

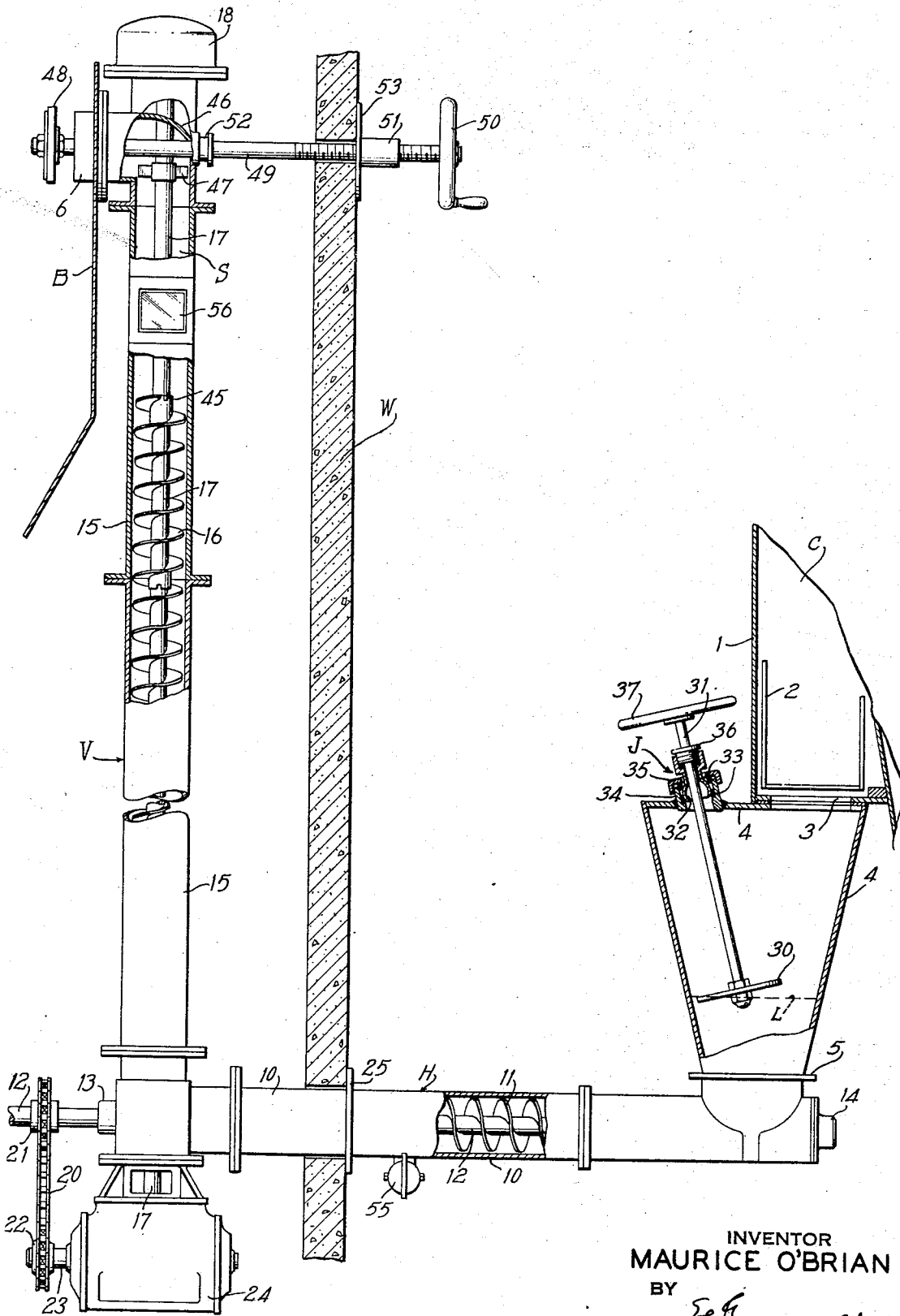
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CONVEYING APPARATUS FOR GAS GENERATORS

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CONVEYING APPARATUS FOR GAS GENERATORS

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This invention relates to conveying apparatus for gas generators, and more particularly to apparatus for safely conveying finely-divided material between the interior of a combustible gas generator and a point outside the generator. The principles of this invention are particularly applicable to the removal of dry calcium hydroxide or lime residue from a generator in which acetylene is generated through the reaction of water and calcium carbide in the process known as "dry" generation.

The process of dry generation of acetylene consists principally of agitating a moving body of calcium carbide and adding to the agitated and moving body an amount of water necessary to react the carbide completely and also an additional amount which by being vaporized reduces the temperature and so avoids a dangerous temperature rise within the generator. In dry generation, calcium carbide and water are continuously introduced into a generating zone, while acetylene gas and the substantially dry residue are removed therefrom. Since the generated acetylene is discharged from the generating zone at a substantial pressure, and water is introduced under pressure, it has been necessary to introduce the carbide into the generating zone by means of a double valve arrangement.

The lime residue or dust is usually discharged from the generating zone proper into a small discharge hopper or receptacle, from which it is conveyed to a lime storage bin or bins, and it has also been necessary to remove the residue from the dry generator through a double valve or similar arrangement.

Such double valve arrangements for introducing carbide and for removing residue have been necessary, since if acetylene escapes from the generator into the generator room or elsewhere, the fire and explosion hazard due to acetylene becoming mixed with atmospheric air is considerable. Furthermore, if in the introduction of carbide or in the removal of the lime residue, air is admitted into the generator, an explosive mixture of acetylene and air will be formed within the generator itself and similarly constitute a fire and explosion hazard.

Among the objects of this invention are to provide apparatus for safely conveying a finely-divided material between the interior of a combustible gas generator and a point outside thereof by maintaining in an enclosed conveying conduit a column of finely divided material of sufficient height to act as a seal and thereby prevent an influx of air or escape of combustible gas; to pro-

vide such apparatus in which the column of finely-divided material is maintained in a packed condition of greater density than that normally caused by gravity; to provide such apparatus by which such a seal may be automatically maintained; to provide a hopper in which a sealing column is maintained in such a packed condition; to provide positive means for indicating the height of material in such a hopper; to provide a conveyor in which a gas-sealing column of finely-divided material of predetermined depth is automatically maintained; and to provide other apparatus adapted to carry out this invention.

The above and other objects and novel features of this invention will become apparent from the following description and accompanying drawing, which is a side elevation, partially in section, of one embodiment of this invention, comprising a generator lime hopper and a conveyor system leading from the generator hopper to a lime storage bin.

Referring to the accompanying drawing, C designates the lower portion of a reaction or generating chamber of an acetylene generator in which acetylene gas and substantially dry lime residue are produced. An annular lime overflow or accumulating trough 1 extends completely around the inside of the generating chamber and receives finely-divided dry lime from the enclosed reaction zone. By means of an agitator or sweep 2, which serves to clean the bottom and sides of the annular trough 1 and thereby prevents the accumulation or incrustation of lime thereon, the dry finely-divided lime within the trough 1 is swept through an outlet opening 3 into a gas-tight lime receptacle or hopper 4, which is operatively connected to the trough 1 of the generator. From an outlet 5 of the hopper 4, the lime is conveyed through an enclosed path by a horizontal conveyor H to a vertical conveyor V, and thence by the vertical conveyor through an outlet 6 to a storage bin B. The hopper 4 and horizontal and vertical conveyors provide an enclosed conduit between the reaction zone of the generator and a point outside thereof, such as the storage bin B.

The lime is moved through a housing 10 of the horizontal conveyor by a helicoid screw feeder 11, which is turned by a shaft 12, journaled in bearings 13 and 14. The lime is positively moved upwardly through a housing 15 of the vertical conveyor by a second helicoid screw feeder 16 turned by a shaft 17, the upper end of which is journaled in a suitable bearing installed within an air-tight housing 18 at the top of the conveyor

V. The bearing 14 is also air-tight, and the bearing 13, as well as the bearing for the shaft 17 at the lower end of the housing 15, is provided with suitable packing to prevent escape of combustible gas or inflow of air.

The shaft 17 is rotated from the shaft 12 by a suitable drive, which includes a chain 20 passing around sprockets 21 and 22, sprocket 21 being mounted on the shaft 12, and sprocket 22 being mounted on a stub-shaft 23, which is journaled in suitable bearings in a gear box 24. Suitable gears, within the gear box 24, and operatively connecting the shaft 17 and stub-shaft 23 complete the drive.

A suitable electrical driving motor (not shown) is connected to the shaft 12, and may be run continuously or periodically as desired, while its control may be manual or automatic. Furthermore, the driving motor may have either a constant or a variable speed. To obviate the possibility of any acetylene and air mixture present in the generating room becoming ignited due to sparks, this motor, as well as the vertical conveyor and storage bin, are placed outside the generator room. The horizontal conveyor H passes through a wall W of the generator room, and a plate 25 fitting snugly about the housing 10 and attached to the wall W provides a seal therefor.

To cause a slight packing of the lime dust and resulting density greater than that normally caused by gravity, thereby providing a more effective seal, the hopper 4, which constitutes an enlarged portion of the enclosed path through which the lime dust moves, tapers downwardly, i. e. decreases in cross-sectional area from top to bottom. In order to provide a sufficient height of lime within the hopper to obtain an effective seal, but without impeding the discharge of additional lime into the upper part of the hopper during continuous operation of the gas generator, the driving motor may be started when the lime reaches an upper predetermined level, and stopped when it reaches a lower predetermined level. For positively determining the height of lime in the hopper 4, a suitable indicator is utilized, such as a "hunting" disk 30 mounted at the lower end of a rod 31. The rod 31 passes through a ball and socket joint J which includes a ball 32, a pair of gaskets 33, a casing 34 attached to the hopper in a suitable manner, such as by welding, and a cap 35 which clamps gaskets 33 tightly against ball 32 to provide a more effective seal. A packing gland 36 seals rod 31, and permits the rod to be moved upwardly and downwardly by a handle 37 to cause the "hunting" disk 30 to contact the body of lime within the hopper 4, thereby indicating the lime level within the hopper, such as at a lower predetermined level L. In addition, through the ball and socket joint which permits lateral movement in any direction as well as longitudinal movement of rod 31, disk 30 may be moved to contact the interior of the container at any point in order to remove any incrustation of lime.

If the seal provided in the hopper alone is utilized, it is normally necessary to operate a constant speed driving motor periodically, but such a driving motor may be operated continuously when a continuous seal is automatically maintained at some point in the discharge path. For this purpose, the upper end 45 of the vertical screw feeder 16 is disposed at a predetermined level which is a sufficient distance below the outlet 6 of the vertical conveyor to provide a sealing section S within the vertical housing 15 in which

a gas-sealing column of pulverous lime of predetermined height will always be maintained. As additional lime is pushed upwardly into the sealing section by the screw 16, lime at the top of the sealing section will be pushed into the outlet 6. To assist the discharge of lime through the outlet, and prevent an accumulation of lime therein, a deflector plate 46 is installed in the housing 15 adjacent the outlet 6, the plate 46 providing a positive guide for directing the lime into the outlet, while a blade 47 mounted on shaft 17 sweeps the lime at the top of the sealing section into the outlet.

To provide an auxiliary gas-tight seal at the outlet 6, when the generator is shut down or for any other reason, a disk 48 of suitable sealing material, such as rubber, is mounted on the end of a shaft 49. The shaft 49 extends through the conveyor housing, being disposed alongside the vertical shaft 17, and may be turned by a hand wheel 50 in the generator room, the end of the shaft adjacent the hand wheel being threaded and cooperating with a fixed nut 51 to permit the disk 48 to be drawn into sealing engagement with the outlet and thereby provide a gas-tight seal. The shaft 49 passes through a stuffing box 52 mounted in the housing 15, which provides a gas-tight seal at the point at which shaft 49 passes through the housing 15; and the fixed nut 51 is provided with a flange 53 attached to the wall W, which prevents the leakage of any combustible gas through the opening in the wall W through which the shaft 49 passes.

A normally gas-tight outlet is provided in a lime-sampler 55, attached to the horizontal conveyor H, by means of which the operation of the generator may be checked by periodically removing samples of lime from the conveyor H and testing such samples. The sealing section S of the vertical conveyor housing 15 is provided with a normally gas-tight inspection hole 56, which may be covered by a metal plate, or may be provided with a transparent window, so that the amount of lime within the sealing section may be observed to insure proper operation of the generator at all times.

The sealing section S in the vertical conveyor may be utilized alone to provide a seal, or a double seal may be had by utilizing also a seal within the hopper 4. In either instance, a seal is automatically provided at all times within the vertical conveyor, irrespective of whether the removal of lime is continuous or periodic.

Normally, lump carbide is used in acetylene generators, but in some cases finely-divided or dust carbide has been used, and the principles of this invention may be employed in providing a seal during conveyance of such dust carbide into the interior of the generator from a point outside thereof. For instance, the hopper 4 may replace one or both of the valves in the double valve arrangement previously referred to, since the tapered construction, or downwardly decreasing cross-sectional area, causes a slight packing and increase in density resulting in a very effective gas-seal. Furthermore, the dust carbide may be conveyed into the generator by a conveyor system which includes a vertical conveyor having a sealing section, such as the vertical conveyor V. In such a case, the generator would occupy the relative position of the bin B. Obviously, the tapering hopper and vertical conveyor may be used in conjunction to provide a double seal, as previously explained with reference to the removal of lime.

Although the gas seal provided by the disclosed apparatus has been described with reference to the generation of acetylene, it will be understood that the principles of this invention may be utilized in other instances. Furthermore, while a particular form of apparatus adapted to carry out the method of this invention has been described, it will be understood that various modifications may be made therein, such as utilizing a conveyor which is not exactly vertical but only substantially vertical, i. e. sloping upwardly at a sufficient angle so that a gas-sealing column of finely-divided material, which material is positively moved upwardly in the conveyor to a first predetermined level therein, will be automatically formed and maintained in the conveyor as the material is pushed upwardly from the first predetermined level to a second predetermined level by only the force of the material being positively moved upwardly from beneath the first predetermined level. The distance between the first and second predetermined levels, in all embodiments of the invention, should be sufficient to accommodate therebetween an effective gas-sealing column of the finely-divided material. It will be apparent that only a portion or section of the conduit or conveyor system need be disposed substantially vertically in order to provide the desired gas-sealing column of material. It will also be understood that other forms of apparatus may be used which will come within the spirit and scope of this invention.

What is claimed is:

1. In apparatus for safely conveying finely-divided material between the interior of a combustible gas generator and a point outside such generator, a conveyor housing disposed substantially vertically and having an outlet adjacent the upper end thereof; and means for positively moving such finely-divided material upwardly in said conveyor housing to a predetermined level which is a sufficient distance below said outlet so that a gas-sealing column of such material will be automatically maintained within said conveyor housing between said predetermined level and said outlet as such material is pushed upwardly from said predetermined level to said outlet only by the force of the material being moved upwardly from beneath said predetermined level.

2. Apparatus for safely removing finely-divided dry lime residue from an acetylene gas generator, comprising a gas-tight hopper operatively connected with said generator and through which such residue passes downwardly; means for removing such residue from said hopper including a conveyor housing disposed substantially vertically and having an outlet adjacent the upper end thereof; a helicoid screw within said conveyor housing and terminating at a predetermined level below said outlet; and means including a shaft for rotating said screw whereby such residue is moved positively upwardly in said conveyor housing to said predetermined level which is sufficiently below said outlet so that a gas sealing column of such residue is automatically maintained between the top of said helicoid screw and said outlet.

3. In apparatus for safely conveying finely-divided dry lime residue from an acetylene generator installed within a generator room, an air-tight conveyor housing disposed horizontally and operatively connected with the lime outlet of said generator, said horizontal conveyor housing passing through a wall of said generator room; an air-tight conveyor housing disposed substantially

vertically and outside said generator room, said vertical conveyor housing being operatively connected with said horizontal conveyor housing and provided with an outlet adjacent the upper end thereof; means within said horizontal conveyor housing for moving said residue through said horizontal conveyor housing to said vertical conveyor housing; and means within said vertical conveyor housing for moving said residue upwardly through said vertical conveyor housing, said last-mentioned means being so arranged as to effect a positive movement of said residue upwardly in said vertical conveyor housing to a predetermined level which is a sufficient distance below said outlet so that a gas-sealing column of lime residue is automatically maintained between said predetermined level and the upper end of said vertical conveyor housing.

4. In apparatus for safely conveying finely-divided material between the interior of a combustible gas generator and a point outside such generator, a hopper through which such material passes downwardly and in which such material is maintained at a predetermined level so as to form a gas seal; and means movable laterally in any direction as well as longitudinally within said hopper for indicating the level of such material within said hopper through positive contact with such material, and for breaking incrustations of such material formed within said hopper.

5. In apparatus for safely conveying finely-divided material between the interior of a combustible gas generator and a point outside such generator, a hopper through which such material passes downwardly and in which such material is maintained at a predetermined level so as to form a gas seal; means for indicating the level of such material within said hopper and for breaking incrustations of such material formed within said hopper through positive contact with such material, said means comprising a rod extending downwardly through the wall of and into said hopper and a disk attached to the lower end of said rod for contacting such material in said hopper; and a joint connecting said rod and the wall of said hopper, said joint and said rod being so constructed and arranged that said rod and said disk are movable laterally as well as longitudinally within said hopper.

6. In apparatus for safely removing dry lime residue from an acetylene generator, an air tight hopper operatively connected with said generator and through which such dry lime residue passes downwardly, such dry lime residue being maintained at a predetermined level within said hopper so as to form a gas seal; a movably mounted rod extending through the wall of said hopper and downwardly into the interior thereof; mounting means connecting said rod and the wall of said hopper and including a ball and socket joint; a packing gland for said rod; and a disk attached to the lower end of said rod for contacting dry lime residue within said hopper whereby incrustations of such residue within said hopper are broken and the level of such residue within said hopper is positively determined in maintaining a column of such residue of predetermined height within said hopper to form a gas seal.

7. Apparatus for safely conveying substantially dry, finely-divided material between an enclosed reaction zone in which a combustible gas is generated and a point outside such zone, comprising an enclosed conduit extending between such reaction zone and such outside point, at

least a portion of said conduit being substantially vertical, and said conduit having an outlet adjacent one end thereof; and means for moving said material through said conduit, such moving means being constructed and arranged to move said material positively upwardly through the substantially vertical portion of said conduit to a first predetermined level which is a sufficient distance below a second predetermined level so that a gas-sealing column of said material will be automatically maintained between said first and second predetermined levels as said material is pushed upwardly from said first predetermined level toward said outlet only by the force of the material being moved positively upwardly from beneath said first predetermined level.

8. Apparatus for safely removing finely-divided dry lime residue from the generating zone of an acetylene generator, comprising an enclosed con-

duit leading from said generating zone to a point outside thereof and having an outlet adjacent such outside point, at least a portion of said conduit being substantially vertical; and means for moving said lime residue through said conduit from said generating zone to said outside point, such moving means being so constructed and arranged that said lime residue is positively moved upwardly within said substantially vertical portion to a predetermined level which is sufficiently below said outlet so that a gas-sealing column of said lime residue will be automatically maintained between said predetermined level and said outlet as said lime residue is pushed upwardly from said predetermined level to said outlet only by the force of the material being positively moved upwardly from beneath said predetermined level.

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