Sept. 11, 1928. 1,684,370

K. R. SCHUSTER

ART OF TRANSPORTING MIXED MATERIALS

Filed Sept. 18, 1925

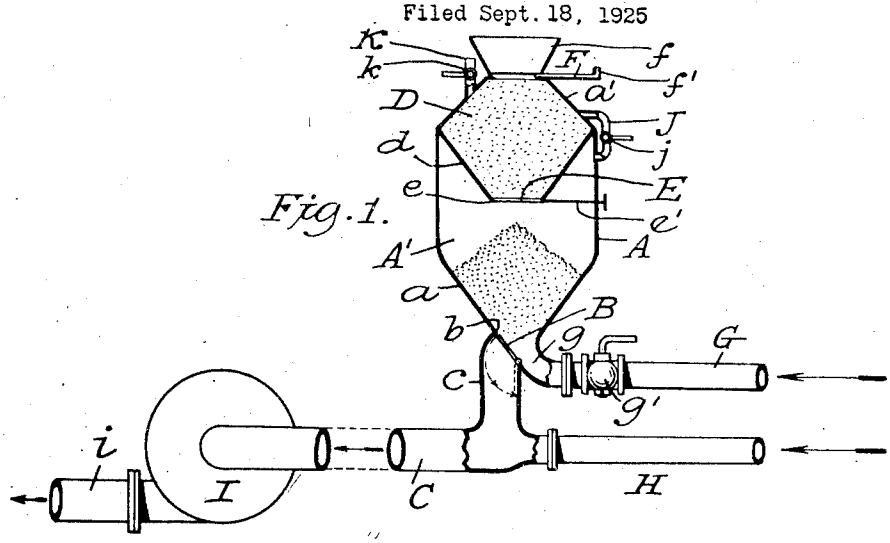


Fig. 1.

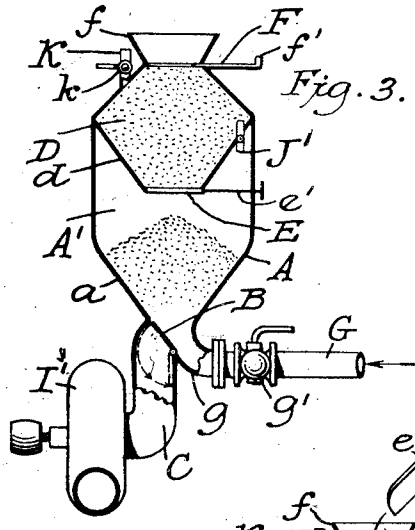


Fig. 3.

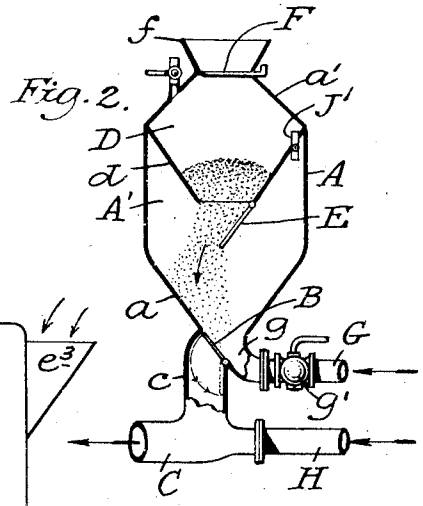


Fig. 2.

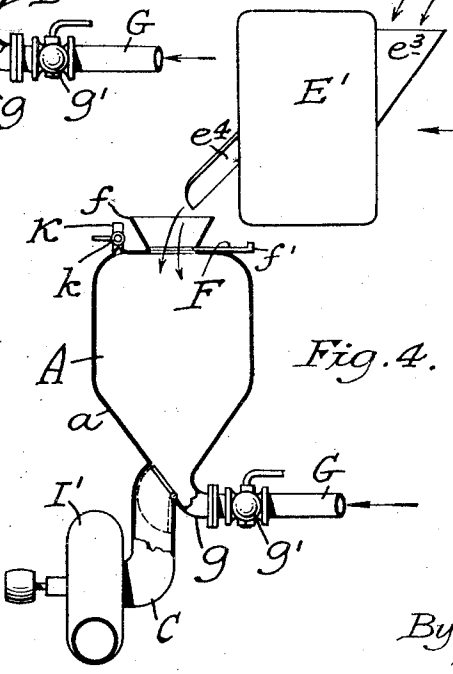


Fig. 4.

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UNITED STATES PATENT OFFICE.

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ART OF TRANSPORTING MIXED MATERIALS.

Application filed September 18, 1925. Serial No. 57,238.

This invention pertains to the art of transporting mixed materials, such as a concrete mixture for building purposes, whereby the materials may be mixed at a plant or station and transported to a distant point or station for utilization at the latter station in building operations of one kind or another.

The transportation of the mixed materials is effected primarily by the power of a pump, but the efficiency of a pump of a type appropriate for handling a concrete mixture is dependent, in large measure, upon keeping said pumping mechanism in a primed condition with the mixed material.

According to one embodiment of the invention, the pump is primed by utilizing the pressure of air or gas employed to agitate and mix the components of the mixture, and to this end, such air or gas is retained under pressure within the mixing chamber and such retained pressure of the mixing agent is utilized to dislodge or to eject the mixture through the mixture outlet, and to feed such mixture to the pump, for priming the latter, and maintaining such pump in a primed condition.

It is not essential that the admixture of the component materials be effected by the agency of air or gas under pressure, for the reason that such admixture of the materials may be obtained by a mechanical mixing machine. To rapidly mix the components and economically transport the same it is desirable, however, to blow air or gas under pressure into contact with the component materials while the latter are confined within a substantially closed chamber, whereby the sand, cement and water of a concrete mixture is diffused within a mass of coarse mineral aggregate, and thus effect the desired mix of such concrete mass. It requires a brief time to mix such a charge of concrete, and the air or gas may be at any pressure suitable for the purpose; but the mix having taken place, the air or gas is retained within the closed chamber until the mixture outlet is opened by the movement of a discharge valve, whereby the pressure of such retained air or gas is utilized to dislodge the mixed mass and to feed the same to the pumping mechanism, as a result of which air or gas pressure is utilized for priming the pump and thus efficiency is attained in the operation of the pump and economy and speed is attained in the transportation of the mixed materials.

In one practical embodiment of the invention, it is embodied in an apparatus comprising a chamber wherein the admixture of the components is conducted to produce a charge and concurrently with such admixture within the chamber, the components for a second charge of concrete is accumulated within a second chamber, the inlet to and the outlet from which second chamber are controllable separately and by independent gates or valves. Following the discharge of the mixed mass from the first chamber into a conduit leading to the pumping mechanism, the outlet valve of said first chamber is closed, and thereafter the accumulated charge within the second chamber is deposited within the first chamber by opening the outlet valve from the second chamber while keeping closed the inlet valve to said second chamber, whereby the second chamber serves the function of an air lock to the first chamber by preventing the outflow of air or gas from the first chamber during the period of time required to mix the components within said first chamber and to discharge to the first chamber the components of the second charge accumulated within the second chamber, as a result of which economy is obtained in the use of air or gas.

Other functions and advantages of the invention will appear from the following description taken in connection with the drawings, wherein different embodiments of my apparatus are disclosed, and wherein—

Figure 1 is a diagrammatic view partly in elevation and partly in section of one form of apparatus for transporting mixed materials.

Figure 2 is a similar view of another form of mixer illustrating a further step in the procedure.

Figures 3 and 4 are similar views of other forms of apparatus for transporting mixed materials embodying the invention.

In Figures 1, 2 and 3, the admixture of the components of a mass is effected primarily by the pressure of air or gas in contact with such components while present within

a closed chamber, whereas in Figure 4 the admixture of the components is obtained mechanically by the action of a mixing machine indicated diagrammatically at E', and of any appropriate construction.

The mixing vessel A of Figure 1 is connected with a pumping mechanism I, and such pumping mechanism is primed by the pressure of air or gas upon a charge of the mixed mass, which pressure acts to dislodge such mixed mass from the vessel and to feed such mixed mass to the intake of the pumping mechanism.

The pump is or may be of any character suitable for the purpose, but one form suitable for transporting a mixed mass is a centrifugal pump such as shown in Figures 1, 3 and 4 the intake to which is connected with the vessel A in order that the mixed mass may be forced by air or gas pressure into the pump for priming the latter. This pump may be positioned in a distant relation to the mixer, as in Figure 1, or it may be in a close relation to the mixer as in Figures 2 and 4, but in some instances, as where the mixer is closely adjacent to the place of utilization of the mixed materials, I may omit the pump, and utilize the pressure of air or gas for transporting the mixed mass within the conduit C so as to transport the mass from the mixer to the place of use solely by air or gas pressure.

In Figure 1 there is shown a hopper-shaped vessel A of suitable form and dimensions. The bottom part *a* of this vessel is of tapering formation for discharging the mixed mass through a port *b*, with which communicates a branch *c* of an eduction pipe or conduit C. The exit or port *b*, is closed by a gate or valve B adapted, when opened, to be turned by any suitable means (not shown) in a way for the gate to be substantially out of the line of flow of the mixed mass.

The vessel is shown as being provided interiorly with a partition *d*, constituting a hopper or chamber D within the upper part of said vessel. The chamber D is of such form and dimensions as to contain a quantity of materials adapted to be accumulated therein for the production of a charge of materials, and this chamber D is within the limits of the vessel A, so that the accumulated materials, or the charge, may be delivered from the accumulating chamber D directly into the mixing chamber A' of hopper A. The partition *d* is of frusto-conical formation, with an opening *e* at the bottom of chamber D, and this opening *e* is adapted to be closed by a gate or valve E, shown as a sliding gate operable by a hand rod *e'*. The inclined upper part *a'* of vessel A constitutes the top of the chamber D, and said top part of the vessel A and of the chamber D is provided with a tapering mouth portion *f*, the latter being closed by a gate or valve F, shown also as a sliding valve operable by a hand rod *f'*.

The agitation of the materials within the mixing chamber A' is effected by the energy of air or gas under pressure. Such air or gas is supplied to vessel A by a pipe G, having a reduced section *g* coupled to the bottom of vessel A. In this instance, the pipe with its reduced section *g* constitutes an air blast means, or said pipe may be provided, or formed, obviously, with a blast nozzle. As shown, the reduced pipe, or its blast nozzle, is positioned for feeding air or gas under pressure within the mass of materials present within the chamber A', such inflow of air or gas being into the materials and above the mixture outlet *b*. The inflow of the agitating fluid is controlled by a cock or valve *g'*, provided at a suitable point in the feed pipe G.

The eduction pipe C is of a desired length and diameter for conducting the mixed mass from the vessel to the place at which the mixture is to be installed or used. In the apparatus of Figure 1, the semi-plastic mass is transported within the conduit C, by the combined action of suction and pressure, the suction being exerted forwardly of the moving mass, whereas the pressure is applied rearwardly of such mass. The pressure impelling medium may be a suitable gas or atmospheric air, supplied by a pressure pipe H, coupled to the eduction pipe C at a point in axial alinement therewith, and if desired a valve or cock (not shown), may be provided in said pipe H. The suction or partial vacuum in the conduit C is due to the action of pump I, the intake of which is connected to the eduction pipe C, and from the outlet of this pump leads a distributing pipe *i*, of any suitable nature, by which the concrete mass may be installed or placed or otherwise disposed of for utilization in accordance with the practice of the trade.

The chamber D within which the materials are accumulated manually, is adapted at a certain stage in the service of the apparatus to have communication with the mixing chamber A' so that the fluid pressure supplied for agitating purposes to chamber A' is free to pass from the mixing chamber into an air lock chamber D, thus accumulating the fluid pressure within said air lock chamber, and thus enabling such accumulated fluid pressure to be utilized for effecting the expulsion of the mixture from the mixing chamber A', and also for clearing out of the chamber D (air lock chamber) any materials which may tend to lodge upon the surfaces within the chamber.

J is a by-pass for the fluid pressure, the

intake of said by-pass being connected with the mixing chamber A′ and the outlet connected to the accumulating (air-lock) chamber D. In this by-pass is a manually controlled valve *j*, adapted to be closed at will. As shown, the by-pass is arranged exteriorly of the vessel A; but this arrangement is optional, for the reason that the by-pass may be positioned interiorly of said vessel as at J′ in Figure 2.

A vent K is provided on the vessel A at the top part thereof, said vent having a valve *k* of any approved kind, whereby fluid pressure within chamber D may be permitted to escape, if desirable in the operation.

The operation is as follows: Valve F is opened, and valves B, E, are closed, whereupon the materials, such as a coarse mineral aggregate, sand and cement, in the desired proportions, are supplied through inlet *f* to the chamber D, water being supplied as required to render the mass semi-plastic. Valve F is now closed, and valve E opened, valve B remaining closed. The charge passes from chamber D to mixing chamber A′, whereupon valve E is again closed to cut off direct communication between mixing chamber A′ and accumulating chamber D, except through the by-pass. Air or gas under the required pressure is supplied by opening the cock *g′* for a desirable period of time, thus admitting a blast of compressed air or gas to chamber A′, the effect of which is to diffuse the sand and cement within the coarse mineral aggregate and to thus effect the mix of the components of the charge of materials.

Following the closing of the valve E, valve F is opened for a short period, and another charge of materials is accumulated within chamber D, the by-pass being shut off during such charging period, and thereafter valve F is closed and the by-pass opened, whereby the air or gas pressure supplied to chamber A′ is conducted through the by-pass to the accumulating chamber D, the effect of which is to equalize the pressure of air or gas within chambers A′, D. The admixture of materials within chamber A′ having been made, the gate B is opened, and the mixed mass is discharged from chamber A′ through the outlet *b* into the conduit C, such discharge utilizing the gravity of the mass and being aided by the air or gas pressure supplied to chamber A′. The mass mixed within chamber A′ is deposited within the conduit, and forced or moved to the pump I for priming the pump, and thereafter the gate or valve B is closed, whereupon the mixed mass or charge is moved through the conduit by fluid pressure supplied rearwardly of the mass through pipe H and by partial vacuum or suction created in conduit C forwardly of the mass by pump I, whereby the mixture may be transported for a desirable distance and the mixed mass during such period of transportation is subjected to further admixture by such pressure and suction. The pump I is or may be located at a distance from vessel A, and said pump is aided in its action upon the charge by the rearward pressure of air or gas supplied by the pipe H, the delivery pipe *i* leading the charge or mixed mass from pump I to the point at which the concrete is utilized. While one charge is undergoing admixture within chamber A′, another charge is being accumulated within chamber D, and while one charge is being mixed within chamber A′, a previously mixed charge is undergoing transportation within conduit C. Thus the mixed masses are supplied in successive charges to the conduit, and subjected to the action of the pump I and to fluid pressure of pipe H, the net result being that the operations are continuous and carried out with economy of gas or air in the mixing and transporting stages of the method. By the use of chamber D and its valves E, F, the materials are accumulated within the hopper A during the mixing and transporting operations of other charges, and by using the valves E, F, in the required order the hopper remains open only for the periods required to deposit the materials within the hopper, thus minimizing the loss and waste of the air or gas, the chamber D functioning as an air lock in economizing in the air or gas pressure, and in feeding the charges into the mixing chamber.

In the apparatus of Figure 2, the construction is essentially the same as in Figure 1, except that the by-pass is positioned interiorly of the vessel, and the pump I is omitted, the successive charges of material being transported within the conduit by pressure supplied by the pipe H, which air or gas pressure is applied rearwardly of such successive charges.

The apparatus of Figure 3 is substantially the same as the apparatus of Figures 1 and 2, except that the transportation of the mixed charges is effected by the action of a pump I′ located in close relation to the vessel A, the fluid pressure pipe H being dispensed with and the pump I′ relied upon to furnish the energy for the propulsion of the mixed charges. In this form of apparatus, the pump I′ is fed with the charges directly from the hopper, and said pump is primed by the air or gas pressure upon the charges within chamber A′.

In Figure 4 there is shown another form of apparatus by which my method of operation may be carried out. As there shown, the vessel A provides a chamber within which is accumulated a charge and the air or gas pressure required to dislodge said charge

and to feed such charge to the pump I′ for priming said pump. The admixture of the components of the charge is effected mechanically by the action of a suitable mixing mechanism, indicated at E′. This mixer is positioned in an elevated relation to the hopper A, and said mixer is shown as having a charging or filling spout e^3, and a discharging spout e^4. The feed spout opens into the mixer E′, and said spout is exposed for convenient access in order that the materials may be dumped into the spout and thus accumulated within said mixer to constitute a charge. The materials thus accumulated may be delivered by spout e^4 by opening a suitable gate (not shown), said spout being in overhanging relation to the charging mouth f of the hopper A.

The charge is mixed within mixer E′ and supplied to hopper A, and such charge is forced from hopper A into the pump by the pressure of air or gas supplied to vessel A by means of a valved pipe G, the valve g' in which may be opened for the air or gas to flow into vessel A (valve F being closed) so that the air or gas may be utilized to dislodge the mixed mass from hopper A and thus prime the pump I′, whereby said hopper acts as an air lock in conserving the use of the compressed air or gas.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In the art of mixing and transporting materials such as concrete, the method which consists in accumulating within a chamber the materials to constitute a charge to be mixed; feeding said charge to a second chamber; blowing compressed air upwardly within the second chamber and exposing the components of the mass constituting the charge to the upward flowing air for effecting the admixture of the materials within the second chamber; accumulating the inflowing air above the mass composing said charge concurrently with the admixture of such charge; dislodging the mixed charge from the second chamber by gravity of the charge and by pressure exerted upon the charge by the air accumulated above the charge; feeding the dislodged mixed mass constituting the charge into a conduit, and transporting the mixed charge within said conduit.

2. In the art of mixing materials such as concrete, the method which consists in accumulating within a chamber the materials to constitute a charge to be mixed; feeding the charge from said chamber to a second chamber; again feeding to the first chamber the materials to constitute therein a second charge; blowing compressed air upwardly within the second chamber and exposing to the upwardly flowing air the component materials of the charge first admitted thereto thereby effecting the admixture of the charge within the second chamber; accumulating the inflowing air under pressure within the second chamber and within the first chamber; dislodging from the second chamber the mixed charge by the pressure upon such charge of the air accumulated within the second chamber; and dislodging from the first chamber by the pressure of the air accumulated therein the mass constituting the second charge, and feeding the latter to the first chamber.

3. In a mixer, a vessel provided at the bottom with a mixture outlet, means for feeding air or gas within said vessel, a pump connected to said vessel, and a valved chamber constituting an air lock within which is adapted to be accumulated the materials to form a charge, and means for controlling the flow of the charge from the air lock chamber to said vessel.

4. In a mixer, a vessel having an outlet, a pump the intake of which is connected to said vessel, means for blowing air or gas into said vessel, an air lock chamber within which is adapted to be accumulated the materials to constitute a charge, and means for feeding the charge of accumulated materials from the air lock chamber to the vessel.

5. In a mixer, a vessel having a mixture outlet, a pump connected to said vessel, means for feeding air or gas to the vessel, an air lock chamber within which is adapted to be accumulated the materials to constitute a charge, means for establishing the flow of air or gas from the vessel to the air lock chamber, and means for discharging from the air lock chamber to the vessel the charge of materials accumulated within the air lock chamber.

6. In a mixer, a vessel having a mixture outlet, a pump, means for feeding air or gas to said vessel, an air lock chamber within which is adapted to be accumulated the materials to constitute a charge, a valved by-pass from the vessel to the air lock chamber, and a valve for discharging the accumulated charge from the air lock chamber to the vessel.

7. A concrete mixer embodying a vessel provided at its upper part with a charging opening and at its bottom part with a mixture outlet, means within said vessel dividing the interior of said vessel into a lower mixing chamber and an upper hopper chamber, valves at the top and bottom of the hopper chamber, a conduit, and a valve for controlling the discharge through the mixture outlet to said conduit.

8. A mixer embodying a vessel provided with an interior member positioned for dividing the same into a mixing chamber and an air lock chamber within which latter chamber may be accumulated the mate-

rials to constitute a charge to be mixed, means for controlling the flow of the charge from the air lock chamber to the mixing chamber, and means for blowing air or gas within the mixing chamber.

9. A mixer embodying a vessel provided with an interior member positioned for dividing the same into a mixing chamber and an air lock chamber within which latter chamber may be accumulated the materials to constitute a charge to be mixed, means for controlling the flow of the charge from the air lock chamber to the mixing chamber, means for blowing air or gas within the mixing chamber, and means for the flow of air or gas from the mixing chamber into the air lock chamber.

10. A mixer embodying a vessel provided with an interior member positioned for dividing the same into a mixing chamber and an air lock chamber within which latter chamber may be accumulated the materials to constitute a charge to be mixed, a valve for cutting off the air lock chamber from the outside atmosphere, a separate valve for controlling the flow of the charge from the air lock chamber to the mixing chamber, means for blowing air or gas within the mixing chamber, and a discharge valve at the lower part of the mixing chamber.

11. A concrete mixer embodying a vessel provided with a chamber and with a mixture outlet, means for blowing air or gas into said chamber, a valved inlet at the top of said vessel, a chamber separate from the mixing chamber within which may be accumulated the materials of a charge adapted to be supplied to the mixing chamber, a conduit for the transport of the charges mixed successively within said mixing chamber, a pump connected to said conduit, and a valve between the mixing chamber and the conduit for controlling the discharge of said charges through the mixture outlet.

12. In the art of mixing and transporting materials such as concrete, the method which consists in accumulating within a chamber the materials constituting a charge to be mixed; feeding the charge from said chamber to a second chamber; accumulating in the first named chamber the materials to constitute a second charge to be mixed; blowing compressed air upwardly within the second chamber and exposing the components of the charge first admitted to said second chamber to the action of the upward flowing air, thereby effecting the admixture within the second chamber of the charge present therein; accumulating in the first chamber and in the second chamber the compressed air blown upwardly within the second chamber; dislodging from the second chamber the mixed charge by the pressure upon such charge of the air accumulated in said second chamber; dislodging from the first chamber the charge subsequently deposited therein by the pressure of the air accumulated in the second chamber, and scavenging the walls of the first chamber from adhesions of material by the outflow of air from the first chamber into the second chamber.

13. In an apparatus for mixing and transporting concrete materials; a mixing chamber having a valved outlet; a charge-accumulating chamber having a valved inlet and a valved outlet, adapted to feed a charge of materials to said mixing chamber; means for blowing compressed air upwardly within said mixing chamber; means whereby the upwardly flowing air is accumulated within the charge-accumulating chamber; a conduit into which a charge from the mixing chamber is adapted to flow under pressure of air accumulated within said mixing chamber, and means co-operable with said conduit for effecting the transportation therein of successive charges supplied from said mixing chamber.

14. In an apparatus for mixing and transporting concrete materials, a mixing chamber, a valved outlet from the lower part of said mixing chamber, a conduit connected for communication with said valved outlet, means for feeding a charge of materials to said mixing chamber; means connected with the lower part of the mixing chamber for blowing compressed air upwardly within said mixing chamber, and accumulating air under pressure therein, and a pump mechanism having its intake connected with the conduit, whereby the pump mechanism is primed with the mixed charge of materials adapted to be dislodged from said mixing chamber by the pressure of air accumulated therein.

15. In an apparatus for handling mixed materials, a chamber, a conduit leading from said chamber, means for blowing air into chamber, and an air lock chamber having a valved inlet and a valved outlet, whereby air is confined within said air lock chamber upon opening the valved outlet for discharging a charge of materials from the air lock chamber into the first named chamber.

16. In an apparatus for handling mixed materials, a chamber, a conduit leading from said chamber, means for blowing air into said conduit, and an air lock chamber having a valved inlet and a valved outlet, said air lock chamber functioning as means for precluding the escape of air from the first chamber when the valved outlet is opened for discharging a charge of materials from the air lock chamber to the first named chamber.

17. In an apparatus for handling mixed

materials, a chamber, a conduit leading therefrom, means for feeding air to the material containing space, an air lock chamber within which materials may be accumulated to form a charge, an outlet valve for controlling the flow of the charge from the air lock chamber to the first chamber, and an inlet valve to the air lock chamber for precluding the outflow of air from the first chamber to the atmosphere when the outlet valve is opened.

In testimony whereof I have hereto signed my name this 17th day of September, 1925.

KARL R. SCHUSTER.