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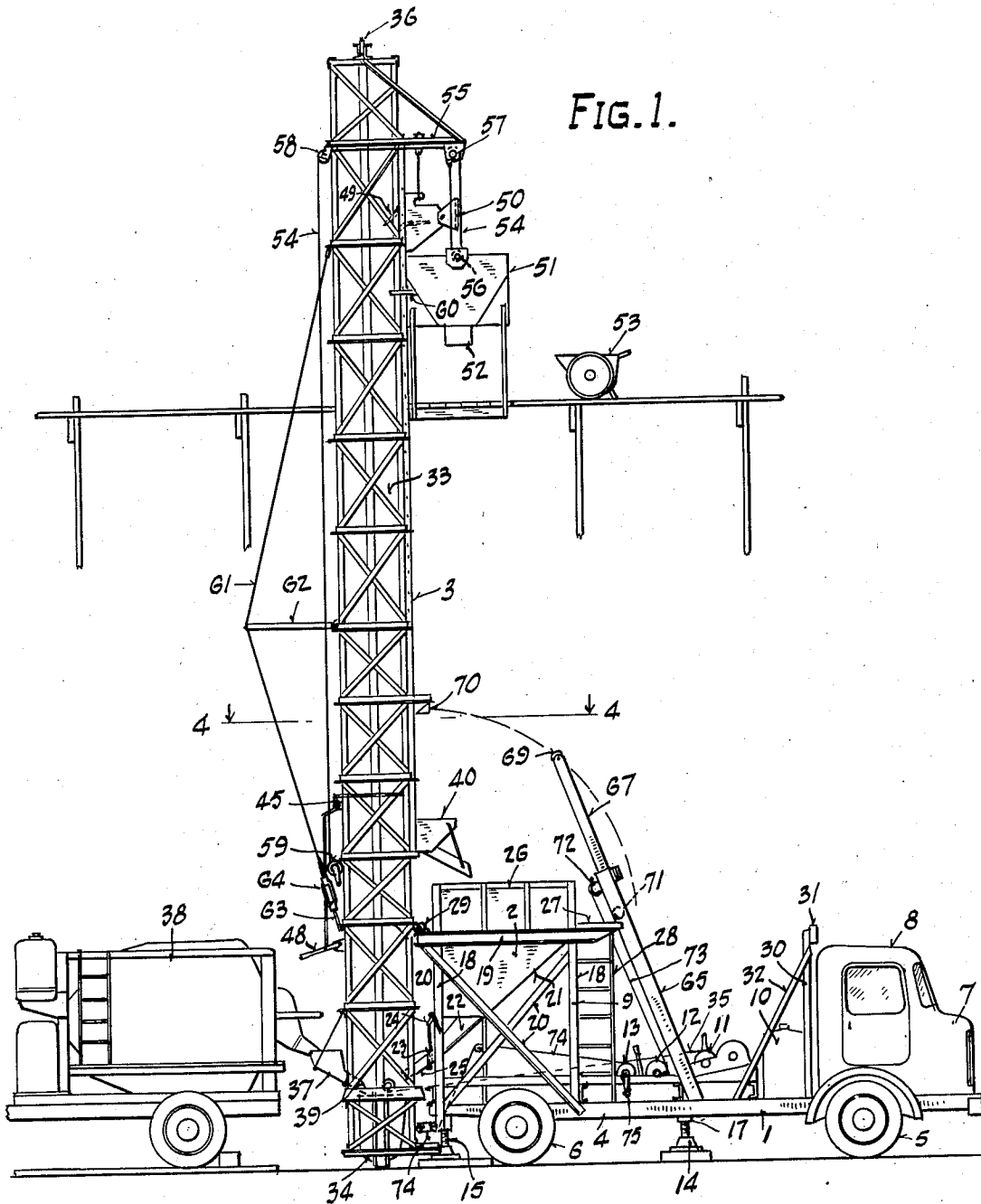
J. S. FRANCO

2,357,583

SYSTEM AND APPARATUS FOR HANDLING CONCRETE

Filed July 29, 1942

5 Sheets-Sheet 1



John S. Franco
INVENTOR.

BY *Levin C. Audrus*
ATTORNEY.

Sept. 5, 1944.

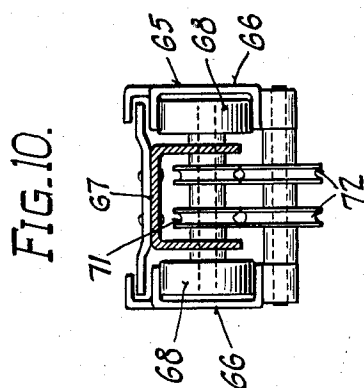
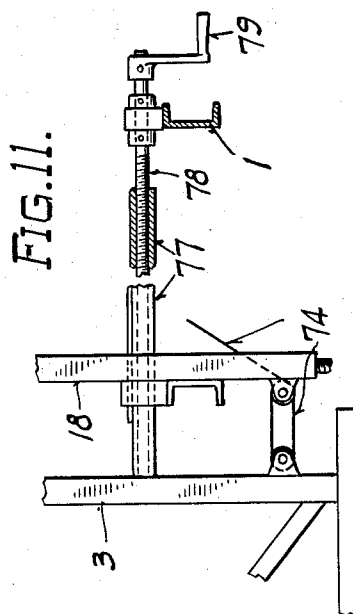
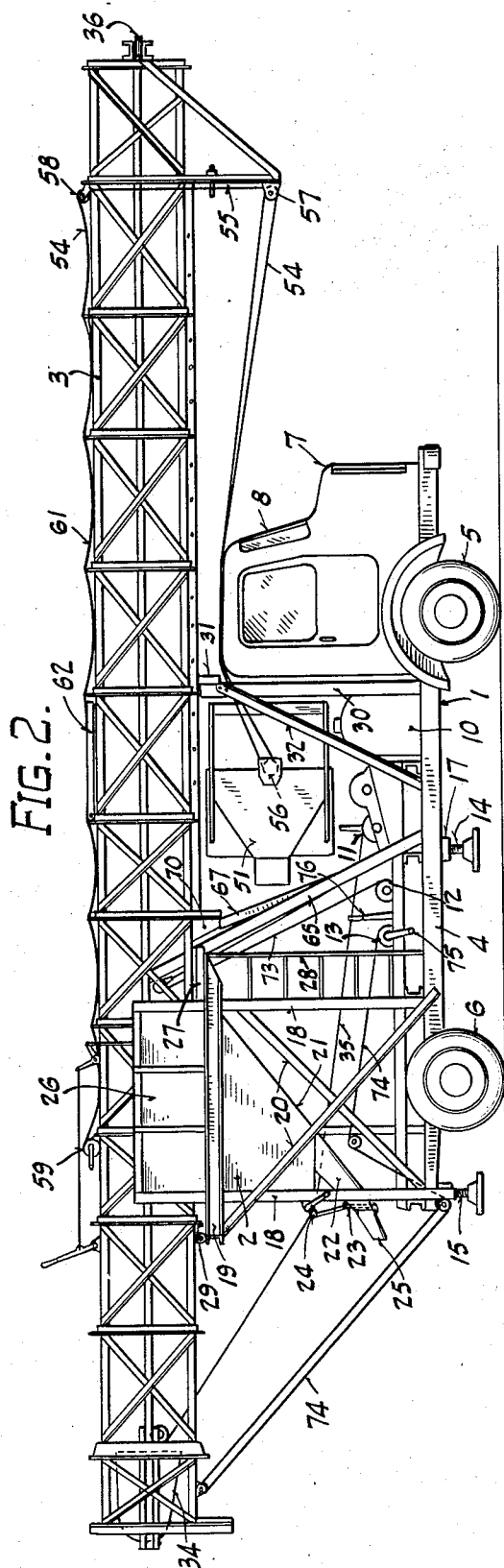
J. S. FRANCO

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SYSTEM AND APPARATUS FOR HANDLING CONCRETE

Filed July 29, 1942

5 Sheets-Sheet 2



John S. Franco
INVENTOR.

BY *Clarence C. Anderson*
ATTORNEY.

Sept. 5, 1944.

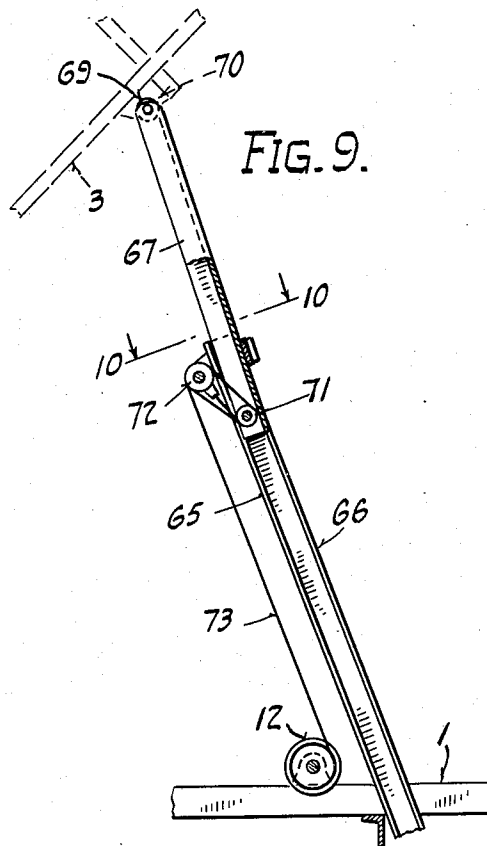
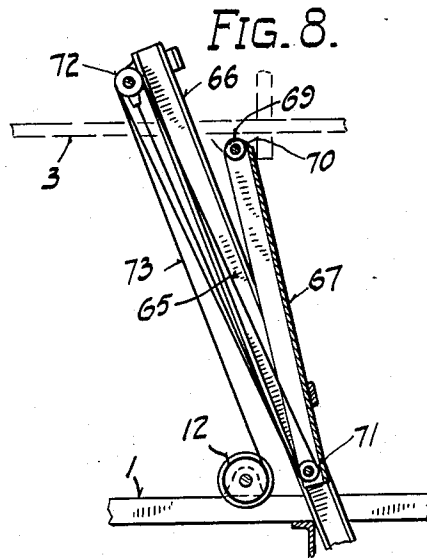
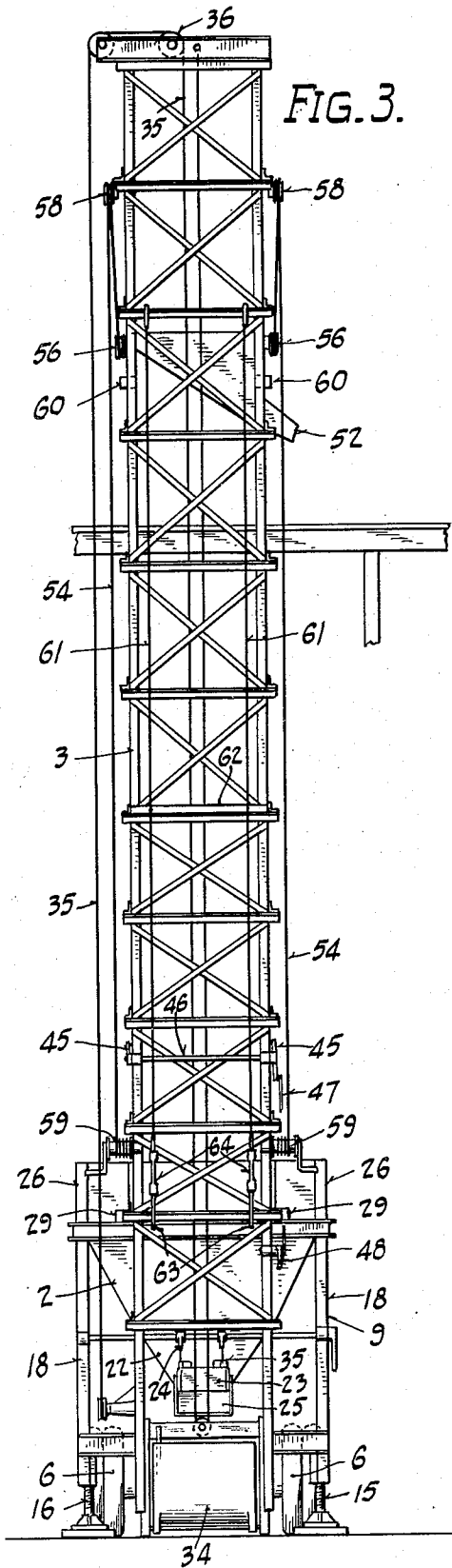
J. S. FRANCO

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SYSTEM AND APPARATUS FOR HANDLING CONCRETE

Filed July 29, 1942

5 Sheets-Sheet 3



John S. Franco
INVENTOR.

BY *Clavin C. Andrews*
ATTORNEY.

Sept. 5, 1944.

J. S. FRANCO

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SYSTEM AND APPARATUS FOR HANDLING CONCRETE

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5 Sheets-Sheet 4

FIG. 4.

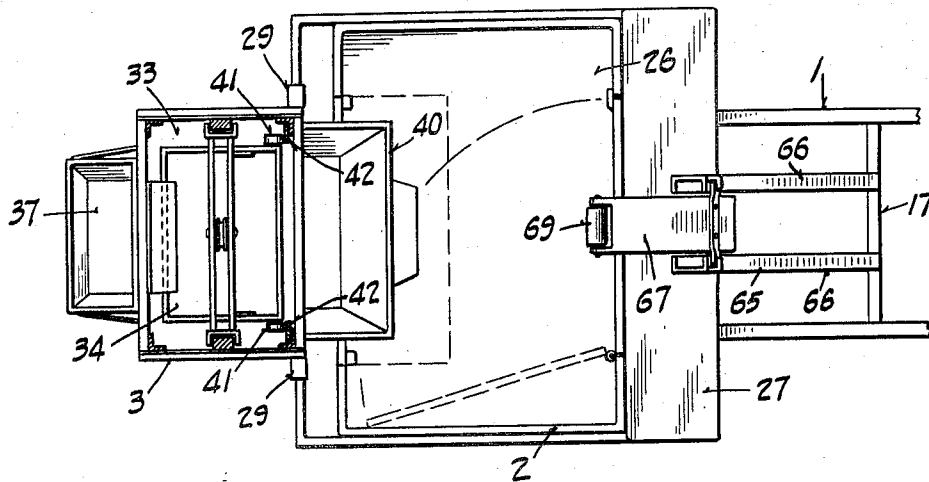
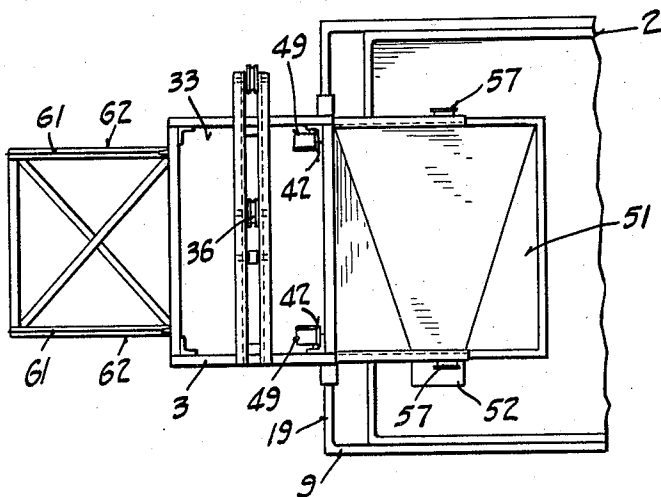


FIG. 5.



John S. Franco
INVENTOR.

BY *Erwin C. Andrews*
ATTORNEY.

Sept. 5, 1944.

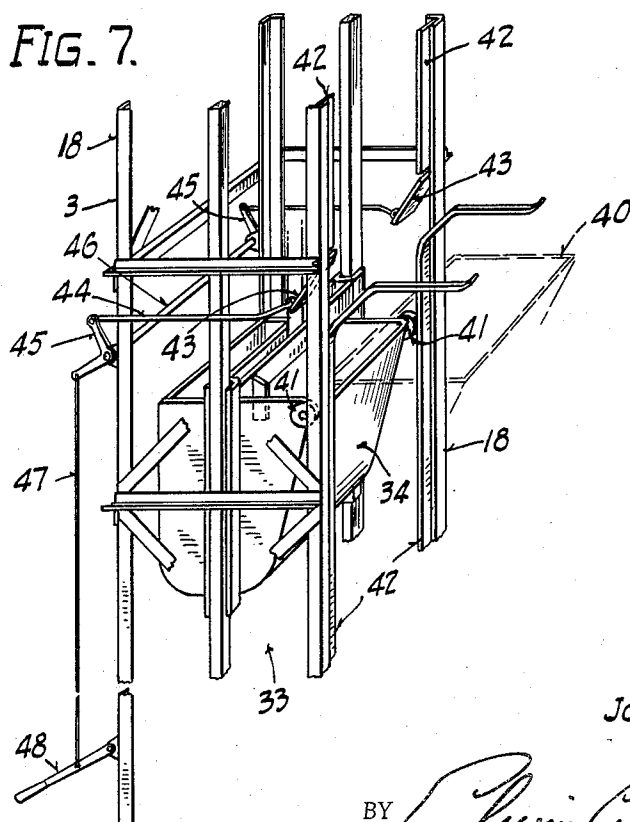
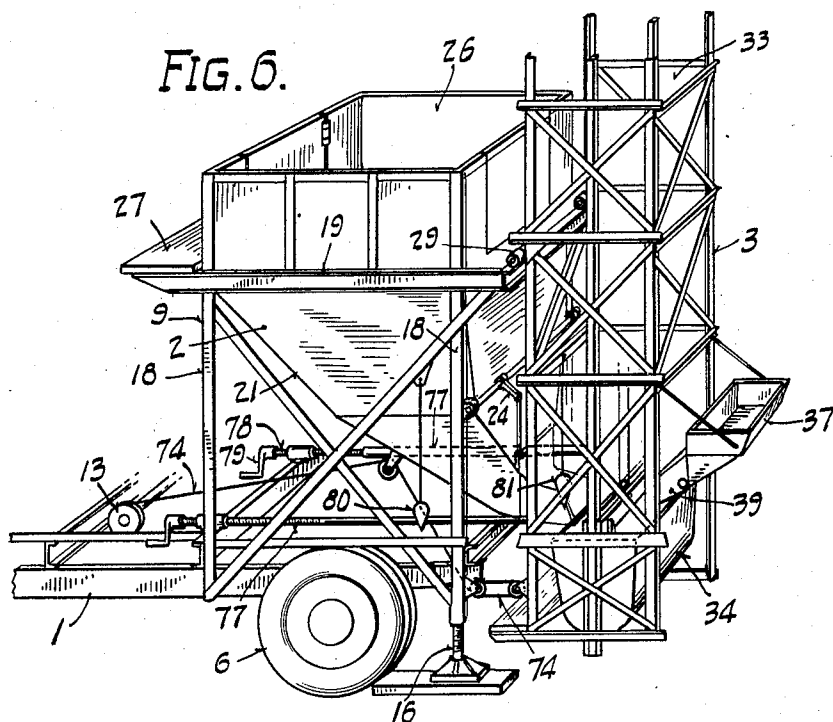
J. S. FRANCO

2,357,583

SYSTEM AND APPARATUS FOR HANDLING CONCRETE

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5 Sheets-Sheet 5



John S. Franco
INVENTOR.

BY

William C. Audrus
ATTORNEY.

UNITED STATES PATENT OFFICE

2,357,583

SYSTEM AND APPARATUS FOR HANDLING
CONCRETE

John S. Franco, Redwood City, Calif.

Application July 29, 1942, Serial No. 452,755

26 Claims. (Cl. 214-120)

This invention relates to a system and apparatus for handling concrete delivered from truck mixers or the like to an erection job requiring elevation and distribution of the concrete.

In the delivery, elevation and distribution of concrete from a central plant, it has been the practice to construct fixed elevator towers on the job or to provide some sort of a portable elevator. Generally the trucks were required to discharge into the elevator bucket and the latter was raised to the top of the tower and emptied into small carts or a chute. The operations were relatively slow and often a truck had to be held on the job for an hour or more while emptying. Failure of the next truck to arrive on time resulted in stopping of the pouring operations, and too early an arrival of the next truck resulted in a waste of time, all of which meant a loss in not only the time of labor, but in large investment costs as well.

Attempts have been made to save in the time for unloading trucks by providing on large jobs a fixed storage bunker employing ramps on which the trucks were run to unload directly into the bunker. In other cases, large buggies or small portable bunkers were employed. Such portable bunkers had to be made low enough to receive the concrete from the truck by gravity flow, and could not be made with capacity to hold any substantial amount of concrete. The concrete was stored temporarily in the bunker and then transferred to an elevator tower by buggies or small carts for distribution to pouring operations.

The difficulty of filling a large bunker and the lack of capacity of the portable bunkers made these practices generally unsatisfactory. There was no way of preventing initial setting of the concrete in the bunker when delays in pouring were encountered. On small jobs the cost and erection of a tower for each job was a substantial item of the contract price.

The principal object of the present invention is to eliminate these difficulties and to provide a system for handling concrete and an apparatus therefor that can be employed universally on small and large jobs alike and that enables the continuous pouring of concrete with lower investment and labor costs and with fewer trucks for delivery of the concrete.

In carrying out the invention in its broader aspect, a combined portable elevator tower and bunker unit is employed to receive the concrete from the delivery trucks. The unit can be set up quickly at any location ahead of the arrival of the trucks, and the latter are emptied quickly

into the bunker and returned for more concrete without delay. The concrete is received from the truck by an elevator in the tower and delivered into the storage bunker from which it is later delivered again to the elevator and elevated to the distributing point as needed. The use of the elevator in the tower for the dual purpose of loading the bunker and of elevating the concrete to the pouring level effects a very considerable saving, and at the same time provides for the unloading of the trucks without the use of special equipment and without limitation of the capacity of the bunker.

Another object is to provide a system and apparatus in which the concrete in the storage bunker may be prevented from taking an initial set during delays encountered in pouring. For this purpose, the invention provides for the recirculation of the concrete by the elevator bucket, the latter successively receiving loads of concrete from the bottom of the bunker and discharging the same into the top of the bunker, thereby constantly mixing the concrete in the bunker. This has the added advantage of mixing the concrete from several batches where the bunker contains more than one truckload of concrete.

Another object is to separate the pouring from the unloading operations so that the same elevator may be used for either operation without interrupting the other operation. This is generally accomplished by providing a secondary storage hopper at the top of the elevator capable of holding sufficient concrete for normal pouring operations during the time required for unloading a truck. In this way the pouring operations can be continued from the concrete in the secondary storage hopper while the elevator is being used to empty a truck into the bunker.

Another object is to provide a large storage bunker on the vehicle carrying the tower with the sides of the bunker folding to furnish room for the tower when the latter is tilted to horizontal position for transporting. This enables the employment of a high bunker capable of holding more than one truckload of concrete and in effect providing for the mixing of different batches of concrete, as by recirculation.

Another object is to provide mechanism for more readily raising and lowering the tower and for bracing the same when raised.

Another object is to provide simple and practical means for leveling the tower and supporting it in upright position.

Another object is to provide for a single ele-

vator to deliver concrete to a storage bunker and to the pouring level alternatively, and to receive concrete from a delivery truck or from the storage bunker alternatively.

In its more specific aspect, one of the objects of the invention is to provide a portable tower for delivering concrete to either side of the tower at adjustable levels and at the same time provide for tilting of the tower to a horizontal position on a vehicle with the delivery mechanism within the lateral boundary lines of the vehicle and tower. This enables the vehicle carrying the tower to be parked in normal position parallel to the curb of a street at an erection job and to deliver concrete at right angles to the loading position so that only a narrow portion of the street need be occupied for the work. Furthermore, with the construction employed there is substantially no lateral loading tending to tip the truck and tower to one side.

Other objects and advantages of the invention will appear hereinafter in the description of the specific embodiment of the invention illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation of the apparatus showing the tower in vertical operating position;

Fig. 2 is a similar elevation showing the tower and parts folded and ready for transportation.

Fig. 3 is a rear elevation of the apparatus with the tower in vertical position;

Fig. 4 is a top plan view of the apparatus taken on line 4—4 of Fig. 1;

Fig. 5 is a top plan view of the upper end of the tower showing the delivery hopper;

Fig. 6 is an enlarged detail diagrammatic view showing the leveling indicators and adjusters for the rear of the truck and the tower;

Fig. 7 is another detail diagrammatic view showing the switch operating mechanism for delivering concrete to the storage bunker;

Fig. 8 is a detail perspective view showing the ram for raising the tower from a horizontal position;

Fig. 9 is a similar view showing the ram extended after raising of the tower; and

Fig. 10 is a section taken on line 10—10 of Fig. 9.

Fig. 11 is a detail view of the tower leveling jack.

The apparatus comprises in general a trailer or truck 1 with a large storage bunker 2 supported thereon and an elevator tower 3 preferably carried by the bunker frame.

The truck 1 may be any suitable transportation vehicle, that illustrated having a strong horizontal frame 4 supported on forward rubber-tired wheels 5 and rear traction rubber-tired wheels 6. The forward end of the frame 4 carries the usual truck engine 7 and driver's cab 8. The rear end of the frame 4 carries a strong bunker frame 9 in which the bunker 2 is secured.

In between the bunker frame 9 and cab 8, the truck frame 4 carries a power unit comprising the engine 10 and suitable winches 11, 12 and 13 for operating the apparatus.

The frame 4 carries three jacks 14, 15 and 16. The jack 14 is located centrally on a crossbeam 17 of the frame intermediate the wheels for supporting the tower elevating mechanism. Jacks 15 and 16 are located at the opposite rear corners of the frame 4, behind the rear traction wheels 6 of the truck. The jacks are employed to level the bunker transversely so that the tower may pivot on a horizontal axis. The jacks also sup-

port the truck under operating loads and relieve the tires from undue weight of concrete during operation of the apparatus.

The bunker frame 9 comprises corner posts 18 supporting the horizontal longitudinal and transverse beams 19 forming a rectangle. Diagonal struts 20 brace the frame 9 on all sides. The bunker 2 is supported within the frame 9 and has a rectangular cross section with the bottom 21 of the bunker slanting downwardly from each side toward the center and a discharge spout 22 slanting downwardly to the rear, with the door 23 closing the spout in the vertical rear plane of the bunker 2 and frame 9. The door 23 is slidable vertically by means of levers and connecting links 24 located in handy reach of the operator. The lower end of spout 22 has a horizontally pivoted section 25 so that it can be manually pivoted upwardly out of the way of the elevator. In its upper position the section 25 serves to catch any concrete leaking past the door 23.

The bunker 2 has upstanding sides 26 above the bunker frame 9, the forward and rear sides being hinged to pivot out of the way of the tower 3 when the latter is lowered to horizontal or reclining position across the bunker. For this purpose, the forward side of the bunker may be hinged on a vertical axis at one corner of the bunker to swing inwardly against one of the sides, while the rear side may be hinged at its bottom along frame 9 to swing downwardly as the tower tilts against it. Suitable catches or latches may be provided to hold the sides in position during operation of the bunker to hold concrete.

The frame 9 of the bunker supports a platform 27 along its forward edge and a ladder 28 is provided for access thereto.

The tower 3 is horizontally pivoted by the bearings 29 to the rear end of the side beams of the bunker frame 9 so that the tower can be pivoted forwardly across the top of the bunker frame from the vertical operating position to the horizontal transporting position. The tower 3 is preferably supported at all times by the pivot 29. When the tower is vertical, its weight is transmitted downwardly through the bearings and rear posts 18 and thence to the rear jacks 15 and 16. When the tower is reclined or substantially horizontal, the weight of its rear end is transmitted downwardly through the rear posts 18 to the truck frame 4, and the weight of its forward end is transmitted downwardly to the frame 4 by a pair of auxiliary posts 30, preferably located immediately to the rear of the cab 8. The posts 30 have a crossbar 31 connecting their upper ends and upon which the front end of the tower rests. Diagonal braces 32 support the posts 30 against tilting on the frame 4.

The tower 3 preferably comprises latticed structural members providing a rectangular horizontal cross section defining an elevator shaft 33. The elevating open-top bucket 34 is raised and lowered in shaft 33 by means of a cable 35 extending over the pulley 36 at the top of the tower and to the elevator winch 11 which is operated by engine 10.

The tower 3 provides three stations for the bucket 34: (1) the lower filling station; (2) the station for discharge of the bucket into the storage bunker 2; and (3) the upper distribution station adjustable in height where the bucket discharges into suitable distributing means.

At the first station for the bucket 34, its upper flanged frame rests on the framework of the tow-

er 3 so that the bottom of the bucket does not come into contact with the ground and become injured. At this station the tower 3 carries a chute 37 which may be adjusted in height to receive mixed concrete from a mixer truck 38 and discharge it into the bucket 34. The chute has its lower end 39 manually pivoted upwardly out of the way of the bucket when the latter is raised. The upward pivoting of end 39 also serves to retain any dripping of concrete in chute 37 from the truck while the bucket is being emptied. The outer end of chute 37 when in operating position is supported by cables so that the chute pivots inwardly when the tower is inclined to its horizontal position.

The second station for the bucket 34 is located just above the bunker 2 where the tower 3 carries a discharge spout 40 for receiving concrete from the bucket and discharging it into the storage bunker. The bucket is tipped upside down in the discharging process and for this purpose its upper forward corners carry rollers 41 which ride on the vertical tracks 42 in the tower. At the second station the tracks 42 have a movable section 43 which guides the rollers 41 laterally forward toward the discharge spout 40. The bucket 34 is suspended by cable 35 in a manner to lift the bucket vertically in the tower until the rollers 41 move forwardly in the switch track provided by section 43, when the continued lifting of the bucket effects a tilting of the latter to the discharge position.

The switch 43 may be operated by a pair of horizontal links 44 on opposite sides of the tower connected by cranks 45 to a shaft 46, the latter being rotated by a crank and vertical link 47 connecting with the bell crank operating lever 48 near the stand of the operator. The track sections 43 are respectively operated by the links 44 and no part of the operating mechanism for the switch is disposed on the forward side of the tower where it might interfere with the dumping of the bucket.

The filling of the storage bunker 2 by the bucket 34 may proceed rapidly. The bunker is normally of a size capable of holding the concrete from two or more large delivery trucks. While the trucks are after successive loads, the bucket 34 is operated to receive concrete from the bunker 2 and deliver it to the third, or upper distribution station, the switch 43 being closed. The first, or filling station for the bucket, is located below the discharge spout 22 of the bunker so that the bucket may be filled with concrete from the storage bunker by opening door 23.

The third station for discharge of the bucket is located at the top of the tower where a switch 49 is located to tilt the bucket forward. Switch 49 is permanently open. Its vertical position may be adjusted to vary the elevation of the third station. A splash guard 50 may be employed to direct the concrete downwardly as it falls from the tilted bucket. The concrete falls into either a chute for distribution to the pouring station or into a hopper 51 capable of holding several bucket loads and from which it can be discharged through a lateral spout 52 into suitable manual carts 53 for pouring into forms. The switch 49 may be adjusted in height by telescoping or extending the sections of track 42 and securing the switch in adjusted position.

The hopper 51 is suspended by cables 54 on either side at a suitable adjusted level and by relative adjustment of the cables the hopper can

be tilted to facilitate its discharge. The cables 54 have their upper ends secured to a forwardly extending arm 55 at the top of the tower, and they extend around the underside of the respective pulleys 56 at the hopper 51, thence upwardly over the pulleys 57 and 58 on top of the tower and down to the manually operated windlasses 59 on the rear side of the tower near the upper level of the bunker. The hopper 51 is secured to the forward side of the tower 3 during operation by clamps 60 to prevent swinging of the hopper.

The tower is braced on its rear side by a folding truss comprising a pair of cables 61, one on each side of the tower. The cables 61 are secured to the tower near the top and pass downwardly over the outer end of a central horizontal strut 62 hinged to the tower. The lower ends of the cables are provided with hooks 63 for manually securing the same to the tower near the bottom and with suitable turnbuckles 64 for tightening the cable after securing the hooks in place. When the tower folds down to horizontal position for transporting, the turnbuckles are loosened and the hooks released so that the strut 62 tips forward and lies flat on the upper side of the tower.

The mechanism for tilting the tower includes a ram 65 having its lower end supported on the central crossbeam 17 of the truck frame and its upper end extending to about the level of the top of the bunker 2. The ram 65 tilts rearwardly and is secured to the forward edge of platform 27 constituting an extension of the bunker frame 9.

The ram 65 comprises two side channel posts 66 facing each other and constituting a housing and track in which the lower end of the ram extension 67 rides up and down by means of rollers 68. The upper end of extension 67 has a roller 69 which guides it into a pocket 70 on the tower 3 so that when the ram is extended and the tower is being lowered from a vertical position, the pocket 70 first receives the end of the ram and then follows down with the same as the ram is lowered to telescoped position. The upper end of extension 67 moves forward freely out of alignment with ram 65 to provide for the traveling of the pocket 70 in an arc of a circle having the pivot 29 as a center.

When the tower is in its lower horizontal position, the ram extension 67 is below the upper end of ram 65 and the latter extends upwardly through the lattice work of the tower. When the tower is in its upper vertical position, it is free of the ram as shown in the drawings and ram extension 67 sticks upwardly in extended position ready to receive the tower when the latter is lowered again. In this position the extension 67 is interlocked with the upper end of ram 65 to prevent accidental swinging of the extension forwardly, as by a man on platform 27.

The ram extension is raised and lowered by a block and tackle arrangement employing a pulley block 71 inside the lower end of extension 67 and a corresponding pulley block 72 at the rear of the upper end of ram 65. The cable 73 passes over the respective pulleys and is wound on winch 12, operated by engine 10.

The ram serves to raise and lower the tower between a reclining or a substantially horizontal position and a tilting position of about 55° from the horizontal. Above this latter position the tower is raised and lowered by means of a cable 74 wound on winch 13 operated by engine 10,

and having its outer end secured to the lower end of the tower.

In raising the tower, winch 12 is first operated to raise ram extension 67 to its extended position where the tower will tilt at an angle of about 55°. During this operation, a removable hand crank 75 may be applied to winch 13 to wind the loose cable 74 on the drum of the winch as the lower end of the tower moves downwardly. When the ram has reached its extended position, the clutch 76 for operating winches 12 and 13 alternatively from engine 10 is moved to effect operation of winch 13 by the engine. This winds cable 74 on the drum of the winch and pulls the lower end of tower 3 forwardly, thereby pivoting the tower to a vertical position.

In order to prevent the tower from tilting too rapidly after its center of gravity passes through the vertical axial plane of pivot 29, the bunker frame 9 carries two horizontal jacks 77, one on either side, which engage the respective vertical corner members of the tower. Ordinarily one of the jacks 77 will be sufficient for this purpose, the other jack being employed for controlling the ultimate vertical position of the tower. After the tower engages the jack 77, the latter is gradually retracted to enable the tower to pivot by its own weight to a vertical position.

For this purpose, the right-hand jack 77 comprises a horizontal telescoping rod 78 having its members threaded together and supported in bearings in the frame 9. A crank 79 is secured to the end of the rotary member of rod 78 in handy reach of the operator at the side of the truck, the other member of rod 78 being fixed against rotation and mounted for axial movement as a jack.

The leveling of the tower is facilitated by suitable plumb bob indicators. One plumb bob 80 is suspended from the bunker frame 9 at a point where the bob will be directly above the vertical flange of a longitudinal lower frame member when the truck is level transversely. The truck is leveled transversely by the jacks 15 and 16, preferably prior to the raising of the tower. The second plumb bob 81 is suspended from one of the frame elements of tower 3, to be directly above a transverse frame element of the tower when the latter is level in a direction longitudinal of the truck. This leveling operation is carried out by means of the jacks 77.

The invention provides an apparatus which can be utilized on successive erection jobs and which substantially increases the rapidity of erection by making the pouring of the concrete independent of its transportation to the job. When a building being erected is ready to receive concrete, the portable tower and bunker unit of the invention is sent to the job where the truck 1 is parked along the curb of the street at the location of the job without taking up any more width of the street than that allotted to parked vehicles. The jacks 14, 15 and 16 are operated to substantially raise the truck so that its weight will not be supported on the tires of the rear wheels 6. The jacks 15 and 16 are adjusted until the plumb bob 80 shows the correct indication that the rear end of the truck is level.

Then the operator, standing beside the truck, starts engine 10 and engages clutch 76 with winch 12. While the latter is winding up cable 73 to raise the ram extension 67 and tower, the operator applies crank 75 to the shaft of winch 13 and manually winds cable 74 on the winch. When the ram extension 67 has reached the up-

per limit of its travel, the hand crank 75 is removed and clutch 76 is changed to connect winch 13 to the drive from engine 10.

The operator turns crank 79 to thread the rod 78 of jack 77 outwardly to a position for abutting the tower as the lower end of the latter is pulled inwardly by the winding of cable 74 upon winch 13. As the center of gravity of the tower passes dead center of the pivot bearings 29, the tower swings against the end of rod 78 by its own weight. The operator then disconnects clutch 76 and by turning crank 79 backwards allows the tower to pivot to vertical position while winding cable 74 on the drum of winch 13 with the crank 75. When the plumb bob 81 indicates that the tower is vertical, jacks 77 are adjusted to position and the cable 74 is tightened to hold the tower against jacks 77. For this purpose the winches 12 and 13 should have suitable brakes such as ratchets for holding the drums from turning and preventing the paying out of cable.

After the tower is raised, the fore and aft sides 26 of the bunker are swung into position for holding concrete and locked by a suitable latch. The truss cables 61 are manipulated to drop strut 62 to horizontal position, hooks 63 are secured to the tower and turnbuckles 64 are tightened. The hopper 51 is unclamped from the tower and raised by means of the windlasses 59 to a level above the scaffolding employed for the carts 53. If the spout 52 of the hopper 51 is on the wrong side, the pulleys 56 with their respective cables are interchanged and again secured to the hopper. The hopper is then unclamped and the tower tilted forwardly until the hopper clears the tower and turns to untwist the cables. After this the tower is again brought to vertical position and the hopper clamped thereto.

In operating the apparatus a mixer truck 38 delivers mixed concrete from a central mixing plant, or the like, to the chute 37 and fills bucket 34. The chute 37 is then closed at 39, its end pivoted upwardly, and bucket 34 raised to the second station, with the switch 43 open. The raising of the bucket is accomplished by levers 82 and 83 which operate winch 11 through a friction clutch and friction brake mechanism, respectively, that alternatively apply hoisting power to cable 35 or braking power thereto, the non-operating position leaving the winch 11 sufficiently free to allow the cable 35 to pay out under the weight of the bucket.

After the bucket 34 is dumped into storage bunker 2 the bucket is returned to the first station where it is again loaded from truck 38 and again raised and dumped into the bunker. Successive similar operations finally empty truck 38 and while the latter is after another load of concrete, the bucket 34 is employed to receive concrete from bunker 2 at the first station and to raise it past the closed switch 43 to the upper station where the concrete is dumped into hopper 51. The hopper is sufficiently large to hold several buckets full of concrete and the men start pouring concrete as rapidly as they can from the hopper 51. Where handcarts 53 are employed, the hopper 51 constitutes a secondary storage bin for the concrete.

When another truck 38 arrives, the hopper 51 should be substantially full so that bucket 34 can be employed to quickly empty the truck into bunker 2 without interrupting the pouring operations, it being preferable to provide sufficient capacity in hopper 51 to continue the pouring

operations during the time required to empty a truck. In this way there is no loss of time on the part of any crew of men nor on the part of any apparatus and investment.

In case a delay is encountered in pouring operations the concrete in the bunker can be prevented from taking an initial set by recirculating the same. This is accomplished by using the elevator bucket 34 to receive successive loads of concrete and dumping the same into the top of the bunker. This not only stirs the concrete and keeps it agitated, but it serves to mix concrete from different batches so that a more uniform consistency of concrete will be obtained.

Should the early pouring operations be at ground level, it is possible to raise chute 37 by means of an auxiliary attachment 84 to bucket 34 so as to clear the rear of the tower at the bottom and provide space for receiving carts 53 directly beneath the spout 22 of the bunker. As the height of pouring increases, the concrete is next raised to the hopper 51 which may be adjusted from its lowermost position just above spout 40 to its highest position just below the top of the tower.

Ordinarily the highest position of hopper 51 will provide for pouring at a level about thirty feet above the ground. However, for higher erection jobs, it is possible to lower the tower to horizontal position and attach thereto an extension which, when raised to operating position, will provide for pouring at higher levels.

After the pouring operations are completed, the hopper 51 is unclamped and lowered to its lowermost position by windlasses 59 and re-clamped to the tower. The fore and aft sides 26 of bunker 2 are folded and secured out of the way of the tower. The turnbuckles 64 are loosened and hooks 63 released. Then the operator, by means of crank 75, pays out cable 74 while turning crank 79 to jack the lower end of the tower outwardly until the center of gravity of the tower swings past dead center. The continued lowering of the tower is then controlled by slowly paying out cable 74 until the upper end of ram extension 67 enters pocket 70 on the tower. From there on down, the tower is supported by the ram, and cable 74 is allowed to pay out freely while ram extension 67 is slowly lowered by the controlled paying out of cable 73.

When the tower reaches its horizontal position, its forward central portion rests on the supporting posts 30. The hopper 51 enters the space between bunker 2 and cab 8, above the engine 10 and winches 11, 12 and 13. The spout 40 enters the bunker 2. The strut 62 folds down flat on top of the tower to reduce the height of the apparatus during traveling.

The jacks 14, 15 and 16 are then raised from the ground to provide freedom for traveling and the apparatus driven to the next erection job.

The invention provides for the use of the apparatus on many successive jobs with only a very short time for erection and removal at each job. The street and sidewalk in front of an erection job need not be obstructed for long periods of time, as often occurs where a fixed tower is built on each job.

Various embodiments of the invention may be employed within the scope of the accompanying claims.

I claim:

1. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle, a tower pivotally mounted on said

vehicle for tilting thereon between a reclining transporting position and an upright operating position, said tower extending downwardly to a position below said bunker and adjacent thereto when in operation, and an elevator operable vertically of said tower for receiving concrete discharged by gravity from said bunker and delivering the same to a higher level for pouring operations, and a device adjacent the bunker top for selectively discharging the concrete from said elevator into said bunker.

2. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle, a tower pivotally mounted on said vehicle for tilting thereon between a reclining transporting position and an upright operating position, said tower extending downwardly to a position below said bunker and adjacent thereto when in operation, an elevator operable vertically of said tower for receiving concrete discharged by gravity selectively from either said bunker or an external source and delivering the same to a higher level for discharge to pouring operations, and a switch to effect discharge from said elevator into said bunker of concrete supplied to said elevator from either source.

3. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle, a tower pivotally mounted on said vehicle for tilting thereon between a reclining transporting position and an upright operating position, said tower extending downwardly to a position below said bunker and adjacent thereto when in operation, and an elevator operable vertically of said tower for receiving concrete discharged by gravity from said bunker and delivering the same to a higher level, the front and rear ends of said bunker having hinged top sections for folding to provide room for said tower to tilt forwardly across the top of the bunker to its horizontal position.

4. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle at the rear end thereof, a tower pivotally mounted on the frame of said bunker for tilting thereon between a substantially horizontal transporting position and a substantially vertical operating position, said tower extending downwardly to a position below said bunker when in operation, and an elevator bucket operable vertically of said tower between a lower loading position and selected alternative discharge positions near the top of said tower for placement of concrete and just above said bunker for discharge into the latter.

5. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle at the rear end thereof, a tower pivotally mounted on the frame of said bunker for tilting thereon between a substantially horizontal transporting position and a substantially vertical operating position, an elevator bucket operable vertically of said tower between a lower loading position and a position discharging into said bunker, and a guide secured to said tower for delivering the concrete from said bucket into said bunker, said guide being disposed to occupy space in said bunker when said tower is tilted forwardly to horizontal position across the top of said bunker.

6. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle at the rear end thereof, a tower pivotally mounted on the frame of said bunker for tilting thereon between a substantially horizon-

tal transporting position and a substantially vertical operating position, an elevator bucket operable vertically of said tower between a lower loading position where it receives concrete from said bunker and an upper discharge position near the top of said tower, and a hopper suspended from said tower at an adjustable level for receiving concrete from said bucket, said hopper being disposed to occupy space on said vehicle just forward of the bunker when said tower is tilted to horizontal position for transportation.

7. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle at one end thereof, a tower pivotally mounted on said vehicle for tilting thereon between a substantially horizontal transporting position and a substantially vertical operating position, said tower extending downwardly to a position below said bunker and adjacent thereto when in operation, a chute on the tower for receiving mixed concrete from delivery trucks, an elevator operable vertically of said tower for receiving concrete discharged by gravity alternatively from said bunker or from said chute and delivering the same to a higher level, and a secondary storage hopper on said tower at said higher level for receiving concrete from said elevator and delivering the same to pouring operations.

8. In combination, a truck having a frame and supporting wheels with power means for driving the same, a driver's cab at the forward end of the truck, a storage bunker for mixed concrete mounted on the rear end of the truck, a tower for elevating concrete to and from said bunker and disposed to tilt between a substantially vertical operating position on the rear side of said bunker forwardly to a substantially horizontal transporting position lying across the bunker and over the top of the driver's cab, and a hopper carried by said tower at adjustable levels and disposed to occupy space on said truck between said cab and said bunker during transportation.

9. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle at the rear end thereof, a tower pivotally mounted on the frame of said bunker for tilting thereon between a substantially horizontal transporting position and a substantially vertical operating position, said tower extending downwardly to a position below said bunker when in operation, an elevator bucket operable vertically of said tower between a lower loading position where it receives concrete from said bunker and an upper discharge position near the top of said tower, a hopper suspended from said tower at an adjustable level for receiving concrete from said bucket, said hopper being disposed to occupy space on said vehicle just forward of the bunker when said tower is tilted to horizontal position for transportation, and an upright standard on said vehicle ahead of the position of said hopper to support the forward end of the tower during such transportation.

10. In combination, a transporting vehicle, a storage bunker for concrete mounted on said vehicle at one end thereof and having a supporting frame around the same, an elevator tower pivotally mounted on the rear of said bunker frame for tilting thereon between a substantially horizontal transporting position in which it lies across the top of said bunker and a substantially vertical operating position, and a ram having its lower end secured to the center of said vehicle and its upper end to the adjacent side of said

bunker frame at the top, said ram having an upwardly movable member for pivotally raising and lowering said tower from and to horizontal position.

11. In combination, a transporting vehicle, a storage bunker for concrete mounted on said vehicle at one end thereof and having a supporting frame around the same, an elevator tower pivotally mounted on the rear of said bunker frame for tilting thereon between a substantially horizontal transporting position in which it lies across the top of said bunker and a substantially vertical operating position, and a ram having its lower end secured to the center of said vehicle and its upper end to the adjacent side of said bunker frame at the top, said ram serving to brace said bunker and tower in operation and having an upwardly movable member free to tilt relative to said ram for pivotally raising and lowering said tower from and to horizontal position.

12. In combination, a transporting vehicle, a storage bunker for concrete mounted on said vehicle at one end thereof and having a supporting frame around the same, an elevator tower pivotally mounted on the rear of said bunker frame for tilting thereon between a substantially horizontal transporting position in which it lies across the top of said bunker and a substantially vertical operating position, a ram having its lower end secured to the center of said vehicle and its upper end to the forward side of said bunker frame at the top, said ram having an upwardly movable member for pivotally raising and lowering said tower from and to horizontal position, a jack for supporting said vehicle at its rear end adjacent the bunker and tower, and a jack for supporting the center of said vehicle against the thrust of said ram.

13. In apparatus of the class described, a pivotally mounted tilting tower with a bucket for elevating concrete and the like, and a ram for raising and lowering the tower from and to substantially horizontal position, said ram comprising a fixed member disposed to lean toward the pivotal axis of the tower from a support substantially below the level of said axis and forward of the same, an upwardly movable member having its lower end operating as though telescoped by said fixed member and having its upper end engaging a seat on said tower, said movable member being free to change its direction from that of said fixed member to provide for its upper and transcribing an arc about the pivotal axis of said tower, and power means for lifting said movable member relative to said fixed member.

14. In apparatus of the class described, a pivotally mounted tilting tower with a bucket for elevating concrete and the like, and a ram for raising and lowering the tower from and to substantially horizontal position, said ram comprising a fixed member disposed to lean toward the pivotal axis of the tower from a support substantially below the level of said axis and forward of the same, an upwardly movable member having its lower end operating as though telescoped by said fixed member and having its upper end engaging a seat on said tower, said movable member being free to change its direction from that of said fixed member to provide for its upper end transcribing an arc about the pivotal axis of said tower, and block and tackle connections between the upper end of said fixed member and

the lower end of said movable member for raising the latter.

15. In apparatus of the class described, a pivotally mounted tilting tower with a bucket for elevating concrete and the like, a fixed member constituting an upwardly extending track disposed beneath the free end of the tower when the latter is in its lower position, a movable push member having rollers at its lower end riding said track, means for suspending said push member from the upper end of said fixed member and for raising said push member thereby, and means at the upper end of said push member for engaging said tower to be raised and for holding said push member against lateral displacement.

16. In apparatus of the class described, a pivotally mounted tilting tower with a bucket for elevating concrete and the like, a fixed member constituting an upwardly extending track disposed beneath the free end of the tower when the latter is in its lower position, a movable push member having rollers at its lower end riding said track, means for suspending said push member from the upper end of said fixed member and for raising said push member thereby, means at the upper end of said push member for engaging said tower to be raised and for holding said push member against lateral displacement, and interlocking means for securing said push member substantially parallel to said fixed member when the former reaches its uppermost position.

17. In apparatus of the class described, a pivotally mounted tiltable tower with a bucket for elevating concrete and the like, a ram for lifting said tower from a substantially horizontal position to a predetermined angle, cable means for completing the raising of said tower from said predetermined angle to a substantially vertical operating position, and power means for selectively operating said ram, cable means and bucket, said ram comprising a fixed track member and an extension member, the latter having its upper end in engagement with said tower during support of the latter by the ram and out of engagement therewith when the tower is upright.

18. In apparatus of the class described, a pivotally mounted tiltable tower with a vertically operable bucket for elevating concrete and the like, a ram for lifting said tower from a substantially horizontal position to a predetermined angle, cable means for completing the raising of said tower from said predetermined angle to a point past dead center in its tilting movement, means to retard the tilting movement of said tower from said point of dead center to substantially vertical operating position, said ram comprising a fixed track member and an extension member, the latter having its upper end in engagement with said tower during support of the latter by the ram and out of engagement therewith when the tower is upright, and means for preventing said extension member of the ram from tilting during its freedom from engagement with the tower.

19. In combination with a folding portable tower of the class described, a bucket operable vertically of said tower to elevate concrete and the like, a hopper on the downwardly tilting side of said tower for receiving concrete from said bucket, a hinged strut on said tower adapted to lie horizontally on the top of said tower when the latter is reclining for transportation and to extend horizontally at right angles to the tower when the latter is in vertical operating position,

and a cable connected to the upper and lower ends of said tower and passing over the outer end of said strut to brace said tower, one of said cable connections being detachable to provide for the folding of said strut for transportation, said bucket and hopper being disposed below the upper side of said tower and said strut folding to a flat position on said tower when the latter is in horizontal position.

20. In combination, a transporting vehicle, a storage bunker for mixed concrete mounted on said vehicle, an elevator tower pivotally mounted on said vehicle at a point below the top of said bunker for tilting between an upright operating position and a reclining transporting position in which latter position the tower lies across and between the sides of said bunker, the upper part of the side of said bunker adjacent the tower being mounted to pivot in the same direction as said tower to provide for receiving the tower in reclining position, and means for holding said bunker side upright in operative position.

21. In combination in a portable tower and bunker unit for handling concrete, in which the tower is supported to tilt between an upright operating position and a reclining transporting position in the latter of which the tower lies forwardly across the bunker, a concrete receiving chute pivoted to said tower and extending to the rear thereof when the tower is upright and folding inwardly of the tower when the latter is in reclining position.

22. In combination, a portable tower and bunker unit for handling concrete, said tower providing an elevator for filling said bunker from truck loads of concrete and for receiving concrete from said bunker to elevate the same to pouring levels, means to selectively discharge said elevator either into said bunker at one level or to pouring operations at another level and said bunker having the capacity to receive more than one truck load of concrete at a time to provide for the mixing of concrete from more than one batch to make the consistency thereof more uniform, and said bunker being disposed at a height to discharge substantially by gravity into said elevator.

23. The system of handling concrete, which comprises delivering mixed concrete to the erection site in trucks, unloading a truck into an elevator having a tower, discharging the mixed concrete from said elevator into a storage bunker at a level higher than said truck discharge, and employing the same elevator to receive concrete from the bottom of said bunker by gravity and elevate the same to a higher level on said tower for pouring while said truck is after another load of concrete.

24. The system of handling concrete, which comprises delivering mixed concrete to the erection site in trucks, unloading a truck into an elevator, discharging the mixed concrete from said elevator into a storage bunker, and while said truck is after another load of concrete employing said elevator to elevate concrete from said bunker to a hopper above the bunker for distribution to pouring operations, and storing a limited quantity of concrete in the hopper to enable use of the elevator for emptying another truckload of mixed concrete into the storage bunker without interrupting pouring operations.

25. The system of handling concrete, which comprises delivering mixed concrete into a storage bunker adjacent an elevator tower at the site of erection, successively filling an elevator bucket

by gravity flow from the bottom of said bunker for lifting to pouring operations at selected elevations of the tower, and during delay in pouring, recirculating the concrete by dumping successive bucket loads filled as described from the bottom of said bunker into the top of said bunker at a level different from said pouring operations.

26. The system of handling concrete, which comprises delivering mixed concrete in succes-

sive batches to a storage bunker at the site of erection, intermittently elevating repeated bucket loads of concrete from said bunker to pouring levels, and alternating therewith agitating the batches of concrete in said bunker by repeatedly filling the elevator bucket by gravity flow from the bottom of said bunker and dumping the same into the top of said bunker.

JOHN S. FRANCO.