

April 25, 1944.

W. E. SAXE

2,347,437

STORAGE DEVICE

Filed June 2, 1941

3 Sheets-Sheet 1

Fig. 2.

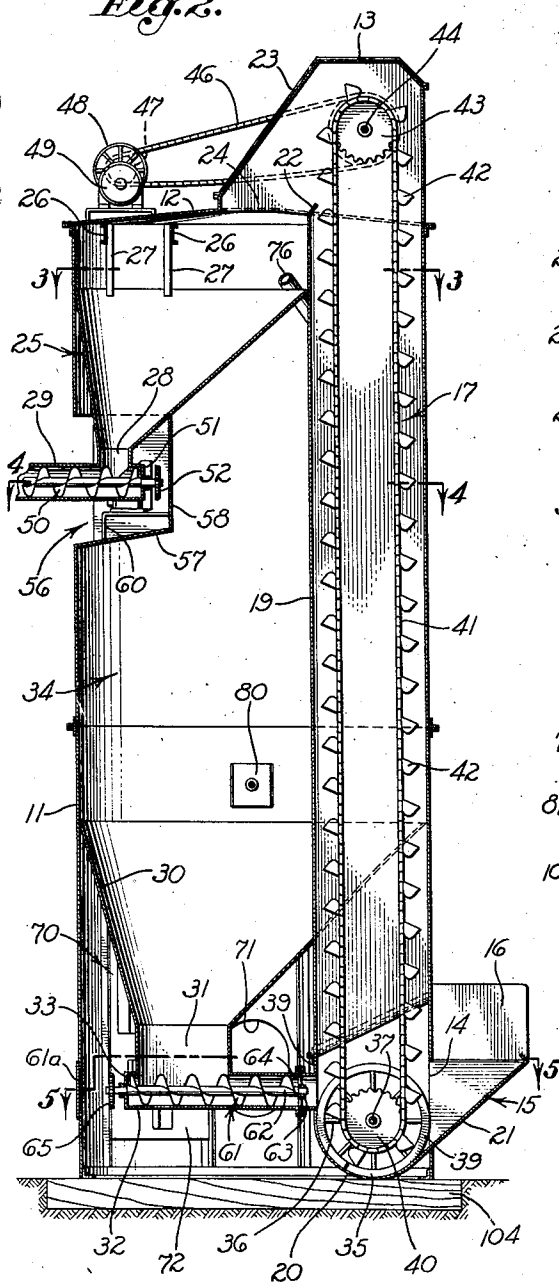
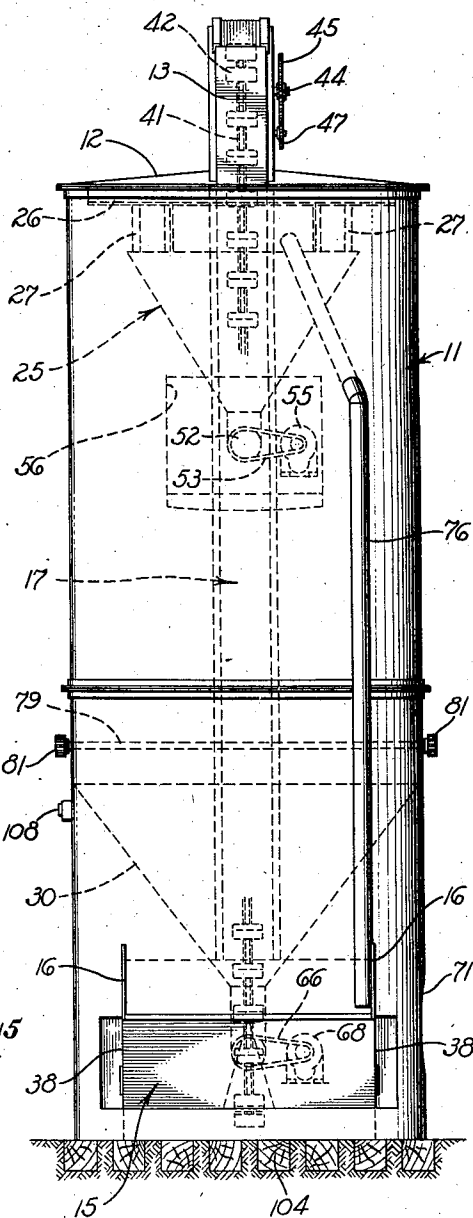


Fig. 1.



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Fig. 3.

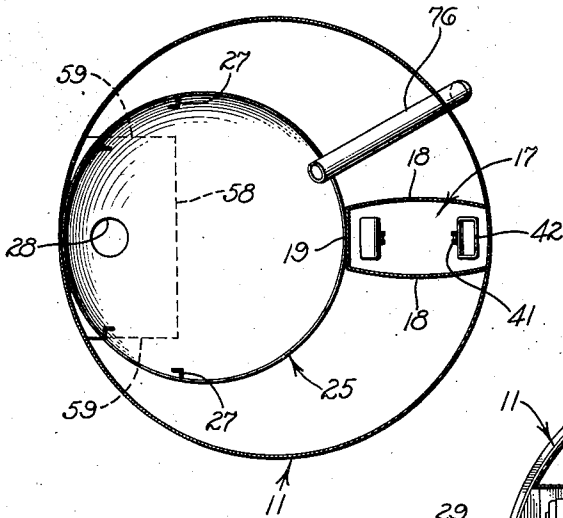


Fig. 4.

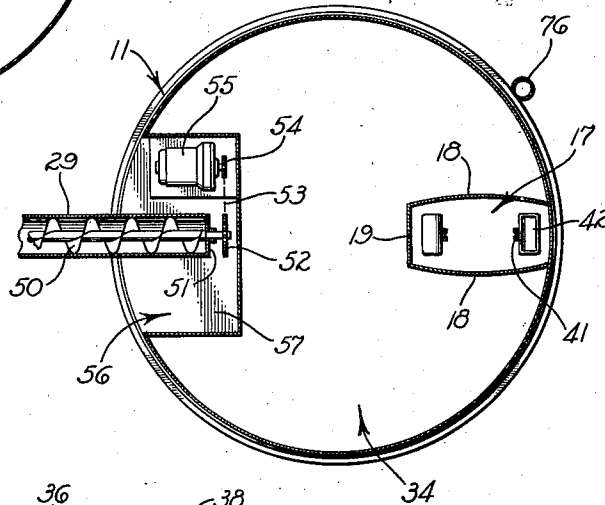
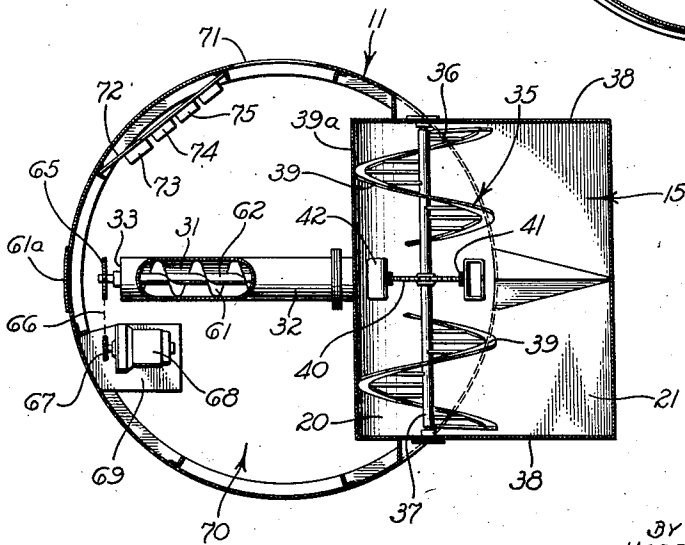


Fig. 5.



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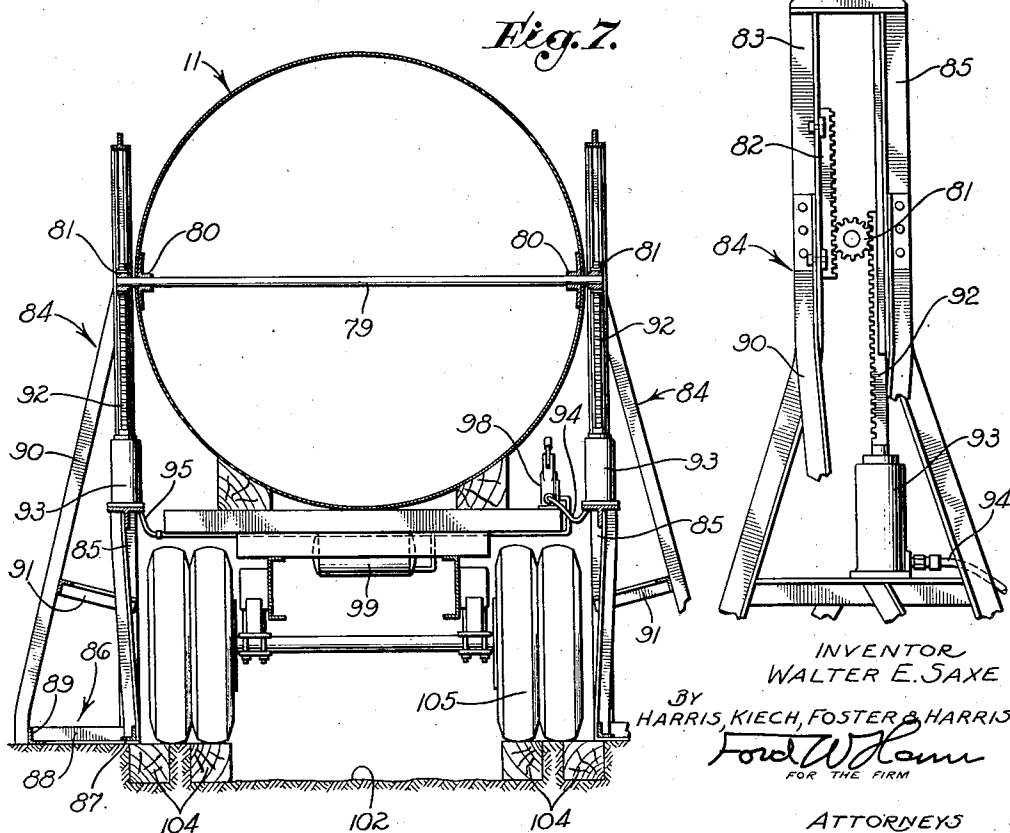
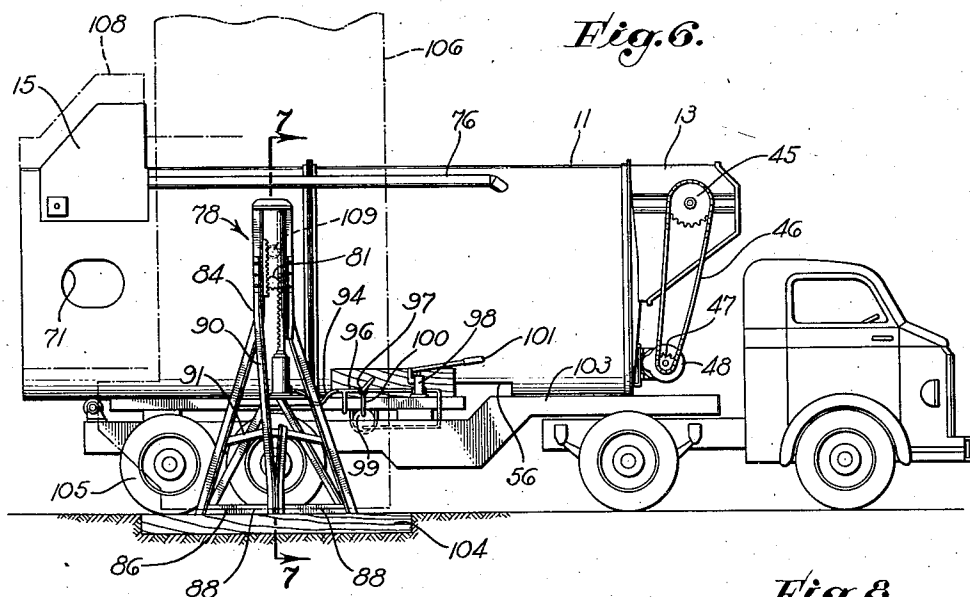
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,347,437

STORAGE DEVICE

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Application June 2, 1941, Serial No. 396,349

10 Claims. (Cl. 214—16)

My invention relates to a storage device and, since it finds particular utility in the storage and dispensing of granular or pulverized materials employed for building purposes, its advantages and that embodiment best adapted for the reception, storage, and dispensing of cement are hereinafter described.

Very considerable savings are effected in the construction of buildings, dams, and the like employing large quantities of cement if the cement is purchased and handled in bulk instead of in sacks or in barrels, since the cost of such receptacles and the workmen's time required for their handling is entirely eliminated.

When bulk cement is employed upon such projects, it is necessary to provide means of storing it adjacent the construction project since its rate of delivery and consumption cannot be maintained equal. It has been proposed to provide such storage devices by assembling them on the work and upon completion of the project disassembling them for future use. Such practice requires the services of skilled workmen over a period of several days in assembling the storage device in its place of use, installing the prime movers for the handling of the material therein, and consumes much time which the builder can usually ill afford.

It is an object of my invention to provide a portable unitary storage device which may be transported as a unit to its place of use and be removed from the transporting vehicle and set up in operative position upon the ground by a single operator and which may upon the completion of the project be positioned upon the transporting vehicle as a unit by a single operator.

Among the other objects of my invention are the provision of a device for storing cement or the like providing a continuous supply of material to a discharge outlet while receiving an intermittent supply of the material at an inlet hopper, and the provision in such a storage device of means for providing a visible indication to the operator when the device is filled to capacity.

Still other objects of my invention include the provision of a storage device which is easily operated by a single individual and which has instruments for the control of all of its various parts grouped in an easily accessible manner within the structure.

An embodiment of my invention capable of performing these objects and providing these advantages and adapted for the reception, storage, and dispensing of cement is described in the following specification, which may be better un-

derstood by reference to the accompanying drawings, in which

Fig. 1 is a side elevational view of the storage device set up for use;

Fig. 2 is a vertical sectional view of the device illustrated in Fig. 1;

Figs. 3, 4, and 5 are horizontal sectional views taken as indicated by the lines 3—3, 4—4, and 5—5 of Fig. 2, respectively;

Fig. 6 is an elevational view of the storage device of my invention resting upon a transporting vehicle with the supporting means engaging the earth in position to remove the device from the vehicle;

Fig. 7 is a vertical sectional view taken as indicated by the line 7—7 of Fig. 6; and

Fig. 8 is an enlarged fragmentary elevational view of the mechanism for moving the storage device vertically relative to the vehicle and the ground.

Referring to the drawings, which are for illustrative purposes only, the numeral 11 indicates a shell of sheet iron or the like of sufficient thickness to withstand without distortion the pressure of material filling it, and preferably cylindrical in cross section. The shell 11 includes a top plate 12 cooperating with an upwardly projecting housing 13 enclosing the upper end of the shell. The shell 11 is provided near its lower end with an inlet opening 14 for the passage of material from a receiving hopper 15 projecting outwardly of the shell 11 and provided with upwardly extending end plates 16. Communicating with the hopper 15 and the inlet opening 14 is a vertical passage 17 formed by vertical side walls 18 joined to the inner surface of the shell 11 and to a vertical end wall 19. At the lower end of the vertical passage 17 and the receiving hopper 15 is provided a curved bottom plate 20 joining an outwardly inclined plate 21 of the receiving hopper 15 so that material is urged by gravity from the receiving hopper 15 to the bottom of the vertical passage 17.

The vertical end wall 19 of the passage 17 is provided at its upper extremity with an inwardly directed shield member 22, for a purpose to be later described, at approximately the same level as the top plate 12 and spaced from an inclined wall 23 of the upwardly projecting housing 13 to define a passage 24 for the discharge of material into a discharge hopper 25 therebeneath. The discharge hopper 25 is supported within the shell 11 in any suitable manner. As illustrated in the drawings, I have provided a pair of U-beams 26 extending across the interior of the

tank 11 adjacent its upper end and two angle irons 27 extending from each of the U-beams 26 to the receiving hopper 25 to support it in the desired position. At its lower end the discharge hopper 25 is provided with an outlet opening 28 communicating with a discharge pipe 29 extending outwardly of the shell 11.

Secured to the inner surface of the shell 11 adjacent but spaced above its lower end is a frusto-conical wall 30 in fluid-tight relationship with the inner surface of the shell 11 and the outer surface of the vertical side walls 18 and the vertical end wall 19 of the vertical passage 17. The frusto-conical wall 30 is provided at its lower end with a discharge opening 31 communicating with a horizontal cylindrical pipe 32, one end of which is closed by an end plate 33 and the other end of which communicates with the vertical passage 17 above the curved bottom plate 20. The frusto-conical wall 30, together with the shell 11 and the walls 18 and 19 of the vertical passage 17, defines a storage receptacle, indicated by the numeral 34, around and beneath the discharge hopper 25.

Means are provided for conveying or directing material in the receiving hopper 15 toward the middle thereof in the form of a ribbon conveyor 35. The ribbon conveyor 35 includes a plurality of radial arms 36 secured to a horizontal shaft 37 mounted for rotation in end walls 38 of the receiving hopper 15. Opposed spiral ribbons 39 are secured upon the radial arms 36 so that they rotate in close proximity to an inner vertical wall 39a of the receiving hopper 15 and urge material in the hopper 15 toward the middle thereof. Fixedly mounted upon the horizontal shaft 37 at the middle thereof is a sprocket 40 adapted for meshing with a chain elevator 41 carrying buckets 42 and which passes over an upper sprocket 43 mounted upon a horizontal shaft 44 supported for rotation in the upwardly projecting housing 13. As is best illustrated in Fig. 2, the sprocket 40 and the buckets 42 are so dimensioned that the buckets are moved in close proximity to the curved bottom plate 20 of the vertical passage 17, scooping material therefrom and discharging it through the opening 24 into the discharge hopper 25. The shield member 22 at the upper end of the vertical end wall 19 of the passage 17 prevents the material so discharged from the buckets 42 from passing into the vertical passage 17.

The upper horizontal shaft 44 is provided with a driven sprocket 45 exterior of the upwardly projecting housing 13 and meshing with a drive chain 46 which passes over a driving sprocket 47. The driving sprocket 47 is rotated through a suitable gear reduction means, indicated by the numeral 48, by a motor 49 mounted upon the upper surface of the top member 12.

Means are provided in the discharge pipe 29 for conveying material from the discharge hopper 25 to the exterior of the shell 11, this means, as illustrated in the drawings, including a screw 50, the shaft of which extends through an inner end plate 51 of the discharge pipe 29 and has attached thereto a driven sprocket 52. The driven sprocket 52 is rotated by a drive chain 53 meshing with a drive sprocket 54 rotated by a suitable motor 55.

The shell 11 is provided with a recess 56 adjacent the lower end of the discharge hopper 25 and defined by an inwardly extending lower wall 57, a vertical inner wall 58, and vertical side walls 59, which vertical walls are secured to

the discharge hopper 25. A motor mount 60 is secured to the lower wall 57 and supports the motor 55 in the desired position where it is accessible for inspection and repair.

Means is provided for conveying or directing material from the storage receptacle 34 through the horizontal cylindrical pipe 32 to the bottom of the vertical passage 17 and the receiving hopper 15, which means is in the form of a screw 61, the shaft 62 of which is supported at its forward end in a bearing 63 mounted on arms 64 connected to the horizontal cylindrical pipe 32. The rearward end of the shaft 62 extends through and is journaled by the end plate 33 and is provided with a driven sprocket 65. An opening in the shell 11, covered by a removable plate 61a, is provided to facilitate the installation of the screw 61. The driven sprocket 65 is driven by a chain 66 meshing with a drive sprocket 67 rotated by a suitable motor 68. The motor 68 is supported upon a motor mount 69 secured to the shell 11.

It will be noted that considerable space is provided within the shell 11 beneath the storage receptacle 34 around the frusto-conical wall 30 and the walls defining the vertical passage 17 and the receiving hopper 15, as illustrated in Figs. 2 and 5. Access to this space, which may be identified as a compartment 70, is provided through an opening 71 in the shell 11. An instrument panel 72 is mounted on the inner surface of the shell 11 within the compartment 70 and supports control devices 73, 74, and 75 for the control of current to the motors 49, 55, and 68, respectively.

When the storage device is set up vertically, as illustrated in Figs. 1 to 5, inclusive, cement or the like may be discharged intermittently into the receiving hopper 15 in which it is urged by the inclination of the walls of the receiving hopper 15 and the rotation of the ribbon conveyor 35 to the middle of the hopper 15. It will be noted that the ribbon conveyor 35 does not move all of the material adjacent the sides of the receiving hopper 15 toward the middle thereof, but acts upon only a portion of such material. The material thus directed to the middle of the conveyor 15 is picked up by the buckets 42 and carried by the chain elevator 41 upwardly in the vertical passage 17 and discharged through the opening 24 into the discharge hopper 25. It will be noted also that, since the chain elevator 41 and the ribbon conveyor 35 are connected to a common shaft 37, the rate at which the material in the receiving hopper 15 is urged toward the middle thereof is a definite function of the rate at which the chain elevator removes the material from the middle of the receiving hopper 15.

The discharge pipe 29 being connected to a place of use of the cement or to an automatic weighing device or the like, the motor 55 is energized either through manipulation of the control 74 or automatically by the weighing device of the batch plant, so that the desired quantity of cement is moved through the discharge pipe 29 by the action of the screw 50 therein, and thereafter the motor 55 is deenergized.

Cement being supplied to the receiving hopper 15 at a rate greater than the withdrawal of the cement from the discharge hopper 25, the cement overflows the discharge hopper 25 and falls into the storage receptacle 34. It will be noted that the intermittent withdrawal of cement from the discharge hopper 25 may be accomplished

during the continuous transportation of cement from the receiving hopper 15 to the discharge hopper 25 and the storage receptacle 34. When it is desired to draw upon the material in the storage receptacle 34 to supply the discharge receptacle 25, the motor 68 is energized, causing the screw 61 to direct material from the storage receptacle 34 through the horizontal cylindrical pipe 32 into the receiving hopper 15 and vertical passage 17 in which it is directed to the chain elevator 41 by the ribbon conveyor 35 as previously described.

Inasmuch as the upper end of the discharge hopper 25 is at a considerable distance above the ground and invisible to the operator, my invention provides means for visibly indicating to the operator on the surface of the ground when the storage receptacle 34 and the discharge hopper 25 are filled to their capacities. This means includes a discharge pipe 76, the upper, open end of which is positioned adjacent the upper edge of the discharge hopper 25 and a distance thereabove such that the material may overflow the discharge hopper 25 into the storage receptacle 34 without passing into the discharge pipe 76 until the level of the material in the storage receptacle 34 is at the top of the discharge hopper 25 and the discharge hopper 25 is filled, at which time material passes through the discharge pipe 76. As illustrated in Fig. 1, the discharge pipe 76 passes downwardly outside of the shell 11 with its lower end adjacent one of the end plates 16 and slightly above the outwardly inclined bottom plate 21 of the receiving hopper 15. When cement is discharged from the lower end of the pipe 76 into the receiving hopper 15, the operator is made aware that the device is filled to capacity, and the operation of the chain elevator 41 should be discontinued until some of the contents of the storage device are withdrawn.

For the purpose of enabling a single operator to move the storage device herein described from a transporting vehicle such as a truck or trailer into its operative position at the desired location, my invention provides a transposing means, indicated generally by the numeral 78. Such means includes a shaft 79, best illustrated in Fig. 7, which extends through the shell 11 near its center of gravity and is rotatably secured thereto by bosses 80. On each end of the shaft 79 is a pinion gear 81 adapted for meshing with a rack 82 fixedly connected to an upright 83 of a supporting member or means 84. The supporting means includes a second upright 85 and a base 86 having an inner straight portion 87 to which the lower ends of the uprights 83 and 85 are connected. The base includes also angled portions 88 connecting the portion 87 to an outer straight portion 89. Inclined brace members 90 are connected at their lower ends to the outer extremities of the angled portions 88 of the base and at their upper extremities to the uprights 83 and 85. Transverse bracing 91 is employed to stiffen each of the supporting means.

A movable rack 92 is mounted for sliding engagement upon each upright 85 in meshing relationship with the pinion gear 81 associated therewith. Each movable rack 92 is connected to a piston in a hydraulic cylinder 93. Lines 94 and 95 deliver fluid under pressure to the cylinders 93 from a supply line 96 which is connected through a two-way valve 97 with a hydraulic cylinder 98 and a fluid reservoir 99. A branch line 100 may by proper actuation of the valve 97

be connected to the supply line 96 to withdraw fluid from the cylinders 93. The cylinder 98 is provided with a piston actuated by a lever 101 so that, a suitable one-way valve being installed between the cylinder and the valve 97, a workman can by reciprocation of the lever 101 force fluid under pressure from the reservoir 99 through the supply line 96 and the lines 94 and 95 to the cylinders 93. This fluid under pressure in the cylinders 93 moves the pistons therein upwardly and thus forces the moving racks 92 upwardly. Such movement of the racks 92 causes rotation of the pinion gears 81, and this rotation by virtue of their meshing relationship with the stationary racks 82 causes the pinions 81 to move upwardly, carrying the shaft 79 and the storage device connected thereto.

Preferably, a shallow pit 102 has been prepared in the ground for the reception of the lower end of the shell 11 before it is elevated from the transporting vehicle, indicated by the numeral 103, and timbers 104 are laid in this shallow pit only to the extent necessary to receive the wheels 105 of the vehicle 103.

The actuation of the lever 101 is continued until the shell 11 is moved upwardly sufficiently to clear the vehicle 103, as indicated by the broken lines 108 of Fig. 6, each pinion gear 81 being moved from the position in which it is indicated in full lines to the position indicated in the dotted lines 109 of the same figure. The shell is retained in this elevated position while the vehicle is moved from under it. Since the shell 11 is suspended upon the shaft 79 at substantially its center of gravity, the operator can rotate the shell 11 upon the shaft 79 into the position indicated by the broken line 106 of Fig. 6.

The absence of timbers 104 in the central portion of the shallow pit 102 permits the forward edge of the bottom of the shell 11 to freely move into the desired position. Thereafter the operator positions beneath the shell 11 additional timbers 104 to support the weight of the storage device and releases the fluid from the cylinders 93, permitting the shell 11 to descend upon such timbers. The control of the fluid in the cylinders 93 after the vehicle 103 is moved from under the shell 11 may be either by the two-way valve 97, the supply line 96 being made of sufficient length to connect it to the lines 94 and 95 after the vehicle is thus moved, or a valve may be interposed in each of the lines 94 and 95 between the cylinders 93 and a coupling permitting a disconnection of such lines from the supply line 96. If desired, the pinion gears may be made removable from the shaft 79 so that the supporting means 78 may be removed from the shell 11 after it is installed in proper position.

The controls 73 to 75 inclusive may be electrically connected in any suitable manner, not shown, to an electrical outlet 108 on the exterior of the shell 11 so that it is only necessary for the workman to plug into the outlet 108 in connection with a suitable source of electric current in order to render the storage device ready for operation.

It will be obvious that when it is desired to move the storage device it is necessary only to reverse the process just described, and it will thus be seen that a single workman can in a very few minutes either remove the storage device from a transporting vehicle and install it in readiness for use or move the storage device from its operative position onto a transporting vehicle for removal from the work. From the de-

scription of the construction and operation of the embodiment illustrated in the drawings, it will be apparent that my invention provides a storage device capable of continuously supplying material to a discharge hopper while receiving material intermittently for storage and a device in which there is a continuous movement of the material from the receiving hopper or storage receptacle to the discharge hopper.

It will likewise be apparent that my invention provides such a device with means for giving a visible indication to the operator on the ground when the device is filled to capacity. By the grouping of all of the controls upon a single, easily accessible instrument panel protected from the weather, my invention also provides a device of the character described which can be easily and positively operated and controlled by a single workman.

While that embodiment of my invention hereinbefore described and illustrated is fully capable of performing the objects and providing the advantages primarily stated, and while it finds particular utility in the receiving, storing, and dispensing of cement, it is to be understood that my invention is not restricted to such embodiments or to such use, but includes such modifications, variations, and different uses as come within the scope of the claims which follow.

I claim as my invention:

1. In a portable storage device, the combination of: a shell; a receiving hopper connected to said shell; a discharge hopper connected to said shell above said receiving hopper; elevator means in said shell adapted for moving material from said receiving hopper to said discharge hopper; a storage receptacle in said shell below said discharge hopper and adapted for receiving material overflowing therefrom; first conveyor means in said shell adapted for directing material in said receiving hopper toward said elevator means; a first drive means connected to said shell adapted for actuating said elevator means and said first conveyor means; second conveyor means in said shell adapted for directing material from said receptacle toward said elevator means; a second drive means connected to said shell adapted for actuating said second conveyor means; discharge conveyor means adapted for directing material from said discharge hopper to the outside of said shell; and a third drive means connected to said shell and adapted for actuating said discharge conveyor means, said three drive means being independent of each other, whereby said discharge conveyor means may be actuated independently of said elevator means and said first conveyor means and independently of said second conveyor means.

2. In a portable storage device, the combination of: a shell; a receiving hopper connected to said shell; a discharge hopper connected to said shell above said receiving hopper; elevator means in said shell adapted for moving material from said receiving hopper to said discharge hopper; a storage receptacle in said shell below said discharge hopper and adapted for receiving material overflowing therefrom, the lower end of said receptacle being spaced from the lower end of said shell and providing a compartment therebetween; first conveyor means in said shell adapted for directing material in said receiving hopper toward said elevator means; a first drive means connected to said shell adapted for actuating said elevator means and said first conveyor means; second conveyor means in said shell

adapted for directing material from said receptacle toward said elevator means; a second drive means connected to said shell adapted for actuating said second conveyor means; discharge conveyor means adapted for directing material from said discharge hopper to the outside of said shell; a third drive means connected to said shell and adapted for actuating said discharge conveyor means; and separate control means in said compartment for each of said drive means.

3. In a portable storage device, the combination of: a shell adapted to receive the material to be stored; supporting members pivoted to said shell; elevating means connected to said members and said shell and adapted for moving said shell vertically when said members are supported upon the ground, whereby said shell may be lifted from a tractive vehicle and, after removal of the vehicle, swung ninety degrees relative to said supporting members and supported upon the ground; and means maintaining equal the vertical movement of said shell relative to each of said members.

4. In a portable storage device, the combination of: a shell adapted to receive material to be stored; supporting members pivoted to said shell; manually operable elevating means connected to said members and said shell and adapted for moving said shell vertically when said members are supported upon the ground, whereby said shell may be lifted from a tractive vehicle and, after removal of the vehicle, swung ninety degrees and lowered to support upon the ground; and means maintaining equal the vertical movement of said shell relative to each of said members.

5. In a portable storage device, the combination of: a shell adapted to receive and discharge material to be stored; supporting members pivoted to said shell substantially at its center of gravity; manually operable elevating means connected to each of said members and said shell and adapted for moving said shell vertically when said members are supported upon the ground, whereby said shell may be moved between positions supported on a vehicle and a position supported on the ground; and means maintaining equal the vertical movement of each of said elevating means.

6. In a portable storage device, the combination of: a shell adapted to receive and discharge material to be stored; supporting members removably pivoted to said shell; manually operable elevating means connected to each of said members and said shell and adapted for moving said shell vertically when said members are supported upon the ground, whereby said shell may be moved between positions supported on a vehicle and a position supported on the ground; and means maintaining equal the vertical movement of each of said elevating means.

7. In a portable storage device, the combination of: a shell adapted to receive and discharge material to be stored; a shaft projecting from each side of said shell substantially at its center of gravity; a supporting member spaced from each side of said shell; and elevating means connecting each of said members to one of said shafts and adapted for moving said shell vertically when said members are supported upon the ground, whereby said shell may be moved between a position supported on a vehicle and a position supported on the ground.

8. In a portable device for storing material, the combination of: a receiving hopper; a dis-

charge hopper; elevating means adapted for lifting material from said receiving hopper and discharging it into said discharge hopper; a storage receptacle so related to said discharge hopper as to receive material overflowing from said discharge hopper, said receptacle so communicating with said receiving hopper as to supply material to said elevating means; and means adapted for providing visible indication of the filling of said discharge hopper and said receptacle to the desired capacity by delivering to said receiving hopper less than all of the material being delivered by said elevating means after said desired capacity has been filled.

9. In a portable device for storing material, the combination of: a receiving hopper; a discharge hopper; elevating means adapted for lifting material from said receiving hopper and discharging it into said discharge hopper; a storage receptacle so related to said discharge hopper as to receive material overflowing from said discharge hopper, said receptacle communicating adjacent its lower end with said receiving hopper; conveyor means adapted for moving material from said receptacle to said elevating

means; and means adapted for providing visible indication of the filling of said discharge hopper and said receptacle to the desired capacity by delivering to said receiving hopper less than all of the material being delivered by said elevating means after said desired capacity has been filled.

10. In a portable storage device, the combination of: a portable shell; a receiving hopper connected to said shell, a discharge hopper connected to said shell above said receiving hopper; elevator means in said shell adapted for moving material from said receiving hopper to said discharge hopper; a storage receptacle in said shell below said discharge hopper and receiving the material overflowing therefrom; means in said shell for directing material from said receptacle to said elevator means; and an overflow member discharging from said shell into said receiving hopper less than all of the material being delivered by said elevator means to said discharge hopper when said receptacle and said discharge hopper are filled to the desired capacity.

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