

Aug. 15, 1967

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SYSTEM AND MEANS FOR SELECTIVELY MIXING CONCRETE AND
INCORPORATING ADDITIVES THEREIN

3,336,011

Filed Sept. 27, 1966

2 Sheets-Sheet 1

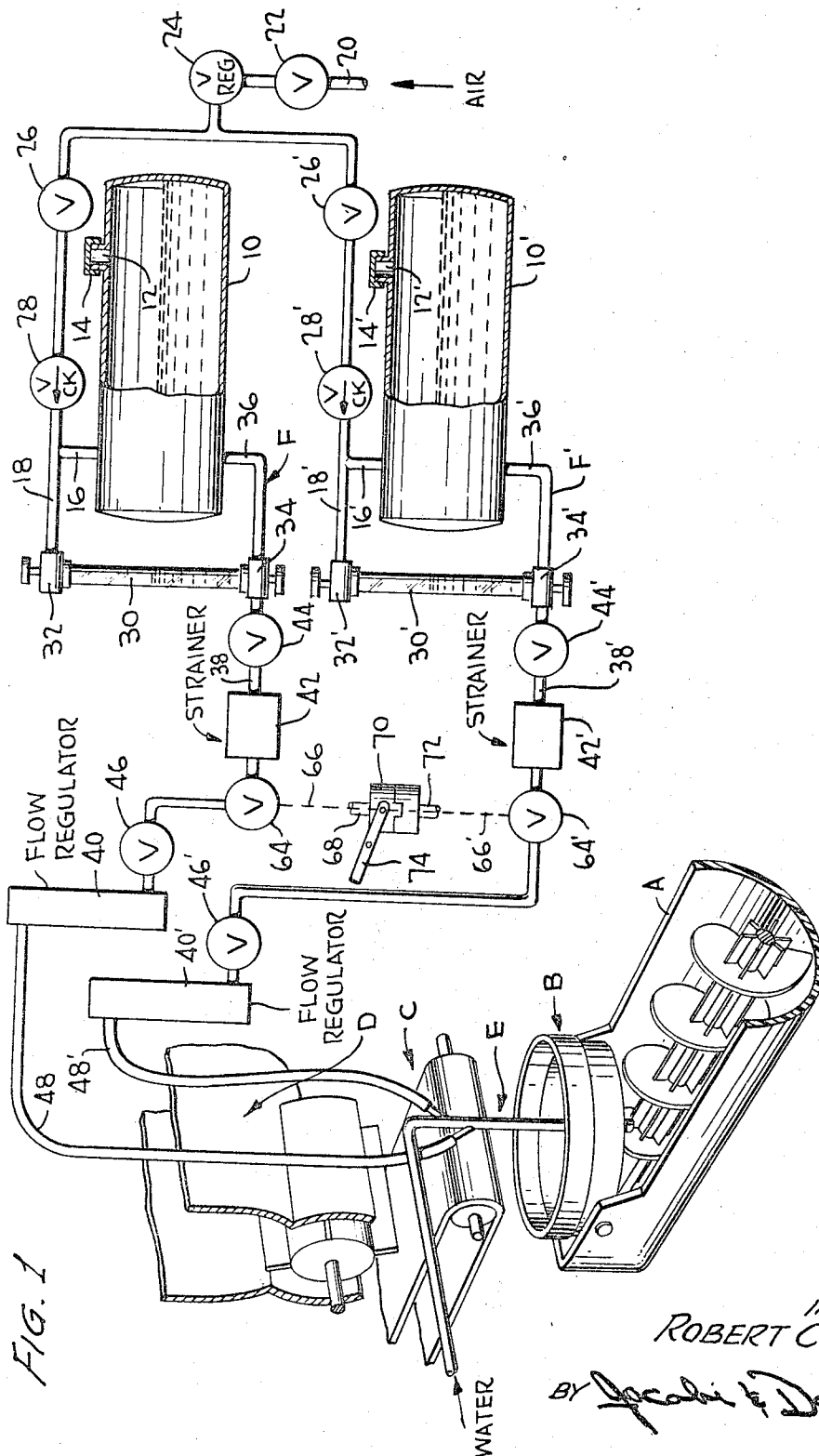


FIG. 1

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2 Sheets-Sheet 2

FIG. 3

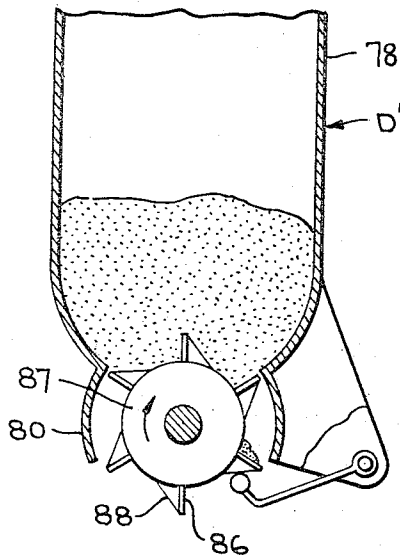


FIG. 4

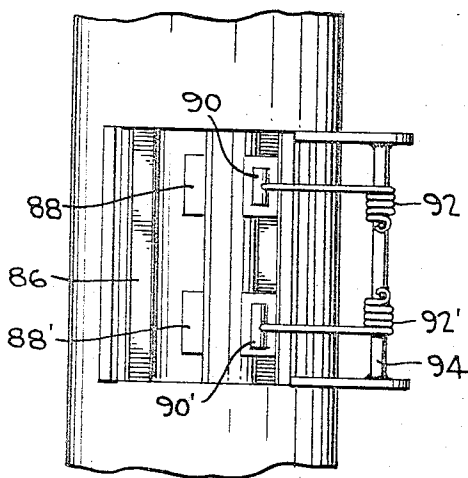
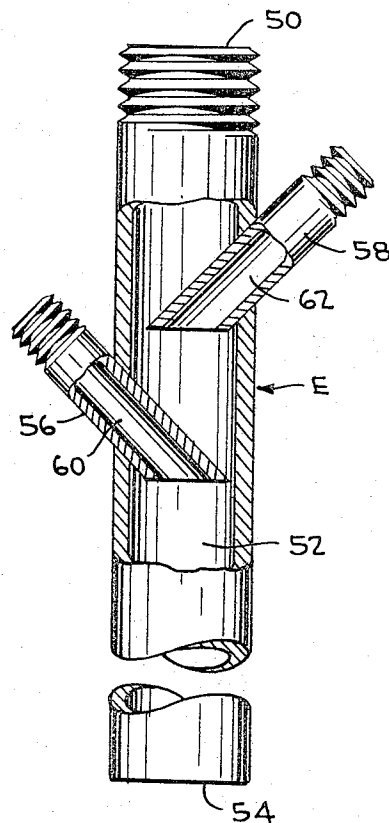


FIG. 2



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Filed Sept. 27, 1966, Ser. No. 582,342
52 Claims. (Cl. 259-148)

This invention relates to concrete mixing equipment of the type disclosed in co-pending application Ser. No. 378,133, now Patent No. 3,310,293, and is particularly concerned with means associated with such equipment to permit liquid additives of various types and/or gases to be easily intermixed with other concrete ingredients in such equipment.

Conventional concrete mixing equipment now in general use rely on a ready-mix truck having a rotatable mixing drum into which all the required ingredients, including water are introduced, prior to departure of the ready-mix truck from its base of operations. The rotation of the mixing drum is continued until all its contents have been delivered regardless of the number of partial deliveries that must be made by the concrete mix truck or the time elapsed before making a single delivery of its entire contents. Accordingly, it is virtually impossible with such equipment to selectively add liquids or gases to parts of a "truck load" as all adding operations are performed at an initial loading station.

Specifically, so-called "ready-mix trucks" are not equipped to readily provide for the addition of anti-freeze solutions, water-reducing chemicals, or coloring materials to the concrete mix in selected batches.

Still another shortcoming that attaches to the use of conventional ready-mix trucks resides in the fact that they are unable to deliver partial loads of concrete to customers who require concrete having different proportions of ingredients in the mix without returning to their base of operations for the rotary drum to be supplied with a different batch of ingredients capable of providing a concrete mix of the desired composition.

Taking into consideration the foregoing deficiencies of systems which provide ready-mix concrete it is a primary object of the present invention to provide concrete mixing and delivery equipment which permits selective small batch operation with the ability to selectively change not only ingredient but also additive proportions at will.

Another primary object of the invention is to provide a concrete mixing system in which dry ingredients are independently and continuously delivered, in the desired proportions, to a mixing device where water to which other substances can be conveniently added, is supplied to the dry mix.

Other significant objects hereof are: (a) to provide a concrete mixing system in which the dry ingredients are continuously fed to a mixing device that can be simultaneously supplied with an anti-freeze solution in winter and a retarder agent in summer that is known to reduce the time required for the concrete mix to set; (b) to provide a concrete mixing system in which the dry ingredients are continuously fed to a mixing device which is simultaneously supplied with a water reducing agent; (c) to provide a concrete mixing system of the continuous delivery type wherein fluid or fluids for coloring the concrete mix can be easily supplied to the concrete mix; (d) to provide a concrete mixing system of the continuous delivery type wherein air can be fed into the concrete mix, and (e) to provide a mixing nozzle in which a flowing stream of water is impregnated with other fluids.

A further important aspect hereof is to provide a con-

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crete mixing system which conforms with the preceding objects and can be carried on and operated from power and fluid sources conveniently carried on a vehicle, such as a truck.

The invention will be better understood, and objects other than those set forth above will become apparent, after reading the following detailed description thereof. Such description refers to the annexed drawings presenting preferred and illustrative embodiments of the invention.

In the drawings:

FIGURE 1 is a schematic view of a system for feeding one or more fluids to the water being delivered to the concrete mixing device.

FIGURE 2 is a sectional view through a mixing nozzle. FIGURE 3 is a longitudinal sectional view through a modified form of cement batcher.

FIGURE 4 is a horizontal sectional view showing the spring activated hammer of the batcher of FIGURE 3.

Referring to the drawings, there is shown in FIGURE 1 a mixing trough A mounted for pivotal movement relative to a horizontal plane and a vertical plane by a hollow swivel coupling B. Mounted adjacent the swivel coupling B and arranged to deliver material therein is an endless conveyor C. The endless conveyor receives sand and gravel delivered thereto from either separate tanks (not shown) or a tank provided with a partition dividing it into separate compartments (not shown). Cement is also fed from a tank or other container by means of a conventional compartmented rotary metering drum D onto the endless conveyor C. A detailed description of elements A, B, C and D appears in copending application Ser. No. 378,133, now Patent No. 3,310,293, referred to previously.

The present application differs from copending application, Ser. No. 378,133, now Patent No. 3,310,293, primarily in the arrangement now to be described for introducing into the water for wetting the solid concrete ingredients, additional fluid substances, or ingredient means, such as, anti-freeze material, retarder agents, water reducing agents, coloring materials and air.

More specifically two substantially identical fluid handling systems F, F' have been provided for effecting the introduction of such additional substances or ingredient means to the concrete mix. The elements of fluid handling system F' which correspond with similar elements of system F are indicated by the same reference characters as employed in system F except that those in system F' have been primed. A description of system F will therefore, suffice for a description of system F'.

Fluid handling system F comprises a fluid-tight tank or other container 10 of any desirable shape so long as it is adapted to fit within the available space on the concrete-mixer truck on which it is to be mounted. Assuming the material to be discharged from the tank 10 to be liquid at normal atmospheric conditions, such liquid may be introduced into tank 10 through filling opening 12 which is provided with a conventional closure cap 14.

Air under pressure is supplied to tank 10 through an air inlet connection 16 and conduit 18 that at its remote end is connected to conduit 20. Conduit 20 receives its air supply from either (a) the normal air supply on the truck, or (b) the normal air supply on the trailer, depending on the particular design of the concrete-mixer. Air conduit 18 adjacent its point of connection with conduit 20 is provided with a conventional shut-off valve 22 which may, for example, be of the gate type, preferably adjacent the gate valve 22 there is provided a conventional pressure regulating valve 24 to limit the pressure of air supplied to tank 10 to any desired value.

Conduit 18 adjacent its connection with tank 10 is provided with a further shut-off valve 26 and a check valve

28. Check valve 28 is arranged to preclude reverse flow of air under pressure from the tank 10 should the pressure upstream of the check valve drop due to leakage, a break in the air supply line or for any other reason.

A sight gauge 30 is connected by means of gauge valve 32 and conduit 18 with the top of tank 10. Sight gauge 30 is connected by means of gauge valve 34 and conduit 36 with the bottom of tank 10. With this conventional arrangement, when tank 10 contains liquid, the level of such liquid can readily be observed.

A conduit 38 is arranged to establish communication between conduit 36 and a flow meter 40. Conduit 38 is provided with a strainer 42 and flow to the strainer and meter may be precluded, when desired, by means of a gate or equivalent shut-off valve 44.

In order to adjust the fluid flow leading to meter 40 to very small quantities, a stop cock valve 46 is provided in the inlet to flow meter 40 since such valves are known for their ability to be frequently adjusted to control the delivery of small quantities of fluid and yet remain fluid tight.

Extending from flow meter 40, hose 48 leads to mixing nozzle E. Mixing nozzle E is arranged to discharge into swivel coupling B, which in turn feeds the dry concrete ingredients delivered thereto by the endless conveyor, as well as the liquid ingredients supplied by mixing nozzle E, to the mixing trough A.

Mixing nozzle E is shown in greater detail in FIGURE 2. It is provided with a threaded inlet 50 that is supplied with water from any convenient source of supply on the truck or trailer. A longitudinal passage 52 extends from the inlet 50 through the nozzle body to the discharge outlet 54. Nozzle E has formed thereon integral oppositely disposed lateral tubular members 56, 58 that extend from the exterior of the nozzle body into longitudinal passage 52. These extensions are, respectively, provided with passages 60, 62 that open into passage 52 at such an angle to the direction of flow of fluid passing through passage 52, that such flow past the terminal ends of passages 60, 62 will induce a flow of fluid through passages 60, 62 into passage 52.

By reason of the shape of the portions of tubular members 56, 58 that extend into passage 52, the angularity of the passages 60, 62 and the proximity of the fluid discharged from passages 60 and 62, considerable turbulence is created in the nozzle which results in a thorough and intimate mixing of the ingredient means supplied to the nozzle. Furthermore, it should be apparent that because of the angular disposition of passages 60 and 62 relative to passage 52, flow of fluid through 52 produces a venturi effect in passages 60 and 62 so that the likelihood of any backflow of fluid into passages 60 and 62 is eliminated.

The fluid handling system F is also provided with a quick acting valve 64 located upstream of stop cock valve 46 and flow meter 40. Valve 64 is arranged to be operated by linkage 66 that is operatively associated with clutch 70. Clutch 70 interconnects the power shaft 68 with shaft 72 which in turn supplies the power necessary for the simultaneous operation of endless conveyor C and compartmented rotary metering drum D. A clutch operating lever 74 is so arranged that when it is operated to effect engagement of the clutch 70, linkage 66 is actuated to effect opening of quick acting valve 64.

In the operation of the embodiment of the invention illustrated in FIGURE 1, closure cap 14 is removed from tank 10 and a liquid ingredient means to be added to the concrete mix, such as an anti-freeze solution, water reducing chemical, retarding agent, air entraining agent or coloring material is introduced into the tank 10. Simultaneously with the adjustment of the clutch lever 74 to effect engagement of the clutch 70 and thereby operation of the endless conveyor C and rotary metering drum D to deliver sand, gravel and cement along with water supplied through nozzle E into mixing trough A, linkage 66 is op-

erated to open quick-acting valve 64. Assuming gate valve 44 to have been previously opened and stop cock 46 adjusted to provide for a predetermined small flow of liquid therethrough, a suction is created in hose 48 by the venturi action of water passing through passage 52. Such suction action produces a metered flow of liquid from tank 10 through hose 48 and passage 60 into passage 52 of nozzle E. The rate of such flow is shown by meter 40.

In addition to the venturi action for effecting flow from tank 10 to the nozzle E, air pressure may be applied above the surface of the liquid in tank 10 to augment the venturi action. Furthermore, the presence of air under pressure above the surface of the liquid in tank 10 tends to make for a more uniform flow of liquid from the tank.

Air for applying pressure to the liquid in tank 10 is derived from any available source on the truck. Such air is supplied through conduits 20 and 18 which are provided with gate valves 22 and 26, a pressure regulator 24 and a check valve 28.

While the operation of system F has been described above, in a manner to provide for the addition of a liquid ingredient means to the water being supplied to the dry concrete ingredients, such liquid can be an air entraining agent, or if desired, air along could be supplied to tank 10. Air from tank 10, controlled in the same manner as liquid, could be fed to nozzle E. Air and air entraining agents present the advantages discussed below. Such air or air entraining agent would produce a concrete mix containing microscopic bubbles and render it less vulnerable to cracks on freezing. Concrete containing microscopic bubbles has also been found to have some flexibility. It has for that reason been recommended by highway departments for use in areas subject to freezing temperatures.

It has also been found that concrete mixes containing entrained air are easier to handle during pouring.

Since the concrete mixing truck is provided with a second fluid handling system F' similar to system F described above, it is apparent that a liquid ingredient means could be supplied to the water passing through nozzle E by way of passage 56 while air could be simultaneously supplied to the water passing through nozzle E by way of passage 58. On the other hand, it may be found desirable to supply but one fluid either air or a liquid to the nozzle E. In such case, one of the hoses 48, 48' is disconnected and replaced by a conventional closure plug.

In some instances it may be desirable to supply two different liquids either together or at different times to the water passing through nozzle E. In order to provide for such operation it is only necessary that different liquids be supplied, respectively, to tanks 10 and 10'.

A modified form cement batcher, designated D', is illustrated in FIGURES 3 and 4. Batcher D' includes a bin or tank 78 which is provided with a discharge compartment 80. The discharge compartment is formed with a pair of inner arcuate walls with which the vanes 86 of a compartmented metering drum 87 cooperate. The leading faces of one or more of the vanes 86 are provided with inclined plane surfaces 88, 88' which cooperate with a pair of hammer members 90, 90' on rotation of the metering drum in the following manner.

Hammer members 90, 90' are supported by spring elements 92, 92' respectively, for rotation about shaft 94 and are normally biased by the spring elements 92, 92' into engagement with inclined plane surfaces 88, 88'. On rotation of the metering drum, hammer elements 90, 91 are displaced by inclined plane surfaces 88, 88' thereby causing springs 92, 92' to be placed under added stress. As metering drum 87 continues to rotate hammer members 90, 90' are freed from engagement with the inclined plane surfaces 88, 88' and impart a hammer blow to the metering drum 87 releasing any cement that may have become trapped in recesses of the batching device.

After reading the foregoing detailed description, it will be apparent the objects set forth initially have been successfully achieved. Accordingly,

What is claimed is:

1. An apparatus for continuously producing a concrete mix which comprises:
 - (a) final mixer means;
 - (b) means to continuously feed dry ingredients of a concrete mix to said mixer means;
 - (c) means to feed a first liquid ingredient means of a concrete mix to said mixer means;
 - (d) means associated with said first liquid ingredient feed means and responsive to the flow therethrough to create a region of subatmospheric pressure in said first liquid ingredient feed means;
 - (e) means in communication with the region of subatmospheric pressure for supplying second ingredient means of a concrete mix into said region; and
 - (f) means for delivering the final mixture of said dry ingredients, said first liquid ingredient means said second ingredient means from said mixer means.
2. The apparatus of claim 1 wherein the means to feed a first liquid ingredient means comprises a water supply means.
3. The apparatus of claim 2 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means.
4. The apparatus of claim 2 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a pair of liquid supply means.
5. The apparatus of claim 2 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises an air supply means.
6. The apparatus of claim 2 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means and an air supply means.
7. The apparatus of claim 1 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means.
8. The apparatus of claim 1 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a pair of liquid supply means.
9. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises an air supply means.
10. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means and an air supply means.
11. The apparatus in claim 1 wherein the means for creating a region of subatmospheric pressure comprises a venturi.
12. The apparatus in claim 11 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means.
13. The apparatus in claim 11 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a pair of liquid supply means.
14. The apparatus in claim 11 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises an air supply means.
15. The apparatus of claim 11 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means and an air supply means.
16. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a

liquid ingredient storage tank, means for applying fluid under pressure to the surface of liquid in said tank, and means for establishing communication between the liquid in the bottom of said tank and said region of subatmospheric pressure.

17. The apparatus of claim 16 wherein the means for applying fluid under pressure includes a fluid pressure regulating valve.

18. The apparatus of claim 17 wherein the means for applying fluid under pressure includes a shut-off valve and a check valve.

19. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a pair of liquid ingredient storage tanks, means for applying fluid under pressure to the surface of liquid in said tanks, and means for establishing communication between the liquid in the bottom of said tanks and the region of subatmospheric pressure.

20. The apparatus of claim 19 wherein the means for applying fluid under pressure includes a fluid pressure regulating valve.

21. The apparatus of claim 20 wherein the means for applying fluid under pressure includes a shut-off valve and a check valve.

22. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying said second ingredient means comprises a liquid ingredient storage tank, means for applying fluid under pressure to the surface of liquid in said tank and means for establishing communication between the bottom of said tank and said region of subatmospheric pressure; and wherein said mixer means comprises a trough having spaced apart mixing blades and screw conveyor flights.

23. The apparatus of claim 22 wherein the means for applying fluid under pressure includes a fluid pressure regulating valve.

24. The apparatus of claim 23 wherein the means for applying fluid under pressure includes a shut-off valve and check valve.

25. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a pair of liquid ingredient storage tanks, means for applying fluid under pressure to the surface of liquid in said tanks, and means for establishing communication between the liquid in the bottom of said tanks and the region of subatmospheric pressure; and wherein said mixer means comprises a trough having spaced apart mixing blades and screw conveyor flights.

26. The apparatus of claim 25 wherein the means for applying fluid under pressure includes a fluid pressure regulating valve.

27. The apparatus of claim 26 wherein the means for applying fluid under pressure includes a shut-off valve and a check valve.

28. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying said second ingredient means comprises a liquid ingredient storage tank, means for applying fluid under pressure to the surface of liquid in said tank and means for establishing communication between the bottom of said tank and said region of subatmospheric pressure; and wherein said mixer comprises a trough mounted for pivotal movement about a vertical and a horizontal axis, and having spaced apart mixing blades and screw conveyor flights.

29. The apparatus of claim 28 wherein the means for applying fluid under pressure includes a pressure regulating valve.

30. The apparatus of claim 29 wherein the means for applying fluid under pressure includes a shut-off valve and a check valve.

31. The apparatus of claim 1 wherein the means in

communication with the region of subatmospheric pressure for supplying said second ingredient means comprises a pair of liquid ingredient storage tanks, means for applying fluid under pressure to the surface of liquid in said tanks, and means for establishing communication between the bottom of said tanks and said region of subatmospheric pressure; and wherein said mixer means comprises a trough having spaced apart mixing blades and screw conveyor flights.

32. The apparatus of claim 31 wherein the means for applying fluid under pressure includes a pressure regulating valve.

33. The apparatus of claim 32 wherein the means for applying fluid under pressure includes a shut-off valve and a check valve.

34. The apparatus of claim 1 wherein the means in communication with the region of subatmospheric pressure for supplying said second ingredient means comprises a pair of liquid ingredient storage tanks, means for applying a fluid under pressure to the surface of liquid in said tanks, and means for establishing communication between the bottom of said tanks and said region of subatmospheric pressure; and wherein said mixer comprises a trough mounted for pivotal movement about a vertical and a horizontal axis, and having spaced apart mixing blades and screw conveyor flights.

35. The apparatus of claim 34 wherein the means for applying fluid under pressure includes a pressure regulating valve.

36. The apparatus of claim 35 wherein the means for applying fluid under pressure includes a shut-off valve.

37. The apparatus of claim 1, further including a vehicular support means for said apparatus to thereby enable said apparatus to be transported between spaced apart locations.

38. The apparatus of claim 37 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means.

39. The apparatus of claim 37 wherein the means in communication with said region of subatmospheric pressure for supplying second ingredient means comprises a pair of liquid supply means.

40. The apparatus of claim 37 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises an air supply means.

41. The apparatus of claim 37 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a liquid supply means and an air supply means.

42. The apparatus of claim 37 wherein the means in communication with the region of subatmospheric pressure for supplying second ingredient means comprises a storage tank, means for applying fluid under pressure to the surface of liquid in said tank, and means for establishing communication between the liquid in the bottom of said tank and the region of subatmospheric pressure.

43. The apparatus of claim 42 wherein the means for applying fluid under pressure includes a fluid pressure regulating valve.

44. The apparatus of claim 43 wherein the means for

applying fluid under pressure includes a shut-off valve and a check valve.

45. The apparatus of claim 37 wherein the means in communication with the region of subatmospheric pressure comprises a pair of liquid ingredient storage tanks, means for applying fluid under pressure to the surface of the liquid in said tanks, and means for establishing communication between the liquid in the bottom of said tanks and the region of subatmospheric pressure.

46. The apparatus of claim 45 wherein the means for applying fluid under pressure includes a fluid pressure regulating valve.

47. The apparatus of claim 46 wherein the means for applying fluid under pressure includes a shut-off valve and a check valve.

48. A method of continuously forming a concrete mix from a plurality of dry and liquid ingredient means stored in separate storage areas, said method comprising the steps of:

separately and simultaneously feeding the dry ingredient means from the storage areas to a mixing area; propelling a first liquid ingredient means at a velocity sufficient to create a region of subatmospheric pressure within the stream;

flowing a second fluid ingredient means into said region of subatmospheric pressure to effect a thorough mixing of said first liquid and said second fluid ingredient means;

discharging said mixed first liquid and said second fluid ingredient means into said mixing area;

finally mixing all of the dry ingredients, the first liquid ingredient means, and said second fluid ingredient means in said mixing area; and

delivering the finally mixed dry ingredients, first liquid ingredient means and second fluid ingredient means from said mixing area.

49. The method of claim 48 wherein said first liquid ingredient means is water and said second fluid ingredient means is a liquid stored under fluid pressure.

50. The method of claim 48 wherein said first liquid ingredient means is water and said second fluid ingredient means is individually stored liquids under fluid pressure.

51. The method of claim 48 wherein said first liquid ingredient means is water and said second fluid ingredient means is stored air under pressure.

52. The method of claim 48 wherein said first liquid ingredient means is water and said second fluid ingredient means is individually stored liquid under fluid pressure and stored air under pressure.

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