

March 21, 1967

H. M. ZIMMERMAN

3,310,293

CONCRETE MIXING AND DELIVERY SYSTEM

Filed June 26, 1964

8 Sheets-Sheet 1

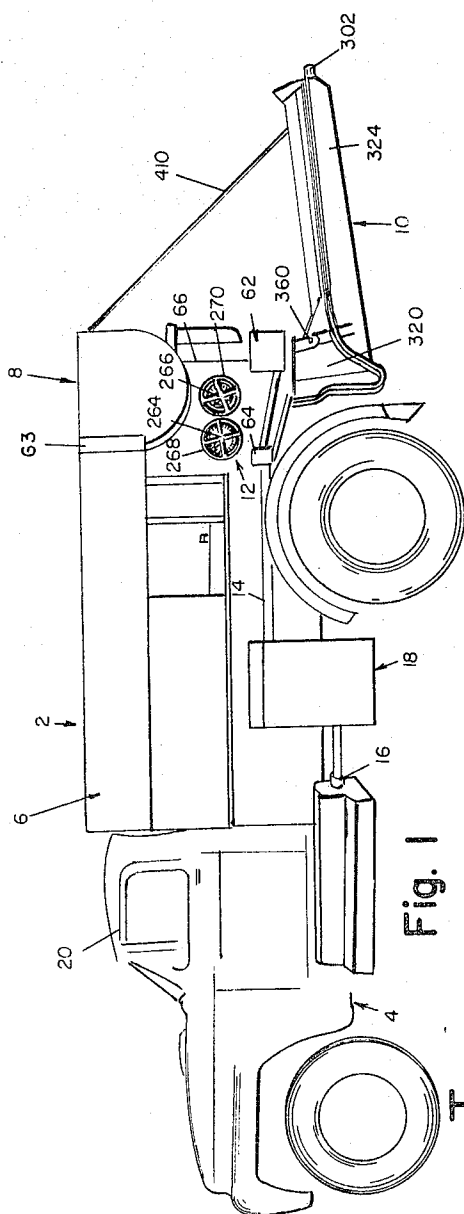


Fig. 1

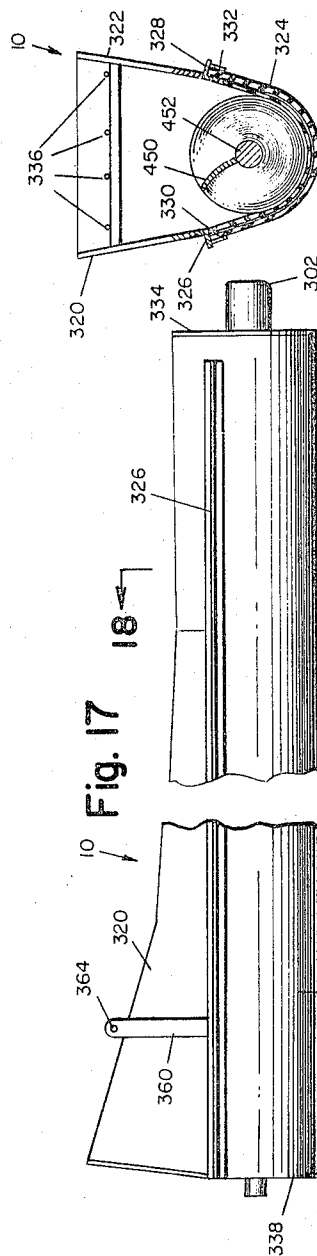


Fig. 18

Fig. 17

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CONCRETE MIXING AND DELIVERY SYSTEM

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8 Sheets-Sheet 2

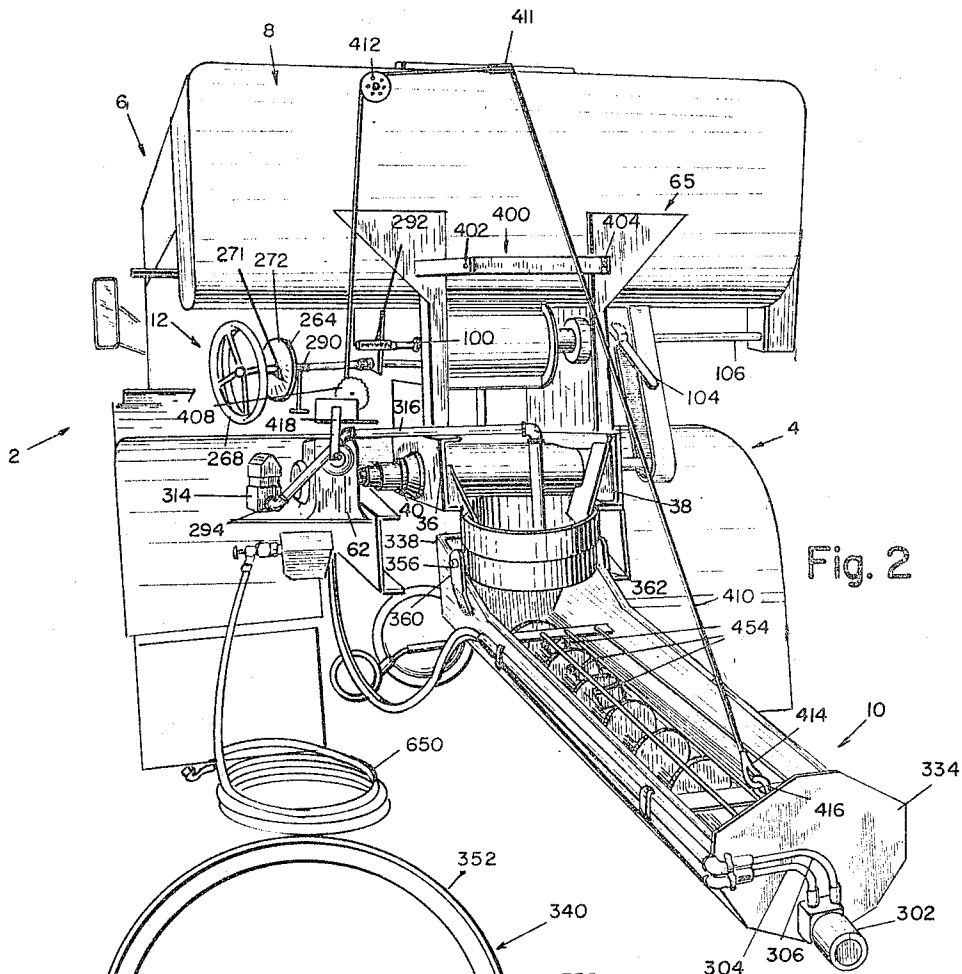


Fig. 2

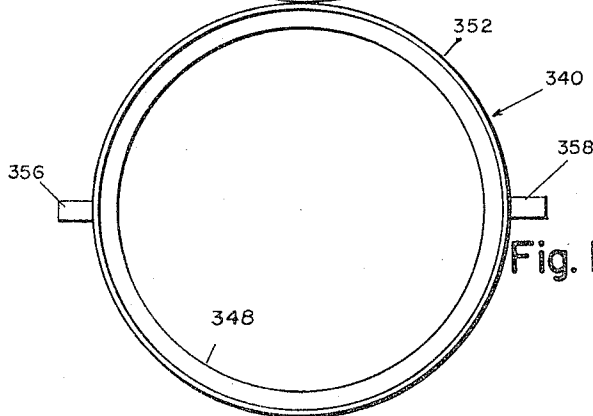


Fig. 14

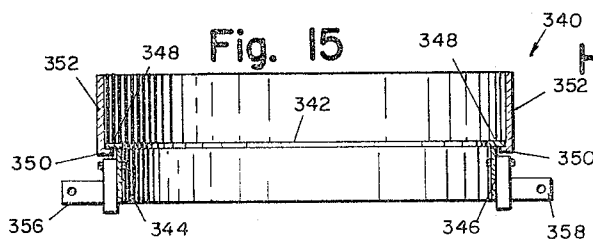


Fig. 15

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## CONCRETE MIXING AND DELIVERY SYSTEM

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8 Sheets-Sheet 4

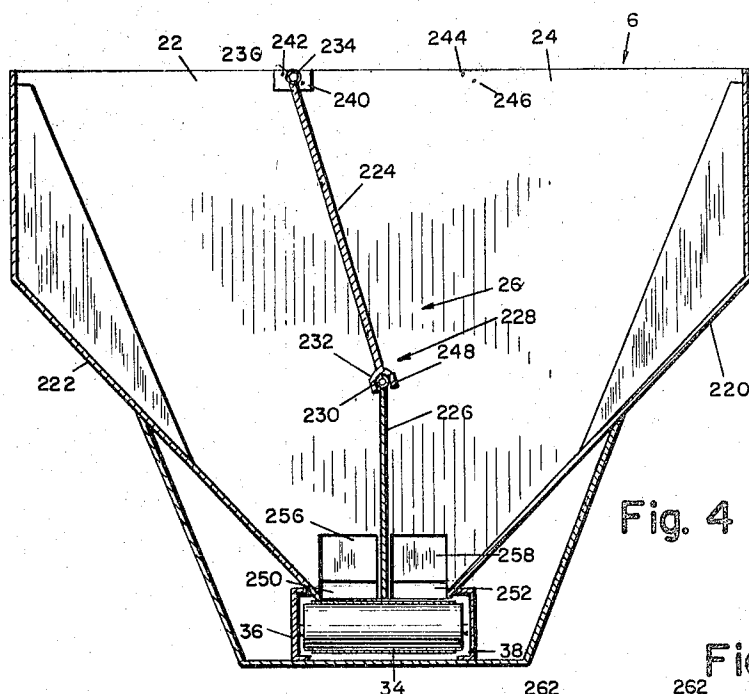


Fig. 4

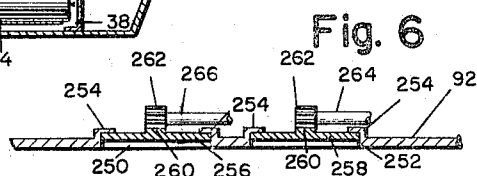


Fig. 6

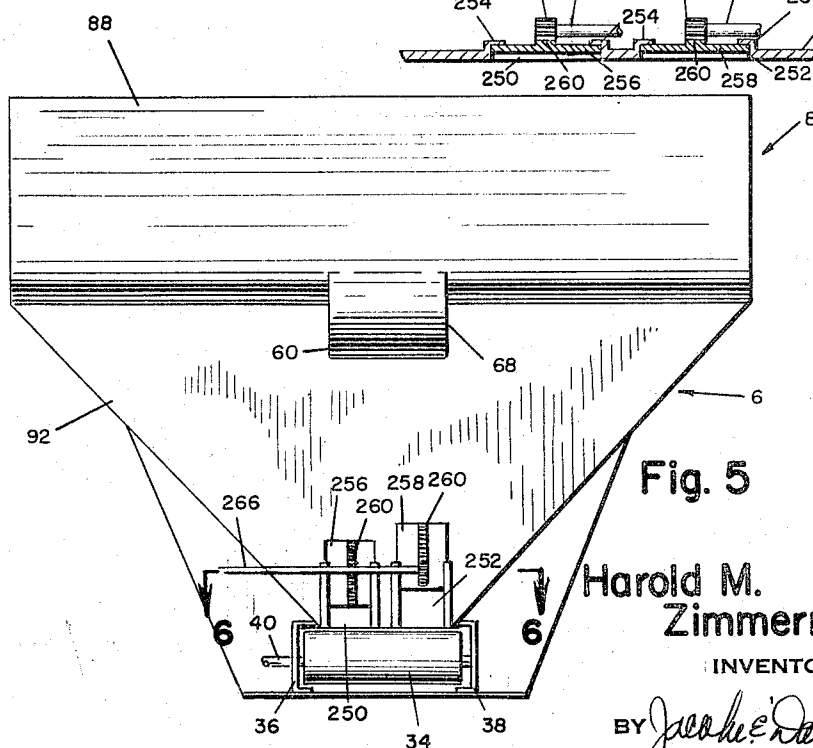


**Fig. 5**

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March 21, 1967

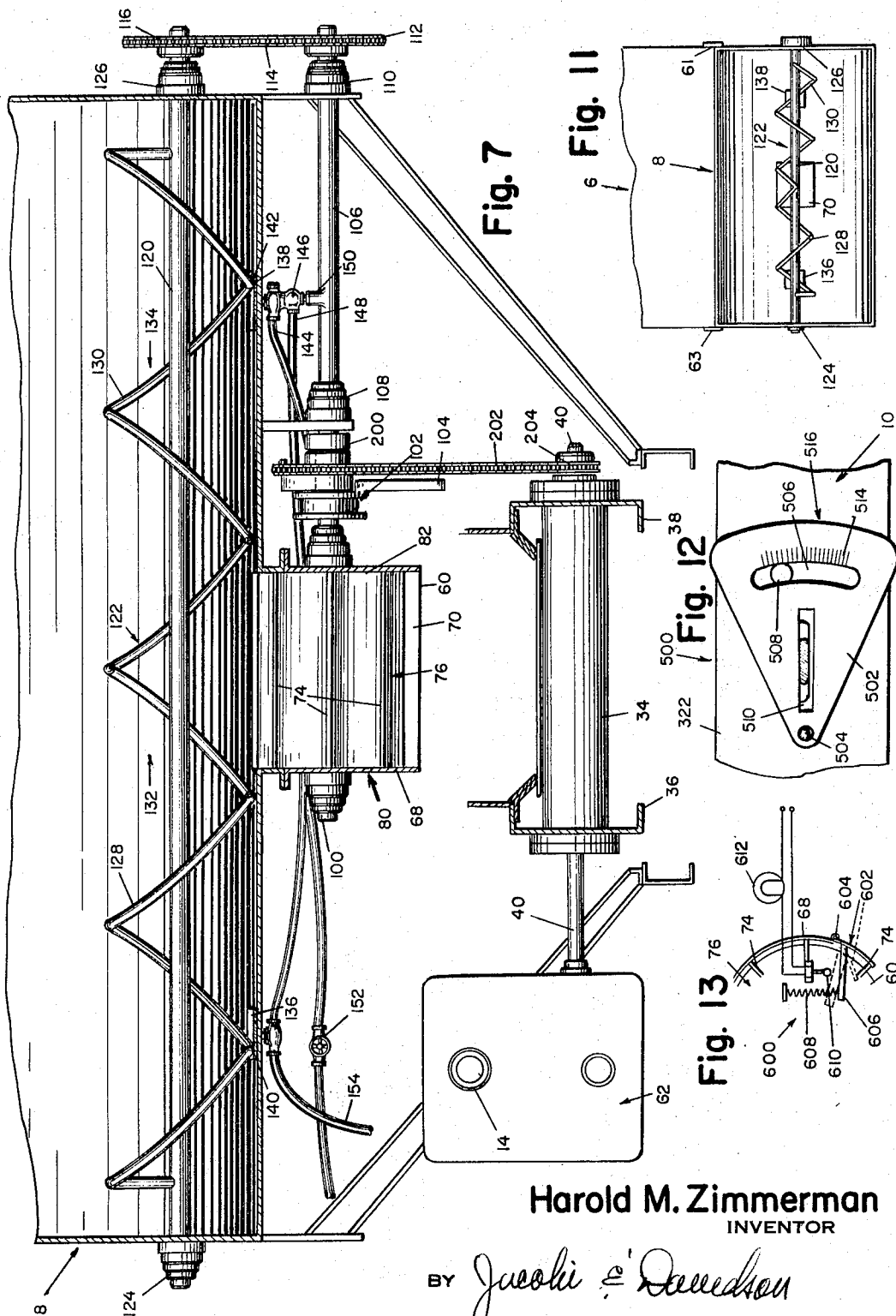
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CONCRETE MIXING AND DELIVERY SYSTEM

Filed June 26, 1964

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CONCRETE MIXING AND DELIVERY SYSTEM

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8 Sheets-Sheet 6

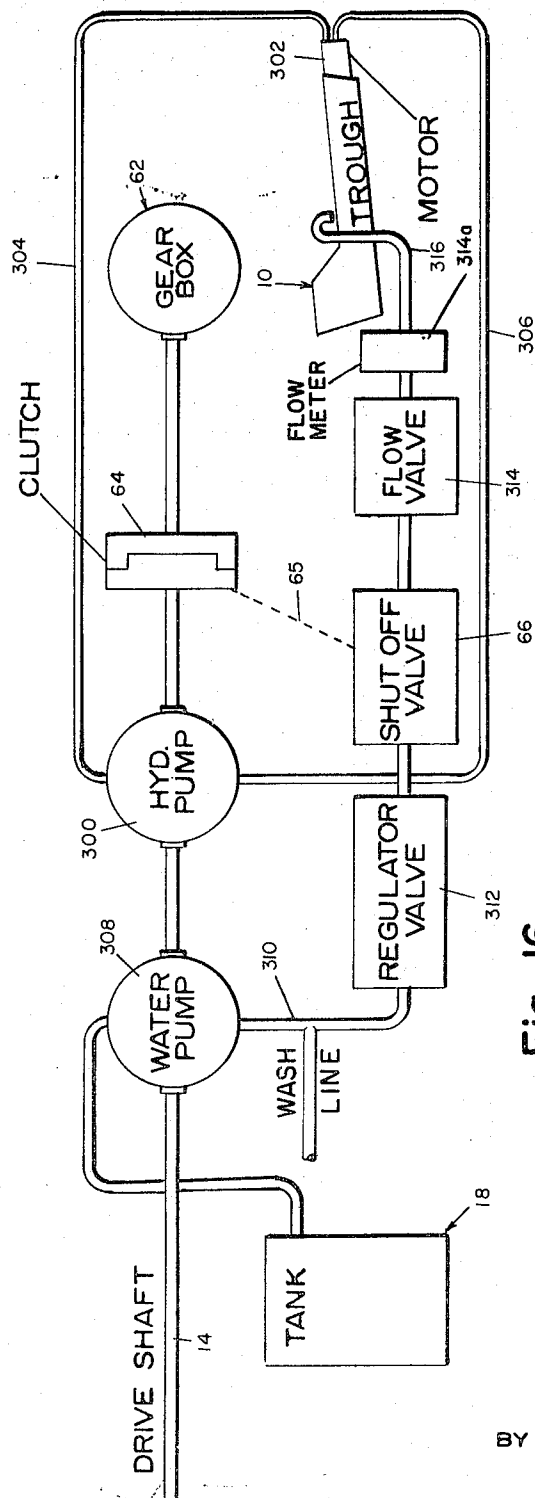


Fig. 16

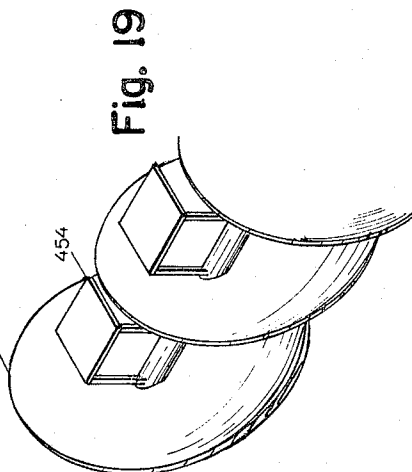


Fig. 19

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CONCRETE MIXING AND DELIVERY SYSTEM

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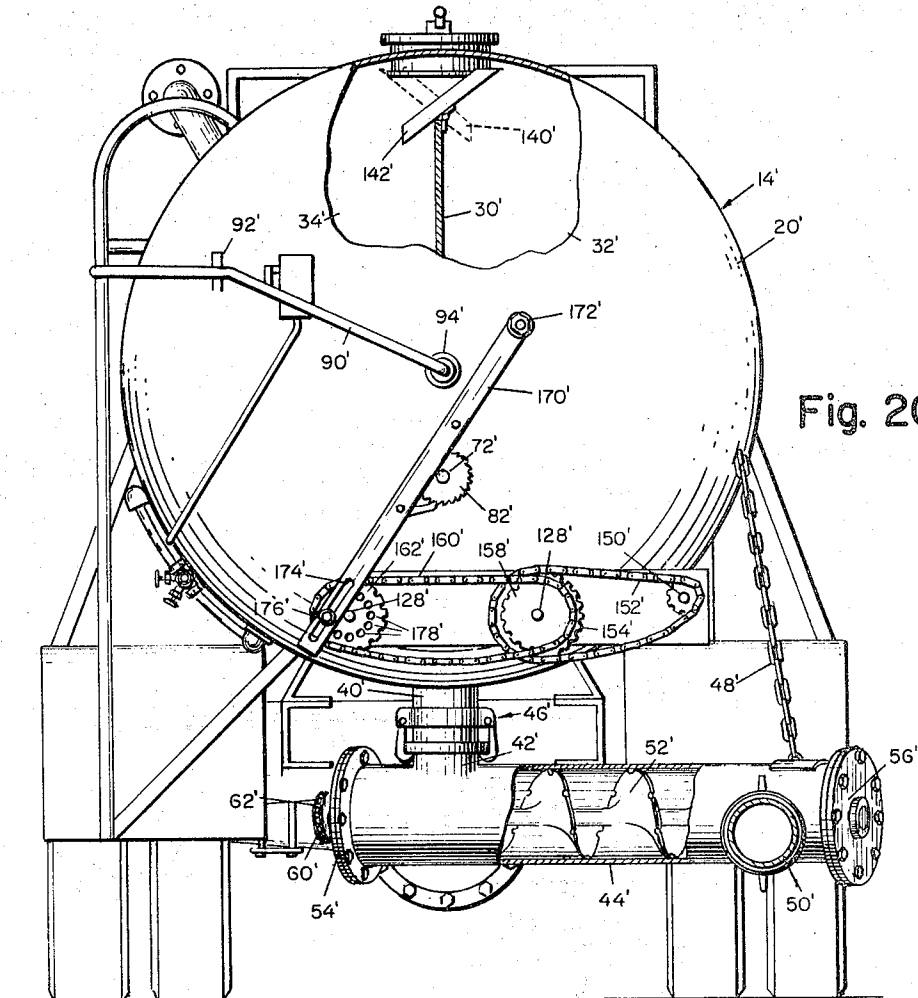


Fig. 20

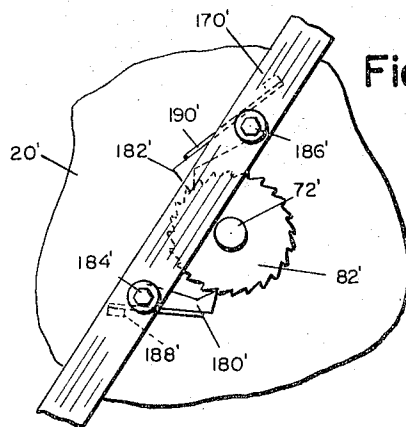


Fig. 22

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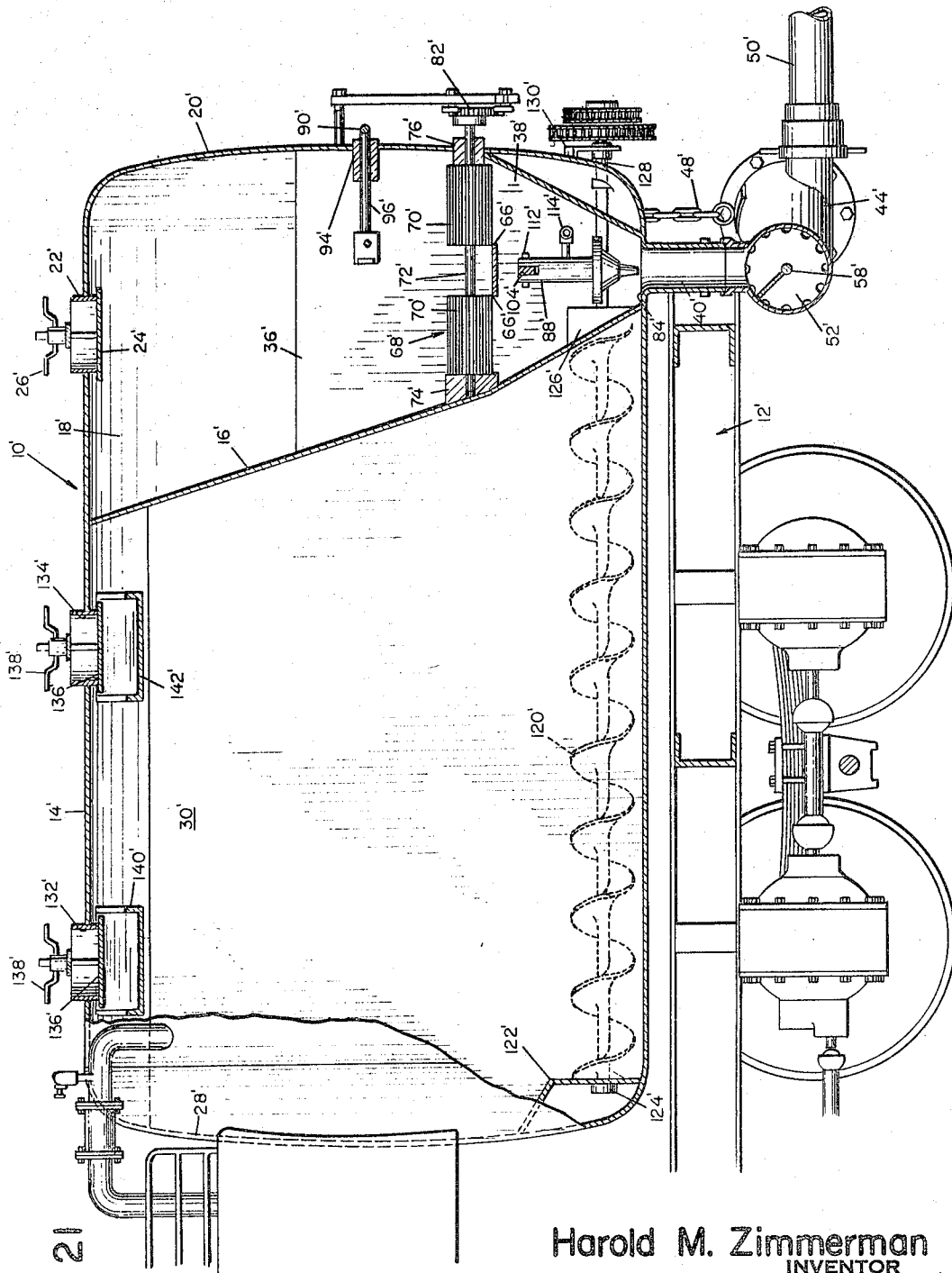
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## CONCRETE MIXING AND DELIVERY SYSTEM

Filed June 26, 1964

8 Sheets-Sheet 8



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## CONCRETE MIXING AND DELIVERY SYSTEM

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Filed June 26, 1964, Ser. No. 378,133

57 Claims. (Cl. 259-148)

This application is a continuation-in-part of my application Ser. No. 114,575, filed Feb. 20, 1961, now abandoned, and entitled, "Concrete Mixing and Delivery System."

This invention relates to a concrete mixing and delivery system and more particularly it relates to an apparatus and method for selectively dispensing concrete ingredients from their separate storage chambers and for combining and mixing such ingredients to form a concrete composition of preselected character and quantity, whereafter such mixed concrete can be delivered to its location of ultimate usage.

As is well-known, the conventional form of concrete mixing equipment is a ready-mix truck having a rotatable mixing drum mounted upon its bed with an opening therein for receiving the concrete ingredients. When such ingredients are received within the drum, it is rotated about its axis to mix the concrete into a usable condition, and when the truck reaches its ultimate destination, an outlet opening on the drum is uncovered to permit the mixed concrete to be discharged or delivered gravitationally from the drum.

Such conventional ready-mix trucks have several serious shortcomings which prevent them from being used for universal or all-purpose applications. One shortcoming of ready-mix concrete trucks is the fact that the batch of concrete must be used in a comparatively short time after it is mixed or compounded or else the water content of the batch, which controls the viscosity or consistency of the concrete, must be altered. Thus, if it is desired to utilize only a small portion of the mixed batch at one location, the remainder of the batch must continue to be mixed while the truck moves to another location and as a result, the batch becomes overmixed. This not only causes excess heat but also causes the concrete to harden and thus requires the addition of extra water. When too much water has been added to the mixture, its quality or consistency becomes weakened and the concrete cannot adequately perform its function.

As a result of the foregoing difficulty, one of two situations arises when a ready-mix truck is used to supply concrete for small applications such as patios, driveways, steps and the like. Either the person ordering the concrete must pay for the entire batch or else a later person who receives concrete from the same batch will get heavily rewetted concrete which is not altogether satisfactory. In either situation, it is obvious that the conventional ready-mix concrete truck is unable to be used satisfactorily in servicing small jobs where only a minimum amount of concrete is required.

Another shortcoming of conventional ready-mix trucks is that a somewhat experienced operator is required to properly introduce the ingredients in the right quantities and to properly operate the mixing drum at the correct speed to assure that the mixed batch of concrete is formed with the desired characteristics of consistency, density, quality, and the like. Moreover, even such an experienced operator is only familiar with compounding a full batch within the mixing drum and would be totally unfamiliar with the mixing speeds and quantities required to make a small batch.

There are, of course, still many more serious shortcomings which exist with conventional ready-mix concrete trucks. As an example, it is difficult and time-consuming to clean the large mixing drum at the end

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of a day's service, yet if such cleaning is not carried out, the remaining concrete will harden within the drum. Also, the speed of delivery may have to be inordinately slow or fast in order to allow the concrete to be mixed at the proper speed. Furthermore, since the ingredients have varying densities, specific gravities, sizes and shapes, the gravity fallout mixing operation performed by ready-mix and transit-mix trucks is not altogether satisfactory, since a positive mixing is lacking. Other shortcomings of conventional ready-mix trucks will be readily apparent to those familiar with their construction and operation.

In contrast to the deficient character of conventional ready-mix concrete trucks, it would be both desirable and beneficial to provide an improved concrete mixing and delivery system which is relatively self-contained and, as such, can (a) form a part of a vehicular machine, such as a truck or a trailer; (b) can form a stationary plant; or (c) can be used in combination and conjunction with a conventional ready-mix concrete truck. Such a system would include a plurality of separate chambers in which the various individual concrete ingredients, such as sand, gravel, cement and water, are stored and from which they can be selectively dispensed in desired quantities. In this manner, the individual ingredients can be suitably transported to or housed at the site of their desired use, and can be dispensed in selected predetermined quantities to form a concrete batch having just the right qualities. Also, such a system would include a small mixing area into which the ingredients could be introduced for compounding of the concrete and means for adjusting the mix rate within that area.

Another prime consideration which would be useful and beneficial in providing an improved form of mixing and delivery system would be to design such a system to permit it to be used in other and varied applications rather than just concrete making and feeding operations. For instance, the apparatus could store, mix and dispense cinders, gravel, salts and the like which are useful in the wintertime for spreading on roadways for melting of snow and ice and for improving vehicular traction. As another example, such apparatus could be used in producing fertilizer which is compounded of several different ingredients. Still further, the apparatus could be used to blend and deliver livestock feed. It can, therefore, be seen that such a system and apparatus would be suited to a variety of different applications and could be successfully and beneficially employed in almost any operation where particulate or fluent material is to be mixed and dispensed.

With the foregoing matter in mind, it is, therefore, a primary object of the present invention to provide a mixing and delivery system such as that described hereinbefore.

Another primary object of the present invention is to overcome the difficulties and deficiencies associated with prior art forms of concrete mixing and delivery equipment and to provide in their stead, an improved system which is capable of storing and mixing, and if desired, transporting, a plurality of ingredients which can be selectively mixed into a batch of concrete of a predetermined quantity and having preselected characteristics.

Further objects of the present invention include the provision of a concrete mixing and delivery system which: (a) permits selective variation of the ingredients of the mixture; (b) permits the formulation and delivery of relatively small batches of concrete which can be used to fulfill orders where only small quantities of concrete are needed, thus preventing the need for taking such quantities from a single large batch; (c) can be applied to vehicular devices of various types including a conventional ready-mix concrete truck; (d) can be used as a stationary batch plant, if desired; and (e) permits a batch

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of preselected quality to be obtained, regardless of the speed of the operating motor of the vehicle on which the system is mounted.

Still further objects of the present invention include the provision of a system for mixing and delivering concrete wherein: (1) the "slump" or water content of the mixed concrete can be easily controlled; (2) a separate extensible mixing trough is provided for performing the mixing in a desired manner and at a desired rate; (3) only a small portion of the system is utilized for mixing and wherein that small portion can be quickly and easily cleaned after completion of a mixing operation; (4) the mixing can be performed "on-site"; (5) the mixing rate and proportions are tabularly presented so that even an inexperienced operator can compound the concrete properly; and (6) the ingredients for the concrete are positively delivered from their separate storage chambers to the common mixing area; and (7) a positive mechanical mixing action is performed to assure a uniform dispersal of all the ingredients of the concrete mix.

Yet a further object of the present invention is to provide a method and apparatus for combining and mixing separate ingredients into an agglomerated mass and for delivering such a mass to a desired site, and wherein the ingredients comprehended can be of any suitable particulate or fluent type.

Other objects, advantages and salient features of the present invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

FIGURE 1 is a side elevational view of a system in accordance with the principles of the present invention wherein the system is mounted upon the frame of a vehicle such as a truck;

FIGURE 2 is a rear perspective view of the system shown in FIGURE 1;

FIGURE 3 is a sectional view through the system of FIGURE 1, detached from the vehicle;

FIGURE 4 is a sectional view through the system as shown in FIGURE 3 and illustrating the interior of the system storage bin;

FIGURE 5 is a rear elevational view of the system shown in FIGURE 3;

FIGURE 6 is a sectional view taken substantially along line 6—6 of FIGURE 5;

FIGURE 7 is a sectional view through the cement bin of the present system, and showing the interior of the bin and certain auxiliary equipment appended to the bin;

FIGURE 8 is a fragmentary top plan view of the adjustable saddles used to mount the system of the present invention;

FIGURE 9 is a sectional view taken substantially along line 9—9 of FIGURE 8;

FIGURE 10 is a fragmentary plan view of a conveyor employed in the system of the present invention;

FIGURE 11 is a fragmentary top plan view of the cement bin with its cover removed;

FIGURE 12 is a fragmentary side elevational view of a level indicating means employed in the system of the present invention;

FIGURE 13 is a fragmentary schematic view of an indicator means employed in the system of the present invention;

FIGURE 14 is a plan view of a swivel coupling means employed in the system of the present invention;

FIGURE 15 is a transverse sectional view through the coupling means of FIGURE 14;

FIGURE 16 is a schematic operating circuit diagram of the system of the present invention;

FIGURE 17 is a side elevational view of a mixing trough employed in the system of the present invention;

FIGURE 18 is a sectional view taken substantially along line 18—18 of FIGURE 17;

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FIGURE 19 is a fragmentary side elevational view of one of the spiral flights employed in the system of the present invention;

FIGURE 20 is a rear end view of a modified system in accordance with the principles of the present invention;

FIGURE 21 is a fragmentary side elevational view, partly broken away, of the modified system of FIGURE 20; and

FIGURE 22 is a fragmentary view showing, in detail, an automatic actuator means utilized in the modified system of FIGURE 20.

As shown in FIGURE 1, the apparatus hereof is mounted upon a vehicle such as a truck generally designated 2 having a frame generally designated 4. The apparatus itself includes a sand and gravel storage bin generally designated 6, a cement bin generally designated 8, a mixing trough generally designated 10, a plurality of controls generally designated 12 and a driving arrangement including a drive shaft 14 which is linked with a power take-off from the vehicle.

Additionally, the apparatus includes a water supply tank means generally designated 18, which is mounted forwardly on the vehicle. Either a single water tank, or two water tanks, may be provided and the tank means is mounted near the truck cab 20 by being secured to the side of the storage bin 6, as shown in FIGURE 1, or by being disposed between the cab 20 and the bin 6.

The use of two water tanks affords the advantage that the load is distributed evenly over the frame 4 of the truck 2, and also it permits an operator to use one tank with generally fresh water, and another tank with water having chemicals mixed therein, such as for example, calcium chloride, to prevent freezing of the cement mixture. Fresh water is particularly desirable for use in cleaning the mixing trough, whereas the water with chemical additives therein is particularly desirable for use in the mixture under specific conditions.

As shown in FIGURE 4, the storage bin 6 includes two longitudinally extending sectional compartments 22 and 24. One of these such compartments is adapted to house the sand ingredients of the ultimate concrete mixture, and the other of such compartments is adapted for housing the gravel ingredient of the ultimate concrete mixture. The bin 6 is formed as an integral one-piece bin having a central partition wall 26 extending longitudinally thereof and preferably from the top to the bottom of the bin. This partition 26, as explained more fully below, is adjustable according to the preferred embodiment hereof.

Respective compartments 22 and 24 in bin 6 are provided above a conveyor generally designated 28 which extends through the bin at the base thereof. The conveyor 28 comprises a conveyor belt 30 supported at opposite ends thereof by being trained over a pair of sprocket wheels 32 and 34. The sprocket wheel 34 is fixed in position between a pair of channels 36 and 38 by being mounted on a driven shaft 40 which has its opposite ends journaled in bearings (not shown) mounted in the channels 36 and 38.

The sprocket wheel 32, as shown in FIGURES 3, 8 and 9, is mounted in a pair of bearings 41 and 42 for supporting an idler shaft 44 extending therethrough. Adjustable saddles 46, only one of which is shown, are provided on opposite sides of the apparatus whereby the shaft 44 is movable parallel to the axis of the roller shaft 40. To effect the desired movement of the shaft 44, the central positioning thereof and the proper tensioning of the conveyor belt 30, and adjustable screw arrangement 48, including a pair of fixed nuts 50 and threaded shafts 52, are associated with each of the saddles 46 so as to permit free movement thereof to desired locations along the longitudinal axis of the bin 6.

The endless belt conveyor 28 can take various forms, but it has been found satisfactory to form the same from a pair of side chains 51 and 53, which extend between the sprockets 54 and 56 secured to the idler shaft 44. A pair

of similar sprockets are secured to the shaft 40 upon which the roller member 34 is secured to. Transversely extending slats 58 extend between the respective side chains 51 and 53 with a cloth reinforced rubber belt extending between the chains and the slats to form the conveyor belt. It should be understood, however, that such belt arrangement could be replaced by a cleat rubber belt with the rollers 32 and 34 having peripheral ridges therein to receive the cleat extending inwardly from the belt. Other modified forms of conveyor belts are also within the purview of the present invention.

The cement bin or tank 8 is preferably carried at the rear of the apparatus so that its outlet 60 is disposed above the rear end of the conveyor belt 30. The cement tank 8 is fixed in position by means of braces 61 and 63, extending between the cement tank and the sand and gravel bin 6, and also preferably by means of a channel frame generally designated 65 disposed at the rear of the apparatus.

The operation of the discharge from the cement bin 8, from the sand and gravel bin 6, and the operation of the mixing trough 10, are controlled from a single drive, namely the power shaft 14, which extends rearwardly along one side of the apparatus and connects with the gear box generally designated 62, through the cooperating clutch member 64. The clutch 64 is of conventional design and is operable, upon being moved to its disengaged position, to essentially stop operation of the conveyor 30 and the metering means associated with the cement tank 8. Furthermore, according to the preferred embodiment, an operating handle (not shown) for the clutch 64 is provided in linked engagement with a shut-off valve means 66 which is in turn associated with the water supply 18. Thus, operation of the clutch handle results in completely stopping the delivery of all ingredients to the mixing trough 10 and simultaneously it stops the water supply through the shut-off valve 66.

The outlet 60 of the cement bin 8 is disposed at the bottom portion of a discharge compartment 68 having arcuate inner walls 70 and 72 which cooperate with the vanes 74 of a compartmented metering drum generally indicated by the reference numeral 76. The vanes 74 are preferably of a flexible material, or at least have flexible outer ends thereon, formed from a suitable durable plastic material such as Teflon (polytetrafluoroethylene) or nylon. The vanes 74 form a plurality of compartments 78 in the drum 76 so that material disposed in the tank 8 is dispensed in metered quantities through the bottom discharge opening 60 of the chamber 68. The compartmented metering drum 76 is preferably closed at its opposite ends by circular plates 80 and 82 which extend from the core or center 86 of the compartmented metering drum 76 outwardly to a location spaced slightly inwardly of the respective arcuate side walls 70 and 72. The ends of the vanes 74 are freely movable with respect to the end plates 80 and 82 of the drum and when cooperating with the walls 70 and 72 effectively seal the cement tank 8 at the lower end thereof. The cover 88 at the top of the cement tank 8 may be removed from the bin by merely lifting the same so as to permit filling of the tank 8, but when still in position, the cover 88 effectively seals the top of the tank thereby sealing the same from the external atmosphere and any undesirable moisture content therein, which can cause the cement to cake or coagulate.

As previously described, the respective plates 61 and 63 are disposed on opposite sides of the bin 8 and connect the same with the bin 6. As seen in FIGURE 3, the bin 8 is mounted with its rear wall 90 in spaced relation to the forward wall 92 of the tank 6. Thus, a spacing 98 is maintained between the respective bins and the space prevents any condensation interiorly of the bin 8 due to temperature differentials.

The operation of the compartmented metering drum 76 results in delivery of metered quantities of cement from

the cement bin 8 onto the conveyor belt 30 to become deposited essentially on top of the sand and gravel which was earlier deposited on the belt from the respective compartments 22 and 24 of the bin 6. It should be noted here that the hub or center portion 86 of the metering drum 76 is fixed on the shaft 100 that projects laterally from opposite ends of the discharge compartment 68 as shown in FIGURE 7. The shaft 100 extends through the housing 68 and then to the right thereof as shown in FIGURE 7, and connects to a clutch mechanism generally designated 102. Such a clutch mechanism is of conventional design and operable through a handle 104 to move between its engaged and disengaged positions. Another shaft 106 is mounted at the base of the bin 8 in suitable journaled brackets 108 and 110, the shaft 106 being linked with the shaft 100 through the clutch mechanism 102. At the extreme right end of the shaft 106 there is a sprocket 112 having a chain 114 trained thereabout. This chain 114 is also trained about another sprocket 116 carried on a shaft 120 extending outwardly from the bin 8 and supporting a feeding screw arrangement 122 therein. The shaft 120 is secured in suitable journaled brackets 124 and 126 secured in opposite side walls of the bin 8.

The feeding screw arrangement 122 includes a pair of spiral conveyors 128 and 130 which are disposed on the shaft 120 to feed the ingredient within bin 8 in opposite directions, i.e., the flight 128 feeding the ingredient in the direction of the arrow 132, and the flight 130 feeding the ingredient in the direction of arrow 134, as shown in FIGURE 7. Thus, the feeding arrangement is disposed in the base portion of the bin 8 so as to deliver cement through the discharge outlet 60 or more specifically into the compartmented metering drum 76 so that the same is maintained full at all times to dispense exact metered quantities of the cement from the bin 8 when the same is in operation.

Not only does the feed conveyor arrangement 122 serve to effect the desired delivery of cement to the metering drum 76, but further it maintains the cement in a loose and non-agglomerated condition. To aid in this further function, however, a pair of openings 136 and 138 are disposed in the base of the bin 8 and are covered by fine meshed cloth members 140 and 142, respectively. These cloth members are fine enough to prevent any cement from passing through the openings 136 and 138. However, they do permit air to be introduced therethrough and into the tank 8, the air being supplied from a line 144 which is connected to an air control valve 146 receiving compressed air through a supply line 148. The air control valve 146 is a mechanically operated valve which is activated by a cam 150 carried beneath it on the shaft 106. Thus, each revolution of the shaft 106 causes the cam 150 to open the valve 146 thereby permitting air from the line 144 to pass through the mesh screens 140 and 142, through the openings 136 and 138 and into the tank 8 to aerate the cement carried therein and prevent any agglomeration thereof.

It has been found desirable to include an additional air supply means in the form of a hand operated valve 152 which also connects with the line 144 and the line 154 by the branch line 148. The hand valve 152 permits an operator to selectively aerate cement in the tank 8, if and when desired, as for instance, at the start of a given operation to loosen any agglomeration which may have occurred during transportation of the apparatus between respective locations.

For purposes of driving the metering drum 76 in the cement tank 8, or more specifically in the discharge compartment 68 thereof, as well as for driving the feeding conveyor flight on the shaft 120 and the cam 150 on the shaft 106, the shaft 106 carries a sprocket 200 thereon. A chain 202 is trained about the sprocket 200 and also trained about a sprocket 204 carried on the shaft 40 of the roller 34. The shaft 40 is in turn journaled in the re-

spective bottom channels 36 and 38 which form the bottom of the frame of the apparatus hereof. These channels are readily adapted for attachment to the chassis or frame of the vehicle on which the system is mounted. The shaft 40 extends to the left as shown in FIGURE 7, into the gear box 62 which is driven by the shaft 14 extending along one side of the vehicle, as shown in FIGURE 1. By means of the cooperating sprockets and chain drives, the conveyor 30 is thus driven synchronously with the operation of the compartmented metering drum 76 in the discharge compartment 68 of the tank 8. However, where desired, the compartmented metering drum 76 can be stopped by operation of the handle 104 of the clutch 102 to move the same to its disengaging position. However, notwithstanding the stopping of the compartmented metering drum, the shaft 106 is maintained in operation, and thus, the feed conveyor arrangement 122 is continuously driven.

Attention is now directed to FIGURE 4 wherein the interior of the bin 6 and the respective compartments are shown. It will be noted that the bin 6 is provided with tapering opposed side walls 220 and 222 which converge toward the base of the bin and lead into the space between the channels 36 and 38 whereat the conveyor 30 is disposed. The side walls 220 and 222 thus lead or direct the material under the influence of gravity onto the conveyor belt 30.

Extending longitudinally of the bin 6 and dividing the same into the respective compartments 22 and 24, is a partition means 26 including an upper partition portion 224 and a lower partition portion 226. The lower partition portion 226 is supported in position by suitable braces (not shown) extending inwardly from the respective side walls 220 and 222. Thus, the lower partition portion is fixed to the frame of the bin 6 while the upper end thereof carries thereon a pipe coupling generally designated 228. The coupling 228 comprises a longitudinally extending pipe member 230 secured to the uppermost end of the lower fixed portion 226 of the partition means 26. This pipe coupling 230 cooperates with an overlying coupling member 232 carried at the base of the upper portion 224 of the partition means 26. This pivotal journal or coupling 228 serves to couple the lower fixed portion 226 of the partition means 26 with the upper movable portion 224 thereof. This upper portion 224 preferably takes the form of a thin and flexible sheet of steel which leads from the coupling 228 upwardly, with the upper portion 224 terminating at its upper edge in a bar 234. Opposite ends of the bar 234 are fixedly secured to the respective plates 236 (only one of which is shown), and the plates are in turn selectively movable from the position shown in FIGURE 4 overlying the compartment 22 to a similar position overlying the compartment 24 at substantially the same angular relationship with the portion 226. By means of the apertures 240 and 242 in the plates 236 and cooperating apertures 244 and 246 in the end walls of the bin 6, the upper portion of the partition means 26 is fixedly secured to the bin. A fork portion 248 on the lower end of the movable portion 244 of the partition means 26 overlies the pipe 230 on the fixed portion 226 and thereby creates a pivotal mounting for the upper portion of the partition means. In this manner, the upper portion of the partition 26 is shiftable from one side of the longitudinal and vertical center of the bin 6 to the other side thereof whereby the capacity of the respective compartments 22 and 24 can be varied so as to render one compartment larger than the other for particular operations and/or for particular mixtures having larger or smaller gravel and sand ingredient ratios.

With reference to FIGURES 4 and 5, it should be apparent that each of the compartments 22 and 24, respectively, is provided with an opening, preferably of rectangular contour at the rear of each of said compartments. The opening for the compartment 22 is generally designated

250 and the opening for the compartment 24 is generally designated 252. These openings are provided with guides 254 disposed on opposite sides thereof, for forming slideways in which doors 256 and 258 are slidably disposed for respectively closing or covering the openings 250 and 252. The doors or gateways 256 and 258 are formed as plates, each carrying thereon a rack gear 260. Disposed in cooperating relation with each of the rack gears 260 is a pinion gear 262, as shown in FIGURES 5 and 6, which gears are mounted on a suitable shaft 264 and 266 journaled in brackets fixed to adjacent parts of the structural frame. The shafts 264 and 266 terminate at their outer ends in the control hand wheels 268 and 270, respectively, as shown in FIGURE 1. Rotation of the control hand wheel 268 results in rotation of the pinion gear 262 via the shaft 264, and in turn, vertically moving the position of the rack gear 260 on the gate 256. Adjustment of the position of the rack 260 either raises or lowers the gate 256 to the predetermined desired level. Similarly, operation of the control hand wheel 270 permits the operator to adjust the pinion 262 and in turn the rack gear 260 secured to the gate means 258. In this manner, the doors or gates can be adjusted to desired elevation in overlying relation to the conveyor 30 thereby increasing or decreasing the size of the openings 250 and 252 leading from the respective compartments 22 and 24.

The operation of the control hand wheels 268 and 270 and the disposition of the respective shafts 264 and 266 are substantially the same so that the description of the operation of control hand wheel 268 shown in FIGURE 2 should suffice for a clear understanding of the overall control operation. It should be noted that the hand wheel 268 or the shaft 264 immediately adjacent the hand wheel is provided with a pointer 271 which passes in indicating relation across a gauge 272 attached to the shaft. The gauge 272 permits an operator to selectively pre-set the given opening of the compartments 22 and 24. As an example, assume that the gauge 272 is associated with the sand compartment 22 and that the hand wheel 268 operates the pinion 262 associated with the rack 260 on the gate 256. In this instance, the operator merely pre-sets the pointer 271 on the gauge 272 to the desired location. The operator then is assured that the door 256 has been adjusted to its proper elevation so as to permit only a preselected quantity of sand to be delivered from the compartment 22 during operation of the conveyor 30. This operation essentially pre-sets the proportion of sand to be included in the ultimate concrete mixture. A similar operation is carried out to pre-set the amount of gravel, crushed stone, or other coarse aggregate to be included in the ultimate mixture by merely adjusting the hand wheel 270. Lock bolts, such as the bolt 290, are associated with each of the hand wheels in respective shafts so that the same can be locked in given position once the control hand wheels have set the shafts and in turn the particular gates to the exact desired position. Without this locking mechanism, there would be a tendency of the gates to move from one position to another after having been pre-set. However, with the locking arrangement shown and described, the doors or gates can be fixed at a particular required pre-set elevation.

In addition to the gauges and controls referred to above, a counter 292 is preferably linked with the shaft 100 extending to the left as shown in FIGURE 2. This counter 292 visually indicates the number of revolutions of the shaft 100 and in turn the number of revolutions of the compartmented metering drum 76. Accordingly, knowing the capacity of the compartmented metering drum, the meter 292 indicates how much cement has been dispensed from the cement tank, for a given operation. A similar metering device 294 can also be provided to indicate the volume of water which has been dispensed into the mixing trough 10 during any given

operation. By comparing the volume of dispensed water with the volume of dispensed cement, the operator can readily check the water-cement ratio chart and make sure that the dispensing has been in accordance with the pre-selected conditions for a given mixture.

The cement indicator of counter 292 further serves to indicate to an operator the total quantity of material which has been used, i.e., the number of yards of concrete which has been dispensed into the mixing trough. In turn, the meter 292 will further indicate the number of yards of concrete dispensed from the mixing trough in the event that the entire material passing through the trough is discharged therefrom.

As shown in FIGURE 16, the drive shaft 14 is shown leading through the clutch 64 into the gear box 62. Operated off the shaft 14 is a hydraulic pump 300 which feeds a hydraulic motor 302 used to drive the mixing trough agitator, as explained more fully below. The hydraulic pump 300 is disposed in advance of the clutch 64 and feeds to the hydraulic motor 302 through the lines 304 and 306. Also driven from the drive shaft 14 is a water pump 308 which is connected at its inlet with the water tank 18, and which feeds to a line 310 at the outlet of the water pump for discharging the water into a water regulator, such as the regulator valve indicated at 312. The water regulator valve in turn feeds through a shut-off valve 66 on to a flow valve 314 and through a flow meter 314a. From the metering valve 314 the conduit 316 extends into or above the trough 10 for discharge of the water thereto. The regulator valve 312 receives water under pressure through the line 310 from the pump 308 and serves to insure that a constant supply of water under a predetermined pressure is maintained in the line 310. The shut-off valve 66 is mechanically linked with the operating handle of the clutch 64 as indicated by the dotted lines 65 in FIGURE 16. In this manner, operation of the clutch 65 to its disengaged position in turn operates the shut-off of valve 66 to stop the water supply through the line 316 into the mixing trough. The flow valve 314, on the other hand, serves to meter the quantity of water which is supplied through the line 316, and in turn to the ultimate mixture in the trough whereby the slump or water content can be adjusted.

By means of a handle on the metering valve 314, and a pointer thereon associated with a gauge (not shown), the metering valve 314 can be opened by the handle to any pre-selected position. Such a position would be determined from a chart supplied by the manufacturer of the apparatus for showing not only the position of the handle, but also the position of the respective operating wheels 268 and 270 which control the respective gates 256 and 258 associated with the outlet openings 250 and 252 for the sand and gravel compartments 22 and 24. The water would thus be controlled through selective operation of the handle on the metering valve in accordance with the respective openings of the gates on the sand and gravel compartments so that the water, sand, and gravel are adjusted in predetermined ratio settings with respect to the amount of cement being dispensed from the tank 8. The amount of cement being dispensed would, by comparison, remain relatively fixed while the supply of the other components would be adjusted with respect thereto, since the adjustments are on the sand, gravel and water discharge mechanisms, rather than on the cement compartmented metering drum 76. However, if in a given operation, cement were not to be supplied to the mixture at any particular time, then the handle 104 of the clutch 102 would be operated to move such clutch to a disengaged position thus selectively shutting-off the supply of cement to the mixture.

Notwithstanding the above, it should be noted from FIGURE 16 that the hydraulic pump 300 and the water pump 308 continue to operate even when the clutch 64

is temporarily disengaged to halt dispensing of cement. Continuous operation of the hydraulic pump 300 is particularly important because this permits mixing in and delivery from the mixing trough 10 to continue, even though supply of ingredients thereto has been stopped.

As shown in FIGURES 17 and 18, the mixing trough 10 includes a pair of fixed opposed side members 320 and 322 which extend longitudinally of the trough for the entire length thereof. These side members 320 and 322 form the upper side portions of the trough, with the lower portion of the trough being formed by a flexible arcuate member 324. Disposed respectively along the side members 320 and 322 are a pair of longitudinally extending metal strips 326 and 328 having depending flanges 330 and 332. The depending flanges 330 and 332, respectively, clamp the sides of the flexible member 324 to the outer surfaces of the side members 320 and 322. Securing means such as bolts can be used to secure the respective strips to the respective sides and thereby secure the flexible bottom member 324 in position. It should be here understood that the flexible bottom member 324 can take the form of a rubber sheet or any other known flexible composition having similar resistive characteristics so that abrasion thereon will not cause excessive wear thereof. It is important to understand that member 324 permits the mixing trough 10 to accommodate coarse aggregate without malfunction of the mixing arrangement even on a continuous basis.

The side members 320 and 322 and the bottom flexible member 324 form an elongated trough 10 having steel upperside portions and a flexible lower base portion. The upper side portions 320 and 322 are maintained in spaced apart relation by the end plate 334 at the outermost end thereof. The side portions 320 and 322 are further supported along their longitudinal length by a grill or rod arrangement 336 which terminates inwardly of the inner end of the mixing trough, or in other words, terminates forwardly of the end wall 338 of the trough 10. The inner end of the trough is secured to a swivel coupling means generally designated 340 secured to the respective side members 320 and 322 of the trough. In this connection, attention is further directed to FIGURES 14, 15 and 17 wherein it will be noted that a circular ring member 342 is provided with depending flanges 344 and 346 at the side thereof. The ring member 342 is also provided with an outwardly extending peripheral flange portion 348 which bears upon an inwardly extending flange 350 on an upper ring coupling member 352. The upper coupling member or ring 352 is secured to the base of the respective channel members 36 and 38 by means of suitable plates and braces, not shown herein. By this particular construction, the ring support member 352 essentially serves as a swivel mounting disposed therein.

The swivel arrangement of the respective ring members 342 and 352 with the cooperating flanges previously described, serve to swivelly mount the mixing trough 10 with a material being discharged into the mixing trough through the openings between the respective ring members. The swivel is thus disposed under the outer or rear end of the conveyor 30 so that the material which is carried thereby is discharged therefrom through the swivel coupling 340 and into the inner end of the mixing trough 10. A pair of links 360 and 362 connect to the trough 10 and are journaled upon the shafts 356 and 358 to thereby secure the trough to the coupling means 340.

If desired, suitable flexible wall guides or chute members can be provided adjacent the swivel member 352 and in association with the conveyor 30 so as to guide the material discharged from the conveyor into the trough through the swivel joint.

It should be noted that the upstanding support brackets or links 360 and 362 which are pivoted to the shafts 356 and 358 and secured thereto by means of conventional means such as cotter pins, not only serve to support and

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couple the mixing trough 10 with the ring member 342 but additionally serve to support the mixing trough whereby the same can be pivoted to any given number of vertical positions. In this manner, the mixing trough 10 would be moved during transit of the vehicle from the generally horizontal position thereof shown in FIGURES 1 and 2 to a vertical position. In the vertical position, a carrying frame 400 as shown in FIGURE 2, projecting from the channel frame 66 at the rear of the apparatus would serve to support the mixing trough 10. By means of the apertures 402 and 404 in the frame 400, the trough is aligned with corresponding apertures in the side walls thereof so that pins can be passed through the aligned apertures to maintain the trough in a vertical position adjacent the rear of the vehicle. Mere removal of such pins from the aligned apertures releases the trough 10 so that the same can be lowered to any desired generally horizontal position or rearward operating inclined position.

To this end, and as further shown in FIGURE 2, a winch 408 is carried at the rear of the apparatus, and from this winch, a cable 410 passes over a pair of elevated pulleys 411 and 412 and terminates in an eye 414 which is secured to a hook 416 on the outward end of the mixing trough 10. Thus, operation of the winch by means of a handle 418 moves the cable 410 inwardly or outwardly and thereby raises or lowers the mixing trough 10 with respect to its pivotal mounting at the swivel joint whereby the same can be maintained at a given pre-set desired elevation or angle of inclination.

As further shown in FIGURES 2 and 18, the mixing trough 10 includes a plurality of spiral flights generally designated 450 disposed about the central longitudinally extending shaft 452. In addition to the spiral flights 450, a plurality of mixing blades 454 are carried on the shaft 452, as shown in FIGURE 19.

These mixing blades serve to pick the material up from the periphery of the mixing trough and essentially drop the same to thereby effect a desired tumbling action for aiding in mixing. The shaft 452 along with its spiral flights 450 and mixing blades 454, provide an agitator and conveyor which properly mixes the material dispensed into the mixing trough and conveys the same rearwardly during the mixing operation. It is to be noted from FIGURE 2 that the water line 316 leads into the mixing trough 10 at the base thereof i.e., at the end thereof nearest the vehicle. The water is thus supplied to the ingredients as they enter the mixing trough, whereby the water can be mixed with the dry ingredients at the base of such trough and as such material moves outwardly therefrom.

The shaft 452 is journaled in respective bearings at opposite ends 334 and 338 of the trough 10 which bearings are carried in the hydraulic motor 302 and in the wall 333 of the mixing trough 10. The hydraulic motor 302 is fed by lines 304 and 306 which lead from the hydraulic pump 300 driven by the primary drive shaft 14 as previously described in connection with FIGURE 16.

Referring now to FIGURE 12, it will be noted that a level indicating means 500 is shown as being pivotally secured to a side wall of the trough 10. This level indicating means 500 includes a plate member 502 which is pivoted about a pivot shaft or pin 504 to the side wall 322 of the trough 10. The plate member 502 is provided with a slot 506 therein for receiving a locking bolt 508 therethrough. Moreover, the plate 502 carries thereon a level gauge 510 of the bubble indicator type. The plate 502 has a scale 514 at the outer end thereof opposite the pivotal attachment 504. The scale 514 can be aligned with an index mark 516 on the side of the trough 10. In this manner, the plate 502 can be pre-set in position by respective loosening and tightening of the bolt 508 to a given position. The winch 408 would then be operated to either let out or bring in the cable 410 until the level indicating means 500 maintained the bubble in the level indicator 510 in its centered position. At this time, the

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pre-set angle of inclination for the mixing trough will have been obtained, and the winch operation would be stopped to maintain the mixing trough 10 at the pre-set inclination. This pre-setting of the elevation of the mixing trough is correlated to the pre-set volume of water, sand and coarse aggregate supply and also to the pre-set quantity of cement so that a given ingredient mixture is mixed with the predetermined action to obtain an ultimate concrete mixture having predetermined characteristics of both ingredient proportion and mixing quality.

Although not essential to the basic operation of the present apparatus, it is desirable to indicate to the operator of the apparatus when the supply of cement in the tank 8 has been exhausted. To this end, an indicator means is provided, such as that shown in FIGURE 13, and generally designated 600. As should be understood, the cement from the bin 8 discharges through the outlet 60 of the discharge compartment 68, in a substantially constant flow. Thus, in order to allow the indicator means 600 to indicate this constant flow, a feeler finger means 602 is pivotally mounted by a pivot pin 604 adjacent the outlet of the discharge compartment. The feeler finger means includes a bar 606 projecting from the finger 602. With a continuous flow of cement through the outlet 60, the feeler finger means 602 assumes its full line or downward position shown in FIGURE 13. However, the finger is normally biased upwardly by a tension spring 608 affixed on the wall of the discharge compartment 68. The spring 608 tends to urge the feeler finger means 602 to its upper or dotted line position, but the finger resists such upward bias as long as the cement is flowing constantly, since the force of the flowing cement overcomes the biasing effect of the spring 608.

It should be noted, however, that when the supply of cement from the tank 8 decreases sufficiently so that a constant flow no longer occurs, then the feeler finger means 602 will move to its upper or dotted line position, and the finger bar 606 thereby comes into contact with a micro-switch 610. When the finger contacts the micro-switch 610, a circuit is closed and a light 612 is activated so that the operator is made aware of the fact that there has been a termination of flow from the tank 8. The feeler finger means 602 would then be disposed in the path of the outer ends of the vanes 74 so that such vanes would move the feeler finger 602 back and forth thereby causing alternate engagement of the micro-switch 610 by the bar 606. Such alternate engagement would result in a flashing of the light 612 to thereby indicate that the supply of cement has been exhausted. If desired, an adjustment means can also be provided at the fixed end of the spring 608 to adjust the tension thereof for desired operation.

It should be apparent from the preceding description that there is no necessity for cleaning the respective ingredients storage tanks. However, it is desirable to clean the mixing trough at the end of any given operation, and to this end, a wash-out hose connects through a valve with a line leading from the clean water or non-chemical additive water carried on the apparatus.

Another further addition to the present apparatus contemplates the addition of an additive bin which would dispense additives into the mixture in controlled relation, much as in the manner that the cement is dispensed, but on a smaller scale. Such an arrangement would eliminate the need for using different watering tanks and the plating of the interior of one given tank so as to prevent undesired reaction or rusting thereof in view of the additive which is being used. The additional metering bin could handle either liquid or dry material, depending on the particular requirements for a given operation. It should also be here noted that the air supply referred to above in connection with the description of the aerating mechanism is preferably operated from the reserve air supply generated by the truck air brake system while the truck is standing stationary during the concrete com-

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pounding and mixing operation. Moreover, additional air vibrators attached to the underside or slope walls of the tank 6 can also be used to loosen the material therein, if desired. Such air vibrators would similarly be operated from the air brake system of the vehicle, but under a manual control.

Attention is now directed to another embodiment of the present invention which embodiment is illustrated in FIGURES 20 through 22. This second embodiment differs from the preferred embodiment previously described insofar as certain delivery and discharge mechanisms and further in the type of discharge and mixing of the cement ingredients into a mixing area. More particularly, it will be seen that numeral 10' designates generally a suitable form of apparatus consisting of a tank truck for carrying the components from which a concrete mixture is to be formed, the same including the usual wheel chassis indicated generally by the reference numeral 12' and having a tank structure 14' mounted thereon. Although the tank 14' is shown as being of cylindrical configuration, it is obvious that it may be formed and constructed in other suitable shapes as desired.

As will be noted from FIGURE 21, the rearward portion of the tank body 14' is provided with a transverse partition 16' which extends from the top of the tank downwardly and rearwardly thereof to thus define at the rear-most portion of the tank a chamber 18' which extends across the entire width of the tank and between the partition 16' and the rear end wall 20' to thus provide a cement compartment in which dry cement is stored. A filling opening 22' is provided for filling and obtaining access to the cement compartment 18', which is provided with an upwardly movable closure member 24' in the form of a plate and which is secured as by a conventional fastener 26'.

Extending forwardly from the partition 16' and toward the dish end wall 28' of the tank is a longitudinally extending vertically positioned medial dividing wall or bulk head or partition 30', which divides the remaining or forward portion of the tank into two separate compartments 32' and 34' which lie on opposite sides of the partition 30' as more clearly shown in FIGURE 20. One of these compartments 32' may constitute a separate storage chamber for sand, while the other compartment 34', may constitute a separate storage chamber for gravel or other coarse aggregate. Each of these compartments extends from the top to the bottom of the tank and from the front wall 28' rearwardly to the partition 16'.

Referring again to FIGURE 21, it will be observed that the cement chamber 18' is provided with downwardly converging bottom or side walls 36' whose medially depressed portion provides a trough-like bottom which is disposed at the bottom of the tank and which thus defines the mixing chamber 38', the latter lying between the partition 16' and the rear end wall 20' as well as below the bottom wall 36' of the cement chamber. In a manner to be subsequently set forth, each of the sand, gravel or other coarse aggregate and cement components of the ultimate concrete mix, are delivered in measured quantities into the mixing chamber 38' where, if desired, water is introduced therein to make a wet mix, and thereafter the mixture, whether wet or dry, is discharged from the bottom of the chamber 38' through a delivery conduit 40'. As shown best in FIGURE 20, there is coupled in any suitable manner to the lower end of the delivery conduit the upwardly projecting inlet sleeve 42' of a horizontally extending cement mix delivery conveyor casing 44'. One end of this conveyor casing is supported by a coupling means 46' on the discharge conduit 40', while the other end is maintained in vertically adjusted position by a suspension member which may consist of an adjustable chain 48'. Obviously, by adjusting this chain, as will be apparent from consideration of FIGURE 21, the delivery conveyor casing may be disposed in various inclinations and may be horizontally swung to a desired position. Suitably connected

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to the end of the conveyor casing which is remote from the coupling 46', is a hose 50' or other discharge means by which the cement mix, either wet or dry, is delivered under pressure to the discharge nozzle (not shown) which may be of any desired character to thereby deliver the cement mix to a desired location.

In order to effect a forceful feeding of the cement mix, the conveyor casing 44' is provided with an auger type conveyor screw 52' which is suitably journaled in the detachable end plates 54' and 56' of the casing and which screw has, as shown in FIGURE 21, a shaft 58' extending therefrom to receive a driving gear or sprocket 60' in order that rotation may be imparted to the conveyor screw as by a sprocket chain 62' driven from any suitable source of power.

It will be now understood that by imparting rotation to the conveyor auger screw, the mix, whether it be wet or dry, received from the mixing chamber 38' is forceably delivered under pressure to the conveyor casing 44' and the delivery hose 50' to its desired destination. It is to be noted that water may be added to the measured mix dry ingredient of the concrete mix by any suitable means either in the mixing chamber 38' or during the passage of the dry mix therefrom through the conduit 40', or even during passage of the dry mix through the conveyor housing 44', or finally by applying the water directly to the dry mix by means of an appropriate type of mixing nozzle at the end of the hose 50'.

It is to be emphasized at this point, however, that the connection of the delivery conveyor casing 44' with the mix delivery conduit 40' is such as to effect both a horizontal swinging movement and a swiveling or tilting movement in order to enable the casing and the hose attached thereto to be disposed conveniently in a large variety of different positions.

In order to control the quantity and rate of delivery of the cement from the cement chamber 18' into the mixing chamber 38', there is provided a measuring or metering valve assembly controlling communication through the partition or bottom walls 36' of the cement chamber 18'. This control means, as will be best apparent from a consideration of FIGURE 21, consists of discharge openings or ports 66' which are controlled by a metering valve assembly 68'. The latter may conveniently consist of a plurality of metering drums 70' of any suitable construction and carried by a valve shaft 72' to which they are rigidly secured, the latter being journaled in suitable bearings as at 74' in partition 16' and at 76' in the end wall 20'. The periphery of each drum is provided with a plurality of circumferentially spaced pockets or recesses 80'. The arrangement is such that the valve body seals off the port 66' and prevents passage of the dry cement from the cement chamber 18' therethrough until the valves are rotated, at which time successive recesses or valve pockets 80' each deliver a measured charge of the cement powder through the ports and into the mixing chamber 38' therebeneath.

The end of the shaft 72' extends through the end wall 20' and is provided with an automatic actuator means including a ratchet wheel 82' thereon, as shown particularly in FIGURE 21. Timed and controlled movement is imparted to the ratchet wheel thus effecting operation of the control valve 68' as set forth hereinafter.

A manually operated control means is provided for effecting communication of the interior of the mixing chamber 38' with the delivery conduit 40'. For this purpose, the upper end of the conduit 40' is provided with a delivery port 84' which is controlled by a valve 86'. This valve has an actuating stem 88' and the valve and the stem are disposed entirely within the mixing chamber 38' and are vertically lifted and lowered to thereby selectively uncover or close the delivery port 84'. In order to effect controlled operation of the delivery valve, a suitable mechanism such as the actuating mechanism to be now described is provided.

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It will be observed that a manually operated delivery valve lever 90' is mounted upon the end wall 20' of the tank 14' and cooperates with a retainer bracket or hook 92' as shown in FIGURE 20, to thereby retain the valve in the open position shown in FIGURE 21. The lever 90' has one end turned perpendicularly to extend through the end wall 20' and a bearing 94' disposed therein along the central axis of the tank. This perpendicularly turned end provides a shaft 96' extending into the interior of the tank. The shaft 96' has a crank arm 98' which crank arm, in turn, is pivoted to a link 100' extending through a restricted opening 102' in the bottom wall 36' of the cement chamber 18'. The latter has its other extremity pivoted at 106' to a bracket 108' disposed upon the interior of the tank and within the mixing chamber and intermediate its ends, the lever is pivoted at 112', as shown in FIGURE 21, to the bifurcated upper end of the valve stem 88'. It will thus be observed that the weight of the lever 90', the link 100' and the lever 104' together with the weight of the valve and valve stem serve to retain the valve closed upon its seat except when the valve is manually lifted therefrom and retained in this position by engagement of the lever 90' with the retaining bracket 92'.

In some instances, the valve 86' and valve stem 88' can be used not only to control the flow of the mix from the mixing chamber to the delivery conduit 40' but may also be employed to supply water to the mix. For this purpose, there may be provided any suitable source of water such as the connection 114' from a water supply conduit with the hollow stem 88' of the valve, while the lower end of the valve may be provided with a nozzle 116' which projects downwardly below the valve and discharges water into the delivery conduit 40'. By this means, water may be conveniently supplied to the measured dry mix to form a wet concrete mix as the dry mix passes from the mixing chamber into the mixture delivery casing 44'. In addition, when the valve is closed upon the seat 84', the water may be supplied in order to cleanse the conduit 40', the conveyor casing 44' and the conveyor screw 42' therein and the hose 50'.

Means are also provided for automatically and positively and at a precise controlled and measured rate, delivering sand and gravel from their individual segregated storage compartments in the tank into the mixing chamber for mixing therein with the cement, and if desired, with water. For this purpose, as will now be best apparent, from the consideration of FIGURE 21, there are provided in the bottom portion of the compartments 32' and 34' and preferably closely adjacent to the divider wall 30' therebetween a pair of auger screw conveyors each designated generally 120'. These conveyors are preferably of identical construction and as shown in FIGURE 21, may have their opposite extremities mounted and suitably supported by brackets 122' with a bearing 124' disposed at the forward wall 28' of the tank and in a bearing assembly 126' disposed in the partition 16' adjacent the bottom of the same. The conveyors are each provided with an axial extending shaft 128' which extends through the rear wall 20' of the tank, is journaled in a bearing bracket 130', and is connected to an operating means to be subsequently described.

Referring now again to FIGURES 20 and 21, it will be observed that the central dividing wall 30' which separates the sand and gravel chambers 32' and 34' from each other, although having its bottom, front and rear edges continuously united to the bottom of the tank in the front end wall 28' and the partition 16' respectively, has its upper edge spaced downwardly from the top of the tank. A pair of longitudinally spaced filling openings 132' and 134' are provided in the top wall of the tank, these being controlled by manually operated closure plates 136' having control handles 138' hereon. Extending downwardly from these filling openings are laterally and oppositely inclined chutes 140' and 142'. The lower ends of these

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chutes discharge into the compartments 32' and 34' respectively, in order that sand and gravel may be supplied to these compartments.

Power operating means are provided for effecting control in variable speed and capacity operation of the means for delivering cement, sand and gravel to the mixing chamber. This power operating means may conveniently consist of any suitable source of power, such as the power plant of the vehicle or of an auxiliary or standby engine provided specifically for this purpose. In any event, a source of power is connected to the shaft 150' which may be termed the power input shaft of the apparatus and which is best shown in FIGURE 20. From the input shaft, power is conveyed by means of a sprocket chain 152' to a sprocket gear 154' on one of the conveyor auger shafts 128'. From the latter, a further sprocket 158' and a sprocket chain 160' convey power to the sprocket gear 162' on the other of the auger conveyor shafts 128'. Thus, power is continuously available through each of the auger shafts by means of which sand, and gravel are delivered from the compartments 32' and 34' into the mixing chamber 38'. Any suitable means, not shown, may be provided for varying the speed ratio of the two conveyors 120' with respect to each other, it being understood that the combined speeds of the two conveyors will be controlled by proper control of the power input shaft 150'.

From the sprocket gear 162' of the last driven conveyor shaft 128', power is also supplied to the ratchet wheel 82' of the automatic actuating means for the control valve 68'. This power supply is provided by means of a lever 170' which is disposed on the exterior of the tank and has one extremity pivoted as at 172' to the end wall 20' thereof. The other extremity of this lever is provided with an elongated longitudinally extending slot 174' in which lies a bolt 176' secured in a selected one of a plurality of circumferentially spaced threaded apertures 178' carried by the sprocket wheel 162'. These apertures are at different distances from the axes of rotation of the shaft 128' and of the sprocket gear 162', so that they will impart different amplitudes of operation to the lever 170'. The latter, in turn, has at a mid-portion thereof a pair of dogs 180' and 182' pivoted to the lever as at 184' and 186', the dogs having spring means such as leaf springs 188' and 190' for yieldingly urging the dogs into engagement with the ratchet wheel 82'. The arrangement, as shown in FIGURE 22, is such that as an oscillating motion is imparted to the lever 170' about its pivot 172', the dogs 180' and 182' will in alternation impart a step-by-step rotation of the ratchet wheel 82' and thus to the measuring valve assembly 68' connected therewith. It will be thus observed that the operation of the measuring valve of the cement is positively interconnected with means for measuring the quantity of sand and gravel delivered to the mixing chamber and that through the connection of the sprocket wheel 162' to the lever 170', relative adjustment of the quantity of cement delivered into the mixing chamber with respect to the quantity of sand and gravel may be accordingly appropriately varied.

It is within the preview of this invention to also mount upon the chassis 12', means for supplying the necessary or desired water to mix with the dry concrete mix and also to supply air under pressure to the interior of the tank, when desired, in order to facilitate flow of the materials therein into the mixing chamber and in order to facilitate the flow of the mixed materials from the mixing chamber into the delivery conduit therefrom. For this purpose the interior of the tank 14' will be made air-tight. It will be observed that free communication is provided for the air and thus for providing equal air pressure to each of the chambers 32', 34' and 18'.

After reading the foregoing detailed description, it should be apparent that the objects set forth at the outset of this specification have been successfully achieved. Accordingly,

What is claimed is:

1. A concrete mixing truck comprising a mobile frame having a first and a second tank thereon, partition means in said first tank for dividing the same into separate compartments for storing concrete ingredients, first operable means for feeding ingredients from each of said compartments, including means for adjusting the ratio of the ingredients fed from each compartment, second operable means for feeding an ingredient from said second tank, mixing means including an elongated mixing trough having a mixing element therein, delivery means disposed to receive the ingredients fed from said compartments and second tank and effect their discharge into the mixing means, and means for simultaneously controlling the rate of operation of said first and second feed means.

2. The apparatus of claim 1 wherein said delivery means includes an endless conveyor disposed in the bottom portion of said first tank in underlying relation to said partition means for receiving ingredients from each of said separate compartments therein, said conveyor extending rearwardly toward said mixing means, an outlet in each of said compartments disposed in overlying juxtaposition to said endless conveyor, a pair of gates having a gear rack on respective faces thereof, said gates being mounted on said first tank for reciprocable vertical movement over respective ones of said outlets, control means comprising control wheel means connected to said gates by means of a pair of shafts, and a gear secured to each one of said shafts and being engageable with respective ones of said gear racks for individually adjustably controlling the height of said gates whereby the flow of ingredients from said one tank to said mixing means is selectively controlled, a compartmented metering drum co-operating with said second tank for discharging the ingredients therein onto said endless conveyor, said drive means comprising a drive shaft and a clutch means operably connected therewith, first coupling means drivingly connecting said drive shaft and said conveyor through said clutch, second coupling means drivingly connecting said first coupling means with said compartmented metering drum through said clutch means, and third coupling means drivingly connecting said mixing means directly with said drive shaft, whereby disengagement of said clutch means stops said conveyor and said compartmented metering drum without stopping said mixing means, operating means for engaging and disengaging said clutch means, said operating means for said clutch and said control wheel means being disposed in adjacent position on the side of said truck whereby the same can be controlled by a single operator.

3. The combination of claim 1 wherein said mixing means comprises a mixing trough longitudinally aligned with said first and second tanks and extending rearwardly thereof, said trough having a flexible bottom wall, said trough being pivotally secured to said mobile frame for movement in a horizontal and vertical plane relative to said first and second tanks, shaft means extending longitudinally of said trough supporting a plurality of spaced apart mixing blades and said shaft means also supporting screw conveyor flights thereon, and means for driving said shaft means.

4. The combination defined in claim 3 wherein said flexible bottom wall extends arcuately over more than one-half the periphery of said screw conveyor flights.

5. The combination of claim 1 wherein said delivery means comprises an endless conveyor disposed in said first tank below said partition means for receiving ingredients from each of said separate compartments therein, said conveyor extending rearwardly toward said mixing means, said second feeding means including metering means disposed in said second tank for discharging predetermined quantities of the ingredient therein onto said conveyor for delivery to said mixing means, and said controlling means comprising drive means for simultaneously operating said conveyor, said metering means and said mixing means.

6. The combination of claim 5 wherein said mixing means comprises a mixing trough longitudinally aligned with said first and second tanks and extending rearwardly thereof, said trough having a flexible bottom wall, said trough being pivotally secured to said mobile frame for movement in a horizontal and vertical plane, shaft means extending longitudinally of said trough for supporting a plurality of spaced apart mixing blades and screw conveyor flights thereon, means for driving said shaft means, said flexible bottom wall extending arcuately over more than one-half the periphery of said screw conveyor flights.

7. The combination of claim 1 wherein said partition means comprises a lower fixed member and an upper pivotal plate member, said upper pivotal plate member having a securing plate at each end thereof for attachment to said first tank at selective positions along the end walls thereof.

8. The combination of claim 7 wherein said lower fixed member includes a longitudinally extending shaft secured along the top edge thereof, said upper pivotal plate member including a forked portion along the lower edge thereof, said forked portion being engageable with said shaft for pivotal movement of said upper plate member about said lower fixed member.

9. A concrete mixing truck comprising a mobile frame having a plurality of tanks thereon for storing concrete ingredients, a mixing trough having a driven mixer therein, delivery means associated with each of said tanks for delivering the ingredients therein to said mixing trough, said mixing trough being disposed in longitudinal rearwardly extending alignment with said tanks and being pivotally mounted on said truck for movement in a horizontal and vertical plane relative to said tanks, drive means for simultaneously driving said delivery means and said mixer, and metering means associated with one of said tanks for indicating the total discharge of its ingredients into said mixing trough.

10. The combination of claim 9 wherein said delivery means comprises an endless belt conveyor disposed in one of said tanks centrally thereof and a compartmented metering drum in the other of said tanks, feeder means disposed within and transversely of said other tank for directing the ingredient therein toward said compartmented metering drum, said drive means operably connecting said conveyor, said compartmented metering drum and said feeder means for simultaneous selective operation.

11. The combination of claim 10 wherein said drive means comprises a drive shaft and a clutch means operably connected therewith, first coupling means drivingly connecting said drive shaft and said conveyor through said clutch means, second coupling means drivingly connecting said first coupling means with said compartmented metering drum and said feeder through said clutch means, and third coupling means drivingly connecting said mixer directly with said drive shaft, whereby disengagement of said clutch means stops drive of said conveyor, said compartmented metering drum and said feeder without stopping drive of said mixer.

12. The combination of claim 9 further including a control assembly for selectively controlling the rate of flow from one of said tanks to said mixing trough, said control assembly comprising outlet means in said one tank in overlying juxtaposition to said delivery means, gate means, gear rack means on said gate means, said gate means being mounted on said one tank for reciprocable vertical movement over said outlet means, control means comprising control wheel means, shaft means connecting said control wheel means to said gate means, and gear means secured to said shaft means and engageable with said gear rack means for adjustable controlling the height of said gate means whereby the flow of ingredients from said one tank to said mixing trough is selectively controlled.

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13. Apparatus for storing and mixing ingredients from which a concrete mixture is formed, said apparatus comprising a frame, a first tank supported on said frame, partition means in said first tank dividing the same into two longitudinally extending sections for separately storing ingredients of concrete, a second tank for storing another ingredient of concrete, a mixing trough disposed rearwardly of said first and second tanks, said mixing trough being pivotally secured to said frame for pivotal movement in a vertical and horizontal plane, operating means secured to said frame and operably engaging said mixing trough for moving the same to any desired position, delivery means extending longitudinally of and disposed in the bottom portion of said first tank in contacting relation to each of said sections, adjustable gate means disposed at the rear of each of said sections in overlying relation to said delivery means, metering means disposed in the bottom portion of said second tank for discharging predetermined metered quantities of said ingredient therein onto said delivery means, said delivery means terminating in overlying relation to said mixing trough for discharging said ingredients thereon into said mixing trough, said metering means overlying said delivery means, and operating means for simultaneously controlling said delivery means and said metering means at selectively predetermined proportional rates of speed.

14. The combination of claim 13 wherein said operating means includes a drive shaft and a clutch means operably connected therewith, first coupling means drivingly connecting said drive shaft and said delivery means through said clutch means, second coupling means drivingly connecting said first coupling means with said metering means through said clutch means, third coupling means drivingly connecting said mixing trough directly with said drive shaft, water supply means, water pump means connected to said water supply means and being drivingly connected with said drive shaft, and valve means disposed between said water pump means and said mixing trough for regulating the flow of water from said pump means to said mixing trough.

15. The combination of claim 14 further including a hydraulic motor means for operating said mixing trough, said motor means being mounted on said trough, said third coupling means comprising a hydraulic pump, and conduit means drivingly connecting said hydraulic pump to said hydraulic motor means.

16. The combination of claim 13 wherein said operating means for moving said mixing trough comprises a winch secured to said frame and a cable extending from said winch to said mixing trough.

17. Apparatus for storing, transporting and mixing ingredients from which a concrete mix is to be formed, said apparatus comprising a wheeled chassis, a first tank means mounted on said wheeled chassis, partition means in said first tank means for dividing the same into a plurality of compartmental sections for receiving separate ingredients of said concrete mix, a second tank means for receiving another ingredient of said concrete mix, a mixing trough pivotally secured to said chassis, said trough extending rearwardly of said first and second tank means, delivery means in said first tank means for directing a controlled flow of the ingredients therein to said mixing trough, metering means in said second tank means for discharging said ingredient therein onto said delivery means, feeder means disposed in said second tank means for directing the ingredient therein toward said metering means, aerating means cooperating with said second tank means for aerating the ingredient therein and preventing agglomeration thereof, and drive means for synchronously driving said delivery means, said metering means, said feeder means, said aerating means and said mixing trough.

18. The apparatus of claim 17 further including at least one water tank mounted on said chassis, conduit means for directing water from said water tank to said mixing trough, and means for metering the flow of water through said conduit means.

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19. The apparatus of claim 17 wherein said delivery means comprises an endless belt conveyor extending through said first tank means centrally below said partition means and rearwardly toward said mixing trough, said conveyor comprising a pair of longitudinally spaced apart support means, a belt trained between said support means, a belt tensioning assembly supporting one of said support means, and a driven conveyor shaft connected to the other of said rollers.

20. The apparatus of claim 19 wherein said metering means comprises an outlet chamber, a compartmented metering drum disposed in said outlet chamber, said outlet chamber being disposed in overlying relation to said belt conveyor, a first shaft extending through said chamber transversely thereof, said compartmented metering drum being mounted on said first shaft, said feeder means comprising a second shaft extending transversely through said second tank means, a pair of opposed spiral flights carried on said second shaft, said first shaft, said second shaft and said driven conveyor shaft being connected by means of a plurality of chain and sprocket members for simultaneous and synchronous operation thereof, and clutch means for disengaging the connection between said first shaft and said second shaft.

21. The apparatus of claim 20 further including cam means on said first shaft for selectively sequentially operating said aerating means.

22. Apparatus for storing and mixing ingredients from which a concrete mix is to be formed, said apparatus comprising a frame, first tank means mounted on said frame, said first tank means having a pair of compartmental sections therein for receiving separate ingredients of the concrete mix, second tank means mounted on said frame rearwardly of said first tank means, conveyor means disposed in said first tank means between said sections and extending rearwardly therefrom below said second tank means, selectively adjustable gate means disposed on the rear end of each compartmental section in overlying relation to said conveyor means for controlling the rate of flow of ingredients from said compartmental sections, metering means disposed in said second tank means for discharging a predetermined amount of said ingredient therein onto said conveyor means, a mixing trough pivotally secured to said frame rearwardly of and in longitudinal alignment with said conveyor means, drive means mounted on said chassis for simultaneously synchronously controlling said conveyor means, said metering means and said mixing trough, and clutch means operatively connected to said drive means for disengaging the same thereby stopping said conveyor means and said metering means while maintaining operation of said mixing trough.

23. The apparatus of claim 22 wherein said adjustable gate means comprise a pair of slidably mounted gates for obstructing respective openings in said compartmental sections, each of said gates being provided with a gear rack on one face thereof, gear means engaging each of said gear racks for selectively raising and lowering said gates over said openings thereby controlling the rate of flow on said conveyor means, and gear control means connected to each of said gear means for individually operating said gates.

24. The apparatus of claim 23 wherein said gear control means comprise a shaft extending from each of said gears to respective control wheels on the side of said first tank means, and a metering gauge associated with each of said control wheels for visually indicating respective settings of said gates.

25. Apparatus for storing and mixing ingredients from which a concrete mix is to be formed, said apparatus comprising a support frame, a plurality of ingredient storing devices mounted on said frame, a mixing trough, delivery means for simultaneously delivering said ingredients to said mixing trough at a controlled rate of flow, said mixing trough comprising a longitudinally extending frame

pivotally mounted relative to said support frame and including rigid side members and a flexible connecting member extending therebetween, a longitudinally extending drive shaft secured to opposite ends of said frame, a plurality of mixing blades secured to said shaft, spiral flights secured to said shaft, and means for changing the inclination of said mixing trough thereby selectively controlling the degree of mixing of said ingredients.

26. The apparatus of claim 25 further including hydraulic motor means mounted on said mixing trough for operating said drive shaft.

27. The apparatus of claim 26 further including a level indicator secured to one of said side members for selecting a predetermined degree of inclination for said mixing trough, said level indicator comprising a pivotally mounted plate, a bubble level secured to said plate, and a gauge cooperating with said plate for setting said plate at a predetermined inclination angle position.

28. The apparatus of claim 26 including means for simultaneously introducing water into said mixing trough while said ingredients are discharged into said mixing trough from said delivery means.

29. Apparatus for storing and mixing ingredients from which a concrete mixture is formed, said apparatus comprising a first tank means having a partition therein for dividing said first tank means into a pair of sections for receiving concrete ingredients therein, said partition being pivotally mounted for selectively changing the area of each of said sections, second tank means for receiving another concrete ingredient therein, mixing means for receiving ingredients from said first and second tank means and mixing the same into a predetermined quantity of concrete, said mixing means extending rearwardly of said first and second tank means and being pivotally mounted with respect thereto for movement in a horizontal and vertical plane, and means for delivering said ingredients from said first and second tank means to said mixing means.

30. The apparatus of claim 29 wherein said mixing means comprises an endless belt conveyor disposed in of opposite side walls and a flexible bottom wall secured along the edges thereof to said side walls, and a pair of end walls secured to respective ends of said side walls.

31. The apparatus of claim 30 wherein said trough further includes a drive shaft extending longitudinally within said trough, a plurality of blades secured to said shaft and being driven thereby, said blades comprising a plurality of mixing blades, a plurality of spiral flights and a plurality of lifting blades, and hydraulic motor means for operating said drive shaft.

32. The apparatus of claim 29 wherein said delivery means comprises an endless belt conveyor disposed in said first tank means, said conveyor extending from the front of said tank means towards said mixing means, a compartmented metering drum, a drive shaft disposed within said second tank means, said drum being secured to said shaft for rotation therewith thereby discharging metered quantities of the ingredient therein onto said endless belt conveyor.

33. Apparatus for storing, transporting and mixing ingredients from which a concrete mixture is formed, said apparatus comprising a wheeled chassis, first tank means supported on said chassis, partition means in said first tank means dividing the same into two longitudinally extending sections for separately storing ingredients of concrete, second tank means supported on said chassis for storing another ingredient of concrete, mixing means extending rearwardly from said first and second tank means, said mixing means being pivotally secured to said chassis at the rear thereof for pivotal movement in a vertical and horizontal plane, first delivery means extending longitudinally of and disposed in the bottom portion of said first tank means, adjustable gate means disposed at the rear of each of said sections in overlying relation to said first delivery means, second delivery means associated

with said second tank means for discharging metered quantities of said ingredient therein onto said first delivery means, said first delivery means overlying said mixing means for discharging all of said ingredients into said mixing means, operating means for simultaneously controlling said first delivery means, said second delivery means, and said mixing means at selectively predetermined proportional rates of speed, feeder means disposed in said second tank means for feeding said ingredient therein toward said second delivery means, and aerating means for maintaining said ingredient in said second tank means in non-agglomerated condition.

34. The apparatus of claim 33 wherein said partition includes a stationary bottom wall and a flexible upper plate member, said upper plate member being pivotally mounted on said bottom wall for movement between a first and second position.

35. The apparatus of claim 34 wherein said bottom wall includes a longitudinally extending shaft secured to the top edge thereof, said upper plate member including a forked portion along the lower edge thereof, said forked portion being engageable with said shaft for pivotal movement of said plate member about said bottom wall.

36. The apparatus of claim 34 wherein said first delivery means comprises an endless belt conveyor, said conveyor being disposed centrally below said bottom wall of said partition, said conveyor comprising a pair of longitudinally spaced apart support rollers, a belt tensioning assembly supporting one of said rollers, and a first shaft connected to the other of said support rollers.

37. The apparatus of claim 36 wherein said second delivery means comprises an arcuately walled discharge compartment depending from said second tank means, a compartmented metering drum rotatably mounted in said compartment, a second shaft extending through said compartment, said drum being secured to said second shaft for rotation therewith, said drum comprising a core portion secured to said second shaft, a plurality of vanes extending radially from said core portion toward the walls of said compartment defining a plurality of discharge areas therebetween, at least the outer portions of said vanes being flexible, and means drivingly connecting said first shaft with said second shaft.

38. The apparatus of claim 37 wherein said operating means comprises a drive shaft and a clutch operably connected therewith, said first shaft being drivingly connected to said drive shaft through said clutch, said second shaft being drivingly connected to said first shaft through said clutch, and a coupling means drivingly connecting said mixing means directly with said drive shaft, whereby disengagement of said clutch stops said conveyor, said compartmented metering drum and said feeder means while maintaining operation of said mixing means.

39. A concrete mixing device including mixing trough comprising oppositely spaced apart longitudinally extending side walls, end walls fixed to respective ends of said side walls, said end walls extending below said side walls, an arcuate bottom member being secured along opposite edges thereof to said side walls and at the ends thereof to said end walls, a drive shaft journaled in said end walls, motor means secured to one of said end walls for rotating said drive shaft, a plurality of mixing blades secured to said shaft, spiral flights secured to said drive shaft, a support frame and means for pivoting said trough in a horizontal and vertical plane relative to said support frame.

40. The mixing trough defined in claim 39 wherein said bottom wall comprises a flexible material and wherein said motor means is hydraulically driven.

41. The mixing trough defined in claim 40 wherein said trough is provided with a level indicator secured to one of said side walls for selecting a predetermined angle of inclination for said trough, said level indicator comprising a pivotally mounted plate, a bubble level secured to said plate, and a gauge cooperating with said plate for

setting said plate at a predetermined inclination angle position.

42. In a concrete mixing apparatus, a supporting frame, a tank having a lower longitudinally extending arcuate wall portion supported horizontally on said frame, an outlet in said arcuate wall portion, an arcuate discharge compartment in communication with said outlet, a rotary metering discharge means in said discharge compartment, rotatably mounted spiral feed means in said tank, disposed along said arcuate wall portion and arranged on rotation to forcibly feed concrete ingredients longitudinally toward said outlet, and means to feed air through said arcuate wall at spaced intervals along said feed means to agitate and aerate said concrete ingredients.

43. The concrete mixing apparatus of claim 42, wherein said discharging means comprises a rotatably mounted compartmented metering drum disposed in said discharge compartment, a transversely extending drive shaft, said drum secured to said drive shaft, a plurality of vanes extending outwardly from said drive shaft toward the walls of said discharge compartment whereby a plurality of recesses are formed for discharging a metered quantity of ingredients from said tank.

44. The concrete mixing apparatus of claim 43 wherein said means for aerating comprises at least one aperture in said tank, a mesh screen disposed in overlying relation to said aperture, an air supply, air valve means secured to said tank, said air valve means including an outlet in covering relation to said aperture, cam means secured to said drive shaft, a cam follower connected to said air valve means whereby rotation of said drive shaft intermittently engages said cam and follower thereby operating said air valve means.

45. The concrete mixing apparatus of claim 43, wherein said vanes are at least partially flexible, wherein said tank further comprises indicating means for visually indicating an empty condition in said tank, said indicating means comprising a pivoted arm member secured to said discharge outlet and being intermittently engageable with said rotating vanes, spring means biasing said arm member into a closed position, an electrical contact, a light signal connected to said electrical contact, said light signal being energized when said arm is in said closed position and in engagement with said contact, whereby continuous discharge of the ingredient from said tank biases said arm member into an open position and out of engagement with said contact.

46. The concrete mixing apparatus of claim 43 wherein said feeding means comprises a transversely extending feeder shaft, a plurality of opposed spiral vanes supported on said shaft, said vanes being rotatable with said shaft for moving the ingredient in said tank toward said discharge compartment, said feeder shaft extending outwardly from said tank, and means for drivingly connecting said drive shaft with said feeder shaft for simultaneous rotation of said drive shaft and said feeder shaft.

47. The concrete mixing apparatus of claim 46 wherein said aerating means comprises a plurality of outlets in the bottom of said tank, screen means covering said outlets for preventing passage of said ingredient therethrough, air valve means cooperating with said outlets for supplying intermittent sequential air bursts into said tank, cam means connected to said drive shaft for operating said aerating means, and clutch means connected to said drive shaft for disengaging said feeder shaft and said cam means while maintaining rotation of said drive shaft.

48. In a concrete mixing apparatus comprising a plurality of ingredient storing and discharge tanks, a mixing trough disposed in longitudinal alignment with said tanks and extending rearwardly therefrom, said mixing trough being pivotally mounted for horizontal and vertical movement relative to said tanks, delivery means for moving said ingredients from said tanks to said mixing trough, the improvement comprising, a drive shaft, a gearing assembly connecting said drive shaft to said delivery means,

and a clutch mechanism disposed between said drive shaft and said gearing assembly for disengaging said delivery means from said drive shaft.

49. The improvement of claim 48 further including a water pump, said water pump being drivingly connected to said drive shaft, a water supply connected to said pump for dispensing predetermined metered amounts of water into said mixing trough, and means for manually closing said water supply to said mixing trough while rotation of said drive shaft is maintained.

50. The improvement of claim 49 further including a hydraulic pump, hydraulic motor means supported on said trough, and hydraulic pump being connected to said motor means for operating said mixing trough, and means provided for disengaging said clutch while simultaneously maintaining operation of said motor means and mixing trough.

51. An apparatus for storing, transporting and mixing ingredients from which a cement mix is to be formed, said device comprising a tank means mounted on a wheeled chassis, said tank means having a plurality of compartmental sections therein for receiving separate ingredients of said cement mix, a mixing chamber disposed in said tank means adjoining said compartmental sections, delivery means in each of said compartmental sections for simultaneously directing a controlled flow of the ingredient therein to said mixing chamber, conduit means in connecting relation to said mixing chamber for discharging said cement mix therefrom, valve means disposed in said mixing chamber whereby said cement mix is discharged in a controlled rate of flow from said mixing chamber into said discharge conduit means, and a water supply nozzle integral with said valve means for simultaneously introducing water into said cement mix while the latter is discharged from said mixing chamber into said discharge conduit means.

52. An apparatus for storing, transporting and mixing ingredients from which a cement mix is to be formed, said device comprising a tank means mounted on a wheeled chassis, said tank means having a plurality of compartmental sections therein for receiving separate ingredients of said cement mix, a mixing chamber disposed in said tank means adjoining said compartmental sections, delivery means in each of said compartmental sections for simultaneously directing a controlled flow of the ingredient therein to said mixing chamber, conduit means in connecting relation to said mixing chamber for discharging said cement mix therefrom, valve means disposed in said mixing chamber whereby said cement mix is discharged in a controlled rate of flow from said mixing chamber into said discharge conduit means, said delivery means in at least one of said compartmental sections comprising at least one rotatably mounted drum having longitudinally extending peripheral recesses on the surface thereof, drive means connected to said drum for rotating the same at a selective predetermined rate whereby a measured charge of the ingredient in said one compartmental section is discharged into said mixing chamber, said drive means comprising a ratchet wheel drivingly connected to said drum, lever means pivotally connected at one end thereof to said tank means and having a slot in the other end thereof, means mounted on said lever for engagement with said ratchet wheel, gear means connected to the delivery means for one of said other compartmental sections, said gear means having a plurality of circumferentially spaced apertures in varying spaced relation to the connection of said gear means with said delivery means, and means disposed in a selected one of said apertures for engagement with the slot of said lever means whereby oscillating motion is imparted to said lever thereby rotating said ratchet wheel and said drum.

53. A cement mixing truck comprising a mobile frame with a tank thereon divided into separate sand, gravel and cement compartments and a separate mixing cham-

ber, means for discharging a cement mix from said mixing chamber, means for simultaneously conveying sand and gravel from their respective compartments into said mixing chamber, means for adjustably controlling the relative quantities of sand and gravel simultaneously delivered by said conveying means into said mixing chamber, means for delivering measured quantities of cement from said cement compartment into said mixing chamber, simultaneously with the delivery of sand and gravel, means for driving said conveying means, means connected to said driving means and said cement delivery measuring means for actuating the latter from the former, and adjusting means associated with said connected means for varying the quantity of cement delivered in proportion to the quantity of said sand and gravel delivered.

54. A cement mixing truck comprising a mobile frame with a tank thereon divided into separate sand, gravel and cement compartments and a separate mixing chamber, means for discharging a cement mix from said mixing chamber, means for simultaneously conveying sand and gravel from their respective compartments into said mixing chamber, means for adjustably controlling the relative quantities of sand and gravel simultaneously delivered by said conveying means into said mixing chamber, means for delivering measured quantities of cement from said cement compartment into said mixing chamber simultaneously with the delivery of sand and gravel, means for driving said conveying means, means connected to said driving means and said cement delivery measuring means for actuating the latter from the former, adjusting means associated with said connected means for varying the quantity of cement delivered in proportion to the quantity of sand and gravel delivered, and a manually operable control means extending to the exterior of said tank for varying the rate at which material is withdrawn from at least one of said sand and gravel compartments by said conveying means.

55. A method of mixing a plurality of ingredients to be formed into a concrete mixture of a predetermined volume, which ingredients are delivered to a mixing area from a plurality of storage tanks, said mixing area having a loading end and a discharge end thereof, said method comprising the steps of:

(a) moving said mixing area into a predetermined angular position whereby said mixing area is inclined toward the loading end thereof;

(b) discharging a metered volume of water into said mixing area while simultaneously delivering a metered quantity of said concrete ingredients into said mixing area;

(c) positively mixing said concrete ingredients and said water in said inclined mixing area by continuously turning said ingredients through an arcuate path and simultaneously lifting portions of said ingredients from said mixture and dropping the same back into said turning ingredients, with the angular position of said mixing area adjusted to determine the gravitational forces exerted on said ingredients and thereby determining the degree of mixing by said turning operation; and,

(d) simultaneously conveying said mixture upwardly through said inclined mixing area toward said discharge end thereof for discharge therefrom.

56. The apparatus of claim 1 wherein a water containing tank is mounted on said frame, said mixing means includes an inlet end and an outlet end and water is supplied from said water tank to the inlet end of said mixing means.

57. A concrete mixing truck comprising a frame having a plurality of concrete ingredient supply means, and an additional concrete supply means, first operable means for feeding ingredients from each of said plurality of supply means, including means for adjusting the ratio of ingredients fed from said plurality of supply means, second operable means for feeding said additional supply means, mixing means, including an elongated mixing trough having a mixing element therein, delivery means disposed to receive the ingredients fed from said supply means and effect their discharge into said mixing means, and means for simultaneously controlling the rate of operation of said first and second operable means.

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