Oct. 22, 1963 H. M. ZIMMERMAN 3,107,901

PRE-MIXED CONCRETE SYSTEM

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Fig. 1

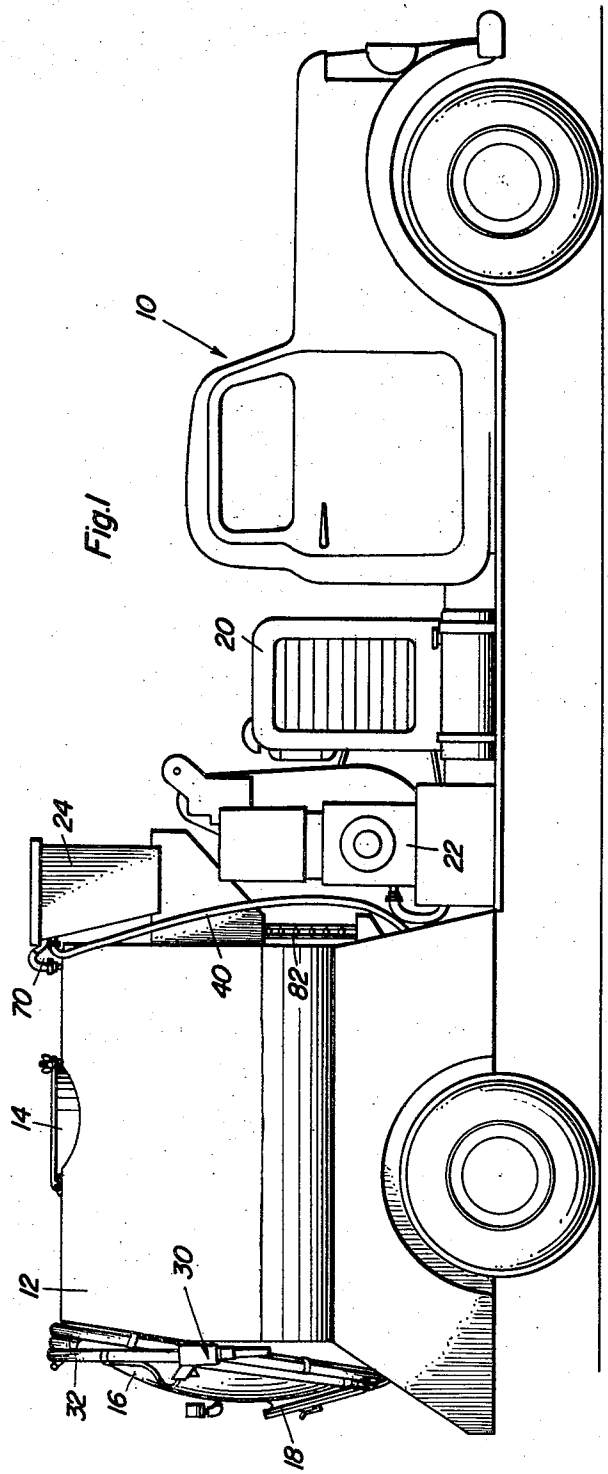
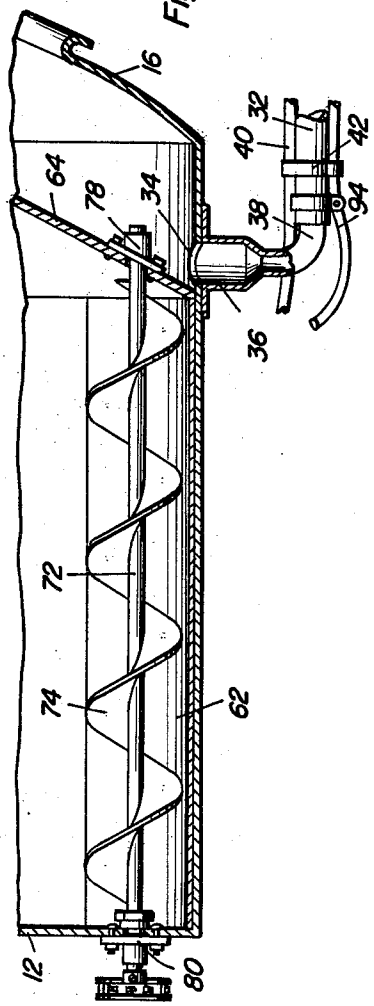


Fig. 4



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PRE-MIXED CONCRETE SYSTEM

Filed Aug. 3, 1959 5 Sheets-Sheet 2

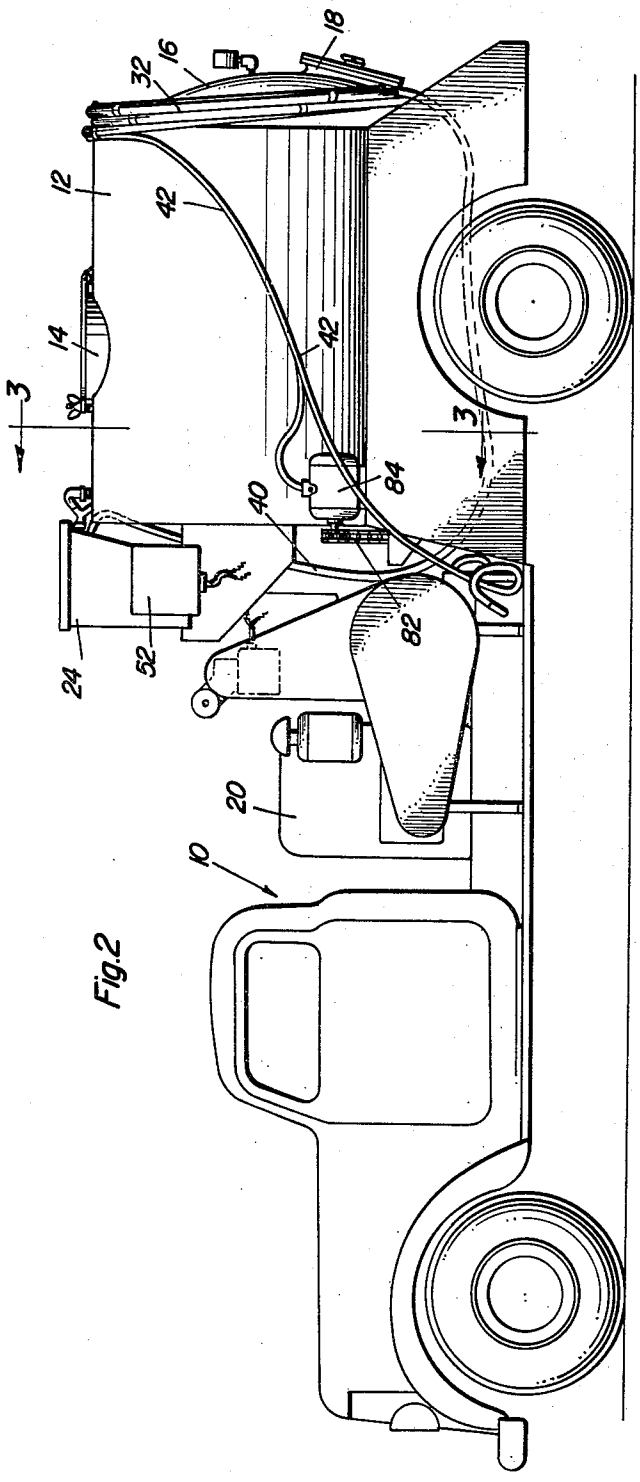
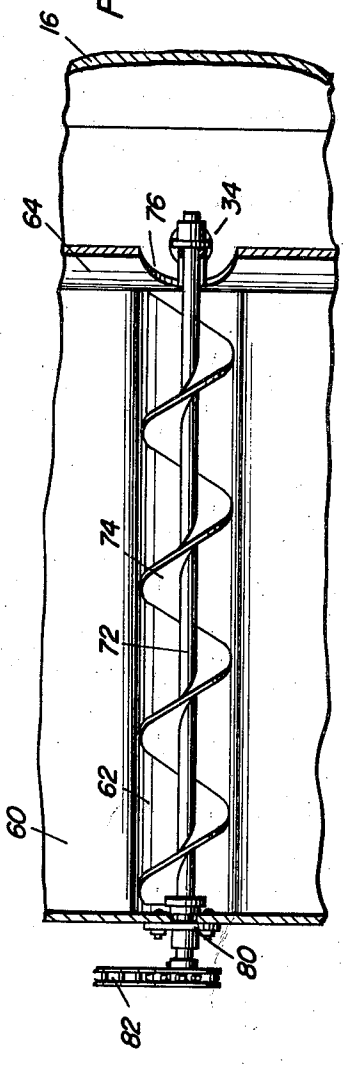


Fig.2

Fig.5



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PRE-MIXED CONCRETE SYSTEM

Filed Aug. 3, 1959 5 Sheets-Sheet 3

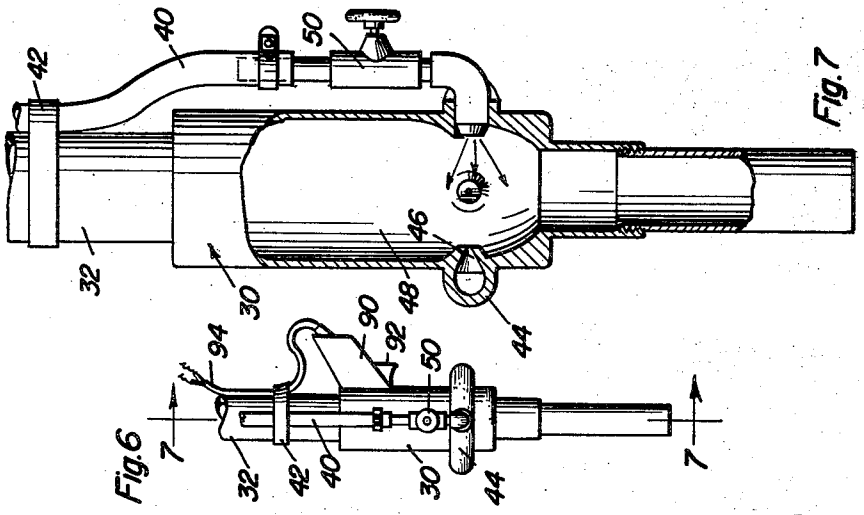

Fig.7

Fig.6

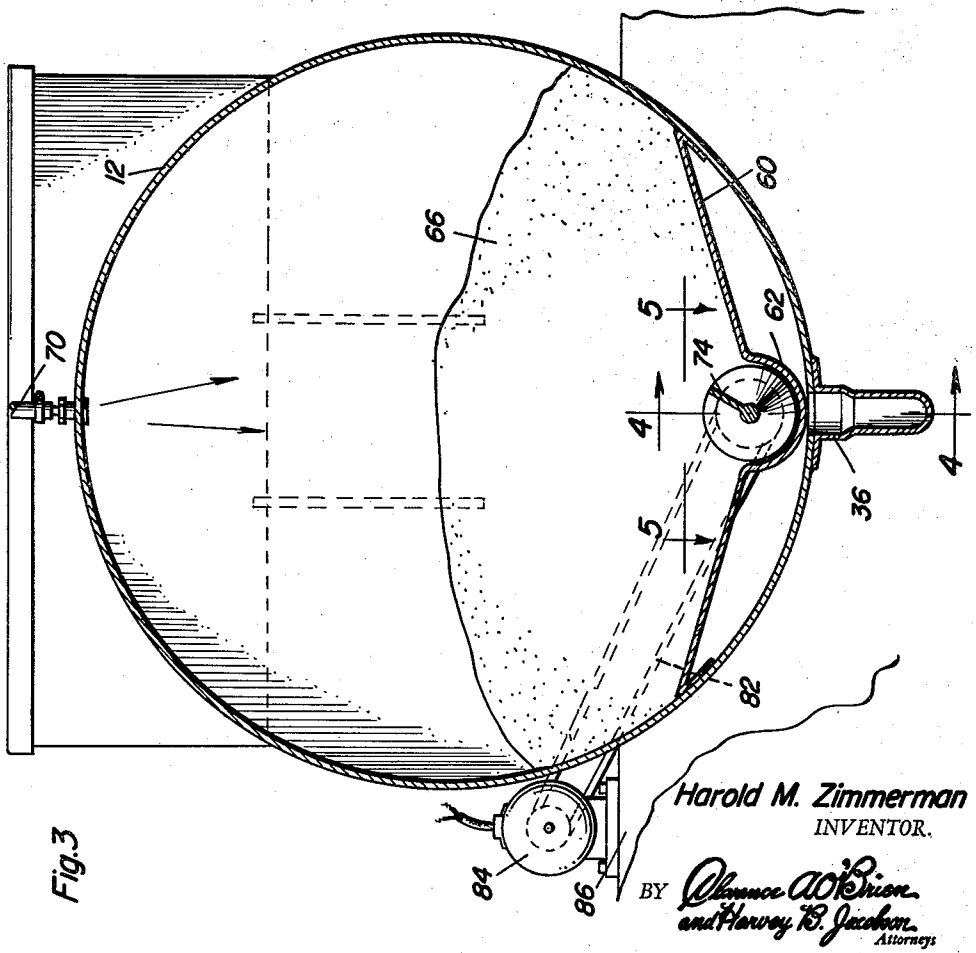

Fig.3

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PRE-MIXED CONCRETE SYSTEM

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Fig.8

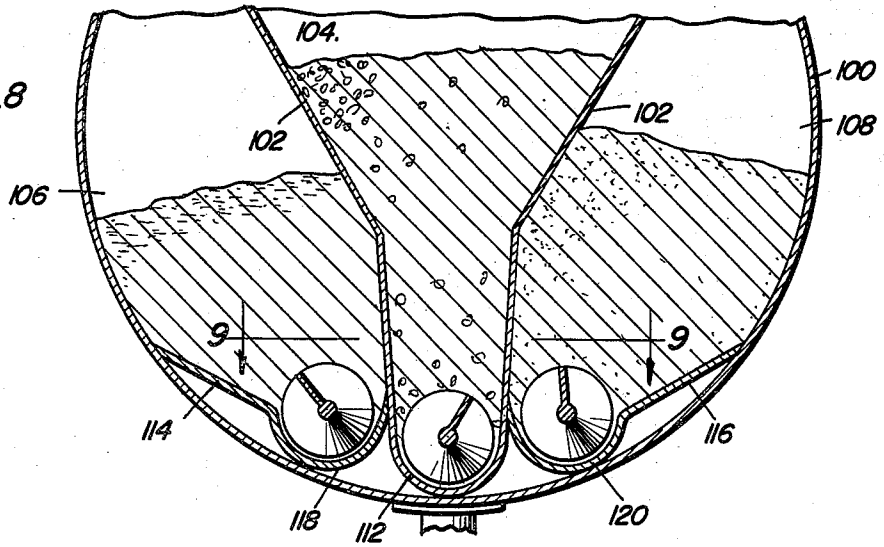


Fig.9

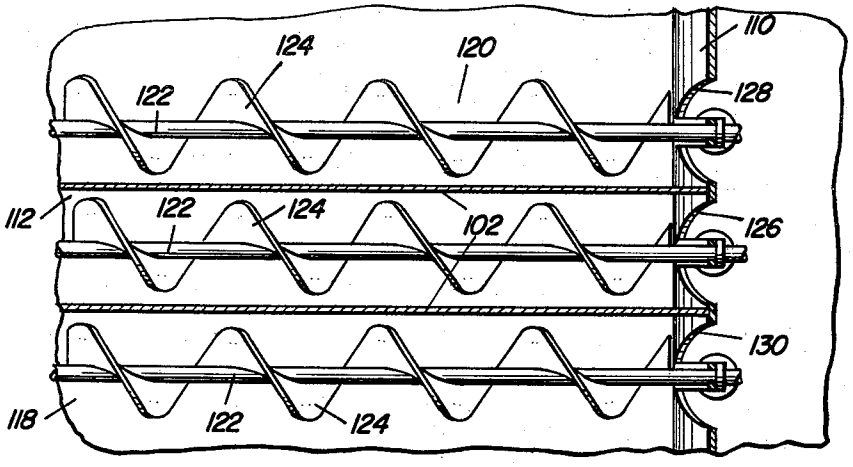
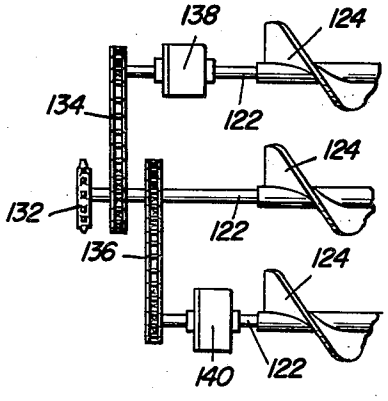


Fig.10



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PRE-MIXED CONCRETE SYSTEM

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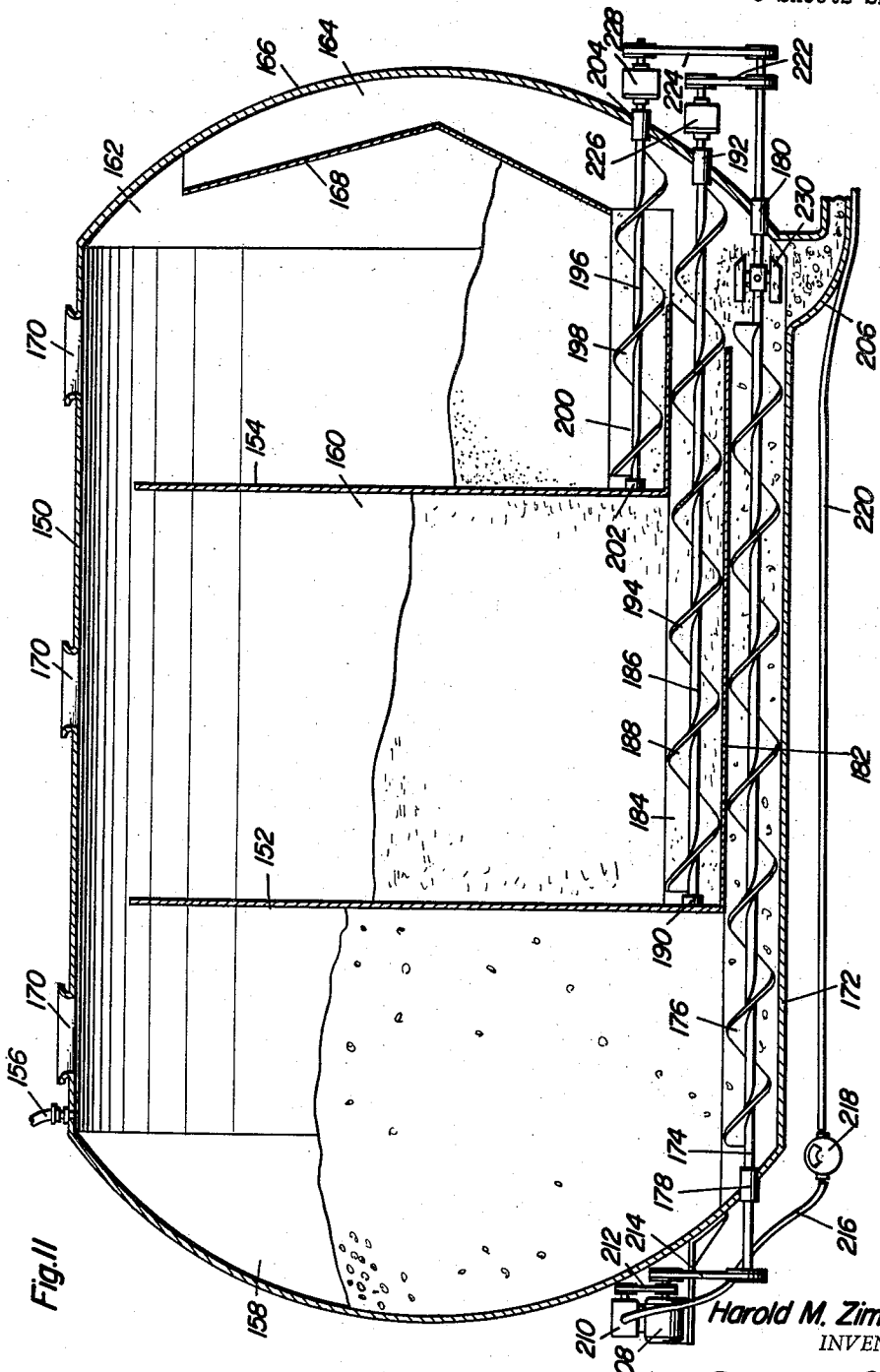

Fig. 11

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3,107,901

PRE-MIXED CONCRETE SYSTEM

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Filed Aug. 3, 1959, Ser. No. 831,421
6 Claims. (Cl. 259—147)

This invention comprises a novel and useful pre-mixed concrete system and more particularly relates to apparatuses and methods for applying pre-mixed concrete by means of a gun or nozzle and by means of high pressure air to a surface to be treated with the concrete.

It has been known heretofore to supply pre-mixed concrete from a tank to a nozzle by means of compressed air supplied to the nozzle, mix the concrete with water in the nozzle, and deliver the concrete under pressure from the nozzle into a mold or upon a surface as desired. However, it has been customary in such systems to either control the flow of concrete by a valve in the nozzle itself or by a valve and a control means therefor at the tank.

It is the primary purpose of this invention to provide a system for dispensing pre-mixed concrete from a mixing nozzle and under pressure in a system of this general type but which will regulate the feeding of the pre-mixed concrete into the air stream at the tank or container, while locating the control for the regulating means upon the nozzle itself.

A further and more specific object of the invention is to provide a portable apparatus wherein there is mounted upon a truck a tank for storing pre-mixed concrete under pressure and sealed from the atmosphere, a hose and a discharge nozzle connected to the tank, a means for continuously supplying compressed air into the tank and through the hose and nozzle, means for supplying water under pressure to the nozzle, together with feed means located in the tank for controllably delivering the pre-mixed concrete into the hose, together with a control means mounted upon the nozzle and operable to vary from zero to a maximum the rate of feed of the pre-mixed concrete into the hose at the tank.

Yet another object of the invention is to provide a system for dispensing pre-mixed concrete from a nozzle in accordance with the foregoing objects wherein a control means upon the nozzle is operable to simultaneously effect the rendering of a signal upon the truck and to vary from zero to maximum the feeding of concrete into the hose from the tank on the truck.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view showing a first embodiment of apparatus incorporating therein the principles of this invention;

FIGURE 2 is a side elevational view of the apparatus in FIGURE 1 but taken from the other side thereof and showing the disposition of parts of the apparatus upon the truck;

FIGURE 3 is a vertical transverse sectional view taken upon an enlarged scale substantially upon a plane indicated by section line 3—3 of FIGURE 2 and showing the internal construction of the pressurized tank for storing therein the pre-mixed concrete in accordance with the invention;

FIGURE 4 is a vertical longitudinal sectional view taken upon an enlarged scale substantially upon the plane indicated by section line 4—4 of FIGURE 3 and showing in particular one suitable form of means for feeding the pre-mixed concrete from the storage compartment

in the container to the outlet therefrom into the discharge hose of the apparatus;

FIGURE 5 is a horizontal sectional detail view taken substantially upon the plane indicated by section line 5—5 of FIGURE 3 and upon an enlarged scale and showing further details of the mounting and location of the feeding means for the pre-mixed concrete;

FIGURE 6 is a fragmentary view in elevation of the discharge nozzle or gun for dispensing the pre-mixed concrete;

FIGURE 7 is a detail view taken in vertical section substantially upon the plane indicated by section line 7—7 of FIGURE 6 upon an enlarged scale, parts being shown in elevation and showing certain details of the nozzle internal structure;

FIGURE 8 is a view similar to FIGURE 3 and showing in vertical transverse section a modified construction of a compartmented truck to which the principles of the invention have been applied;

FIGURE 9 is a fragmentary view taken in horizontal section substantially upon the plane indicated by the section line 9—9 of FIGURE 8;

FIGURE 10 is a fragmentary detail view showing the drive means for the three conveyor auger screws of the embodiment of FIGURE 8; and,

FIGURE 11 is a vertical longitudinal sectional view of a further modified construction of that shown in FIGURES 8–10.

Referring first to the embodiment of FIGURES 1–8, attention is directed first to FIGURES 1 and 2 which shows by way of exemplification of the principles of the invention a suitable apparatus in accordance therewith. The numeral 10 designates generally a truck upon which is mounted the container or tank 12 which is sealed from the atmosphere, being provided upon its surface with a filling means 14 by means of which pre-mixed concrete may be introduced into the tank, and the latter may then be sealed. At the rear end of the tank 16 there is provided a discharge or inspection opening 18 which is customarily sealed in order to retain the interior of the tank under pressure.

Likewise mounted upon the truck there is a source of power such as internal combustion engine 20 by means of which there is driven an air compressor 22. Further mounted upon the truck and preferably in an elevated position thereon is a water tank 24 sealed from the atmosphere.

Shown at 30 is a gun or mixing nozzle by which dry pre-mixed concrete from the tank 12 is mixed with water and then discharged under pressure as desired. This nozzle is connected to a hose or flexible conduit 32 which is of such length as to permit the gun to be moved in any desired distance from the truck 10 during the applying or dispensing of the concrete. As shown in FIGURES 1 and 2, the hose is wound or stored about the rear end of the tank 12 when not in use, but will be unwound therefrom during operation of the apparatus.

Referring now especially to FIGURE 4 it will be observed that the tank 12 adjacent its rear end is provided with an opening 34 which communicates with a fitting 36 comprising a discharge outlet for the tank, this fitting terminating in a tubular neck 38 to which the previously mentioned hose 32 is connected. A second hose 40 is connected to water tank 24 and supplies water from the latter to the nozzle, the water conduit or hose 40 being taped or otherwise secured in side-by-side relation to the hose 32 as by means of the fasteners 42, as shown best in FIGURES 6 and 4.

As will be best apparent as by reference to FIGURES 6 and 7, the water hose communicates with an annular manifold 44 surrounding the nozzle and having inlet ports 46 disposed circumferentially of the nozzle whereby

the water is discharged into a mixing chamber 48 within the interior of the nozzle body. A manually operated control valve 50 provides a means whereby the flow of water, normally continuous, may be shut off when the gun or nozzle is not in use.

Any suitable means may be employed for applying pressure upon the water to insure feed of the same at a sufficient rate to the nozzle. For this purpose there may be provided a pump operated electrically or by other means, as shown diagrammatically at 52 in FIGURE 2, or if desired air pressure from air compresser 22 may be supplied to the top of the water tank for this purpose; and in some instances a gravity head may be sufficient to effect the desired result.

Referring now especially to FIGURES 3, 4 and 5, it will be observed that the interior of the tank or container 12 is preferably provided with sloping bottom walls as at 60 which at their longitudinal medial portion are depressed to form a trough or sump 62. Adjacent the rear wall 16 of the tank but spaced slightly forwardly therefrom is a partition or baffle 64 which extends preferably entirely across the tank at the bottom thereof, but terminates below the top of the tank, to thus define two compartments longitudinally spaced in the tank which communicate with each other at the top of or if desired through openings adjacent the top of this partition or baffle 64. The larger compartment or chamber lying between the partition 64 and the front of the tank constitutes a chamber which receives a supply of dry pre-mixed concrete, as indicated generally by the numeral 66 in FIGURE 3. The chamber between the rear wall 16 and the partition 64 and which is much smaller in size, has continuous communication through the previously mentioned opening 34 with the outlet 36. By means of a conduit 70 compressed air from the compressor 22 is delivered into the tank 12 which as above mentioned is sealed from the atmosphere in order to maintain an above atmospheric pressure within the tank. This air thus communicates with both compartments on opposite sides of the baffle or partition 64, applying and maintaining a pressure upon the supply of dry pre-mixed concrete 66 to assist in feeding the same to the outlet 36, and also to effect a continuous flow or stream of air into the outlet 36 and the hose 32 to the nozzle 30.

The present invention envisions a feeding means within the tank for effecting a positive feeding of or movement of the dry pre-mixed concrete into the outlet 36 and into the stream of air flowing therethrough whereby this air will carry the concrete to the nozzle where it will be mixed with the water in the chamber of the nozzle.

Although it is within the purview of this invention to employ any suitable means for effecting a positive feeding of the concrete to the outlet and into the air stream, including such means as chain conveyors, rams or the like, a satisfactory means for this purpose consists of a conveyor in the form of an auger screw which is disposed in the trough 62. This conveyor includes a stem or shaft 72 having a helical fin or blade 74 spirally mounted thereon and is so disposed in the trough that upon rotation of the screw the material will be advanced longitudinally of the trough towards the baffle or partition 64. The latter has an opening 76 therethrough, see FIGURE 5, through which the conveyor positively delivers the dry pre-mixed concrete which latter then drops into the chamber between the partition 64 and the end wall 16 of the container and directly into the discharge outlet 36 previously mentioned. As will be observed from FIGURES 3 and 4, the opposite ends of the conveyor stem or shaft 72 are mounted in suitable supporting bearings as at 78 and 80 respectively carried by the partition 64 and the front wall of the tank 12, the conveyor shaft extending through the bearing 80 to the exterior of the tank.

Any desired operating means are provided for effecting rotation of the conveyor screw. Conveniently such an operating means may consist of a chain drive 82 which is driven from a source of power such as an electric motor 84 mounted upon a suitable support 86 at the side of the tank 12 or upon the truck 10. Whenever it is desired to feed concrete into the outlet 36 for discharge by the nozzle, the motor 84 is energized causing rotation of the conveyor and positively feeding concrete from the storage chamber to the left of the partition 64 to the air chamber at the right thereof.

An essential feature of the present invention is the provision of a control means designated generally by the numeral 90 and which is mounted upon the body of the nozzle 30. In the particular construction illustrated, a suitable electrical circuit is provided to actuate the motor 84, this circuit being controlled by a suitable switch indicated diagrammatically at 92 in FIGURE 6, a portion of the electrical conduits of the electrical circuit being shown at 94. These electrical conduits are likewise taped by the fasteners 42 to the hose 30 together with the water hose 40 so that upon operation of the control 92 upon the nozzle, direct operation of the motor 84 and of the conveyor screw can be obtained.

It is also within the purview of this invention to connect this connecting means by which the control 90 is connected to the feeding means such as the conveyor screw to a suitable signalling device not shown whereby an audible or a visual signal may be rendered upon the truck in accordance with the feeding of the pre-mixed concrete from the tank.

It is a further important feature of this invention to provide a precise and complete control of the operation of the rate of feed of the conveyor or other feeding means by control means 90 of the nozzle 30. Where the feeding means is electrically operated, as by an electric motor 84, the switch 92 and the circuit is such that the speed of the motor can be varied from zero to a maximum to thereby in turn vary the rate of feed of concrete from the storage chamber in the tank to the outlet 36 likewise from zero to a maximum. Thus, while the flow of air through the hose 32 remains substantially constant, the concrete can be fed into this air stream intermittently at varying rates under the direct control of the operator by manipulating the control means 90 on the nozzle. When the supply of concrete is cut-off, the continuing air flow will of course cleanse the hose completely. Further, the control of the flow of concrete does not in any way effect the desired continuing flow of air through the nozzle or of water into the nozzle under control of the valve 50.

It has been previously mentioned, that the conveyor screw which feeds concrete to the outlet means from the tank is exemplary only of the principles of the invention. It is also possible to employ any other power operated means for effecting a positive feed at varying rates of the concrete from its storage compartment to the outlet 36, and wherein the rate of supply can be varied from zero to a maximum. Further, although an electrical circuit has been illustrated as described hereinbefore as a means for effecting remote control of the operation of the feed means from the nozzle, it is evident that other control systems could be provided. For example, a mechanical linkage could be provided for this purpose, hydraulic or pneumatic pressure could be employed or any other means be provided as desired.

The essential and basic feature of this invention resides in the provision of means located upon the nozzle which will enable the positive varying control of the feed of pre-mixed concrete from a remote source into the air stream flowing to the nozzle.

In some instances, it may be desired to employ this system in a stationary installation rather than in a mobile apparatus such as upon a truck. The above mentioned essential features of the invention are likewise applicable to such stationary installations.

It is further possible to simultaneously control and

interlink the control of the operation of the concrete feeding means and the delivery of water from the tank 24 to the water conduit 40 and effect common actuation of the feeding of both water and concrete from a control means 90 upon the nozzle.

In the herinbefore described embodiment of FIGURES 1–7, the principles of the invention have been disclosed as applied to an apparatus in which the pre-mixed concrete or other material to be delivered to a mixing nozzle is stored in a single compartment and thus is necessarily a single homogeneous material. It is however possible to apply this invention to constructions in which different segregated materials are stored in a tank; are positively supplied at controllable, variable and variably proportioned rates into the conveying air stream and from thence through the hose to the mixing nozzle. Such a construction permits the simultaneous storing of separate materials and a proportionate mixing of the same by the apparatus, and for an understanding of such an arrangement attention is now directed to the embodiment of FIGURES 8–10.

Shown in vertical transverse section at 100 is a portion of a tank which is similar to and may replace the previously disclosed tank 12 of the arrangement of FIGURES 1–7. By means of suitable longitudinally extending partitions 102 within the tank 100 the interior of the tank is divided into a longitudinally extending central compartment 104 together with a pair of longitudinally extending compartments 106 and 108 on opposite sides of the central compartment. There are thus provided three transversely spaced longitudinally extending storage compartments within the tank 100, with the longitudinal dividing walls 102 communicating at their forward end with the front of the tank 100 and at their rear ends being engaged with the transverse partition wall 110 which is of the same construction with and corresponds to partition wall 64 previously mentioned.

At their lower ends, the side walls 102 have a rounded bottom 112 which comprises a longitudinally extending trough, sump or channel and a pair of bottom walls as at 114 and 116 extend from the sides of the tank 100 into contact with the sides of the walls 102, each being provided adjacent thereto with a longitudinally extending depression comprising a trough, sump or channel as at 118 and 120 respectively.

Similar to the preceding embodiment there is disposed in each of these troughs 112, 118 and 120 a spiral auger or conveyor screw each consisting of an axle or shaft 122 with a helical fin or blade 124 disposed thereon. These conveyor screws are journalled in the same manner disclosed in connection with the preceding embodiment, the individual conveyor screws communicate and discharge the material from the respective compartments 104, 106, 108 past the partition 110 into the chamber between the latter and the rear end of the vehicle through discharge openings 126, 128 and 130, it being understood that this compartment at the rear end of the partition 110 is likewise provided with the same discharge means and connection with the hose 40 as that previously mentioned.

Insofar as the operation of the conveyors is concerned, each will positively feed material from its storage compartment into the chamber at the forward side of the partition 110 where it will be mixed with air and delivered by the house 32 to the nozzle exactly in the same manner as that previously described.

However, it is preferred to provide a different form of driving means for positively driving the conveyors in response to operation of the control switch 92 upon the nozzle 30. Thus, as shown in FIGURE 10, each of the conveyor shafts 122 has its forward end extending through the wall of the tank 100 in the same manner as in the arrangement of FIGURES 1–7, and the driving means is secured to these forwardly extending extremities. One of the conveyor shafts as for example the central shaft has a sprocket wheel 132 secured thereto to which power is supplied as by the sprocket chain 82 previously mentioned from the electric motor 84 and under the control system previously described. From the central conveyor shaft 122 having the sprocket wheel 132 thereon, power is transmitted to each of the other conveyor shafts of the other two compartments. Thus, a sprocket chain system 134 and 136 distributes power to the two conveyors of the compartments 106 and 108. Thus all three conveyors are driven from the single source of power consisting of the motor 84 under the control means 90 of the nozzle 30. However, in order to provide a variable proportioning of the flow of the material from the three compartments by controlling the relative rates of delivery of the three conveyor screws, there are provided any suitable form of manually adjustable speed transmission means as at 138 and 140 which are interposed in the conveyor shafts 122 between the drive and sprocket systems 134 and 136 and the same. By manual adjustment of the two transmissions 138 and 140 any desired speed of ratio can be given to the other two conveyor shafts with respect to each other and with respect to the central driving conveyor shaft which rotates at a constant speed with respect to the sprocket 132. It will also be appreciated that in some instances a transmission mechanism may be interposed in the drive of the central conveyor in order that its rate of delivery may also be varied with respect to the sprocket 132 thereby enabling each of the three conveyors to be independently varied with respect to a constant speed of drive of the sprocket 132.

The advantage of this arrangement is that three separate materials can be received in the tank 100 and these may be individually dispensed and at adjustable rates by the positive feeding means afforded by the spiral conveyors. Obviously, by adjusting one of the transmissions 138, 140 to an inoperative position, the apparatus may be caused to dispense only those materials desired from the various compartments 104, 106, and 108.

Once the proportionate speed of the selected conveyor or conveyors has been obtained by manual adjustment of the transmissions such as those at 138 and 140, the selected material or materials may then be automatically controlled by operation of the control means 90 at the nozzle in the manner previously described.

A still further arrangement is illustrated in the drawings which permits the storing of separated materials in a tank with a proportionate positive feeding of the materials to a hose by which they are conveyed to a mixing nozzle. Such an arrangement is shown in FIGURE 11 in which the tank 150 corresponds to the tanks 12 and 100 of the preceding embodiments. However, in this arrangement the interior of the tank is divided into longitudinally spaced storage compartments by virtue of transversely extending partitions 152 and 154. These partitions extend entirely across the tank being connected thereto but open at their top in order to afford communication at the upper end of the tank between the various compartments. Air under pressure may be supplied by conduit 156 at the top of the tank to thus impose an air pressure upon each of the materials which are stored in the separate compartments 158, 160 and 162, as well as in the rearmost compartment 164 formed between the rear end wall 166 of the tank and a partition 168 which corresponds to the previous partition 64 of FIGURES 1–7. Suitable filling openings as at 170 provided with suitable cover means, not shown, afford access to the interior of the various compartments for the purpose of filling or servicing the same.

A spiral conveyor system is employed for positively feeding material from each of the compartments into the chamber 164 at the rear end of the tank. For this purpose the lower portion of the tank is provided with a longitudinally extending medially disposed depression or trough 172 in which is journalled the axle 174 of a spiral conveyor including a helical fin or blade 176 thereon,

this axle extending through journal bearings as at **178** and **80** in the end walls of the tank **150**. A horizontally extending bottom wall **182** constitutes the top of the casing of the trough **172** from the partition **152** backwardly thereof and in turn constitutes and has therein a trough or casing **184** in which is received an axle **186** of a second spiral conveyor **188** which is journalled as at **190** in the partition **152** and is further journalled as at **192** in the end wall **166**. This second axle likewise has a helical fin or blade as at **194** and this conveyor housing **184** opens into the bottom of the compartment **160** as shown. Finally, a third conveyor axle **196** and a helical blade **198** is disposed in the compartment **162**, being received in a trough **200** which opens into this compartment. The axle **196** is journalled as at **202** and **204** in the partition **154** and the end wall **166** as shown, and it will be observed that all three of these conveyors discharge into the compartment **164**. From the bottom of the latter there is disposed the outlet openings **206** similar to the member **36** and which delivers the air and the pre-mixed concrete to the hose **32** as previously mentioned.

In this arrangement it will be observed that an electric motor as at **208** suitably mounted upon the forward end of the tank is employed to drive a water pump **210** as by a pulley drive means **212**, and also drives as by a pulley drive means **214**, the axle **174** of the lowermost screw conveyor. Water from the pump **210** is delivered by a conduit **216** and through a water meter **218** to a further conduit **220** which corresponds to the previously mentioned water conduit **40** of the embodiment of FIGURES 1–7 to supply water to the nozzle **30**.

At the rearward ends of the tank, the axles of the screw conveyors are connected together, it being observed that a pulley system **222** serves to couple the axle **174** to the axle **186** of the conveyor immediately thereabove, while a further pulley **224** in turn serves to couple axle **174** to the axle **196** of the uppermost conveyor. Thus, all three conveyors are coupled together in timed relation for synchronous operation. As in the preceding embodiment, a pair of manually adjusted transmission assemblies **226** and **228** are interposed between the driving conveyor axle **174** and the driven conveyor axles **186** and **196** respectively thereby permitting the speeds of the conveyors to be varied and thereby the proportions of the materials delivered from the compartments **158**, **160** and **162** to be adjusted as desired.

By way of example, the compartment **158** may contain stone, or gravel, the compartment **160** receiving sand and so forth, while the compartment **162** receives cement. Obviously, various other materials can be stored in and delivered from these compartments to the nozzle as desired.

In order to facilitate thorough mixing of the materials, the lowermost conveyor axle **174** may have paddles **230** secured thereto which by virtue of rotation of the axle serve to facilitate a thorough mixing of the various materials passing from the chamber **164** through the outlet **206** thereof.

The operation of this form of the invention is identical to that previously described.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. An apparatus for dispensing pre-mixed concrete comprising

(*a*) a container sealed from the atmosphere,

(*b*) partitions in said container defining therein a plurality of storage compartments each receiving a dry ingredient for a concrete mix and a mixing compartment in which said dry ingredients are mixed,

(*c*) a discharge outlet having continuous and uninterrupted communication which said mixing compartment,

(*d*) a separate feeding means for each storage compartment positively and controllably delivering dry material from the associated storage compartment into said mixing compartment,

(*e*) a hose having an inlet communicating with said discharge outlet and having an exit,

(*f*) a nozzle secured to said hose and communicating with said exit,

(*g*) means for continuously supplying at a pressure above atmospheric compressed air to said discharge outlet and from thence to said nozzle for transporting dry pre-mixed concrete from said mixing tank to said nozzle,

(*h*) means for supplying water to said nozzle for mixing therein with said dry pre-mixed concrete,

(*i*) control means mounted on said nozzle and connected to said feeding means for regulating the rate of feed of dry pre-mixed concrete from said container to said discharge outlet.

2. The combination of claim 1 wherein said control means controls the rate of feed of dry ingredients from said storage chambers into said mixing chambers.

3. The combination of claim 2 including means interconnecting said separate feed means for varying the relative rates of feed of dry ingredients from said storage chambers into said mixing chambers.

4. The combination of claim 1 including means interconnecting said separate feed means for varying the relative rates of feed of dry ingredients from said storage chambers into said mixing chambers.

5. The combination of claim 1 wherein said feeding means comprise auger screw conveyors disposed in side-by-side relation and each disposed in the bottom of a storage chamber and entering said mixing chamber.

6. The combination of claim 1 including control means on said nozzle regulating the rate of flow of water thereinto.

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