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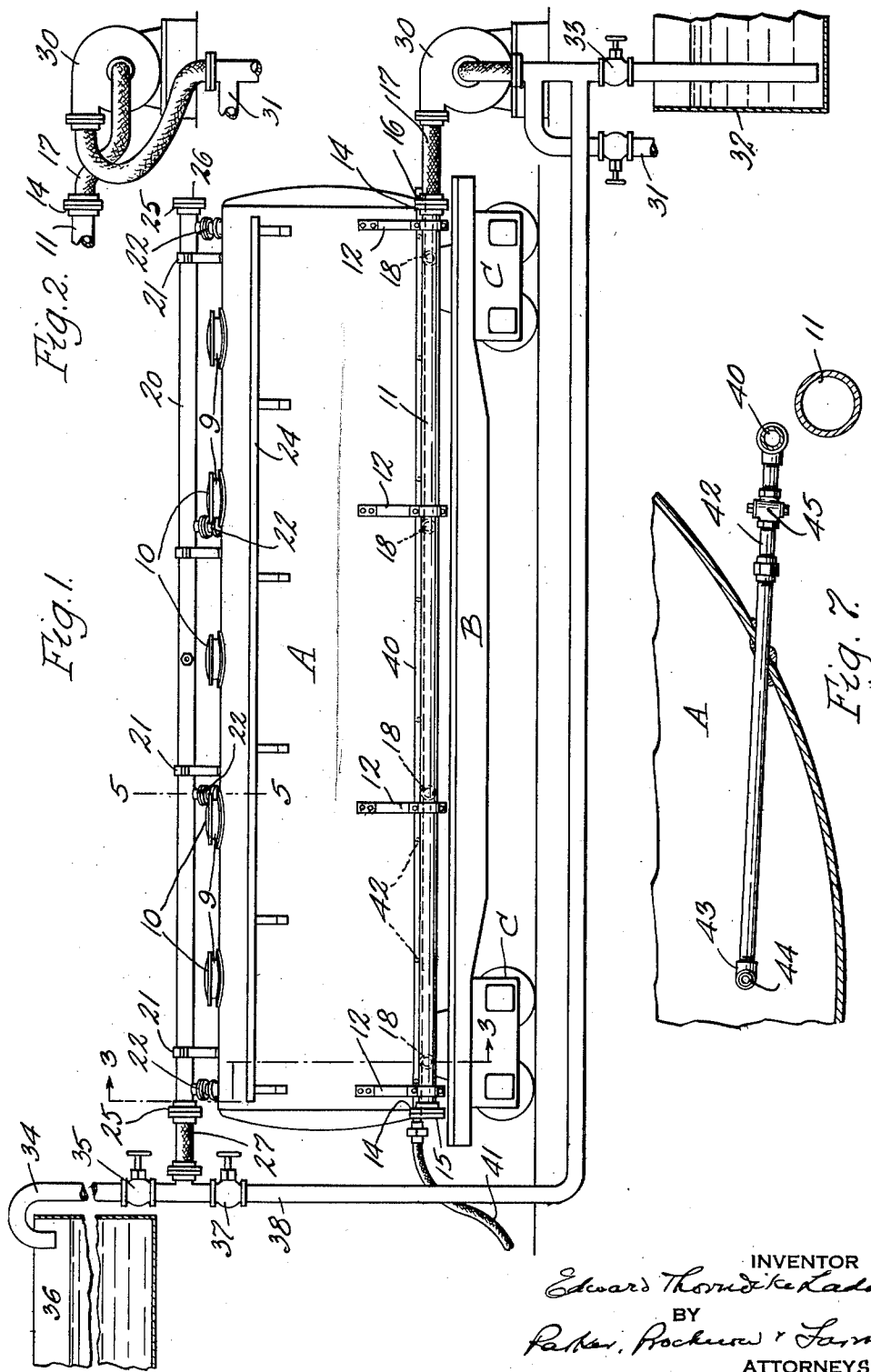
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METHOD OF AND APPARATUS FOR TRANSPORTING AND HANDLING MATERIALS

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3 Sheets-Sheet 1



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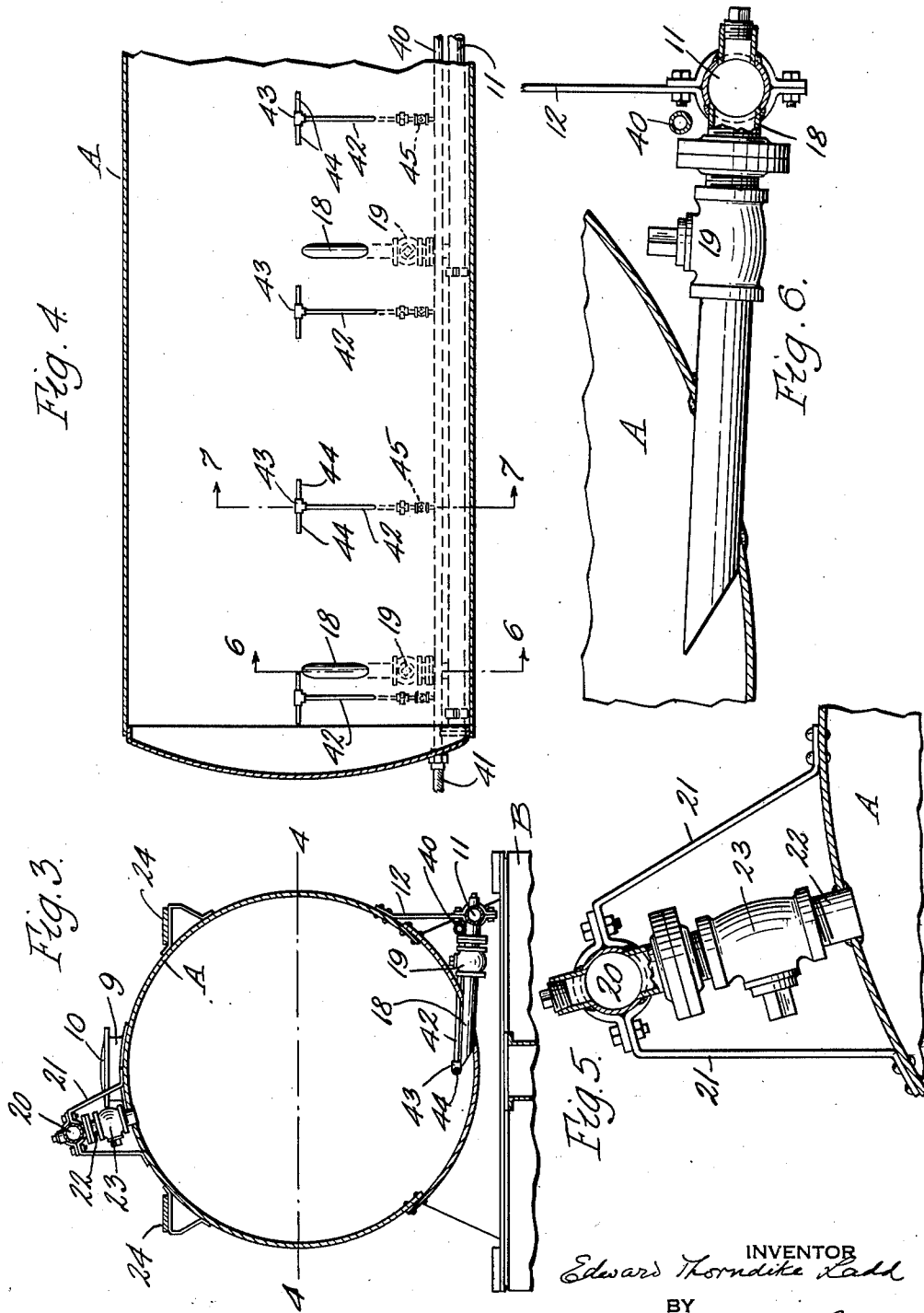
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3 Sheets-Sheet 2



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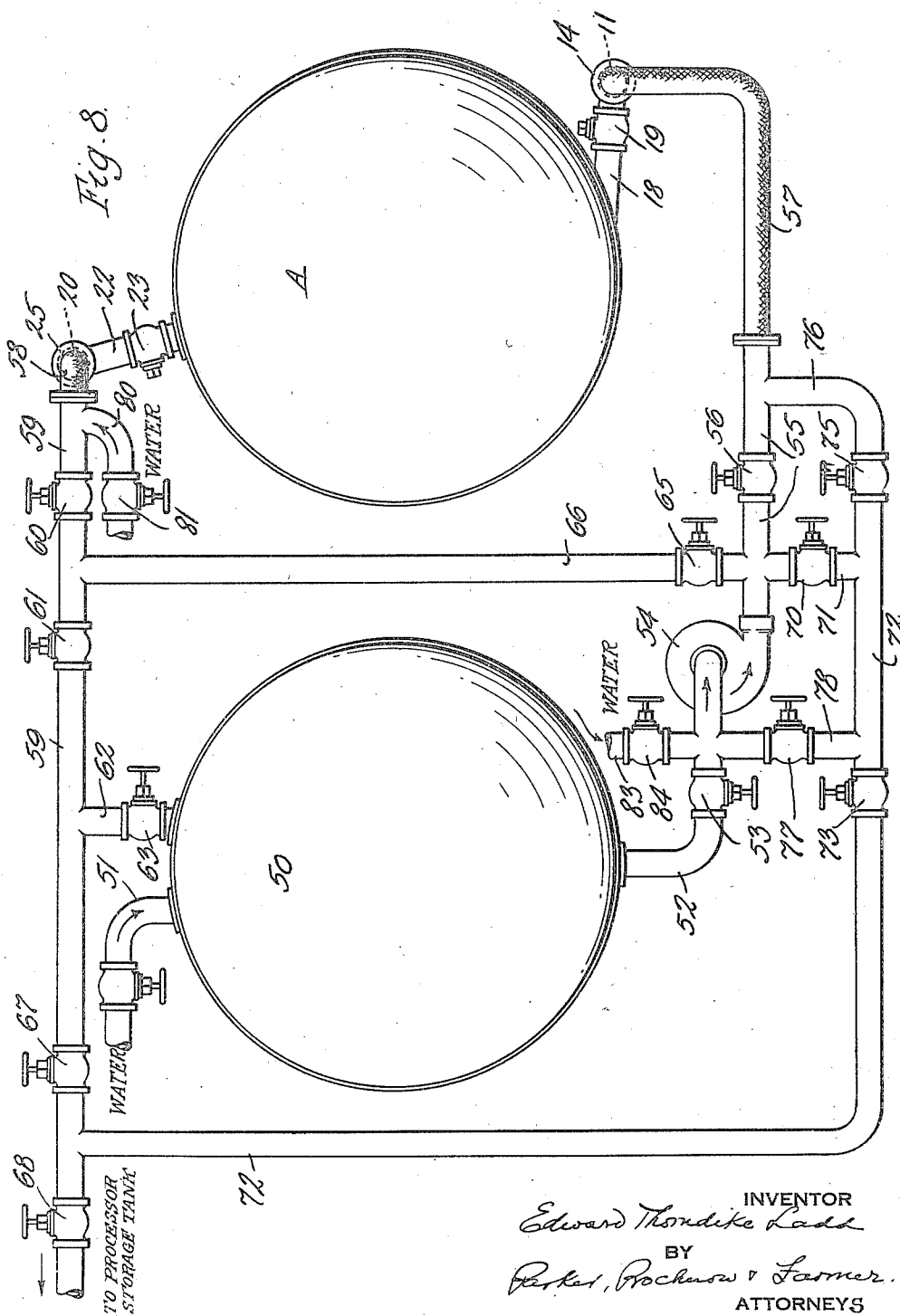
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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR TRANSPORTING AND HANDLING MATERIALS

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19 Claims. (Cl. 214—152)

This invention relates to a method of and apparatus for transporting and handling soluble or suspensible materials.

There are many substances in solid form which are readily soluble in water or other liquids or which form slurries or suspensions which can be readily carried with a stream of water. Such materials when being transported are generally in finely divided form so that care must be used that the cars or containers in which they are transported are free from cracks or holes through which such materials may flow or sift out and also the materials must be transported in boxcars and other containers, in which they are protected from rain or moisture. It frequently happens that when such materials arrive at their destination, they are used either in solutions, suspensions or slurries and the materials must in that case be unloaded from a box car and transported to the tank where the solution or suspension is made. Also it is generally more expensive to load such materials in box cars, since they cannot be loaded in such cases entirely by gravity through chutes or from hoppers.

One of the objects of this invention is to provide a method and apparatus for facilitating the transporting, loading and unloading of soluble or suspensible materials. Another object of this invention is to provide a method in accordance with which the materials while substantially dry are loaded into water-tight containers, such for example as tank cars, and which containers may be unloaded by passing water or other liquid through the same, by means of which the material is carried out of the container either in the form of a solution or a suspension. Still another object of this invention is to unload a container having solid material therein by making a solution or suspension of the solid material in the container and discharging the same from the container. Another object is to provide a method of unloading a container by dissolving or suspending the contents thereof in a liquid and to agitate the contents to facilitate such dissolving or suspending.

It is also an object of this invention to provide a container for transporting solids which is so constructed that a liquid may be admitted to the same to make a solution or suspension of the material therein. Another object is to provide a tank car which is so constructed that the material in substantially dry form can readily be loaded into the tank car, and which tank car is provided with suitable pipes or the like through which liquid may be passed into the car and

discharged therefrom for unloading the car. It is also an object of this invention to provide a container with means for agitating the material in the container to expedite the making of solutions or suspensions of the material in the liquid.

Other objects of this invention will appear from the following description and claims.

In the accompanying drawings:

Fig. 1 is a side elevation of a tank car showing the same connected with piping for unloading the car.

Fig. 2 is a fragmentary view of the piping showing different connections with the pump to reverse the flow of liquid.

Fig. 3 is a transverse sectional elevation of the car on line 3—3, Fig. 1, the lower portion of the car being omitted.

Fig. 4 is a fragmentary sectional plan thereof on line 4—4, Fig. 3.

Fig. 5 is a fragmentary sectional elevation on an enlarged scale on line 5—5, Fig. 1, showing a pipe connected with the tank of the tank car.

Figs. 6 and 7 are fragmentary sectional views, on lines 6—6 and 7—7 respectively of Fig. 4.

Fig. 8 is an end view of a tank of my improved tank car and showing, partly diagrammatically, another piping arrangement for unloading the tank car.

In accordance with my method of transporting and handling materials, I load the material while in substantially dry form into a liquid tight container, such for example as a tank of a tank car, which has been provided with suitable piping connections for passing a current of liquid through the tank. The material is then transported to its destination where it is to be used. At the destination, the tank or container is connected with suitable piping connections so that water or other liquid, in which the material is either soluble or in which it may be suspended, may be passed through the tank or container, and the resulting solution or suspension is then discharged from the tank to a storage container or to a process in which it may be used. If the material is not readily soluble or suspensible, liquid may be recirculated or passed through the tank or container a number of times until the desired content of material in the liquid is attained. If on the other hand, the liquid is very readily soluble or suspensible a single passage of the liquid through the tank may be sufficient. In order to avoid the possibility of the clogging of pipes connected with the tank or container, the liquid is preferably passed into the tank near the bottom

thereof and discharged from near the top of the tank.

In the accompanying drawings, I have illustrated my invention as applied to a tank car including a tank A suitably mounted on a car frame B having trucks C on which the car wheels are journaled. It will be understood, however, that this invention is not concerned with the car frame or trucks nor with the particular tank shown, and furthermore, the tank may, if desired, be permanently or removably mounted on a vehicle of any other type such, for example, as an automotive vehicle or boat. The tank A is provided with suitable means for permitting easy loading of the same with a dry material. For example, a plurality of domes or openings 9 may be provided at intervals lengthwise of the top of the tank, and each of which is provided with a substantially water-tight lid or cover 10. When the car is being loaded, these covers are removed so that the material may be dropped by gravity into the car to fill the same, and after loading, the covers are secured to the domes so that material in the car will be protected against the weather, as well as against loss by sifting through cracks, crevices and the like.

In accordance with this invention, when the tank A arrives at its destination, the material contained within the tank is removed from the same by means of water or other liquid in which the material may be dissolved or suspended, and this may be accomplished in any suitable or desired manner. I have shown in the accompanying drawings a tank car provided with pipe connections by means of which liquid may be introduced into the tank and other pipe connections by means of which liquid having the material dissolved or suspended therein may be conducted from the tank, but it will be understood that the piping arrangements herein shown are merely for purpose of illustrating some embodiments of this invention, and it is not intended to limit this invention to the particular pipe connections herein shown. In the arrangement shown, I provide along a side of the tank, preferably near the bottom thereof, a longitudinally extending pipe or tube 11, which may be secured in place beside the tank A in any suitable manner, for example, by means of straps or hangers 12, the upper ends of which are fastened to the tank in any suitable manner, and the lower ends of which are suitably secured to the pipe 11. The pipe 11 is provided at its ends with suitable flanges 14, Fig. 1, to which plates or caps 15 may be secured when it is desired to close the ends of the pipe. One or both of these plates may be removed to permit a coupling 16 of a hose or tube 17 to be secured thereto at the point of unloading of the tank car.

The pipe 11 is provided with one or more branches 18 which are preferably controlled by means of suitable valves 19 and which extend through the wall of the tank A and terminate in the interior of the tank adjacent to the bottom thereof. Four such branch pipes are shown in the construction illustrated, see Fig. 1, and are spaced substantially equidistant from each other lengthwise of the tank. Any other means for admitting liquid to the tank may, of course, be provided, if desired.

The liquid in which the material is dissolved or suspended may be discharged from the tank in any suitable manner, for example, through a pipe or tube 20 which may also be mounted on the tank A in any desired manner, for example,

by means of brackets or standards 21, the ends of which are secured to the wall of the tank. The pipe 20 is provided with a number of branch pipes 22, each controlled by means of a valve 23. These branch pipes extend into the tank along the upper portion thereof and are also spaced apart lengthwise of the tank. The tank may also be provided at opposite sides thereof with the usual platforms or walks 24. The pipe 20 is also provided at its ends with flanges 25 to each of which a closing cap or plate 26 may be secured. The coupling flange member 25 may also cooperate with a coupling member of a tube, hose or duct 27 through which liquid may be discharged from the tank at the destination.

The piping arrangements for removing the material from the tank or container A at its destination may, of course, vary greatly, depending upon the manner in which the material is to be used. One arrangement for handling the material at its destination is illustrated in Fig. 1, in which liquid is supplied to the pipe 11 by means of a pump 30 which may be mounted on a foundation adjacent to the side track on which the tank car is located when being unloaded. The discharge of the pump may be connected to the tube or hose 17 which connects with the pipe 11 of the tank. The suction or intake of the pump may be connected either with a valve controlled water or solvent supply pipe 31 or with a tank 32 in case a valve 33 is opened. The liquid discharged from the pipe 11 into the tank A will fill the tank and then pass out of the discharge pipe 20 through the flexible hose 27 connected therewith to a pipe 34 if a valve 35 is opened, and into a tank or container 36 in which the liquid may either be stored or further treated or processed.

If the liquid discharged from the tank A no longer has the desired material content or concentration, the liquid may be recirculated through the tank by shutting off the inlet to the pump either from the fresh water supply or from the tank 32 and by closing the valve 35 and opening the valve 37, so that the liquid is returned to the intake of the tank through a pipe 38. In this manner, the liquid may be circulated through the tank until the same attains the desired concentration, whereupon it may be discharged to the storage tank 36 in any suitable manner. For example, as shown in Fig. 2, the tubes or ducts leading to the pump 30 may be reversed so that the pump receives liquid from the duct or hose 17 which is connected with the pipe 11 of the tank and discharges liquid from the tank A through the pipe 38 in to the tank 36, if both valves 35 and 37 are open. The flow of liquid into the tank A through the pipe 20 may be prevented by closing the valves 23.

When the tank A no longer contains sufficient material to form a solution or suspension of the desired concentration, a quantity of water or other liquid may be circulated through the tank A until all of the material in the tank has become dissolved, and this solution may then be discharged into the tank 32 in any suitable manner, for example, by stopping the pump 30 and opening the valve 33, and by admitting some air into the top of the tank A. The solution collected in the tank 32 may then be pumped through the next car of material to bring it up to the desired concentration, and then discharged to the tank 36.

It may also be desirable at times to provide for agitation of the material in the tank, this

being frequently advisable when the amount of material in the tank has been greatly reduced. Any suitable or desired means for producing such agitation may be provided, and in the particular construction shown, for this purpose, I have provided means for discharging compressed gaseous fluid into the bottom of the tank. For this purpose, an air or steam pipe 40 may be provided at the side of the tank near the bottom thereof which may be suitably connected to a flexible tube or hose 41 leading to a supply of compressed air or other gas or steam (not shown). The pipe 40 may be provided with a plurality of branch pipes 42 which extend through the wall of the tank into the interior thereof and each of which may be provided at its inner end with a T coupling 43 to which two short pipes 44 are connected, so that gas or steam discharged through the same will be blown lengthwise along the bottom of the tank A. Any other discharge nozzles for the gaseous fluid may be provided and preferably each branch pipe 42 is controlled by means of a valve 45. Any gas or steam admitted under pressure in the tank will, of course, break up any piles or residue of material lying in the bottom of the tank and will agitate the material in the bottom of the tank. If air or other gas is used it will bubble up through the liquid in the tank and pass out through the discharge pipe 20 together with any liquid that may be discharged through such pipe. The agitation of the material by a gaseous fluid speeds up the dissolving or suspension of the material in the liquid.

In Fig. 8, I have illustrated an alternative arrangement for removing the material from the portable tank or container A. In this construction, a stationary tank 50 is provided at the destination into which water may be admitted through a valve controlled pipe 51 and which is connected by means of a pipe 52 and valve 53 to the inlet of a pump 54 the discharge of which is connected to a pipe 55 having a plurality of branches. If a valve 56 is opened and the valves in other branches are closed, liquid from the tank 50 passes into a portable tube or hose 57 which is connected to the coupling 14 of the pipe 11 of the tank car. One of the coupling members 25 of the upper pipe 20 of the tank A may be connected through the medium of a flexible tube or hose 58 to a pipe 59 containing valves 60 and 61, which, if opened, permit the liquid to pass through a branch pipe 62 and valve 63 into the tank 50. Consequently, liquid may be circulated through the tanks 50 and A until the liquid acquires the desired concentration, whereupon the valves 56, 60, and 63 may be closed and a valve 65 in a branch 66 of pipe 55 opened to permit liquid from the tank 50 to be discharged into the pipe 59. By opening two other valves 67 and 68 in the pipe 59, liquid may be discharged to a storage tank (not shown) or to a process in which the liquid is used. By means of the piping arrangement shown, it is also possible to discharge liquid from the tank 50 to a storage tank by opening a valve 70 in another branch pipe or duct 71 leading to a pipe 72 containing a valve 73. If the valve 73 is opened, the liquid will flow through the pipe 72 into the pipe 59 between the valves 67 and 68 and by closing the valve 67 and opening the valve 68, liquid may be discharged to a further process or to the storage tank.

When most of the material has been removed from the tank A, so that liquid may flow through the same in the reverse direction without danger

of clogging the pipes 18 and 11, the portable tank A may be pumped out and the contents thereof discharged through the valve 68 to the storage tank or further process. This can be done by closing the valve 56 and opening a valve 75 in the pipe 72, which is connected by means of an elbow 76 to the pipe 55. The valves 70, 73 and 53 are closed and a valve 77 is opened so that liquid from the pipe 72 can pass to the inlet of the pump through a connecting pipe 78. By opening valves 65, 61 and 67 and 68, the liquid discharged by the pump 56 may pass through pipes 66 and 59 to the further process or storage tank.

When there is not sufficient material left in the tank to form a solution of suspension of the desired concentration and when it is desired to wash out the tank, water may be admitted into the top of the tank from a main pipe or duct 80 by opening the valve 81 and closing valve 60. In order to drain this liquid from the portable tank A, the pump is operated as has been described to withdraw liquid from the bottom of this tank and to discharge the same into pipes 66 and 59, but by closing the valve 67 and opening the valve 63, this liquid will be discharged into the stationary tank 50, where it may be stored until the next tank car or portable tank A arrives, whereupon the concentration of the liquid in the tank 50 may be increased by pumping the same through the material in the next tank car.

When the system is started, it is possible to admit water from a pipe 83 by opening a valve 84 and closing the valve 53, whereupon by proper manipulation of the valves, water may flow through the pump into the bottom of the portable tank A and then into the stationary tank 50 and when both tanks A and 50 have been filled to the desired extent, the water valve 84 may be shut off and liquid circulated by the pump from the tank 50 into the portable tank A.

It will, of course, be obvious that pet or test cocks may be provided wherever necessary so that samples of liquid may be withdrawn for the purpose of testing its concentration, and by means of the piping disclosed in Fig. 8 a very accurate control of the concentration of the liquid can be maintained.

The process and apparatus herein described are very desirable for use in connection with any readily soluble material such as, for example, alkali metal salts, carbonates and the like, as well as for materials which are not soluble but which may become suspended in liquids to form suspensions or slurries. By means of the described process and apparatus a very considerable amount of labor is saved in that the unloading of the material and the separate step formerly necessary of dissolving the material after unloading the same, or of making a suspension or slurry thereof, are combined into a single process, since this dissolving operation takes place simultaneously with the unloading. The process and apparatus described has the further advantages that labor is saved in the loading of the material into the container A, and the loss of material during transportation of the same is eliminated. By flowing the liquid through the tank in such manner that liquid carrying the material is discharged from the top of the tank, clogging of the discharge passage is avoided and when the material is of a nature which forms a true solution, the minimum of undissolved particles will be carried out of the tank by the liquid.

As herein used the words "soluble material" are intended to include not only materials which dis-

solve in liquids to form true solutions, but also any material which may be suspended in liquid to form a suspension or slurry. Similarly the word "solution" as hereinafter used is intended to include suspensions and slurries.

I claim as my invention:

1. A method of transporting and making a solution of soluble material, which includes placing said material while in substantially dry form into a liquid-tight container, transporting the container to the desired destination, then admitting liquid to said tank and making a solution of the material in said container, by passing liquid into the same, and withdrawing the solution from said container.

2. The method of shipping and making a solution of a soluble material, which includes placing a material while in substantially dry form into a tank of a tank car, transporting the car to the desired destination, admitting liquid to said tank and making a solution of the material in the tank, and removing material from said tank by withdrawing the solution therefrom.

3. A method of transporting and making a solution of a soluble material, which includes placing the material while in relatively dry form into a liquid-tight container, and unloading and dissolving the material from said container by passing through the container and the material contained therein a liquid, and removing the liquid carrying said material from said container.

4. A method of transporting and handling a soluble material, which includes placing said material while in substantially dry form into a liquid-tight container, transporting the container to the desired destination, pumping liquid into said container to form a solution of the material, discharging said solution from the container, continuing the pumping of liquid into said container until the percentage of said material in said solution decreases, then recirculating liquid discharged from said container through said container to increase the percentage of material contained in said liquid, and then discharging said liquid from said container.

5. A method of transporting and making a solution of a soluble material, which includes placing said material while in substantially dry form into a liquid-tight container, transporting said container to the desired destination, passing liquid through said container to dissolve and remove material therefrom, and agitating the material in said container while liquid is flowing through said container.

6. A method of transporting and making a solution of a soluble material, which includes placing said material while in substantially dry form into a liquid-tight container, transporting said container to the desired destination, passing liquid through said container to dissolve and remove material therefrom, and discharging gaseous fluid into the bottom of said container to agitate said material.

7. A method of shipping and handling soluble materials, which includes placing a material while in substantially dry form into a tank of a tank car, transporting the car to the desired destination, circulating a body of liquid through said tank to form a solution of the desired material content in said liquid, discharging said body of liquid from said tank when said liquid has attained the desired concentration of the material contained therein, and supplying fresh liquid to said tank to remove further material from said tank.

8. A container mounted on a vehicle and having a plurality of domes arranged at intervals in the upper portion thereof through which material in substantially dry form may be loaded into said container, means for forming liquid tight closures for said domes, a pipe communicating with said container near the bottom thereof for admitting liquid into said container, and a discharge pipe near the upper portion of said container through which liquid carrying said material may be discharged therefrom when said domes are closed.

9. A tank car including a tank having a relatively large opening near the top thereof through which material in substantially dry form may be loaded into said tank, means for tightly closing said opening, a pipe extending into said tank for admitting liquid thereto, and a passage leading from the upper portion of said tank through which liquid carrying said material may be discharged therefrom to a level higher than said opening in said tank, for unloading said tank.

10. A tank car including a tank having a relatively large opening near the top thereof through which material in substantially dry form may be loaded into said tank, means for tightly closing said opening, a pipe extending into said tank for admitting liquid thereto, a passage leading from the upper portion of said tank through which liquid carrying said material in solution may be discharged therefrom, for unloading said tank, and means for agitating the material contained in said tank.

11. A tank car including a tank having a relatively large opening near the top thereof through which material in substantially dry form may be loaded into said tank, a pipe extending into said tank for admitting liquid into the lower portion thereof, a passage leading from the upper portion of said tank through which liquid carrying said material may be discharged therefrom, for unloading said tank, and means for admitting compressed gaseous fluid into said tank near the bottom thereof for agitating said material.

12. A tank mounted on a vehicle and having a relatively large opening through which soluble material in substantially dry form may be loaded into said tank, means for forming a substantially liquid-tight closure for said opening, a pipe extending adjacent to the bottom of said tank and provided with a plurality of branches for discharging liquid into different parts of said tank, and another pipe arranged adjacent to another part of said tank and having branch pipes extending into said tank for receiving liquid carrying said material, and delivering the same to a level higher than the top of said tank.

13. A tank car having a plurality of openings in the upper portion thereof through which material in solid form may be discharged into said tank, means for closing said openings, a liquid admission pipe arranged lengthwise of said tank and having a plurality of branch pipes extending into said tank at different portions thereof and through which liquid may be admitted to said tank, a discharge pipe for the liquid extending substantially lengthwise along the upper portion of said tank and having a plurality of branch pipes extending into said tank for receiving liquid carrying said material.

14. A tank car having a tank provided with a plurality of openings in the upper portion thereof through which solid material can be loaded into said tank, a pipe having a plurality of branches extending at intervals into a portion of said tank, valves controlling each of said branches, a dis-

charge pipe having branches connecting at intervals with another portion of said tank for withdrawing liquid carrying said material from said tank, and valves controlling said last mentioned branch pipes, whereby different streams of liquid pass into contact with different parts of the material in said tank.

15. A tank car having a tank provided at the upper portion thereof with relatively large openings for admitting material in substantially dry form to said tank, a pipe extending lengthwise near the bottom of said tank and provided with a plurality of branches spaced at intervals and which extend into said tank for discharging liquid into different portions of said tank, a discharge pipe having a plurality of branches communicating with different portions of said tank to withdraw liquid carrying said material from said tank, and a compressed fluid pipe also extending lengthwise of said tank and having branch pipes extending into said tank for discharging gaseous fluid near the bottom thereof to agitate said material.

16. A tank car having a tank provided at the upper portion thereof at intervals with relatively large openings for admitting material in substantially dry form to said tank for substantially filling said tank, means for tightly sealing said openings, a pipe extending into said tank for discharging liquid into the same, another pipe for receiving liquid carrying said material from the upper portion of said tank, and means for discharging compressed gaseous fluid into the bottom of said tank to agitate said material.

17. An apparatus for unloading and dissolving solid material contained in a tank car, including a stationary tank, means for admitting liquid to said stationary tank, means for circulating liquid

from said stationary tank through said tank car to dissolve material contained therein, and means for discharging liquid from said tanks when said liquid has attained the desired concentration.

18. An apparatus for handling and transporting a soluble solid material, including a portable tank mounted on a vehicle and having a relatively large opening for loading soluble material in substantially dry form into said tank, a stationary tank into proximity to which said portable tank may be moved, an inlet pipe for liquid extending from said stationary tank into one portion of said portable tank, a discharge pipe for liquid having said material dissolved therein and communicating with another portion of said portable tank and which discharges liquid into said stationary tank, and a pump adapted to be connected with said inlet pipe for passing liquid from said stationary tank through said portable tank into contact with said material to dissolve the same and to discharge said solution to said stationary tank.

19. An apparatus for dissolving and unloading a soluble solid material from a tank mounted on a vehicle, said tank having a relatively large opening for loading said soluble material in substantially dry form into said tank, an inlet pipe for liquid extending into one portion of said tank, a discharge pipe for carrying a solution of said material and communicating with another portion of said tank, a pump adapted to be connected with said inlet pipe for passing liquid through said tank for dissolving material in said tank, and piping connections for recirculating liquid discharged from said tank through said pump and again into said tank for further dissolving material in said tank.

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