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[54] **APPARATUS FOR PROVIDING A NON-REACTING ATMOSPHERE WITHIN A STORAGE BIN**

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[51] **Int. Cl.** **B67d 5/08**

[58] **Field of Search** ..... 222/52, 146 H, 152, 53, 222/190; 220/85 S, 88 B; 23/281

[56] **References Cited**

UNITED STATES PATENTS

3,348,922	10/1967	Bose et al.	23/281
3,469,947	9/1969	Drury	23/281
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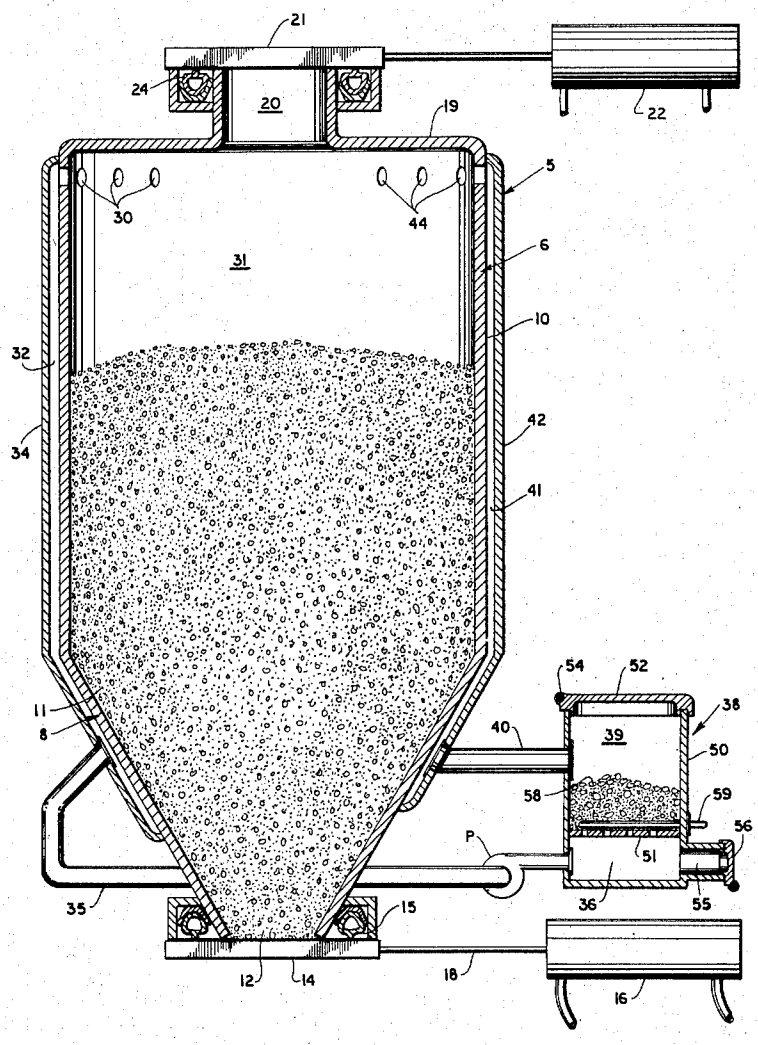
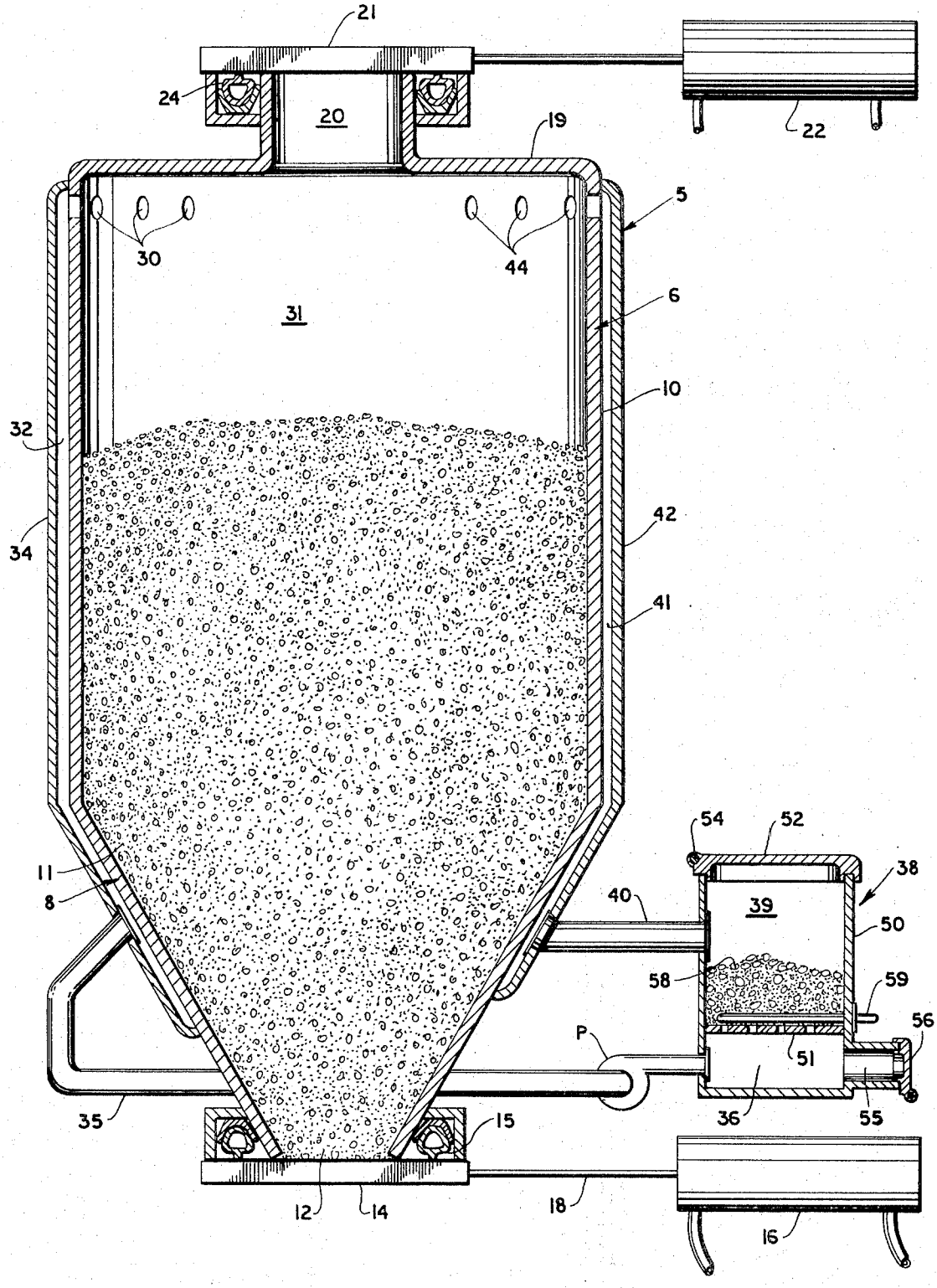
[57] **ABSTRACT**

Means for providing a non-reacting atmosphere within a storage bin wherein the fluid comprising the atmosphere is removed from the storage bin, the fluid is passed through a converter to convert the reacting components of the fluid to non-reacting components, and the fluid is replaced in the storage bin. In asphalt storage bins, the reacting component in the fluid is oxygen, and the converter includes high temperature carbon to convert the oxygen to carbon dioxide.

7 Claims, 1 Drawing Figure

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APPARATUS FOR PROVIDING A NON-REACTING ATMOSPHERE WITHIN A STORAGE BIN

This invention relates to storage bins for storing various mixes such as a hot asphalt mix, and is more particularly concerned with means for providing such storage bins with an atmosphere that is non-reactive with the material being stored within the bin.

Storage bins are very commonly used in various fields, and especially in the paving industry for storing hot asphalt mix. The asphalt mix must be maintained at an elevated temperature to prevent the mix from setting up, and some means must be provided to prevent deterioration of the stored, hot asphalt mix by chemical reaction with elements of the atmosphere within the bin.

In the past, asphalt bins and the like have been provided with a non-reactive atmosphere by the simple expedient of forcing a non-reacting gas into the void above the asphalt that is stored within the bin. Examples of such prior storage bins are found in U.S. Pat. Nos. 3,348,739; 3,532,252; and Re. 26,786. Though this simple technique works reasonably well to achieve the desired result, there are some undesirable features in such a system. In the first place, it is inherent in such a system that the storage bin must be maintained at a super-atmospheric pressure, and the fact of the super-atmospheric pressure demands that the entire bin be hermetically sealed to prevent the escape of the non-reacting gas that is used as the atmosphere. The necessity for sealing the bin is disadvantageous in that newly-mixed asphalt must be periodically added to the bin, so the sealing means must be opened to allow the new mix to be dumped into the bin, the sealing means must be closed, and the escaped atmosphere must be replaced. The bin must also be arranged so that asphalt can be dispensed from the storage bin, and the non-reacting atmosphere must fill the additional void left by removal of a portion of the asphalt mix. All of these operations in conjunction require rather intricate control means to assure that all steps take place in proper sequence and to assure that there is always a sufficient quantity of the non-reactive atmosphere within the storage bin. Such non-oxidizing gas systems of the prior art are not fail-safe, moreover, since the discontinuance of a constant supply of fresh non-reactive gas to the storage bin, resulting from malfunction or exhaustion of the source of such gas, results in the inevitable loss of the super-atmospheric pressurized condition within the storage bin.

The apparatus of the present invention overcomes the above-mentioned and other difficulties with the prior art storage bins by providing a storage bin that is maintained substantially at atmospheric pressure. The fluid making up the atmosphere within the storage bin is removed from the storage bin, the reactive components of the fluid are converted to non-reactive components, and the same fluid is placed back into the storage bin. This process may be operated continuously or at sufficiently frequent intervals to maintain a desirable atmosphere within the bin in spite of the addition of outside air to the bin.

In the case of an asphalt storage bin, the deleterious aspect of the atmosphere is oxygen, so that it becomes a very simple matter to convert the oxygen to carbon dioxide. This can be done by passing the fluid that makes up the atmosphere over heated carbon so that the carbon reacts with the oxygen in the fluid to convert the oxygen to carbon dioxide. This technique allows the storage bin to remain substantially at atmospheric pressure, which substantially eliminates the tendency of the non-oxidizing atmosphere to escape from the storage bin whenever a material inlet is opened.

These and other features and advantages of the invention will become apparent upon consideration of the following specification when taken in conjunction with the accompanying drawing in which:

The single FIGURE is a schematic representation of a cross-sectional view through a storage bin having the atmosphere control apparatus in accordance with the present invention installed thereon.

Referring now more particularly to the drawing, and to that embodiment of the invention here chosen by way of illustration; it will be seen that the storage bin **5** comprises an upper cylindrical portion **6** and a lower, inverted frustoconical portion **8**, the lower portion **8** having an opening **12** that is closed by a movable gate **14.** A gasket or the like **15,** which may advantageously be selectively inflatable to control sealing contact with the gate **14,** is provided as an effective seal between the gate **14** and the lower portion **8** of the bin **5.** The gate **14** is movable between a closed position and an open position by means of a fluid-operated cylinder **16** having the piston rod **18** attached to the gate **14.**

The upper portion **6** of the bin **5** is closed by a top wall **19** having a central opening **20** through which asphalt mix can be placed into the bin **5.** A gate **21** is selectively movable between a closed position and a open position relative to the opening **20** to contain the atmosphere that is within the bin. Movement of the gate **21** is accomplished by the fluid-operated cylinder **22.** A gasket or the like **24,** which may be similar to the gasket **15,** is positioned between the top wall **19** and the gate **21,** in surrounding relation with the opening **20,** for fluid-tight sealing cooperation with the closed gate **21.**

It will now be seen that there is provided a storage bin **5** into which the commodity to be stored, such as asphalt mix, can be deposited through the opening **20** and simply dropped through the air curtain **21.** When the asphalt mix is to be dispensed from the storage bin, the fluid-actuated cylinder **16** will be retracted, causing the piston rod **18** to be moved to the right as viewed in the drawing, and thereby causing the gate **14** to be positioned away from the opening **12.** As the asphalt mix is dispensed from the bin, there will be a tendency to draw a partial vacuum within the bin, and this vacuum will be dissipated by atmospheric air flowing through the opened central opening **20,** if necessary, until atmospheric pressure is again attained. The cylinder **22** may be operatively interconnected with the discharge cylinder **16,** if desired, so that the gate **21** is automatically opened to admit atmospheric air whenever the discharge gate **14** is opened.

In order to remove the fluid that makes up the atmosphere from the bin, there is a plurality of exit openings **30** in the cylindrical wall **10** of the upper portion **6,** and close to the top **19.** The holes **30** connect the interior **31** of the bin **5** with an exit duct **32,** the exit duct **32** being conveniently although not necessarily formed between a duct wall **34** and the wall **10** of the bin. The duct wall **34** surrounds a significant portion of the bin wall **10** to cover all of the openings **30,** and the duct

wall **34** extends down to cover a portion of the wall **11** of the frusto-conical section **8.** A pipe **35** extends through the duct wall **34** to communicate with the duct **32,** the pipe **35** being connected to the suction side of a pump P while the high pressure side of the pump P is connected to a plenum chamber **36** of a converter generally designated at **38.**

From the upper section **39** of the converter **38,** there is a pipe **40** that is in communication with an entrance duct **41,** the entrance duct **41** being conveniently formed between a duct wall **42** and the walls **10** and **11** of the bin **5.** The entrance duct **41** is similar to the exit duct **32** in that the duct wall **42** extends around a substantial portion of the bin **5** and covers holes **44** which are entrance ports for fluid entering the bin.

Thus far, it will be seen that the pump P will be operated to move the fluid making up the atmosphere within the bin through the holes **30,** through the exit duct **32,** through the pipe **35,** pump P and into the plenum **36.** From the plenum **36,** the fluid will be forced into the upper chamber **39** of the converter **38,** through the pipe **40,** through the duct **41** and into the bin through the entrance ports **44,** thereby effecting a substantially continuous flow of fluid from the bin, through the chamber **38,** and back into the bin **5.**

The converter **38** is the apparatus that converts the oxygen in the fluid into a non-oxidizing component. The converter **38** includes a housing **50** having the plenum **36** and the upper chamber **39** separated by a grate **51.** The upper chamber **39** has a hinged lid **52** which is pivoted at **54.** The junction of the lid **52** with the walls of the chamber **38** is here shown as rabbetted or otherwise constructed to provide a relatively tight closure.

The plenum **36** is provided with a clean-out **55** having a hinged cover **56.** Though not here shown in detail, the cover **56** would also be provided with fastening means to make the clean-out **55** relatively air tight when the cover **56** is closed.

A very convenient source of carbon to achieve the desired reaction is charcoal which is placed in the upper chamber **39** as indicated at **58.** Since the charcoal **58** must be hot to bring about the conversion of the oxygen into carbon dioxide, an electric heating element **59** is provided at the bottom of the chamber **39** to provide the initial heat input.

At this point, some discussion of the process involved would be appropriate. Due to the arrangement of the apparatus, it will be readily seen that the only air that reaches the charcoal **58** is the fluid from the bin that passes through the pump P and through the plenum **36.** Therefore, the atmospheric air which is initially in the bin is continuously recirculated through the converter **38** for conversion of the oxygen into non-oxidizing carbon dioxide. Atmospheric air which is drawn into bin, whether through the opening **20** or otherwise, is immediately introduced into the recirculating fluid flow and is thereby conveyed to the converter **38** for conversion to a non-oxidixing fluid and for subsequent return to the bin.

In the event that the converter **38** becomes inoperative, whether by inadvertent failure to replenish the supply of charcoal **58** or otherwise, the non-oxidizing atmosphere will continue to be recirculated and returned to the bin. The pressure of the recirculating non-oxidizing atmosphere within the bin is essentially the same as the outside atmospheric pressure, and so no substantial escape of the non-oxidizing gas occurs.

Charcoal is also very desirable for use in the converter **38** because the charcoal, once ignited, will continue to burn without additional energy input. As a result, the electric heating element **59** can be energized long enough to ignite the lowermost pieces of charcoal **58,** then the heating element **59** can be de-energized and the ignited charcoal will ignite the remaining charcoal in the converter **38.** The ignition of the remaining charcoal will be especially fast because of the forced draft through the converter **38.**

From the foregoing it will be seen that the present invention provides a storage bin with a non-reacting atmosphere in which the interior of the bin remains at atmosphere pressure. The non-reacting atmosphere is provided by a fluid recirculation system in which the fluid making up the atmosphere is removed from the bin, reacting components of the fluid are converted to non-reacting components, and the fluid is replaced in the storage bin. When the reacting component of the atmosphere is oxygen, as in asphalt storage bins, a charcoal converter is used to convert the oxygen to carbon dioxide.

It will be understood by those skilled in the art that, since a closed recirculation system is provided, the location of the pump P is not critical but can be in any convenient location within the system to cause movement of the fluid through the system.

Baffles, or other fluid directing means, can be used within the bin **5** in conjunction with the entry ports **44,** if desired. When carbon dioxide is produced by the converter **38,** the incoming carbon dioxide will be heavier than the oxygen to be displaced so that there will be natural convection currents to separate the incoming fluid from the outgoing fluid.

It will of course be understood that the particular embodiment of the invention here chosen by way of illustration is intended to be in no way restrictive, and that numerous changes and modifications may be made, and the full use of equivalents resorted to, without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. Apparatus for receiving and storing asphalt mix, comprising:

an enclosed storage bin adapted to receive and store a quantity of asphalt mix in an interior which is in substantial isolation relative to an ambient atmosphere surrounding the storage bin;

selectably sealable inlet means at an upper location on said storage bin to admit asphalt mix into the interior of said storage bin;

selectively sealable discharge means positioned at a lower location on said storage bin to selectively release asphalt mix previously stored in said storage bin;

means for withdrawing the fluid making up the atmosphere within the interior of said storage bin;

converting means connected to receive said removed fluid and operative for converting components of the removed fluid which are reactive with asphalt mix to components which are non-reactive with asphalt mix; and

means for returning said converted fluid from said converting means to the said interior of storage bin.

2. Apparatus as in claim 1, in which said withdrawing means, said converting means, and said returning means are operative to maintain the atmosphere within the the interior of said storage bin, substantially at the pressure of the surrounding ambient atmosphere.

3. Apparatus as in claim 1, wherein:

said means for withdrawing the fluid includes at least one exit port in communication with the interior of said storage bin, and an exit duct establishing fluid flow communication between said exit port and said converting means;

said means for returning the fluid includes at least one entrance port in communication with the interior of said storage bin, and an entrance duct establishing fluid flow communication between said converting means and said entrance port;

said exit duct, said converting means, and said entrance duct comprising a fluid recirculation system; and,

pump means operatively disposed in said fluid recirculation system to move fluid from the interior of said storage bin, through said exit duct, through said converting means, and through said entrance duct to return to said storage bin.

4. Apparatus according to claim 1, in which the said reacting components include oxygen, and the said converting means includes high-temperature carbon to convert the said oxygen to carbon dioxide.

5. Apparatus according to claim 1, said converting means including a plenum, an upper chamber, a grate between said plenum and said upper chamber, said grate being adapted to receive charcoal thereon, and heating means adjacent to said grate for igniting the charcoal, the said plenum receiving the said removed fluid from the said storage bin, the said upper chamber being connected to return the said fluid to the said storage bin.

6. Apparatus according to claim 1, wherein said storage bin has an upper opening for admission of material to the said storage bin, closure means selectively positioned at said upper opening to maintain a fluid-tight seal across said upper opening to contain the said atmosphere within the storage bin, the said bin has a lower opening for the discharge of material, and a movable gate positioned to selectively close said lower opening to retain material within the storage bin and to open said lower opening for discharge of material from the storage bin.

7. Apparatus according to claim 1, wherein said storage bin, said means for removing fluid, said converting means, and said means for replacing fluid constitute a fluid recirculation system, and including pump means operatively positioned in said recirculation system to provide fluid flow through said recirculation system.

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