 85 to the left, thus clamping the cable 32 about the winch E to brake it and at the same time fluid is withdrawn from the cylinder 80 to release the clutch.

Operation of the clutch cylinder and brake cylinder for the winch F is effected in the same manner.

Inasmuch as the worm 70 and worm gear 69 constitute a self-locking arrangement, there is no need for brake means for the winch G. Therefore, the control cylinder for actuating the clutch 77 may be a single acting clutch, of the type shown as 84 or 80. In such event movement of the control lever for the cylinder 126*a* would move the fluid in a direction to cause engagement of the clutch 77 so that rotation of the shaft 74 by the pinion 76 is accomplished. This clutch is held in position by latching the control lever for this particular cylinder in its proper notch of the segment until its winch has been rotated sufficiently in its then direction of rotation. When it has completed its proper number of revolutions, the control lever is moved back to neutral position whereupon the winch comes to rest and is locked in that position.

The relationship of the cylinders and parts is such that when the control levers 131 for the cylinders 80 are in neutral position, the clutches are off and the brake bands 32 and 33 are eased from braking engagement with their respective winches.

The function of the springs 83 and 89, in the cylinders 80, 84 and 90 is to urge the pistons in such direction as to force fluid out of the cylinders when the control levers are actuated in a direction to release the clutches and brakes.

There are two winches E and F illustrated for operating the load lines 67 and 68. One of these winches may be used for operating one of the cables as a lifting line and the other winch operated to actuate the other cable as a holding line, where two cables are employed, such, for instance, with a clam shell bucket. If only one line is being used, then of course, but one of the winches will be utilized in the operation of the crane.

Reverse movement of the winches E and F is accomplished by actuation of either of the clutches 55 or 56 on the jack shaft 43 to couple the shaft 52 in driving relation with the jack shaft to effect the desired rotation of the winches.

Reversal of rotative movement of the winch G is accomplished by actuation of either of the friction clutches 62 or 63 to connect the shaft 57 in proper driving relation with the jack shaft 43. The jack shaft 43 being driven from the crank shaft of the engine, rotates in the same direction, so that suitable means, such as those herein described and shown, must be employed to secure reversal of rotation of the several winches of the crane structure.

It will be observed that the fluid control system of the present invention is effective through the axis of rotation of the turntable D for controlling movement of the winches on the turntable, so that it is possible to swing the turntable D through any angular direction less than

or more than 360°, without in any manner hampering the action of the several cables for raising or lowering the boom and for raising or lowering the load. Inasmuch as the winches and their control mechanisms are all supported on or by the turntable this axial control arrangement of the present invention is made possible.

Referring to Figures 11 to 21 inclusive, these have reference to a mechanical control system which also is effective through the axis of rotation of the turntable of the crane.

In this form of the invention there is utilized a stem designated generally at H in Figs. 12 and 14, which stem extends through the hollow shaft 40, as heretofore described. In this form of the invention, the various clutches and brakes are operated by linkage, movement of which is effected by making the stem H of several relatively movable parts and separately connecting these parts to various linkages as will now be described.

The form of stem H illustrated in Figure 12 is shown in greater detail in Fig. 15 and includes three parts 132 and 133, as the outer parts, and 134 as an inner or intermediate part. Fig. 18 shows these parts in section.

Welded to the part 133 is a collar 135, a collar 136 is welded to the other outer part 132 while a collar 137 is welded to the inner or intermediate part 134. Thus, as the outer part 133 is reciprocated, its collar 135 will be reciprocated accordingly. In like manner collar 136 will be reciprocated with its part 132 and the collar 137 with its part 134.

In this form of the invention, there are two winches K and L for actuating the load lines, 67 and 68 and a boom winch M. The winch K is rotated through a suitable clutch mechanism 138 which connects its gear 139 in driving relation with the winch. The winch L is connected by its clutch mechanism 140 with its gear 141 in similar driving relation when the clutch is actuated. The gears 139 and 141 are rotated by pinions 35a and 38a, operating as described with reference to pinions 35 and 38 of the first described form of the invention.

The clutch mechanism for the boom winch M is actuated by appropriate linkage mechanism.

Referring to Figures 13 and 14, plates 142 and 143 are secured to the bearings for the stub shafts carrying the pinions 35a and 38a and support a two-part oscillating shaft 144. On the shaft 144 is an oscillatable sleeve 145 having one arm 146 extended, with its ends bifurcated to enter the collar 137 of the stem H, to be rocked as the intermediate part 134 of the stem is moved. Integral with the sleeve 145 is another arm 147 pivoted at 148 to a link 149 which extends underneath the winches, as is shown in full lines in Fig. 13 and connected at its other end to one arm of a bell crank 150 pivoted at 151 to a standard cast as a part of the turntable. The other arm of the bell crank is pivoted to a link 153 which extends upwardly to actuate the clutch for the boom winch M.

The clutch 140 is actuated by linkage mechanism which includes an arm 153 pinned to a part of the two-section shaft 144 and with its other end bifurcated to engage the lowermost collar 135 of the stem H. Integral with the arm 153 is a crank 154 which is pivoted at 155 to a link 156, the other end of which is pivoted to a crank 157 connected to a rock shaft 158. The rock shaft 158 is supported in the plate 142 and another plate 159, outwardly of which is a crank 160 connected to a link 161 which is at its other end connected to a link of the clutch mechanism 140 for actuating it. Thus as the lower collar 135 is raised, the clutch 140 connects the gear 141 to its winch L.

The clutch mechanism 138 for the winch K is operated in a similar manner, and by similar linkage mechanism arranged in reverse order, as may be observed in Fig. 13. This linkage is actuated by the middle collar 136 of Fig. 15.

For imparting movement to the sections 132, 133 and 134 of the stem H, of the form described, control levers 159 are provided. Figure 14 illustrates one such lever pivoted at 160 to a suitable support 161, formed as a part of the sub-frame B of the crane apparatus. The lever 159 is connected by a link 162 to a bell crank 163 pivoted at 164 to a suitable supporting bracket 165 and by means of a link 166 is connected to one of the sections of the stem. The other sections of the stem are provided with other control levers in a similar manner. The position of the lever 159 of Figure 14 shows the part in neutral position, that is, with the clutches disengaged.

The stems illustrated in Figures 16, 17 and 20 operate in the same manner as described with reference to that of Figure 15, but are, however, of slightly different construction.

The stems illustrated in Figures 16 and 19 comprise three segmental parts, 167, 168 and 169 substantially 120° in extent, shaped and interfitting as shown in Fig. 19. The lowermost collar is welded to the part 167, the next collar is welded to the part 168, and the uppermost collar is welded to the part 169.

The form of stem shown in Fig. 17 consists of a rod 170 carrying at its end the upper collar 171, a sleeve 172 carrying the intermediate collar 173 and a second sleeve 174 surrounding the sleeve 172 and carrying the lowermost collar 175.

The form of stem illustrated in Figure 20 includes a rod 176 having its upper end reduced and provided with a collar 177 having oppositely disposed trunnions 178 on it for engagement with slots 179 in a link 180, which may be substituted for the arms illustrated in Figure 14. The collar 177 is retained in position on the rod 176 by means of nuts 181 engaging the threaded extremity of the rod.

Surrounding the rod 176 is a sleeve 181 having its upper end reduced to receive a like collar 182 also provided with trunnions 183 and retained in position by nuts 184. Surrounding the sleeve 181 is a second sleeve 185 carrying a head 186 provided with trunnion 187 held in position by nuts 188 threaded into the upper end of the sleeve 185.

The lower ends of the several sections of the stems illustrated in Figures 16, 17 and 20 are connected, by suitable means, to the operating levers 159 for actuation in the manner described with reference to the stems shown in Figs. 12 and 15.

It will be observed that the form of control mechanism, that is the mechanical control system, illustrated in Figs. 12 to 21 inclusive, is effective through the axis of rotation of the turntable so that all of the control of the winches on the turntable may be effected irrespective of the extent of angular movement of the turntable.

Figure 11 illustrates the position of the several control levers 159 with respect to the driver's seat of the tractor.

Rotation of the winches, of this form of the invention, may be accomplished by driving

mechanism of the character illustrated and described with reference to the first form of the invention, that is the driving mechanism illustrated in Fig. 3, or, may use a planetary system of gearing in which event driving power may be taken from the transmission of the tractor through a drive shaft 189 (Fig. 11) sprocket 190, sprocket chain 191 and a sprocket wheel 192 suitably connected to the planetary gear system of the turntable or crane structure.

It will be observed that the forms of the invention herein illustrated and described, are effective to control operation of the crane, through the axis of rotation of the turntable. Because of the novel control system here described, it is possible to actuate the crane when the tractor is moving as well as when it is at rest, as there is nothing to interfere with the operation of the crane by movement of the tractor or movement of the tractor by operation of the crane. The provision of counter-balance means for the boom and its supported load prevents capsizing of the tractor even when the boom is swung at right angles to the axis or length of the tractor.

Instead of using hand levers for the control cylinders, a driven pump may be used for moving the fluid in the control system. Such pump might be an air pump, for pressure or vacuum, or one using water, oil, or the like.

Suitable bands may be employed for the cables 32 and 33 of the brake mechanism.

Duct 109, through the member 91 may be utilized to receive electric leads, whenever a magnet is suspended from the boom. In such event, a suitable generator would be mounted on the sub-frame B for supply of electric current.

The duct might be used as a conduit for oil or air supply to a reservoir, on the turntable.

Band brakes, operated by the clutch linkage, for the winches K and L may be employed. Such would be similar to that described with reference to winches E and F.

The counterweights of the apparatus of the present invention are so arranged as not to swing over the head of the tractor operator while seated in the operator's seat on the tractor.

The invention has been described herein more or less precisely as to details, yet it is to be understood that the invention is not to be limited thereby, as changes may be made and equivalents may be substituted, without departing from the spirit and scope of the invention.

The invention is claimed as follows:

1. A combined tractor and swinging crane construction, including a gasoline driven tractor having a seat for a driver; a crane structure on said tractor having a turntable adapted for swinging movement about a vertical axis; a boom pivoted to said table; a boom cable; winch and cable mechanisms on said table for raising and lowering the boom; winch mechanism on said table for actuating the boom cable; brake means on said table for braking said winch mechanisms; drive means on said table for driving said winch mechanisms; said driving means including clutch means; means supported on said table for operating said clutch means and brake means; manually operable manipulating means disposed adjacent the driver's seat; and connections between said manually operable means and said operating means on said table, passing through the axis of rotation of said table to enable complete operation of the tractor, turntable, boom and winches by the tractor driver.

2. In a swinging crane having a rotatable turntable and a boom operating mechanism on said table, winch mechanism on said table, means including clutch means for driving said winch means, fluid pressure operating means on said table for actuating said clutch means, brake means on said table for braking said winch means, fluid pressure operating means on said table for operating said brake means, manual control means for said fluid pressure operating means on said base, and fluid connections between said control means and operating means extending through the axis of rotation of the table, said connections including relatively movable parts whereby rotative movement of the table will not disturb fluid communication between the control and operating means.

3. A combined tractor and swinging crane construction, including a gasoline driven tractor having a seat for a driver; a crane structure on said tractor having a turntable adapted for swinging movement about a vertical axis; a boom pivoted to said table; a boom cable; winch and cable mechanisms on said table for raising and lowering the boom; winch mechanism on said table for actuating the boom cable; brake means on said table for braking said winch mechanisms; drive means on said table for driving said winch mechanisms; said driving means including clutch means; means supported on said table for operating said clutch and brake means; manually operable manipulating means disposed adjacent the driver's seat; and mechanical relatively shiftable members including shiftable parts passing through the axis of rotation of said table, connecting said manually operable manipulating means adjacent the driver's seat with the means on said turntable for selectively operating said clutch means and said brake means, to enable complete operation of the turntable, boom, winch and tractor by the tractor driver.

4. In combination; a tractor having a driver's seat from which the tractor driver controls the movement of the tractor and crane; a swing crane mounted on said tractor; said crane including a turntable, winches on said turntable for effecting boom and load movements, gear means for operating said winches, clutch means for connecting any gear means in driving relation with its winch; manually operable manipulating means disposed adjacent the driver's seat; and linkage mechanism including relatively shiftable members including parts passing through the axis of rotation of the turntable connecting said manipulating means with said clutch means for selectively operating the same to enable complete operation of the turntable, boom, winches and tractor by the tractor driver.

5. In combination, a tractor, a swing crane mounted on said tractor, said crane including a turntable, winches on said turntable for effecting boom and load movements, gear means for operating said winches, clutch means for connecting any gear means in driving relation with its winch, fluid pressure responsive means for selectively actuating said clutches, a member having a plurality of passages in it extending through the axis of rotation of said turntable, said member having a head above said turntable with outlets therefrom and communicating with said several passages in said member and with the respective fluid pressure responsive means for said several clutches, and manually operable con-

trol cylinders mounted on said crane and having communication with said member below said turntable for selectively actuating any of said fluid pressure responsive means through the axis of rotation of said turntable for actuating its associated clutch.

6. In combination, a tractor, a swing crane mounted on said tractor, said crane including a turntable, winches on said turntable for effecting boom and load movements, gear means for operating said winches, clutch means for connecting any gear means in driving relation with its winch, brake means for said winches, fluid pressure responsive means for selectively actuating said clutches and said brake means, a member having a plurality of passages through it extending through the axis of rotation of said turntable, said member having a head above said table with outlets therefrom in communication with said several passages and with respective fluid pressure responsive means for said several clutches and brakes, and manually operable control cylinders mounted on said crane frame and having communication with said member passages below said turntable for selectively actuating any of said fluid pressure means for operating said clutches and brakes.

7. In combination, a tractor, a swing crane mounted on said tractor, said crane including a turntable, winches on said turntable for effecting boom and load movements, gear means for operating said winches, clutch means for connecting any gear means in driving relation with its winch, brake means for said winches, fluid pressure responsive means for selectively actuating said clutches and said brake means, a member having a plurality of passages through it extending through the axis of rotation of said turntable, said member having a head above said table with outlets therefrom in communication with said several passages and with respective fluid pressure responsive means for said several clutches and brakes, and fluid pressure creating means having communication with said member passages below said turntable for selectively actuating any of said fluid pressure responsive means for operating said clutches and brakes.

8. In combination, a road vehicle such as a tractor, a full swing crane mounted on said tractor and operable by the tractor operator, said crane including a base supported by said tractor, a turntable mounted on said base to swing through any angular distance to 360° or more, a boom supported on said turntable to pivot about a horizontal axis, winch and cable means on said turntable for operating said boom and its supported load, connections between said tractor drive and the table axis for swinging said table, said connections being operative to swing said table while the tractor is in motion as well as at rest, mechanisms on said table for operating and braking said winch operating means, control means on said base disposed conveniently for operation thereof by the tractor operator while in his seat, and operative connections between said control means and said winch operating means passing axially through the axis of rotation of the table and effective for selectively operating any of said winch operating means and table swing, the position of the winch means on the table above said base enabling full swing movement of the table and boom without limitation as to the extent of angular swing and without twisting of the boom and load cables.

9. In a device for operating mechanisms mounted on a turntable and controllable from a point remote from the table and operative through the axis of rotation of the table, comprising relatively axially shiftable members extending through the axis of rotation of the table to points above and below said table, connections above the table between said shiftable members and the mechanisms on the turntable for actuating the same, connections below the table to said shiftable members for selectively actuating said shiftable members, and manually operable control means operatively connected to said last mentioned connections.

FRED G. MANLY.