Aug. 29, 1967 C. J. KORANDA 3,338,635

SPARGER TYPE RAILROAD CAR

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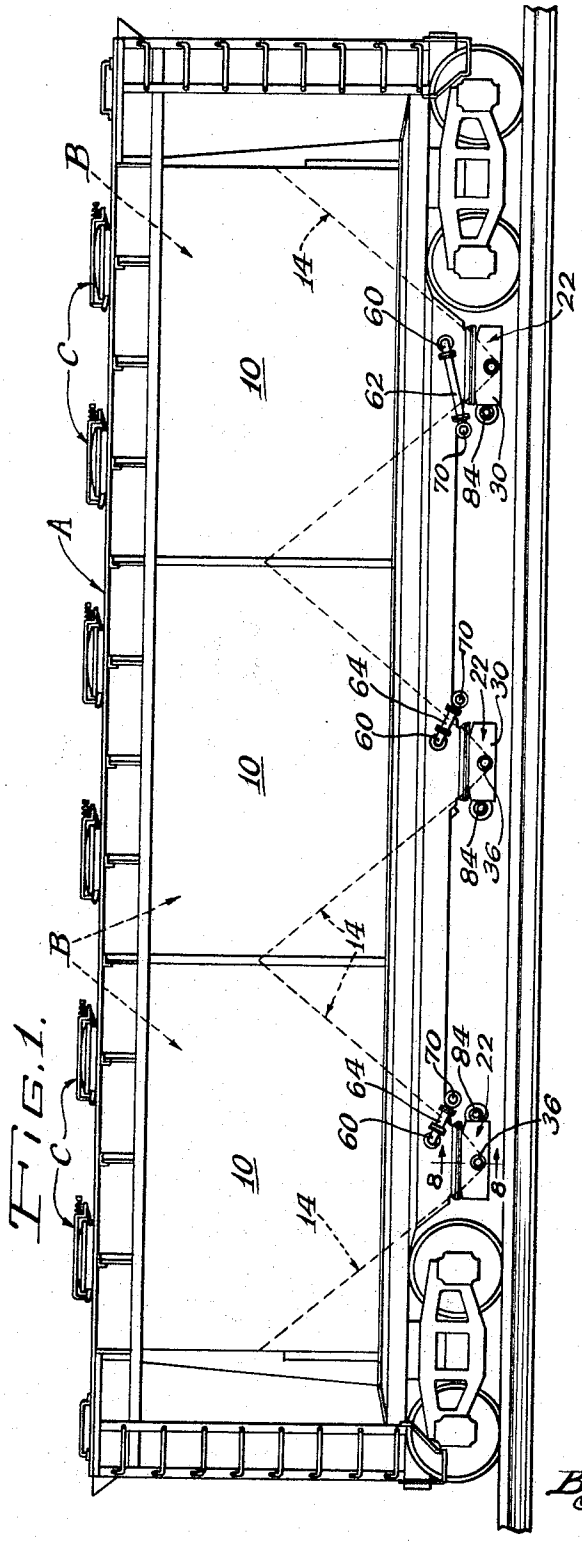


FIG. 1.

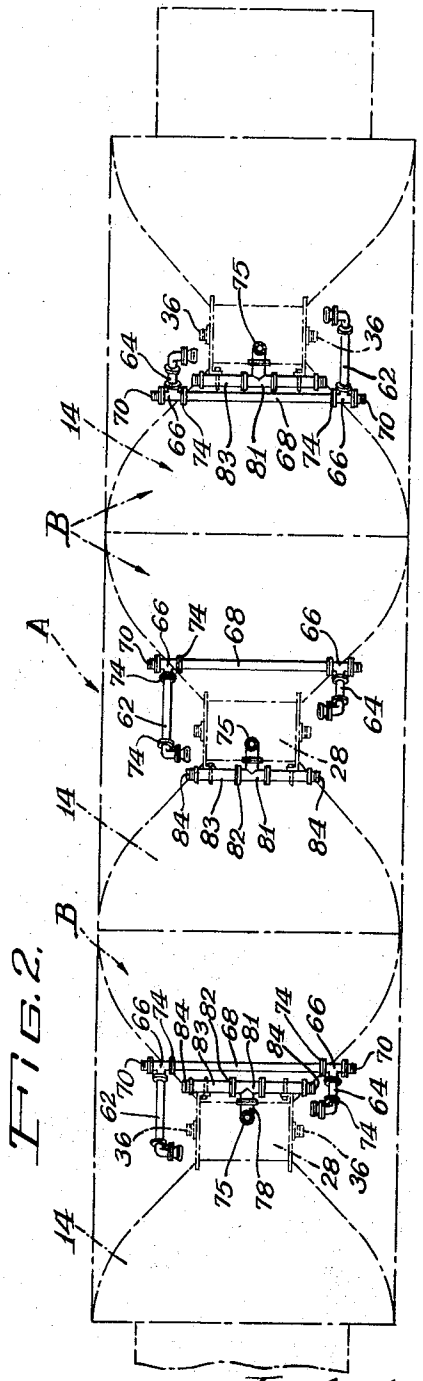


FIG. 2.

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SPARGER TYPE RAILROAD CAR

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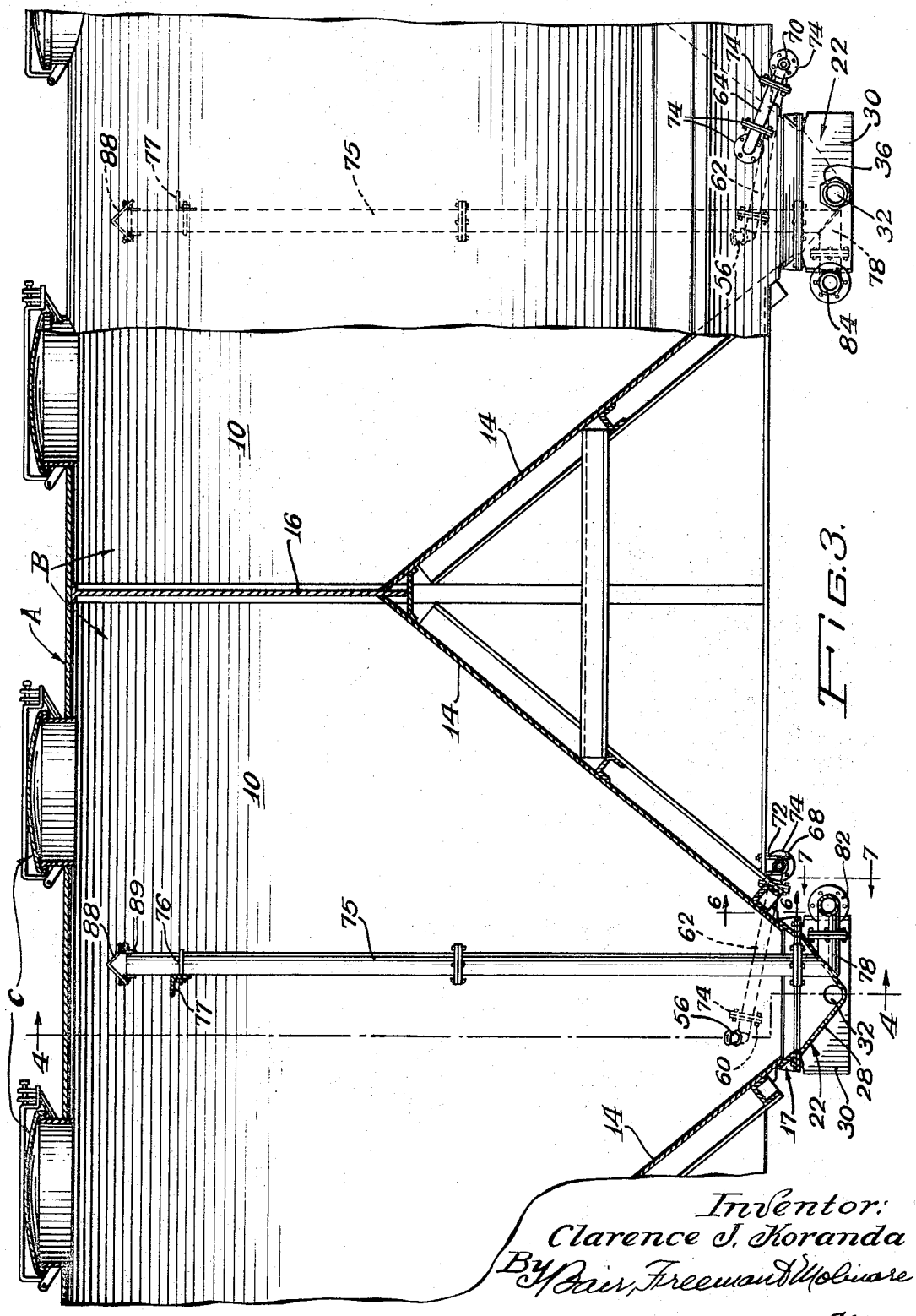


FIG. 3.

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SPARGER TYPE RAILROAD CAR

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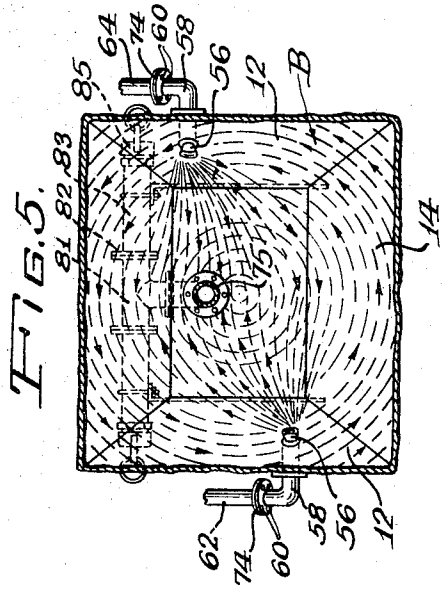


FIG. 5.

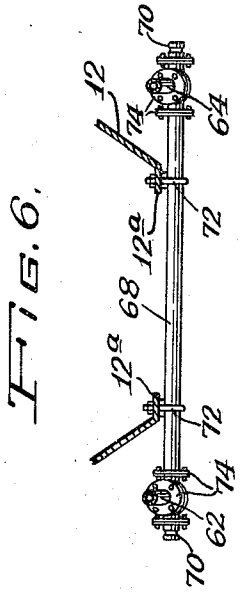


FIG. 6.

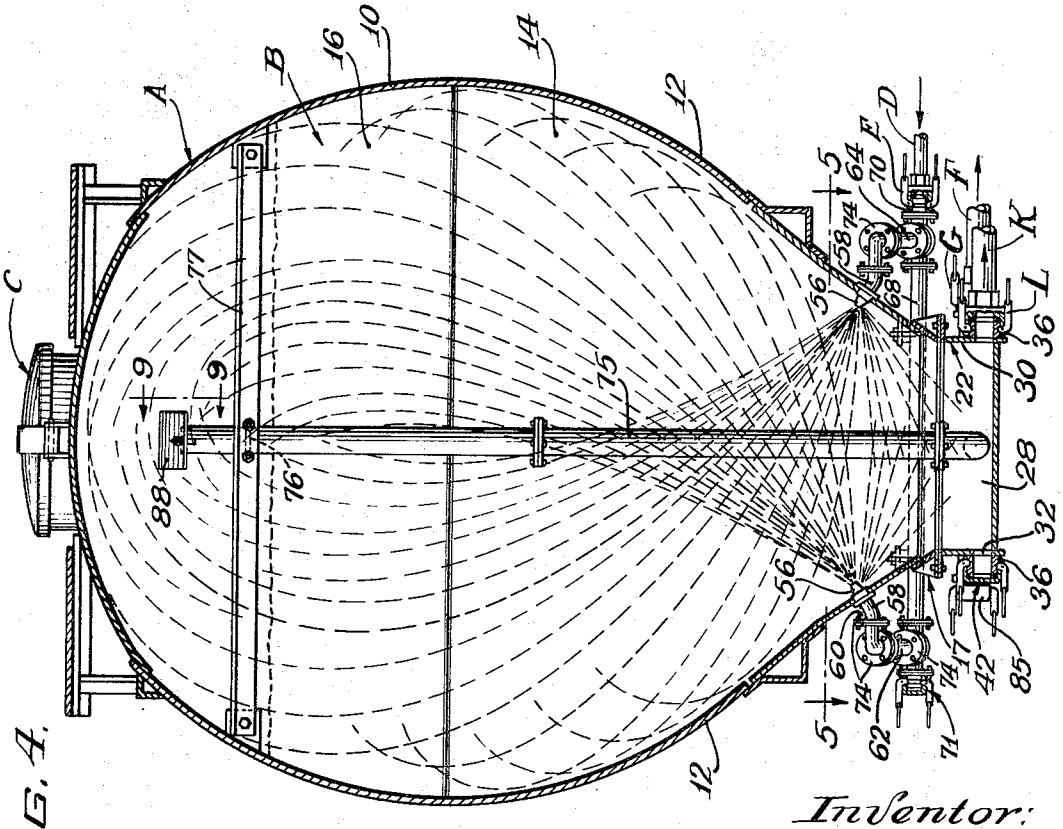


FIG. 4.

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SPARGER TYPE RAILROAD CAR

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FIG. 7.

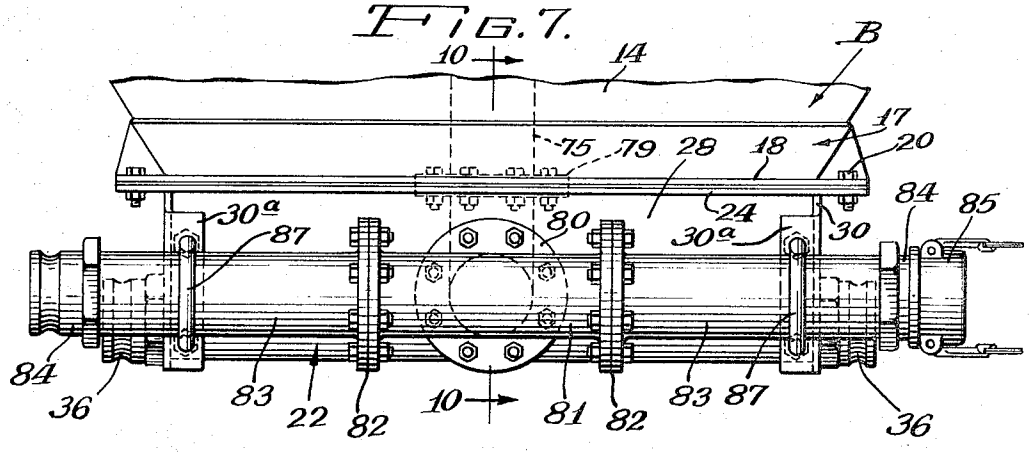


FIG. 9.

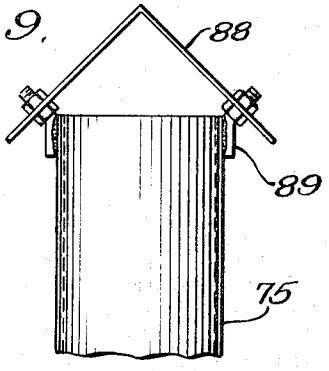
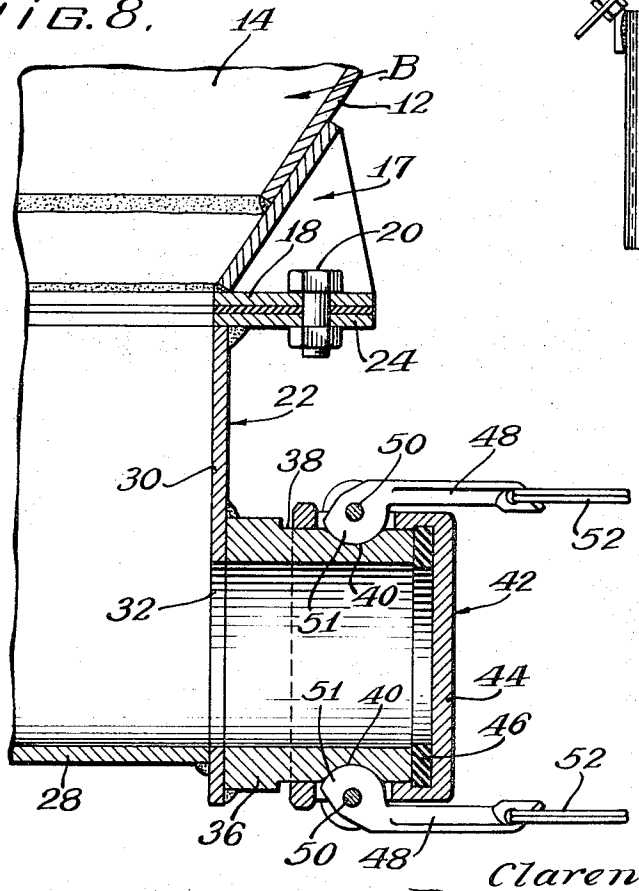


FIG. 8.



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FIG. 10.

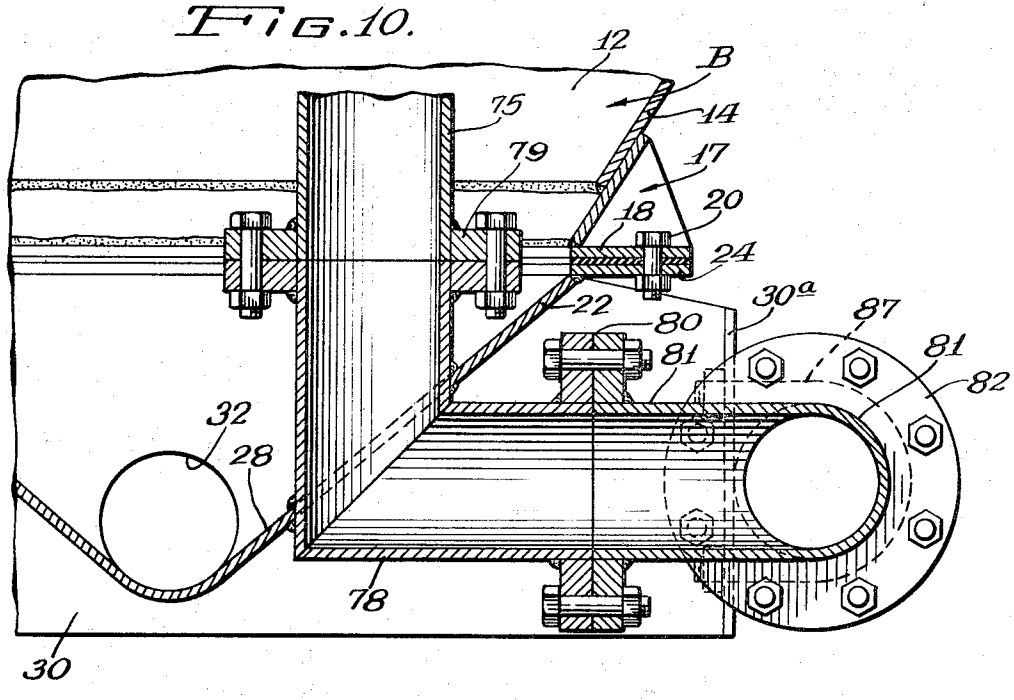
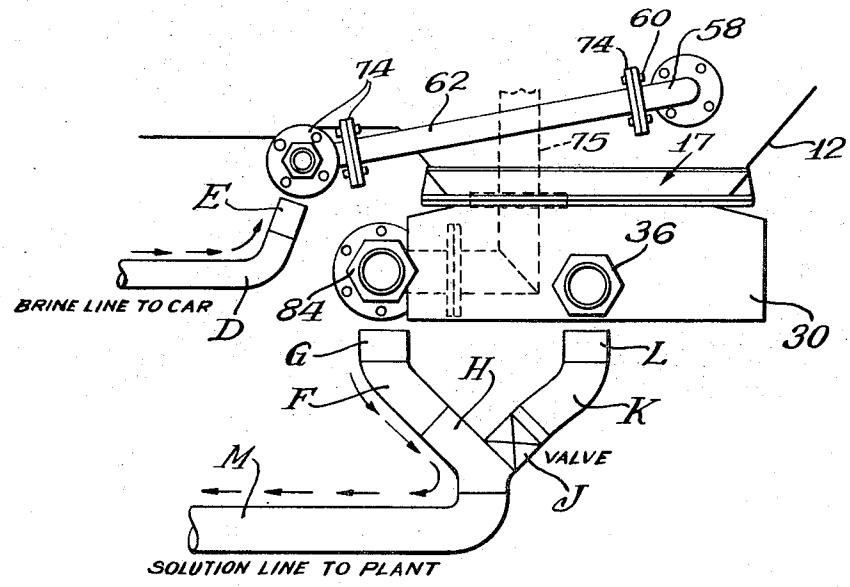


FIG. 11.



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United States Patent Office 3,338,635 Patented Aug. 29, 1967

3,338,635

SPARGER TYPE RAILROAD CAR

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Filed Oct. 29, 1965, Ser. No. 505,627
8 Claims. (Cl. 302—16)

This invention relates to hopper type railroad cars for handling of dry bulk commodities that dissolve in a suitable liquid and, more particularly, to a novel method and apparatus for use with a sparger type covered hopper railroad car for the expeditious removal of all of the bulk commodity, in the form of a solution, from the hoppers of the cars.

The more general practice of transporting and unloading dry bulk commodities from railroad cars consists in shipping the commodity in box cars to the destination where the commodity is removed from the cars by mechanical equipment. Such practices normally require the use of manned equipment, such as a power unloader for transferring the commodity from the car to a hopper conveying system, or transferring it directly to a saturator. Such an operation is costly, time consuming and usually requires approximately ten hours to unload one hundred (100) tons of such a commodity. Such prior practices result in substantial waste or loss of the commodity in handling it and always presents the problem of possible contamination of the load by reason of the box car containing a quantity of some other material from a prior load in the car. In handling of certain types of dry bulk commodities, such material, while in transit, cakes and forms large solid bodies of material which must be broken up for convenient handling, thus requiring additional expenditure of labor. All of the foregoing conditions and disadvantages add substantial costs to the processors and users of such commodities.

Sparger type railroad cars, due to their design, are capable of handling approximately twice the tonnage of a conventional box car, and hence, for large quantity shipments involving the use of several cars, demurrage charges are reduced or eliminated, as compared to using box cars, and the necessity for movement of the cars from a siding to a desired unloading position is likewise reduced or eliminated. By using sparger type railroad cars, great savings are additionally effected by reason of the elimination of any need for pay loader type equipment and the operator thereof, and there also results total elimination of waste of material due to handling, such as exists in connection with unloading conventional type box cars.

While there have been some attempts to utilize sparger type railroad cars for handling of dry bulk commodities, such use, in the main, has not heretofore been found totally acceptable or satisfactory for many reason. The main disadvantage is that they necessitate the use of substantial manual labor to effect and complete the unloading of the commodity from the cars and in the cleansing of the hopper portions of the cars after the unloading and the time required to complete unloading of cars has been found to be quite substantial.

Heretofore there have also been used hopper type cars for discharging of various dry commodities by the introduction of warm or hot water or brine or other liquids to cause the commodity to go into solution and in which cars standpipes have been employed for causing the solution to overflow and discharge from the hopper but which cars have not been totally satisfactory. Due to the location and arrangement of the standpipe in the prior constructions, it has been found that in discharging portions of the solution through such a standpipe certain types of dry bulk material, such as, for example, potassium chloride, resulted in the commodity again reverting to crystal type form around and in the standpipe causing plugging or restriction of flow of solution therethrough. When such a condition occurred, it necessitated the expenditure of time as well as use of additional hot water or hot brine or liquid to dilute the solution and cause the crystals, so formed and accumulated, to go into solution so that the remaining solution to be overflowed through the standpipe could then be discharged. This particular problem obviously is more serious and becomes more aggravated at low temperatures and will vary depending on the characteristics of the bulk material to be discharged.

In transporting certain types of material, with a view to expediting unloading from the cars, such material has been shipped in tank cars with the material in the form of a solution such as sugar dissolved in water, which, in effect, forms a syrup for use in the production of various types of consumable products such as, for example, soft drinks. Tank cars of this type, handling such a solution, necessarily had to be well insulated to prevent freezing of the solution in low temperatures and usually steam coils are provided for raising the temperature of the solution in the tank car for permitting free discharge of the solution therefrom. Such a manner of handling materials of this general type has been deemed unsatisfactory and inefficient because of the substantial increase in costs in the transportation of the liquid or water as well as the high cost of construction of such cars to provide insulation and steam coils.

More specifically, the present invention is directed to improvements in sparger type covered hopper cars, as disclosed in my copending patent application Ser. No. 418,800, filed Dec. 16, 1964, now Patent No. 3,316,023, by virtue of which improvements warm or hot water or brine or other suitable liquid is directed into contact with the commodity while in the hopper to dissolve the commodity to form a solution, in which form it is discharged from the cars.

One of the objects of this invention is to provide a novel method and apparatus for efficiently unloading dry bulk commodity from sparger type covered hopper railroad cars by first converting the commodity to a solution.

Another object is to provide a novel method and apparatus for unloading certain types of dry bulk commodities from sparger type railroad cars by first converting the commodity to a solution and which unloading operation requires approximately one-fifth (⅕) the time normally required for complete unloading of a similar quantity of such material in dry form from box cars.

Still another object is to provide a novel method and apparatus for unloading dry bulk commodities from a sparger type railroad car wherein a suitable liquid is introduced into the hopper of the car, into contact with the commodity to form a solution which is completely and rapidly discharged from the hopper in the car, and by virtue of which great economies and savings are effected as compared to other currently used methods and apparatus.

Other objects and advantages of this invention will be apparent from the following description, taken in connection with the accompanying drawings in which:

FIG. 1 is a side elevational view of a sparger type covered hopper railroad car embodying the present invention.

FIG. 2 is a plan view of the car with the hopper arrangement shown in dot and dash outline, and the sparger and other apparatus being shown in full lines.

FIG. 3 is an enlarged fragmentary, elevational view of the railroad car, a portion being shown in section and a portion being shown in elevation, with respect to two adjacent hoppers of the car.

FIG. 4 is a transverse, vertical sectional view, taken substantially as indicated at line 4—4 on FIG. 3.

FIG. 5 is a horizontal sectional view through the lower portion of one of the hoppers, taken substantially as indicated at line 5—5 on FIG. 4.

FIG. 6 is a fragmentary sectional view showing a portion of the sparger apparatus for one of the hoppers, taken substantially as indicated at line 6—6 on FIG. 3.

FIG. 7 is an enlarged fragmentary elevational view of the lower portion of a hopper, taken substantially as indicated at line 7—7 on FIG. 3.

FIG. 8 is an enlarged fragmentary sectional view through the lower portion of one of the hoppers, taken substantially as indicated at line 8—8 on FIG. 1.

FIG. 9 is a fragmentary view in elevation of the upper end portion of the standpipe, taken as indicated at line 9—9 on FIG. 4.

FIG. 10 is an enlarged fragmentary sectional view through the lower portion of the hopper, taken as indicated at line 10—10 on FIG. 7.

FIG. 11 is a schematic view of the outlet and inlet connections and conduits of the lower portion of a hopper and the hose lines to be connected thereto.

Referring now in detail to the drawings, the raliroad car to which the present invention is directed and which is indicated generally at A is of the sparger, covered hopper type, formed essentially of metal and, as shown, includes three separate, connected hoppers B. Each of the hoppers is of generally inverted pear shape design in vertical cross section, as may be seen in FIG. 4 of the drawings, and each of the hoppers is provided with two normally closed hatches, as indicated at C, for loading of the hopper with dry bulk commodity. As may be seen in FIG. 4, each of the hopper's lateral walls 10 is, in the main, curved, with the upper portion being substantially semi-circular in contour and the lower portions thereof, as indicated at 12, being curved in an inwardly and downwardly converging direction. The hopper's transverse walls each comprise a downwardly inclined wall portion 14, and an upright wall 16 which is a common wall with respect to two adjacent compartments or hoppers B.

For convenience I will now describe a single hopper unit and the sparger arrangement therefor. As may be seen in FIGS. 1 and 2, the sparger apparatus is identical for each hopper, except that for the right hand end hopper it is located in an opposite relation to that for the hopper at the left end of the car.

Surrounding the lower marginal edge portions of the curved side walls 12 and the inclined end walls 14 is a frame member 17 which is welded to said wall portions. Said frame member includes a horizontally disposed flange 18 to which is secured by bolts 20, a lower hopper section 22, having a horizontal flange 24, registering with the flange 18, at the lower end of the main hopper body, as seen in FIG. 8 of the drawings. The lower hopper section includes a bottom 28, formed to provide two oppositely inclined portions extending generally in the direction of the end walls 14 of the hopper as seen in FIG. 10 of the drawings. The inclined portions of the bottom are connected by a curved section to form a sump or trough. Welded to the ends of the bottom 28, of the lower hopper section, are end walls 30, in the form of plates, to complete the closure for the lower hopper section. The end plates 30 are each formed with a large circular discharge opening 32, adjacent the lower edges thereof, with the marginal edge of the opening 32 coinciding with the curved section of the bottom 28, as seen in FIG. 10 of the drawings. Preferably the openings 32 are of a diameter in the range of 4" to correspond in size to a discharge conduit which is to be associated therewith as hereinafter described. Welded to the exterior of each of the end plates 30, in registration with the openings 32, are coupling adapters 36. The external surface of each adapter is formed with a suitable annular groove 38 and a pair of recesses 40 for cooperative engagement with locking elements of a conventional quick connect-disconnect type of

closure unit 42, for effecting a sealed closure for the end of the adapter 36, as seen in FIG. 8 of the drawings. The closure unit includes a cap member 44 with a gasket 46 within the cap member, positioned to abut against the end of the adapter and a pair of operating arms 48, pivotally connected at 50 to the cap member, said arms having locking members 51 for coacting with the notches 40, formed in the outer wall of the adapter. Normally, when the car is in transit and the hopper is loaded, the ring elemnts 52 at the outer ends of the arms 48, are interconnected by a suitable, conventional wire seal, not shown. It will be noted that the discharge openings 32 and their adapters 36, with their closure 42, at opposite ends of the bottom section of the hopper, are located at opposite sides of the car, as seen in FIG. 4 of the drawings, for purposes of selective unloading of the commodity from the hopper at either side of the car, as hereinafter described.

Each of the hoppers of the car is provided with a sparger arrangement and while they are herein shown as separate arrangements, they may, if desired, be interconnected into a common system. Each of the sparger arrangements includes a pair of nozzles 56, which are mounted in the lower curved, opposite portions 12 of the side walls of the hopper, as may be seen in the drawings. The pair of nozzles 56, are mounted with their discharge orifices facing in an upwardly direction in the hopper, above and adjacent the sump of the hopper, in staggered, offset relation to the geometric center of the hopper, as clearly seen in FIGS. 4 and 5 of the drawings. The nozzles may be of any suitable type but preferably of the form disclosed in my copending patent application Ser. No. 418,800, for directing streams of liquid in upwardly, downwardly, forwardly and lateral directions. Each nozzle includes a tubular body 58, extending exteriorly of the hopper, terminating in a circular mounting flange 60 for connection to piping, as hereinafter described.

Connected to the flanges 60 of each of the nozzles, at opposite sides of the car, are downwardly inclined branch conduits 62 and 64, which are interconnected by T fittings 66, to a transversely extending main liquid supply conduit 68, by virtue of which liquid is caused to be supplied through the nozzles 56 to the interior of the hopper. The opposite ends of the main conduit 68 are provided with coupling adapters 70, which are normally closed by a conventional quick connect-disconnect closure unit 71 (as seen in FIG. 4) substantially identical, except for size, to the closure unit 42 applied to the adapter at the outlet of the sump for the hopper, as shown in FIG. 8 of the drawings. The main conduit 68 is supported in connected relation to the nozzles by a pair of U bolts 72, securing the conduit 68 to the inturned flanges 12*a*, constituting extensions of the side wall portion 12 of the hopper, intermediate adjacent hoppers, as seen in the drawings. The conduits 62, 64 and 68, for convenience, are in the nature of pipes and to facilitate assembly and mounting of the nozzles in proper position, suitable pipe couplers 74 are interposed in the piping constituting the conduits and for connection to flanges 60 of the respective nozzles 56.

It is to be understood that the adapters and piping for liquid supply for the sparger system may be of any suitable size and preferably, when utilizing a 4" diameter discharge opening 32 in the sump portion of the hopper, said piping and adapters for supplying liquid to the hopper would be in the range of 2" diameter. It is further to be understood that, when liquid is to be introduced into the hopper, the quick connect-disconnect closure 71, at the end of the main conduit 68 (at the side of the car where convenient to a source of liquid for the hopper is available), is removed and a suitable conduit provided with a quick connect-disconnect coupler, of conventional design, is then connected to the adapter 70, by virtue of which liquid is then supplied to both nozzles in the hopper.

Each of the hoppers of the car is provided with a standpipe overflow discharge arrangement, including an upwardly extending standpipe **75**, located in close proximity to the geometric center of the hopper, as seen in FIGS. 4 and 5 of the drawings. The upper end of the standpipe is rigidly attached by means of a U bolt **76**, to a transversely extending structural member **77**, secured in the upper portion of the hopper, as seen in FIG. 4 of the drawings. The lower portion of the standpipe is connected to an elbow fitting **78**, by means of a pipe coupling **79**, with one leg of the elbow extending through and welded in one of the inclined portions of the bottom **28** of the sump of the hopper, as seen in FIG. 10. Connected to the free end of said one leg of the elbow **78**, by means of a pipe coupling **80**, is a T-fitting **81**, and connected to the opposite ends of the cross leg of the T, by pipe couplings **82**, are a pair of laterally and horizontally extending pipe sections or conduits **83**, terminating at opposite sides of the hopper. The free ends of said pipes **83** are each provided with adapters **84**, on which is normally mounted a conventional quick connect-disconnect closure type unit **85**. The closures **42**, **71** and **85** for the respective adapters **36**, **70** and **84** are of a commercially available type and are illustrated in FIGS. 4, 7 and 8. The upper end of the standpipe is provided with a suitable hood to preclude the commodity, when being loaded into the hopper, from entering the standpipe **75**. The horizontal discharge piping for the standpipe, comprising the T-fitting **81**, coupling **82** and pipe sections **83**, are fixedly supported below the hopper by a pair of U-bolts **87**, connected to inturned flanges **30***a* of the end plates **30**, of the sump portion of the hopper, as seen in FIG. 7 of the drawings.

The hood for the upper end of the standpipe **75**, as seen in FIGS. 4 and 9 of the drawings, comprises an elongated plate **88**, of annular formation and which is fixedly attached by stud bolts **89**, welded to the upper end of the standpipe **75** to support the bond plate **88** in spaced relation to the upper end of the standpipe so as to permit liquid to freely flow into the upper end of the standpipe.

The location of the standpipe **75**, in close proximity to the geometric center of the hopper, is of substantial importance because in this location it is always subject to the maximum temperature of the water, brine or other liquid introduced into the hopper so as to insure at all times that the solution may freely overflow into the standpipe and that the latter is unobstructed by any build up of the solid material initially contained in the hopper. It has been found that such solutions are freely discharged through the standpipe when it is so located, even at relatively low outside temperatures and even considering the different chemical characteristics of the material constituting the load in the hopper.

To unload the commodity from one of the hoppers of the car, said car is first positioned adjacent a liquid supply line (of the type to insure that the material constituting the load will dissolve therein and go into solution), as well as adjacent a solution-receiving conduit. The quick connect-disconnect closure **71** is removed from the adapter **70**, at the end of the main sparger conduit **68**, and the liquid supply line indicated at D, which is provided with a quick connect-disconnect coupler E, at its end, is then connected to the coupler adapter **70** for supplying liquid under pressure to the two nozzles **56** to the interior and at opposite sides of the hopper. The quick connect-disconnect closure **85**, at the same side of the car, associated with the coupler adapter **84** of the overflow pipe discharge conduit **83** is removed and a solution discharge hose F, provided at its end with a quick connect-disconnect coupler G, is then connected to the adapter **84**, associated with the main discharge conduit **83**, constituting a part of the standpipe arrangement. Said hose F is provided with a Y-fitting H, one leg of which is provided with a valve J, connected to a hose section K, provided at its free end with a quick connect-disconnect coupler L which is attached to the adapter **36**, associated with the discharge outlet opening **32** of the sump of the hopper. The other end of the Y-fitting is attached to a hose M for conveying the solution to the plant. Either one or both of the hatches C of the hopper are then opened to assure venting of the hopper to atmosphere and the valve J is adjusted to a closed position. The pump for the liquid supply line D is then started and liquid is then discharged through the nozzles **56** into the hopper, into contact with the commodity therein. As above mentioned, the liquid may be water, brine or other material of a nature to insure that, when it comes into contact with the commodity, said commodity will be readily dissolved to form a solution. For certain types of commodities, the liquid introduced desirably should be either warm or hot to insure that the commodity rapidly dissolves into the form of a solution. The liquid is introduced into the hopper through the nozzles to form sprays or jets directed in upwardly, downwardly and lateral directions for effecting a rapid and thorough mixing of the commodity and liquid and causing substantial agitation of the commodity and liquid within the hopper to produce a turbulent action within the hopper for quick conversion of the commodity into a solution. After initiating injection of liquid into the hopper and into contact with the commodity, a pump associated with a main solution line M to the plant is then placed in operation. The level of the soltuion gradually builds up in the hopper and overflows into the standpipe **75** and is discharged through the conduit **83**, through the hoses F and M, to the plant where the solution is to be either directly used or discharged into storage. The system continues to operate in this manner until all of the solids constituting the commodity are dissolved into solution; and, when this condition is attained, the pump in the liquid supply line D is turned off and the valve J is opened. The solution remaining in the hopper is then discharged from the sump portion thereof directly through the outlet opening **32** in the side wall of the sump portion of the hopper, into the hoses K and M for discharging into the plant. After all of the solution has been discharged from the hopper, the pump for the liquid supply line D is then again placed in operation and liquid is directed through the nozzles **56** into the interior of the hopper for effecting a thorough cleansing of the entire interior surfaces of the hopper and which simultaneously removes any commodity residue that may have remained in the hopper; and the liquid thus introduced into the hopper is withdrawn through the hose K into the main solution line M to the plant. After this thorough cleansing operation, all three hose conduits, D, F and K, are disconnected from the corresponding adapters **70**, **84** and **36**, respectively, and the quick connect-disconnect closures **71**, **85** and **42** are then replaced on the respective adapters. The jets of liquid, introduced into the hopper for cleansing, impinge upon all inner surfaces of the hopper, as diagrammatically represented in FIG. 4.

The liquid that is introduced into the hopper is preferably under substantial pressure, in the general range of 40 p.s.i. or greater, so as to insure that the liquid rapidly penetrates through the body of the commodity for thorough and rapid agitation and mixing to expedite creation of a solution of the commodity. By this arrangement, there will be no need to provide mixing apparatus at some plant installations for the production of a solution of the commodity involved, as was heretofore required. This arrangement, in addition, for some installations, eliminates the necessity for storage tanks because it permits withdrawing of the solution from the hopper of the car, as it may be required and used in the plant. For other types of installations, it may be necessary that the solution be temporarily stored for subsequent use.

It has been found that by virtue of the present novel method and apparatus it is possible to totally unload thirty-three (33) tons of commodity from one hopper in approximately thirty-five (35) minutes and to remove

the load of commodity from all three hoppers of the car in about two (2) hours. Hence, by virtue of the present invention, it is possible to unload approximately one hundred (100) tons of commodity in about one-fifth (⅕) of the time required to unload the same quantity of commodity from box cars as is the general present practice.

It will be noted, from FIGS. 1 and 3 of the drawings, that the sparger apparatus and, more particularly, the branch conduits **64**, are preferably disposed at an inclined angle so that when the load is totally removed from the hopper there will be no residual liquid in the hopper or piping which might impair or contaminate the next load of commodity which may be introduced into the hopper. This condition would be more likely to occur if such a subsequent load of commodity is of a hygroscopic character. In addition, the presence of such liquid in the system might cause hardening of portions of the subsequent load of commodity, prior to the time that it is to be discharged from the hopper, and might also present an obstruction to the rapid mixing of the liquid and commodity for creating a solution.

Although I have here shown and described a preferred embodiment of my invention, manifestly it is capable of modification and rearrangement of parts without departing from the spirit and scope thereof. I do not, therefore, wish to be understood as limiting this invention to the precise embodiment herein disclosed, except as I may be so limited by the appended claims.

I claim:

1. The method of unloading dry bulk commodity, in the form of a solution, from a hopper of a railroad car comprising the step of introducing streams of liquid into the hopper, adjacent the bottom of the hopper, into direct contact with the commodity for creating an agitated, swirling mass and dissolving of the commodity into solution, the step of continuing the introduction of liquid into the hopper until the level is raised to cause the solution to overflow into the upper end of a standpipe located within and adjacent the geometric center of the hopper for discharging the solution from the hopper, and when substantially all commodity solids are dissolved in the liquid the step of discontinuing the introduction of liquid into the hopper and the step of discharging the solution remaining in the hopper through a discharge outlet at the bottom of the hopper.

2. The method defined in claim **1**, wherein the streams of liquid introduced in the hopper in upwardly, downwardly and lateral directions to create rapid dissolving of the commodity into solution.

3. The method of unloading dry bulk commodity, in the form of a solution, from a hopper of a railroad car comprising the step of providing an upright standpipe within the hopper, adjacent the geometric center of the hopper, with the lower end of the standpipe opening through the bottom wall of the hopper, the step of introducing streams of liquid into the hopper, adjacent the bottom of the hopper, into direct contact with the commodity for creating an agitated, swirling mass and dissolving of the commodity into solution, the step of continuing the introduction of liquid into the hopper until the level is raised to cause the solution to overflow into the upper end of the standpipe for discharging the solution from the hopper and, when substantially all commodity solids are dissolved in the liquid, the step of discontinuing the introduction of liquid into the hopper and the step of discharging the solution remaining in the hopper through a discharge outlet at the bottom of the hopper.

4. In a railroad car having a hopper for receiving dry bulk commodiy, said hopper being formed with downwardly and inwardly converging lower wall portions, sump means at the lower end of the hopper, a nozzle carried on one wall of the hopper at the lower end of the hopper and having a discharge end portion extending into the hopper, a conduit connected to the other end of the nozzle for supplying liquid to the nozzle, outlet means associated with said sump means and having a normally closed outlet opening, an upright standpipe within the hopper having a portion adjacent the geometric center of the hopper, said standpipe having an inlet opening at its upper end for receiving liquid overflow from the hopper, a transversely extending conduit connected to the lower end of the standpipe and having a normally closed outlet opening for the discharge of the overflow.

5. In a railroad car, as defined in claim **4**, having the standpipe extending upwardly throughout its length and wherein the lower end extends through the bottom of the sump means.

6. In a railroad car, as defined in claim **5**, characterized by the sump means having a pair of inwardly converging wall portions connected and formed to provide an inverted apex portion of rounded contour and having the outlet opening located in alignment with the apex portion and the lower end of said standpipe opening through one of the wall portions adjacent the apex portion.

7. In a railroad car, as defined in claim **4**, wherein the transversely extending conduit is provided with normally closed outlet openings at opposite sides of the car for selective discharge of the overflow to either side of the car.

8. In a railroad car, as defined in claim **5**, having a hood mounted on the upper end of the standpipe in spaced relation to its inlet opening and serving to preclude commodity when being loaded into the hopper from entering said standpipe.

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