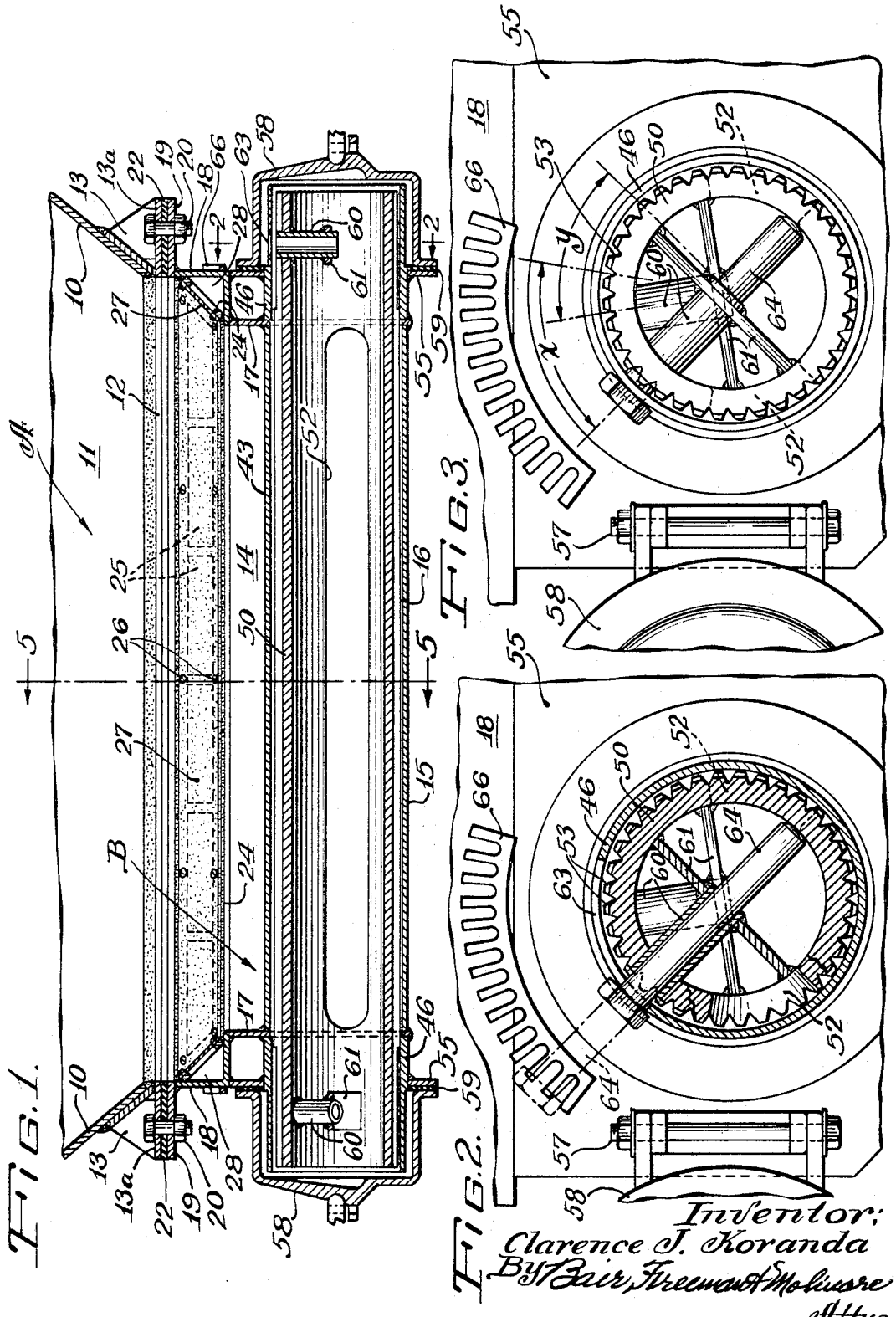
Oct. 29, 1968 C. J. KORANDA 3,408,117

RAILROAD CAR HOPPER DISCHARGE APPARATUS

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RAILROAD CAR HOPPER DISCHARGE APPARATUS

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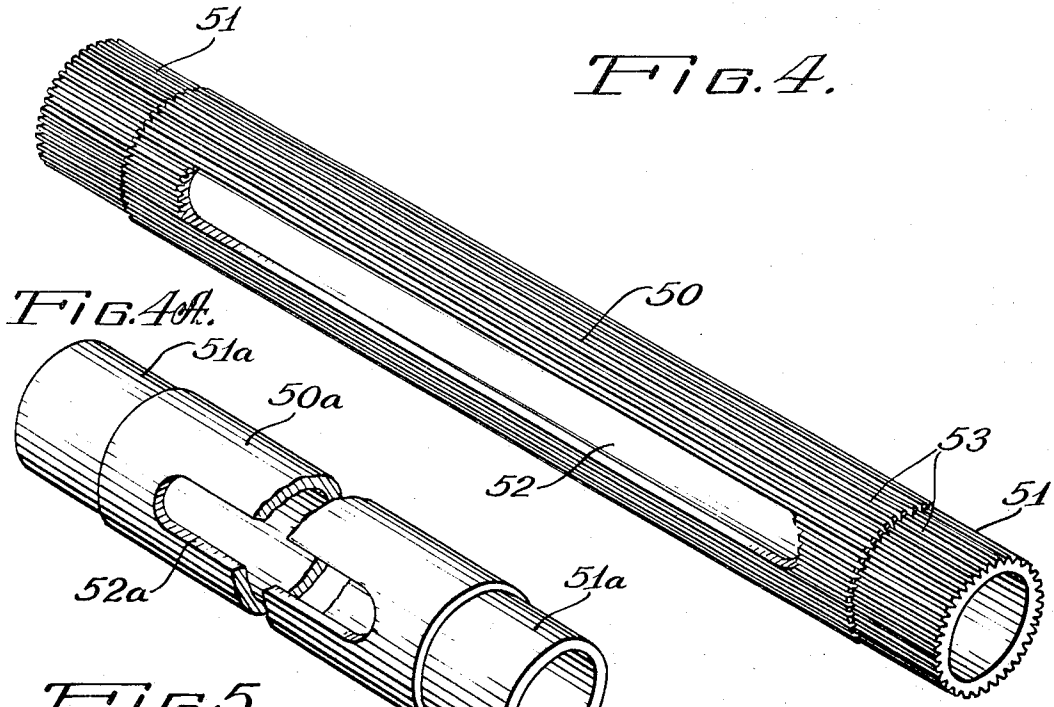
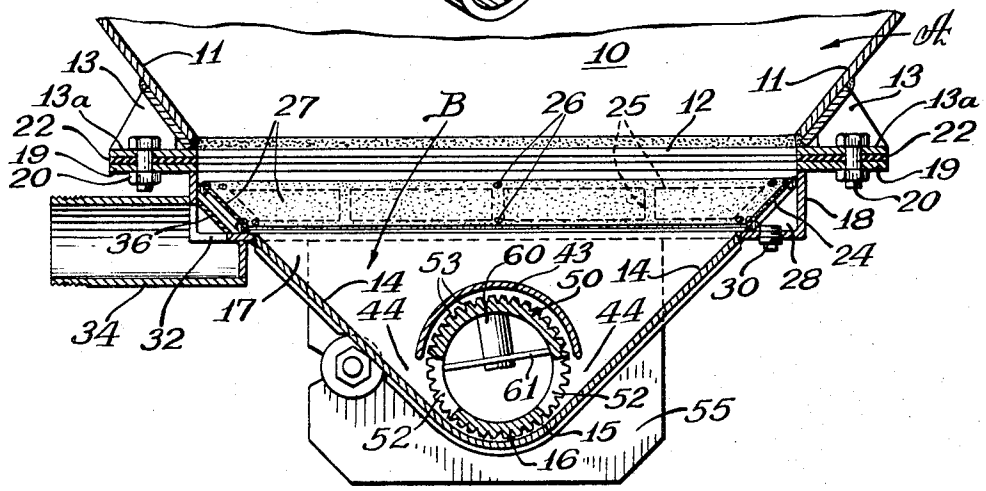


FIG. 4.

FIG. 4A.

FIG. 5.



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FIG. 6.

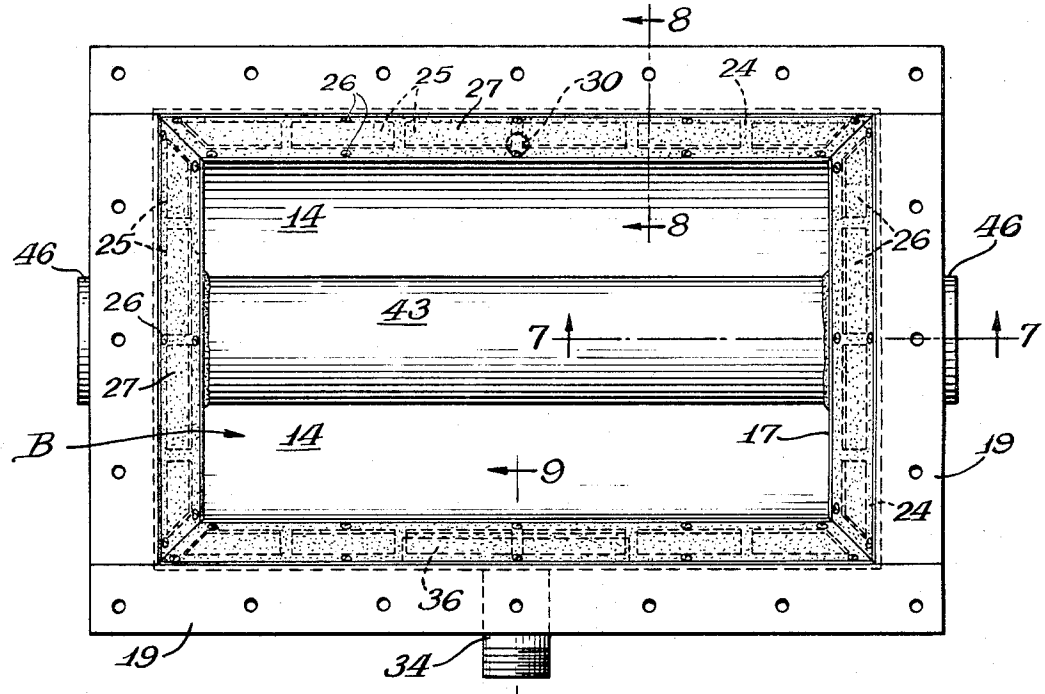
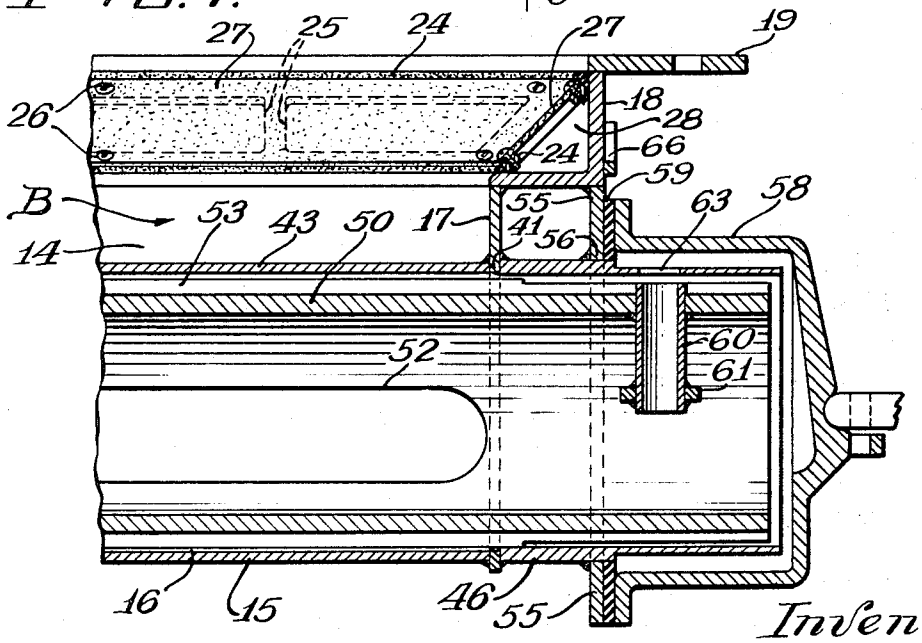


FIG. 7.



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FIG. 8.

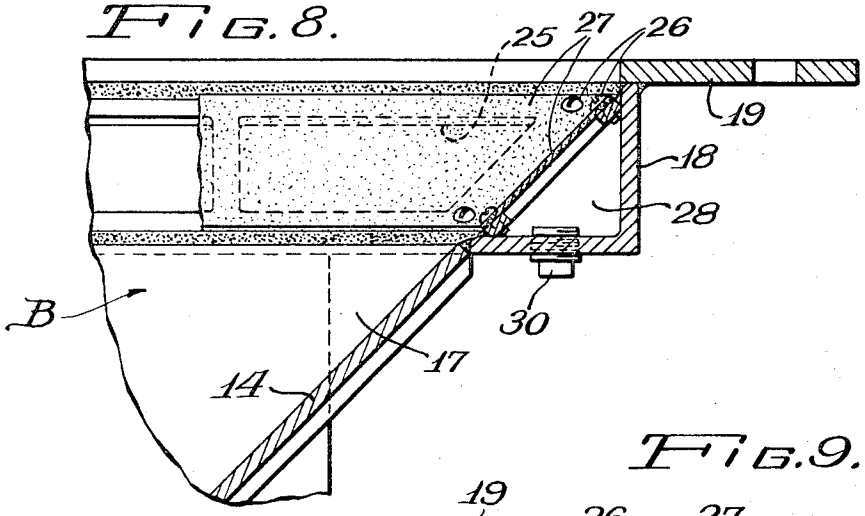


FIG. 9.

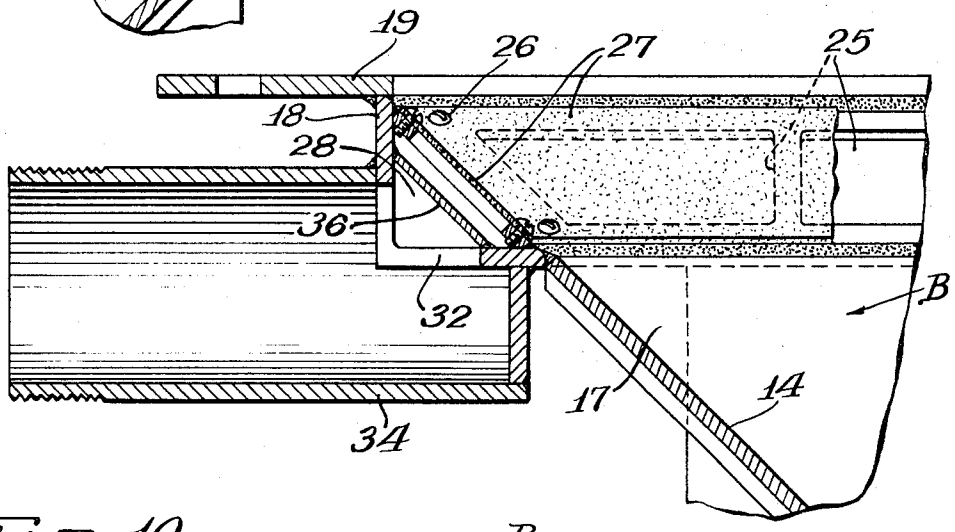
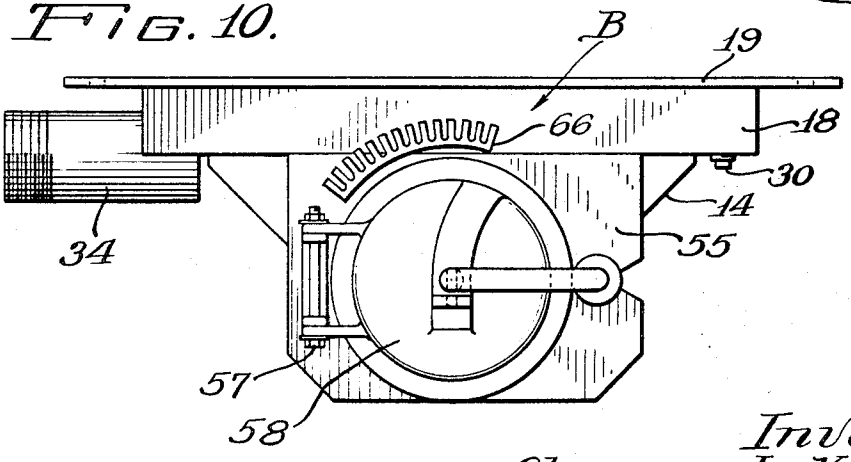


FIG. 10.



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RAILROAD CAR HOPPER DISCHARGE APPARATUS

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Filed Oct. 17, 1967, Ser. No. 675,868
16 Claims. (Cl. 302—52)

ABSTRACT OF THE DISCLOSURE

Discharge apparatus for railroad car hoppers adapted to contain pulverulent, pellet or granular types of dry bulk materials.

Background of the invention

This invention relates to hopper discharge apparatus and, more particularly, to discharge apparatus of the type for use in a hopper type railroad car for discharging pellet, granular or pulverulent types of dry bulk materials from the hoppers of the car by employing conventional vacuum hose conduit connections.

While heretofore there has been available hopper type railroad cars provided with suitable discharge apparatus, one type of car has, in the main, been used in connection with granular or pellet type materials. The common practice for withdrawing dry granular or pellet type materials from hoppers of such a railroad car is by attaching a vacuum hose conduit connector to a discharge tube, communicating with a trough at the bottom of the hopper of the car, and drawing the material out of the hopper in a stream of air. Another but different type of car has been used in connection with pulverulent material in which the material is caused to become a slurry or a solution while in the hopper, prior to discharge therefrom. Such discharge apparatus as have been heretofore available have not proved entirely satisfactory for discharging dry pulverulent material from hoppers of railroad cars.

There has also been heretofore employed a special non-hopper type of railroad car for handling dry pulverulent material and discharging it in dry form, such as, for example, flour but the construction and arrangement of the discharge and associated apparatus for such cars is relatively expensive to manufacture and install and, more importantly, occupies a very substantial part of the normal storage capacity of the roalroad car, thus greatly reducing the load carrying capacity for such a car as well as resultant high cost.

The above referred to types of railroad cars for handling granular or pellet type materials or pulverulent material, due to their specific types of discharge apparatus, are restricted for use in handling only such respective materials and hence necessitates, because of such restricted use, a substantial investment in separate and different types of cars for handling materials of such different characteristics.

One of the objects of this invention is to provide a novel form of hopper discharge apparatus which permits the hoppers of the railroad cars to be used for transporting either dry bulk pellet or granular or pulverulent types of material and which apparatus is capable of efficiently and rapidly effecting a complete discharge of all of either type of such dry bulk material contained in the hopper.

Another object is to provide a novel hopper discharge apparatus of the character referred to, which permits utilization of substantially all of the storage capacity of the hoppers.

A further object is to provide a novel form of discharge apparatus which permits quick and easy cleansing of the interiors of the hoppers.

Still another object of this invention is to provide novel hopper discharge apparatus having a tubular sleeve valve loosely mounted in the bottom of the sump of the hopper and readily rotatable to an open or closed position for controlling the discharge of material from the hopper.

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

Brief description of the drawings

FIGURE 1 is a transverse sectional view through the lower portion of the hopper of a railroad car provided with discharge apparatus embodying the present invention taken, substantially as indicated at line 1—1 on FIGURE 6.

FIGURE 2 is an enlarged view, part in section and part in elevation, taken substantially as indicated at line 2—2 on FIGURE 1, showing the sleeve valve adjusted to an open position and with the cover or closure member in in open position.

FIGURE 3 is a view similar to FIGURE 2 but in end elevation.

FIGURE 4 is a perspective view of one form of the sleeve valve constituting a part of the discharge apparatus.

FIGURE 4A is a partial perspective view of another form of sleeve valve.

FIGURE 5 is a vertical sectional view through the lower portion of the hopper, taken substantially as indicated at line 5—5 on FIGURE 1.

FIGURE 6 is a top plan view of the bottom hopper section equipped with the discharge apparatus of the present invention.

FIGURE 7 is an enlarged sectional view of one end portion of the bottom hopper section, taken as indicated at line 7—7 on FIGURE 6.

FIGURES 8 and 9 are enlarged, fragmentary vertical sections through the bottom hopper section, taken as indicated at lines 8—8 and 9—9 respectively on FIGURE 6.

FIGURE 10 is an end elevational view (at one side of the railroad car) of the bottom hopper section.

Description of the preferred embodiment

As seen in the drawings, the hopper comprises a main hopper body A and a bottom hopper section B. The main hopper body is formed with interconnected lower side and end walls **10** and **11** respectively which taper downwardly and inwardly to define a generally rectangular opening **12**. Secured externally to the lower side and end walls, at their lower edges, as by welding, is a frame **13**, totally surrounding the main hopper body and including a laterally extending mounting flange **13***a*.

The hopper discharge apparatus embodying the present invention is formed as a unitary part of the bottom hopper section B. The bottom hopper section is formed with end walls **14**, tapering downwardly and inwardly, at substantially the same angle as the main hopper section end walls **11**, the lower portions of which are joined by an arcuate bottom section **15** to form an elongated, transversely extending trough **16**, constitutes a part of the sump at the bottom of the bottom hopper section B. The end walls **14** and the arcuate section **15** are formed from a single continuous piece of sheet metal. Vertically positioned side walls or plates **17** are welded to the adjacent edges of the end walls **14** to complete the body portion of the bottom hopper section. On the upper ends of the end walls **14** and side walls **17** is secured, as by welding, an angle iron frame member **18** of generally rectangular

outline, with the upper edge of the upright leg of the angle iron frame **18** being welded to a rectangular, laterally extending flange **19** which is adapted to register with and be secured to the flange **13***a* of the main hopper section A. The respective flanges **13** and **19** are suitably apertured, with the apertures positioned for registration with each other, and rigidly secured together, thus connecting the two hopper sections by means of bolts **20**, with a gasket **22** interposed therebetween, so that the main opening of the bottom hopper section is in complete registration with the rectangular opening **12** of the main hopper section A.

Framing members or plates **24**, as seen in FIGURES 6 and 7 of the drawings, are positioned at an incline in each side of the angle iron members of frame **18**, and disposed in a plane corresponding approximately to the planes of the end walls **14** of the bottom hopper section. These framing members **24** are rigidly secured in position to the two respective legs of the angle member **18**, on all four sides, as by welding. Each of the framing members **24**, is formed with a multiplicity of elongated openings **25**. Secured to each of the respective framing members, in overlying relationship, as by means of screws **26**, are panels or strips of porous, sintered material **27**, such as bronze, so as to cover each of the elongated openings **25**. The space in the angle member **18**, beneath the framing members **24** and panels or strips **27** of sintered material, serves as a plenum chamber **28** which extends around all four walls of the bottom hopper section. The lower leg of the angle iron frame member **18**, adjacent one of the end walls **14** of the bottom hopper section, is provided with a removable pipe plug **30** for affording access to the plenum chamber, such as for cleansing. The opposite side of the angle iron frame member **18**, as seen in FIGURES 5 and 6, is formed with an air inlet opening **32** and rigidly secured to the exterior of the angle iron frame member **18**, in surrounding relationship to the opening **32**, is a pipe fitting **34** the free end of which is threaded and adapted to be connected to a "T" fitting from which extends a pair of pipes (not shown) projecting laterally and to the ends of which are attached quick connect-disconnect type of couplings in order to provide for connection to a source of compressed air from either side of the railroad car for supplying air under pressure to the plenum chamber **28**.

Due to the nature of the sintered metal strips or panels **27**, and the extremely fine interstices thereof, it is possible to introduce air under pressure, through said panels to the interior of the hopper, in an efficient and controlled manner, so as to effect sufficient agitation of a body of pulverulent material in the hopper, for causing said material to flow and be readily removed from the sump portion of the hopper as will hereinafter be described. To insure uniform distribution of compressed air in the plenum chamber on all sides, the plenum chamber is provided with an elongated deflector member **36**, as seen in FIGURES 5, 6 and 9 of the drawings, so that the air as it is introduced through the fitting **34** is deflected in opposite directions so as to insure that compressed air passes through all of the sintered metal panels **27** on all four sides of the bottom hopper section.

As is well known, when the hopper of a railroad car is filled with pulverulent material, such material while in transit packs down rather firmly into a condensed mass and hence will bridge in the hopper and normally will not flow for free discharge. It is for this reason that the condensed mass must be broken up and aerated so as to cause it to freely flow from the hopper. The apparatus for effecting aeration of the load of material is extremely simple in construction and economical to manufacture and may, if necessary, by quickly and easily serviced for repair or replacement or cleaning of all parts.

Each of the side walls or plates **17** is formed with a cylindrical opening **41**, the lower portion of which registers with the curved inner surface of the connecting portion **15** of the end walls **14**, as seen in FIGURES 1 and 7 of the drawings. The bottom hopper section is also provided with a horizontally extending baffle or hood **43**, positioned immediately above and in spaced relation to the trough created by the arcuate portion **15** of the end walls **14**. Said baffle or hood is arcuate in cross section and its ends are welded to the inner surfaces of the end walls or plates **17** of the bottom hopper section, as seen in FIGURES 6 and 7 of the drawings. The lower edges of the baffle are positioned in close spaced-apart relationship to the lower portions of the end walls **14** to define a pair of elongated discharge openings **44** which extend parallel to the trough, as seen in FIGURE 5 of the drawings.

Secured, as by welding, to the outer surfaces of each of the side plates **17**, is a tubular conduit member **46** having an internal diameter slightly less than the diameter of the openings **41** in plates **17**, as seen in FIGURE 7 of the drawings. The conduit members are adapted for connection in the usual manner to a connector of a vacuum discharge hose for withdrawing the material from the hopper in a manner well understood in the art.

Removably mounted in the trough of the bottom hopper section is a tubular sleeve valve **50**, the opposite ends of which are of reduced diameter as indicated at **51**. The sleeve valve is provided with a pair of elongated discharge openings **52** adapted when in operative position to register with the openings **44** formed by the terminal longitudinal edges of the baffle **43** and end walls **14**, as seen in FIGURE 5 of the drawings. In the construction as shown, each of the openings **52** is of approximately 54° circumferential extent and the length thereof corresponds substantially to the distance between the side plates **17** of the bottom hopper section as seen in FIGURE 1 of the drawings. FIGURE 4A discloses an alternate form of tubular sleeve valve **50***a* with reduced ends **51***a* and a pair of elongated openings **52***a*. The sleeve valve **50***a* preferably has its entire external surface formed with a multiplicity of longitudinally extending flutes **53** extending from end to end, including the two reduced end portions **51**. This particular form of sleeve valve shown in FIGURE 4 may be used in hopper discharge apparatus for handling either pulverulent material or pellet or granular types of material.

FIGURE 4A discloses an alternate form of sleeve valve, **50***a*, having reduced end portions **51***a* and a pair of elongated openings **52***a* and is identical to sleeve valve **50** except that the external flutes are omitted. This latter form of sleeve valve is to be used in hopper discharge apparatus of the type that is intended only for handling of dry pulverulent material.

As may be seen in FIGURE 7 of the drawings, by reason of the reduced end portions **51** and **51***a* of either of the respective forms of sleeve valves, said sleeve valves have journal support at only a relatively restricted area indicated at **46***a* in the bottoms of the two conduit members **46**, so that the sleeve, by reason of the relatively small bearing contacts in the conduit members, may be quickly and easily rotated to position the openings **52** or **52***a* into or out of registration with the openings **44** through which material may flow into the interior of the sleeve valve and be withdrawn from the hopper by a conventional vacuum hose connection. Since the circumferential extent of the openings **52** or **52***a* in the sleeve valves is 54°, it will be apparent that the sleeve valve when moved from an open position to a closed position should be rotated through an angle indicated at X or Y in FIGURE 3 (54°) to a position with its openings out of registration with the openings **44** formed between the baffle or hood **43** and the end walls **14**.

The presence of the flutes in the outer surfaces of the sleeve valve shown in FIGURE 4 and in other views of the drawings is to facilitate quick and easy removal of pellet type or granular type material from the hopper under the influence of vacuum applied by the conventional vacuum hose connections. Any pellets or granular ma-

terial that may be in registration with or lodged in the grooves of the fluted surfaces of the valve will be subject to the vacuum action and will be readily withdrawn into the discharge hose and thus effect a complete removal of all commodity from the hopper. Likewise when the material in the hopper is of the pulverulent nature, it too will be readily withdrawn completely from the hopper. The same is also true with respect to the removal of all the pulverulent material when the discharge apparatus includes a sleeve valve **50***a* having a smooth outer surface as seen in FIGURE 4A of the drawings. The limited area of journal support of the sleeve valve in the conduit members **46** makes it possible to easily rotate the valve to and from open position.

Secured, as by welding, to the outer corners of the angle frame member **18** of the plenum chamber, at opposite sides, are a pair of depending end plates **55** each having an opening **56**, for accommodating the tubular conduit members **46** therein and to which the plates are welded, as seen in FIGURE 7 of the drawings. The end plates **55** provide support for hinges as indicated at **57** for closure or cover members **58**, adapted for enclosing the outer ends of the conduit members in sealed relation during the time that the car is in transit. These cover members are in closed position, seated against gaskets **59** and are normally protected by a conventional car sealer to be broken at the place of destination by the ultimate consignee of the material, at which time the cover **58** at the proper side of the car is opened for enabling a vacuum hose connection to be made to the adjacent conduit member **46**.

Rigidly secured, as by welding, in each outer end portion of the sleeve valve is a section of pipe **60**, extending radially within the sleeve valve, with its inner free end secured to a brace member **61**, the ends of which are welded to the inner surfaces of the valve sleeve as seen in FIGURES 2 and 7 of the drawings.

The sections of pipe **60**, at opposite ends of the valve sleeve, are angularly offset with respect to each other to the extent of 36°. This particular relationship is necessitated by reason of the fact that the cover assemblies **58**, at opposite sides of the car, are disposed in opposed or opposite relation to each other and because either closure member may be opened and the material withdrawn from either side of the car, depending upon the relation of the car to the discharge hose at the consignee's plant where the material is to be delivered.

The top of each conduit member **46** is formed with a transverse, elongated slot **63** and a headed pin **64** is projected through the slot **63** into the pipe section **60**, with the head normally seated against the outer surface of the conduit member as seen in FIGURE 2 of the drawings. The slots **63** at opposite ends of the valve sleeve are offset with respect to each other the same as the tubes **60**. When it is desired to rotate the sleeve valve to a fully open position, the pin at the side of the car at which the material is to be discharged is partially withdrawn, to the dot and dash position, as represented in FIGURE 2 of the drawings so that said pin in an extended position serves as a lever for the application of force for rotatably adjusting the sleeve valve to open or closed position. To facilitate rotation of the sleeve valve by minimum force, a notched plate **66** is welded, at each side of the car, to the adjacent end plate **56** and angle iron frame **18**, forming the plenum chamber in such relation as to permit any suitable instrument to be inserted in one of the notches of a plate **66** and against one surface of pin **64** when extended for nudging and forcing rotation of the sleeve valve to either an open or closed position. Any suitable instrument may be employed for this purpose such as a bar or large screwdriver. It is to be understood that the notched plate at the side of the car opposite of that seen in FIGURE 2 will be in opposite relation to the position represented in FIGURE 2, due to the reverse mounting of the cover assembly on said opposite side of the car. It is this fact that necessitates the different location of the other pipe section **60** of the sleeve valve, at the opposite side of the car. Pipe section **60** in the sleeve valve, at the opposite side of the car, is mounted at an offset angle with respect to the pipe section at the near side of the car, as seen in FIGURE 2, making it possible to rotate the sleeve valve conveniently, from either side of the car. The sleeve valve is moved from open position by rotating from the near side of the car, clockwise through an angle (54°) indicated at X to a closed position and at the opposite side of the car that sleeve is rotated through the same angle as indicated at Y. The slots **63** in the conduit members **46** may be of a size so that the ends serve as stops for the pins **64** to limit rotation of the sleeve valve **50** at full open or closed position.

The sleeve valve **50**, because it is of substantial size, is preferably made of aluminum to reduce weight and permit rotative adjustment with little effort. Thus the sleeve valve may be quickly and easily removed from the hopper after removal of the headed pins **64**, for cleansing the valve and the trough and conduit members **46** of the hopper to again be replaced in operative position.

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

I claim:

1. In a hopper discharge apparatus for a hopper body including a main hopper section having downwardly converging walls terminating in a rectangular bottom opening, and a bottom hopper section adapted to be secured to the lower end of the main hopper section, in registration with said bottom opening; the improvement wherein the bottom section includes framing members each of which is formed with one or more openings, porous sintered metal panels secured to said framing members and covering said openings therein, said framing members being secured in the lower hopper section with said panels at an angle so as to extend in planes constituting extensions of the downwardly converging walls of the main hopper section, said bottom hopper section having a pair of opposite side walls, tapering toward each other and located in planes constituting extensions of said panels, and said side walls terminating at their lower ends to form an elongated trough, conduit means registering with one end of the trough for discharging material from the bottom hopper section, and means on the bottom hopper section providing a plenum chamber externally of the body and in communication with said openings in the frame members and said panels and having an inlet opening for supplying air under pressure, from a source of supply, for forcing air through the panels and aerating material in the hopper.

2. The hopper discharge apparatus of claim **1** in which the framing members, panels and plenum chamber are provided on each side wall of the bottom hopper section.

3. The hopper discharge apparatus of claim **1** in which the framing members and panels are of elongated form and mounted on each side wall of the bottom hopper section and located adjacent the upper end of said bottom hopper section.

4. The hopper discharge apparatus of claim **2** in which a deflector is mounted in the plenum chamber in registration with the inlet opening for distributing air throughout the plenum chamber.

5. The hopper discharge apparatus of claim **3** in which the plenum chamber surrounds the upper end of the bottom hopper section in communication with each of said panels.

6. The hopper discharge apparatus of claim **1** having an elongated baffle mounted in the bottom hopper section above and in spaced registration with said trough with its side edges terminating in close spaced relation to said pair of side walls to form a pair of elongated openings

through which material is fed from the hopper toward the bottom of the trough.

7. The hopper discharge apparatus of claim 6 wherein said baffle is of arcuate contour in cross-section and is secured at its ends to a pair of opposite side walls of said bottom hopper section.

8. The hopper discharge apparatus of claim 6, having a tubular sleeve valve mounted for free rotary adjustment in the bottom of the trough and having a pair of elongated openings adapted to be registered with said openings formed by the baffle and said pair of side walls of the bottom hopper section, with one end of said sleeve valve registering with said conduit means.

9. The hopper discharge apparatus of claim 8 wherein said tubular sleeve valve having its outer periphery formed with a multiplicity of longitudinally extending flutes.

10. In a hopper discharge apparatus for a hopper body including a main hopper section having downwardly converging walls terminating in a rectangular bottom opening, and a bottom hopper section adapted to be secured to the lower end of the main hopper section, in registration with said bottom opening; the improvement wherein said bottom section includes a pair of opposite side walls, tapering toward each other and interconnected to form an elongated trough, conduit means registering with opposite ends of the trough for discharging material from the bottom hopper section, an elongated baffle mounted in the bottom section above and in spaced registration with said trough with its side edges terminating in close spaced relation to said pair of side walls to form a pair of elongated openings through which material is fed from the hopper toward the bottom of the trough, and a tubular sleeve valve mounted for free rotary adjustment in the bottom of the trough and having a pair of elongated openings adapted to be registered with said openings formed by the baffle and said pair of side walls of the bottom section, with the ends of said sleeve valve registering with said conduit means.

11. The hopper discharge apparatus of claim 10 in which the sleeve valve is supported at its ends in said conduit means, with the portion of the sleeve within the bottom hopper section out of contact with the bottom of the trough.

12. The hopper discharge apparatus of claim 10 in which the sleeve valve has its outer periphery formed with a multiplicity of longitudinally extending flutes.

13. The hopper discharge apparatus of claim 12 in which the flutes extend throughout the length of the sleeve valve.

14. The hopper discharge apparatus of claim 10 together with means for rotating said sleeve valve to position its openings in or out of registry with said openings formed by the edges of the baffle and said pair of side walls of the bottom section.

15. The hopper discharge apparatus of claim 10 in which the outer ends of the conduit means and the sleeve valve are provided with externally accessible cooperating means for rotatably adjusting the sleeve valve with its openings in or out of registry with said openings formed by the edges of the baffle and said pair of side walls of the bottom section.

16. The hopper discharge apparatus of claim 15 in which said cooperating means comprises a tubular guide fixedly mounted in and opening through the sleeve valve in registry with a circumferentially extending slot formed in the conduit means and an elongated member slidably mounted in the guide with a portion extending externally of the conduit means, whereby said member may be partially withdrawn from its guide to serve as a lever for rotatably adjusting the sleeve valve.

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