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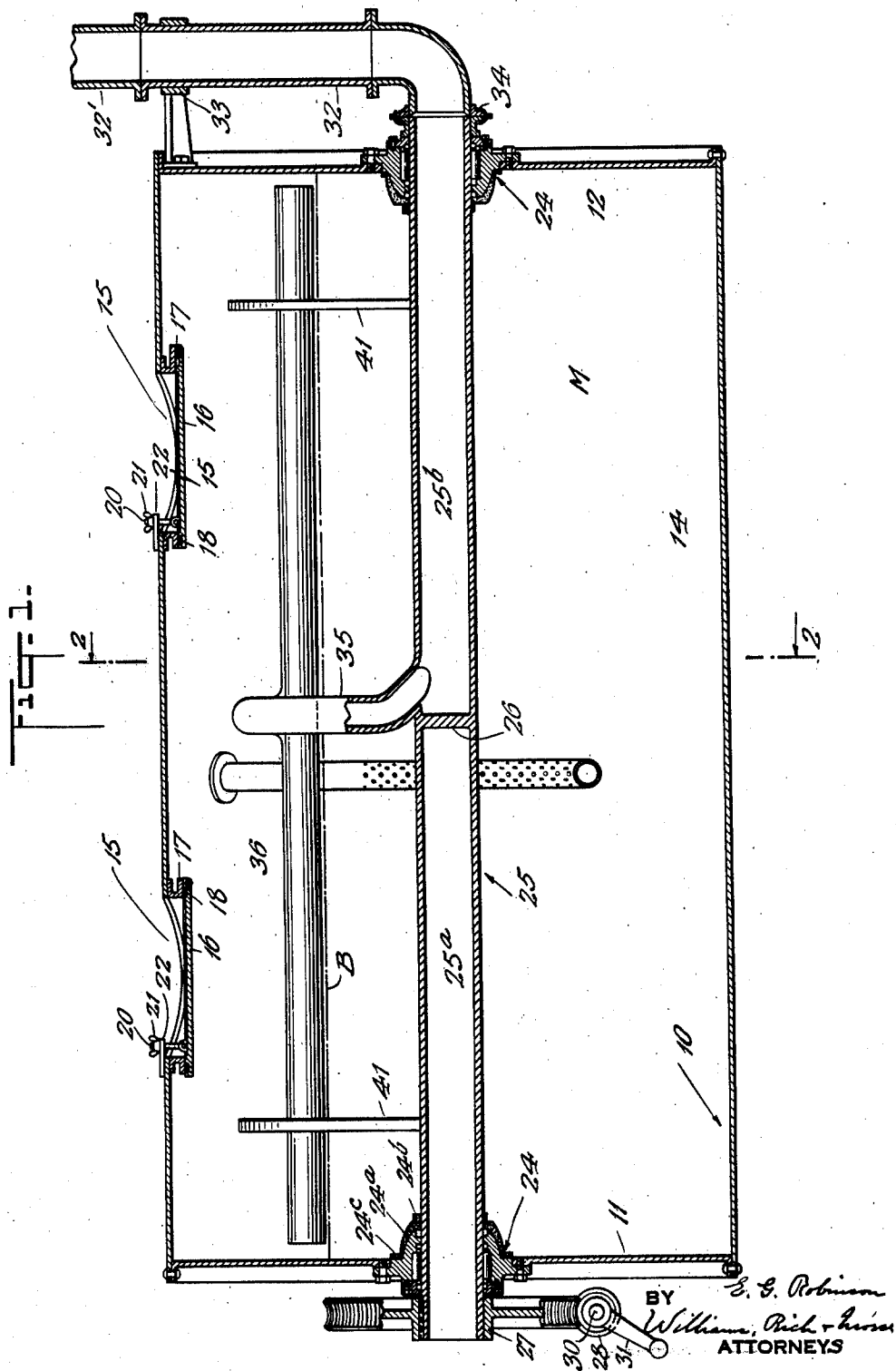
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MATERIAL HANDLING APPARATUS

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2 Sheets-Sheet 1



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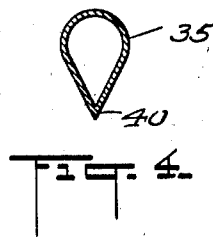
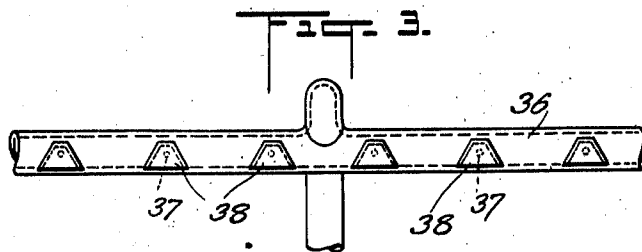
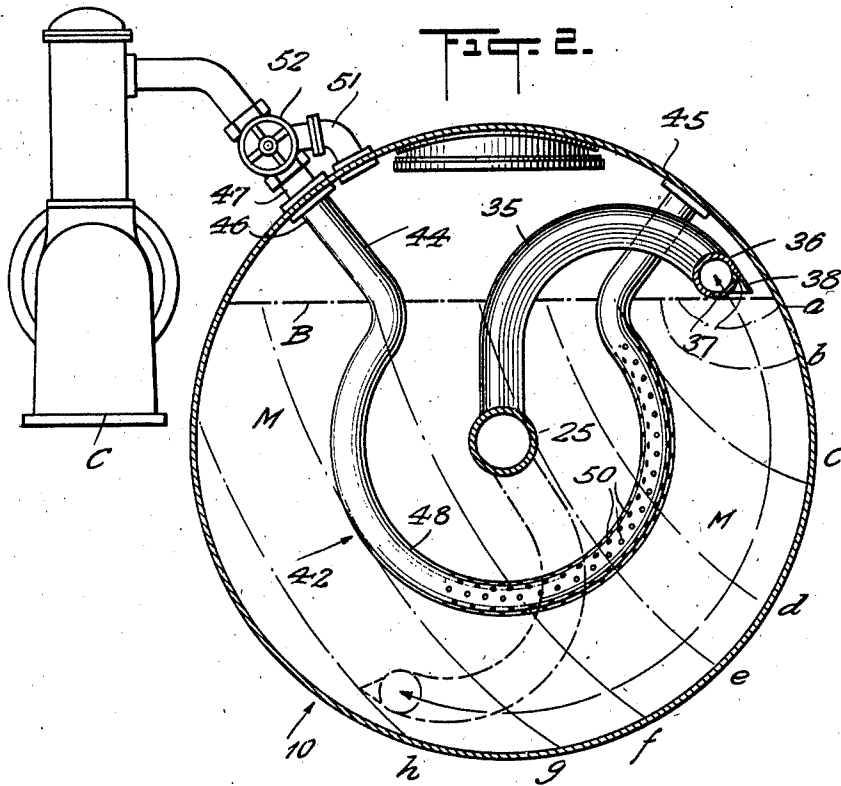
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2 Sheets-Sheet 2



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MATERIAL HANDLING APPARATUS

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10 Claims. (Cl. 302—53)

This invention relates to material handling apparatus, and is directed particularly to means for the pneumatic removal of such as granular, flocculent, pulverulent or similar materials from receptacles or containers such, for example, as railway cars, storage bins or chambers and the like.

The general object of the invention is to provide an improved apparatus of the character mentioned, which is relatively simple in construction and which is highly effective in operation and is capable of ready adaptation to many fields of industry, wherein expeditious and economical handling is desired of any material which is of such character that it is capable of being carried through a conduit under the influence of a moving body of air therein.

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

Fig. 1 is a vertical central sectional view of a tank or container in association with which are shown in section and in elevation certain elements entering into the apparatus embodying this invention; Fig. 2 is a vertical sectional view taken on line 2—2 of Fig. 1; Fig. 3 is a fragmental view in elevation of a pick-up conduit adapted to be mounted for rotation about a given axis within the tank or container, as shown in Fig. 1, and Fig. 4 is a transverse sectional view of the connector pipe.

Although this invention is adapted for use in connection with various types of receptacles or containers, it is herein illustrated in association with a cylindrical tank 10, which is such that it may be mounted on railway trucks, not shown, and there employed as a portable means for the transportation by rail of granular, flocculent, pulverulent or similar materials M, which are of such a nature that they can be carried through a conduit under the influence of a moving body of air therein, and are hence of such a nature that they may be expeditiously and economically removed or unloaded from the tank. This tank includes a pair of heads 11 and 12, suitably connected to the ends of the cylindrical wall 14 of the tank, which wall is provided with one or more filling openings 15, with which are associated inwardly opening closures 16. These closures are hinged to suitable fittings 17, secured to the inner face of the wall 14 adjacent the openings 15, and are provided with gasket rings 18, which are adapted to engage the lower face of the respective fittings 17 when the closures are swung upwardly into closed

positions where they may be locked by suitable fastening devices, which may comprise screw-threaded bolts 20, pivotally connected to the closures 16 and provided with wing nuts 21, adapted to be screwed down into firm engagement with bifurcated lugs 22, between the prongs of which the bolts may be moved preparatory to locking the closures in sealing position.

Associated with each of the ends 11 and 12 of the tank, is a roller bearing 24 of a standard high compression grease-seal type, within which is journaled a hollow shaft 25, which is disposed centrally and longitudinally of the tank and is provided intermediate its ends with a division wall 26, which serves to block off the front section 25a of that shaft from the rear section 25b thereof so that such rear section may serve as a discharge conduit. Each of the bearings is protected from within the tank 10 by a flexible housing 24a, of suitable material such as leather, one end of which is secured to the shaft 25 by a clamp ring 24b, and the other end of which is secured to the bearing 24 by a flange ring 24c, the housings being such that they will flex when the shaft is rotated without being subjected to any appreciable strain at their points of connection with the shaft and the respective bearings. To one end of the shaft 25, is secured a worm gear 27, which meshes with a worm 28, carried by a shaft 30, journaled in suitable bearings, not shown, and provided with a crank 31, by which the worm gear, together with its associated shaft, may be rotated. To the other end of the shaft 25, is connected a discharge conduit 32, which is anchored to the end 12 of the tank by a bracket 33, the connection of the conduit 32 with the shaft 25 being made by a swivel joint 34, which will permit the shaft to rotate while communication is maintained between the discharge conduit 25b and the discharge conduit 32.

Secured to the shaft 25 intermediate its ends, is a connector pipe 35, which, at one end, communicates with the discharge conduit 25b and is so curved adjacent its point of connection with that conduit that material, during the operation of the apparatus, is directed from the connector pipe into the conduit in the general direction of the flow of air through that conduit, as will hereinafter more clearly appear. The connector pipe 35, as shown most clearly in Fig. 2, extends substantially radially from the pipe 25 and is thereafter curved upwardly and then downwardly toward its point of connection with a longitudinally disposed pick-up pipe 36, having closed ends and a length substantially equal to the inside longi-

tudinal dimension of the tank. This pick-up pipe is provided at spaced intervals with pairs of inlet openings 37, each pair of such openings being shielded by a deflector hood 38 which is suitably connected to the pick-up pipe 36. Each of the deflector hoods 38 is so shaped that its wall converges outwardly in all directions from its point of connection with the pick-up pipe, so as to facilitate the entrance of material into the pick-up pipe through the inlet openings 37 thereof during the removal of material from the tank, the relation of the pick-up pipe to the material being such at all times that the pick-up tube is in the vicinity of and preferably slightly above the material, the normal level of which is indicated in Fig. 2 at the beginning of the material-removing operation. Preferably, the connector pipe 35 is substantially pear shaped in cross-section, as shown in Fig. 4, so as to present an edge-like area or surface 40 at the front thereof which, when the pick-up pipe is being moved from its full line position shown in Fig. 2 to its dotted line position shown therein, permits the pick-up pipe to pass with ease through the material lying in its path of movement.

The pick-up pipe 36 is supported with respect to the shaft 25, by the connector pipe 35, in part, and, in part, by a plurality of, herein shown as two, supporting arms 41, which are connected to the shaft 25 and to the pick-up pipe 36 near opposite ends thereof, the supporting arms 41 being of the same curvature as the connector pipe 35 and relatively narrow so as to permit their being moved through the material M with as little resistance as possible as the pick-up pipe is moved in a clockwise direction as viewed in Fig. 2.

Certain materials, such for example, as dry cement in powdered form, undergo considerable packing, as when in transit, and in order to loosen such packed material so that it may be readily handled by the apparatus embodying this invention, there is provided, preferably adjacent the path of travel of the connector pipe 35, suitable aerating or agitating means 42. This aerating means comprises a pipe 44, which, at opposite ends 45 and 46, is connected to the wall 14 of the tank, the end 45 of the pipe being closed and the end 46 of that pipe being in communication with a pressure supply pipe 47 which is connected to the tank and is adapted to be connected to a source of pressure supply, such as a compressor C of suitable design. The pipe 44 is curved intermediate its ends, whereby the intermediate portion 48 thereof is disposed in a concentric relation to the tank intermediate the cylindrical wall thereof and the rotatable shaft 25. A suitable area of the intermediate portion 48 of this pipe is provided with a plurality of perforations 50, which permit air to be forced from the pipe 44 into the material, whereby such material is loosened particularly in the vicinity of the path of travel of the connector pipe 35 preparatory to the material-handling operation so as to permit such connector pipe to be moved in a clockwise direction, as viewed in Fig. 2, through the material with as little resistance as possible.

Connected to the supply pipe 47, is a service pipe 51, which communicates with the tank 10 at a point above the normal level of the material M. At the junction of the pipe 51 with the pipe 47, a suitable two-way valve 52 is provided, the valve being such that communication between the tank 10 and the pressure supply pipe 47, by way of the service pipe 51, is severed when communica-

tion between the service pipe and the pipe 44 is established and such that communication between these latter pipes is severed when communication is established between the tank 10 and the pipe 47 by way of the service pipe 51.

When loading the tank 10 with material M, the pick-up pipe 36 is positioned as shown in Fig. 2, and upon filling the tank the closures 16 are locked in sealing position, the material being thus protected against weather conditions, as when in transit. When it is desired to remove the material from the tank, the valve 52 is moved so as to permit air under pressure to pass into the pipe 44 from which it is forcibly directed into the material through the perforations 50 of that pipe, thereby loosening the material, particularly in the vicinity of the path to be traversed by the connector pipe 35 during the material-handling operation. This aeration or agitation of the material is continued as long as is deemed sufficient for proper loosening of the material, whereupon the air supply from the pipe 47 to the pipe 44 is severed by the valve 52. Upon extending the discharge pipe 32 to the desired point of delivery, as by an attachable extension pipe or conduit 32', communication is established between the tank and the pressure supply pipe 47 through the service pipe 51 by rotating the valve 52. As pressure builds up within the tank 10, it being borne in mind that the closures 16 form air-tight seals for the openings 15, air rushes into the pick-up pipe 36 through the inlet openings 37 thereof and passes through the connector pipe 35 into the discharge conduit 25b and thence, by way of the discharge pipe 32 and extension pipe 32', to the point at which the material is to be delivered from the tank. Due to the passage of air from the tank into the pick-up pipe 36, material is picked up and carried along with the air in its passage through the ports 37, connector pipe 35, discharge conduit 25b, discharge pipe 32, and extension pipe 32', and delivered at the desired point of discharge. As the level of the material in the vicinity of the pick-up pipe 36 is lowered, the shaft 25 is rotated by the worm gear 27 and worm 28 in a direction to lower the pick-up pipe 36, thus keeping it in a proper relation to the mass of material to insure efficient operation. As the material is removed, the contour of the surface of the material will vary according to the character of the material being handled and may present surfaces, when the material is for example dry, finely divided cement, represented respectively by the dot and dash lines *a, b, c, d, e, f, g* and *h*. In the handling of such material, movement of the pick-up pipe 36 from its full line position shown in Fig. 2 its dotted line position shown therein may be necessary to effect complete removal of that material, whereas in the handling of material of a lesser self-sustaining nature, such as grain, movement of the pick-up pipe through a considerably shorter arc may be sufficient to effect complete removal of the material.

From the above, it will be understood that regardless of the consistency of the material that is to be handled, providing of course that it is of such a nature that it can be transported through a conduit under the influence of a moving body of air therein, complete removal of material from the tank may be effected by moving the pick-up pipe more or less as required in a clockwise direction, as viewed in Fig. 2. It will also be understood that should the pick-up pipe 36, the connector pipe 35, the discharge conduit

25b, the discharge pipe 32 or the extension pipe 32' become clogged, the full available pressure may be employed, by lifting the pick-up pipe 36 a substantial distance from or out of the material M, to forcibly eject the clogging material, and thus easily and quickly condition the apparatus for resumed operation.

Although only one form of the invention is herein shown and described, it will be understood that various modifications may be made without departing from the spirit of the invention or the scope of the following claims.

What is claimed is:

1. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a rotatable and horizontally disposed discharge conduit leading from said receptacle, a pick-up pipe disposed within said receptacle and connected to and communicating with said conduit, means for effecting the passage of a fluid through said pick-up pipe and said conduit whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, and means for rotating said discharge conduit whereby said pick-up pipe is correspondingly moved to maintain a functional relation between said pick-up pipe and the material to be removed as the latter recedes.

2. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a closure for said receptacle, a rotatable and horizontally disposed discharge conduit leading from said receptacle, a pick-up pipe disposed within said receptacle and connected to and communicating with said conduit, means for generating fluid pressure within said receptacle to be directed into said pick-up pipe and through said discharge conduit when said closure is closed whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, and means for rotating said discharge conduit whereby said pick-up pipe is correspondingly moved to maintain a functional relation between said pick-up pipe and the material to be removed as the latter recedes.

3. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a discharge conduit journaled in said receptacle and leading therefrom, a pick-up pipe disposed within said receptacle in a spaced relation to said conduit and communicating with said conduit, connecting means between said pick-up pipe and said conduit, means for effecting the passage of a fluid through said pick-up pipe and said conduit whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, means for effecting relative movement between said pick-up pipe and said receptacle whereby a functional relation is maintained between said pick-up pipe and the material to be removed as the latter recedes, and aerating means disposed adjacent the path of relative movement between said connecting means and said receptacle.

4. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a discharge conduit leading from said receptacle, a pick-up pipe disposed within said receptacle and communicating with said conduit, means for effecting the passage of a fluid through said pick-up pipe and

said conduit whereby material is caused to enter said pick-up pipe and passed therefrom through said discharge conduit, means for effecting relative movement between said pick-up pipe and said receptacle whereby a functional relation is maintained between said pick-up pipe and the material to be removed as the latter recedes, means for loosening the material within the receptacle preparatory to its removal and comprising a perforated pipe disposed about said conduit and adapted for connection with a source of fluid pressure.

5. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a rotatable discharge conduit journaled in the walls of said receptacle and leading therefrom, a pick-up pipe located within said receptacle and disposed substantially parallel to said discharge conduit and having a plurality of inlet openings spaced longitudinally of the same, a connector pipe connecting said pick-up pipe with said conduit and serving to support the former in a spaced relation to the latter, means for effecting the passage of a fluid through said inlet openings, said pick-up pipe, said connector pipe and said conduit, whereby material is caused to enter said pick-up pipe by way of said inlet openings and pass therefrom through said connector pipe and said conduit, and means for rotating said conduit whereby said pick-up pipe is correspondingly moved to maintain a functional relation between said pick-up pipe and the material to be removed as the latter recedes.

6. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a horizontally disposed discharge conduit located within and leading from said receptacle, a pick-up pipe disposed within said receptacle and connected to and communicating with said conduit, means for effecting the passage of a fluid through said pick-up pipe and said conduit whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, and means for effecting relative rotation between said discharge conduit and said receptacle whereby said pick-up pipe is moved relatively to said receptacle and a functional relation is thereby maintained between said pick-up pipe and the material to be removed as the latter recedes.

7. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a closure for said receptacle, a horizontally disposed discharge conduit located within and leading from said receptacle, a pick-up pipe disposed within said receptacle and connected to and communicating with said conduit, means for generating fluid pressure within said receptacle to be directed into said pick-up pipe and through said discharge conduit when said closure is closed, whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, and means for effecting relative rotation between said discharge conduit and said receptacle whereby said pick-up pipe is moved relatively to said receptacle and a functional relation is thereby maintained between said pick-up pipe and the material to be removed as the latter recedes.

8. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a discharge conduit leading from said receptacle, a horizontally disposed pick-up pipe disposed within said recep-

tacle and connected to and communicating with said conduit, means for effecting the passage of a fluid through said pick-up pipe and said conduit whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, and means for effecting relative movement between said pick-up pipe and said receptacle whereby a functional relation is maintained between said pick-up pipe and the material to be removed as the latter recedes.

9. A material-handling apparatus comprising a receptacle adapted for the reception of material to be removed therefrom, a discharge conduit leading from said receptacle, a horizontally disposed pick-up pipe disposed within said receptacle and connected to and communicating with said conduit, means for effecting the passage of a fluid through said pick-up pipe and said conduit whereby material is caused to enter said pick-up pipe and pass therefrom through said discharge conduit, means for effecting relative movement between said pick-up pipe and said receptacle whereby a functional relation is maintained be-

tween said pick-up pipe and the material to be removed as the latter recedes, and aerating means disposed within said receptacle in a spaced relation to said conduit for loosening the material within the receptacle preparatory to its removal.

10. A material-handling apparatus comprising a horizontally disposed cylindrical receptacle adapted for the reception of material to be removed therefrom, a discharge conduit extending longitudinally within said receptacle and leading therefrom, a pick-up pipe disposed within said receptacle and arranged longitudinally thereof and connected to and communicating with said conduit, means for effecting the passage of air through said pick-up pipe and said conduit whereby material is caused to enter said pick-up pipe and pass therefrom through said conduit, and means for rotating said conduit whereby said pick-up pipe is moved and maintained in a functional relation to the material to be removed at the surface of the same as such material recedes.

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