

May 14, 1940.

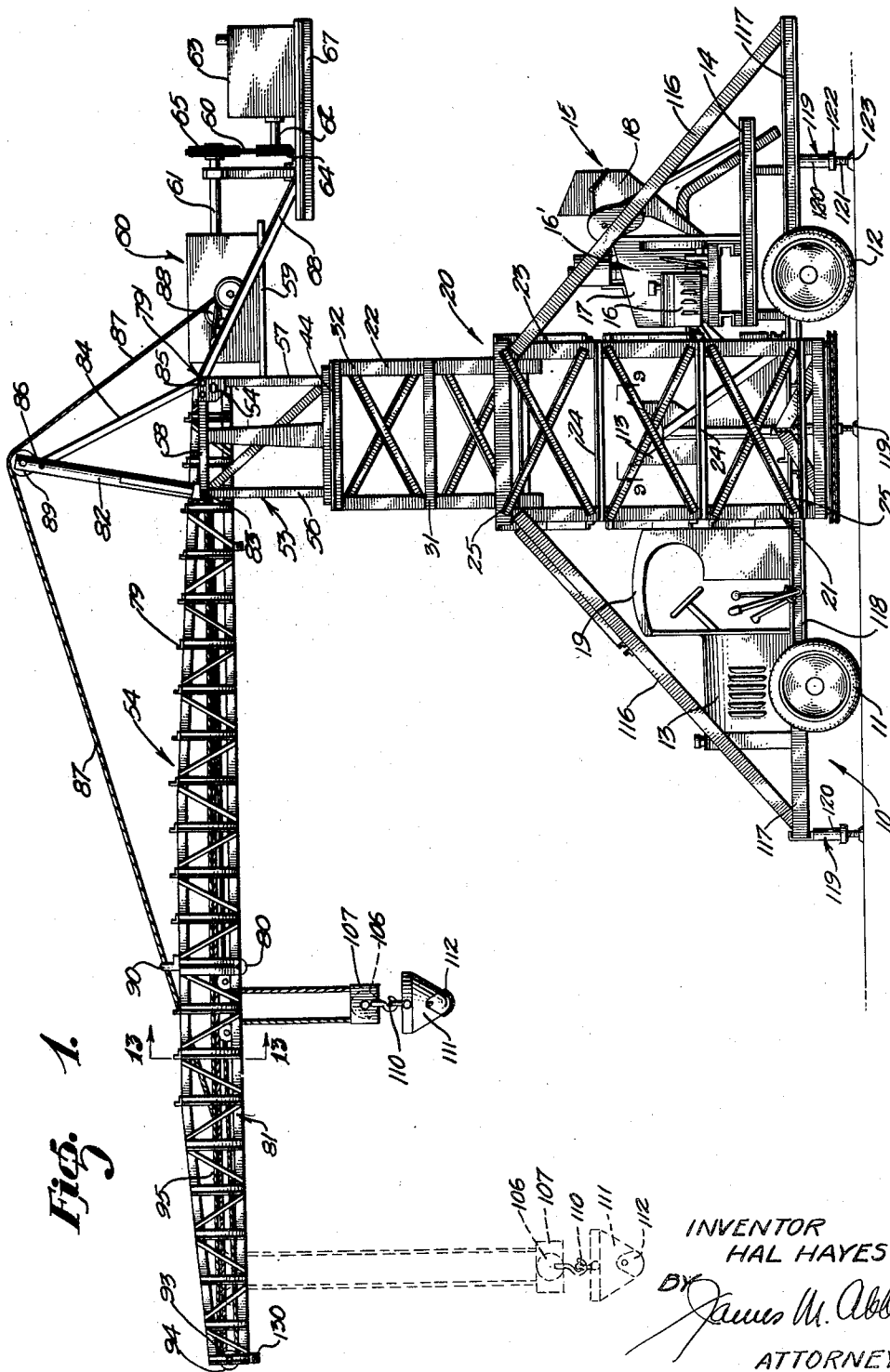
H. HAYES

2,200,274

PORTABLE CRANE

Filed Nov. 26, 1938

5 Sheets-Sheet 1



May 14, 1940.

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2,200,274

PORTABLE CRANE

Filed Nov. 26, 1938

5 Sheets-Sheet 2

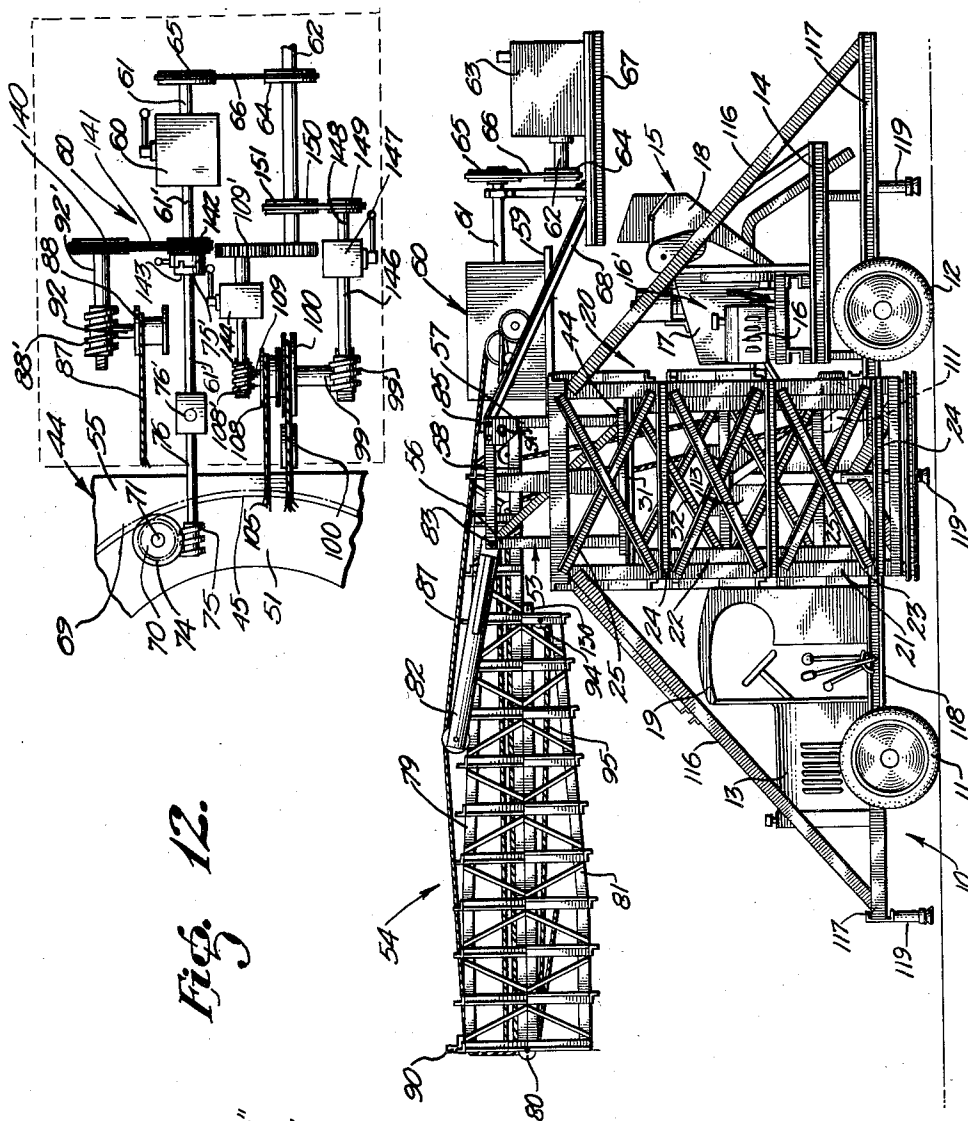


Fig. 12.

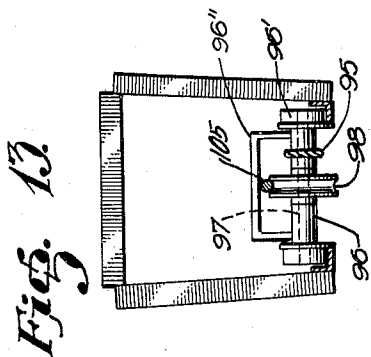


Fig. 13.

Fig. 2.

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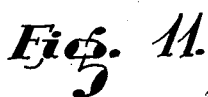
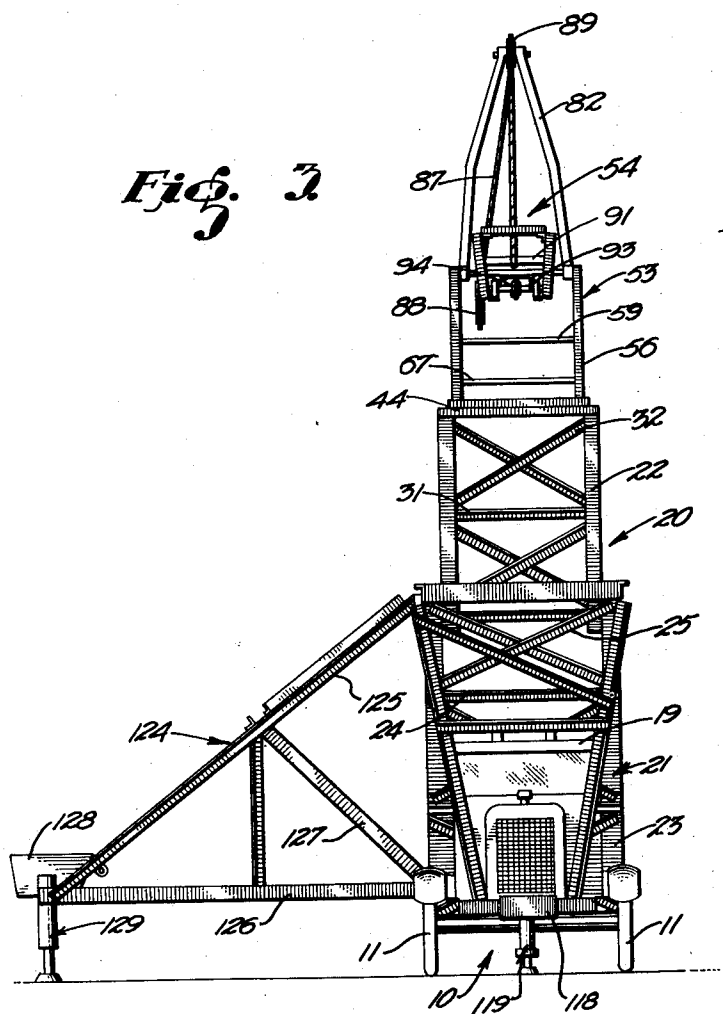
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5 Sheets-Sheet 4

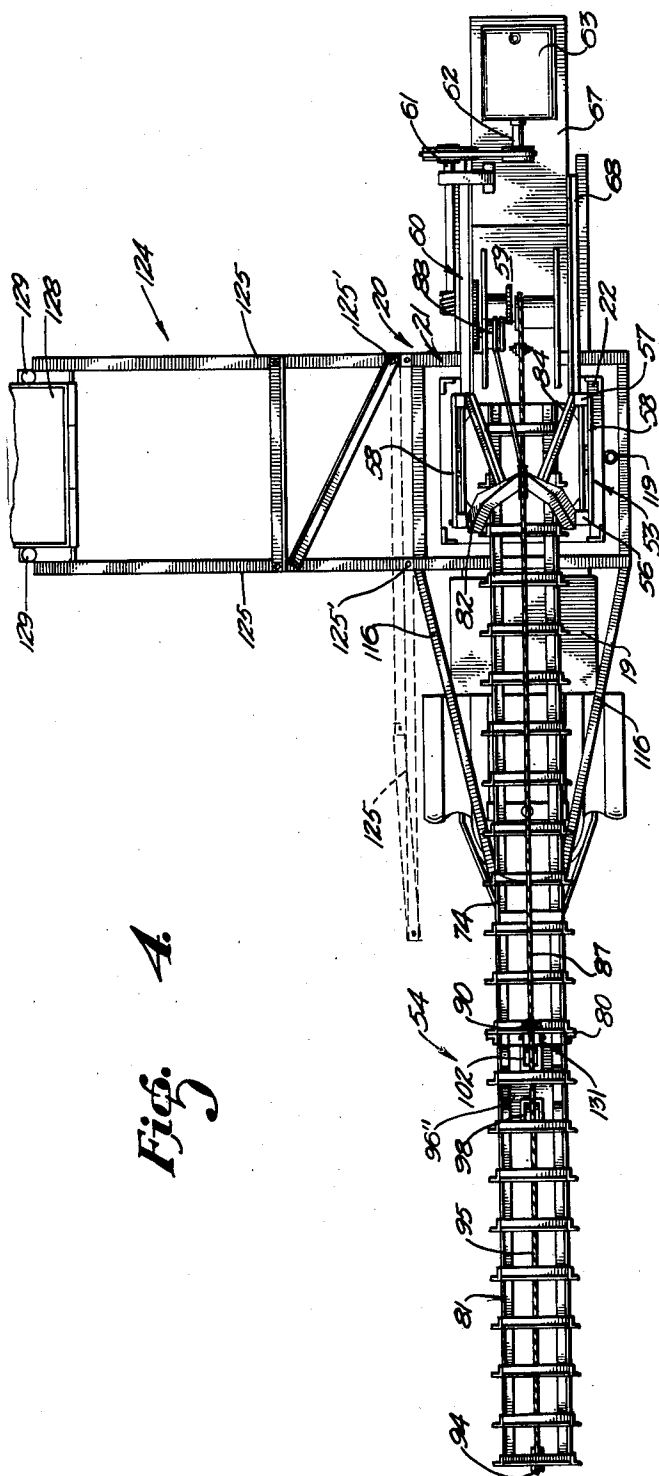


Fig. 1.

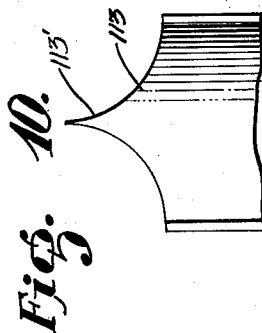


Fig. 2.

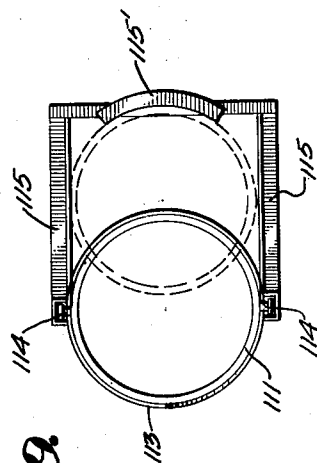


Fig. 3.

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Fig. 6.

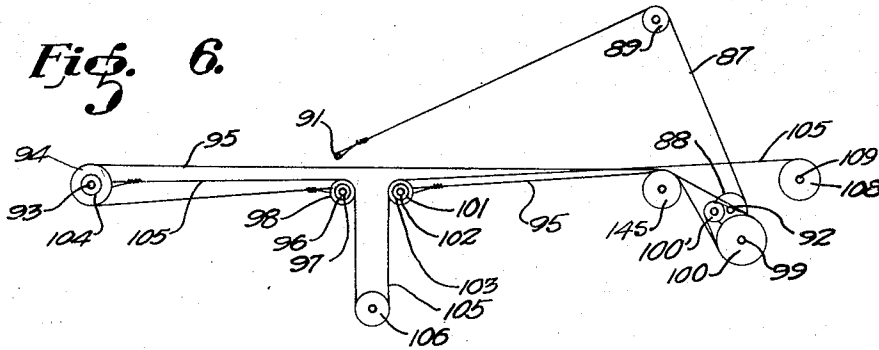


Fig. 7.

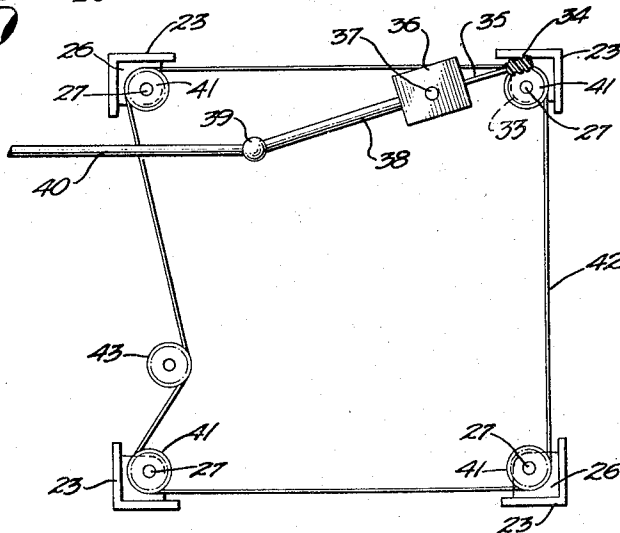
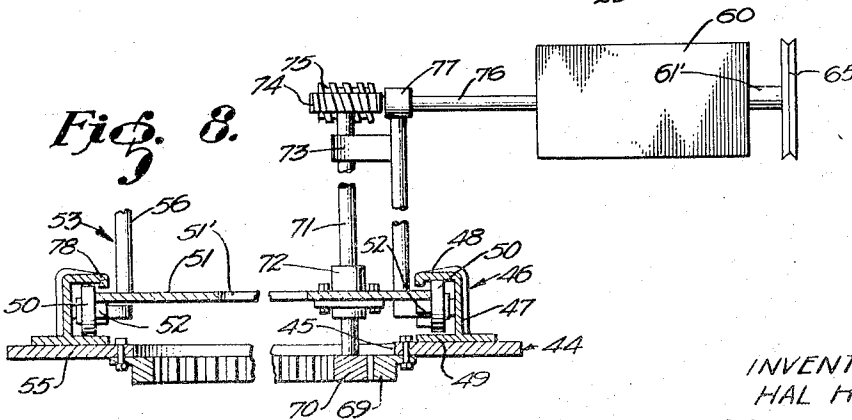


Fig. 8.



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PORTABLE CRANE

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Application November 26, 1938, Serial No. 242,551

4 Claims. (Cl. 212-49)

This invention relates to a portable crane.

In the building of various structures, particularly those concerned with the placing of concrete or other cementitious material, it is usually necessary to provide forms which must be set in place and removed therefrom. After these forms are positioned it is then necessary to prepare and place concrete in or around them in order to make a wall structure. A device of this particular character is shown in my co-pending application entitled "Portable crane", filed in the United States Patent Office July 12, 1937, and bearing Serial No. 153,180, now Patent No. 2,143,111 granted January 10, 1939. In this type of crane it is desirable to provide a structure which is mobile and may be readily set up for use at a desired point of operation, the structure being easily folded for transportation and unfolded so that it will have sufficient overhead clearance to elevate and place wall forms of a height as represented by the top of a building to be constructed, and which crane may be then used to mix and place concrete in and around the forms, and thereafter may be used to elevate the forms and leave the concrete walls standing as supported by their own strength.

It is the principal object of the present invention to provide a portable crane of the type previously described having various features of improvement in construction and operation of the crane tower, the boom thereon and the concrete mixing and placing apparatus.

The present invention contemplates the provision of a truck designed to carry an extensible tower and concrete mixing and conveying mechanism, the upper end of said tower being fitted with a boom made in sections and which may be extended horizontally to a length giving it a reach sufficient to swing over the entire area of operation around the truck, the structure being fitted with further novel means whereby concrete may be conveyed from a mixing device carried by the truck to any suitable point along the length of the boom.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view in side elevation showing the complete portable crane in its operative position.

Fig. 2 is a view in side elevation similar to Fig. 1 showing the structure collapsed and ready for reversal and transportation.

Fig. 3 is a view in end elevation showing the structure with side bracing tending to stabilize the crane when the boom hangs in an over-bal-

anced relation to the vehicle which serves as its base.

Fig. 4 is a view in plan showing the crane as indicated in Fig. 3.

Fig. 5 is an enlarged fragmentary view showing the driving means for extending or contracting the tower.

Fig. 6 is a view in diagram indicating the cable arrangement for the boom.

Fig. 7 is a view in diagram indicating in plan the manner in which the tower extending and collapsing mechanism is driven.

Fig. 8 is an enlarged fragmentary view in vertical section and elevation showing the driving means for the turntable.

Fig. 9 is an enlarged view showing the bucket guide as seen on the line 9-9 of Fig. 1.

Fig. 10 is an enlarged fragmentary view in side elevation indicating the centering means for the bucket.

Fig. 11 is a view in transverse section as seen on the line 11-11 of Fig. 5 and showing the construction of the posts of the tower.

Fig. 12 is a fragmentary view in plan indicating in diagram the various clutch and transmission units carried on the tower.

Fig. 13 is an enlarged view in transverse section as seen on the line 13-13 of Fig. 1 and shows the construction of the traveling carriage and the method of mounting it on the boom.

Referring more particularly to the drawings, 10 indicates the chassis of a motor truck having the usual front wheels 11 and rear wheels 12. At the forward end of the truck is the usual motor unit 13. In this particular construction a frame 14 is mounted on the chassis at the rear end of the truck and receives a concrete mixing unit 15. This unit includes a power unit 16 driving a concrete mixer 16' and in connection with which a skip 18 is mounted to feed the ingredients of a cementitious mixture into the drum of the mixer 17.

Mounted between the cab 19 of the truck and the concrete mixing unit 15 is a tower structure 20. This includes a unit 21 which is rigidly fastened on the chassis 10 and provides a support for an extensible tower unit 22 which moves vertically with relation to the unit 21. The lower fixed unit 21 is constructed with vertical corner posts 23 which are tied together by horizontal elements 24 and diagonal elements 25. Mounted in the corners of said vertical posts 23 are bearings 26 which receive vertical shafts 27. The shafts 27 extend upwardly and are secured at their upper ends to bearings 28. The bearings 26 and 28

rotatably hold the shafts 27. As shown in Fig. 5 of the drawings, the shafts 27 are threaded throughout their length and each receives a nut 29 which is fixed to a vertical corner post 30 of the upper movable section 22. The upper movable section 22 is of smaller dimensions in a horizontal plane than the lower fixed section 21, and in view thereof it can move downwardly and telescope within the fixed section. The corner posts 31 and diagonal elements 32. One of the shafts 27 is fitted with a worm wheel 33 at its lower end and this is in mesh with a worm gear 34 so that it may be driven thereby. The worm gear 34 is carried upon a drive shaft 35 which leads into a clutch 36 which is controlled by a shifting lever 37 so that the drive of the shaft 35 may be established and driven in advance or reversed direction.

The driving element of the clutch 36 is connected with a drive shaft 38. This shaft is fitted with a universal joint 39. A shaft 40 is also connected with the universal joint and is placed in driving connection with the engine unit 13. In order that all of the shafts 27 may operate in unison each is fitted with a sprocket 41 to receive an endless chain 42 which leads around the outer periphery of all the sprockets. A tension sprocket 43 is provided to deflect the chain 42 at a point between two of the shafts 27 and to thereby maintain the chain in driving engagement with all of the sprockets 41 all the time. By this arrangement the shafts 27 may be simultaneously driven to raise and lower the movable section 22 of the tower.

Mounted upon the upper end of the tower section 22 is a platform 44. This platform has a central opening 45 through it for a purpose to be hereinafter described. The opening is preferably circular. Arranged around the opening and thereabove is an annular track 46 which has a vertically extending cylindrical side wall 47, an overhanging flange 48 and a trackway 49. Resting upon the trackway 49 are wheels 50 of a turntable 51. These wheels are mounted in bearings 52 which are carried by a frame structure 53 forming a boom mounting for the boom 54. The frame structure 53 includes a plurality of transverse horizontal tie plates 55 with a central opening therethrough and vertical uprights 56 and 57. The upper ends of the frame structure 53 are tied together by horizontal elements 58. Suspended from the frame structure 53 is a platform 59 carrying a transmission unit 60, the details of which are indicated in diagram in Fig. 12. A driven shaft 61 is provided for this unit and is driven from a drive shaft 62 forming a part of a power unit 63. The driving action is accomplished by sprockets 64 and 65 and a driving chain 66. It will be seen that the power unit 63 is mounted on a platform 67 carried by hangers 68. This places the transmission 60 and the power unit 63 in an overhanging position as supported by the tower extension 53 and upon the diametrically opposite side thereof from the boom 54. The details of construction of the transmission will be more fully described hereinafter.

It is intended that the tower extension 53 shall rotate around the longitudinal vertical central axis of the tower 20. This is accomplished by providing a ring gear 69 which is secured to the platform 44 and circumscribes the central opening 45 therethrough. In mesh with this ring gear is a pinion 70 carried by a vertical shaft 71. The vertical shaft 71 is supported in bearings 72

and 73 on the tower extension 53 and at its upper end is provided with a worm wheel 74 in mesh with a worm gear 75. The worm gear 75 is mounted upon a shaft 76 which is suitably disposed in driving relation to the transmission 60. The shaft 76 has a bearing 77 carried by the tower extension 53, thus it will be seen that as the pinion 70 is driven the tower extension 53 will be caused to rotate around a central vertical axis as determined by the guide track structure 46 and the rollers 50. An inner overhanging lip 78 prevents the rollers from moving laterally.

Secured with relation to the tower extension 53 is a horizontally disposed boom section 79. This overhangs the tower at the opposite side from that upon which the power unit is mounted and is pivoted thereto for vertical movement at 79'. The length of this section is a length substantially sufficient to cause the boom to overhang an end of the truck. At the outer end of the boom section 79 is a hinge structure 80. This hinge structure carries a boom section 81 which may swing downwardly and then upwardly to a folded position beneath the boom section 79, as particularly shown in Fig. 2 of the drawings. In order to support the overhanging weight of the boom when it is in its unfolded position a mast 82 is pivotally secured to the tower extension 53 upon pivots 83. This mast is provided with a brace post 84, which is pivoted to the tower extension 53 at 85 and detachably secured to the mast at 86. A guy cable 87 is provided and is led from a winch 88 upwardly over a pulley 89 at the top of the mast 82 and then is led outwardly and downwardly through an eye 90 carried at the outer end of the fixed boom section 79 and into a fastening pin 91 carried by the free section 81 of the boom. This guy wire 87 may be wound or unwound by operation of the transmission 60 and by driving the pulley 88 through its shaft 92.

Mounted at the outer end of the boom section 81 is a shaft 93 carrying a pulley 94. Led around the pulley 94 is a cable 95. One end of this cable attaches to the bearing 96 of a traveling pulley shaft 97, upon which a travelling pulley 98 is mounted. The other end of the cable 95 is led around a drive shaft 99 and over a pulley 100. This end of the cable 95 is attached to a bearing 101 carrying a shaft 102 of a travelling pulley 103. These pulleys and shafts are supported by the bearing structure 96 and carry flanged wheels 96' which travel along the lower rails of the boom sections 79 and 81. Thus, when the cable 95 moves in one direction the traveling structure including the two pulleys 98 and 103 moves outwardly in unison along the boom and when it moves in the opposite direction the two traveling pulleys 98 and 103 move inwardly along the boom. Secured to the bearing 104 which rotatably supports the pulley shaft 93 at the outer end of the boom section 81 is a cable 105. This cable is led around the pulley 106 of a traveling block 107. The opposite end of the cable 105 is led around a winding drum 108 mounted on a shaft 109 and driven through a gear set unit 109' of the transmission 60. As the cable 105 is paid out the traveling block will be lowered irrespective of the position at which the traveling pulleys 98 and 103 are disposed. When the cable 105 is wound upon the drum 108 the traveling block 107 will be elevated. The traveling block 107 carries a hook 110 by which a bucket 111 may be supported. The bucket may be provided with a movable bottom section 112 which when moved

from its closed position will permit the contents of the bucket to be discharged.

The bucket 111 may be transported to and from the concrete mixing unit to any desired point along the length of the boom and to any desired level between the boom and the ground. When the bucket 111 is moved into a position within the tower extension 53 it may then be lowered down through the center of the tower until it reaches a catcher 113. This catcher is formed with wedge shaped fans 113' which will be engaged by pins 114 on opposite sides of the bucket and will rotate the bucket to bring the pins in register with guides 115. The pins 114 are disposed along opposite sides of the bucket and when in register with guide channels 115 will position the bucket for filling. These guide channels extend downwardly and toward the rear of the tower so that the bucket may assume the position shown in Fig. 2 of the drawings and will be so disposed as to receive the mixed concrete from the concrete mixing unit 15, after which the bucket may be elevated and moved laterally to place the concrete as desired.

In view of the long reach provided by the boom it is necessary to brace the tower and to counter-balance the boom, and it is also necessary to stabilize the chassis so that it will not rest upon the vehicle springs. The structure may be braced lengthwise of the motor truck by diagonal braces 116 which are secured by their upper ends to the fixed tower section 21 at a convenient height. The lower ends are secured to a frame extension 117 which projects horizontally beyond the forward end of the motor truck radiator. A transverse beam 118 extends horizontally to tie the separate brace members 116 and 117. Carried by these transverse beams 118 is a plurality of jacks 119. These jacks include a body portion 120, a threaded screw 121 which engages a nut 122 and carries a foot 123 at its lower end. Similar jacks 119 are carried at the rear of the truck and thus take all of the weight of the structure off of the springs so that the tower 20 will be held rigidly in its vertical position during operation.

In the event that the boom is required to swing to the side of the longitudinal axis of the truck, which would be often the case, stabilizing frames 124 are provided. These include diagonal frame elements 125 secured to the fixed tower section 21 near the upper end thereof and extend downwardly and outwardly to be secured to a horizontal beam 126. Suitable diagonal bracing 127 is provided to give the structure rigidity. Disposed between sets of the bracing elements 125 and 126 is a ballast receiving platform or bin 128. Sand, gravel or other available weighting material may be placed in this bin to counter-balance the boom when it is swinging on the opposite side of the truck from that on which the structure 124 is mounted. Suitable jacks 129 are provided to support the bin 128 and its weight and also to prevent the brace structures 124 from swinging downwardly at their outer ends. This structure is mounted on the tower structure at 125' so that the structure may swing to the collapsed position indicated in dotted lines in Fig. 4 of the drawings.

In operation of the present invention the structure is assembled as particularly shown in Fig. 1 of the drawings, and when ready for transportation appears as shown in Fig. 2. In actual practice the boom is swung to a trailing position. In this condition the jacks 119 will be elevated and the side brace elements 124 will be swung alongside the tower for transportation. The tower is

in its collapsed condition with the movable section 22 and the extension 53 lowered to a point of rest on the supporting frame of the structure. At the same time the bucket 111 will be lowered down through the tower and disposed in the guides 115 where it will seat against a stop 115'. The boom 54 will be folded around the hinge 80 so that the boom section 81 will be swung in and beneath the section 79 and will be held by suitable fastening means 130. At this time the various cables 87, 95 and 105 will be drawn around the folded end of the boom in position for subsequent use. When it is desired to use the structure it is moved to a selected position, after which the various jacks 119 are adjusted to assume positions shown in Fig. 1 and to hold the entire structure level on the ground upon which the wheels of the truck are resting. The brace structure 124 may then be swung into position and supplied with ballast on the side upon which it is required, or if necessary similar brace structures may be used on both sides of the tower. The boom may then be rotated through the power unit 63 and the transmission unit 60 so that the shaft 71 will be driven. This will swing the folded boom 54 from a position of longitudinal alignment with the truck to a position where the lower section 81 of the boom may be swung outwardly and upwardly from the position indicated in Fig. 2 of the drawings to the position indicated in Fig. 1 of the drawings. It will be understood that the action of moving the boom through the drive shaft 71 will cause the boom to travel in a horizontal plane around the vertical axis established by the tower. The driving action to thus swing the boom includes elements within the transmission unit 60.

By reference to Fig. 12 it will be seen that the shaft 61 drives a reversible clutch 60'. This drives a shaft 61' leading to a speed changing transmission 76'. The transmission 76' is designed to have a neutral point so that driving action could be interrupted from the shaft 61' to the shaft 76. The shaft 76, as previously described, carries the worm 75 in mesh with the worm gear 74. It will thus be evident that by manipulation of the reversible clutch 60' the direction of rotation of the worm 75 may be produced, and that by setting the transmission 76' in neutral the driving action may be interrupted. The worm 75 and the gear 74 are irreversible in their action so that the turntable will remain locked as set.

In order to swing the outer boom section 81 upwardly to its desired position or to swing the boom around its pivot 54' the cable 87 may be moved by rotation of the drum 88. This drum which is mounted on shaft 92 is driven by worm gear set 88' from a shaft 92'. The shaft 92' carries a wheel 140 which may be a sprocket wheel or a pulley and around which a flexible driving element 141 is led. The element 141 also is led around a driving wheel 142 which is freely mounted upon the shaft 61'. A clutch element 143 is splined to the shaft so that the sprocket 142 may be keyed to the shaft for driving action or disconnected therefrom when it is not desired to manipulate the cable 87. In event it is desired to operate the carriage structure carrying the sheaves 98 and 103 the cable 95 may be operated. When the outer boom section 81 has been properly positioned in longitudinal alignment with the section 79 the two elements may be fastened together by suitable fastening means 131.

When it is desired to raise and lower the bucket the cable 105 may be manipulated. This cable is

wound on drum 108 carried upon a shaft 109. A worm structure 108' drives the shaft 109 from a reversible clutch unit 144. The clutch unit 144 is driven through gears 109' carried by a drive shaft 62, thus the cable 105 may be unwound or wound when the clutch unit 144 is thrown to an advance or reverse position, and will remain motionless when the clutch 144 stands in a neutral position.

In the event it is desired to raise and lower the structure 107 and the hook 110 the cable 95 may be shifted. This cable is led over a guide sheave 145 and is connected by its opposite ends to the bearing structures 96 and 101 of the carriage 96'' upon which the sheaves 98 and 103 are mounted. The cable 95 is also led around sheave 100 and looped around an idler sheave 100' so that sufficient friction will be exerted upon the cable to prevent it from slipping on the sheaves as they are driven. The sheave 100 as mounted upon the shaft 99 is driven through a worm gear set 99'. A shaft 146 drives the worm gear from a reversible clutch 147. This clutch is provided with a shaft 148 carrying a drive wheel or sprocket 149 around which a belt or chain 150 is led. This element is led around a wheel or sprocket 151 upon the shaft 62, thus when the reversible clutch 147 stands in a neutral position the shaft 146 will not be driven, but when in either of its active positions will drive the cable 95 to shift the carriage 96'' and the sheaves 98 and 103 thereon. This will cause the supporting hook 110 and the bucket 111 to move longitudinally of the boom to a supported position along the length of the boom or to a position within the tower so that the bucket may be lowered through the opening 51' in the plate 52 and then through the center opening occurring in ring gear 69. When the bucket is so lowered the pins 114 thereon will strike the inclined faces 113' of the guide structure 113 and direct the pins 114 into the channels 115, as shown in Fig. 9 of the drawings. This will insure that as the bucket is lowered to a position where it may be filled from the cement mixing unit 15 that the bucket 111 will stand in a proper position irrespective of that in which it may have been hanging on the cable 105. Thus, it will be seen that as the structure is manipulated the material from the mixing unit 15 may be directly placed within the bucket and elevated directly up through the center of the tower and then horizontally and outwardly along the boom without requiring any intermediate transfer of material in moving it from its vertical path of travel to its horizontal one.

When it is desired to discontinue use of the structure and move the entire device to another point of operation the bucket 111 and the hook 110 will be drawn upwardly and into the top of the tower, after which the fastening 131 may be disconnected to permit the outer boom section 81 to swing on the hinge 80 so that its outer end would swing downwardly and could be then swung around to a position beneath and parallel to the boom section 79, as shown in Fig. 2 of the drawings. The turntable may then be rotated to place the folded boom in a trailing position on the vehicle, after which the tower may be lowered by establishing driving connection through the transmission 36 to the worm gears 34 and 41 so that the driving action will be simultaneously imparted to the endless chain 42 which is led around the various shafts 27 and the sprockets thereon. By this arrangement the shafts 27 will

be rotated to advance the nuts 29 along the screw sections of the shafts so that the upper tower section 22 may be lowered into the lower tower section and assume the collapsed position indicated in Fig. 2 of the drawings. When the lowering operation has been completed the driving operation through the transmission 36 may be interrupted. The side braces 124 may then be swung alongside the vehicle to the collapsed positions shown in Fig. 4 of the drawings and indicated by dotted lines.

It will be obvious from an examination of the drawings and an understanding of the operation that by the means here shown a portable crane is provided which may be transported readily from place to place and which may be used to support and move heavy loads, and to quickly transport concrete and other building materials from a point adjacent to the ground to a point at any level reached by the tower and the boom.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction and arrangement of parts by those skilled in the art, without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A device of the character described comprising a motor vehicle, a telescoping tower mounted thereon, means optionally driven by the power plant of the vehicle for extending and contracting said tower, a boom formed of a plurality of folding sections, one of which is supported by the tower whereby the boom will overhang the tower, conveying means on the boom, power means for the conveyor, said power means being mounted on the tower in a manner to counter-balance the boom, a turntable structure driven by said power means whereby the boom may be swung in a horizontal plane, and means associated with the power means for raising and lowering the boom.

2. A device of the character described comprising a motor vehicle, a telescoping tower mounted thereon, means optionally driven by the power plant of the vehicle for extending and contracting said tower, a boom formed of a plurality of folding sections, one of which is supported by the tower whereby the boom will overhang the tower, conveying means on the boom, power means for the conveyor, said power means being mounted on the tower in a manner to counter-balance the boom, a turntable structure driven by said power means whereby the boom may be swung in a horizontal plane, means associated with the power means for raising and lowering the boom, a bucket carried by said conveying means, and means associated with the power means for raising and lowering the bucket.

3. A device of the character described comprising a motor vehicle, an extensible tower mounted thereon, means associated with the power plant of the motor vehicle for optionally raising and lowering said tower, a turntable structure at the upper end of the tower adapted to rotate around a vertical axis, a boom carried at the top of the turntable structure and supporting the same above and in vertical spaced relation from the turntable structure, said turntable structure having a central opening therethrough, power means for rotating the turntable structure and swinging the boom horizontally, a bucket support on the boom, a bucket carried thereby, and means for manipulating the bucket support whereby the

bucket may be moved horizontally and vertically to a desired position with relation to the boom or lowered through the opening in the turntable structure and into the tower.

5 4. A device of the character described including an extensible tower, power means for driving the same, a turntable structure at the upper end of the tower adapted to rotate around a vertical axis, a boom carried at the top of the turntable
10 structure and supporting the same above and in vertical spaced relation from the turntable

structure, said turntable structure having a central opening therethrough, power means for rotating the turntable structure and swinging the boom horizontally, a bucket support on the boom, a bucket carried thereby, and means for manipulating the bucket support whereby the bucket
5 may be moved horizontally and vertically to a desired position with relation to the boom or lowered through the opening in the turntable structure and into the tower.

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